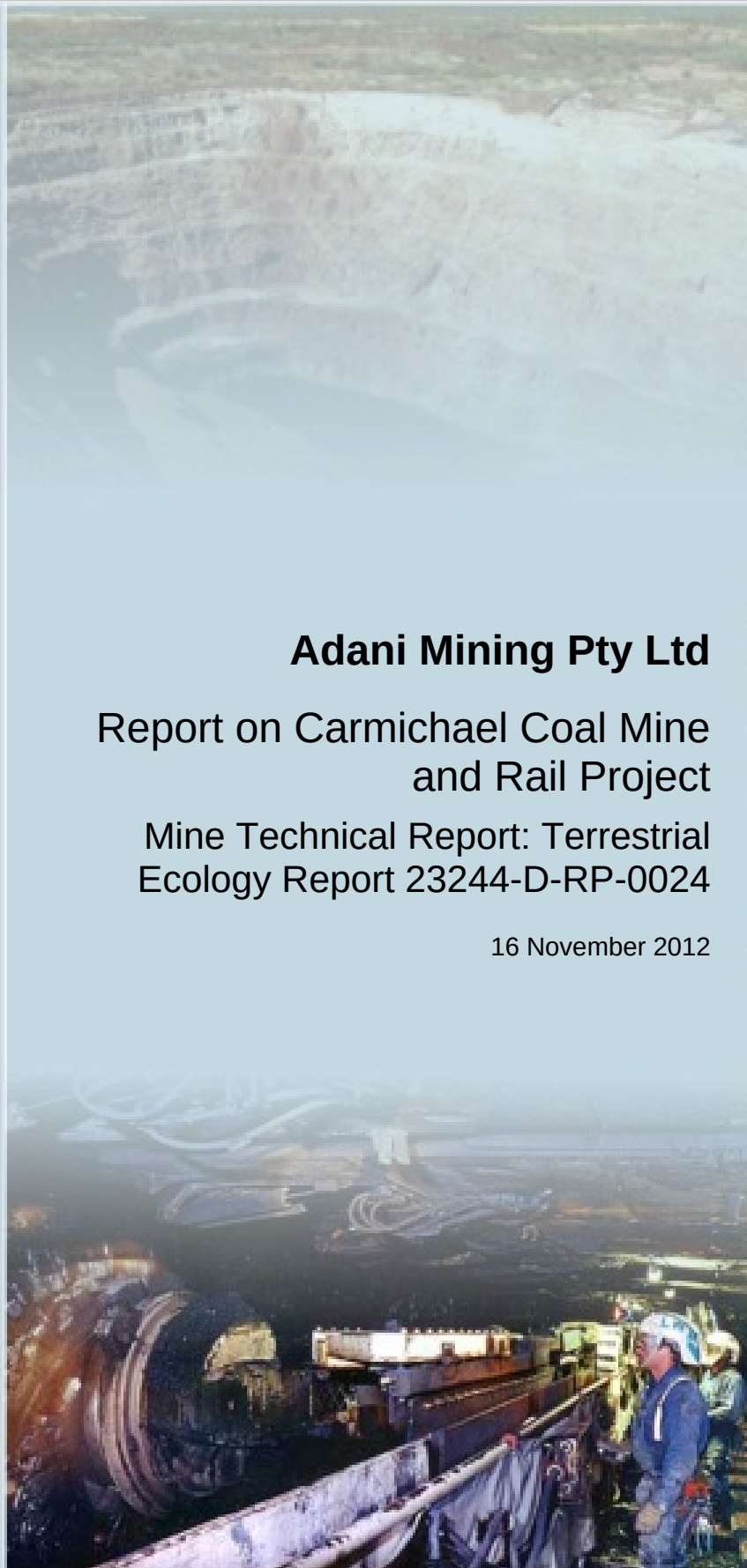




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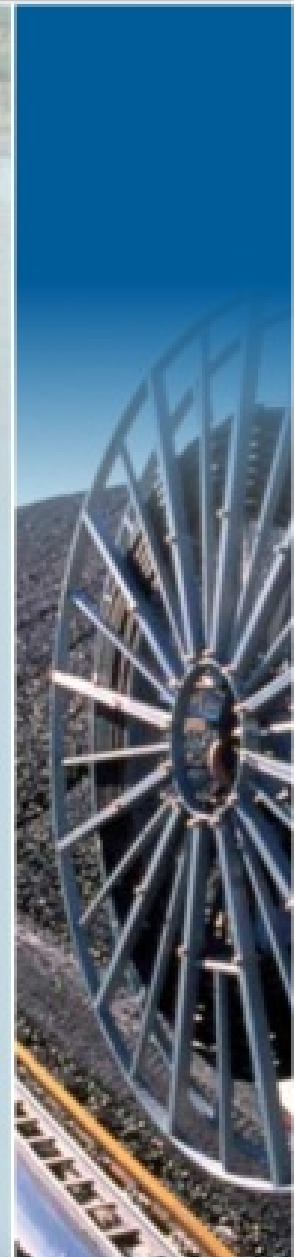


Adani Mining Pty Ltd

**Report on Carmichael Coal Mine
and Rail Project**

**Mine Technical Report: Terrestrial
Ecology Report 23244-D-RP-0024**

16 November 2012





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Contents

Abbreviations and Glossary	xiii
Executive Summary	xv
1. Introduction	1-1
1.1 Project Overview	1-1
1.2 Report Scope	1-4
1.3 Assessment Scope	1-8
1.4 Legislation and Policy	1-8
1.4.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999	1-8
1.4.2 Commonwealth EPBC Act Environmental Offsets Policy	1-9
1.4.3 Queensland State Development and Public Works Organisation Act 1974	1-9
1.4.4 Queensland Nature Conservation Act 1992	1-10
1.4.5 Queensland Vegetation Management Act 1999	1-10
1.4.6 Queensland Sustainable Planning Act 2009	1-10
1.4.7 Queensland Land Protection (Pest and Stock Route Management) Act 2002	1-11
1.4.8 Queensland Environmental Protection Act 1994	1-11
1.4.9 State Planning Policy (SPP) 4/11: Protecting Wetlands of High Ecological Significance in Great Barrier Reef Catchments (Wetlands SPP)	1-11
1.4.10 Queensland Government Environmental Offsets Policy Framework	1-12
1.5 Methods – EPC 1690 Study Area	1-12
1.5.1 Nomenclature	1-12
1.5.2 Desktop Assessment	1-12
1.5.3 Field Surveys	1-17
1.5.4 Terrestrial Flora	1-18
1.5.5 Terrestrial Fauna	1-21
1.5.6 Summary of Fauna Survey Effort	1-32
1.5.7 Likelihood of Occurrence Assessment	1-32
1.5.8 Impact Assessment	1-33
1.6 Limitations	1-33
2. Existing Environment	2-1

2.1	Introduction	2-1
2.2	Regional Context	2-1
2.2.1	Burdekin Catchment	2-1
2.2.2	Brigalow Belt Bioregion	2-1
2.2.3	Belyando Downs Subregion	2-2
2.2.4	Desert Uplands Bioregion	2-2
2.2.5	Alice Tableland Subregion	2-2
2.2.6	Land Use	2-3
2.3	Terrestrial Flora	2-3
2.3.1	Regional Ecosystems and Environmentally Sensitive Areas	2-3
2.3.2	Vegetation Communities	2-57
2.3.3	Groundwater Dependent Ecosystems	2-63
2.3.4	Flora Species Diversity	2-63
2.3.5	Exotic or Weed Flora Species	2-64
2.4	Terrestrial Fauna	2-65
2.4.1	Fauna Habitats	2-65
2.4.2	Fauna Species – Desktop Assessment Summary	2-78
2.4.3	Fauna Species – Field Assessment Summary	2-79
2.5	Threatening Processes	2-88
3.	Conservation Significant Terrestrial Ecological Values	3-1
3.1	Introduction	3-1
3.2	Commonwealth Matters of National Environmental Significance	3-3
3.2.1	World Heritage Properties	3-3
3.2.2	National Heritage Places	3-3
3.2.3	Ramsar Wetlands	3-3
3.2.4	Listed Threatened Flora	3-4
3.2.5	Listed Threatened Fauna	3-11
3.2.6	Listed Threatened Ecological Communities	3-45
3.2.7	Listed Migratory Species	3-48
3.2.8	Great Barrier Reef Marine Park	3-54
3.2.9	Other Commonwealth Matters	3-55
3.3	State Matters of Conservation Significance	3-61
3.3.1	Regional Ecosystems	3-61
3.3.2	Environmentally Sensitive Areas	3-61
3.3.3	Mapped Regrowth Vegetation	3-61
3.3.4	Essential Habitat	3-61
3.3.5	State Listed Threatened Flora	3-64



3.3.6	State Listed Threatened Fauna	3-69
3.3.7	Protected Areas	3-79
3.4	Regional Matters of Conservation Significance	3-85
3.4.1	Department of Environment and Heritage Protection Biodiversity Planning Assessment Mapping	3-85
3.4.2	Biodiversity Planning Assessment Expert Panel Reports	3-85
3.4.3	Burdekin Natural Resource Management Region Priority Taxa	3-85
4.	Summary of Existing Terrestrial Ecological Values of Project Area	4-1
5.	Potential Impacts and Mitigation Measures — Construction Phase	5-1
5.1	Introduction	5-1
5.2	Vegetation Clearing	5-4
5.2.1	Overview	5-4
5.2.2	Loss of Vegetation and Fauna Habitat	5-5
5.2.3	Fauna Mortality	5-9
5.2.4	Habitat Fragmentation	5-11
5.2.5	Habitat Degradation	5-11
5.3	Disturbance of Water Resources	5-12
5.3.1	Overview	5-12
5.3.2	Loss of Habitat for Terrestrial Species	5-13
5.3.3	Water Quality and Hydrological Changes	5-14
5.4	Introduction and Proliferation of Weeds and Feral Species	5-15
5.4.1	Overview	5-15
5.4.2	Potential Impacts	5-15
5.4.3	Management and Mitigation	5-16
5.4.4	Summary	5-16
5.5	Fauna Behavioural Disruption	5-17
5.5.1	Overview	5-17
5.5.2	Potential Impacts	5-17
5.5.3	Management and Mitigation	5-17
5.5.4	Summary	5-17
6.	Potential Impacts and Mitigation Measures — Operation Phase	6-18
6.1	Introduction	6-18
6.2	Overview – Management of Operation Phase Impacts	6-20

6.2.1	Management Approach	6-20
6.2.2	Overview of Offset Strategy for Operation Phase	6-23
6.3	Vegetation Clearing	6-25
6.3.1	Overview	6-25
6.3.2	Loss of Vegetation	6-26
6.3.3	Loss of Fauna Habitat	6-37
6.3.4	Loss of Habitat – EPBC Act Listed Fauna	6-40
6.3.5	Fauna Mortality	6-59
6.3.6	Habitat Fragmentation	6-61
6.3.7	Habitat Degradation	6-63
6.4	Loss of Water Resources used by Terrestrial Species	6-64
6.4.1	Potential Impacts	6-64
6.4.2	Management and Mitigation	6-65
6.4.3	Summary	6-66
6.5	Alteration of Groundwater Regime	6-66
6.5.1	Potential Impacts	6-67
6.5.2	Management and Mitigation	6-69
6.5.3	Summary	6-71
6.6	Introduction and Proliferation of Pests and Feral Species	6-71
6.6.1	Overview	6-71
6.7	Altered Exposure to Disturbance	6-73
6.7.1	Overview	6-73
6.7.2	Fauna Behavioural Disruption	6-73
6.7.3	Changes to Fire Regime	6-74
6.7.4	Changes to Habitat Structure – Subsidence	6-74
7.	Potential Impacts and Mitigation Measures – Decommissioning	7-1
8.	Conclusion	8-1
9.	References	9-1

Table Index

Table 1-1	Terms of Reference cross reference	1-4
Table 1-2	Summary of desktop information sources	1-13
Table 1-1-3	Average weather conditions during field surveys	1-17
Table 1-4	Summary of terrestrial flora survey methods	1-18
Table 1-5	Summary of terrestrial fauna survey methods	1-23



Table 1-6	Summary of threatened terrestrial fauna species surveys undertaken	1-28
Table 1-7	Summary of terrestrial fauna survey effort	1-32
Table 2-1	Summary of Regional Ecosystem mapping changes from field verification	2-8
Table 2-2	Regional Ecosystem descriptions	2-11
Table 2-3	Broad Vegetation Communities within the EPC 1690 Study Area (in order of area) ¹	2-58
Table 2-4	Queensland declared plants recorded within the EPC 1690 Study Area	2-64
Table 2-5	Fauna habitat types at EPC 1690 Study Area	2-66
Table 2-6	Summary of desktop assessment results – terrestrial fauna	2-78
Table 2-7	Summary of field assessment results – terrestrial fauna	2-79
Table 2-8	Fauna diversity by habitat type – Spring 2010 survey	2-80
Table 2-9	Fauna diversity by habitat type – Autumn 2011 survey	2-80
Table 3-1	Summary of conservation significant terrestrial ecological values of Project Area	3-1
Table 3-2	Commonwealth listed threatened flora species – likelihood of occurrence	3-5
Table 3-3	Commonwealth listed threatened fauna species – likelihood of occurrence	3-12
Table 3-4	Commonwealth listed migratory species – likelihood of occurrence	3-49
Table 3-5	Habitats for listed migratory species	3-54
Table 3-6	Commonwealth listed marine species recorded at Project Area	3-55
Table 3-7	Commonwealth listed marine birds – likelihood of occurrence	3-57
Table 3-8	Essential Habitat within 50 km of Project Area	3-61
Table 3-9	State listed threatened flora - likelihood of occurrence	3-65
Table 3-10	State listed threatened fauna – likelihood of occurrence	3-71
Table 3-11	Back on Track priority taxa of relevance to Project Area	3-86
Table 5-1	REs impacted during construction of the MIA and offsite infrastructure	5-5



Table 6-1	Approximate areas of impact for threatened ecological community REs	6-27
Table 6-2	Approximate areas of impact for Category B ESA REs	6-29
Table 6-3	Endangered REs and expected clearing impacts	6-31
Table 6-4	Of Concern REs and expected clearing impacts	6-32
Table 6-5	Least Concern REs and Expected Clearing Impacts	6-33
Table 6-6	Summary of loss of vegetation categories impacted for mine operations	6-37
Table 6-7	Fauna Habitats – areas to be cleared of vegetation in Project Area	6-38
Table 6-8	Fauna Habitats - areas not to be cleared of remnant vegetation in Project Area	6-39
Table 6-9	Approximate areas of vegetation potentially to be impacted by subsidence	6-76
Table 6-10	Approximate areas of fauna habitat potentially to be impacted by subsidence	6-77
Table 6-11	Approximate areas of potential conservation significant species habitat potentially to be impacted by subsidence	6-79

Figure Index

Figure 1-1	Project Location	1-2
Figure 1-2	Project Area	1-3
Figure 1-3	Terrestrial Flora Survey Sites	1-19
Figure 1-4	Terrestrial Fauna Survey Sites	1-22
Figure 1-5	Location of Black-throated Finch (southern) Waterbody Watch Surveys	1-31
Figure 2-1	Environmentally Sensitive Areas – DEHP Certified Mining Activities	2-6
Figure 2-2	Environmentally Sensitive Areas – Category B Field Verified	2-7
Figure 2-3	Regional Ecosystems – DNRM Certified	2-22
Figure 2-4	Regional Ecosystems – Field Verified	2-37
Figure 2-5	Regulated Regrowth Vegetation under the VM Act	2-56
Figure 2-6	Broad Vegetation Communities and Fauna Habitat Types	2-62



Figure 2-7	BPA Mapping – Ecosystem Value at Regional Scale	2-75
Figure 2-8	BPA Mapping – Ecosystem Diversity	2-76
Figure 2-9	BPA Mapping – Context and Connection	2-77
Figure 3-1	Black-throated Finch (southern) Records at Project Area	3-23
Figure 3-2	Potential Black-throated Finch (southern) Habitat at the Project Area	3-26
Figure 3-3	Potential Black-throated Finch (southern) Habitat Beyond the Project Area	3-28
Figure 3-4	Black-throated Finch (southern) Important Areas	3-29
Figure 3-5	Squatter Pigeon (southern) Records at Project Area	3-32
Figure 3-6	Potential Squatter Pigeon (southern) Habitat at the Project Area	3-33
Figure 3-7	Potential Squatter Pigeon (southern) Habitat Beyond the Project Area	3-34
Figure 3-8	Koala Records and Potential Habitat at the Project Area	3-37
Figure 3-9	Potential Koala Habitat Beyond the Project Area	3-38
Figure 3-10	Potential Yakka Skink Habitat at the Project Area	3-42
Figure 3-11	Potential Ornamental Snake Habitat at the Project Area	3-43
Figure 3-12	Brigalow TEC at Project Area	3-47
Figure 3-13	Essential Habitat in the Landscape Surrounding the Project Area	3-63
Figure 3-14	Location of State Listed Threatened Fauna Records at Project Area	3-77
Figure 3-15	Protected Areas within 50 km of Project Area	3-80
Figure 5-1	Indicative Mine Plan – Areas of Impact	5-3
Figure 5-2	Conceptual Diagram of Potential Construction Phase Impacts	5-4
Figure 6-1	Conceptual Diagram of Potential Operation Phase Impacts	6-20
Figure 6-2	Conceptual diagram of subsidence	6-75



Plate Index

Plate 1-1	Pitfall trap – funnel traps – drift-fence complexes (November 2010)	1-24
Plate 1-2	Elliott 'A' trap	1-25
Plate 1-3	Cage trap	1-25
Plate 1-4	Remote camera at stock trough (April 2011)	1-26
Plate 2-1	Ornate Burrowing Frog	2-81
Plate 2-2	Spotted Grass Frog	2-81
Plate 2-3	<i>Carlia munda</i> (November 2010)	2-82
Plate 2-4	Bearded Dragon (November 2010)	2-82
Plate 2-5	Pale-headed Snake (November 2010)	2-82
Plate 2-6	Freckled Monitor (April 2011)	2-82
Plate 2-7	Common Brushtail Possum (April 2011)	2-83
Plate 2-8	Stripe-faced Dunnart (May 2011)	2-83
Plate 2-9	Red Kangaroo (April 2011)	2-83
Plate 2-10	Eastern Grey Kangaroo (May 2011)	2-83
Plate 2-11	Red-tailed Black-cockatoo (April 2011)	2-85
Plate 2-12	Brown Falcon (May 2011)	2-85
Plate 2-13	Emu (November 2010)	2-85
Plate 2-14	Hooded Robin (April 2011)	2-85
Plate 2-15	Black-throated Finch (southern) (May 2011)	2-85
Plate 2-16	Squatter Pigeon (southern) (April 2011)	2-85
Plate 2-17	Pale-headed Rosella (May 2011)	2-86
Plate 2-18	Apostlebird (April 2011)	2-86
Plate 2-19	European Rabbit (November 2010)	2-87
Plate 2-20	Pig (April 2011)	2-87
Plate 3-1	Waxy Cabbage Palm, taken at Moses Spring to the west of the Project Area	3-10
Plate 3-2	Black-throated Finches (southern) observed at stock troughs near southern boundary of Bygana West Nature Refuge (April 2011)	3-20
Plate 3-3	Black-throated finches (southern) drinking at farm dam at north of Project Area (May 2011) and observed at northwest of Project Area (May 2011)	3-21
Plate 3-4	Water sources at southern part of Project Area from which black-throated finches (southern) were observed drinking (April 2011)	3-21



Plate 3-5	Open eucalypt woodland with native grass understorey at southern part of Project Area (April 2011)	3-22
Plate 3-6	Open eucalypt woodland with native grass understorey at northern part of Project Area (May 2011)	3-22
Plate 3-7	Farm dam at northern part of Project Area (May 2011)	3-22
Plate 3-8	Squatter pigeons (southern) recorded in central part of Project Area (May 2011)	3-31
Plate 3-9	Habitat where squatter pigeons (southern) were recorded – open eucalypt woodland along ephemeral creek (April 2011) (left); Open ironbark woodland with native grass understorey (April 2011) (right)	3-31
Plate 3-10	<i>Eucalyptus brownii</i> woodland with grass understorey that typifies southern part of Bygana West Nature Refuge (April 2011)	3-82
Plate 3-11	Eucalyptus (left) and Acacia (right) woodland fringing ephemeral drainage Line – southern part of Bygana West Nature Refuge (April 2011)	3-82

Appendices

- A Terms of Reference Cross Reference
- B EPC 1080 Existing Terrestrial Ecological Values Report
- C Survey Effort and Locations (EPC 1690)
- D Desktop Database Search Results
- E Flora Survey Results (EPC 1690)
- F Weeds
- G Fauna Survey Results (EPC 1690)
- H Threatened Fauna Survey Results (Project Area)
- I Land Zone Descriptions

Abbreviations and Glossary

Project Specific Terminology	
Abbreviation	Term
the EIS	Carmichael Coal Mine and Rail Project Environmental Impact Statement- refers to the particular document that GHD is preparing to facilitate approval of the Project
the Proponent	Adani Mining Pty Ltd
the Project	Carmichael Coal Mine and Rail Project
Generic Terminology	
Abbreviation	Term
BOM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment
BVC	Broad Vegetation Community
BVG	Broad Vegetation Group
CAMBA	Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment
DEEDI	Former Department of Employment, Economic Development and Innovation (Qld)
DEHP	Department of Environment and Heritage Protection
DERM	Former Department of Environment and Resource Management (Qld)
DEWHA	Department of Environment, Water, Heritage and the Arts (Cwlth) (now Department of Sustainability, Environment, Water, Population and Communities)
DNRM	Department of Natural Resources and Mines (Qld)
EIS	Environmental Impact Statement
EPA	Former Environmental Protection Agency (Qld)
EP Act	<i>Environmental Protection Act 1994 (Qld)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)</i>
EPC	Exploration Permit for Coal
ESA	Environmentally Sensitive Area
GAB	Great Artesian Basin
GDE	Groundwater Dependant Ecosystem
GIS	Geographic Information System
HES	High Ecological Significance
IBRA	Interim Biogeographic Regionalisation of Australia
IRC	Isaac Regional Council



JAMBA	Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment
LGA	Local government area
LP Act	<i>Land Protection (Pest and Stock Route Management) Act 2002 (Qld)</i>
MIA	Mine Infrastructure Area
NES	National Environmental Significance
NC Act	<i>Nature Conservation Act 1992 (Qld)</i>
NRM	Natural Resource Management
Project Area	The Mine site (EPC 1690 and the adjacent eastern portion of EPC 1080 the (proposed location of out of pit waste dumps, water management dams and the Mine Infrastructure Area (MIA))) and the proposed locations of associated offsite infrastructure, as illustrated at Figure 1-2.
ROKAMBA	Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds
QBOP	Queensland Biodiversity Offset Policy
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971 (Qld)</i>
SEWPAC	Department of Sustainability, Environment, Water, Population and Communities (former DEWHA, Department of Environment, Water, Heritage and the Arts) (Cwlth)
SP Act	<i>Sustainable Planning Act 2009 (Qld)</i>
SPP	State Planning Policy
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
VAST	Vegetation Assets, States and Transitions
VM Act	<i>Vegetation Management Act 1999 (Qld)</i>
VMOP	Vegetation Management Offsets Policy
WONS	Weed of National Significance



Executive Summary

Adani Mining Pty Ltd (Adani) is proposing to develop a 60 million tonne (product) per annum thermal coal mine in the north Galilee Basin approximately 160 kilometres (km) north-west of the town of Clermont, Central Queensland. All coal will be railed via a privately owned rail line connecting to the existing Goonyella rail system south of Moranbah, and shipped through coal terminal facilities at the Port of Abbot Point and/or the Port of Hay Point (Dudgeon Point expansion). The Carmichael Coal Mine and Rail Project (the Project) will have an operating life of approximately 90 years.

The Project is comprised of two major components:

- ▀ The Project (Mine): a greenfield coal mine over EPC1690 and the eastern portion of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure.
- ▀ The Project (Rail): a greenfield rail line connecting the Mine to the existing Goonyella rail system to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and/or the Port of Abbot Point.

This report outlines the baseline terrestrial ecological values of the Mine Project Area. The Project Area is approximately 160 km north-west of Clermont, and is approximately 48,000 hectares (ha) in area.

The potential impacts of the construction and operation of the Mine and associated infrastructure on the identified terrestrial ecological values of the Project Area are presented, as are measures to manage and mitigate potential impacts.

A combined desktop and field assessment was undertaken by GHD Pty Ltd to describe the existing terrestrial ecological values of the Project Area. A Spring field survey was undertaken in November 2010 and an Autumn field survey was undertaken in April/May 2011 at EPC 1690. Flora and fauna surveys incorporated:

- ▀ Twenty comprehensive and 160 rapid flora assessment sites
- ▀ Sixteen comprehensive and 36 rapid fauna assessment sites

A Spring survey of the eastern part of EPC 1080 was undertaken in November 2011, comprising:

- ▀ Forty-eight rapid flora assessment sites
- ▀ Six comprehensive and 40 rapid fauna assessment sites

A description of the existing terrestrial ecological values of the Project Area, based on the results of the desktop assessment, field studies at EPC 1690 (Spring 2010 and Autumn 2011), field studies at eastern portion of EPC 1080 (Spring 2011), and a targeted black-throated finch (*Poephila cincta cincta*) survey in May 2012, is provided. The key findings from this terrestrial ecological assessment are summarised below.

Project Area in the Landscape

The Project Area occurs in an agricultural landscape, where historic and current land use practices associated with cattle grazing have altered the extent, connectivity and ecological integrity of vegetation communities and the fauna habitat they provide. Furthermore, disturbances associated



with introduced plant and animal species are a feature of this agricultural landscape. The Project Area itself comprises a mix of remnant vegetation, regrowth vegetation and cleared areas, with cattle grazing the primary land use.

Vegetation Communities and Fauna Habitats at Project Area

Remnant vegetation occurs over approximately 60 per cent of the Project Area (approximately 28,752 ha of the 48,042 ha). Where remnant vegetation occurs, an assortment of habitat resources are available for fauna, in contrast with surrounding areas that have been previously cleared.

Seven broad vegetation communities were identified in the Project Area based on the particular vegetation communities and land forms present. A total of 36 field verified regional ecosystems (REs) were identified within the Project Area, 22 from the Desert Uplands bioregion and 14 from the Brigalow Belt bioregion.

The remnant vegetation in northern, western and southern parts of the Project Area forms part of larger tracts of remnant vegetation to the north-east, north, west, south and south-east of the Project Area. A large area of cleared land dominates much of the central part of the Project Area mainly between the Carmichael River and the Moray-Carmichael Road. Habitat values for native fauna are limited in this cleared area, due to the lack of microhabitats and the prevalence of buffel grass (*Cenchrus ciliaris*). Other fragments of cleared land occur near the eastern boundary of the Project Area to the north of the Moray-Carmichael Road, and to the south of the Carmichael River. Fauna habitat values are similarly limited in these fragments. The value of these cleared areas is further limited at the eastern-most part of the Project Area where much of the surrounding landscape is cleared.

Connectivity between remnant vegetation associated with the Belyando River and the south-east part of the Project Area (i.e. the eastern part of the Bygana West Nature Refuge) is maintained through a tract of partially fragmented (though wholly connected) mapped remnant vegetation. Vegetation within the Project Area forms part of potential corridors associated with the Belyando River, Carmichael River and Bygana West Nature Refuge.

The Project Area contains a range of fauna habitat types that share broadly similar habitat values (based on habitat structure), but vary in their value for wildlife based on the specific forage and shelter resources they provide. Ironbark-box woodland was the most widespread fauna habitat type at the Project Area. In general, across the Project Area, disturbance to fauna habitats from cattle, weeds and feral animals was observed to be low. These disturbances were mainly observed in cleared areas, where ecological value is relatively low, between the Carmichael River and the Moray-Carmichael Road, and in eastern parts of the Project Area.

The Queensland Department of Environment and Heritage Protection (DEHP) Biodiversity Planning Assessment (BPA) mapping indicated that some remnant vegetation within and surrounding the Project Area is of ecosystem value at a regional level, while much of this remnant vegetation is ranked as having very high or high ecosystem diversity and (ecosystem) context and connection.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed threatened ecological community (TEC), Brigalow (*Acacia harpophylla* dominant and co-dominant), was identified as present at the Project Area during field surveys. The presence of this TEC was recorded from the occurrence of REs 11.3.1, 11.4.8 and 11.4.9 within the Project Area. Approximately 267 ha of these REs are present, predominantly south of the Carmichael River in the east of the Project Area.



Approximately 1,060 ha of Category B Environmentally Sensitive Areas (ESAs) (endangered Biodiversity Status REs), recorded from the occurrence of seven RE types (10.4.3, 10.9.3, 11.3.1, 11.4.5, 11.4.6, 11.4.8 and 11.4.9), were identified from the Project Area (based on field-verified RE mapping).

No State mapped essential habitat occurs in the Project Area, although a number of patches (for a variety of species) occur in the landscape around the Project Area.

Flora Species

The Project Area supports a diversity of flora species – consolidated desktop search results for the region (i.e. the desktop search extent) revealed 962 vascular plant taxa have been previously recorded from the database Wildlife Online and 701 vascular taxa plant have been previously recorded from the HERBRECS database.

Native flora species were prevalent across much of the Project Area, in association with areas of remnant vegetation. Field studies identified 373 native flora taxa and 27 introduced taxa in the Project Area. Of the 27 introduced species, five are declared Weeds of National Significance (WONS) and declared weeds under the Queensland *Land Protection (Pest and Stock Route) Management Act 2002* (LP Act).

One threatened flora species, listed under both the EPBC Act and the Queensland *Nature Conservation Act 1992* (NC Act), was recorded within the Project Area from field surveys – waxy cabbage palm (*Livistona lanuginosa*). This species is restricted to the Carmichael River channel. One EPBC Act listed threatened flora species and two flora species listed under the NC Act may occur at the Project Area (based on suitability of habitat, previous records from the region and current known distribution).

Fauna Species

A total of 232 fauna species were recorded during field studies at the Project Area (213 species recorded during Spring 2010 and Autumn 2011 surveys at the EPC 1690 Study Area; 173 species recorded during Spring 2011 survey at the EPC 1080 Study Area). The vast majority of fauna species recorded from the Project Area were common, widely distributed species. A limited number of introduced fauna species were recorded. Other than the cane toad (*Rhinella marina*), introduced animals were recorded to occur at relatively low densities.

Two threatened birds and one mammal listed under the EPBC Act were recorded – the endangered black-throated finch (southern) (*Poephila cincta cincta*), the vulnerable squatter pigeon (southern) (*Geophaps scripta scripta*) and the vulnerable koala (*Phascolarctos cinereus*). Both bird species appeared to be locally common where suitable habitat was present at the Project Area, whilst the koala is likely to be present at low densities. Potential habitat occurring within and beyond the Project Area for these species was identified. Two additional EPBC Act listed threatened fauna species, yakka skink (*Egernia rugosa*) and ornamental snake (*Denisonia maculata*), were not recorded from field studies, however are considered likely to occur at the Project Area (based on suitability of habitat, previous records from the region and current known distribution).

Three common EPBC Act listed migratory bird species, eastern great egret (*Ardea alba*), rainbow bee-eater (*Merops ornatus*), and satin flycatcher (*Myiagra cyanoleuca*) were recorded at the Project Area. In addition to these, 15 EPBC Act listed migratory bird species not recorded during field studies



have the potential to occur at the Project Area. However, habitats at the Project Area are not considered likely to support important assemblages of migratory species.

Three threatened fauna species listed under the NC Act were recorded (in addition to the two birds also listed under the EPBC Act (black-throated finch (southern) and squatter pigeon (southern)) – the near threatened black-necked stork (*Ephippiorhynchus asiaticus*), cotton pygmy-goose (*Nettapus coromandelianus*) and little pied bat (*Chalinobus picatus*). Potential habitat occurring within the Project Area for these species was identified. An additional two threatened fauna species listed under the NC Act (in addition to the two species also listed under the EPBC Act) are considered likely to occur at the Project Area (based on suitability of habitat, previous records from region, current known distribution).

Five NC Act listed special least concern fauna species were recorded at the Project Area (the three EPBC Act listed migratory birds mentioned above, echidna (*Tachyglossus aculeatus*), and koala).

One priority fauna species described in the Burdekin NRM 'Back on Track Actions for Biodiversity' report (Department of Environment and Resource Management (DERM), 2010a) was recorded at the Project Area (black-throated finch (southern)). A further four priority fauna species, yakka skink, ornamental snake, red goshawk (*Erythrorhynchus radiatus*) and Australian painted snipe (*Rostratula australis*), have the potential to occur at the Project Area.

Protected Areas

One protected area occurs within the Project Area. Bygana West Nature Refuge, at the southern part of the Project Area, is dominated by ironbark-box woodland, although smaller patches of three other fauna habitat types were recorded within its boundary. The land use of the nature refuge is cattle grazing. Two threatened species were recorded along its southern boundary - black-throated finch (southern) and squatter pigeon (southern). Both (sub) species are likely to utilise habitats within the Nature Refuge.

Potential Impacts to Terrestrial Ecological Values

Construction and operation phase impacts to the terrestrial ecological values of the Project Area were identified. Construction phase impacts are associated with the mine infrastructure area, and offsite infrastructure. These facilities will be constructed predominately within already cleared land within and to the east of the eastern portion of EPC 1080. Operation phase impacts are associated with open cut mining, out of pit waste dumping, water management dams and underground mining (and potential for subsidence). Vegetation clearing will impact approximately 12,672 ha (44 per cent) of remnant vegetation within the Project Area. This includes areas of threatened species habitat (i.e. black throated finch (southern), squatter pigeon (southern), koala, little pied bat, black-necked stork, cotton pygmy-goose).

The approach to mitigating and managing operation phase impacts will include a combination of prevention or reduction of all avoidable impacts to the greatest extent possible, active management to maintain and where possible enhance habitats that will not be impacted during staged operations, and active management of areas that will be disturbed during staged mining operations such that they retain their existing values until such time that they are disturbed. Research and monitoring will be a fundamental component of the impact management approach, with a dual objective of informing management of environmental impacts at and near the Project Area, as well as contributing to the understanding and protection of ecological values in the Galilee Basin. As unavoidable impacts are



an inherent aspect of this Project, given that its operations are entirely related to the locality of the coal resource within the mining lease, offsets will form a substantial component of the impact management approach. Whilst all reasonable efforts will be made to minimise impacts to flora and fauna values within the operation phase footprint, vegetation loss, fauna habitat loss and fauna mortality will occur. The overarching objective of managing impacts during the operation phase will be to maintain and where at all possible enhance the ecological values that characterise the Project Area and the surrounding landscape, with a view to achieving no-net-loss of regional biodiversity values.

1. Introduction

1.1 Project Overview

Adani is proposing to develop a thermal coal mine in the north Galilee Basin approximately 160 km north-west of the town of Clermont, Central Queensland. All coal will be railed via a privately owned rail line connecting to the existing rail system, and shipped through coal terminal facilities at the Port of Abbot Point and/or the Port of Hay Point (Dudgeon Point expansion). The Project will have an operating life of approximately 90 years.

The Project is comprised of two major components:

- ▶ The Project (Mine): a greenfield coal mine over EPC 1690 and the eastern portion of EPC 1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including:
 - A workers accommodation village and associated facilities
 - A permanent airport site
 - Water supply infrastructure
- ▶ The Project (Rail): a greenfield rail line connecting the Mine to the existing Goonyella rail system to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and/or the Port of Abbot Point, including:
 - Rail (west): a 120 km dual gauge portion from the Mine site running west to east to Diamond Creek
 - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah

The Project has been declared a 'significant project' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and as such an Environmental Impact Statement (EIS) is required. The Project is also a 'controlled action' and requires assessment and approval under the EPBC Act.

The Project EIS has been developed with the objective of avoiding or mitigating all potential adverse impacts to environmental, social and economic values and enhancing positive impacts. Detailed descriptions of the Project are provided in Volume 2, Section 2 Project Description (Mine) and Volume 3, Section 2 Project Description (Rail).

The **Project Area**, which is the focus of this baseline terrestrial ecological study and impact assessment, comprises EPC 1690, the eastern portion of EPC 1080 and the mine offsite infrastructure. It is predominantly located on the Moray Downs cattle station, approximately 160 km north-west of Clermont. Figure 1-1 shows the Project location, while Figure 1-2 presents the Project Area assessed for this study. The Project Area for the Mine is approximately 46,576 ha in extent (comprising 26,015 ha in EPC 1690, 18,714 ha in EPC 1080 and 1,847 ha for the Mine offsite infrastructure).



LEGEND

- | | | | |
|----------------------|-------------------------|----------------|------------------|
| ○ Town | — State Road | Project (Rail) | ■ Project (Mine) |
| ⚓ Major Port | — Local Road | — Rail (West) | ■ Mine (Offsite) |
| — Other Rail Network | — Watercourse | — Rail (East) | |
| — Goonyella System | — Local Government Area | | |
| — Newlands System | | | |

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:2,000,000 (at A4)

0 10 20 30 40 50

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Project Location

Job Number	41-25215
Revision	L
Date	28-08-2012

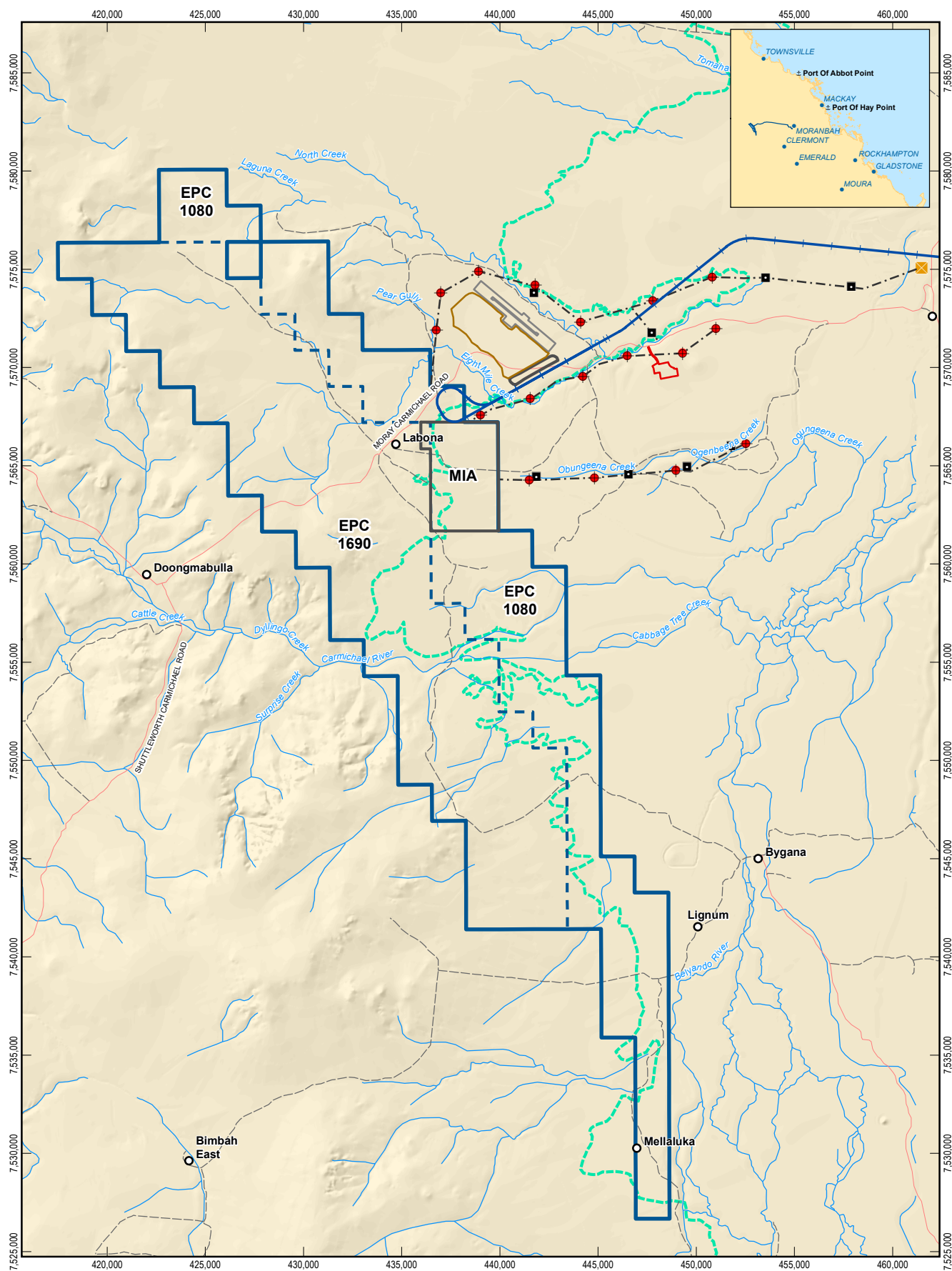
Figure: 1-1

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Data Sources: © Commonwealth of Australia (Geoscience Australia); Town, Railways, Watercourses (2007); DERM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment Opt9 Rev3 (2012). Created by: BW, JVC



LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | ■ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | ■ Mine Infrastructure Area | ■ Storage Site (Instream) | ■ Industrial Area |
| — Watercourse | ■ Bioregion Boundary | ■ Storage Facility (Offstream) | ■ Workers Accommodation Village |
| | | — Pipeline Network | |

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Terrestrial Ecology
Project Area

Job Number 41-25215
Revision D
Date 05-09-2012

Figure 1-2

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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); DERM: Bioregion Boundary (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); Created by: BW, CA

1.2 Report Scope

This terrestrial ecological assessment addresses the terms of reference (ToR) for the Project (Mine) component of the Carmichael Coal Mine and Rail Project Environmental Impact Statement (May 2011). Table 1-1 provides a cross reference with the Project terms of reference, full details are provided in Appendix A. The assessment scope is outlined in Section 1.3, whilst applicable legislation is summarised in Section 1.4.

Section 1.5 of this report (referred to as the 'Mine Terrestrial Ecology Report') provides an overview of the assessment methodology employed to describe the baseline terrestrial ecological values of EPC 1690) (hereafter, the '**EPC 1690 Study Area**'). The methods used to describe the ecological values of the eastern part of EPC 1080, as well as the areas relating to the Mine offsite infrastructure including a workers accommodation village, airport and water supply infrastructure (hereafter referred to as the '**EPC 1080 Study Area**'), are presented in Appendix B.

Section 2 of this report presents an overview of the baseline terrestrial ecological values of the EPC 1690 Study Area. Appendix B details the existing terrestrial ecological values of the EPC 1080 Study Area.

The baseline terrestrial ecological values of the EPC 1690 Study Area (described in Section 2) and the EPC 1080 Study Area (described in Appendix B) are combined from Section 3 of this report. This section details the conservation significant terrestrial ecological values of the '**Project Area**' (that is, the EPC 1690 Study Area and the EPC 1080 Study Area (including the area of the Mine offsite infrastructure), as identified through the desktop and field studies undertaken for the Project.

A summary of the identified conservation significant terrestrial ecological values of the Project Area is presented in Section 4.

An assessment of potential impacts to the identified conservation significant terrestrial ecological values of the Project Area is presented in Section 5 (construction phase), Section 6 (operations phase) and Section 7 (decommissioning phase). Measures to manage and mitigate potential impacts are outlined in these sections.

Table 1-1 Terms of Reference cross reference

Terms of Reference	Section
3.3. Nature Conservation	Section
Detail the existing nature conservation that may be affected	Section 2, Section 3 and Appendix B
Flora and Fauna Surveys should address species structure, assemblage, diversity and abundance	Section 1.5
Where possible seek the involvement of the local Indigenous community to conduct field observations and survey activities, to identify the traditional and contemporary Indigenous uses of species.	Volume 1, Section 7 and Volume 4, Appendix F
Describe methodologies and standards used for flora and fauna surveys and compare them to best practice in the appendices in the EIS	Section 1.5 and Appendix B
Identify key flora and fauna indicators of ongoing monitoring	Section 5 and 6



Terms of Reference	Section
3.3. Nature Conservation	Section
3.3.1 Sensitive Environmental Areas	
On a map of suitable scale, identify areas in proximity to the project that are environmentally sensitive. This should include areas classified as having national, state, regional or local biodiversity significance, or flagged as important for their integrated biodiversity values	Section 2, Section 3 and Appendix B
Refer also to both Queensland and Commonwealth Government legislation and policies on threatened species and ecological communities	Section 1.4 and Section 3
Areas regarded as sensitive with respect to flora and fauna should be identified and mapped	Section 2, Section 3 and Appendix B
Sites containing high biodiversity, for example areas identified in both the Desert Uplands and Brigalow Belt North Biodiversity Planning Assessments, that are of a suitable size or with connectivity to corridors/protected areas to ensure survival in the longer term	Section 3.4
Areas of special sensitivity	Section 3
Discuss all the likely direct and indirect impacts of the project on species, communities and habitats of local, regional or national significance in sensitive environmental areas as identified above	Section 5 and 6
Cover terrestrial and aquatic environments and address any fragmentation impacts	Section 2.4.1, Appendix B, Section 5 and Section 6
Also, include human impacts and the control of any domestic animals introduced to the area	Section 5.4 and Section 6.6
Demonstrate how the project would comply with the following hierarchy. avoid impacts, mitigation through rehabilitation and restoration, replace or offset the loss of conservation value	Section 5 and Section 6
Explain why the measures above would not apply in areas where loss would occur	Section 5 and Section 6
Discuss the boundaries of the areas impacted by the project within or adjacent to an endangered ecological community, including details of footprint width	Section 5.2 and Section 6.3
Where the project area would impact upon a threatened community, the discussion should include reasons for the preferred alignment and the viability of alternatives	NA – applies to rail component of Project
Consider the high biodiversity values of Bygana West NR and, in accordance with mining best practice, first demonstrate ways to avoid impacting this area, second demonstrate mitigating measures and offsetting impacts relating to Bygana West Nature Refuge	Section 3.3.7.1 and Section 6.3.2
Address any actions of the project or likely impacts that require an authority under the NC Act, and/or would be assessable development for the purposes of the VM Act	Section 1.4, Section 5.2 and Section 6.3
Outline how these measures will be implemented in the overall EMP for the project	See Volume 2 Section 13
Where relevant, discuss environmental offset requirements in accordance with the <i>Queensland Government Environmental Offsets Policy</i> and take into account the applicable specific-issue offset policies	Section 5.2, Section 6.2.2 and Volume 1, Section 8



Terms of Reference	Section
3.3. Nature Conservation	Section
Proposals to offset unavoidable impacts to biodiversity values are to be made via use of the framework outlined in the draft Policy for Biodiversity Offsets	Section 5.2, Section 6.2.2 and Volume 1, Section 8
Describe any departure from no net loss of ecological values.	See Volume 1, Section 11
3.3.2 Terrestrial Flora	
Specifically assess any potential impacts on a Category A or B environmentally sensitive area and propose measures and impacts.	Section 2.3.1.2, Section 6.3.2, Figure 2-2 Figure 2-1 and Appendix B
Describe and assess the potential impacts of any actions of the project or likely impacts that require an authority under the NC Act and VM Act	Section 1.4, Section 5.2 and Section 6.3
Provide vegetation mapping for all relevant project sites	Section 2.3, Figure 2-3 to Figure 2-6 and Appendix B
Survey and describe terrestrial vegetation within the affected areas at an appropriate scale (max. 1:10,000),	Section 1.5, Section 2.3 and Appendix B
Vegetation surveys should be undertaken at an appropriate number of sites, and satisfying state and commonwealth requirements	Section 1.5 and Appendix B
Existing information may be used instead of new survey work, provided that the data is derived from previous surveys at the site consistent with the above methodology	Section 1.5.2
Discuss all foreseen direct and indirect impacts on vegetation and the potential level of environmental harm to the ecological values of the area	Section 5.2 and Section 6.3
Provide digital spatial data of clearing within the railway corridor in ESRI shapefile format	See Volume 3
Describe action plans for protecting rare or threatened species and vegetation identified as having high conservation value	Section 3 and Section 6.3
Weed management strategies are required for containing existing weed species and ensuring no new plants are introduced	Section 5.4 and Section 6.6
Measures to mitigate the impacts of the project on vegetation types identified as having high conservation values	Section 5.2 and Section 6.3
3.3.3 Terrestrial Fauna	
Describe the terrestrial and riparian fauna occurring in the areas affected by the proposal	Section 2.4, Appendix B and Section 3
The assessment of potential impact should discuss all foreseen direct and indirect effects, including direct and indirect impacts due to loss of habitat, cumulative effects and threatening processes leading to progressive loss	Section 5 and Section 6
Strategies for protecting rare or threatened species should be described	Section 5.2 and Section 6.3
Describe and assess the potential impacts of any actions of the project or likely impacts that will require an authority	Section 1.4
Provide the mitigation strategies	Section 5 and Section 6



Terms of Reference	Section
3.3. Nature Conservation	Section
Outline how these measures will be implemented in the EMP	Section 5, Section 6 and Volume 2, Section 13
Outline EPBC or State recover plans for potentially affected threatened species	Section 3.2.5, Section 3.4.3
Address feral animal management strategies and practices	Section 5.4 and Section 6.6

1.3 Assessment Scope

A combination of desktop assessments and field studies were undertaken to describe the existing terrestrial ecological values of the Project Area. Desktop studies provided information on mapped vegetation assemblages, sensitive areas and flora and fauna species presence (known or predicted) within and/or of relevance to the Project Area. Field studies allowed for desktop-derived information to be ground-truthed and supplemented, thereby providing detailed and current information on the existing terrestrial ecological values of the Project Area. Surveys particularly sought to document the occurrence of conservation significant terrestrial ecological values, including:

- ▀ Of concern and endangered regional ecosystems (REs) protected under the Queensland *Vegetation Management Act 1999* (VM Act)
- ▀ REs that are constituents TECs protected under the EPBC Act
- ▀ Queensland Department of Natural Resources and Mines (DNRM) mapped Essential Habitat
- ▀ ESAs identified by DEHP
- ▀ Protected areas
- ▀ Locally and regionally important habitat remnants and habitat corridors
- ▀ Flora and fauna species listed as critically endangered, endangered or vulnerable under the EPBC Act
- ▀ Fauna species listed as 'migratory' and/or 'marine' under the EPBC Act
- ▀ Flora and fauna species listed as endangered, vulnerable, near threatened or special least concern under the NC Act (and its regulations, namely the *Nature Conservation (Wildlife) Regulation 2006*)
- ▀ Priority flora and vertebrate fauna species identified in the *Burdekin Natural Resource Management (NRM) Region Back on Track Actions for Biodiversity* report (DERM, 2010a)

In characterising the terrestrial ecological values of the Project Area, potential impacts arising from construction and operation of the Project (Mine) were identified. The risk associated with these impacts to identified terrestrial ecological values was determined. Mitigation measures and management actions seeking to avoid/minimise/reduce the risk associated with identified impacts to the terrestrial ecological values of the Project Area were developed.

Outlined in the following section is an overview of the key regulatory instruments of relevance to this terrestrial ecology assessment.

1.4 Legislation and Policy

1.4.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Commonwealth's principal piece of environmental protection legislation. It provides a national framework for the protection of the Australian environment and its unique biodiversity.

Specifically, the EPBC Act aims to protect the environment by reducing significant impacts to matters of national environmental significance (matters of NES), these being:

- ▶ World heritage properties
- ▶ National heritage places
- ▶ Wetlands of international importance (listed under the Ramsar Convention)
- ▶ Listed threatened species and ecological communities
- ▶ Migratory species (protected under international agreements)
- ▶ Commonwealth marine areas
- ▶ Great Barrier Reef Marine Park
- ▶ Nuclear actions

The EPBC Act also provides a systematic framework for assessment and approval of actions potentially impacting matters of NES. The Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) on 18 November 2010 (EPBC 2010/5736). It was declared a 'controlled action' requiring assessment and approval under the EPBC Act on 6 January 2011. The controlling provisions for the Project (i.e. those matters of NES which the Project (Mine and Rail) is likely to have a significant impact on) include:

- ▶ World Heritage properties (section 12 & 15A)
- ▶ National Heritage places (section 15B & 15C)
- ▶ Wetlands (Ramsar) (section 16 & 17B)
- ▶ Listed threatened species and communities (sections 18 & 18a)
- ▶ Listed migratory species (section 20 & 20A)
- ▶ Great Barrier Reef Marine Park (section 24B & 24C)

1.4.2 Commonwealth EPBC Act Environmental Offsets Policy

The Commonwealth Government's EPBC Act Environmental Offsets Policy outlines the Australian Government's position on the use of environmental offsets under the EPBC Act. While offsets may not necessarily ameliorate 'onsite' impacts to matters of NES, they seek to provide a net environmental gain through targeted actions (onsite or offsite). Under the EPBC Act, environmental offsets can be used to maintain or enhance the health, diversity and productivity of the environment as it relates to matters protected by the Act. However, environmental offsets are not applicable to all approvals under the EPBC Act, and they should not be applied where the impacts of a development are considered to be minor in nature or could reasonably be mitigated.

1.4.3 Queensland State Development and Public Works Organisation Act 1974

On 26 November 2010 the Project was declared a 'significant project' requiring an EIS under section 26(1)(a) of the *State Development and Public Works Organisation Act 1974* (SDPWO Act). The Commonwealth has accredited the Queensland EIS process under the SDPWO Act and as such, the Project will be assessed by the Commonwealth Environment Minister under the bilateral agreement with the Queensland Government. Approval for the Project under Part 9 of the EPBC Act will be required from the Commonwealth Environment Minister before it can proceed.

1.4.4 Queensland Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) provides for the conservation of nature through protection of all native plants and animals in Queensland. Protection is provided under the NC Act through conservation of land as protected areas and wildlife protection outside of protected areas. Actions impacting on protected native flora and fauna are regulated under the NC Act. Permits for disturbance to native flora and fauna can be administered under the NC Act. The *Queensland Nature Conservation (Wildlife) Regulation 2006* lists flora and fauna species considered to be extinct in the wild, endangered, vulnerable, near threatened and least concern in Queensland.

1.4.5 Queensland Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act) provides a framework for the regulation of woody, terrestrial native vegetation located outside of protected areas. The stated purpose of the Act is to regulate the clearing of native vegetation in a way that:

- Conserves remnant vegetation that is an endangered, of concern or least concern RE
- Conserves vegetation in declared areas
- Ensures clearing does not cause land degradation
- Prevents biodiversity loss
- Maintains ecological processes
- Manages the environmental effects of the clearing to ensure the above purposes are obtained
- Reduce greenhouse gas emissions

The VM Act provides for the establishment and mapping of REs that encompass vegetation community descriptions within a geological and bioregional context, and for the creation and use of clearing codes (among other things). In addition, it provides a process for applying to change RE mapping and for the investigation and prosecution of clearing offences. Details on what clearing activities require assessment against the various regional clearing codes authorised under the VM Act are provided by the *Sustainable Planning Act 2009* (SP Act).

1.4.6 Queensland Sustainable Planning Act 2009

The purpose of the *Sustainable Planning Act 2009* (SP Act) is to achieve ecological sustainability by:

- Managing the process by which development takes place, including ensuring that the process is accountable, effective and efficient and delivers sustainable outcomes
- Managing the effects of development on the environment
- Providing for the coordination and integration of planning at the local, regional and State levels

For the most part, the SP Act is not applicable to the Project (Mine), which will be assessed under the provisions of the SDPWO Act, and regulated under the various Acts relating to mining in Queensland. However, Schedule 24 of the *Sustainable Planning Regulation 2009* (the SP Regulation) outlines purposes for which clearing of native vegetation may be conducted without a permit. Of relevance for the Project, Schedule 24 of the SP Regulation states that mining activities are exempt from the requirement for a clearing permit under the SP Act.



Some SP Act approvals will be required, for example for development that takes place outside of the proposed mining lease areas including the offsite infrastructure.

1.4.7 Queensland Land Protection (Pest and Stock Route Management) Act 2002

The *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) identifies declared pest plant and animal species, and provides for their control. The LP Act imposes a legal responsibility on all landowners to control declared species on their land (subject to certain conditions). Specific management actions are required by landholders depending on the classification of declared pests under the LP Act, with three separate categories of declared pest prescribed being Class 1, Class 2 and Class 3. Landowners are required to remove Class 1 and Class 2 pests from their property and prevent them spreading to other areas. Class 3 pests cannot be sold or traded but are required to be controlled only if growing adjacent to an environmentally sensitive area (as declared by local councils).

1.4.8 Queensland Environmental Protection Act 1994

The aim of the *Environmental Protection Act 1994* (the EP Act) is to protect Queensland's environment while allowing for development that improves the quality of life as well as maintaining the ecological processes on which it depends. Environmental aspects of mining activities are regulated under the EP Act and mining activities must be in accordance with an environmental authority issued under this Act.

The EP Act also imposes a general environmental duty on all persons (including corporations) not to conduct any activity that causes, or is likely to cause, environmental harm, unless they take all reasonable and practicable measures to prevent or minimise the harm.

The Environmental Protection Regulation 2008 identifies environmentally relevant activities (ERAs) prescribed under the EP Act, including mining activities. The Mine is classified as a Level 1 mining activity. A site specific environmental management plan is required as part of the application of an environmental authority for the Project. Among other matters, the regulation also defines Category A, Category B and Category C ESAs.

1.4.9 State Planning Policy (SPP) 4/11: Protecting Wetlands of High Ecological Significance in Great Barrier Reef Catchments (Wetlands SPP)

The Wetlands SPP seeks to ensure development involving high impact earthworks in or near wetlands of high ecological significance (HES) is planned, located, designed, constructed and operated appropriately. The Wetlands SPP took effect on 25 November 2011. DEHP has produced a map of referable wetlands, indicating where the Wetlands SPP applies. Wetlands considered being of HES in Great Barrier Reef catchments have been mapped as Wetland Protection Areas. These core protection areas have a 500 metre assessable development trigger area (measured from the wetland boundary) around them. The Wetlands SPP includes an assessment code to guide decision makers with regards to future development in wetlands considered to be of HES in Great Barrier Reef catchments.

1.4.10 Queensland Government Environmental Offsets Policy Framework

The Queensland Government Environmental Offsets Policy provides a framework for the use of environmental offsets in Queensland, in order to counterbalance unavoidable, negative environmental impacts that result from an activity or a development. This policy is based on the premise that offsets are used consistently and transparently across the State, and are only considered after all environmental impacts have been avoided and minimised and all other government environmental standards have been met.

In Queensland, four issue-specific offset policies have been developed to provide detailed direction for offsets that address specific environmental issues:

- Policy for Vegetation Management Offsets (Version 3)
- Queensland Biodiversity Offsets Policy (QBOP) (Version 1)
- Fish Habitat Management Operational Policy (FHMOP 005): 'Mitigation and Compensation for Works or Activities Causing Marine Fish Habitat Loss'
- Koala Habitat — 'Offsets for Net Gain of Koala Habitat in South East Queensland Policy'

The QBOP applies to activities undertaken on a mining lease while the Policy for Vegetation Management Offsets will apply to offsite infrastructure. Based on the location of the Project and the environmental values documented here, the FHMOP 005 and the Offset for Net Gain of Koala Habitat in South East Queensland will not apply to the Project.

1.5 Methods – EPC 1690 Study Area

This section outlines the approach to describing the existing terrestrial ecological values of the **EPC 1690 Study Area**. The methods for describing the terrestrial ecological values of the **EPC 1080 Study Area** are largely similar to those detailed below, with any differences detailed in Appendix B.

1.5.1 Nomenclature

Scientific and common names for flora and fauna are consistent with those used in the following sources:

- Census of the Queensland Flora (Bostock and Holland, 2010) and botanical binomials presently accepted by the Queensland Herbarium, DEHP
- Handbook of Australian, New Zealand and Antarctic Birds Volume 1 – Volume 7 (Oxford University Press, 1990-2006)
- A Field Guide to the Mammals of Australia (Menkhorst and Knight, 2004)
- A Complete Guide to Reptiles of Australia (Wilson and Swan, 2008)
- A Field Guide to Australian Frogs (Barker *et al*, 1995)

1.5.2 Desktop Assessment

Information relating to the terrestrial ecological values of the region was obtained from a variety of sources. Details of these sources are provided in Table 1-2.

Table 1-2 Summary of desktop information sources

Source and name	Description of information source	Desktop Search extent	Limitations of use
Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) Protected Matters Search Tool and Environmental Reporting Tool	The SEWPAC Protected Matters Search Tool identified matters of NES and other matters protected by the EPBC Act that may occur within or relate to the EPC 1690 Study Area. The tool predicts the potential presence of a species/ecological community in an area based on bioclimatic modelling, known distribution and habitat preferences. The SEWPAC Environmental Reporting Tool was also queried to provide information on invasive species that have the potential to occur, and nationally important wetlands within or near the EPC 1690 Study Area.	A point search (approximating with the centre of the EPC 1690 Study Area: -22.041, 146.364) with a 50 km buffer was searched.	This is a predictive tool only – it does not necessarily indicate that a species/ecological community occurs in a defined area. Presence of a species/ecological community is predicted based on a combination of bioclimatic modelling, known distribution and habitat preferences. In predicting species/community presence, it allows for field survey efforts to be targeted.
SEWPAC Directory of Important Wetlands	The Directory identifies nationally important wetlands. The SEWPAC Protected Matters Search Tool (see above) lists nationally important wetlands occurring within or related to prescribed search extents.	A point search (approximating with the centre of the EPC 1690 Study Area: -22.041, 146.364) with a 50 km buffer was searched via the SEWPAC Environmental Reporting Tool (see above).	NA - this mapping identifies the location of wetlands that satisfy at least one criterion agreed upon by the Australian and New Zealand Environment and Conservation Council Wetlands Network in 1994.
DNRM Regional ecosystem (RE) mapping	The Queensland DNRM maps remnant vegetation using the RE classification system. REs are defined as 'vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil' (Sattler and Williams, 1999). REs are classified under the Queensland VM Act as being endangered, of concern or least concern.	Mapping was obtained for the EPC 1690 Study Area and the adjacent landscape in an electronic data layer for analysis in a Geographic Information System (GIS) environment.	RE mapping is informed by interpretation of landform, substrate, photo/satellite imagery and where available, field data. The mapping has undergone little or no ground-truthing in many parts of Queensland. Because of this, and the scale at which the mapping is created, RE mapping does not always accurately depict vegetation assemblages on the ground. As such, ground-truthing of REs is a fundamental aspect of field studies for ecological survey.

Source and name	Description of information source	Desktop Search extent	Limitations of use
DEHP Environmentally Sensitive Areas Map – Mining Activities	ESAs identified under the Queensland EP Act and represent locations with environmental values that contribute to maintaining biological diversity and integrity, have intrinsic or attributed scientific, historical or cultural heritage value, or are important in providing amenity, harmony or sense of community. ESAs are defined and mapped as either Category A, B or C areas and impacts to each ESA category are subject to separate environmental conditions.	An area search based on EPC 1690.	Mapped information is provided as an information source only. ESAs identified on the map may require field survey and ground-truthing exercises for accuracy. Some boundaries and indicated values presented may change over time.
DNRM Regrowth vegetation mapping	Mapped 'high value regrowth vegetation' produced by DNRM.	Mapping obtained for the EPC 1690 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	Regrowth mapping is informed by statewide landcover and tree study (SLATS) foliage protective cover (FPC) and pre-clearing RE mapping. The mapping has undergone little or no ground-truthing in many parts of Queensland and as like the RE mapping does not always accurately depict on the ground characteristics As such, ground-truthing is required.
DNRM Essential habitat mapping	Essential Habitat is defined as 'vegetation in which a species that is endangered, vulnerable or near threatened under the NC Act has been known to occur' (DERM, 2011a). DNRM maps Essential Habitat (and Essential Regrowth Habitat) in conjunction with remnant and regrowth vegetation mapping.	Mapping obtained for the EPC 1690 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	As Essential Habitat and Essential Regrowth Habitat mapping is underpinned by RE/regrowth mapping, the constraints associated with mapping scale and lack of ground-truthing are applicable to this information source.
DEHP Wetland mapping	Various mapping layers produced by DEHP (including Wetland Protection Areas).	Mapping obtained for the EPC 1690 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	Wetlands are identified using the DEHP AquaBAMM Methodology – the on-ground values of individual wetlands identified through this methodology have not necessarily been assessed, as designation is primarily based on existing literature and expert opinion. As such, designation does not reveal the value of these systems for local flora and fauna.

Source and name	Description of information source	Desktop Search extent	Limitations of use
DEHP Biodiversity Planning Assessment mapping – Brigalow Belt bioregion and Desert Uplands bioregion and Biodiversity Planning Assessment (BPA) expert panel reports	Identifies landscape scale biodiversity features at varying levels of significance (local, regional, state). The mapping methodology is underpinned by DNRm's RE mapping. Expert panel reports provide information on the landscape-scale values of bioregions, and in some instances identify bioregional priority taxa.	Mapping obtained for the EPC 1690 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	As BPA mapping is underpinned by RE mapping, the constraints associated with mapping scale and lack of ground-truthing is applicable to this information source.
DEHP Burdekin Natural Resource Management (NRM) Region Back on Track Actions for Biodiversity report (DERM, 2010a)	This document identifies priority species in the Burdekin NRM region, details the regional threatening processes impacting upon these species, and proposes a range of actions to address regional threats. Priority taxa are identified through the DEHP Back on Track species prioritisation framework, in consultation with a range of stakeholders from the region. The document seeks to guide priority species conservation in the region over the next five years.	The document covers the entire Burdekin NRM region (in which the EPC 1690 Study Area occurs).	Some species/impacts listed in this document are not relevant to the EPC 1690 Study Area, as the Burdekin NRM region encompasses a large area of central Queensland.
DEHP Wildlife Online database	The DEHP Wildlife Online database maintains a catalogue of animal and plant species records from specific localities across Queensland. As well as common species, records of animals and plants listed as threatened under the NC Act are contained within the database.	A point search (approximating with the centre of the EPC 1690 Study Area: -22.041, 146.364) with a 50 km buffer was searched.	This database catalogues known records of species in a defined area. DEHP recommend that independent verification of records should be undertaken to inform the accuracy and completeness of information catalogued within this database (i.e. field surveys).

Source and name	Description of information source	Desktop Search extent	Limitations of use
DEHP (Queensland Herbarium) HERBRECS specimen database	The HERBRECS database catalogues flora specimen records obtained throughout Queensland.	A rectangular area was searched, such that the diagonal extending from the approximate centre of the EPC 1690 Study Area (22.041, 146.364) to each corner was 50 kms. The co-ordinates of the search were between latitudes - 21.598 and -22.512, and longitudes 145.865 and 146.837.	This database catalogues known records of species in a defined area. The age of species records may limit their value for inclusion in current studies in some instances.
Queensland Museum Queensland Museum Data Search	The Queensland Museum catalogues vertebrate fauna specimen records obtained throughout Queensland.	A rectangular area was searched, such that the diagonal extending from the approximate centre of the EPC 1690 Study Area (22.041, 146.364) to each corner was 50 kms. The co-ordinates of the search were between latitudes - 21.598 and -22.512, and longitudes 145.865 and 146.837.	This database catalogues known records of species in a defined area. The age of species records may limit their value for inclusion in current studies in some instances.
Birds Australia Bird Atlas Data	Birds Australia maintains a database of bird records from across Australia.	A rectangular area was searched, such that the diagonal extending from the approximate centre of the EPC 1690 Study Area (22.041, 146.364) to each corner was 50 kms. The co-ordinates of the search were between latitudes - 21.598 and -22.512, and longitudes 145.865 and 146.837.	This database catalogues known records of species in a defined area. The age of species records may limit their value for inclusion in current studies in some instances.

1.5.3 Field Surveys

Seasonal field surveys were conducted to identify the existing terrestrial ecological values of the EPC 1690 Study Area and to supplement and ground-truth the information obtained from the desktop assessment. Field surveys conducted within the EPC 1080 Study Area were largely analogous those detailed below, with any differences detailed in Appendix B.

The 'Spring 2010' survey was undertaken between 9 November 2010 and 13 November 2010. The 'Autumn 2011' survey was undertaken over three five day periods in April and May 2011:

- ▶ Week 1: 5 April 2011 – 9 April 2011
- ▶ Week 2: 13 April 2011 – 17 April 2011
- ▶ Week 3: 4 May 2011 – 8 May 2011

All weather data presented below was sourced from the nearest Australian Bureau of Meteorology (BOM) weather station – Clermont Sirius Street (Station ID035019), located approximately 150 km south-east of the EPC 1690 Study Area (BOM, 2011).

In the three months leading up to the Spring 2010 survey (i.e. August – October 2010) 308.8 millimetres (mm) of rain was recorded in Clermont. This is well above the long-term average (1870-2010) of 74.8 mm for these three months (BOM, 2011). During the five day survey period in early November, conditions were typically warm, humid and cloudy during the day, and mild at night. Average minimum and maximum temperatures in Clermont were 19.3 °C and 29.5 °C, respectively. Rainfall events occurred on several days, particularly Thursday 11 November and Friday 12 November, 2010. In Clermont, 89.8 mm of rain were recorded during the survey period, of which 88.8 mm were recorded on Saturday November 13, 2010 (Table 1-1-3).

In the three months leading up to the Autumn 2011 survey (i.e. January – March 2011) 277 mm of rain was recorded in Clermont. This is marginally below the long-term average (1870-2010) of 306.7 mm for these three months (BOM, 2011). Weather conditions during the Autumn 2011 survey were typified by warm, clear days and mild to cool nights. Average weather conditions for each of the three survey weeks are summarised in Table 1-1-3.

Table 1-1-3 Average weather conditions during field surveys

Survey Period	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
Spring 2010	19.3	29.5	89.8
Autumn 2011			
Week 1 – April	15.1	27.3	0.0
Week 2 – April	15.0	27.6	2.2
Week 3 - May	10.9	25.5	2.0

1.5.4 Terrestrial Flora

1.5.4.1 Overview

Flora surveys were undertaken at 20 comprehensive survey sites and 160 rapid assessment sites. Locations of terrestrial flora survey sites are presented in Figure 1-3. GPS coordinates for each survey site are provided in Appendix C. Flora surveys undertaken within the EPC 1080 Study Area are detailed in Appendix B. Comprehensive sites equate to a secondary level of survey using the CORVEG methodology developed by the Queensland Herbarium and outlined in *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al*, 2005).

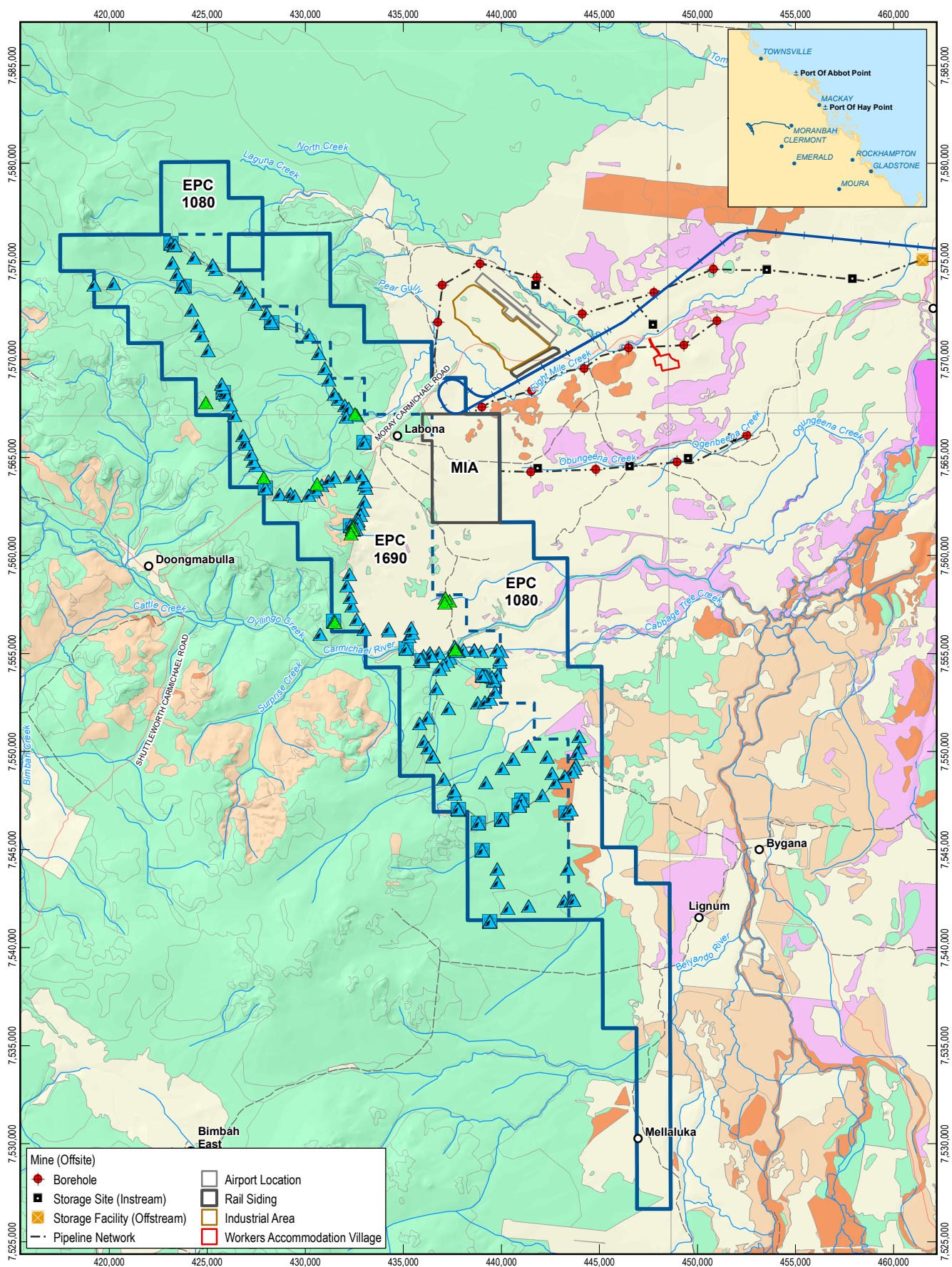
A summary of flora survey methods employed at comprehensive survey sites and rapid assessment sites is shown in Table 1-4. These methods are described in greater detail below.

Table 1-4 Summary of terrestrial flora survey methods

Comprehensive survey sites	Rapid survey sites	Targeted and random meander searches
▶ CORVEG secondary site methodology used ▶ Quadrat sampling (500 square metres (m²)) ▶ Complete site lists of woody and non-woody flora species ▶ Three measures of abundance collected for woody species, non-woody species relative abundance measured ▶ RE verification ▶ General site description with notes recorded on landform, geology, soils, past disturbance and weeds ▶ All sites photographed extensively	▶ Equates to a quaternary CORVEG site ▶ Plotless sampling technique ▶ Level of detail collected varies – at all sites, dominant species recorded ▶ Extensive species lists generated at a number of sites ▶ RE verification ▶ Brief notes recorded on landform, geology, soils, weeds	▶ Literature review conducted to determine habitat requirements of rare and threatened species ▶ Targeted searches conducted onsite based on habitat requirements ▶ Random meander searches were also utilised

Flora surveys were conducted in areas of remnant vegetation including mapped REs. Flora sampling methods included:

- ▶ Quadrat sampling
- ▶ Site species lists
- ▶ Random meander and targeted habitat search techniques
- ▶ Verification of REs using quaternary site assessments
- ▶ Site descriptions



LEGEND

- | | | | | |
|--|---|--|---|--|
| <ul style="list-style-type: none"> Flora Rapid Survey Site - Spring 2010 Survey Flora Rapid Survey Site - Autumn 2011 Survey Flora Comprehensive Survey Site - Autumn 2011 Survey | <ul style="list-style-type: none"> Homestead Local Road Track Watercourse | <ul style="list-style-type: none"> Rail (West) Mine (Onsite) Mine Infrastructure Area | <ul style="list-style-type: none"> Regional Ecosystems v6.1 Endangered - Dominant Endangered - Sub-dominant Of Concern - Dominant | <ul style="list-style-type: none"> Of Concern - Sub-dominant Of Least Concern Non-remnant |
|--|---|--|---|--|

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
Terrestrial Flora Survey Sites

Job Number 41-25215
Revision D
Date 05-09-2012

Figure 1-3

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1.5.4.2 Quadrat Sampling

Quadrat assessments were conducted at sites considered to be representative of a particular vegetation community. Ecotonal boundaries and areas of disturbance were avoided. At these sites, a 10 x 50 metre (m) quadrat was investigated to a secondary CORVEG level. Approximately three secondary sites were investigated in each broad vegetation community.

Within each quadrat, the following information was recorded:

- ▀ Site observations such as soils, geology, apparent disturbance including clearing/fire/flood history, landform, slope, aspect, weed cover and presence of grazing
- ▀ Vegetation community details including strata present, stratum height and cover, and dominant species composition of each strata
- ▀ All vascular plant species present (voucher specimens were sent to the Queensland Herbarium for identification where necessary), with abundance data collected by measuring the basal area (with a Bitterlich stick), stem count (for trees and shrubs only) and relative abundance (recorded by stratum)
- ▀ Vegetation condition was recorded using the VAST (Vegetation Assets, States and Transitions) methodology (Thackway and Lesslie, 2005)
- ▀ A minimum of six photographs were taken at each transect – one each looking inwards along the centreline, with two at the centre point at each end facing diagonally across the quadrat

1.5.4.3 Site Species Lists

At each of the comprehensive sampling sites, a complete species inventory was collected from within the transect. Quaternary site data can be conducted at a range of intensities. At most quaternary sites, a brief list of the dominant species and relevant landscape information was collected, although in some cases, quaternary site data included a relatively detailed species list.

Plant species were either identified in situ or collected for later identification. For species for which identification or confirmation was required, a vouchered specimen was sent to the Queensland Herbarium.

1.5.4.4 Random Meander and Targeted Habitat Searches

The random meander technique (Cropper, 1993) is a widely accepted method to survey for rare or threatened plant species or other species of interest that may not occur in surveyed quadrats or sample sites. It involves traversing sections of the EPC 1690 Study Area at random searching for flora species that may not have been located using more structured search methods. This technique is particularly suitable for locating species that typically occur at very low densities, or that may be grouped in isolated clumps, as is often the case with many plants listed as rare or threatened.

In addition, literature reviews of habitat requirements were used to assist in targeted searches for rare and threatened species.

1.5.4.5 Verification of Mapped Regional Ecosystems

Regional ecosystems that appear on the certified mapping for the EPC 1690 Study Area were verified at 160 quaternary level sites. Quaternary site assessments are used primarily as a record of field traverses and to verify RE/vegetation mapping. The objective of quaternary surveys (as they were

undertaken for this Project) was to gather enough information to confirm and ground-truth existing or suspected vegetation community mapping, and the level of information recorded was adjusted accordingly. As a minimum, dominant species were recorded for the ecologically dominant layer (generally the tallest layer, with the exception of emergent layers). Quaternary sites were collected wherever possible when vegetation patterns were observed to have changed.

1.5.5 Terrestrial Fauna

1.5.5.1 Permits

All surveys were conducted in accordance with the Queensland *Animal Care and Protection Act 2001* and the following permits: GHD Scientific Users Registration Certificate (Registration Number 132) and Queensland Government Scientific Purposes Permit (Permit Number WISP06498409). Survey techniques were approved by the Queensland Government accredited GHD Animal Ethics Committee.

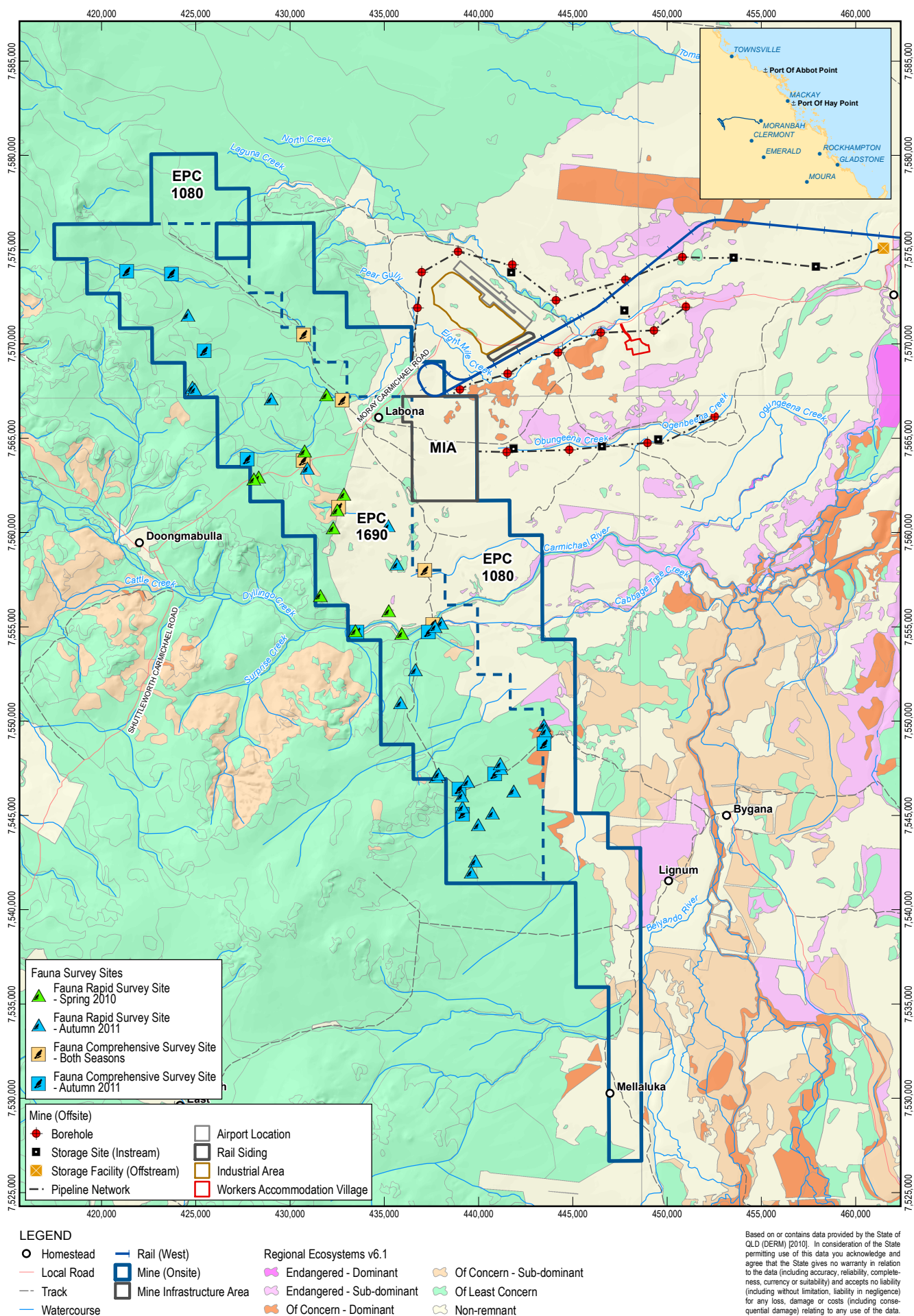
1.5.5.2 Overview

Terrestrial fauna surveys were undertaken at 16 comprehensive survey sites and 36 rapid assessment sites. The distribution of fauna survey sites across the EPC 1690 Study Area is presented in Figure 1-4. Fauna surveys undertaken within the EPC 1080 Study Area are detailed in Appendix B.

Survey sites were selected to sample representative vegetation communities and fauna habitat types present in the EPC 1690 Study Area. Sites were selected using a two-step process, incorporating desktop information and ground-truthing in the field. RE mapping and aerial photography were primarily used to provide a broad indication of the diversity and distribution of habitats across the EPC 1690 Study Area to select potential survey sites. Factors considered in identifying potential sites included RE type, representation of REs across the EPC 1690 Study Area, accessibility and presence of protected areas (i.e. wetland protection areas). During a one day site reconnaissance visit (October 2010) potential sites were refined. The subset of sites aimed to maximise the number of sites and range of habitats to be sampled within project timeframes while providing adequate representation for description of the site. A total of 16 sites were assessed comprehensively during the survey program in addition to other rapid assessment locations. These represent the habitats within the EPC 1690 Study Area and provide spatial variation in assessment.

For the purposes of this assessment, terrestrial fauna are defined as animals that only spend limited periods of time in aquatic environments. This includes amphibians and water birds. Fish, freshwater turtles, aquatic macroinvertebrates and platypus are considered in the Mine Aquatic Ecology Report (Volume 4, Appendix O1).

Terrestrial fauna survey methods employed at comprehensive and rapid survey sites are summarised in Table 1-5. Each method is described in greater detail below, including surveys for threatened terrestrial fauna species (Table 1-6). Sampling effort at each comprehensive survey site is summarised in Table 1-7 and presented in Appendix C.



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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
Terrestrial Fauna Survey Sites

Job Number 41-25215
Revision D
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Figure 1-4

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Table 1-5 Summary of terrestrial fauna survey methods

Comprehensive survey sites	Rapid assessment sites	Other areas throughout EPC 1690 Study Area
- Systematic trapping (typically 20 Elliott 'A' traps, 10 cage traps, 8 funnel traps, 4 pitfall traps*) - Habitat assessment - Opportunistic search for wildlife traces - Three standardised (20 minute) bird surveys - One hour of active searches for herpetofauna - One night (minimum) of ultrasonic bat detection (Anabat) - Standardised spotlighting for nocturnal fauna - Call-playback for owls	<u>All rapid assessment sites</u> - Habitat assessment - Opportunistic search for wildlife traces - One standardised (20 minute) bird survey - Half an hour of active searches for herpetofauna <u>Some rapid assessment sites</u> - One night (minimum) of ultrasonic bat detection (Anabat) - Standardised spotlighting for nocturnal fauna - Call-playback for owls	- Remote camera - Water body watches - Opportunistic wildlife records

*Pitfall traps only used at some comprehensive survey sites. Where pitfall trapping not undertaken, four additional funnel traps were deployed. Refer to Appendix C for sampling effort at each comprehensive survey site.

1.5.5.3 Terrestrial Habitat Assessment

Terrestrial habitat assessments were undertaken at each of the 16 comprehensive (i.e. fauna trapping) survey sites and at 36 rapid assessment sites throughout the EPC 1690 Study Area. The following parameters were recorded during habitat assessments:

- Landscape context (size, shape, connectivity or relative isolation of habitat remnants)
- Structural and floristic complexity of vegetation (i.e. tree density, canopy cover, vertical structural complexity of vegetation strata – canopy, shrub and understorey layers, ground cover)
- Structural complexity and relative heterogeneity of ground-level microhabitats (i.e. substrate type, vegetation cover, leaf litter, woody debris, presence of rocks, logs or boulders)
- Habitat features (i.e. hollows, fallen logs, rock outcrops, nests, burrows, water bodies, gilgais)
- Relative abundance of hollows and hollow-bearing (habitat) trees
- Sources of disturbance (i.e. adjacent land-uses, feral animals, predation, weed infestation)

1.5.5.4 Systematic Trapping Surveys

Systematic trapping for small ground-dwelling fauna was undertaken at each of the 16 comprehensive survey sites. This involved a five day, four night survey of each site using cage traps, Elliott 'A' traps and pitfall/funnel trap/drift fence complexes.

At each site, traps were deployed along two parallel linear transects comprising (up to) 20 Elliott 'A' traps and (up to) 10 cage traps, set within optimal microhabitats. Four pitfall trap/funnel trap/drift fence complexes were placed at each site, set in areas with suitable microhabitat adjacent to the linear transects. Traps were set and checked each morning for four consecutive nights. The trap configuration comprised:

- ▶ Pitfall traps, funnel traps and drift fence: Four complexes were established at each site. Each complex consisted of a six metre long (30 centimetre high) flywire drift fence with two funnel traps along the fence line either side of a 20 litre bucket (Plate 1-1), or in some cases a third funnel. Wet sponges were placed in each bucket and funnel. These were covered with vegetation to provide shade and protection.
- ▶ Elliott 'A' box traps: Each site comprised up to 20 Elliott 'A' traps baited with universal bait (a mixture of peanut butter, rolled oats and sardines and/or honey) (Plate 1-2). Traps were located in shady areas or covered with vegetation to minimise heat exposure to animals.
- ▶ Cage traps: Up to 10 cage traps were set at each site. Cages were baited with universal bait and covered with hessian to shelter trapped animals (Plate 1-3).

Plate 1-1 Pitfall trap – funnel traps – drift-fence complexes (November 2010)



Plate 1-2 Elliott 'A' trap



Plate 1-3 Cage trap



1.5.5.5 Opportunistic Surveys for Wildlife Traces

At each comprehensive survey site, a minimum of one person hour (0.5 hours at rapid assessment sites) was spent searching for wildlife traces (i.e. bones, hair traces, tracks, scats, diggings, burrows, nests, skins) that could indicate the presence of cryptic fauna species.

1.5.5.6 Standardised Bird Surveys

Standardised bird surveys were undertaken at each comprehensive survey and rapid assessment site using the methods recommended for surveys by Birds Australia. This involved a timed 20 minute survey of a two hectare search area by one ecologist, recording the number of birds seen or heard calling. Bird surveys were undertaken in early morning or afternoon in clear conditions. Standardised bird surveys were undertaken a minimum of three times at each comprehensive survey site and once at each of the rapid assessment sites. A total of 28 person hours were dedicated to bird surveys within the EPC 1690 Study Area.

1.5.5.7 Diurnal Active Searches for Reptiles and Amphibians

Active searches were undertaken for reptiles and amphibians at each site. This involved searching beneath rocks, logs, bark, and corrugated iron and among soil and leaf litter. Vegetation at the edges of local water bodies was also searched for frogs and aquatic reptiles. Diurnal active searches were standardised by time, with each diurnal active search event lasting one person hour at each comprehensive survey site and 0.5 person hours at each rapid assessment site. A total of 34 person hours were dedicated to active searches within the EPC 1690 Study Area.

1.5.5.8 Nocturnal Spotlighting and Call-playback

Nocturnal spotlighting surveys were undertaken at comprehensive survey sites. One person hour was spent at each site, using a combination of high-powered spotlights and head torches. Visual surveys were undertaken in a two hectare area, searching trees, shrubs and understorey habitats for arboreal mammals, ground mammals, reptiles, frogs and nocturnal birds.

Call-playback surveys were undertaken at selected comprehensive sites to detect nocturnal birds. Call-playback surveys involved broadcasting the call of individual target species for two minutes. This was followed by a listening period of two minutes. Species featured in call-playback included:

- ▀ Spotted nightjar (*Eurostopodus argus*)

- ▶ White-throated nightjar (*Eurostopodus mystacalis*)
- ▶ Australian owl-nightjar (*Aegotheles cristatus*)
- ▶ Tawny frogmouth (*Podargus strigoides*)
- ▶ Southern boobook (*Ninox novaeseelandiae*)
- ▶ Barking owl (*Ninox connivens*)
- ▶ Masked owl (*Tyto novaehollandiae*)
- ▶ Eastern grass owl (*Tyto longimembris*)
- ▶ Eastern barn owl (*Tyto javanica*)

An additional 20 person hours were spent spotlighting from vehicles on roads within the EPC 1690 Study Area. These surveys targeted nocturnal ground-dwelling reptiles, owls, frogs and mammals.

1.5.5.9 Microchiropteran Bats

Anabat bat detectors were used to survey microchiropteran (insectivorous) bats by recording their echolocation calls. Detectors were placed at each of the comprehensive survey sites for a minimum of one night. Anabat units were placed in potential bat 'flyways' just before dusk and left to record calls overnight. Detectors were positioned on the ground with the microphone orientated upwards at a 45° angle from the ground. All bat calls recorded were sent to an experienced bat-call analyst (Greg Ford) for identification. Only bat calls positively identified were included in the results.

1.5.5.10 Remote Cameras

Remote cameras (Plate 1-4) were deployed for between one and four nights at 16 sites throughout the EPC 1690 Study Area. Typically these cameras were placed in areas likely to concentrate wildlife – for example, stock water troughs, dams, riparian habitats and fauna movement trails in dense vegetation. Cameras were deployed for a total of 1088 hours within the EPC 1690 Study Area.

Plate 1-4 Remote camera at stock trough (April 2011)



1.5.5.11 Threatened Terrestrial Fauna Species Surveys

In general, surveys for Commonwealth listed threatened terrestrial fauna species for which recommended survey approaches were available at the time of field surveys, were incorporated into, and undertaken via the sampling methodologies outlined above (i.e. ground-trapping and opportunistic searches for threatened reptiles, Anabat detection for threatened bats, standardised bird surveys, spotlighting surveys). Survey guidelines for threatened species prepared by the Commonwealth Government were reviewed for those threatened species considered likely to occur, or confirmed present at the EPC 1690 Study Area. The survey effort applied for these species is summarised in Table 1-6. Whilst the survey effort (i.e. number of days, number of hours) was not always met, in general, the survey techniques detailed in the applicable guidelines were employed, to assist in detection of the species listed in Table 1-6. It should be noted that at the time field surveys for the Project were undertaken, the koala was not a listed threatened species (Commonwealth). As such, targeted surveys for this species were not undertaken, although fauna surveys conducted, including habitat assessments, scat searches and spotlighting provided information relating to this species at the EPC 1690 Study Area.

Note: a targeted black-throated finch (southern) survey was undertaken across the Project Area and in the immediately surrounding landscape in May 2012. A report detailing the methods and findings of this survey is provided in Volume 4 Appendix N3 Black-throated Finch Report.

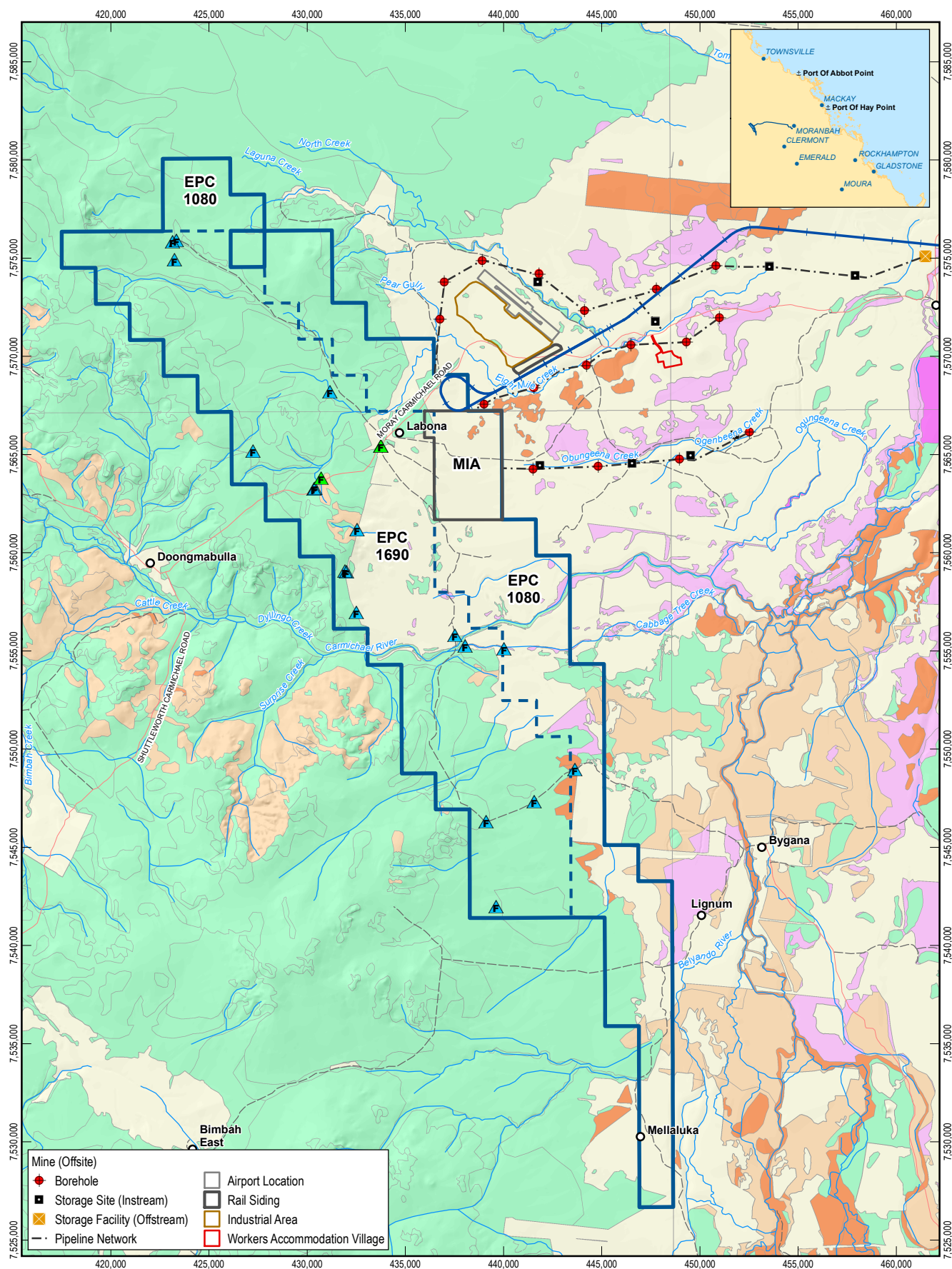
Table 1-6 Summary of threatened terrestrial fauna species surveys undertaken

Species	EPBC Act / NC Act status	Recommended survey approach and source	Surveys undertaken at EPC 1690 Study Area
black-throated finch (southern) <i>Poephila cincta cincta</i>	endangered / endangered	<i>Survey Guidelines for Australia's Threatened Birds</i> (Department of Environment, Water, Heritage and the Arts (DEWHA (now SEWPAC), 2010) - Land-based area searches (area < 50 ha) over five days for total of 10 hours - Targeted searches of waterbodies and woodswallow nests over two days for total of six hours <i>Significant Impact Guidelines for the Endangered Black-throated Finch (southern) (Poephila cincta cincta) Background Paper</i> (DEWHA, 2009a) - Targeted searches: one hour per ha with maximum of 10 hours per search area (i.e. within 600 metres of water source) - Water source observations: minimum of six hours a day for two days for each water source - Habitat assessment surveys to determine the context of the site within the broader landscape (collection of information relating to land use, vegetation (grass species diversity, presence of potential nesting trees), presence and spatial distribution of surface water, connectivity to other areas of potential habitat)	- Waterbody watches were undertaken at two locations in the centre of the EPC 1690 Study Area during the Spring 2010 survey and at 19 locations across the EPC 1690 Study Area during the Autumn 2011 survey (Figure 1-5) - A total of 41.5 person hours were invested in waterbody watches for black-throated finches (southern) during the Spring 2010 and Autumn 2011 surveys - Watches were carried out at waterbodies including farm dams, natural waterways and stock troughs - Targeted searches of vegetation around water bodies were generally not undertaken – rather, during all vehicle movements across the EPC 1690 Study Area, particularly in the vicinity of water bodies, slow driving surveys for finches were undertaken. Where finches were flushed from the ground, the birds were watched and identified when they alighted - Information recorded from surveys included the location (i.e. a waypoint and a general description of the habitat type), number of birds seen, time of day, weather conditions and other bird species present - Information collected during fauna habitat assessments, flora surveys, and desktop analyses assessed to determine extent of potential habitat for subspecies within and surrounding the EPC 1690 Study Area - Full details of targeted black-throated finch (southern) survey effort at the EPC 1690 Study Area are presented in Appendix C

Species	EPBC Act / NC Act status	Recommended survey approach and source	Surveys undertaken at EPC 1690 Study Area
squatter pigeon (southern) <i>Geophaps scripta scripta</i>	vulnerable / vulnerable	<i>Survey Guidelines for Australia's Threatened Birds</i> (DEWHA, 2010) Area searches or transects in suitable habitat	- Slow traverses of tracks (by vehicle) were undertaken, with details of any squatter pigeons (southern) observed during these traverses recorded - Information collected during fauna habitat assessments, flora surveys, and desktop analyses assessed to determine extent of potential habitat for subspecies within and surrounding the EPC 1690 Study Area
ornamental snake <i>Denisonia maculata</i>	vulnerable / vulnerable	<i>Survey Guidelines for Australia's Threatened Reptiles</i> (SEWPAC, 2011a) - Most likely to be encountered around suitable gilgai habitats when frogs are active - Driving on roads at night when frogs are active - Diurnal searches under sheltering sites (rocks, logs etc.) - Pitfall and funnel trap complexes <i>Draft Referral guidelines for the nationally listed Brigalow Belt reptiles</i> (SEWPAC, 2011b)* - Pitfall and funnel trap complexes (six x 20 litre buckets under 30 metre drift fence, with funnel trap at each end) – two replicates per habitat type, over four days of survey - Diurnal searches (1.5 hours per hectare for minimum of three days) and spotlighting (1.5 hours per hectare for minimum of three days) - Opportunistic survey of roads	- Spotlighting surveys undertaken during Spring 2010 and Autumn 2011 surveys in potentially suitable habitat, including brigalow/gilgai habitat (Fauna Site 9, Fauna Site 15 (Autumn 2011 only)) and riparian habitat (Fauna Site 6, Fauna Site 10, Fauna Site 11 (Autumn 2011 only)) (sites depicted in Figure 1-4) - During all spotlighting surveys, slow traverses of roads were undertaken - Diurnal searches (0.5 - one person hour per site, per survey (Spring 2010/Autumn 2011)) undertaken in various habitats, including one person hour of searching at survey sites featuring potentially suitable habitat (as listed above) - Pitfall and funnel trap complexes established at 16 comprehensive survey sites, including survey sites featuring potentially suitable habitat (as listed above) - Information collected during fauna habitat assessments, flora surveys, and desktop analyses assessed to determine extent of potential habitat for species within the EPC 1690 Study Area

Species	EPBC Act / NC Act status	Recommended survey approach and source	Surveys undertaken at EPC 1690 Study Area
yakka skink <i>Egernia rugosa</i>	vulnerable / vulnerable	<i>Survey Guidelines for Australia's Threatened Reptiles</i> (SEWPAC, 2011a) - Searching for burrow systems and communal defecation sites - Elliot trapping around burrows <i>Draft Referral guidelines for the nationally listed Brigalow Belt reptiles</i> (SEWPAC, 2011b)* - Diurnal searches (1.5 hours per hectare for minimum of three days) and spotlighting (1.5 hours per hectare for minimum of three days); transect searches in potentially suitable habitat - Elliot and cage trapping near possible burrow entrances (one of each trap, over four days)	- Diurnal searches and habitat assessments undertaken at 16 comprehensive (trapping) sites and 36 rapid survey sites. Searches included searches for traces of fauna (i.e. defecation sites) and searches of fauna habitat features (i.e. burrow complexes) - Elliot and cage trapping undertaken at 16 comprehensive survey sites. Microhabitats targeted where possible. - Information collected during fauna habitat assessments, flora surveys, and desktop analyses assessed to determine extent of potential habitat for species within the EPC 1690 Study Area

*Draft referral guidelines released on 23 May 2011 (after Autumn 2011 survey) – information presented here for reference purposes.



LEGEND

- Black-Throated Finch Waterbody Watch Site - Spring 2010 Survey
- Black-Throated Finch Waterbody Watch Site - Autumn 2011 Survey

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area

Regional Ecosystems v6.1

- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Of Least Concern
- Non-remnant

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1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project

Location of Black-throated Finch (southern) Water Body Watch Surveys

Job Number 41-25215
Revision D
Date 05-09-2012

Figure 1-5

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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); DERM: Regional Ecosystems v6.1 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Black Throated Finch Sites (2011). Created by: BW, CA

1.5.6 Summary of Fauna Survey Effort

Table 1-7 summarises the terrestrial fauna survey effort at the EPC 1690 Study Area. Site-specific survey effort is provided in Appendix C.

Table 1-7 Summary of terrestrial fauna survey effort

	Elliott 'A' trapping	Cage trapping	Funnel trapping	Pitfall trapping	Anabat detection	Spotlighting	Bird surveys	Diurnal active searches
	<i>Trap nights - number of nights x number of traps</i>				<i>No. of nights</i>	<i>Person hours (comprehensive sites only)</i>		
Spring 2010 survey	480	192	168	72	7	6	6	6
Autumn 2011 survey	1300	600	640	128	15	13	16	16
Total	1780	792	808	200	22	19	22	22

1.5.7 Likelihood of Occurrence Assessment

The information obtained through the desktop and field assessments was used to characterise the existing terrestrial ecological values of the Project Area (the EPC 1690 Study Area and the EPC 1080 Study Area). For conservation significant species, a likelihood of occurrence assessment was undertaken to inform the impact identification process. This assessment considered information relating to:

- ▀ Habitat preferences
- ▀ Distribution
- ▀ Relative abundance
- ▀ Previous records from the region
- ▀ The occurrence of suitable habitat at the based on field observations
- ▀ The confirmed presence of conservation significant species at the Project Area

A likelihood of occurrence ranking was attributed to each conservation significant species, based on the following framework:

- ▀ **Unlikely to occur:** species has not been recorded in the region (no records from desktop search extent as defined in Table 1-2) **AND/OR** current known distribution does not encompass Project Area **AND/OR** suitable habitat is generally lacking from Project Area
- ▀ **May occur:** species has not been recorded in the desktop search extent (as defined in Table 1-2) although species' distribution incorporates Project Area **AND** potentially suitable habitat occurs at the Project Area



- ▶ **Likely to occur:** species has been recorded in the desktop search extent (as defined in Table 1-2) and potentially suitable habitat is present at the Project Area
- ▶ **Confirmed present:** species recorded during field surveys

1.5.8 Impact Assessment

With an understanding of construction and operational activities of the proposed Mine, potential impacts to vegetation communities, flora species, fauna habitats and fauna species occurring within or of relevance to the EPC 1690 and EPC 1080 Study Areas were identified and described. Mitigation measures to avoid/minimise/offset impacts resulting from Project (Mine) activities (construction and operation) to identified terrestrial ecological values, and particularly conservation significant terrestrial ecological values were proposed.

1.6 Limitations

Limitations of the study include:

- ▶ Seasonal variability has been assessed using two field visits during spring and autumn months in combination with desktop information regarding species seasonality. Field visits were not achievable during some months as a result of site accessibility – this was especially the case during the wet season of 2011, when field teams could not access the Project Area until April. Habitat assessment and species profiles have been used to provide an understanding of the flora and fauna communities throughout the year.
- ▶ Planning and development of a Mine plan for the Project (Mine) has evolved as ecological surveys have been conducted. Initial terrestrial ecology surveys focused on the central portion of EPC 1690 (Spring 2010 survey event). This was then expanded to cover the entire area of EPC 1690 (Autumn 2011 survey event). All figures displaying survey effort for EPC 1690 differentiate between the two survey events. Additional habitat assessment efforts during the Autumn 2011 survey in conjunction with desktop species information and information from the Spring 2010 survey have been considered suitable to describe the existing environment and seasonal character for EPC 1690. The addition of the eastern portion of EPC 1080 during the Spring 2011 survey has been assessed through desktop and field surveys (refer to Appendix B).

2. Existing Environment

2.1 Introduction

This section of the report presents an overview of the baseline terrestrial ecological values of the **EPC 1690 Study Area**. The existing terrestrial ecological values of the **EPC 1080 Study Area** are detailed in Appendix B. Information presented in Section 2.2 (Regional Context) is applicable to the Project Area.

2.2 Regional Context

The Project Area is in central Queensland within the Burdekin Catchment, at the boundary of the Brigalow Belt and Desert Uplands bioregions. The vast majority of the Project Area is within the Isaac Regional Council (IRC) local government area (LGA). The extreme north-western corner of the Study Area occurs within the Charters Towers Regional Council LGA.

The nearest towns (straight line distances) to the Project Area are the small regional centres of Alpha (approximately 150 km south) and Clermont (approximately 140 km south-east). The nearest large regional centre is the town of Emerald (approximately 225 km south-east). The Project Area is approximately 320 km west of the coast of central Queensland.

2.2.1 Burdekin Catchment

The Burdekin Catchment encompasses 130,057 km² of north-east and central Queensland (DERM, 2011b). Waterways of this catchment drain into the Coral Sea at Upstart Bay via the Burdekin River. The Burdekin Catchment comprises six basins and 48 sub-catchments, which are exposed to distinct wet and dry seasons (Dight, 2009).

The Project Area is in the Carmichael River sub-catchment of the Belyando Basin (Dight, 2009). Unlike the more undulating and wetter northern part of the Burdekin Catchment which features highly erodible soils, the Belyando Basin is characterised by generally low relief floodplains drained by braided channels and surrounded by wide alluvial plains (Dight, 2009).

2.2.2 Brigalow Belt Bioregion

The Brigalow Belt bioregion occurs over 364,000 km² of central Queensland, extending from Townsville in the north to the New South Wales border (Sattler and Williams, 1999). The bioregion also extends further south through New South Wales to Narrabri (Sattler and Williams, 1999). Brigalow (*Acacia harpophylla*) forests and woodlands growing on clay soils are one of the major vegetation types that characterise the bioregion (Sattler and Williams, 1999). While historically brigalow vegetation covered up to six million hectares of the bioregion in Queensland, extensive broad scale clearing, predominantly for agriculture, has greatly reduced brigalow communities through the bioregion (Sattler and Williams, 1999). In addition to remnant brigalow vegetation, other ecosystems that typify the bioregion include eucalypt forest and woodlands, grasslands, dry rainforest, cypress pine woodland and riparian communities (Sattler and Williams, 1999).

The Interim Biogeographic Regionalisation of Australia (IBRA) divides the Brigalow Belt bioregion into the Brigalow Belt North and Brigalow Belt South (Sattler and Williams, 1999). The geology of the Brigalow Belt North bioregion features Permian volcanics and Permian-Triassic sediments, Carboniferous and Devonian sediments and volcanics, and Cambrian and Ordovician rocks (and



associated Tertiary deposits) (SEWPAC, 2009a). The climate is sub-humid to semi-arid (SEWPAC, 2009a). Approximately 1.2 per cent of the total area of the bioregion is under conservation tenure (SEWPAC, 2009a).

The Brigalow Belt North bioregion comprises 13 subregions, of which only one, the Belyando Downs subregion is intersected by the Project Area (Figure 1-2).

2.2.3 Belyando Downs Subregion

The section of the Project Area within the Brigalow Belt bioregion is located within the Belyando Downs subregion. Variable geology through the subregion is associated with a number of predominant vegetation communities, namely:

- ▀ Brigalow and gidgee (*Acacia cambagei*) communities on fine textured soils
- ▀ Silver-leafed ironbark (*Eucalyptus melanophloia*) woodlands on plateau remnants of upper Tertiary surfaces
- ▀ On Palaeozoic rock outcrops, lancewood (*Acacia shirleyi*) and bendee (*Acacia catenulata*) occurs on rocky hills with skeletal soils, and cypress (*Callitris glaucophylla*) and silver-leafed ironbark woodland occurs where deeper soils are present
- ▀ Poplar box (*Eucalyptus populnea*) woodlands and Queensland bluegrass (*Dichanthium sericeum*) grasslands on Tertiary surfaces
- ▀ Poplar box and brigalow communities on widespread alluvial deposits (Sattler and Williams, 1999)

2.2.4 Desert Uplands Bioregion

The Desert Uplands bioregion covers approximately 70,000 km² of central northern Queensland, between Blackall and Pentland (Sattler and Williams, 1999). The bioregion is dominated by sandstone ranges and sand plains, with soils that are typically of poor structure and low fertility (Sattler and Williams, 1999). The climate is semi-arid (Sattler and Williams, 1999). *Eucalyptus whitei*, *Eucalyptus similis* and *Corymbia trachyphloia* woodlands are the predominant vegetation communities in the Desert Uplands (SEWPAC, 2009b). Vegetation clearing has historically occurred in the south-east of the bioregion, corresponding with areas of acacia vegetation on heavier soils (Sattler and Williams, 1999). More recently, eucalypt woodlands on less fertile sand plains have experienced clearing (Sattler and Williams, 1999). Introduced buffel grass (*Cenchrus ciliaris*) forms extensive stands in the bioregion (Sattler and Williams, 1999). Approximately 2.3 per cent of the total area of the bioregion is under conservation tenure (SEWPAC, 2009b).

Three subregions comprise the Desert Uplands bioregion, of which only one, the Alice Tableland subregion is intersected by the Project Area.

2.2.5 Alice Tableland Subregion

The geology of the Alice Tableland subregion is characterised by sandstone ranges and extensive plains, with the most common soil type being deep red soils of intact Tertiary sand sheets (Sattler and Williams, 1999). Other, less extensive geological features of the Alice Tableland include calcareous sandstone outcrops in valleys of the central east, dune areas and associated clay lake deposits, and alluvial clay soils along watercourses (in southern areas) (Sattler and Williams, 1999). Two large internal drainage basins occur in the Alice Tableland – Lake Galilee and Lake Buchanan.

2.2.6 Land Use

Agriculture is the dominant land use in the Burdekin Catchment, with cattle grazing and cropping (particularly sugar cane) accounting for approximately 87 per cent of land use (Dight, 2009). In the Belyando Basin (in which the Project Area occurs) grazing accounts for 94.4 per cent of land use (Dight, 2009). Other land uses include conservation and minimal use (3.61 per cent), forestry (1.33 per cent), dryland agriculture (0.46 per cent), water (0.14 per cent), horticulture (0.03 per cent), mining (0.02 per cent) and urban and semi-urban (0.01 per cent) (Dight, 2009).

Cattle grazing occurs across the entire EPC 1690 Study Area. Approximately 37 per cent of the EPC 1690 Study Area has been cleared (i.e. is non-remnant vegetation). The Bygana West Nature Refuge occurs over part of the southern extent of the EPC 1690 Study Area, south of the Carmichael River. The nature refuge covers an area of approximately 1,487 ha, of which the majority is within the EPC 1690 Study Area.

A number of improvements also exist within the Project Area, such as a homestead, air strip, cattle yards, farm dams and bores.

2.3 Terrestrial Flora

2.3.1 Regional Ecosystems and Environmentally Sensitive Areas

2.3.1.1 The Regional Ecosystem Framework

REs are ordered on three levels, reflected in the three part codes used to identify them. At the highest level is the bioregion – the Queensland Herbarium (the organisation responsible for defining REs and for the initial creation of RE maps) has adopted the Stanton and Morgan (1977) bioregional mapping for Queensland as outlined in Sattler and Williams (1999). Each bioregion is given a number, which is the first number that appears in the RE code (for example, the RE 11.7.2 belongs to bioregion 11). Bioregions are in turn divided into provinces or subregions, although this information is not incorporated into the RE code (although it can be of value in determining the identification of an RE).

The second level is that of the land zone, of which there are 12 (the land zone is the second number – the RE 11.7.2 is found on land zone seven). Land zones are a landscape unit based on a combination of geology, pedology and land form pattern. The final level of organisation is the ecosystem (described in terms of the dominant vegetation in terms of above ground biomass), which is specific to a land zone within a bioregion (unlike bioregional organisation and land zone units, which are consistent across Queensland) (Sattler and Williams, 1999). Therefore, the RE 11.7.2 is the second described ecosystem on land zone seven in bioregion eleven. Ecosystem descriptions within each bioregion have been derived from Queensland Herbarium detailed sampling in combination with other published sources, which are usually quoted with each RE description.

REs are rated or classed in two ways. Under the VM Act, the remnant extent of an RE is measured against the estimated extent before Europeans began clearing (Sattler and Williams, 1999). This is a quantitative measure of an RE's remnant extent and has legislative force. The categories under the VM Act are as follows:

- ▶ **Endangered** REs are those that have either:
 - less than 10 per cent of the pre-clearing extent remaining or

- 10 to 30 per cent of the pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha.
- ▶ **Of concern** REs are those that have either:
 - 10 to 30 per cent of the pre-clearing extent remaining or
 - more than 30 per cent of the pre-clearing extent remaining and the remnant vegetation remaining is less than 10,000 ha.
- ▶ **Least concern** REs are those that have more than 30 per cent of the pre-clearing extent remaining and the remnant vegetation remaining is more than 10,000 ha.

The second method of rating REs is by its biodiversity status. This method takes into account the condition of the RE as well as its remnant extent. Condition is assessed based on soil quality, species diversity and the ability of species diversity to recover. In addition, the presence of threatening processes such as clearing, development pressure, inappropriate fire management, fragmentation and weed incursion are considered. Therefore, this is a rating system that combines quantitative and qualitative data with a threat assessment, assigning ratings of endangered, of concern and no concern at present. Sattler and Williams (1999) give the following rationale for these ratings:

- ▶ 'The **endangered** class is based upon the category established for plant species, namely a species at serious risk of disappearing from the wild within 10 – 20 years if present land use and other causal factors continue to operate'
- ▶ 'The **of concern** class indicates that a significant reduction in the distribution or condition of a RE has occurred and that a particular management response is needed to ensure that it does not become endangered'
- ▶ 'The **no concern at present** class indicates that the ecosystem is relatively widespread'

Unlike the VM Act classifications, the biodiversity status has no legislative force however it can be relevant to determining offsets under the QBOP.

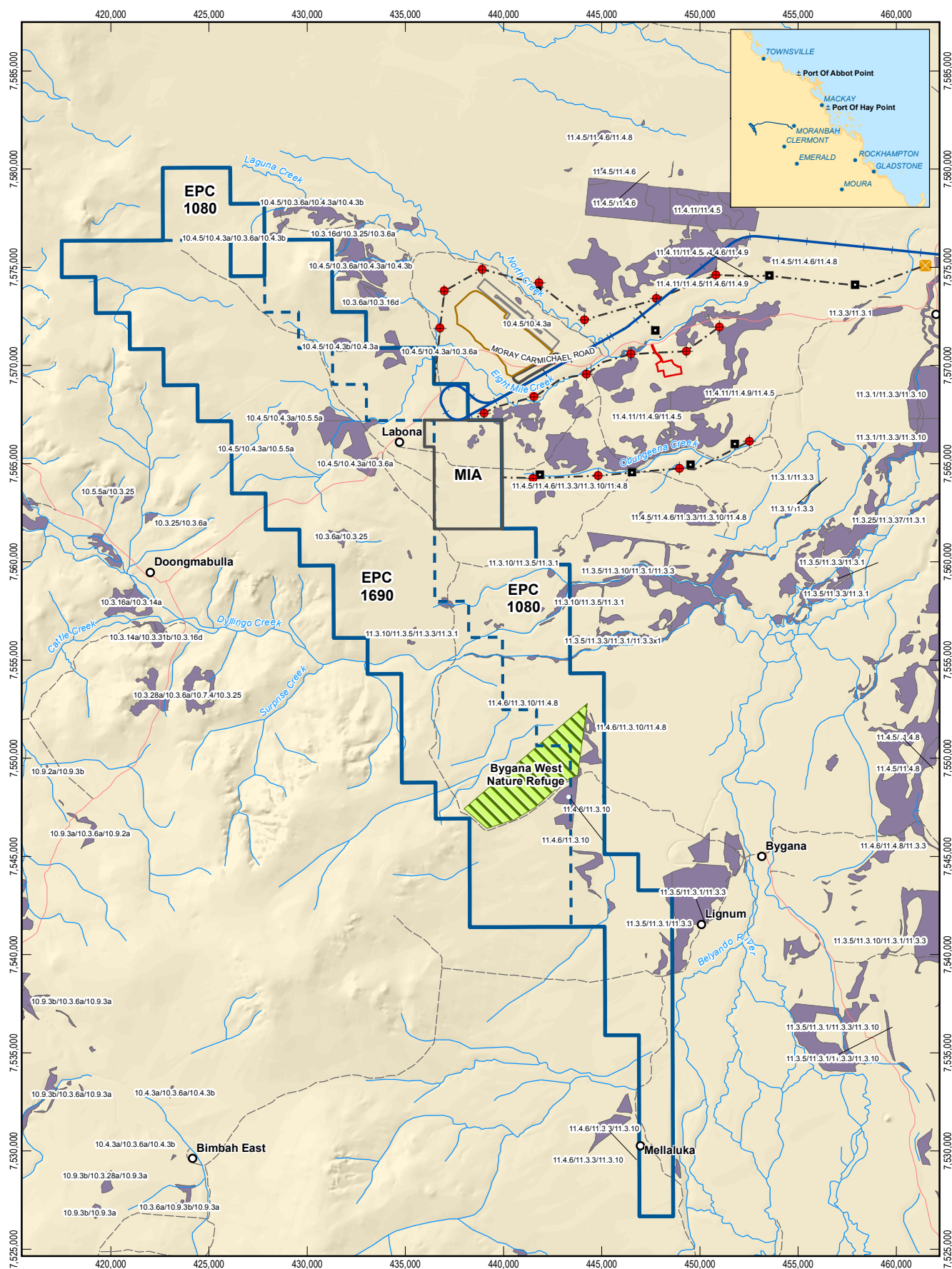
Endangered (biodiversity status) regional ecosystems are also classified as Category B ESAs under the *Environmental Protection Regulation 2008*.

2.3.1.2 Environmentally Sensitive Areas within the EPC 1690 Study Area

Category A ESAs include national parks, conservation parks and forest reserves listed under the NC Act; the wet tropics area listed under the *Wet Tropics World Heritage Protection and Management Act 1993*; the Great Barrier Reef Region listed under the *Great Barrier Reef Marine Park Act 1975* and marine parks (not including general use zones) listed under the *Marine Parks Act 2004*. No Category A ESAs are present within the EPC 1690 Study Area. Regional ecosystems with a biodiversity status of endangered are classified as Category B ESAs. The DEHP ESA Map for Mining Activities identifies a number of patches of Category B ESA areas as present within the EPC 1690 Study Area. Five RE types classified as Category B ESAs (10.3.25, 10.4.3, 11.3.1, 11.4.6 and 11.4.8), covering an area of 785 ha, are mapped from DNRM certified RE mapping within the EPC 1690 Study Area (refer to Figure 2-1). Field verifications of the DNRM certified RE mapping identified that six REs (10.4.3, 10.9.3, 11.3.1, 11.4.6, 11.4.8 and 11.4.9), classified as Category B ESAs, were present within the EPC 1690 Study Area. The field verified Category B ESA REs cover an approximate area of 728 ha within the EPC 1690 Study Area. Their location within the EPC 1690 Study Area is presented Figure 2-2. A summarised description of Category B ESA RE types is provided in Table 2-2.



The Bygana West Nature Refuge located within the EPC 1690 Study Area is classified as a Category C ESA. Further discussion of the Bygana West Nature Refuge is presented in Section 3.3.7. ESAs within the EPC 1080 Study Area are discussed in Appendix B.



LEGEND

- | | | | | |
|---------------|----------------------------|---|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Category C Environmentally Sensitive Area | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | Category B Environmentally Sensitive Area - Endangered Regional Ecosystem | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | | — Pipeline Network | |

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1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Environmentally Sensitive Areas
DERM Certified Mining Activities

Job Number 41-25215
Revision D
Date 29-08-2012

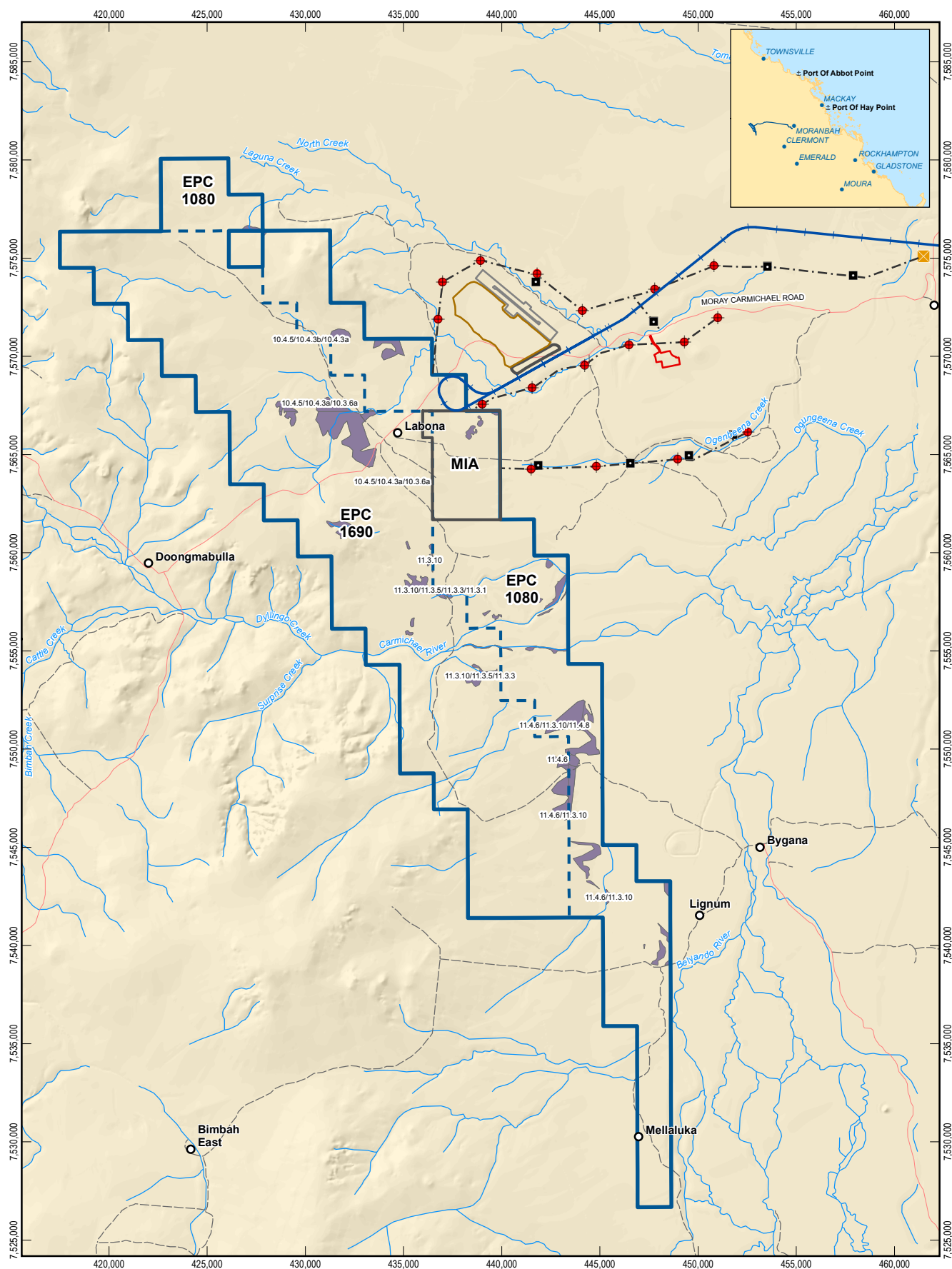
Figure 2-1

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LEGEND

- | | | | |
|---------------|---|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | ■ Mine (Offsite) | □ Airport Location |
| — Local Road | ■ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | ■ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | ■ Endangered Regional Ecosystem (Biodiversity Status) | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
Environmentally Sensitive Areas
Category B Field Verified

Job Number | 41-25215
Revision | C
Date | 29-08-2012

Figure 2-2

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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); DERM: Regional Ecosystems v6.1 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Verified Sensitive Areas (2011). Created by: BW, CA

2.3.1.3 Regional Ecosystems in the EPC 1690 Study Area

A total of 19 Desert Uplands REs and seven Brigalow Belt REs are mapped within the EPC 1690 Study Area (see Figure 2-3 and Table 2-2). All but one of the mapped Desert Uplands REs are classified by the VM Act as being least concern – the exception is the of concern RE 10.7.4. The mapped Brigalow Belt REs include two endangered REs and two of concern REs. However, results of the flora surveys indicate that five Desert Uplands REs and three Brigalow Belt REs are not actually present within the EPC 1690 Study Area. In addition, four Desert Uplands REs and one Brigalow Belt RE were found to be present that are not officially mapped. These changes from the latest DNRM certified RE mapping are summarised in Table 2-1 and presented in Figure 2-4. In total, 25 REs were identified within the EPC 1690 Study Area, 19 from the Desert Uplands and six from the Brigalow Belt. Henceforth, this report will refer to the field verified REs unless otherwise indicated (by the prefix 'officially mapped').

Regional ecosystems within the EPC 1080 Study Area are discussed in Appendix B and illustrated in Figure 2-4 of Appendix B.

Table 2-1 Summary of Regional Ecosystem mapping changes from field verification

Bioregion	Officially mapped but not present	Present but not officially mapped
Brigalow Belt	11.3.3, 11.3.5, 11.4.8 (3 REs)	11.4.9 (1 RE)
Desert Uplands	10.3.12, 10.3.25, 10.5.2, 10.7.10, 10.7.11 (5 REs)	10.3.13, 10.5.7, 10.7.5, 10.9.3 (4 REs)

REs within the EPC 1690 Study Area occur on five land zones (see Appendix I for a full description of these units), summarised here in order of the relative elevation in which they occur (higher to lower):

- Land zone seven – represented by low rises of Triassic sandstone with a laterite capping and skeletal soils, present near the centre of the EPC 1690 Study Area, and by plains of shallow red sand over a ferricrete pavement present along the north-western boundary of the EPC 1690 Study Area
- Land zone nine – represented by minor occurrences of Triassic sandstone at the base of the laterised low rises
- Land zone five – represented by broad plains of red or grey sands and sandy loams, and covering the majority of the site
- Land zone four – represented by clay plains with minor gilgai micro-relief in places – much of this land zone has been cleared and is now dominated by pasture grasses
- Land zone three – represented by alluvium plains associated with the Carmichael River, and the Carmichael River itself and its tributaries; this land zone is the second most common in terms of area, with large alluvial plains present in the southern half of the EPC 1690 Study Area

Land zone five

The land zone with the greatest area within the EPC 1690 Study Area is land zone five. This land zone is represented by broad sand plains comprised of either red or grey sand. There are five REs mapped in the amended RE mapping for this land zone, all of which are low open woodland or open



woodland. Four of these REs are dominated by yellowjacket (*Eucalyptus similis*), rough-leaved bloodwood (*Corymbia setosa*) or silver-leaved ironbark (*Eucalyptus melanophloia*). Other commonly occurring tree species include *Corymbia brachycarpa*, narrow-leaved ironbark (*Eucalyptus drepanophylla*) and Dallachy's gum (*Corymbia dallachiana*). One of the land zone five REs is comprised of tall shrubland (RE 10.5.7), which contains a mix of shrub species including *Acacia excelsa*, beefwood (*Grevillea striata*) and prickly pine (*Bursaria incana*). All land zone five REs are classed as least concern under the VM Act.

Land zone three

The next most common land zone within the EPC 1690 Study Area is land zone three. This land zone is represented by landforms derived from alluvial processes, and can be divided into two main types – level to gently undulating plains, and river channels, minor creeks, drainage lines and relict channels (such as Cabbage Tree Creek). Land zone three has the greatest RE diversity of the EPC 1690 Study Area, with 10 REs represented - six Desert Uplands REs and four Brigalow Belt REs. Of the seven land zone three REs present on alluvial plains, three are dominated by acacias (REs 10.3.3, 10.3.4 and 11.3.1) – either brigalow (*Acacia harpophylla*) or gidgee (*Acacia cambagei*). Another three (REs 10.3.6, 10.3.28 and 11.3.10) are dominated by silver-leaved ironbark or Reid River box (*Eucalyptus brownii*) – cumulatively these three REs account for most of the area covered by land zone three REs within the EPC 1690 Study Area, occurring over broad plains primarily in the southern section. The remaining land zone three RE occurring on alluvial plains (RE 10.3.14) comprises open forest dominated by river red gum (*Eucalyptus camaldulensis*), coolabah (*Eucalyptus coolabah*) and/or carbeen (*Corymbia tessellaris*). This RE can also occur as a fringing woodland or open forest along watercourses.

Three land zone three REs occur as open forest fringing watercourses. The RE 11.3.25 is dominated by river red gum and weeping paperbark (*Melaleuca leucadendra*), and is restricted within the EPC 1690 Study Area to the Carmichael River channel. This vegetation community is considered to be a groundwater dependent ecosystem. The RE 10.3.13 also occurs along the Carmichael River, fringing the southern bank. Cabbage Tree Creek, an oxbow waterhole formerly part of the Carmichael River, is characterised by the wetland RE 11.3.27, and is comprised of a diversity of canopy species including river red gum, weeping paperbark and coolabah. All land zone three REs within the EPC 1690 Study Area are classed as least concern under the VM Act, with the exception of the brigalow RE 11.3.1, which is classed as endangered.

Land zone seven

Land zone seven is also well represented within the EPC 1690 Study Area, with five REs (all Desert Uplands REs). Land zone seven incorporates land forms characterised by Cainozoic duricrust, which in the EPC 1690 Study Area takes the form of ferricrete capping over sandstone. This ferricrete is exposed as undulating to rolling rises in places along the western boundary of the EPC 1690 Study Area, and near the centre. In addition, along the north-west boundary of the EPC 1690 Study Area land zone seven is also represented by a large level to gently undulating ferricrete plain buried beneath a shallow layer of red sand. Two of the land zone seven REs within the EPC 1690 Study Area are associated with the ferricreted rises and minor pediments at the foot of the rises, or remnants of these landforms. These REs (10.7.2 and 10.7.4) comprise generally low open woodland dominated by *Eucalyptus persistens*, with Dallachy's gum also present. The ground layer is characterised by a mid-dense to sparse grass layer of soft spinifex (*Triodia pungens*), and a pea-gravel 'rock mulch'. Another land zone seven RE, 10.7.5, occurs in only very small patches at the



base of one of the ferricrete rises, and is dominated almost entirely by yapunyah (*Eucalyptus thozetiana*).

The final two land zone seven REs are associated with ferricreted landforms that are buried beneath a shallow sand layer. The RE 10.7.3 is present in very small patches along the north-western boundary, and comprises low woodland and open forest dominated almost exclusively by lancewood (*Acacia shirleyi*). The RE 10.7.7 is a more significant RE within the EPC 1690 Study Area – it is located across a number of red sand plains in the north-western section, and is comprised of tall shrubland dominated by a range of species, including Townsville wattle (*Acacia leptostachya*), *Acacia stipuligera*, fringe myrtle (*Calytrix microcoma*), *Platysace valida*, *Comesperma pallida* and golden parrot tree (*Grevillea pteridifolia*). Heart-leaf poison bush (*Gastrolobium grandiflorum*) was also present in this RE. All of the REs within land zone seven in the EPC 1690 Study Area are classed as least concern under the VM Act, with the exception of RE 10.7.4, which is classed as of concern.

Land zone four

Land zone four is represented in the EPC 1690 Study Area by four REs, two from the Desert Uplands and two from the Brigalow Belt. This land zone occurs on level to gently undulating plains formed from Cainozoic clay deposits. Two of the land zone four REs within the EPC 1690 Study Area (REs 10.4.3 and 11.4.9) are dominated by brigalow open woodland to open forest, often with an emergent layer of Dawson's gum (*Eucalyptus cambageana*). The other two land zone four REs within the EPC 1690 Study Area (10.4.5 and 11.4.6) are woodland to low woodland dominated by gidgee. These REs are likely to have been more common in the area prior to European settlement. However, as clay plains are often highly suitable for improved pastures, they have generally been targeted for clearing, and as a consequence they are now poorly represented in terms of area. The REs on land zone four as a group have the highest conservation value of all of the REs within the EPC 1690 Study Area – the two Desert Uplands REs are classed as least concern, but the Brigalow Belt REs are classed as of concern (RE 11.4.6) or endangered (RE 11.4.9). In addition, the RE 11.4.9 is a component of the EPBC Act listed endangered TEC 'Brigalow (*Acacia harpophylla* dominant and co-dominant)'.

Land zone nine

The land zone within the EPC 1690 Study Area with the lowest representation in terms of area and RE diversity is land zone nine, which is represented by only one RE, 10.9.3. This RE is comprised of brigalow low open woodland and woodland with Dawson's gum emergents, and is present near the centre of the EPC 1690 Study Area as run-on areas in association with low rises. The sandstone in this area is from the Triassic period, and is generally located beneath a shallow soil profile. The RE 10.9.3 is classed as least concern under the VM Act.

2.3.1.4 Regulated Regrowth Vegetation

Regrowth vegetation as defined by the VM Act comprises vegetation that is non-remnant. Regrowth vegetation specially regulated under the VM Act is non-remnant vegetation that has reached an advanced stage of regrowth, generally having not been cleared since 31 December 1989. The EPC 1690 Study Area includes one patch of regulated regrowth vegetation, with an area of approximately 6 ha and mapped as a least concern regrowth RE (representing RE types 11.3.28a/11.3.6a), located south of the Carmichael River. The regrowth mapping is provided as Figure 2-5. Regrowth vegetation within the EPC 1080 Study Area is discussed in Appendix B and illustrated in Figure 2-5 of Appendix B.

Table 2-2 Regional Ecosystem Descriptions

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
Desert Uplands REs				
10.3.3	least concern/ no concern at present	Occurs on alluvial plains.	Low open-woodland of <i>Acacia harpophylla</i> +/- <i>Eucalyptus cambageana</i> emergents or open-woodland of <i>Eucalyptus cambageana</i> +/- understorey of <i>Acacia harpophylla</i> over a very open tussock grassland ground layer.	Present in a lower catchment location on alluvial associated with, and south of, the Carmichael River. Approximately 136 ha within the EPC 1690 Study Area.
10.3.4	least concern/ of concern	Occurs on heavy clay and texture contrast soils on alluvial plains.	Low open-woodland to woodland of <i>Acacia cambagei</i> with very open tussock grassland. Minor occurrences of <i>Acacia tephрина</i> woodland.	A minor element of the EPC 1690 Study Area vegetation, present south of the Carmichael River in two small patches. Approximately 20 ha within the EPC 1690 Study Area.
10.3.6	least concern/ no concern at present	Occurs on alluvial plains with clays and texture contrast soils.	<i>Eucalyptus brownii</i> open-woodland to woodland.	One of the major vegetation communities in the EPC 1690 Study Area, present on plains in large tracts contiguous with ironbark woodland. Approximately 2933 ha within the EPC 1690 Study Area.

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
10.3.12	least concern/ no concern at present	Occurs on sandy alluvial terraces in the east.	Fringing and frontage <i>Corymbia plena</i> and <i>C. dallachiana</i> open-woodland, usually with <i>Aristida</i> spp. dominant in the ground layer. <i>Corymbia plena</i> dominates the canopy (18-26 m tall) usually with <i>C. dallachiana</i> co dominant. The low tree layer (3-6 m tall) is usually very sparse or more commonly there are scattered small trees including <i>Acacia coriacea</i> , <i>A. torulosa</i> and <i>Melaleuca nervosa</i> . <i>Aristida ingrata</i> usually dominates the very sparse to sparse ground layer. Other graminoids frequently present include <i>Schizachyrium fragile</i> and <i>Eriachne mucronata</i> . Commonly occurring forbs include <i>Lomandra leucocephala</i> , <i>Evolvulus alsinoides</i> , <i>Bonamia media</i> and <i>Chrysocephalum apiculatum</i> .	Not observed.
10.3.13	least concern/of concern	Occurs mostly as narrow bands along channels and on levees with sandy to clayey soils along larger watercourses.	<i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> and/or <i>Eucalyptus camaldulensis</i> open- woodland and woodland.	Not officially mapped but present in one patch on a scroll plain associated with the Carmichael River. Approximately 18 ha within the EPC 1690 Study Area.
10.3.14	least concern/ of concern	Occurs on channels, levees and flood plains with sandy to clayey soils along larger watercourses.	<i>Eucalyptus camaldulensis</i> and/or <i>E. coolabah</i> woodlands and open-woodlands on channels, levees and floodplains. <i>Acacia harpophylla</i> or <i>A. cambagei</i> may be present as clumps or scattered trees.	Present along the Carmichael River, and in a small, isolated patch on the Carmichael River floodplain. Approximately 32 ha within the EPC 1690 Study Area.



RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
10.3.25	least concern/ endangered	Occurs on flood plains with sandy clay to clay soil.	<i>Eremophila mitchellii</i> with or without <i>Lysiphyllum carronii</i> shrublands to low woodlands. <i>Senna artemisioides</i> sometimes forming a shrub stratum. <i>Eremophila mitchellii</i> dominates the very sparse canopy (2-7 m tall). <i>Lysiphyllum carronii</i> , <i>Atalaya hemiglauc</i> a and <i>Psyrax oleifolius</i> are usually present in the canopy. <i>Flindersia maculata</i> is commonly present in western areas. <i>Carissa lanceolata</i> often dominates the very sparse shrub layer (0.5-3 m tall). <i>Senna artemisioides</i> is occasionally present. <i>Sporobolus actinocladus</i> is usually present and sometimes dominant in the very sparse ground layer. <i>Oxychloris</i> <i>scariosa</i> , <i>Enneapogon polyphyllus</i> and <i>Tripogon loliiformis</i> are frequently present graminoids.	Not observed.
10.3.28	least concern/ no concern at present	Occurs on sandy alluvial fans with yellow earth and duplex soils formed from outwash from sandstone hills.	Open-woodland to woodland of <i>Eucalyptus</i> <i>melanophloia</i> or <i>Eucalyptus crebra</i> . <i>Eucalyptus melanophloia</i> dominates the very sparse to sparse canopy (8-18 m tall). <i>Corymbia dallachiana</i> is occasional present in the canopy or subcanopy. A low tree layer or shrub layer are usually absent although there can be scattered small trees and shrubs present. <i>Aristida benthamii</i> , <i>Sehima</i> <i>nervosum</i> , <i>Digitaria brownii</i> , <i>Chrysopogon</i> <i>fallax</i> , <i>Enneapogon polyphyllus</i> , <i>Schizachyrium fragile</i> and <i>Eriachne mucronata</i> occur as dominants and some co dominants. Other graminoids usually present include <i>Aristida</i> spp., <i>Panicum effusum</i> , <i>Tripogon</i> <i>loliiformis</i> and <i>Heteropogon contortus</i> . Forbs usually present include <i>Evolvulus alsinoides</i> , <i>Rostellularia adscendens</i> , <i>Sauropus</i> <i>trachyspermus</i> and <i>Brunoniella australis</i> .	One of the major vegetation communities within the EPC 1690 Study Area, present in large patches contiguous with box woodland. Approximately 4567 ha within the EPC 1690 Study Area.

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
10.4.3	least concern/ endangered	Occurs on clay and texture contrast soils, gently undulating downs and plains on Cainozoic lake deposits.	<i>Acacia harpophylla</i> and/or <i>Eucalyptus cambageana</i> open-woodland.	Present as <i>A. harpophylla</i> woodland with <i>E. cambageana</i> emergents in relatively large patches in the vicinity of the Moray-Carmichael Rd, intergrading with box woodland. Contains the densest vegetation within the EPC 1690 Study Area. Approximately 472 ha within the EPC 1690 Study Area.
10.4.5	least concern/ of concern	Occurs on plains and gently undulating downs on Cainozoic lake deposits. Cracking clay soils, usually gilgaied, and minor areas of texture contrast soils.	<i>Acacia cambagei</i> low woodland sometimes with <i>A. harpophylla</i> . <i>Acacia cambagei</i> dominates the very sparse to sparse canopy (6-15 m tall). Other trees often present in the canopy or occur as scattered small trees include <i>Terminalia oblongata</i> and <i>Acacia harpophylla</i> . <i>Eremophila mitchellii</i> and <i>A. cambagei</i> usually dominate the very spares large shrub layer (2-4 m tall). <i>A. cambagei</i> , <i>Eremophila deserti</i> , <i>Senna artemisioides</i> and <i>Carissa lanceolata</i> are usually common or dominant in the small shrub layer (0.5-2 m tall). <i>Enteropogon acicularis</i> , <i>Eragrostis lacunaria</i> , <i>Tripogon loliiformis</i> and <i>Oxychloris scariosa</i> or <i>Leptochloa decipiens</i> occasionally occur as dominant graminoids in the very sparse ground layer. Other graminoids often present include <i>Sporobolus actinocladus</i> , <i>Enneapogon polyphyllus</i> and <i>Paspalidium caespitosum</i> . <i>Enchylaena tomentosa</i> and <i>Sclerolaena</i> spp. are forbs usually present.	Present within a mosaic with brigalow, in relatively dense patches to the west and north-west of the Labona homestead. Approximately 98 ha within the EPC 1690 Study Area.

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
10.5.1	least concern/ no concern at present	Occurs on deep red earths on Tertiary sand plain.	Largely <i>Eucalyptus similis</i> and/or <i>Corymbia brachycarpa</i> and/or <i>Corymbia setosa</i> low open-woodland to open-woodland. There is frequently a dense shrub layer. Small areas of <i>Eucalyptus chartaboma</i> and/or <i>E. tetradonta</i> , or <i>E. drepanophylla</i> or <i>Lysicarpus angustifolius</i> occur in the north.	Present in a 'red sand plain mosaic' and found roughly along the western boundary, mostly north of the Carmichael River but with a patch in southern section. Hosts a number of endemic and/or threatened species. Considered to have high faunal values. This RE comprises recharge zones for the Great Artesian Basin aquifers (Qld Herbarium 2009). Habitat for the vulnerable <i>Acacia ramiflora</i> (which was not found). Approximately 2833 ha within the EPC 1690 Study Area.
10.5.2	least concern/ no concern at present	Occurs on deep sands and earths on sand plains.	Mostly <i>Corymbia plena</i> and <i>C. dallachiana</i> and sometimes with or without <i>C. terminalis</i> open-woodland in the west. A lower tree or shrub layer of scattered plants is often present, including <i>Melaleuca nervosa</i> and <i>Petalostigma pubescens</i> .	Approximately 26 ha within the EPC 1690 Study Area.
10.5.4	least concern/ no concern at present	Occurs on sandy red and yellow earths on undulating sand plain.	Open-woodland of <i>Eucalyptus crebra</i> or <i>E. drepanophylla</i> usually with <i>Corymbia dallachiana</i> and/or <i>C. brachycarpa</i> .	Present in an upper catchment location in the north-west of the EPC 1690 Study Area, near the apex of a low laterised ridge. Approximately 160 ha within the EPC 1690 Study Area.
10.5.5	least concern/ no concern at present	Occurs on loamy red and yellow earths on undulating sand plains.	Mostly <i>Eucalyptus melanophloia</i> open-woodland with open-grassland understorey of <i>Aristida</i> spp. and/or <i>Triodia</i> spp. Occasionally present are small areas of <i>Acacia coriacea</i> or <i>Archidendropsis basaltica</i> or rarely grassland.	One of the most common communities within the EPC 1690 Study Area, present in large tracts contiguous with box woodland, generally in a mid-catchment position. Habitat for <i>Acacia ramiflora</i> . Approximately 7343 ha within the EPC 1690 Study Area
10.5.7	least concern/ of concern	Occurs on red sandy earths and deep sandy texture contrast soils on relict sand plain.	<i>Acacia excelsa</i> , <i>Grevillea striata</i> and <i>Corymbia terminalis</i> low open-woodland with or without a shrubby understorey. Can include minor areas of <i>Acacia cambagei</i> on finer-textured red soils.	Not officially mapped, but present in one patch south of the Carmichael River, in a mid-catchment position. Approximately 248 ha within the EPC 1690 Study Area.

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
10.5.8	least concern/ no concern at present	Occurs on lower slopes in gently undulating terrain with pale sandy soil.	Low open-woodland of <i>Corymbia setosa</i> sometimes with <i>Grevillea pteridifolia</i> and /or <i>Melaleuca nervosa</i> and sparse hummock grass understorey of <i>Triodia pungens</i> or low (open-) woodland of <i>Melaleuca nervosa</i> with sparse ground layer of tussock grasses.	This RE dominates large areas along the north-western boundary, often intergrading with ironbark woodland. Approximately 77 ha within the EPC 1690 Study Area.
10.7.2	least concern/ no concern at present	Occurs on gently sloping terrain with shallow to skeletal soils usually near margins of laterised plateaus above scarps.	<i>Eucalyptus persistens</i> or <i>Corymbia dallachiana</i> or <i>E. socialis</i> subsp. <i>eucentrica</i> low open- woodland of usually with open hummock grassland understorey of <i>Triodia</i> spp. or open- grassland of <i>Triodia pungens</i> and/or <i>Eriachne</i> <i>mucronata</i> or <i>Amphipogon caricinus</i> .	Present as low open woodland of <i>E. persistens</i> with <i>Triodia pungens</i> located along the top of a series of low rises in the centre-west of the EPC 1690 Study Area, north of the Carmichael River. Occurs on hard, stony country with a 'mulch' of lateritic pea gravel. Approximately 141 ha within the EPC 1690 Study Area.
10.7.3	least concern/ no concern at present	Occurs on the exposed mottled zone on scarps with skeletal soils, and above scarps with red earths usually on ferricrete, at the margins of Tertiary plateaus.	<i>Acacia shirleyi</i> woodland and/or <i>A. catenulata</i> low woodland and /or <i>Corymbia lamprophylla</i> and/or <i>C. leichhardtii</i> . Includes small areas <i>Acacia microcephala</i> and <i>Corymbia blakei</i> in the far west, and <i>A. burdekensis</i> in White Mountains NP. Also, there are small areas of <i>A. shirleyi</i> and rarely <i>A. catenulata</i> .	Occurs in one small patch dominated by <i>Acacia shirleyi</i> in an upper catchment position, just to the north of the Carmichael River. Approximately 40 ha within the EPC 1690 Study Area.
10.7.4	of concern/ of concern	Occurs on pediments below scarps of laterised Tertiary plateaus. Texture contrast soils.	<i>Eucalyptus persistens</i> low open-woodland. <i>Eucalyptus persistens</i> dominates the mostly very sparse canopy (5-22 m tall). <i>Triodia</i> spp. dominate the very sparse to sparse ground layer. Other graminoids frequently present include <i>Panicum effusum</i> , <i>Eragrostis lacunaria</i> , <i>Eragrostis spartinooides</i> and <i>Paspalidium</i> <i>gracile</i> .	Present along the apron slope of low rises in the centre-west of the EPC 1690 Study Area, to the north of the Carmichael River, downslope from RE 10.7.2. Occurs on hard, stony country with a 'mulch' of lateritic pea gravel. Approximately 103 ha within the EPC 1690 Study Area.

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
10.7.5	least concern/ of concern	Occurs on scarps with skeletal soils and on pediments below scarps of laterised plateaus with shallow texture contrast soils.	<i>Eucalyptus thozetiana</i> woodland. <i>Eucalyptus thozetiana</i> dominates the mostly very sparse and sometimes sparse canopy (8-22 m tall). <i>Eremophila mitchellii</i> is sometimes present as scattered small trees (2.5-6 m tall). <i>Carissa lanceolata</i> and <i>Eremophila deserti</i> are frequently present as scattered shrubs (0.5-2 m tall). <i>Triodia pungens</i> usually dominates the very sparse to sparse ground layer. <i>Enchylaena tomentosa</i> is frequently present.	Not officially mapped but observed along base of laterised low hills/rolling rises on minor pediments. Approximately 10 ha within the EPC 1690 Study Area.
10.7.7	least concern/ no concern at present	Occurs on ferricrete with skeletal soils and shallow earths often on margins of Tertiary plateaus.	Shrubland dominated by a range of <i>Acacia</i> spp., <i>Calytrix</i> spp., <i>Melaleuca</i> spp. and healthy species.	10.7.7a: Present as large areas of mixed shrubland along the north-western boundary of the EPC 1690 Study Area. 10.7.7b: Present in small patches in the form of <i>Melaleuca tamariscina</i> heath. Approximately 888 ha within the EPC 1690 Study Area.
10.7.10	least concern/ no concern at present	Occurs on gently undulating terrain with shallow sandy soil on ferricrete on Tertiary plateaus.	<i>Eucalyptus whitei</i> or <i>Corymbia setosa</i> low open-woodland.	Not observed.
10.7.11	least concern/ no concern at present	Occurs on gently undulating terrain with shallow yellow earths on ferricrete mostly on margins of plateaus of Tertiary sand plains.	<i>Eucalyptus melanophloia</i> dominates the very sparse canopy (8-14 m tall). <i>Corymbia dallachiana</i> is often present in the canopy. <i>Acacia coriacea</i> is present in the small tree layer (3-7 m tall). <i>Acacia tenuissima</i> is often present as scattered shrubs or in the very sparse shrub layer (0.6-2 m tall). <i>Triodia pungens</i> usually dominates the very sparse to mid-dense ground layer. <i>Themeda triandra</i> , <i>Eriachne mucronata</i> and <i>Cymbopogon bombycinus</i> are usually present. Small areas of open-tussock grassland have also been recorded.	Approximately 4 ha within the EPC 1690 Study Area.

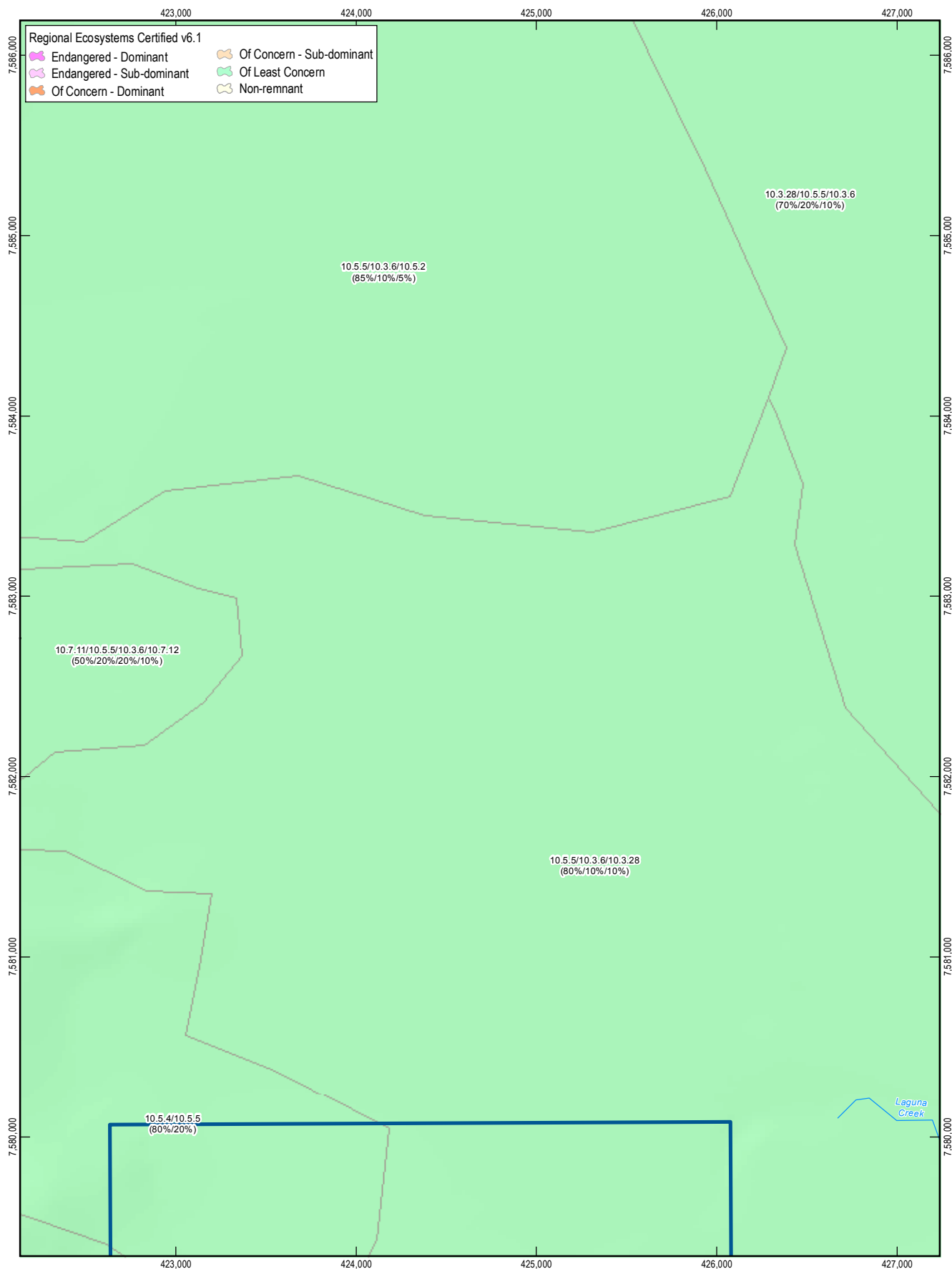


RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
10.9.3	least concern/ endangered	Occurs on flat to undulating terrain with shallow clay soils overlying fine-grained Mesozoic sediments.	<i>Acacia harpophylla</i> low open-woodlands to woodlands or <i>Eucalyptus cambageana</i> open-woodland with or without <i>Acacia harpophylla</i> understorey or open-tussock grassland.	Not officially mapped but present in association with RE 10.7.7. Approximately 91 ha within the EPC 1690 Study Area.
Brigalow Belt REs				
11.3.1	endangered/ endangered	Associated with Cainozoic alluvial plains which may be occasionally flooded. Landforms range from level to very gently sloping plains, alluvial flats, drainage floors, back-swamps and abandoned channels. Associated soils are predominantly deep to very deep cracking clays, sometimes with gilgai or texture contrast soils with sandy surface.	Open-forest dominated by <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> (particularly in southern parts), with or without scattered emergent <i>Eucalyptus</i> spp. such as <i>E. coolabah</i> , <i>E. largiflorens</i> , <i>E. populnea</i> , <i>E. orgadophila</i> , and <i>E. pilligaensis</i> . A low tree layer dominated by <i>Geijera parviflora</i> and <i>Eremophila mitchellii</i> is usually present. The vegetation sometimes occurs as low open-forest or woodland. Tree height generally about 11-15 m and the low tree (to tall shrub) understorey layer is between 2 and 8 m high (where present). Ground cover is generally sparse.	Present in small patches in association with other brigalow and gidgee communities, on alluvial plains associated with the Carmichael River. Part of the EPBC Act Threatened Ecological Community 'Brigalow'. Approximately 49 ha within the EPC 1690 Study Area.
11.3.3	of concern/ of concern	Occurs on Cainozoic alluvial plains or levees with clay or sometimes texture contrast soils.	<i>Eucalyptus coolabah</i> woodland to open-woodland with a grassy understorey. A mid layer is often absent but scattered tree or shrub species, such as <i>E. populnea</i> , <i>Melaleuca bracteata</i> , <i>Alectryon oleifolius</i> , <i>Terminalia oblongata</i> (in the north) and <i>Acacia pendula</i> , <i>A. cambagei</i> , and occasionally <i>Muehlenbeckia florulenta</i> may be present. The ground layer is dominated by a range of grass and forb species depending on season, soil and management conditions. Can include small areas of grassland with scattered trees.	Not observed.

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
11.3.5	least concern/ of concern	Occurs on levees on alluvial plains which are rarely flooded. Associated soils are often texture contrast with sandy surfaces.	<i>Acacia cambagei</i> +/- <i>A. harpophylla</i> low woodland or open-forest sometimes clumped, on Cainozoic alluvial plains. <i>Acacia cambagei</i> dominates the canopy (8-16 m high) sometimes in association with <i>A. harpophylla</i> as a sub-dominant. <i>Eucalyptus coolabah</i> , <i>E.</i> <i>largiflorens</i> (subregion 35) or <i>Acacia</i> <i>harpophylla</i> may be present. Often <i>Eremophila mitchellii</i> is present as an open low tree layer (1.5-4 m high) or as scattered shrubs to small trees. <i>Psyrax oleifolia</i> and <i>Atalaya</i> <i>hemiglauc</i> are occasionally present. A small shrub layer sometimes occurs dominated by <i>Senna artemisioides</i> with or without suckers of <i>Acacia cambagei</i> or both species may occur as scattered shrubs. The ground layer is often poorly formed except under the canopy where there is usually a very sparse cover of dominants which include <i>Paspalidium</i> <i>caespitosum</i> , <i>Sporobolus actinocladus</i> and <i>Brachyachne convergens</i> . Other graminoids frequently present are <i>Bothriochloa ewartiana</i> , <i>Iseilema vaginiflorum</i> , <i>Eragrostis microcarpa</i> and <i>Aristida latifolia</i> .	Approximately 3 ha within the EPC 1690 Study Area.
11.3.10	least concern/ no concern at present	Occurs on Cainozoic alluvial plains.	<i>Eucalyptus brownii</i> grassy woodland. This unit usually occurs as woodland of <i>Eucalyptus</i> <i>brownii</i> . There is usually a grassy groundlayer of <i>Aristida</i> spp., <i>Chloris</i> spp., <i>Fimbristylis</i> <i>dichotoma</i> , <i>Eriachne</i> spp., <i>Eragrostis</i> spp. and <i>Chrysopogon fallax</i> . Areas subject to less intensive grazing or on better soils contain <i>Heteropogon contortus</i> , <i>Bothriochloa bladhii</i> and <i>Chrysopogon fallax</i> .	Present in a small patches on the outer edge of the northern Carmichael River flood plain, on yellow alluvial outwash. Approximately 57 ha within the EPC 1690 Study Area.

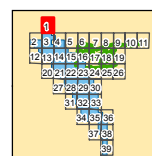
RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
11.3.25	least concern/ of concern	Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth.	<i>Eucalyptus camaldulensis</i> or <i>E. tereticornis</i> open-forest to woodland. Other tree species such as <i>Casuarina cunninghamiana</i> , <i>E. coolabah</i> , <i>Melaleuca bracteata</i> , <i>Melaleuca viminalis</i> , <i>Livistona</i> spp. (in north), <i>Melaleuca</i> spp. and <i>Angophora floribunda</i> are commonly present and may be locally dominant. An open to sparse, tall shrub layer is frequently present dominated by species including <i>Acacia salicina</i> , <i>A. stenophylla</i> or <i>Lysiphyllum carronii</i> . Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs such as <i>Imperata cylindrica</i> , <i>Bothriochloa bladhii</i> , <i>B. ewartiana</i> , <i>Chrysopogon fallax</i> , <i>Cyperus dactylotes</i> , <i>C. difformis</i> , <i>C. exaltatus</i> , <i>C. gracilis</i> , <i>C. iria</i> , <i>C. rigidellus</i> , <i>C. victoriensis</i> , <i>Dichanthium sericeum</i> , <i>Leptochloa digitata</i> , <i>Lomandra longifolia</i> or <i>Panicum</i> spp..	Comprises the vegetation fringing the Carmichael River, in the form of <i>E. camaldulensis</i> open forest with <i>Melaleuca leucadendra</i> lining the actual channel, and forming woodland along the southern bank. A groundwater dependant ecosystem. Approximately 98 ha within the EPC 1690 Study Area.
11.3.27	least concern/of concern	Occurs in a variety of situations including lakes, billabongs, oxbows and depressions on floodplains.	Freshwater wetlands. Vegetation is variable including open water with or without aquatic species and fringing sedgeland and eucalypt woodlands.	Located as a fringing open forest/woodland along Cabbage Tree Creek, just to the south of the Carmichael River (Cabbage Tree Creek is a relict stream channel formerly part of the Carmichael). Approximately 10 ha within the EPC 1690 Study Area.
11.4.6	of concern/ endangered	Occurs on gently undulating plains formed from Cainozoic sediments. Associated soils are texture contrast with thin sandy or loamy surface horizons and strongly alkaline clay subsoils.	<i>Acacia cambagei</i> dominates the tree canopy (10-13 m high). There is a sparse to open low tree layer (7-9 m high) dominated by <i>Lysiphyllum carronii</i> , <i>Geijera parviflora</i> , <i>Acacia harpophylla</i> , and sometimes <i>A. argyrodendron</i> , <i>Terminalia oblongata</i> , and <i>Eremophila mitchellii</i> . An open shrub layer (1 m high) dominated by species such as <i>Carissa ovata</i> , <i>Capparis lasiantha</i> , <i>Eremophila deserti</i> , <i>Apophyllum anomalum</i> and <i>Alectryon diversifolius</i> is also often present. The ground layer is sparse to open and dominated by grasses.	Located with brigalow along the south-eastern boundary of the EPC 1690 Study Area. Approximately 3 ha within the EPC 1690 Study Area.

RE	VM Act class/ Biodiversity status	Land form	Description	Comments (inc. area within EPC 1690 Study Area)
11.4.8	endangered/ endangered	Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoils. Surface or subsurface gravel is common.	Woodland to open-forest dominated by <i>Eucalyptus cambageana</i> and <i>Acacia harpophylla</i> or, sometimes in the north, <i>A. argyrodendron</i> . <i>E. thozetiana</i> is sometimes present on shallower soils. There is a moderately dense low tree layer (5 m high) layer dominated by species such as <i>Eremophila mitchellii</i> and a low shrub layer (2 m high) dominated by species such as <i>Carissa ovata</i> and <i>Geijera parviflora</i> .	Part of the EPBC Act Threatened Ecological Community 'Brigalow'. <1 ha within the EPC 1690 Study Area.
11.4.9	endangered/ endangered	Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas.	Open-forest, occasionally woodland, dominated by <i>Acacia harpophylla</i> usually with a low tree mid-storey of <i>Terminalia oblongata</i> and <i>Eremophila mitchellii</i> . <i>Casuarina cristata</i> sometimes replaces <i>Acacia harpophylla</i> in the overstorey and <i>Lysiphyllum cunninghamii</i> sometimes co-dominates. Other low tree or shrub species such as <i>Alectryon diversifolius</i> , <i>Carissa ovata</i> , <i>Pittosporum spinescens</i> , <i>Ehretia membranifolia</i> , <i>Geijera parviflora</i> and <i>Flindersia dissosperma</i> may occur in the mid-storey or low shrub layer. <i>Acacia harpophylla</i> trees have been recorded as 11- 17 m high, the mid-storey layer 2- 8 m high and the low shrub layer 1-2 m high.	Not officially mapped but present within the EPC 1690 Study Area in small patches along the south-eastern boundary. Part of the EPBC Act Threatened Ecological Community 'Brigalow'. Approximately 113 ha within the EPC 1690 Study Area.

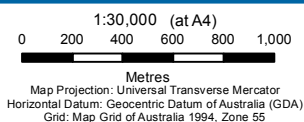


LEGEND

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|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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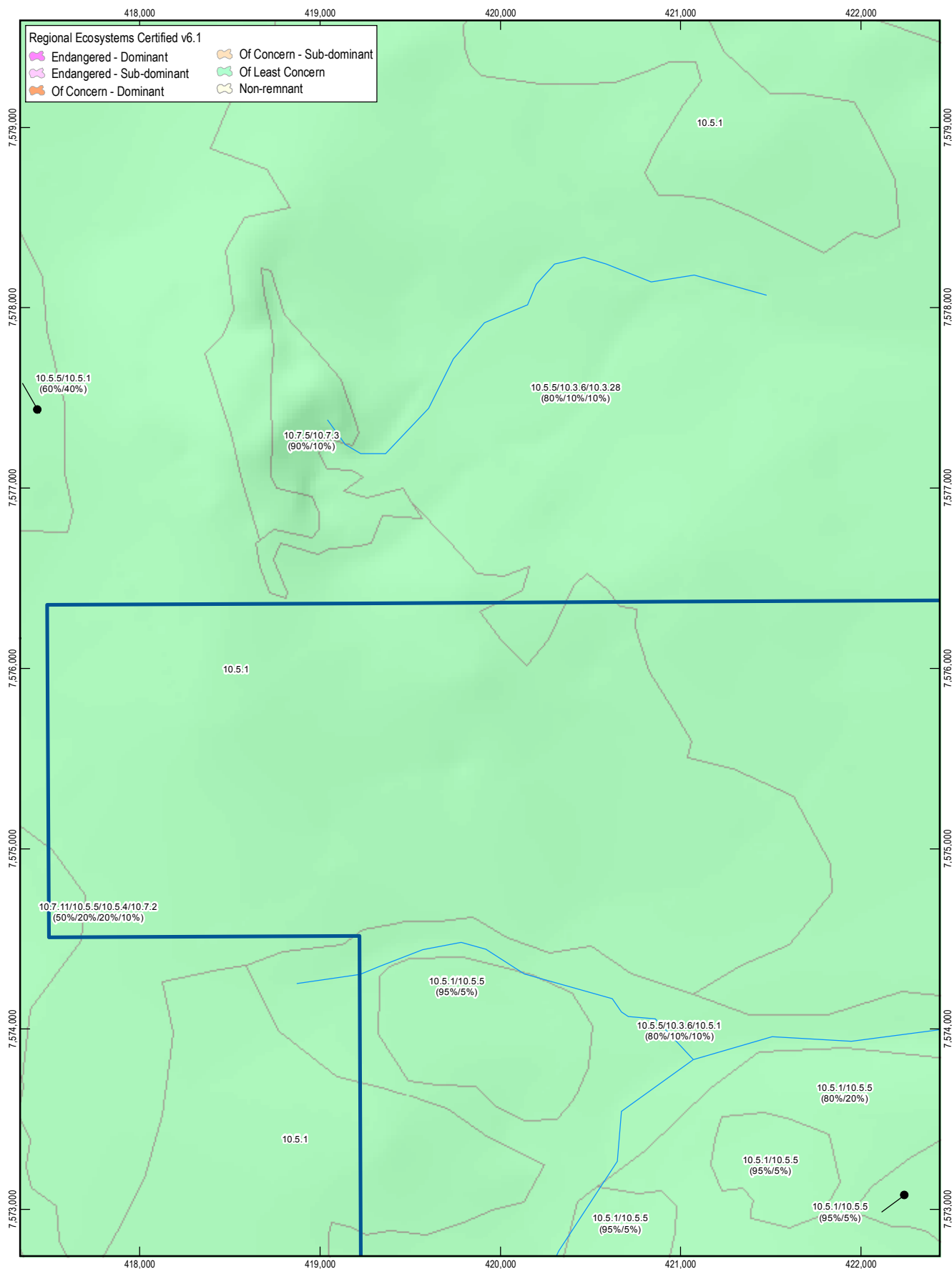
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Revision C
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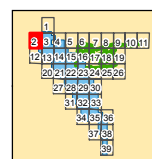
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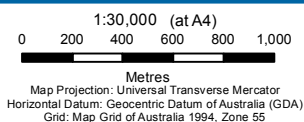


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
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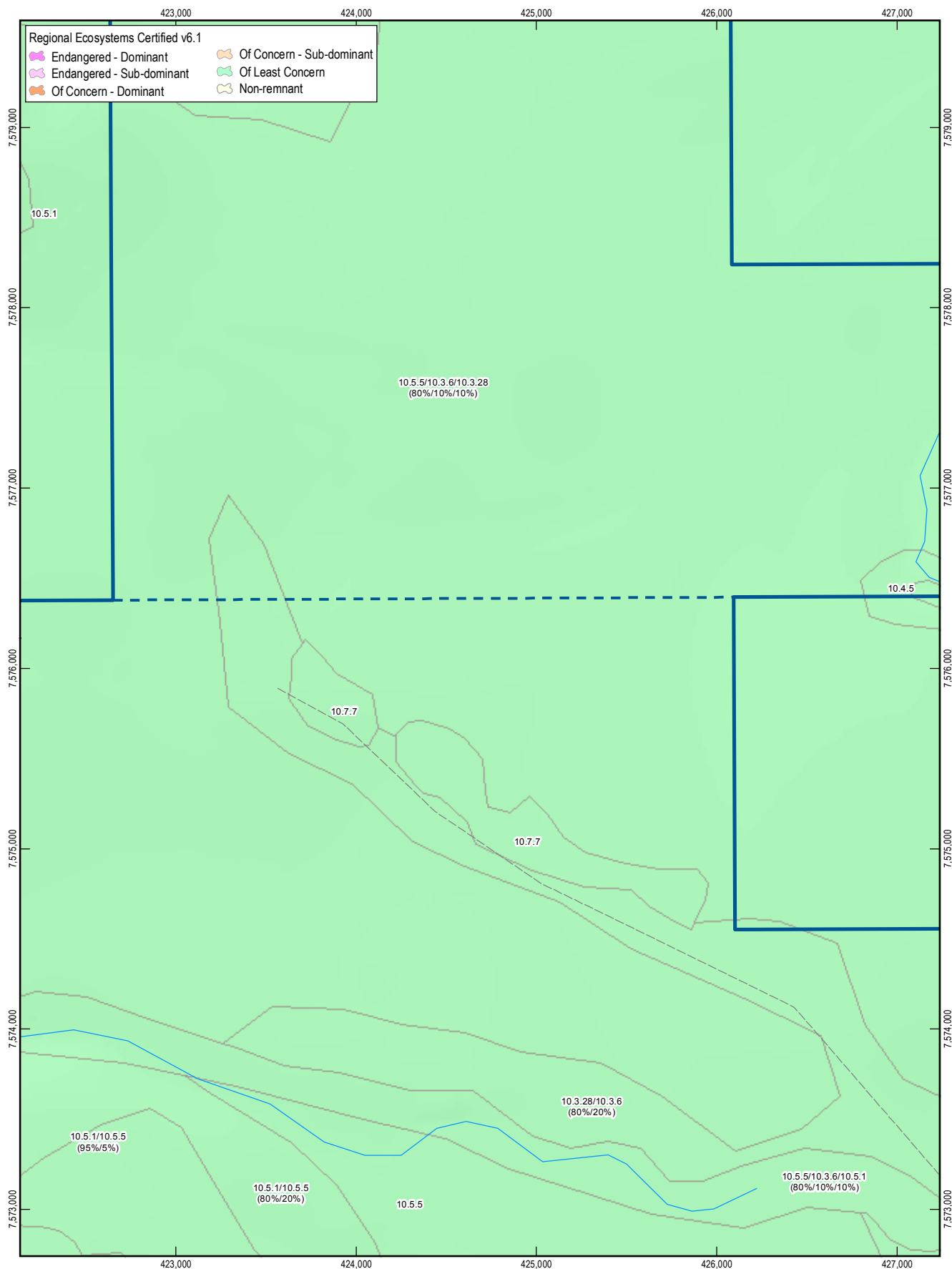
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Revision C
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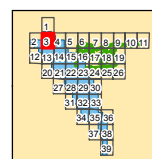
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LEGEND

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- Rail (East)
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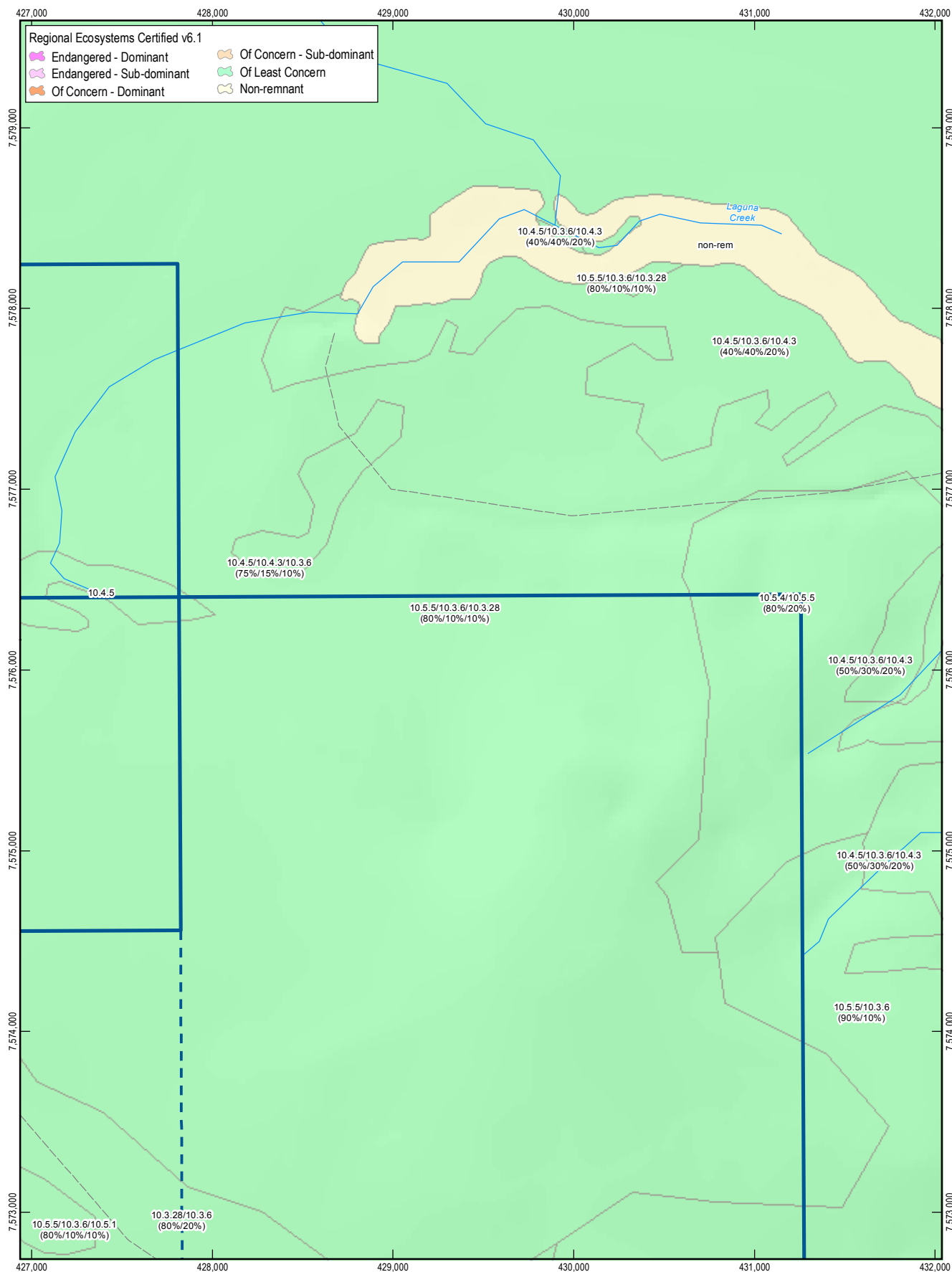
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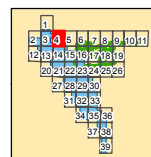
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LEGEND

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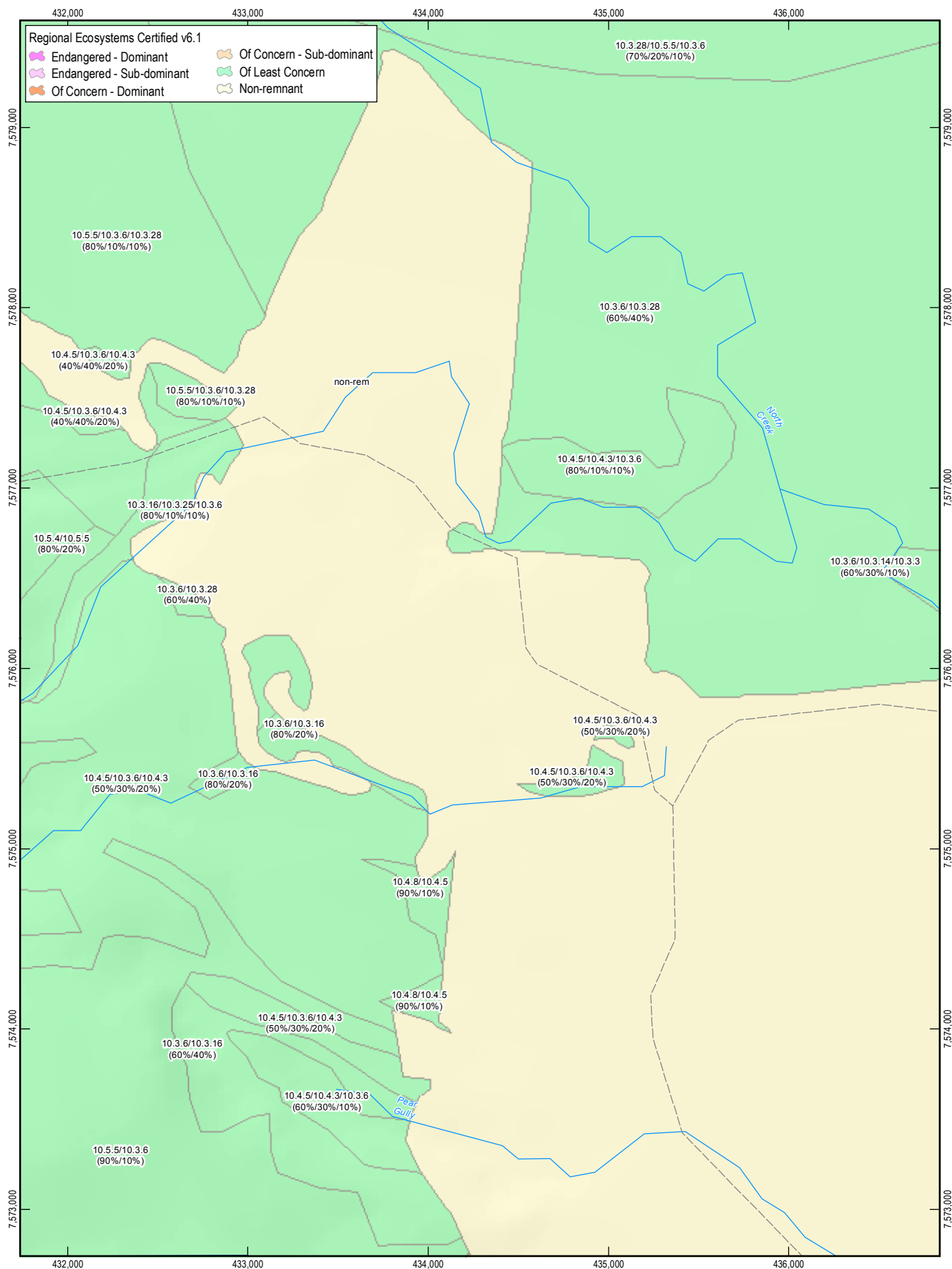
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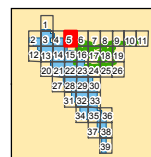
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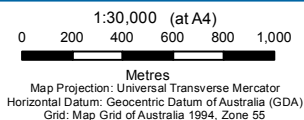


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| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| --- Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
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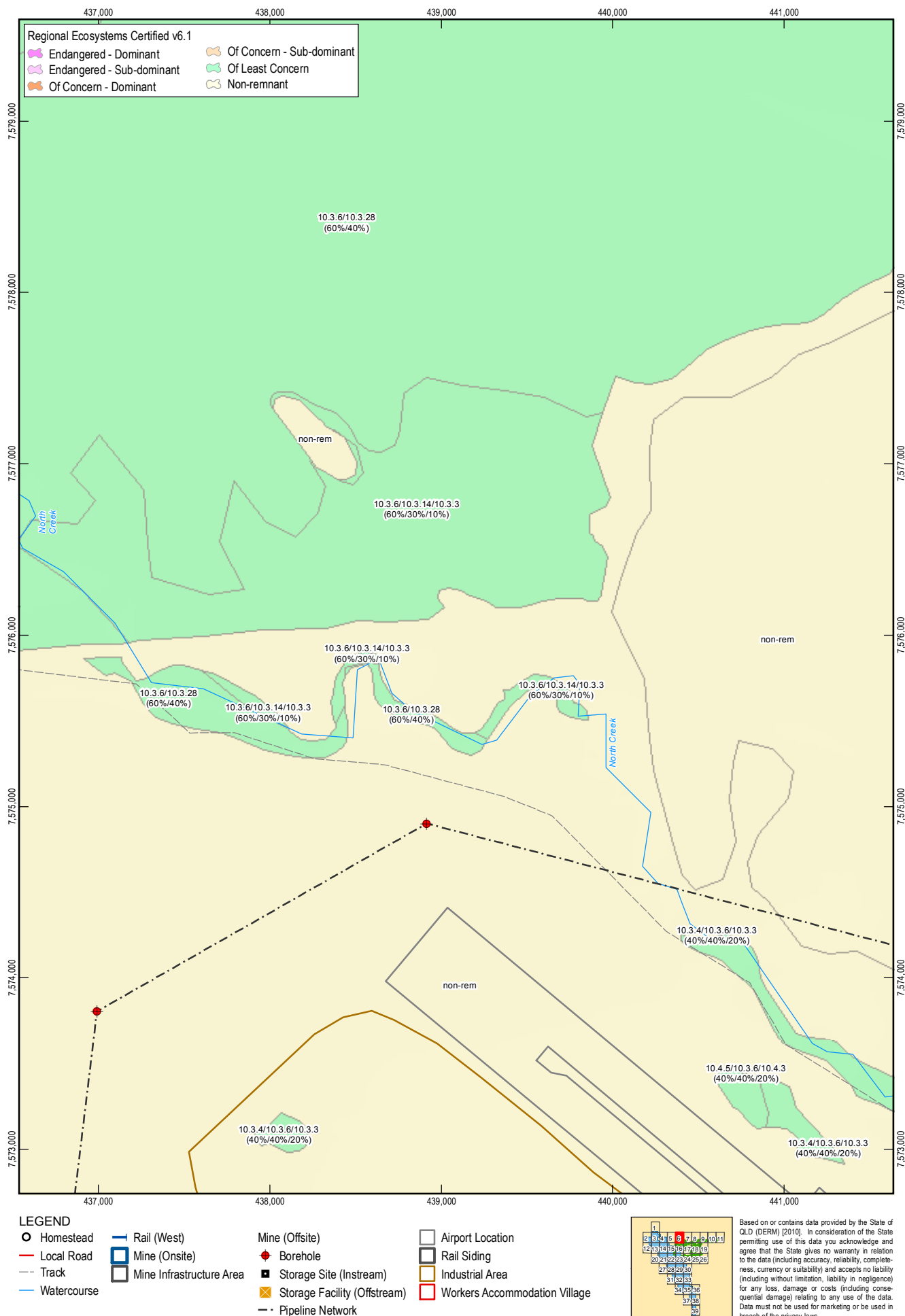
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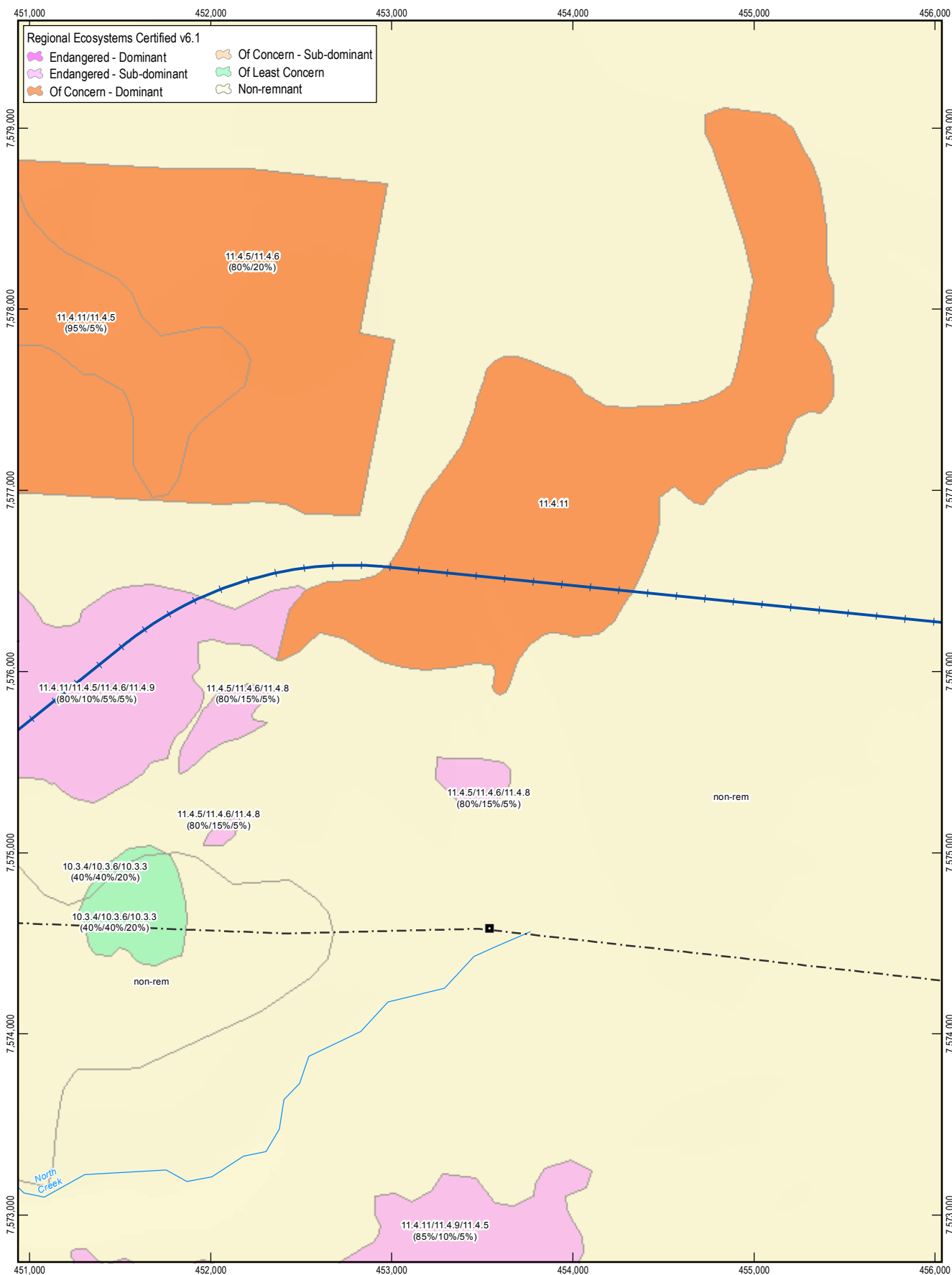
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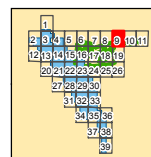
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LEGEND

- Homestead
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- Local Road
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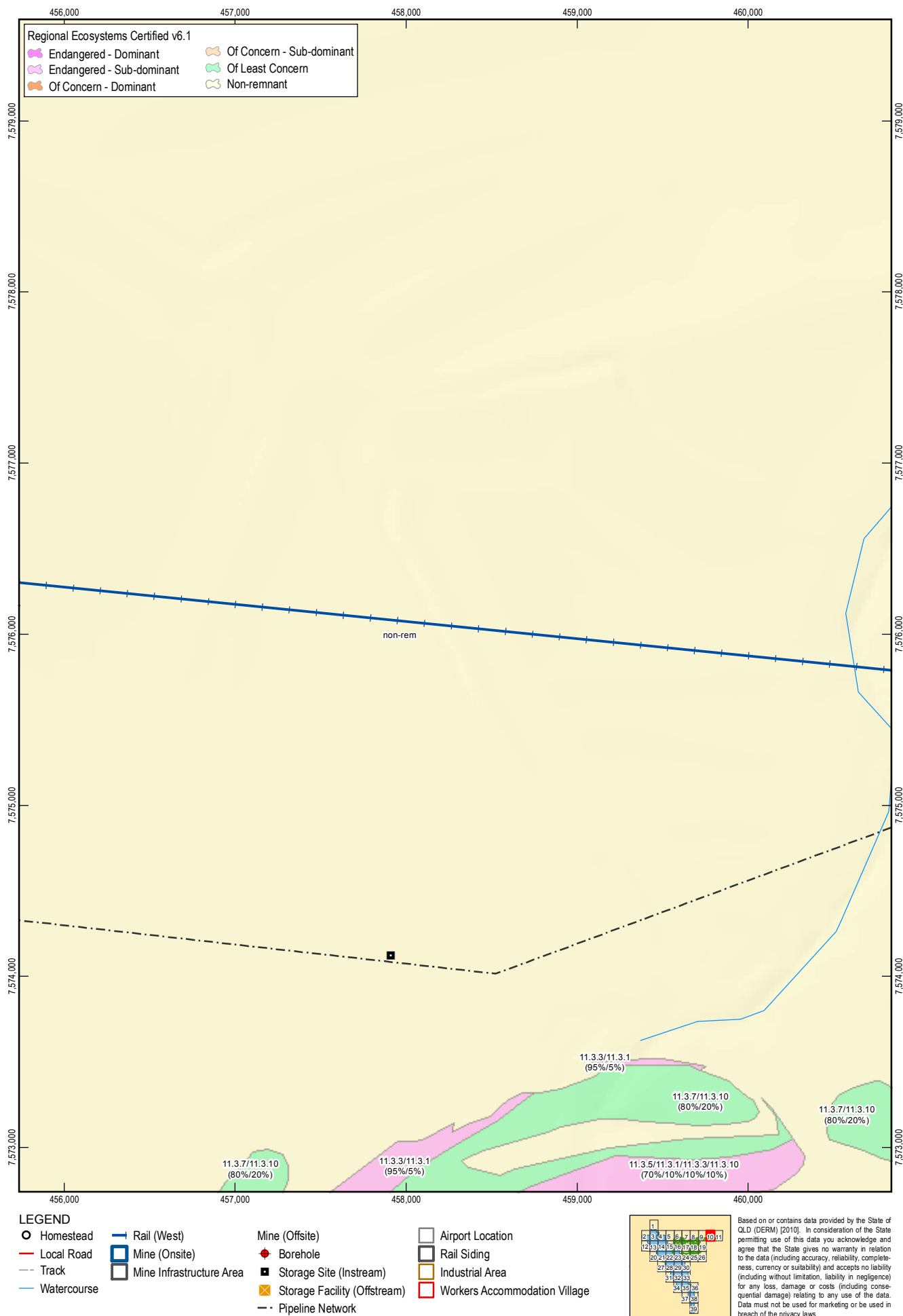
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Revision C
Date 29-08-2012

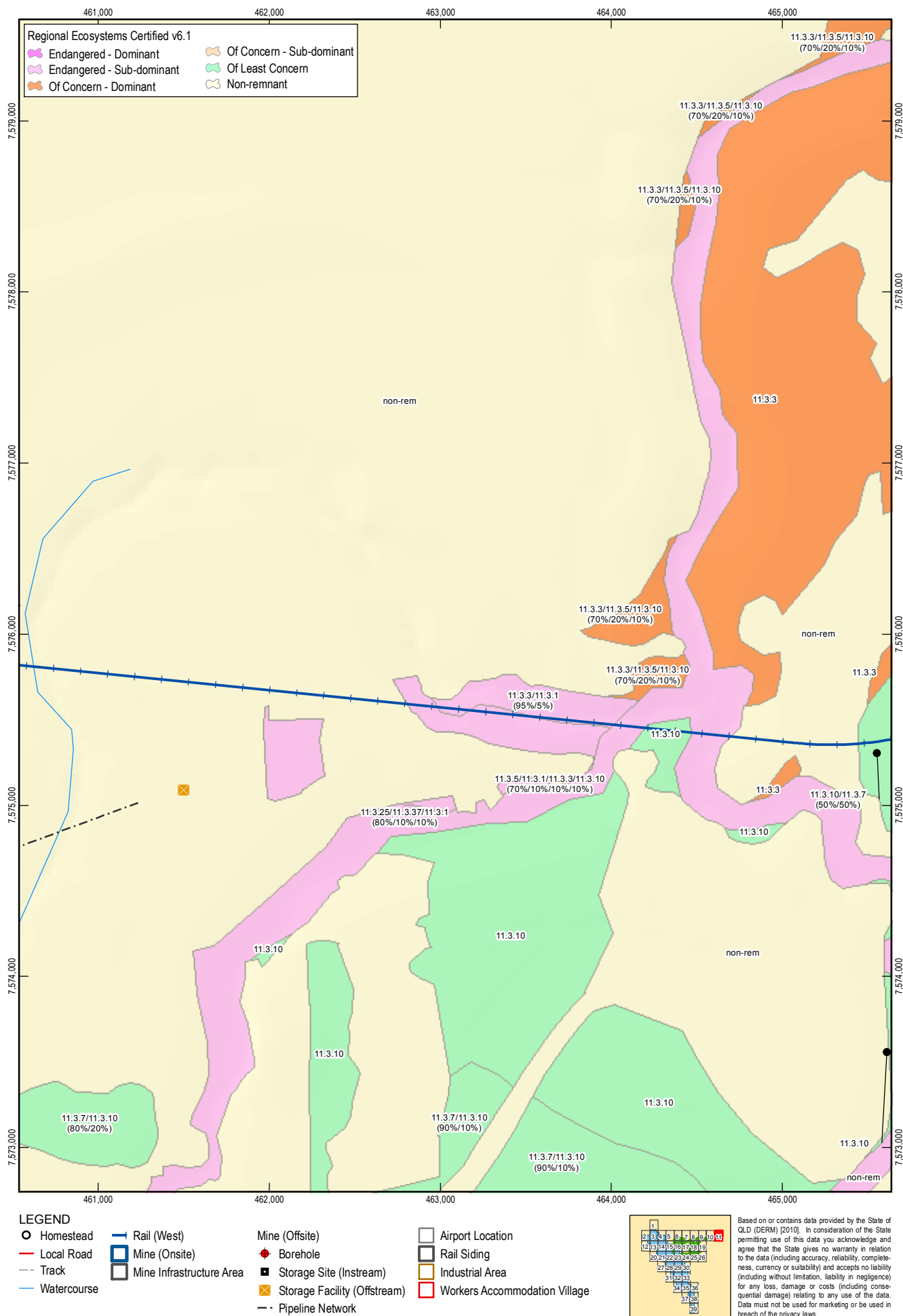
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Sheet 9 of 39

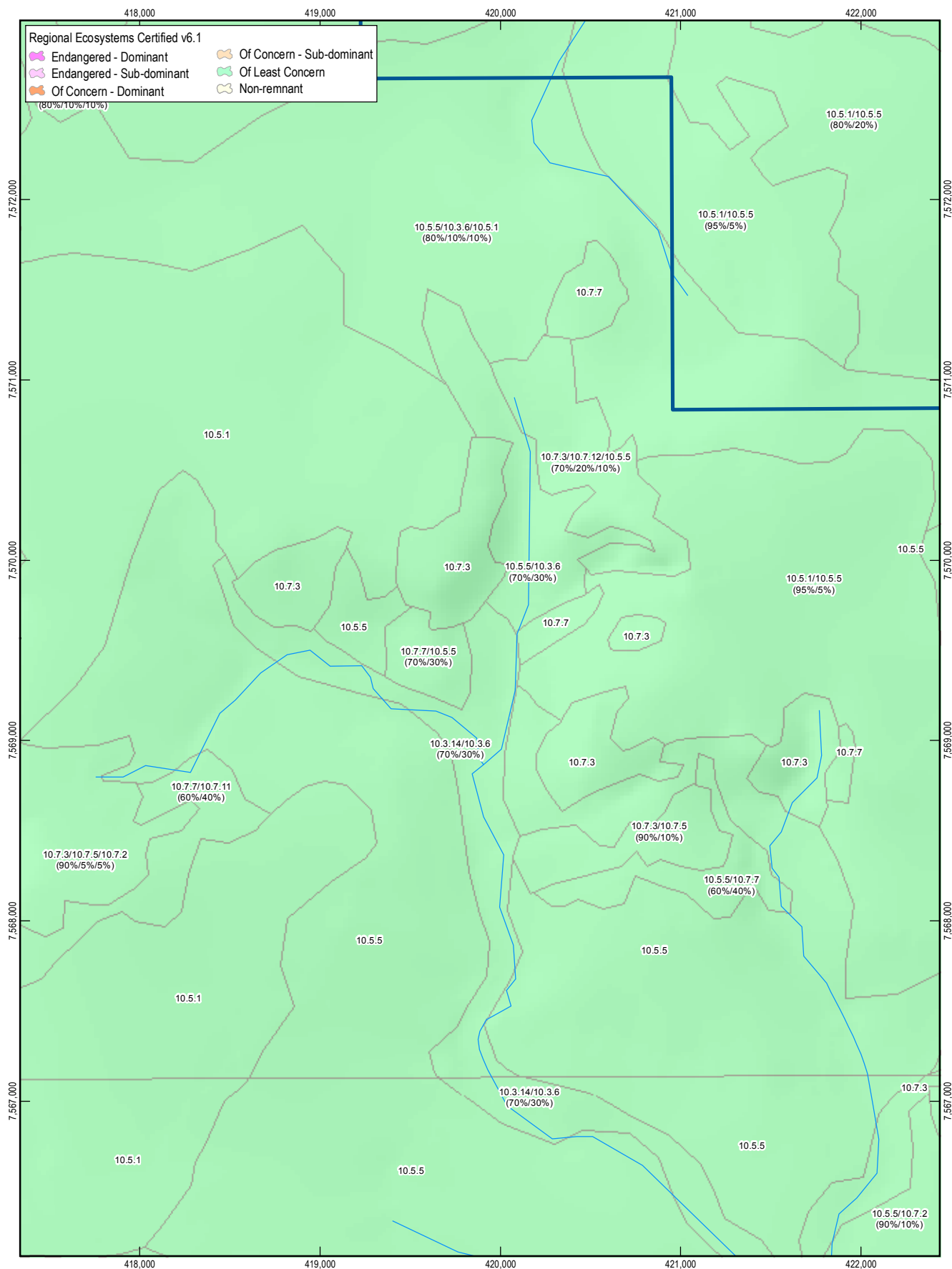
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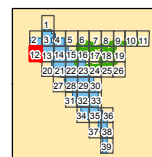






LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village



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0 200 400 600 800 1,000
Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
DERM Certified (V6.1)

Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 12 of 39

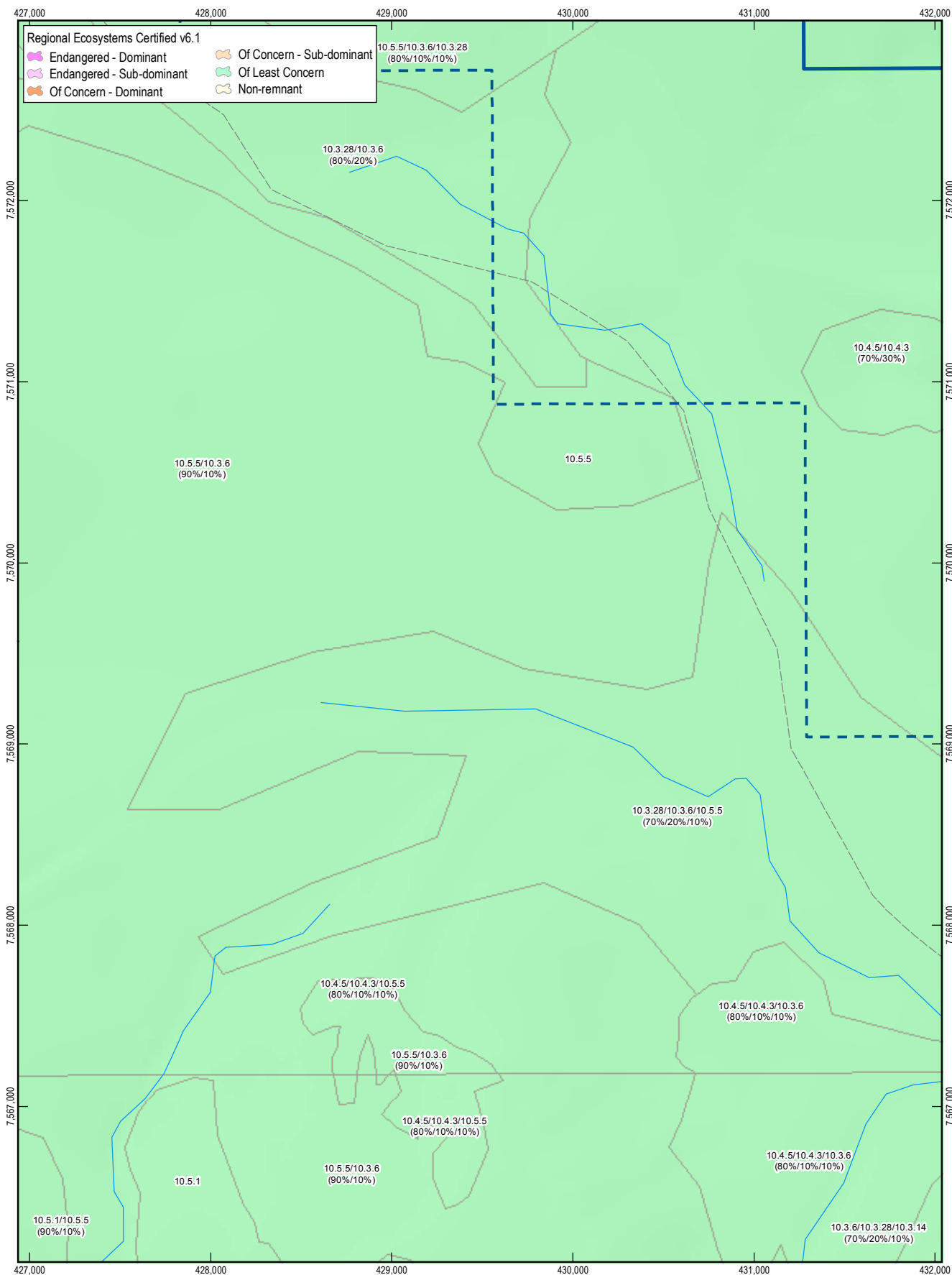
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LEGEND

- | | | | |
|---------------|--------------------------------|---------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | ■ Storage Facility (Offstream) | — Pipeline Network | □ Workers Accommodation Village |



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Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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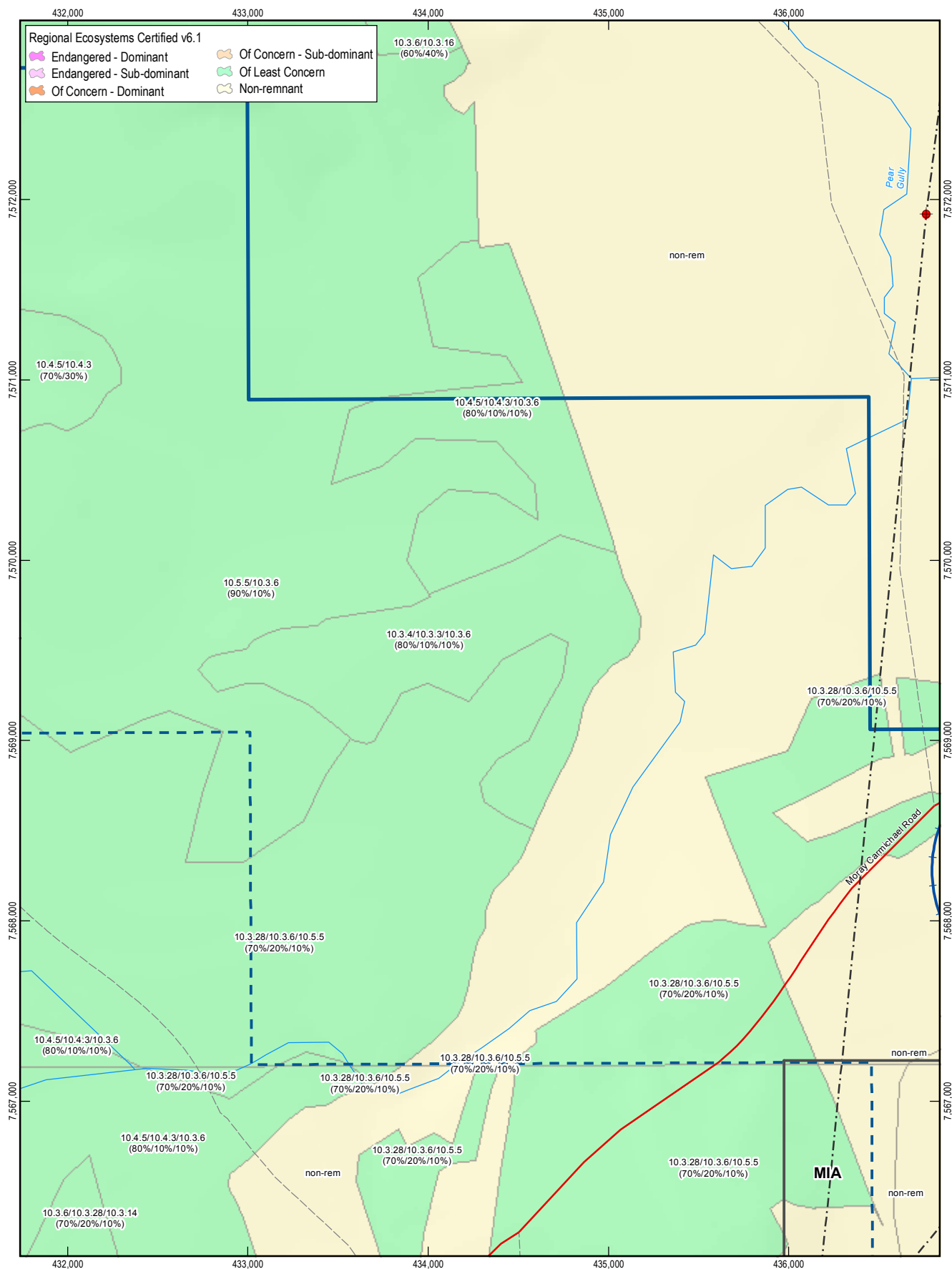
Job Number 41-25215
Revision C
Date 29-08-2012

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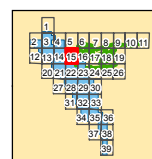
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LEGEND

- Homestead
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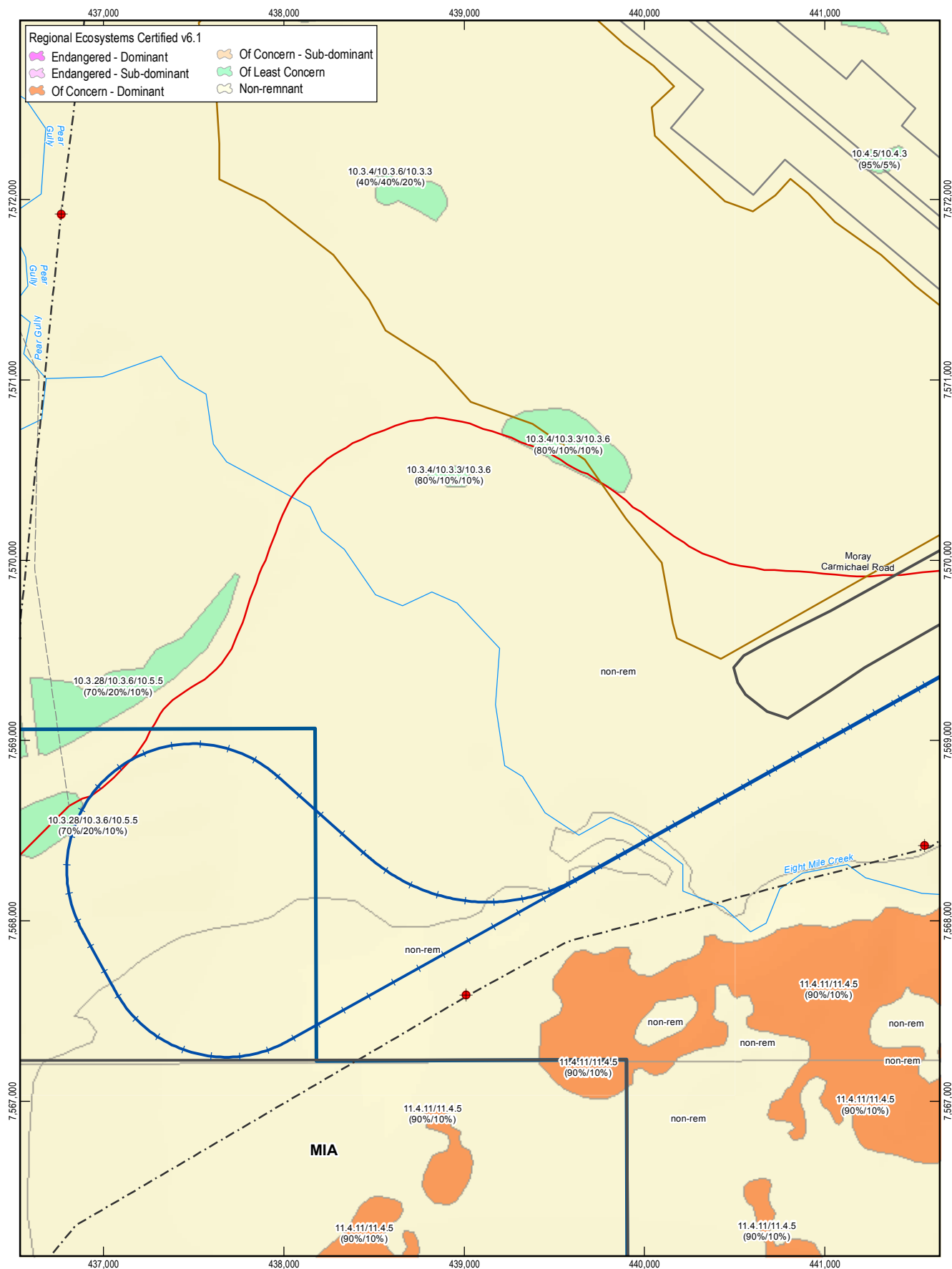
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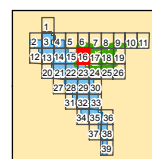
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LEGEND

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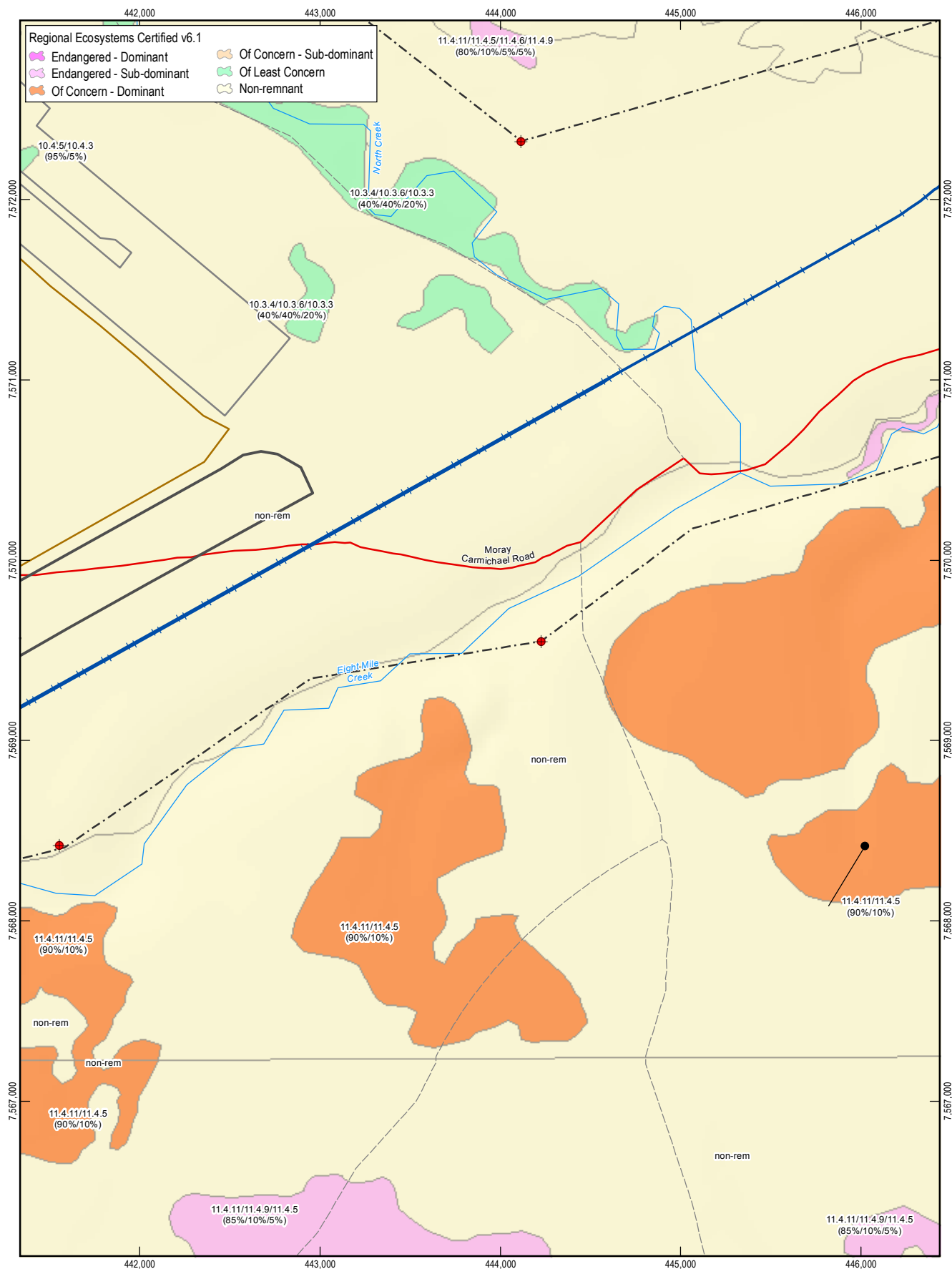
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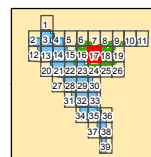
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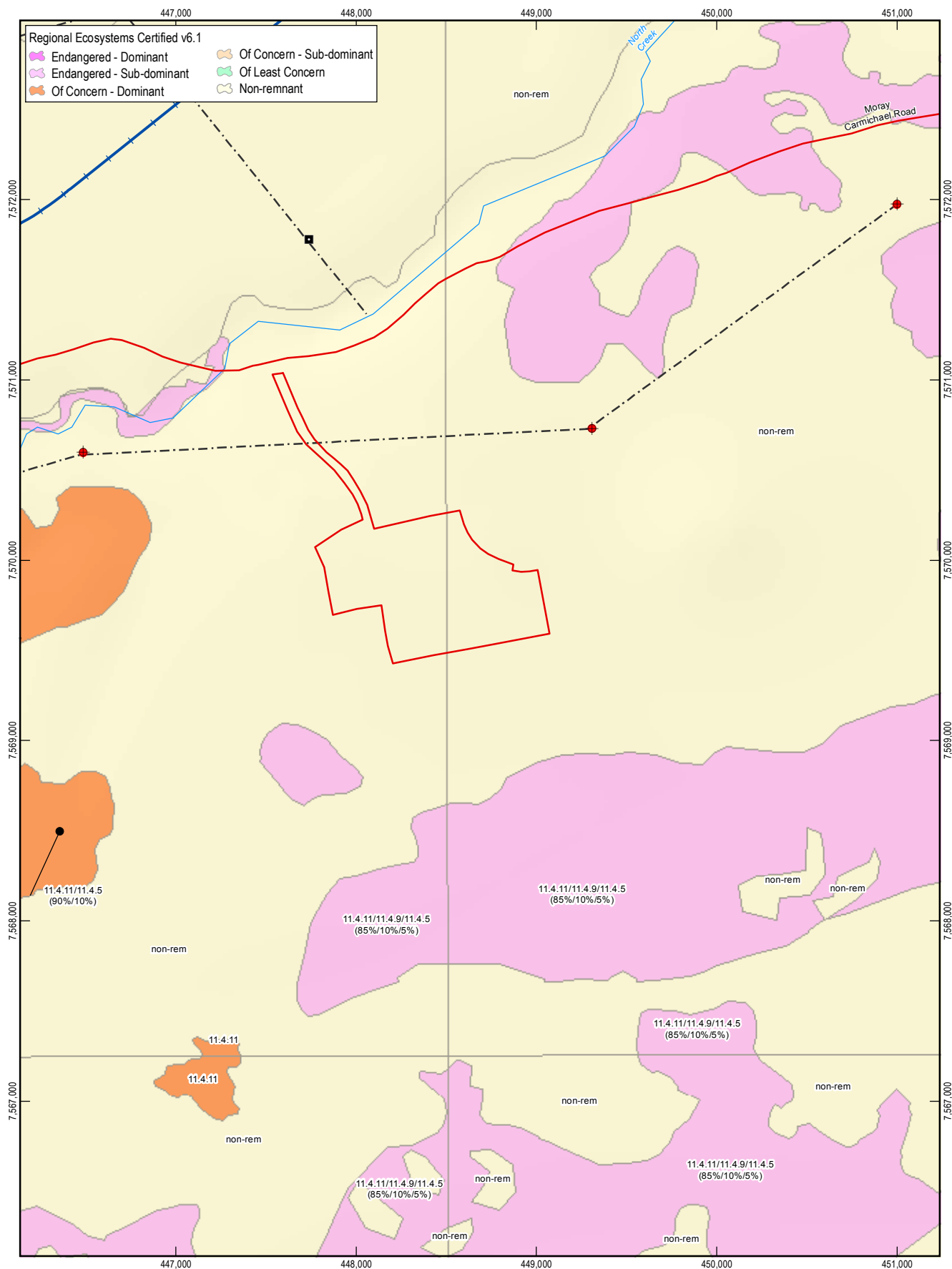
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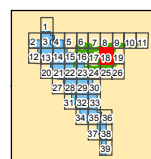
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LEGEND

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Carmichael Coal Mine and Rail Project
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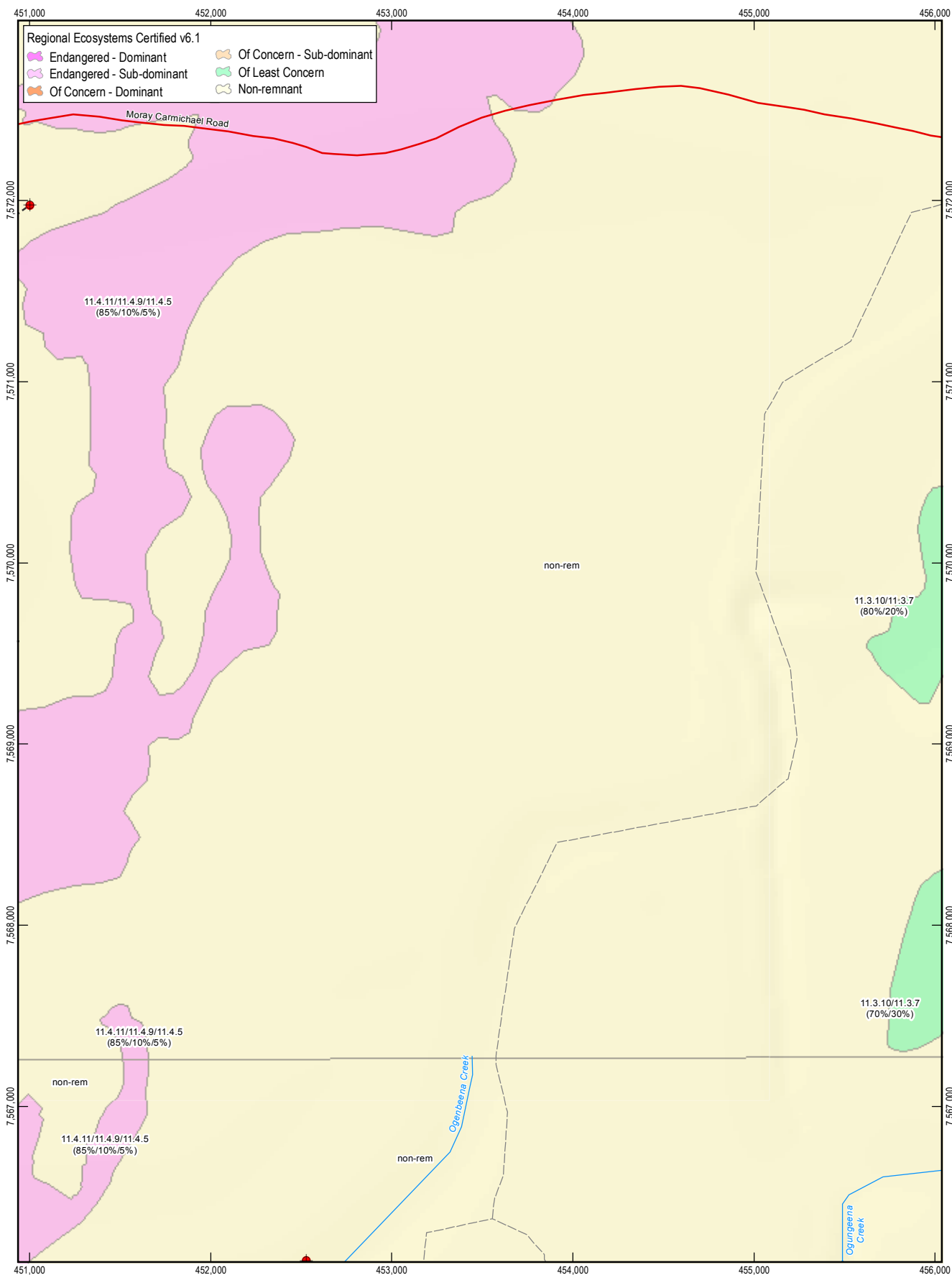
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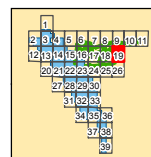
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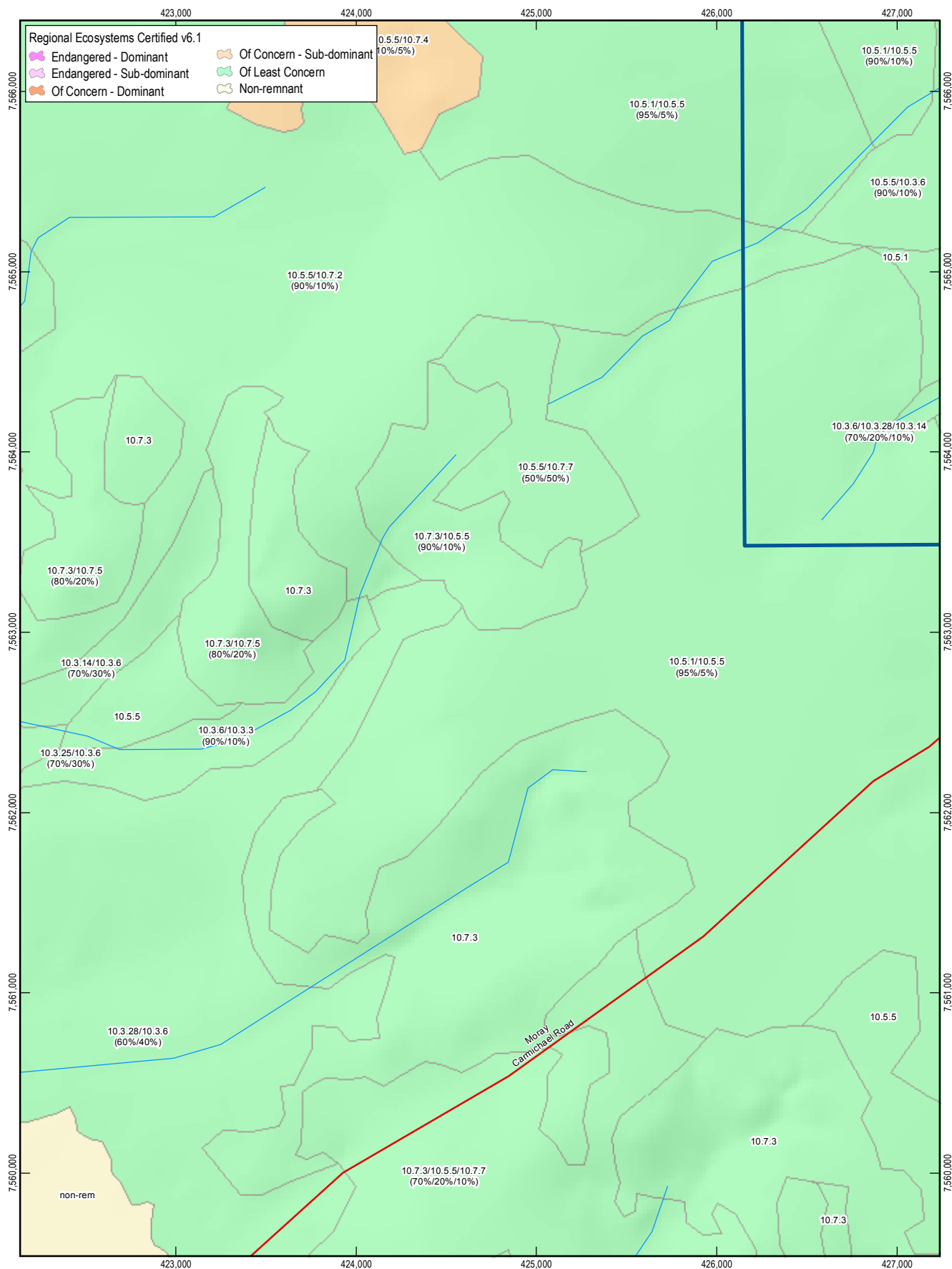
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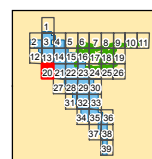
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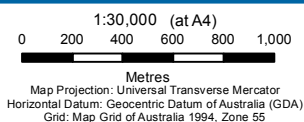


LEGEND

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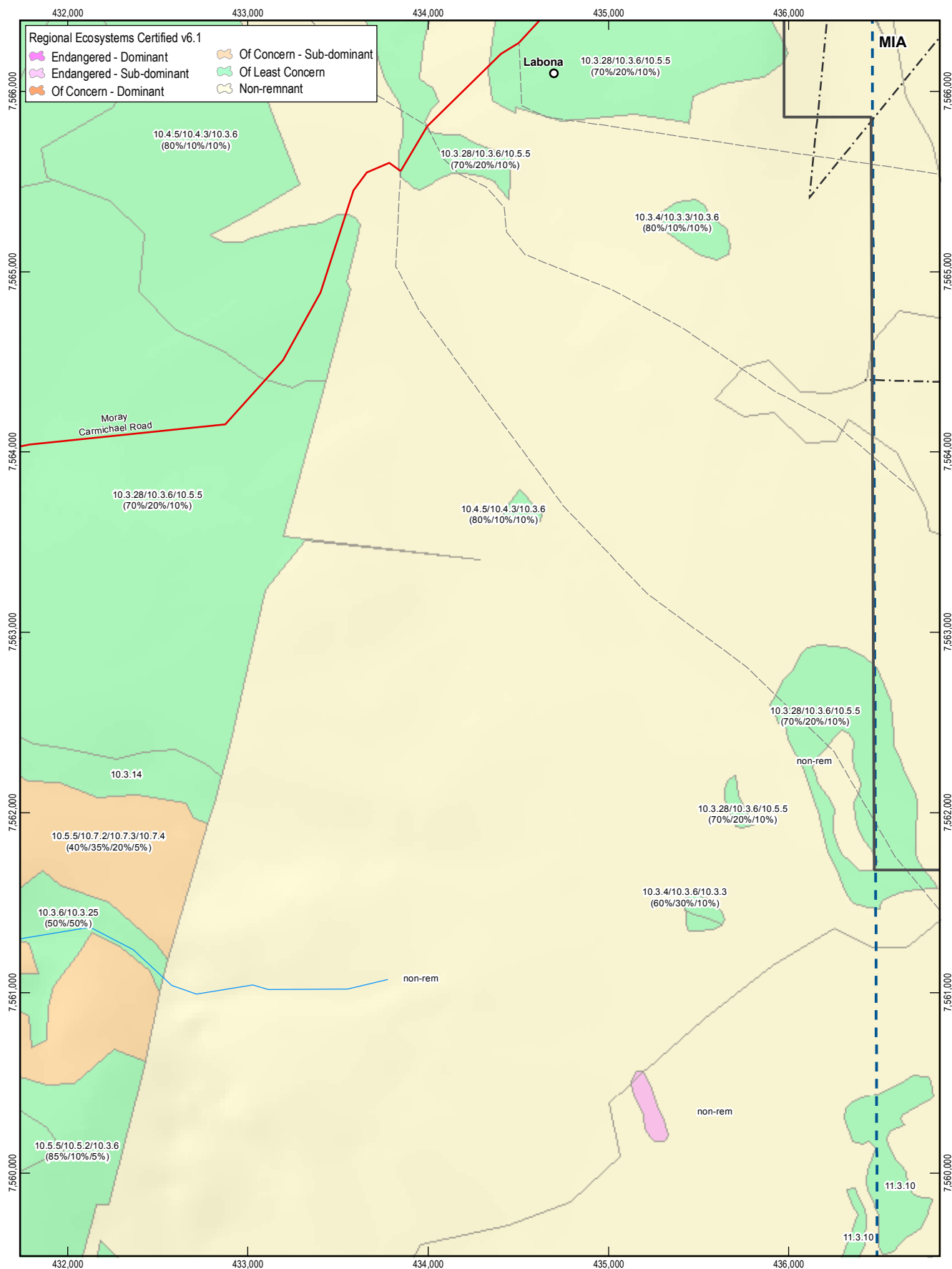
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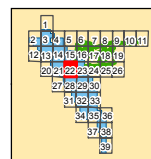
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Metres

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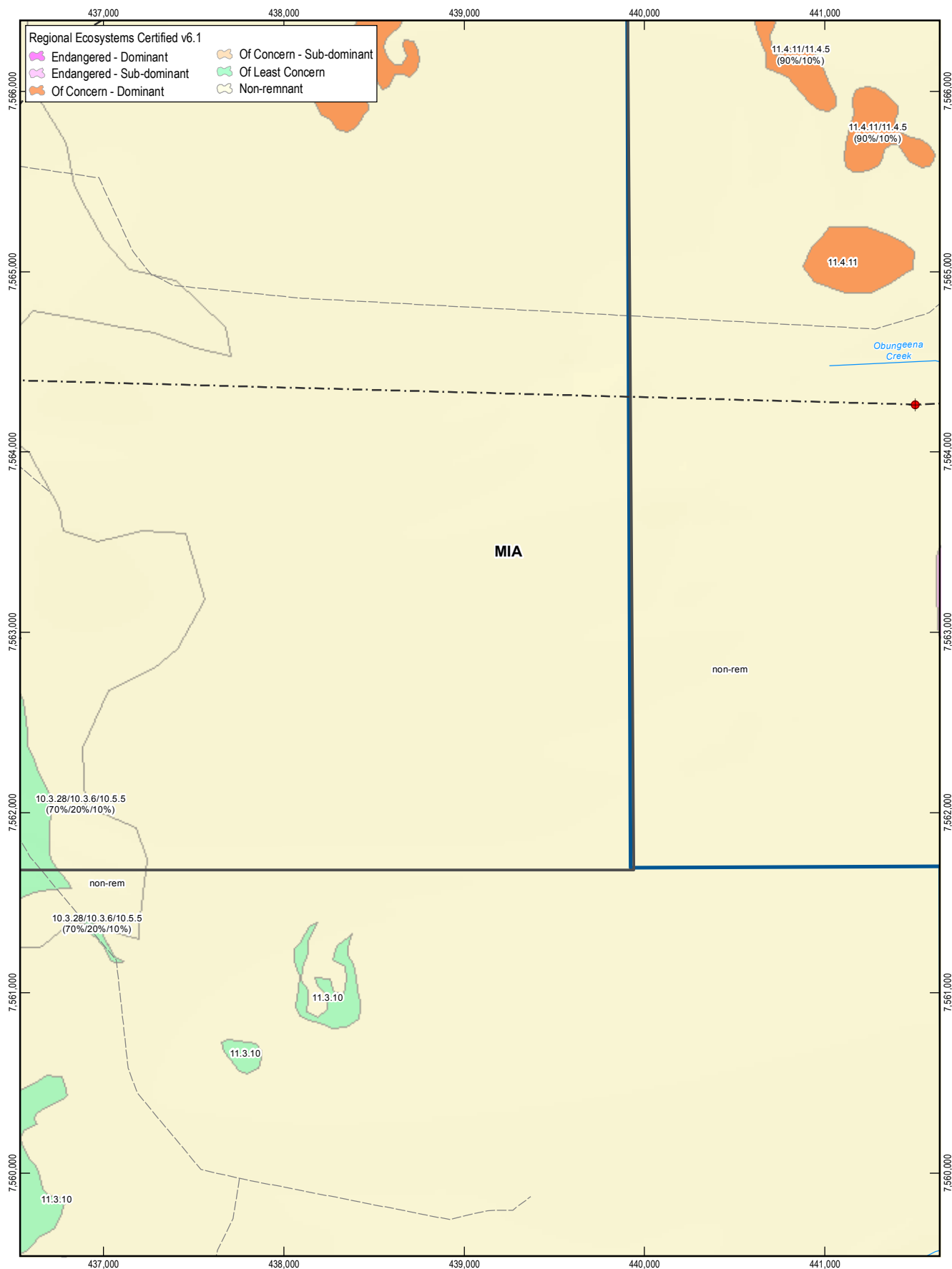
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Figure 2-3
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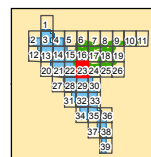
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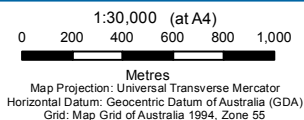


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village



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Carmichael Coal Mine and Rail Project
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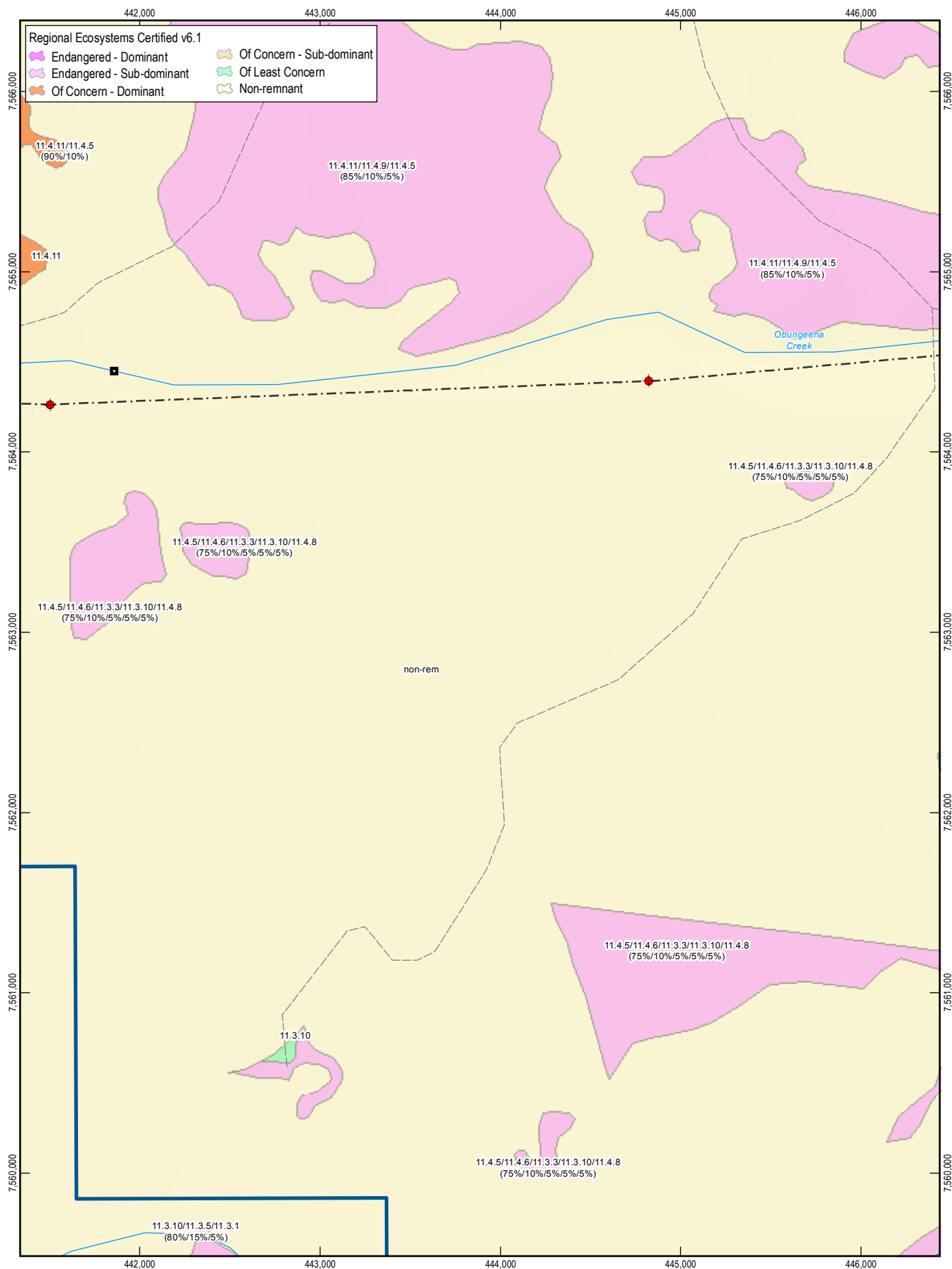
Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 23 of 39

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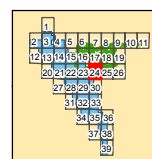
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LEGEND

- Homestead
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Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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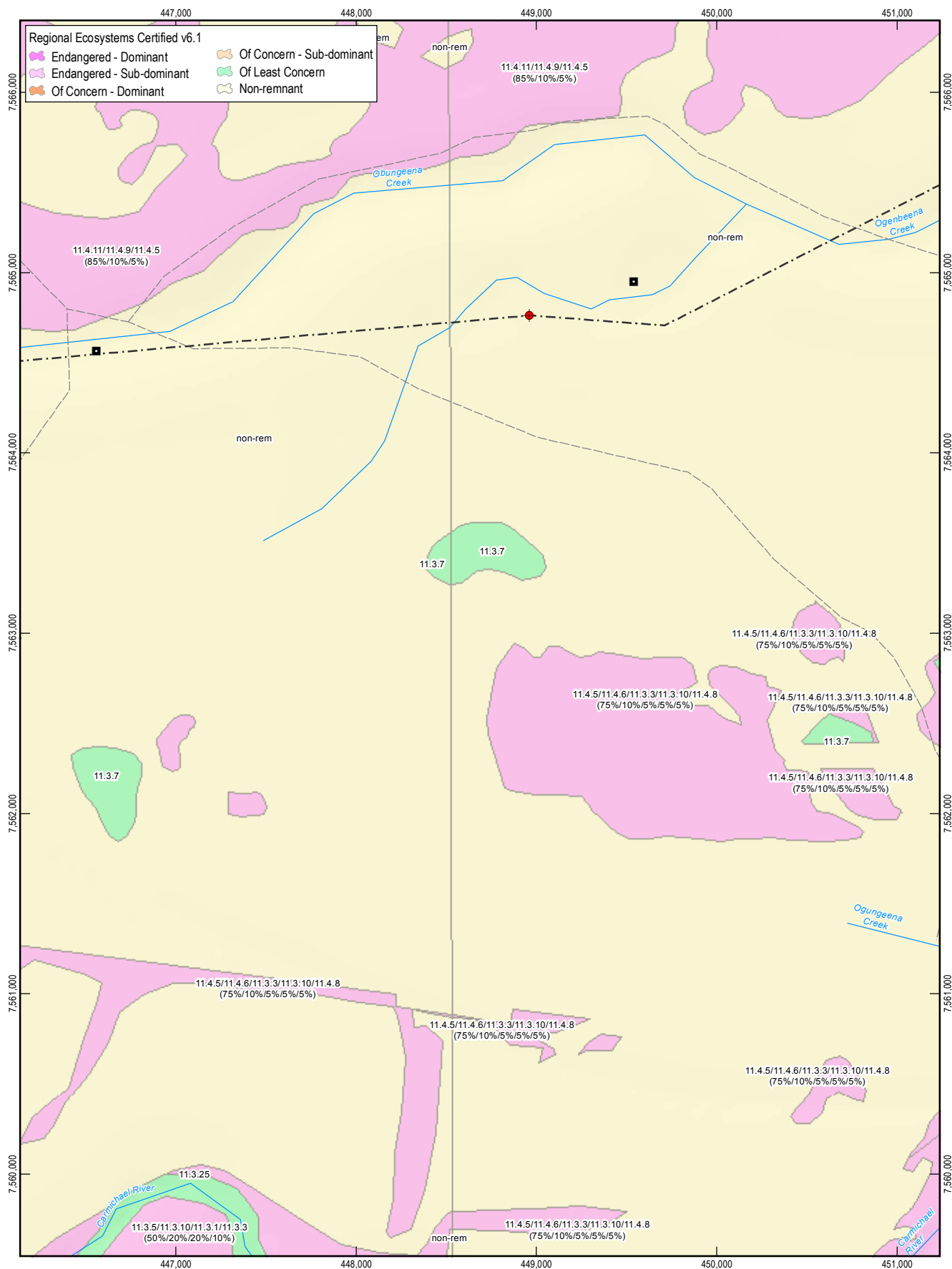
Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 24 of 39

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LEGEND

- Homestead
- Rail (West)
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- Borehole
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1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33
34	35	36	37	38	39	40	41	42	43	44

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Metres
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Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



adani

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Carmichael Coal Mine and Rail Project
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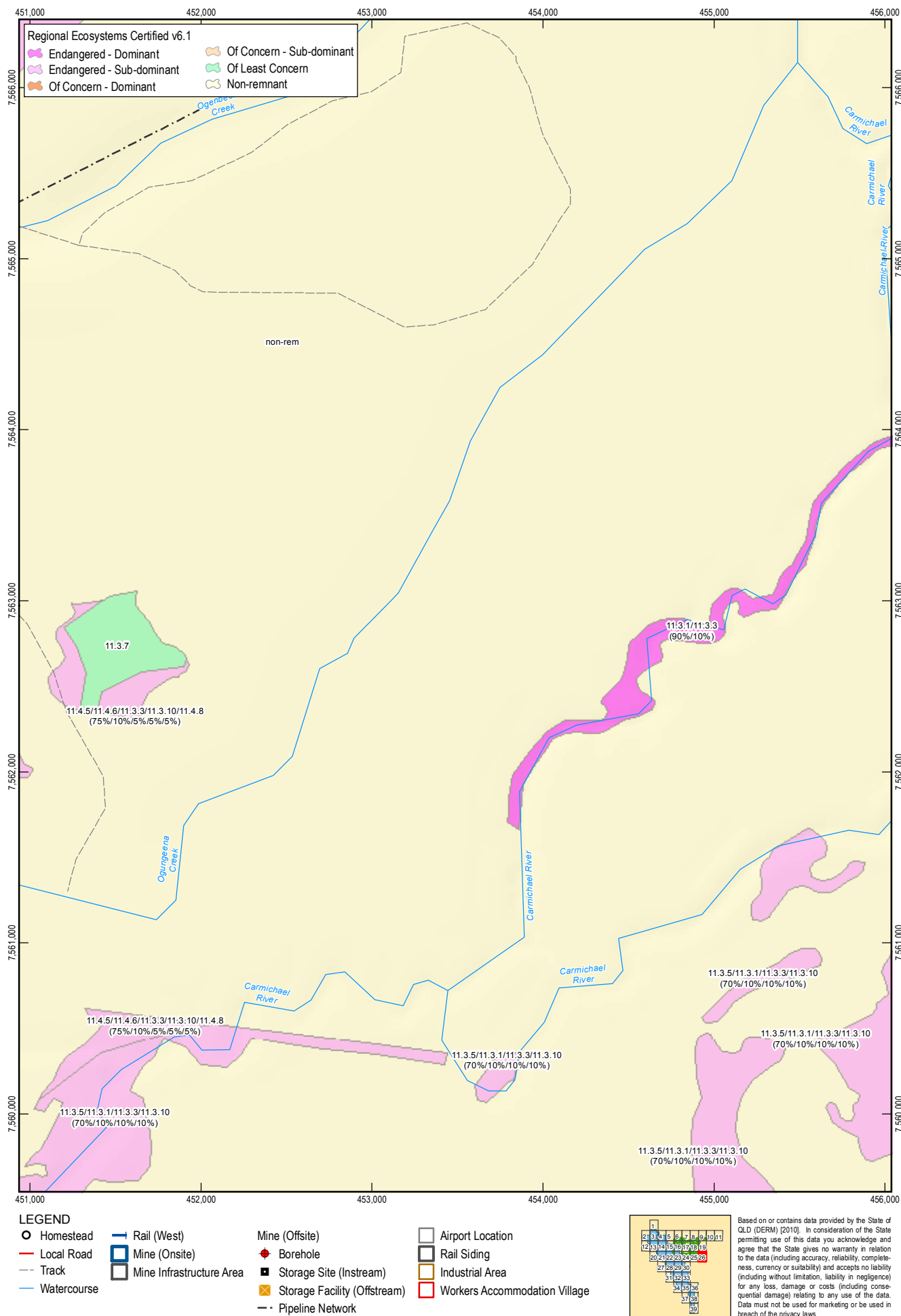
Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 25 of 39

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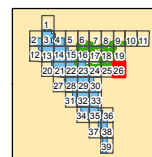
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- Workers Accommodation Village



1:30,000 (at A4)
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Metres
Map Projection: Universal Transverse Mercator
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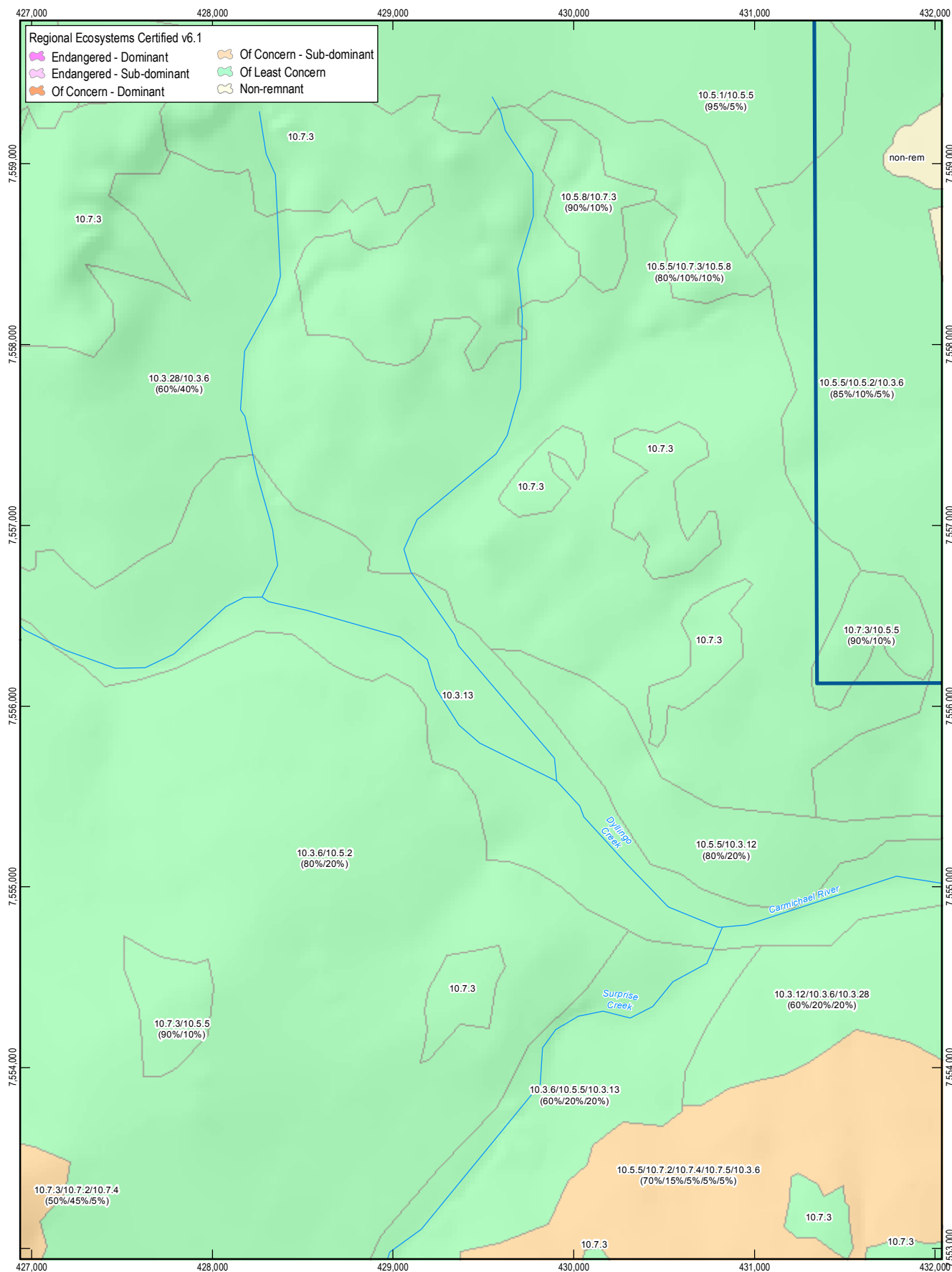
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Figure 2-3
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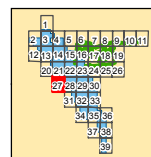
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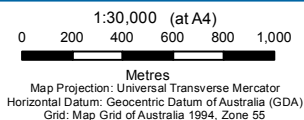


LEGEND

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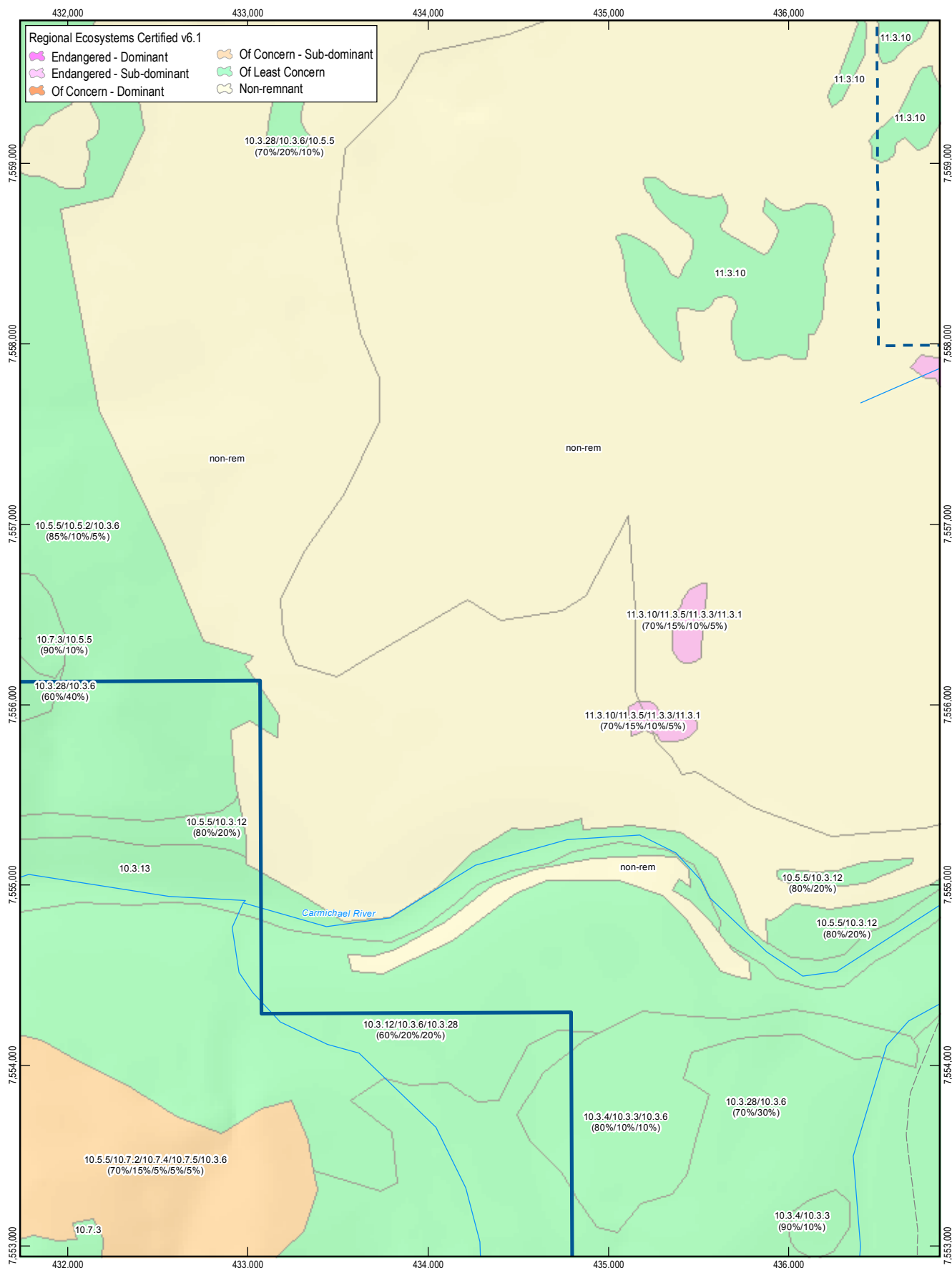
Job Number 41-25215
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Date 29-08-2012

Figure 2-3
Sheet 27 of 39

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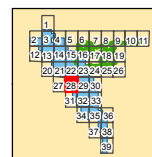
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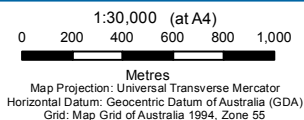


LEGEND

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- Local Road
- Track
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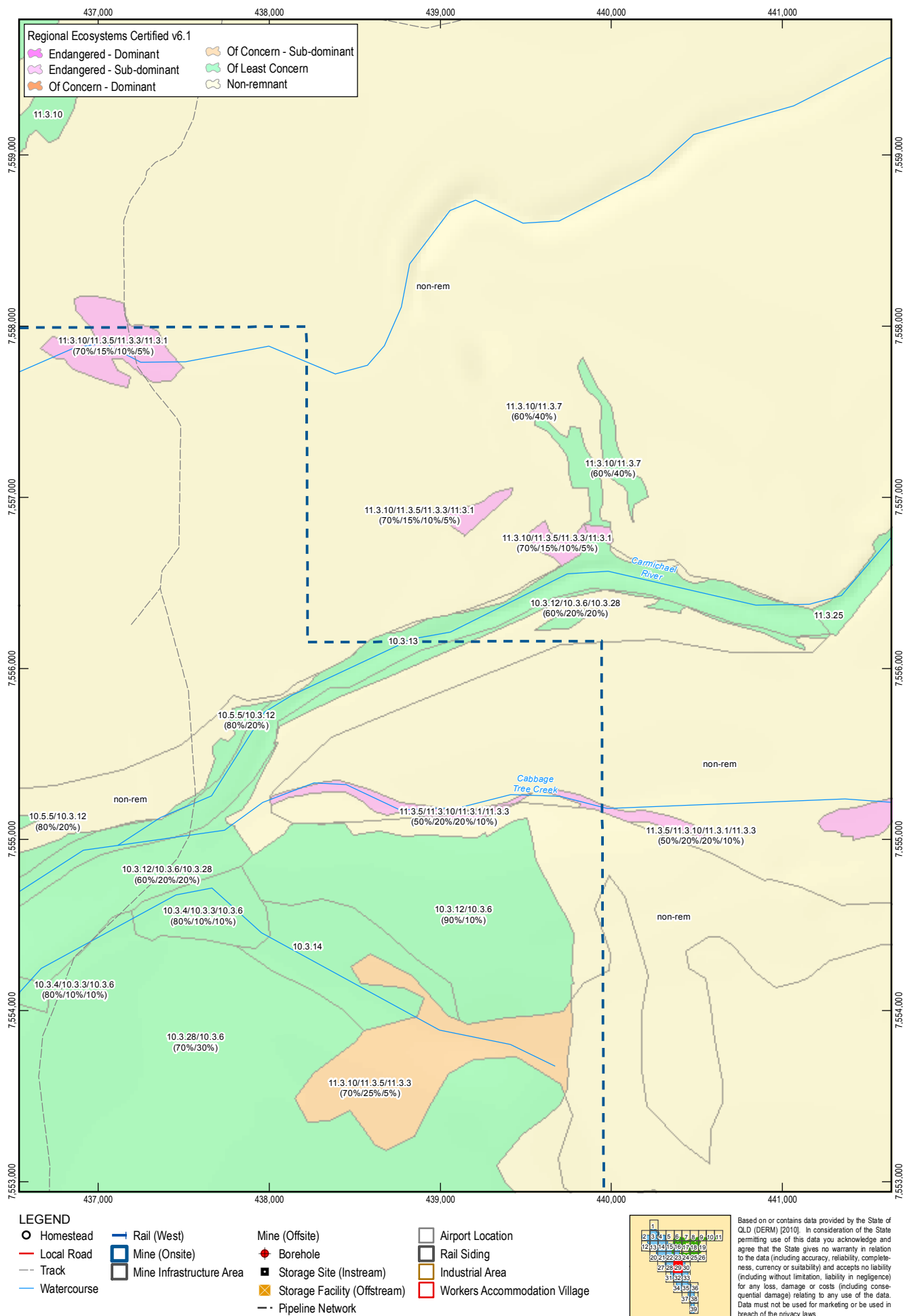
Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 28 of 39

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 Carmichael Coal Mine and Rail Project

Regional Ecosystems
 DERM Certified (V6.1)

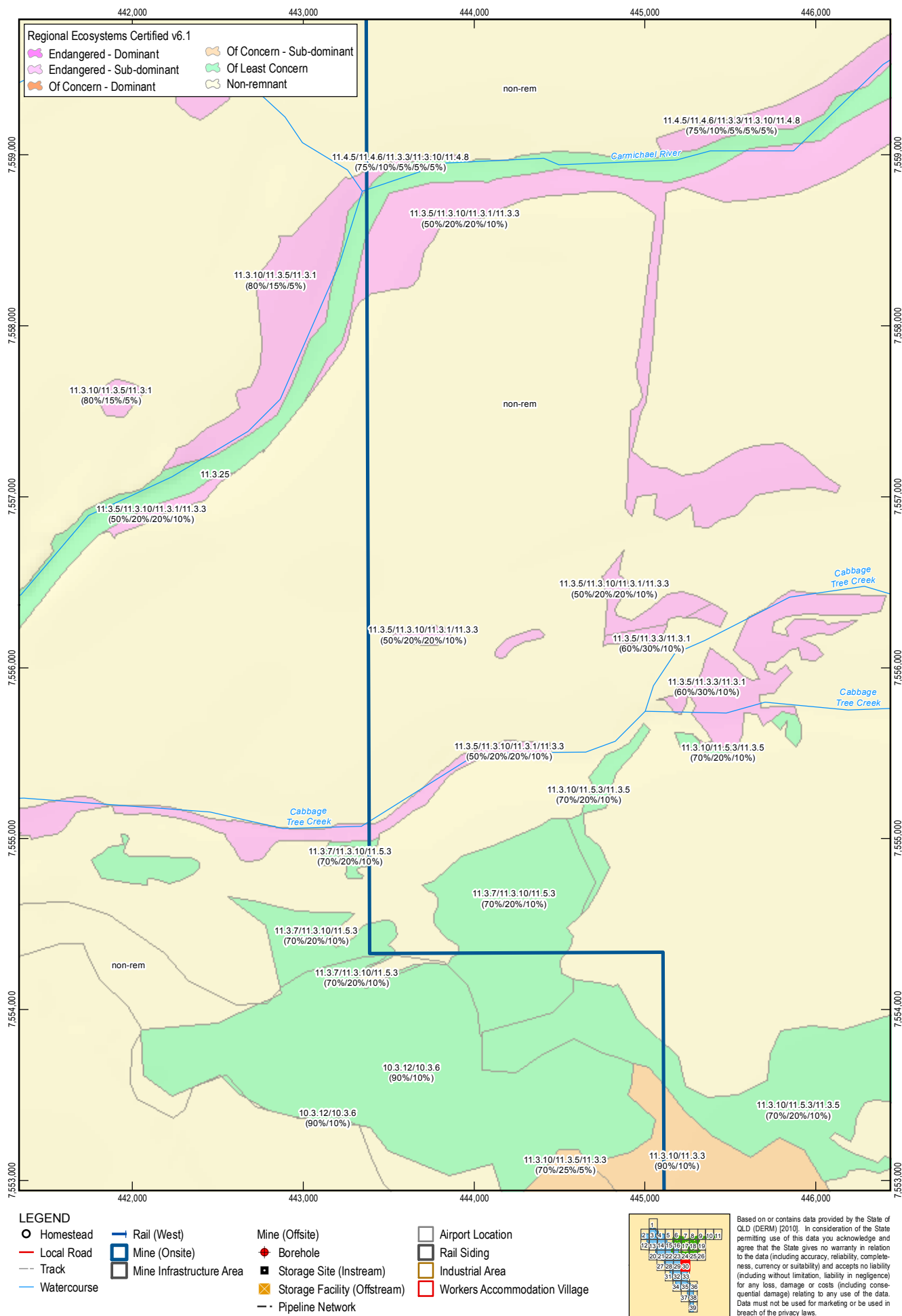
Job Number 41-25215
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Figure 2-3
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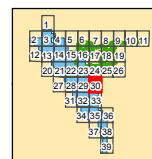
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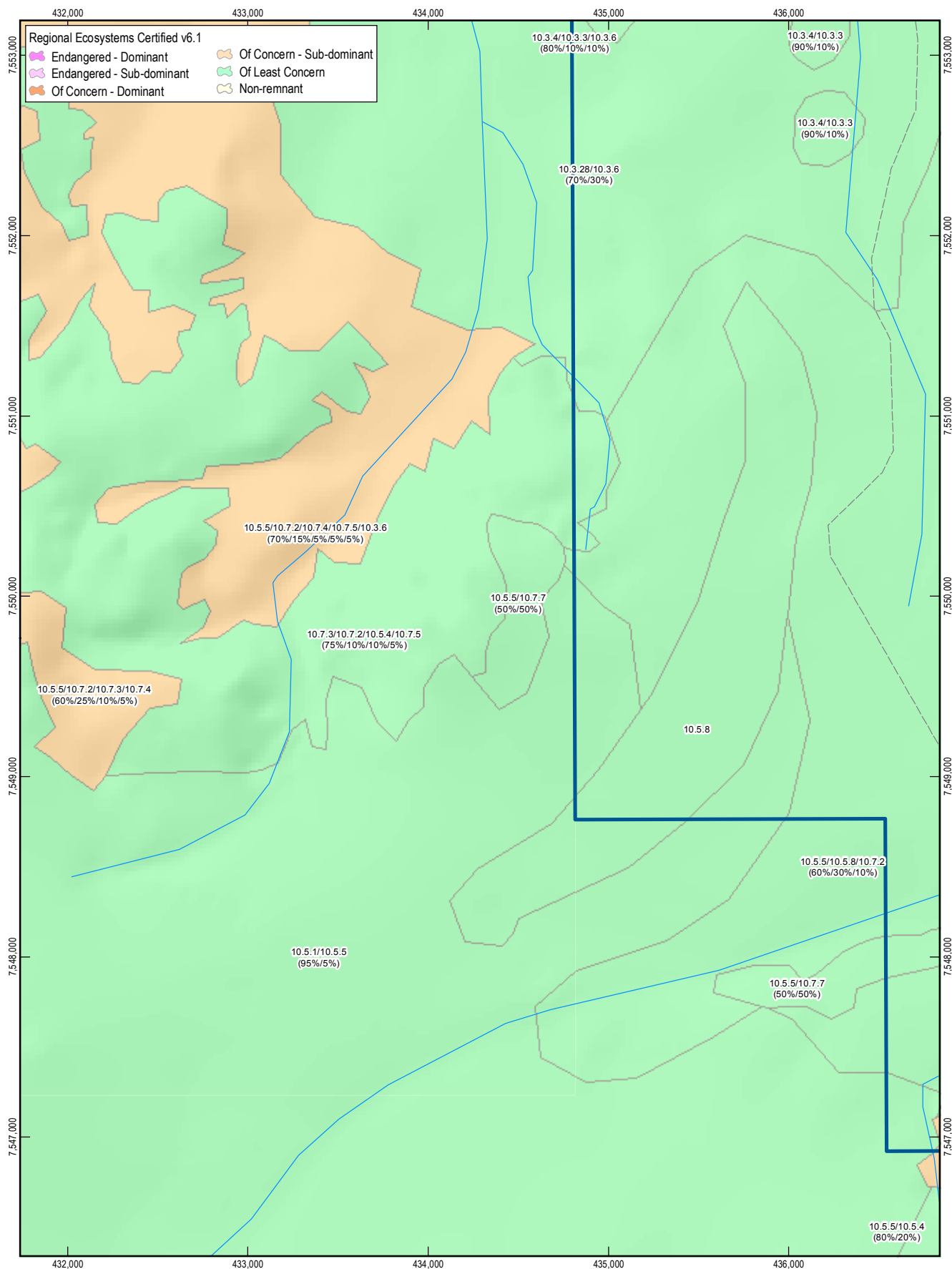


LEGEND

- Homestead
- Rail (West)
- Local Road
- Track
- Watercourse
- Mine (Offsite)
- Mine (Onsite)
- Mine Infrastructure Area
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- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

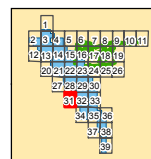


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Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
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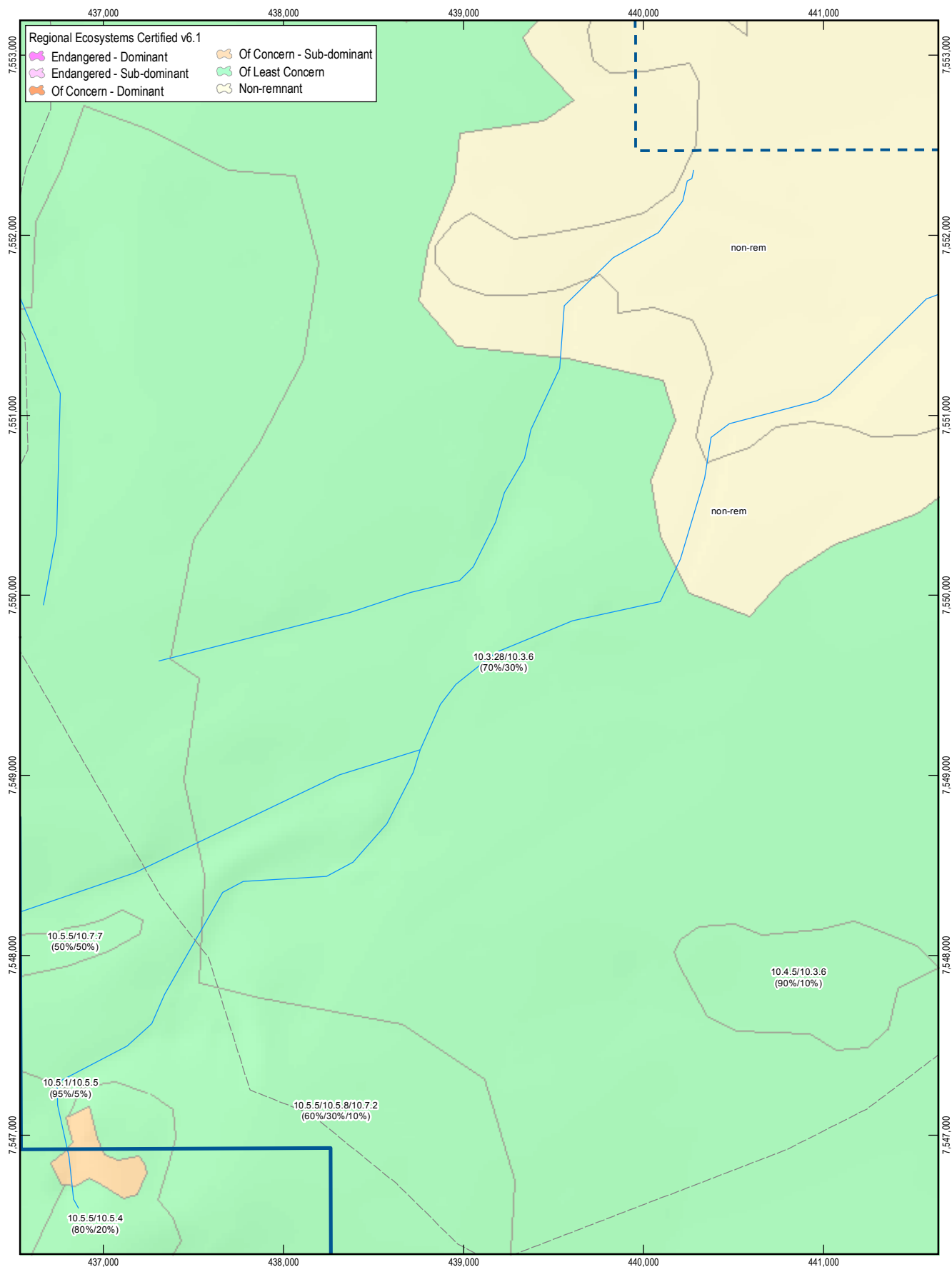
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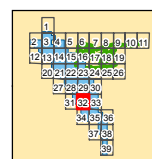
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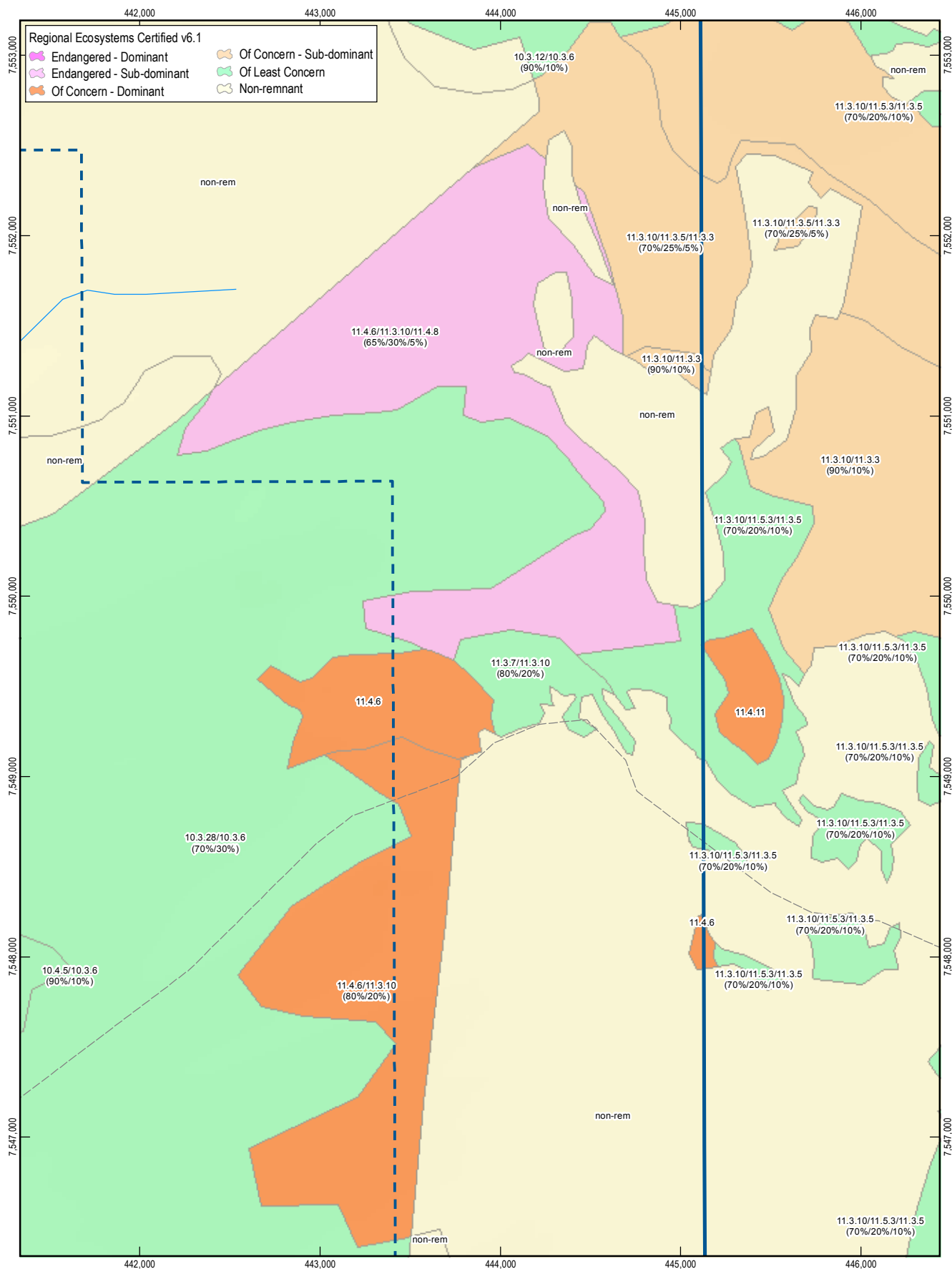
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Figure 2-3
Sheet 32 of 39

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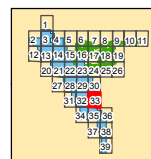
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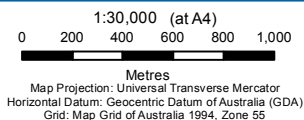


LEGEND

- Homestead
- Rail (West)
- Local Road
- Track
- Watercourse
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village



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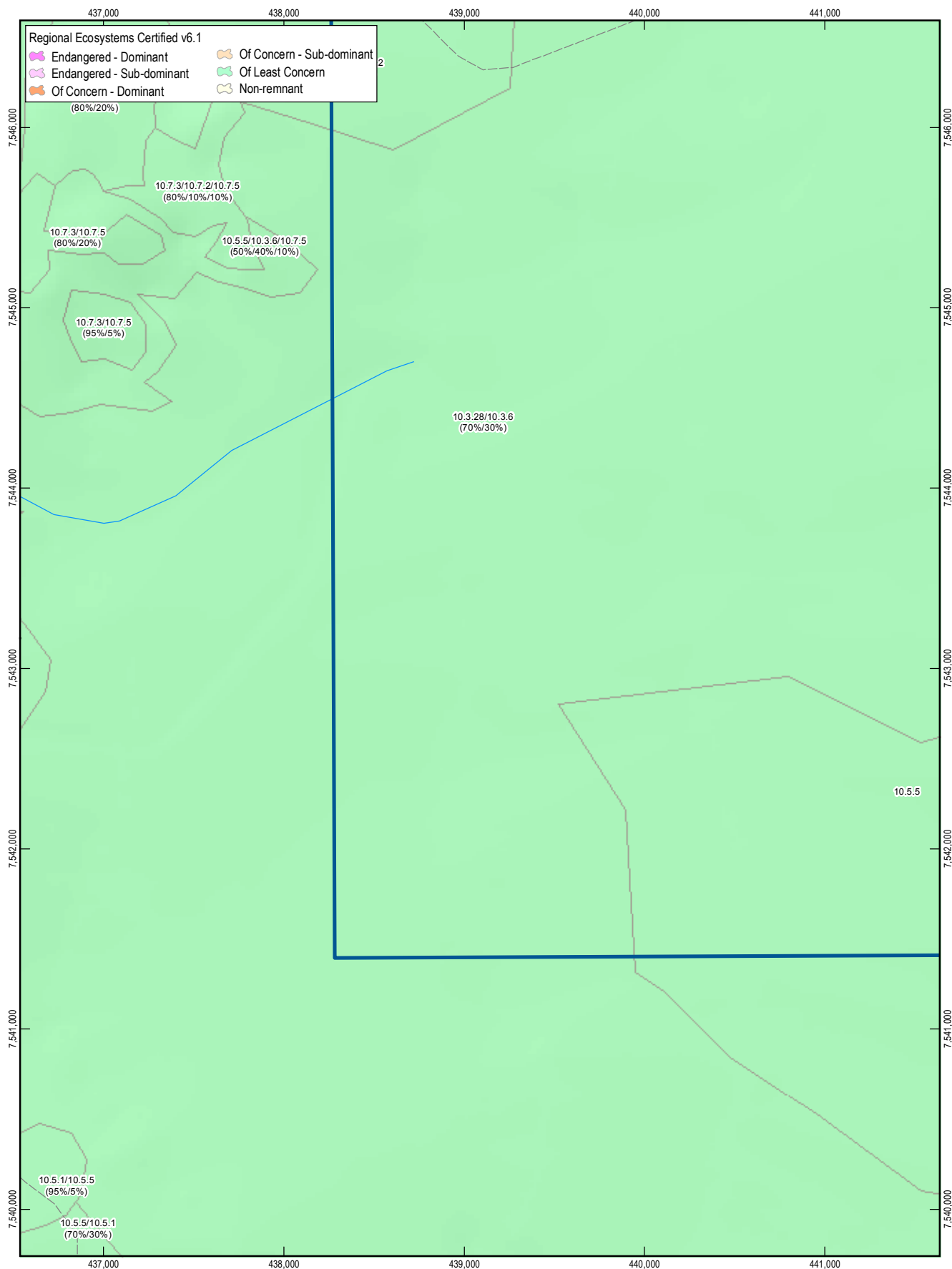
Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 33 of 39

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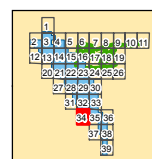
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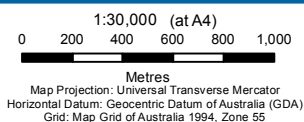


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
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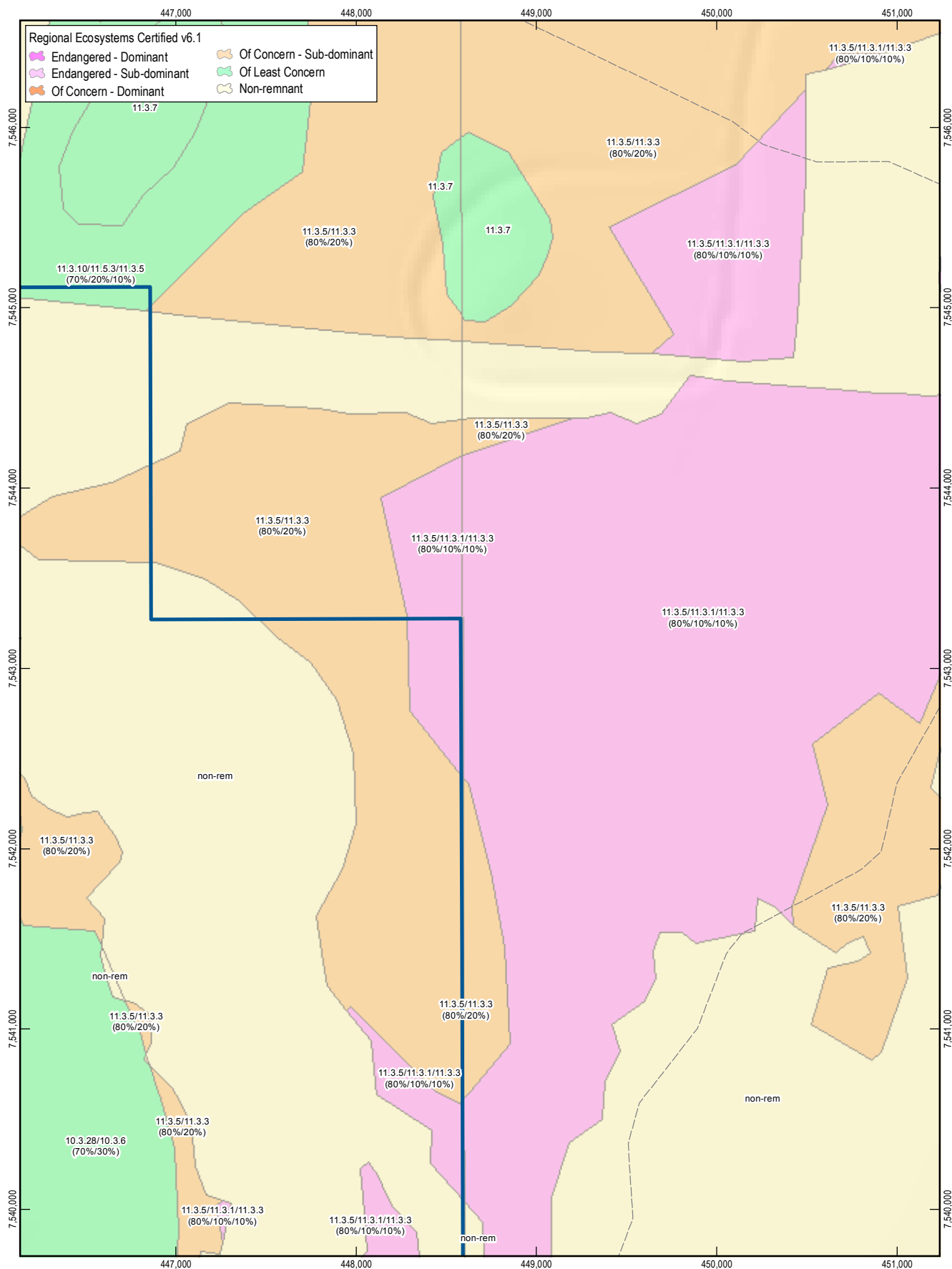
Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 34 of 39

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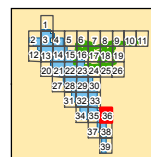
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LEGEND

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Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
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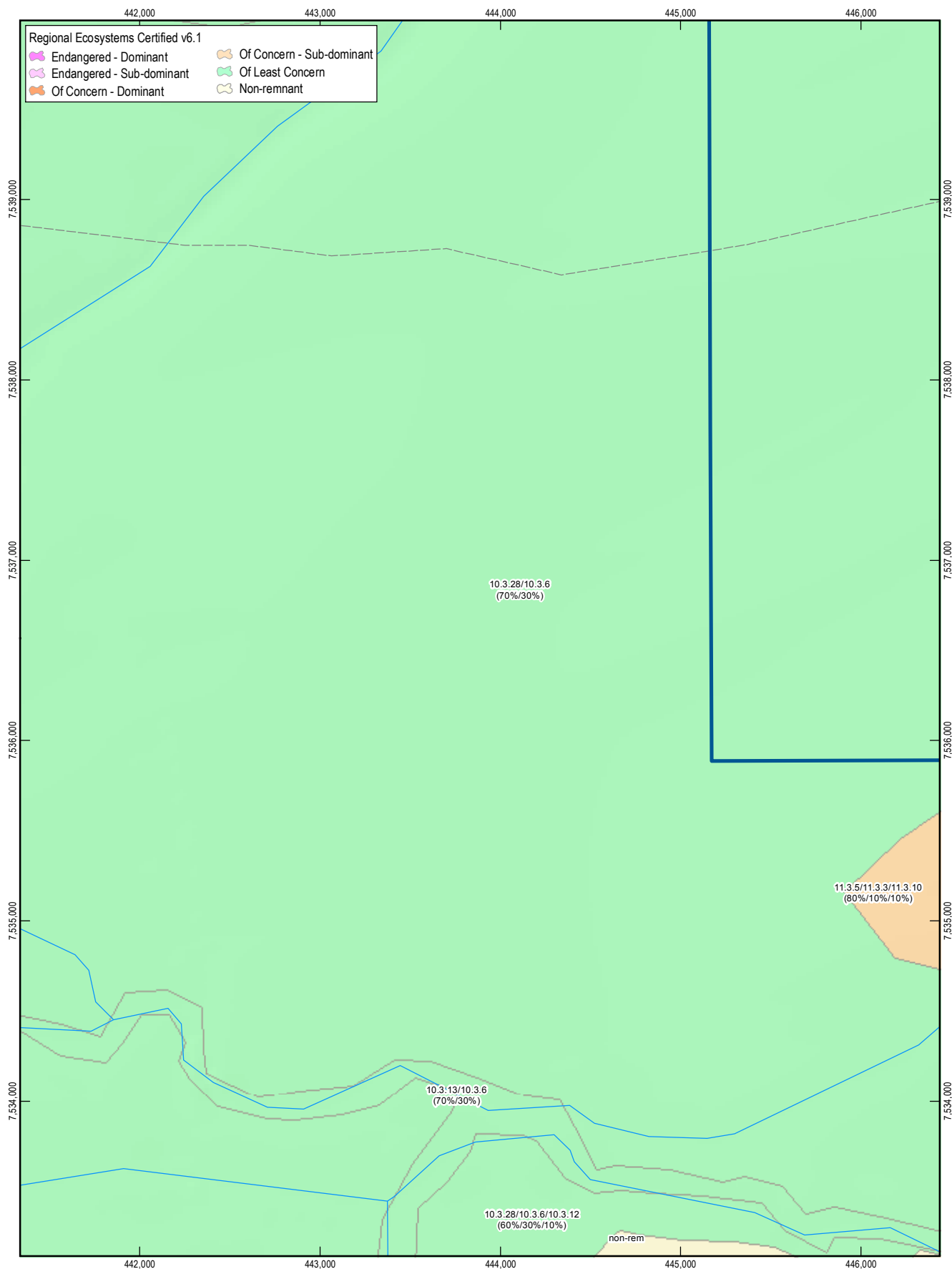
Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-3
Sheet 36 of 39

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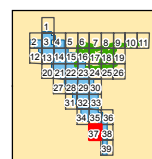
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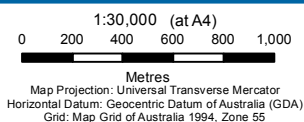


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
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- Mine Infrastructure Area
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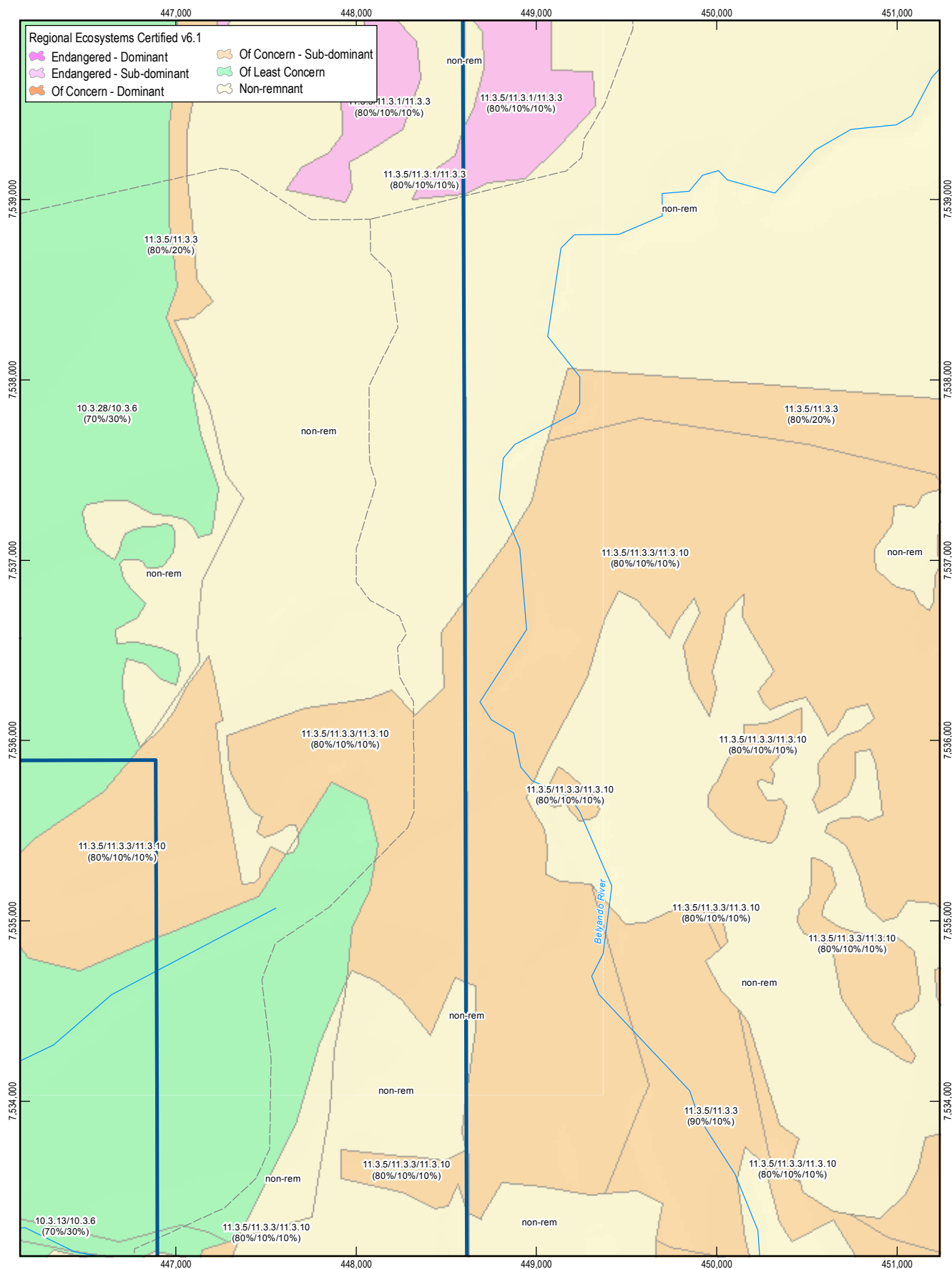
Job Number 41-25215
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Date 29-08-2012

Figure 2-3
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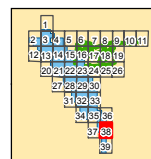
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LEGEND

- Homestead
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1:30,000 (at A4)
0 200 400 600 800 1,000
Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
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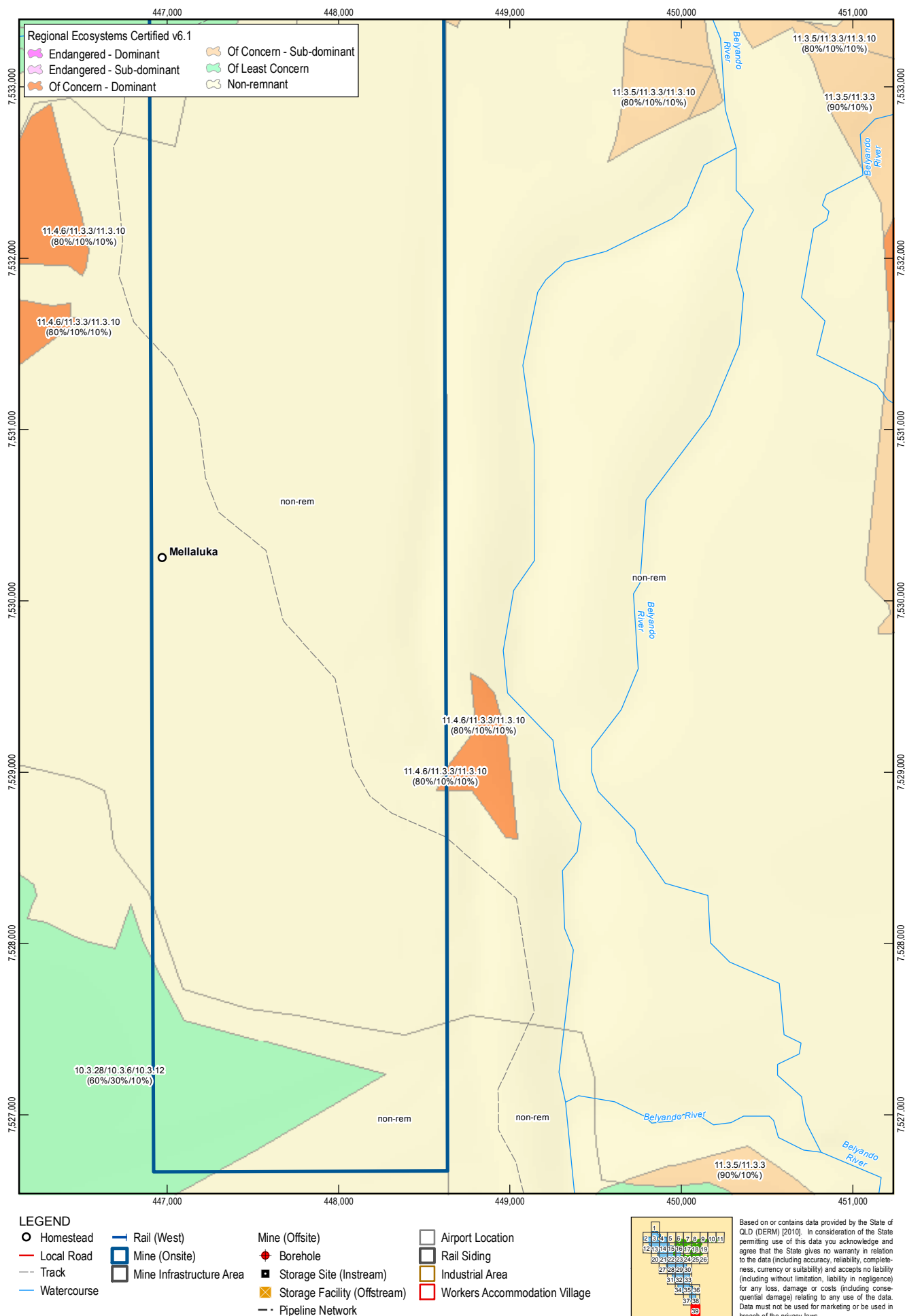
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Date 29-08-2012

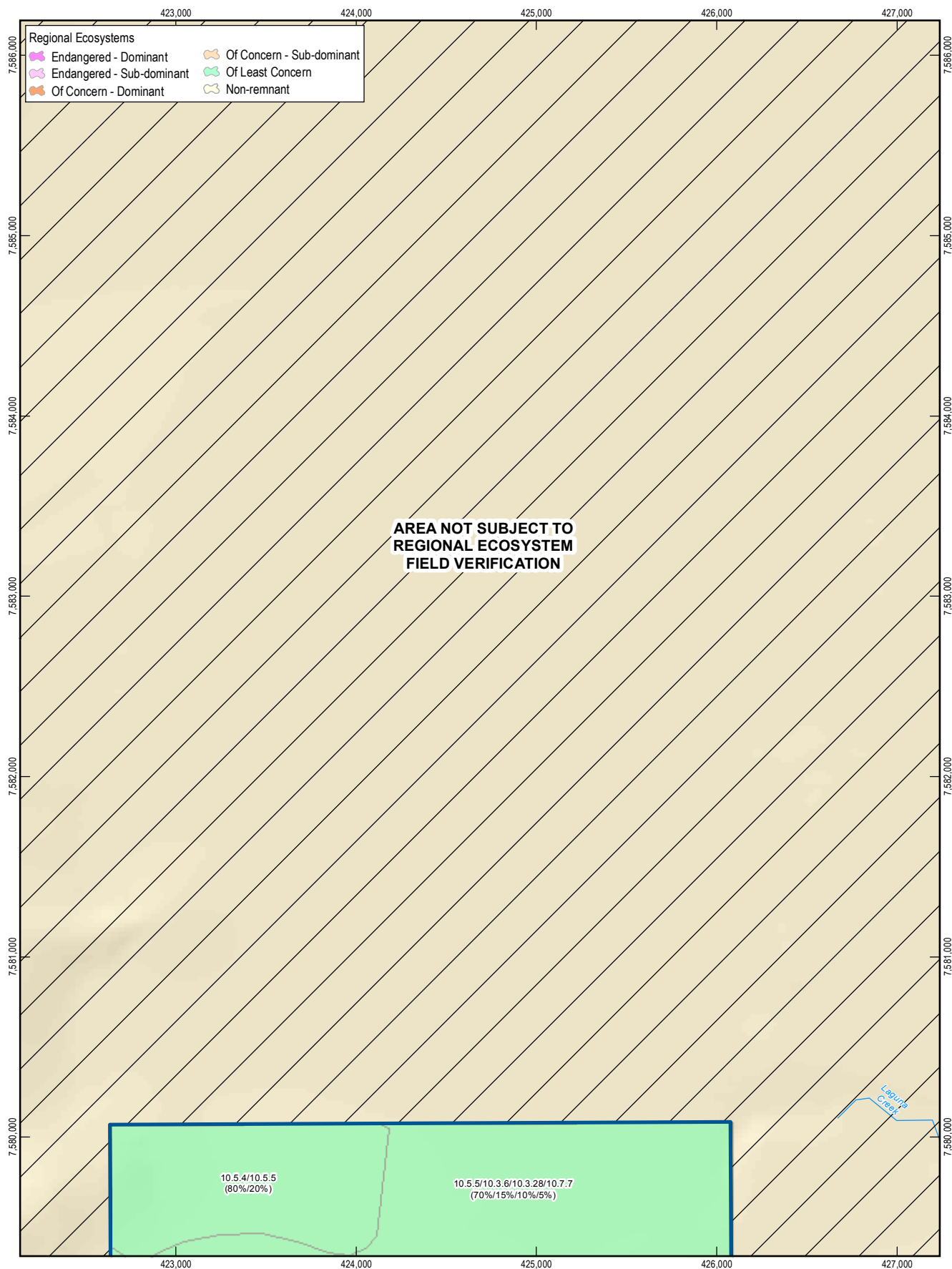
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Sheet 38 of 39

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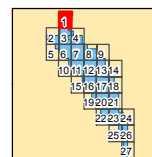
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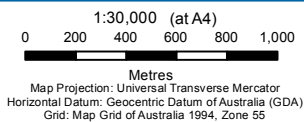


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

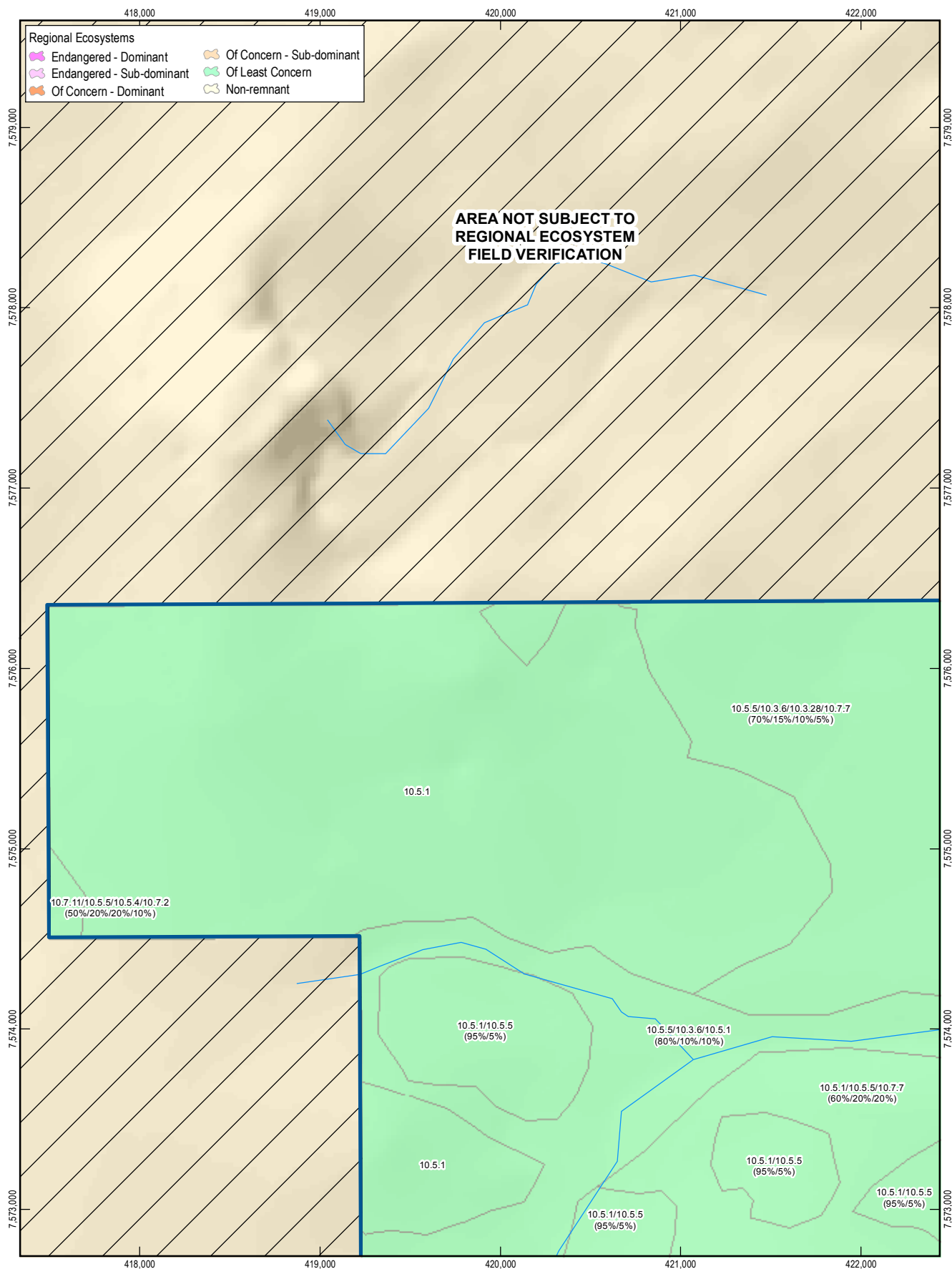
Figure 2-4
Sheet 1 of 27

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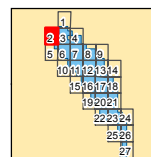
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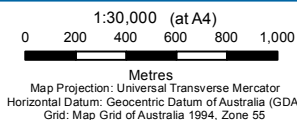


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
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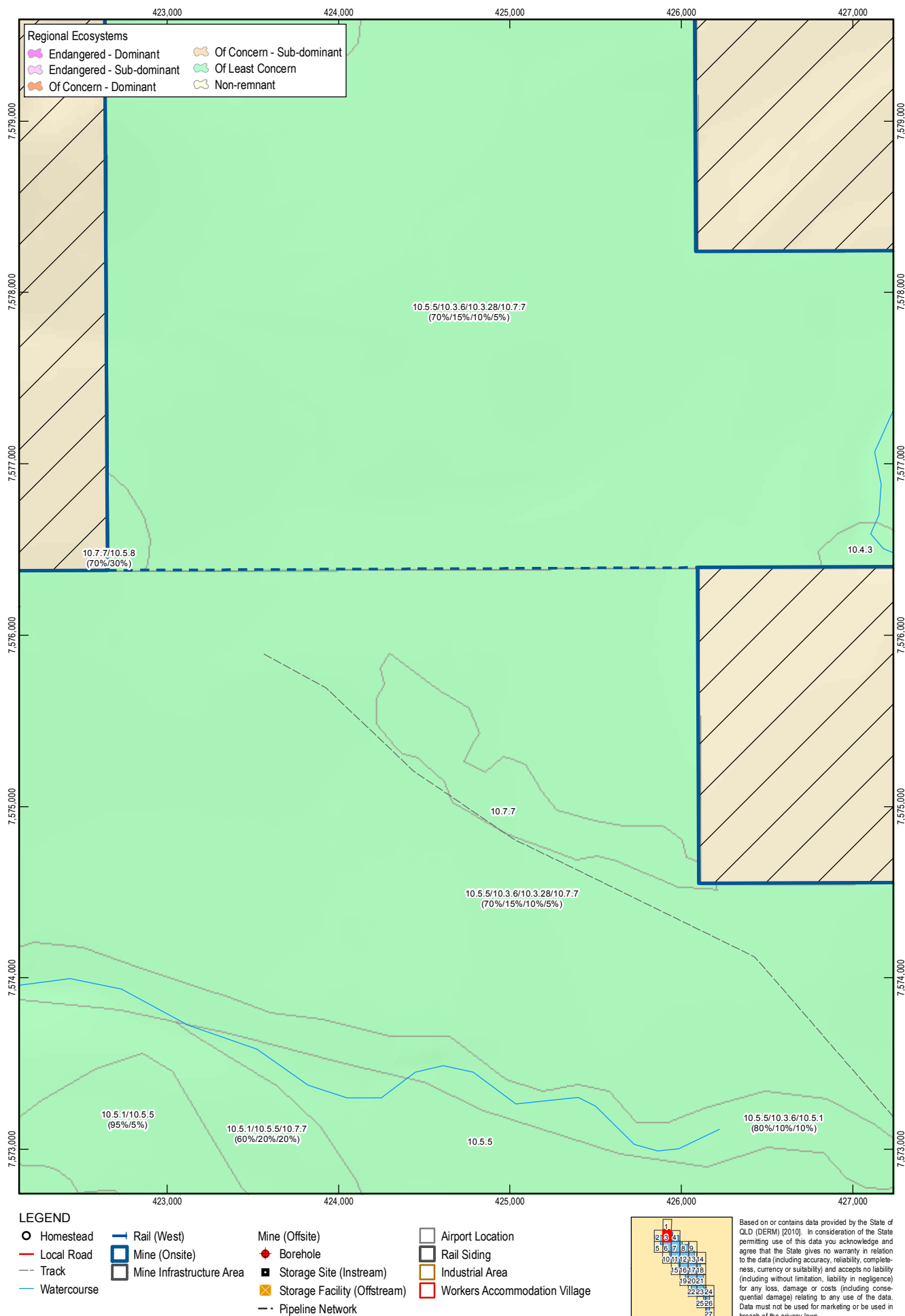
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Revision D
Date 29-08-2012

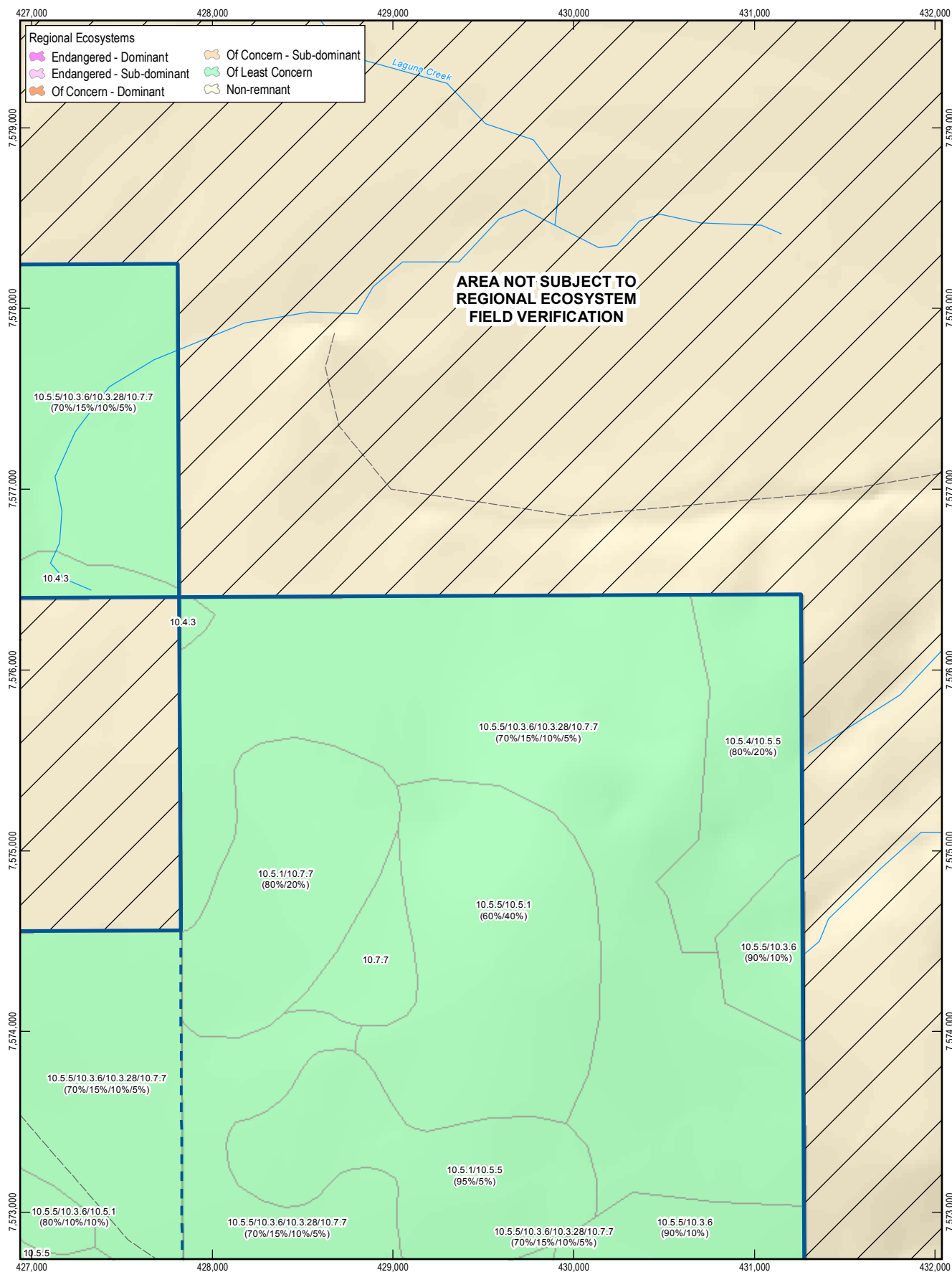
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Sheet 2 of 27

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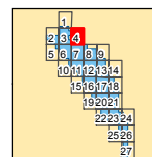
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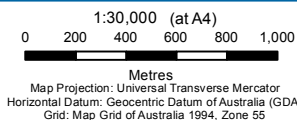


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
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Carmichael Coal Mine and Rail Project

Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

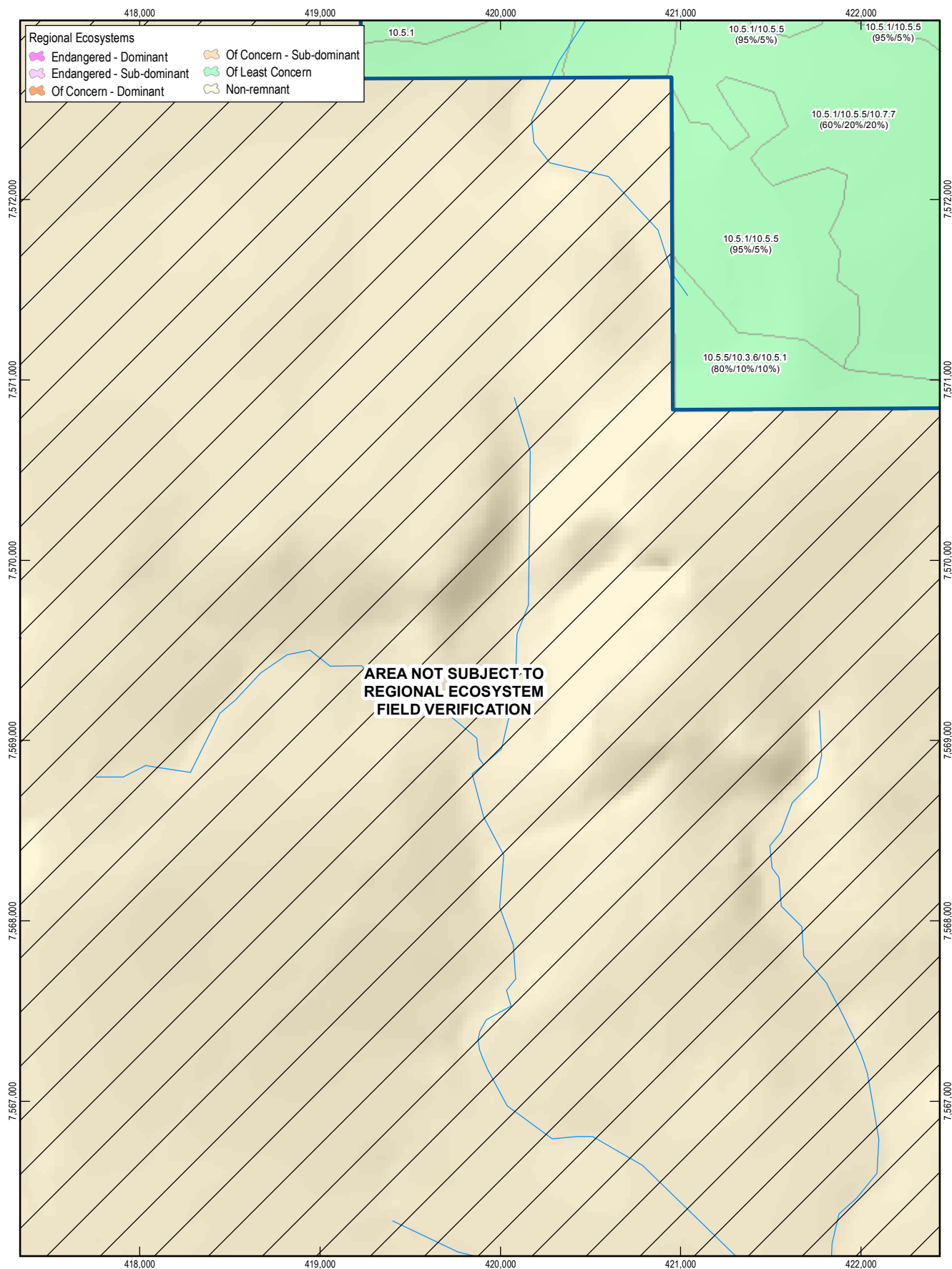
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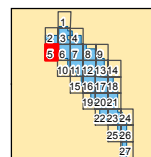
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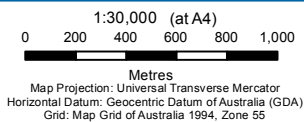


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

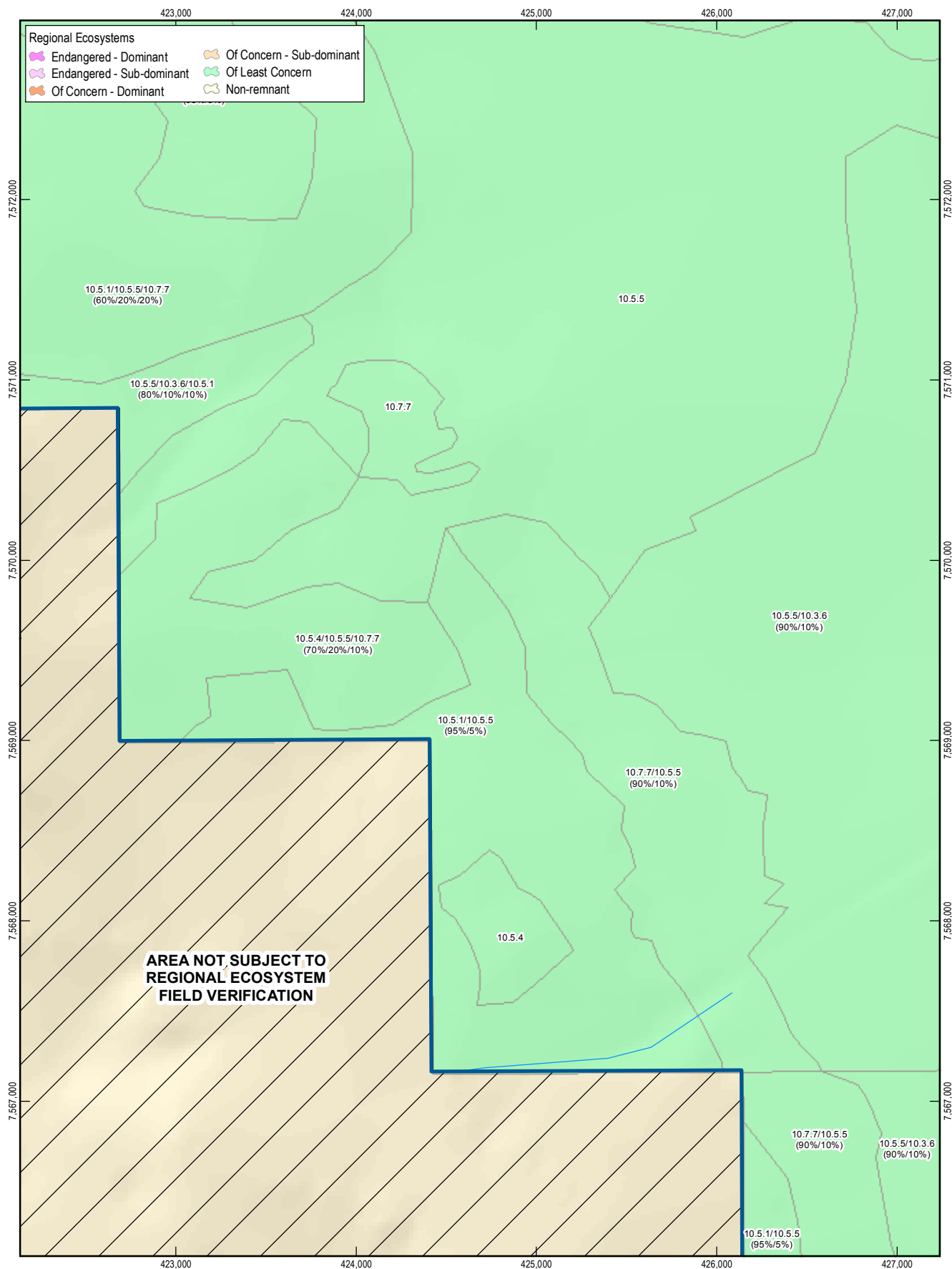
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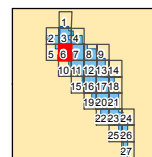
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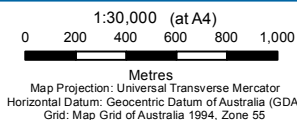


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
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| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

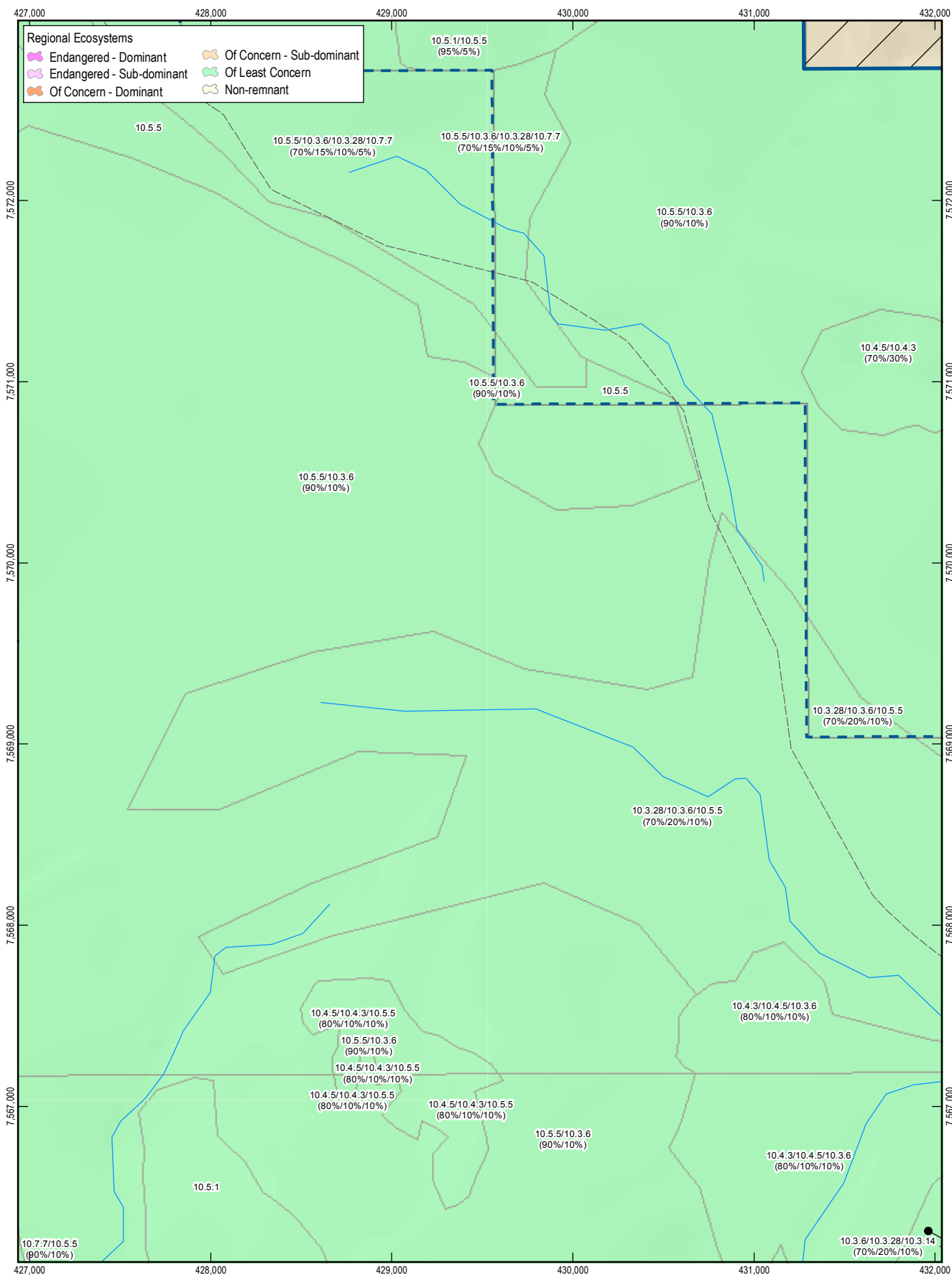
Figure 2-4
Sheet 6 of 27

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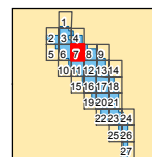
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LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village



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1:30,000 (at A4)
0 200 400 600 800 1,000
Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-25215
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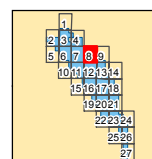
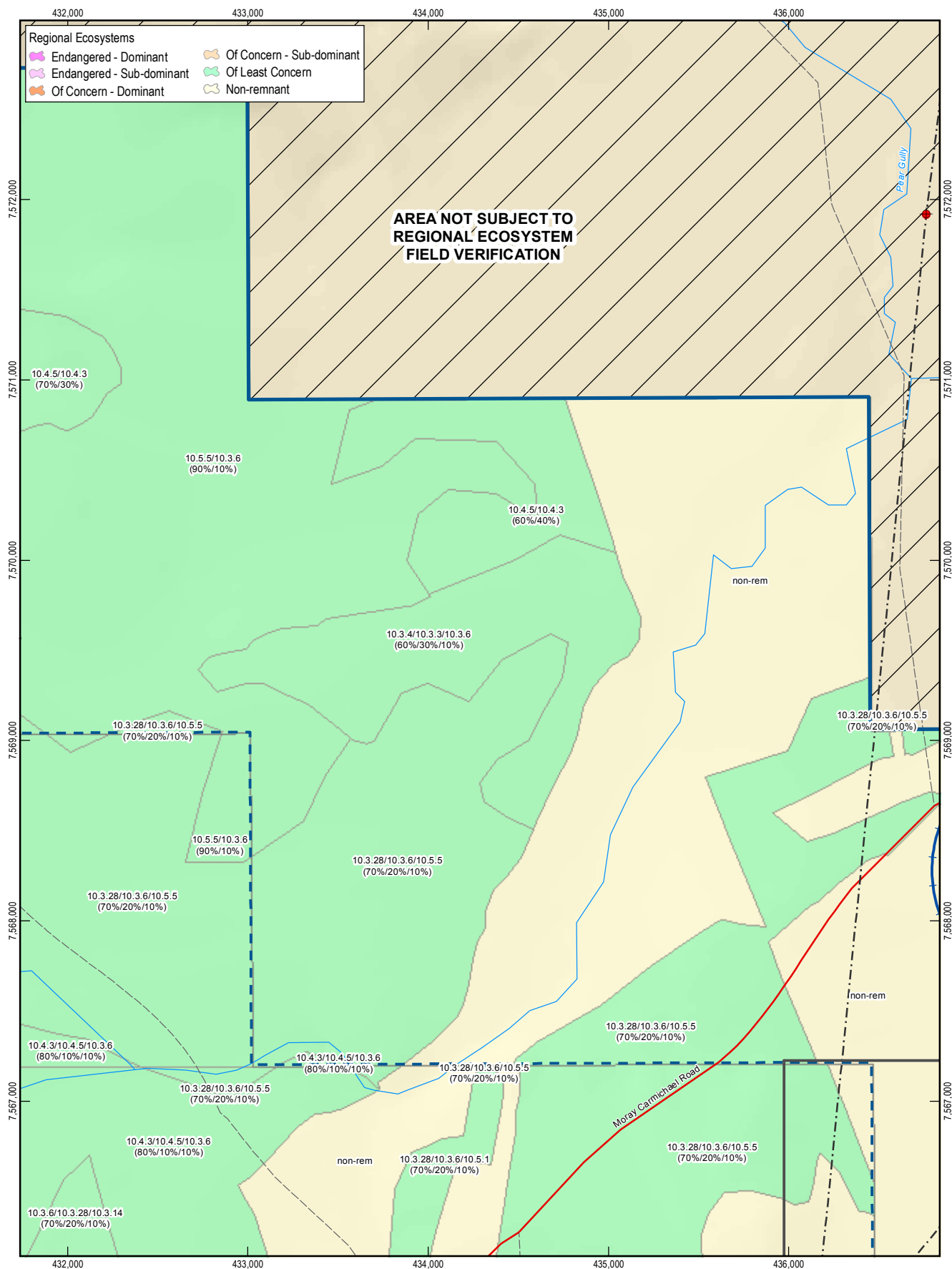
Figure 2-4
Sheet 7 of 27

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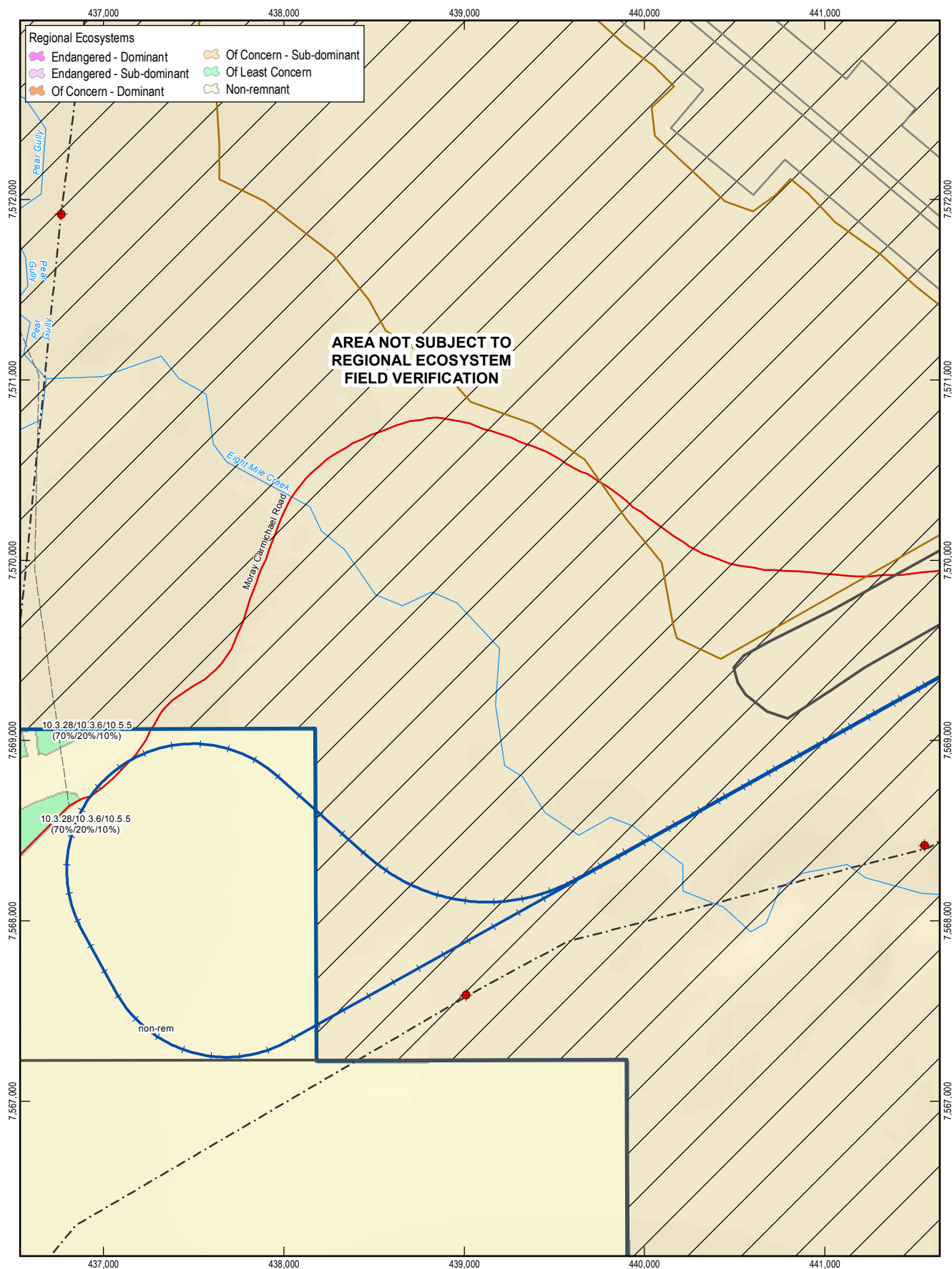
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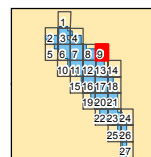


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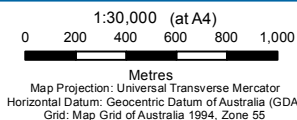


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

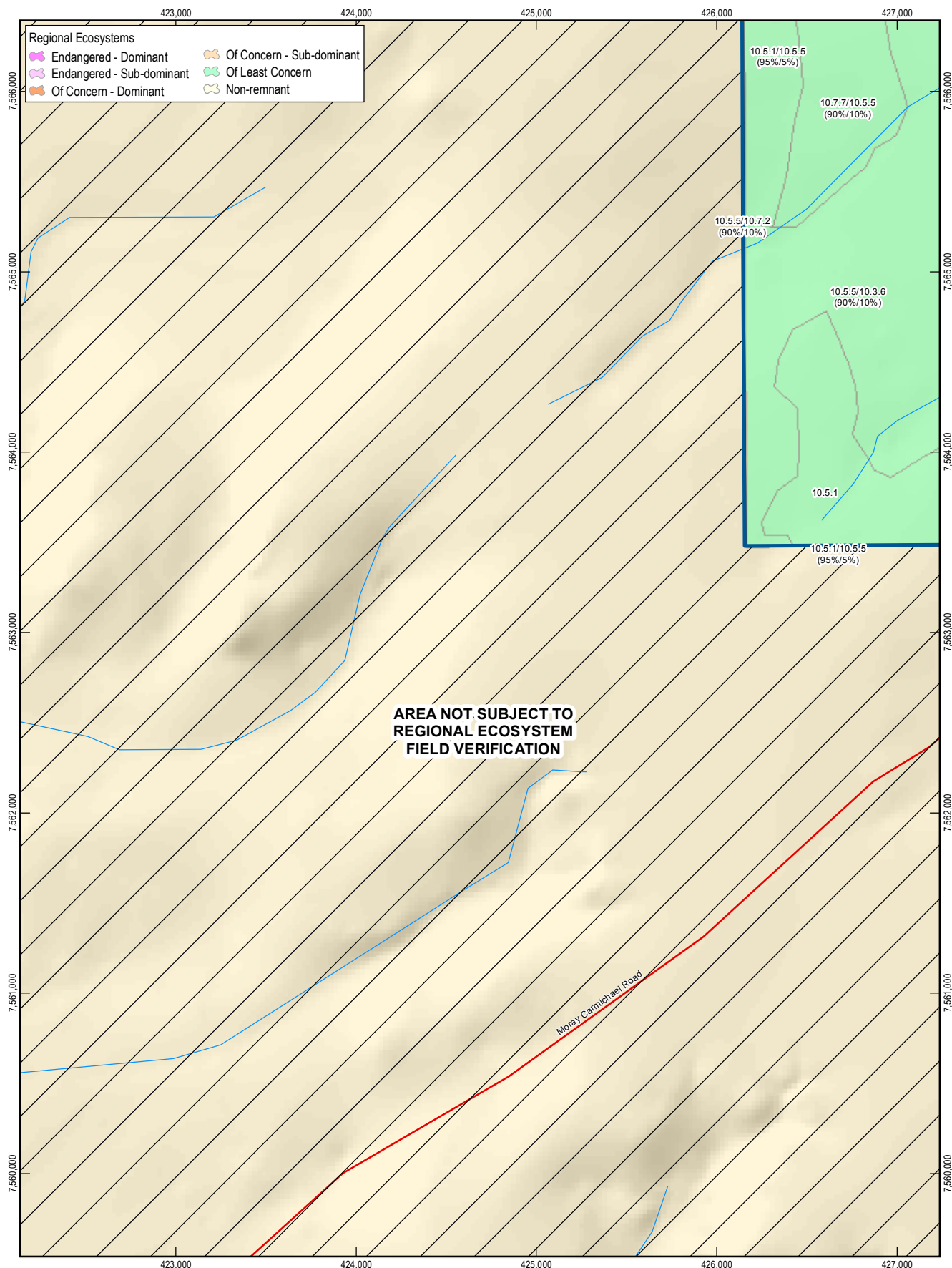
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Sheet 9 of 27

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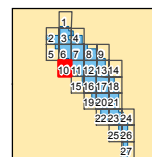
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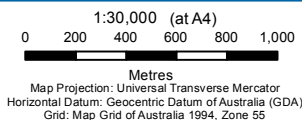


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village



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Regional Ecosystems
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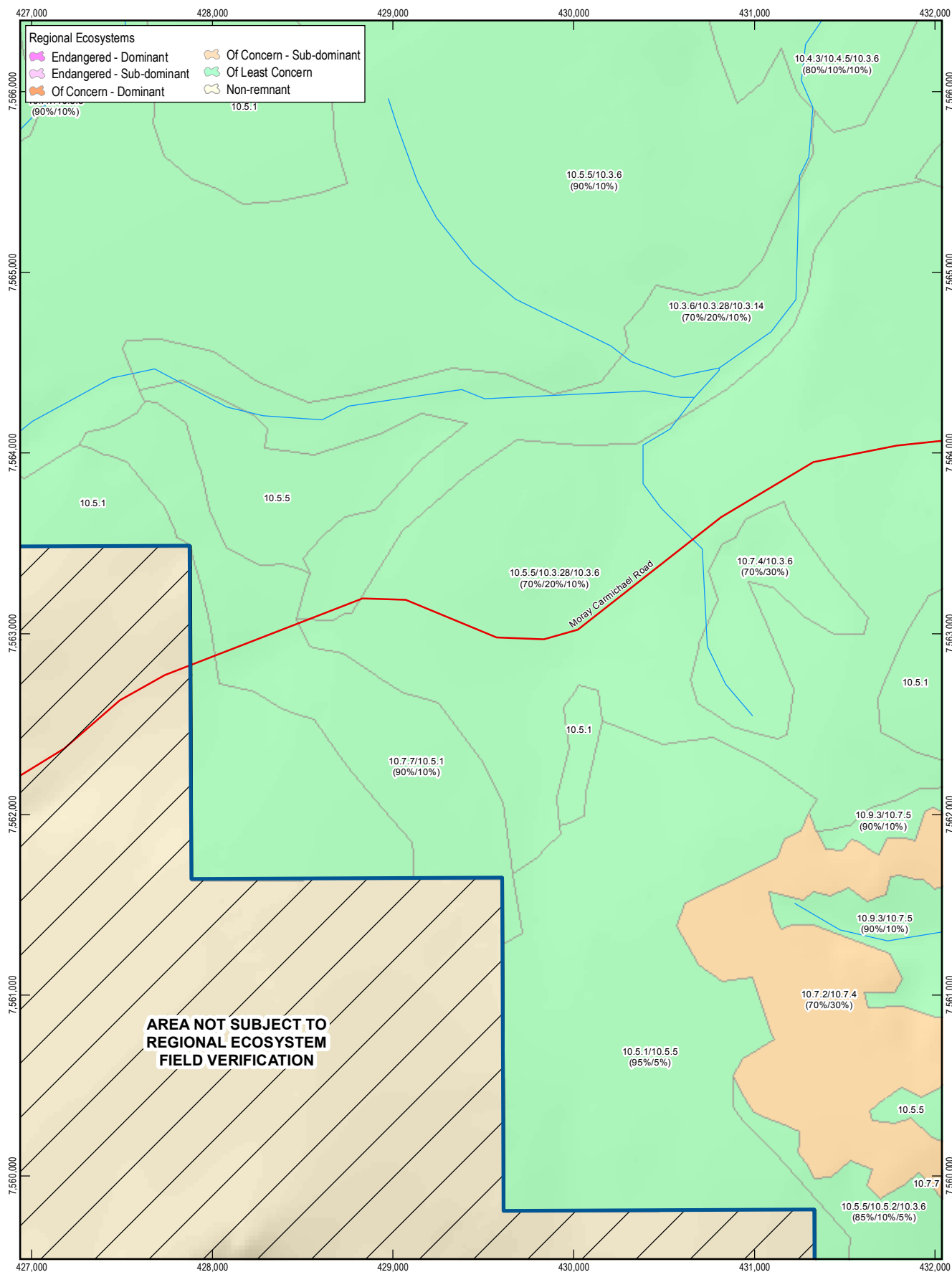
Job Number 41-25215
Revision D
Date 29-08-2012

Figure 2-4
Sheet 10 of 27

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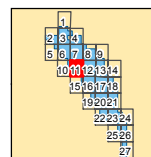
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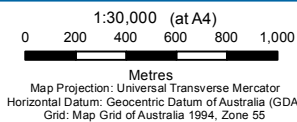


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

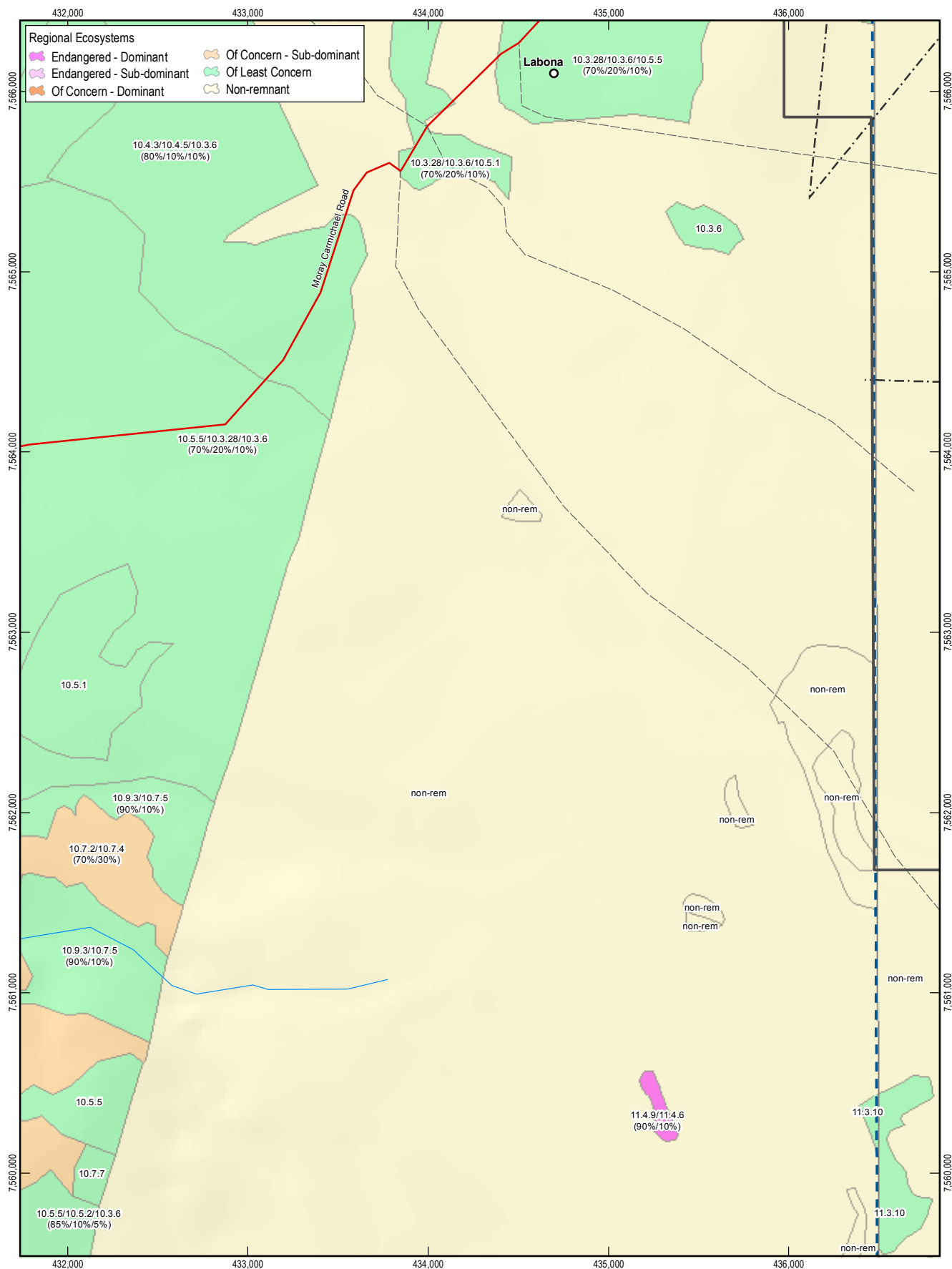
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Sheet 11 of 27

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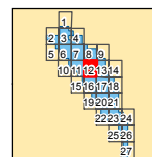
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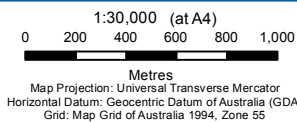


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
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- Rail Siding
- Industrial Area
- Workers Accommodation Village



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Regional Ecosystems
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Date 29-08-2012

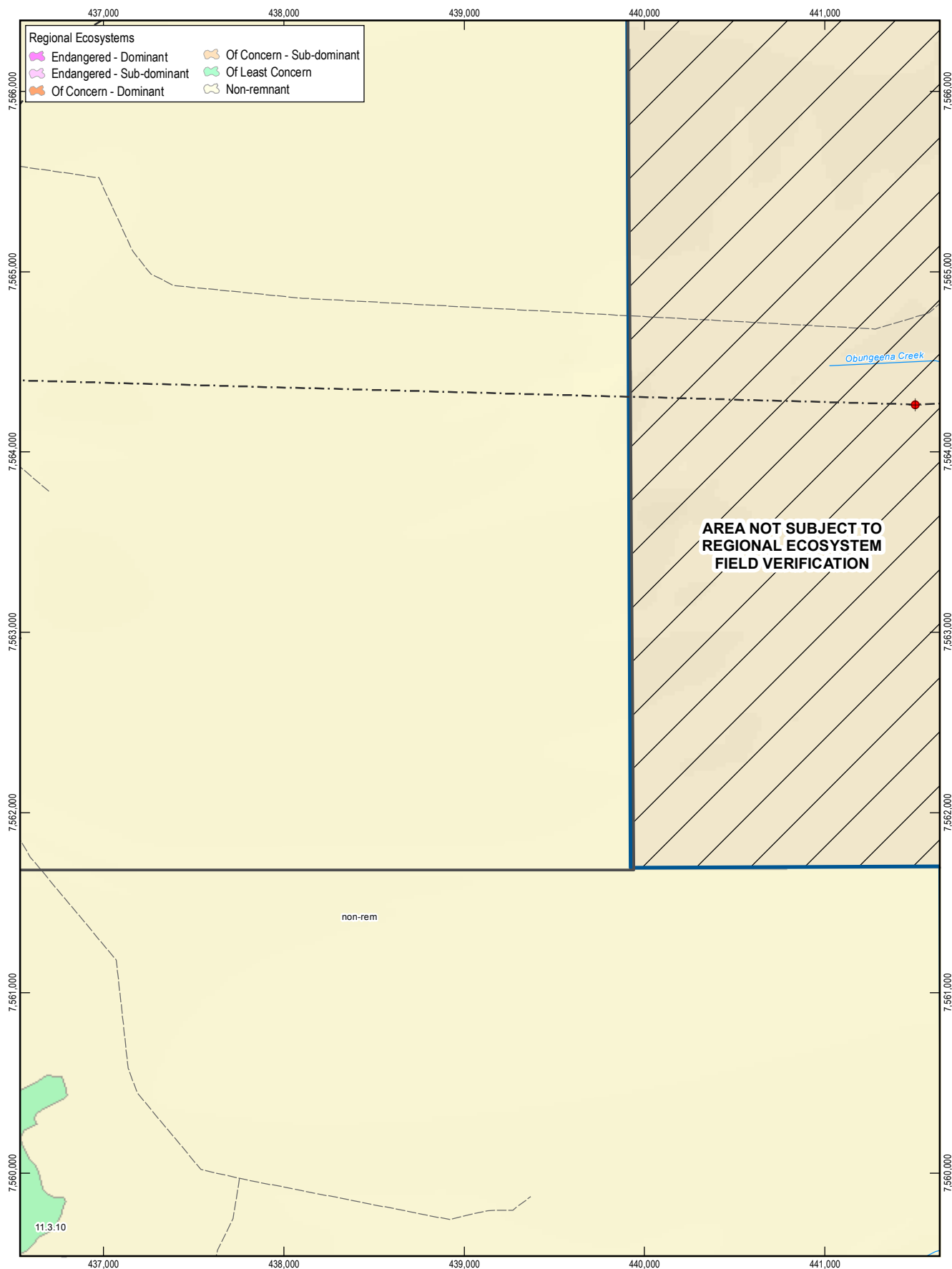
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Sheet 12 of 27

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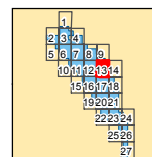
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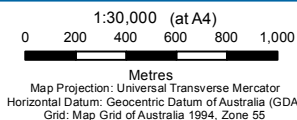


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
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| | | — Pipeline Network | |



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Regional Ecosystems
Field Verified

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Date 29-08-2012

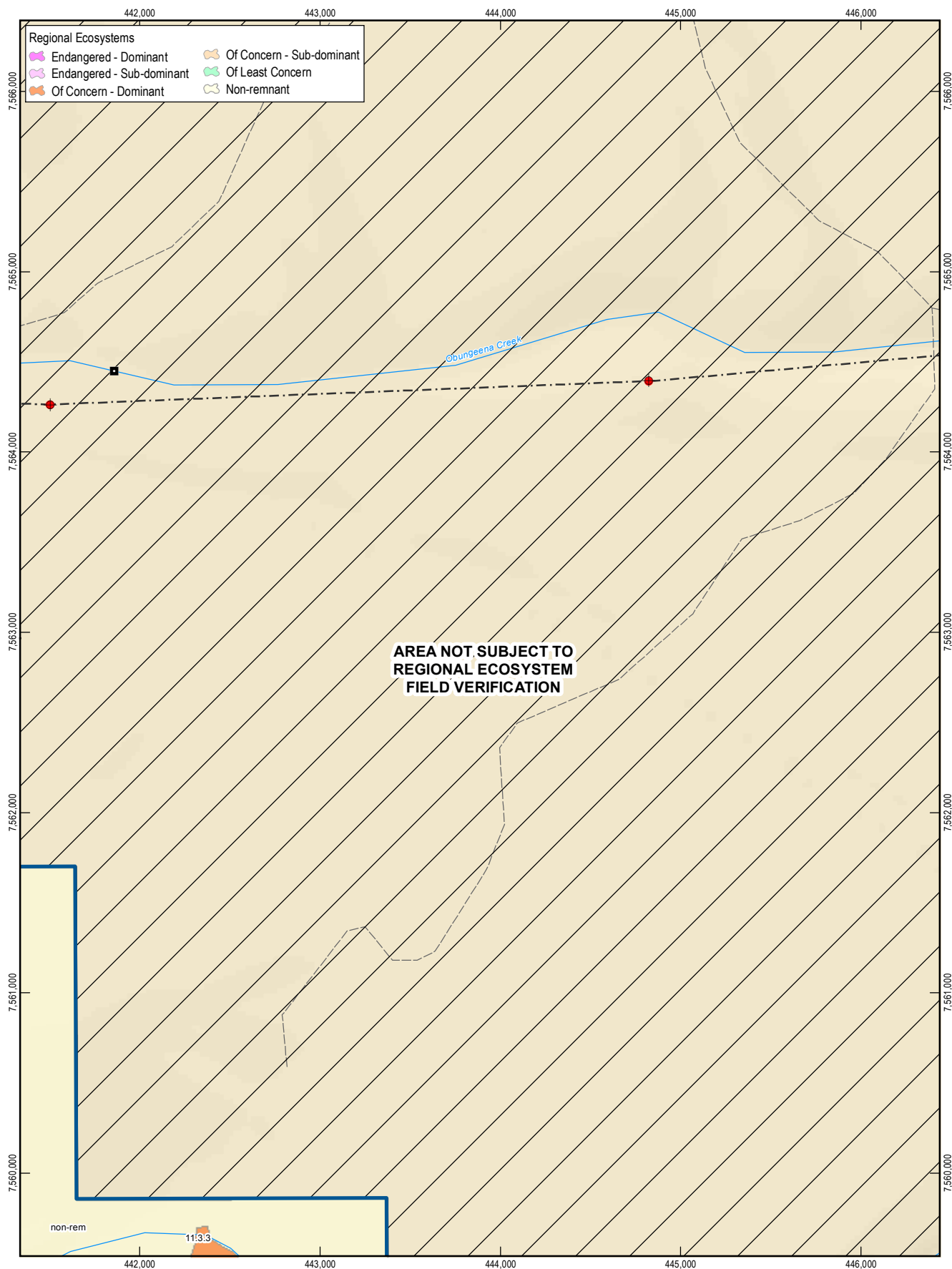
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Sheet 13 of 27

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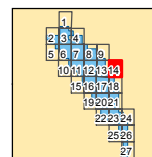
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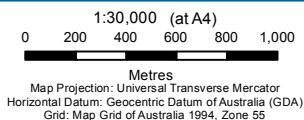


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

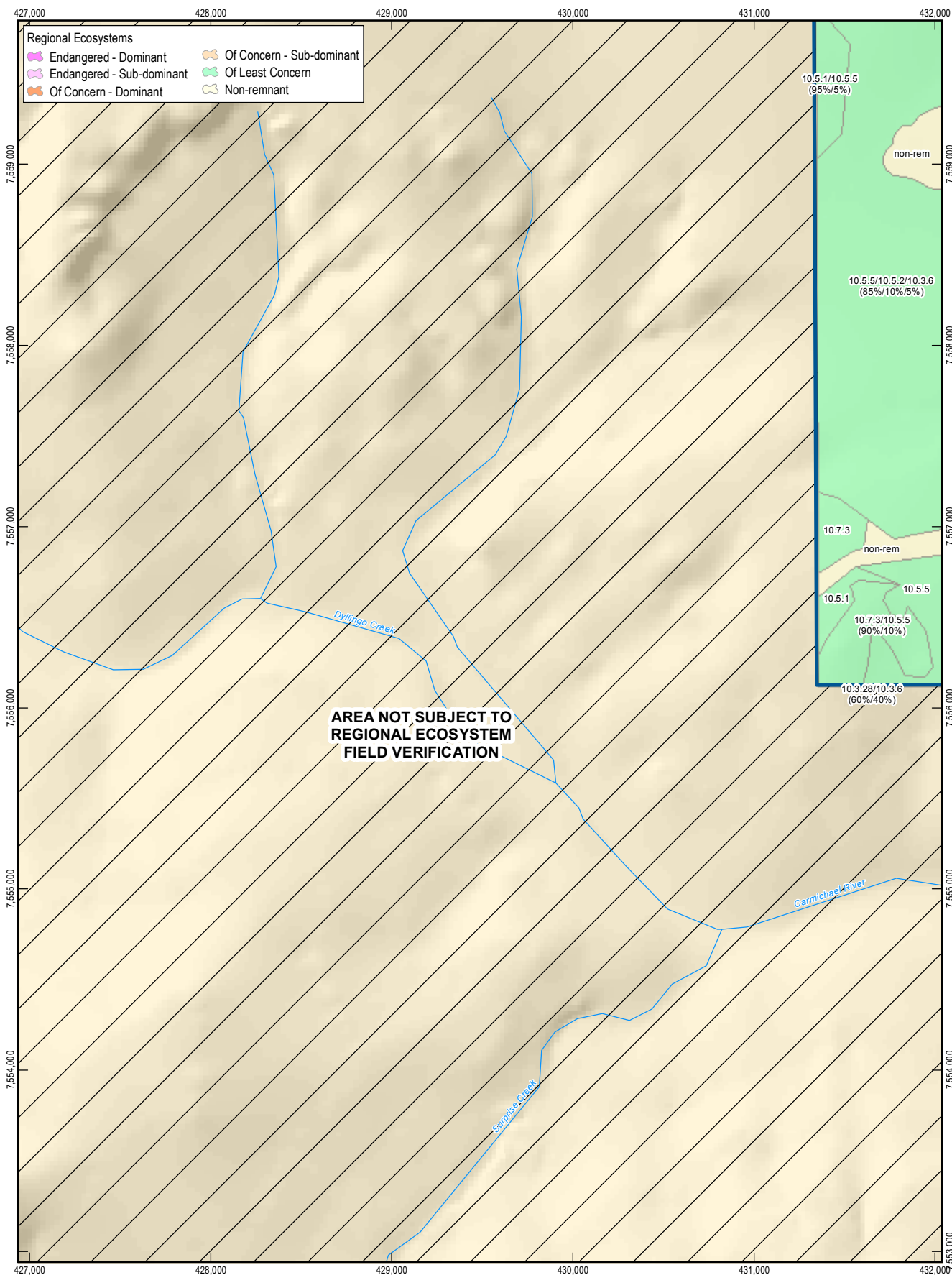
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Revision D
Date 29-08-2012

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Sheet 14 of 27

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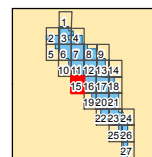
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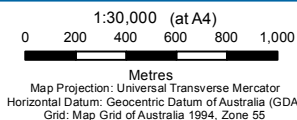


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
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Carmichael Coal Mine and Rail Project

Regional Ecosystems
Field Verified

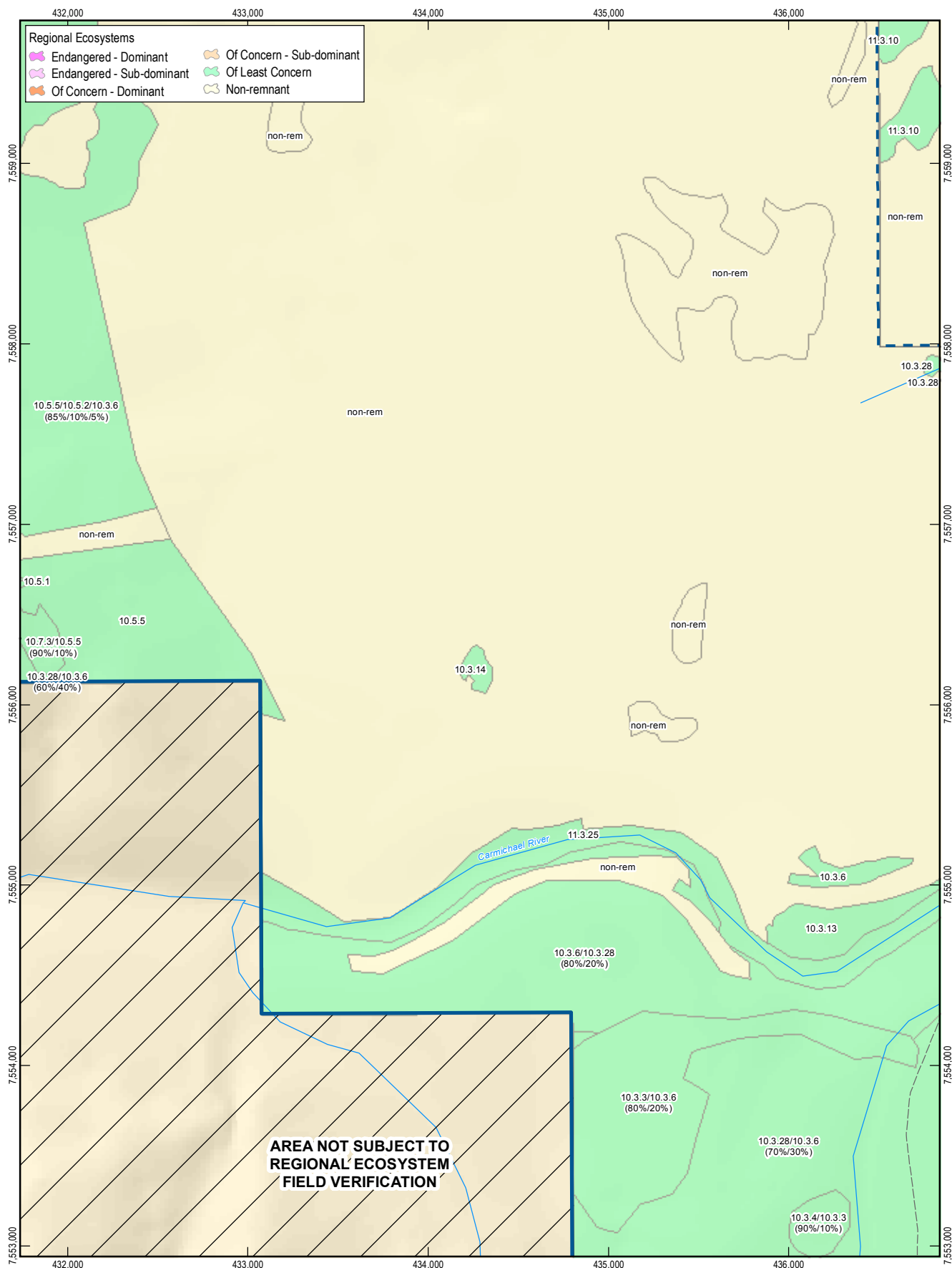
Job Number 41-25215
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Figure 2-4
Sheet 15 of 27

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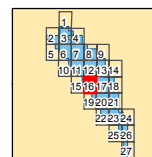
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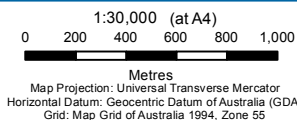


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

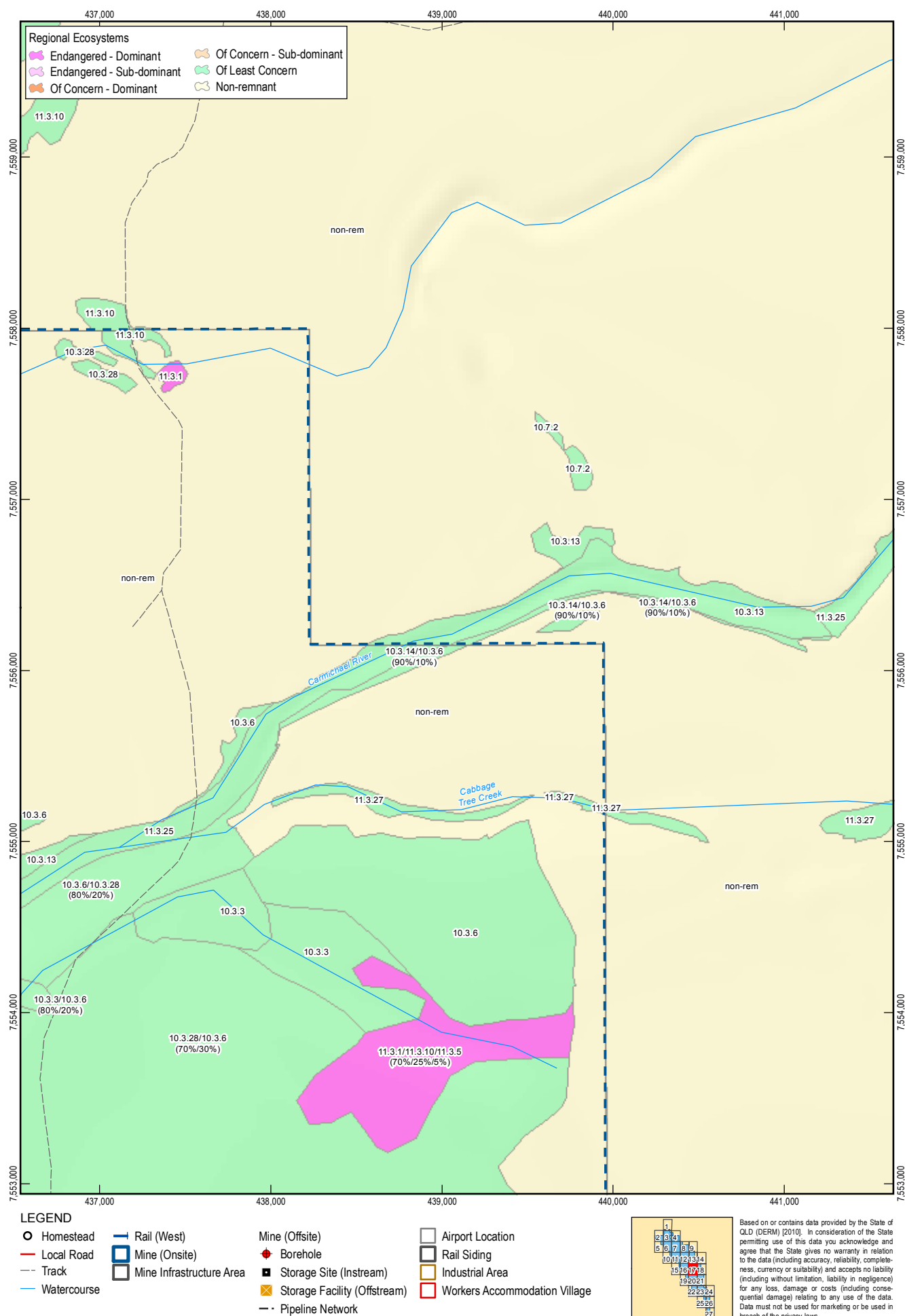
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Sheet 16 of 27

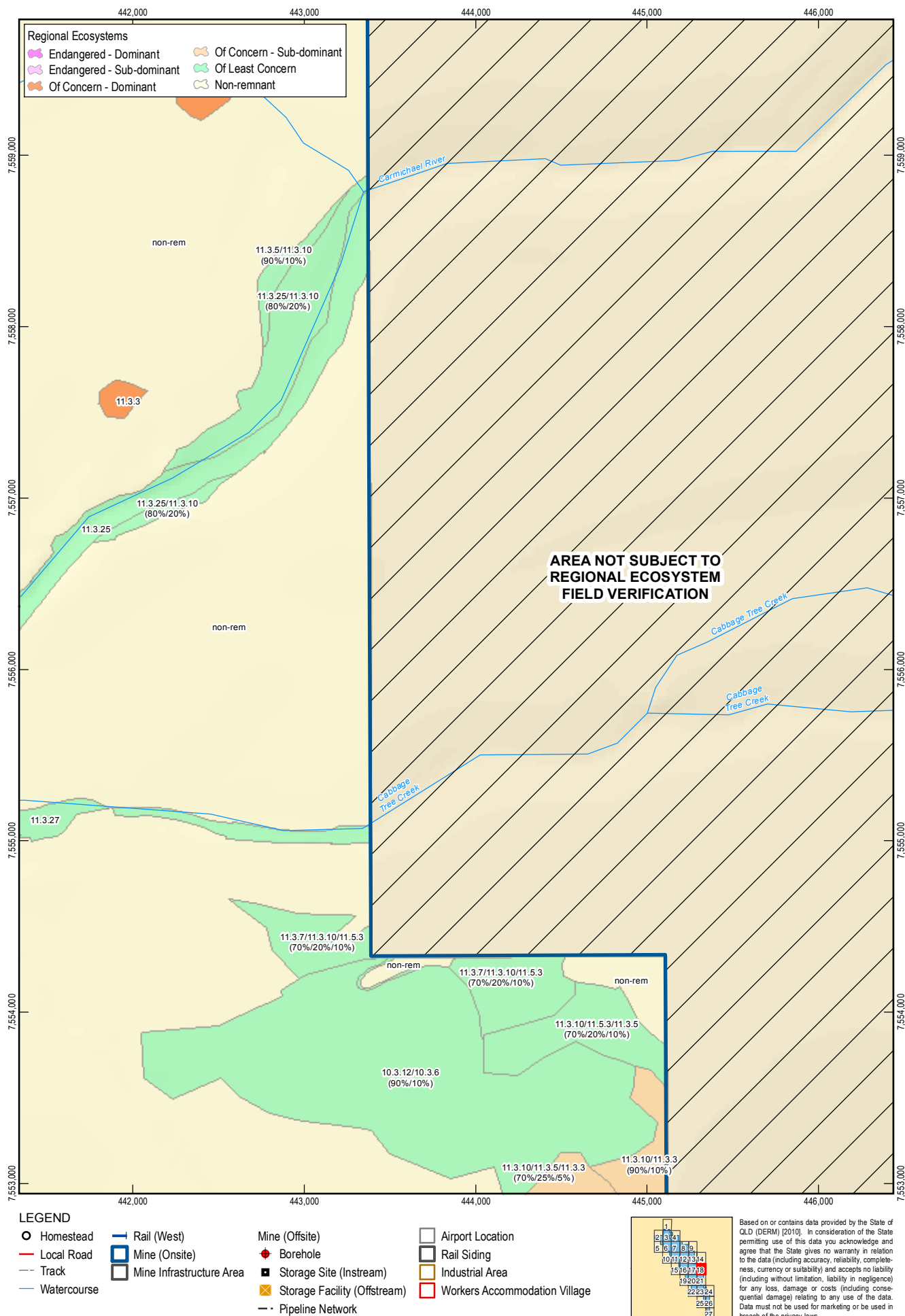
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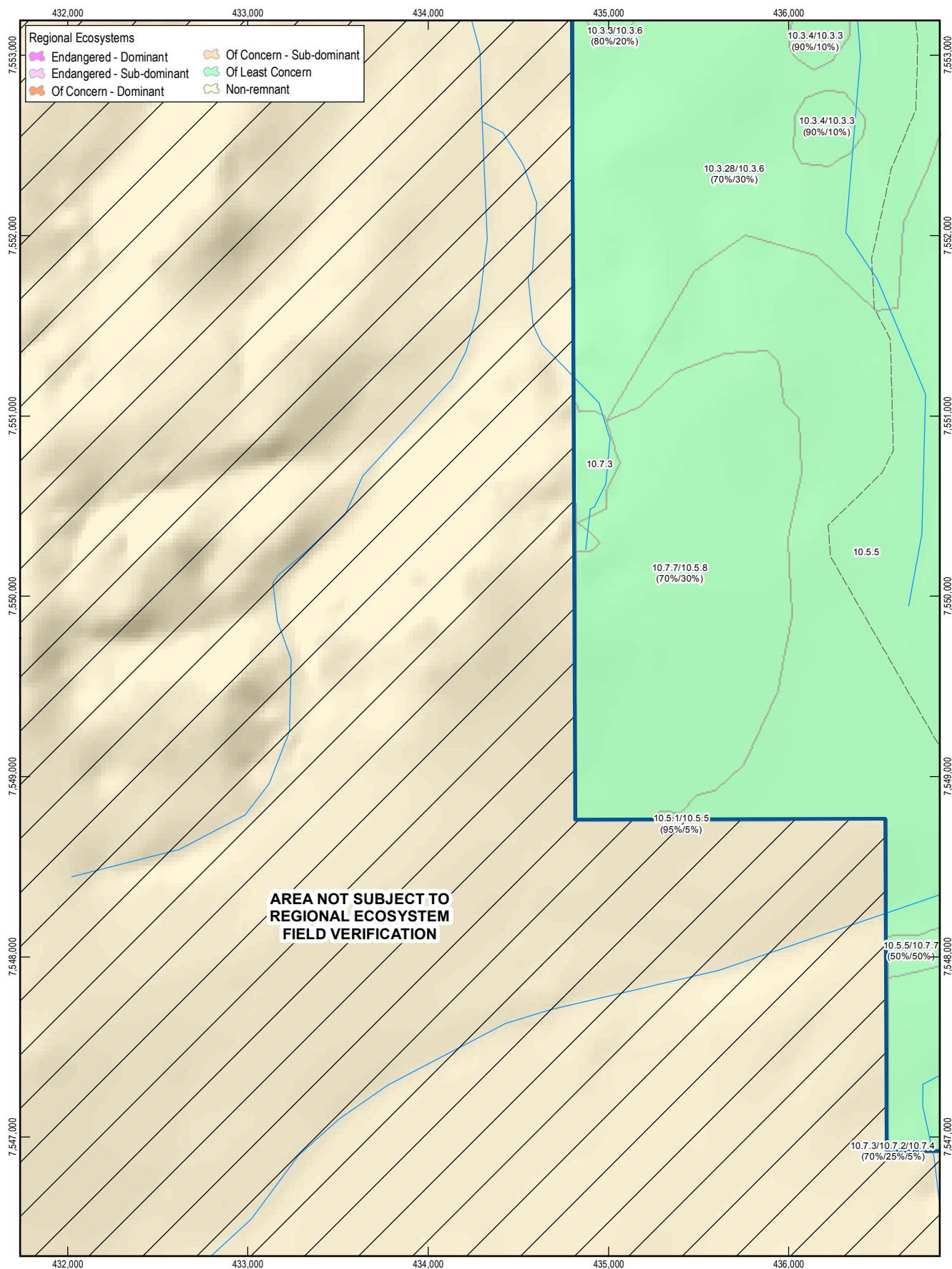
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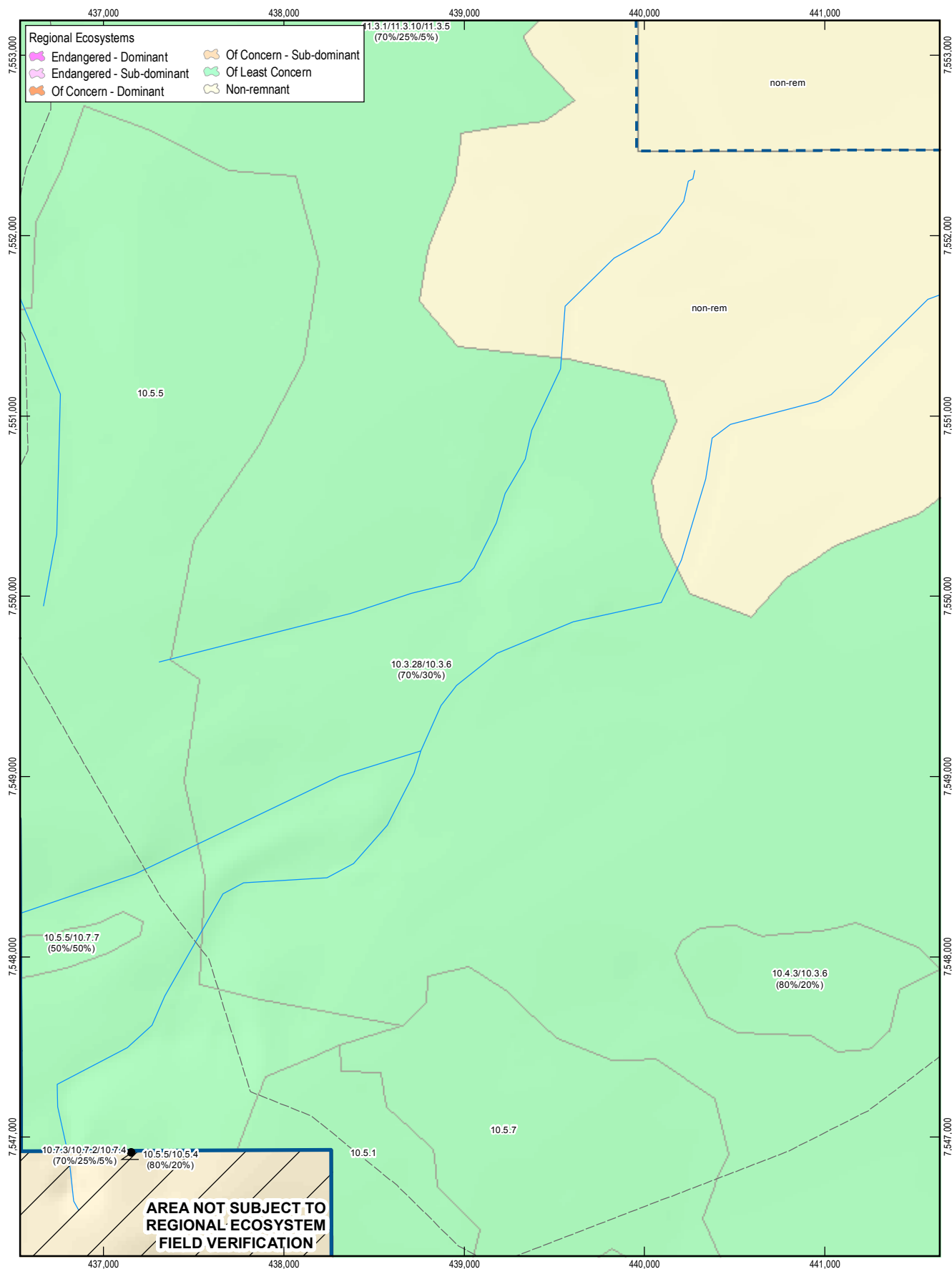
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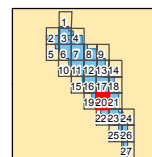




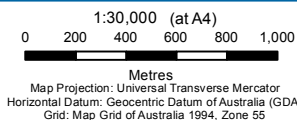


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | ■ Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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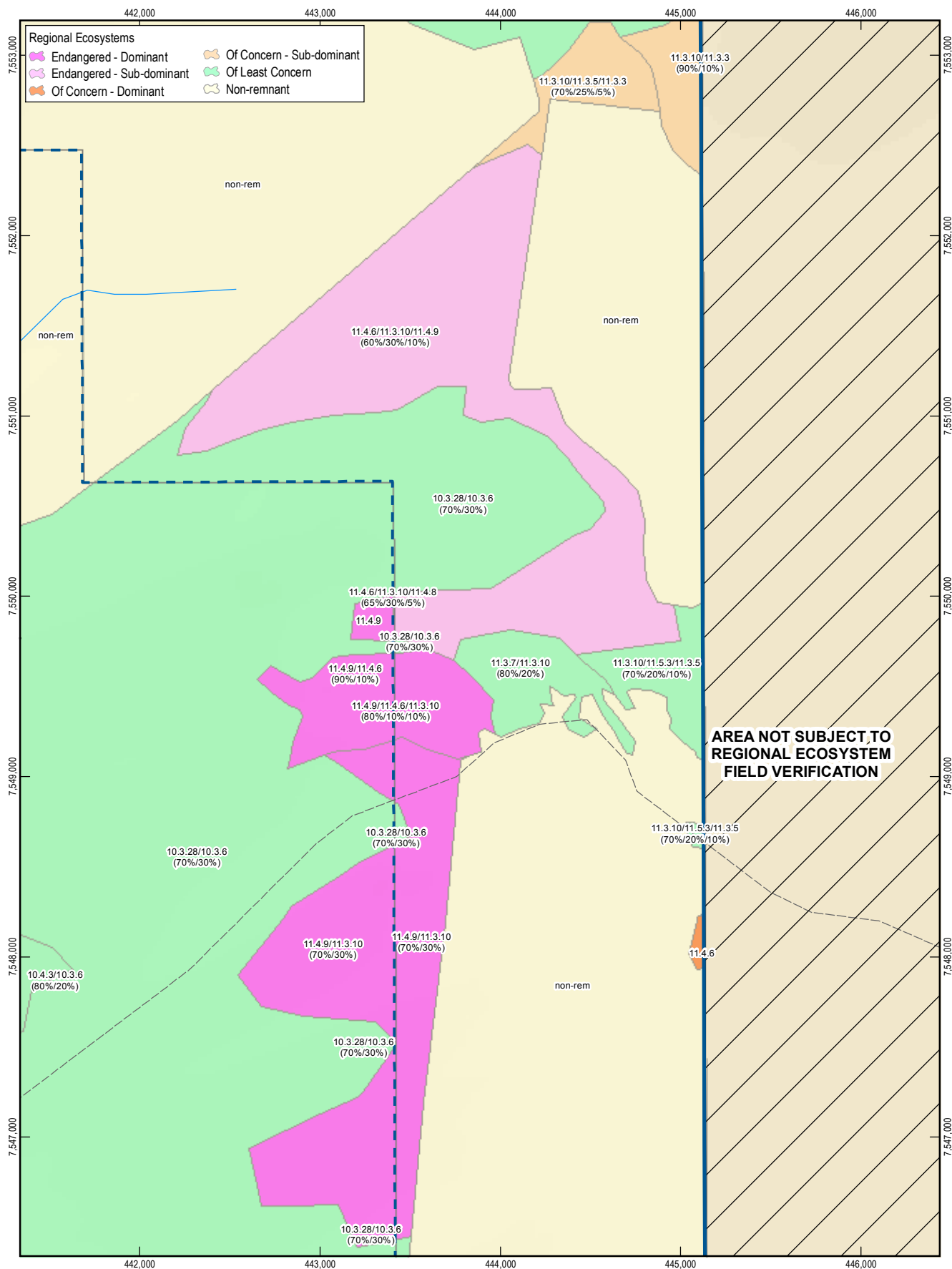
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Figure 2-4
Sheet 20 of 27

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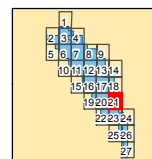
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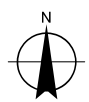
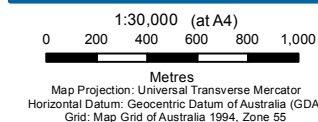


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village



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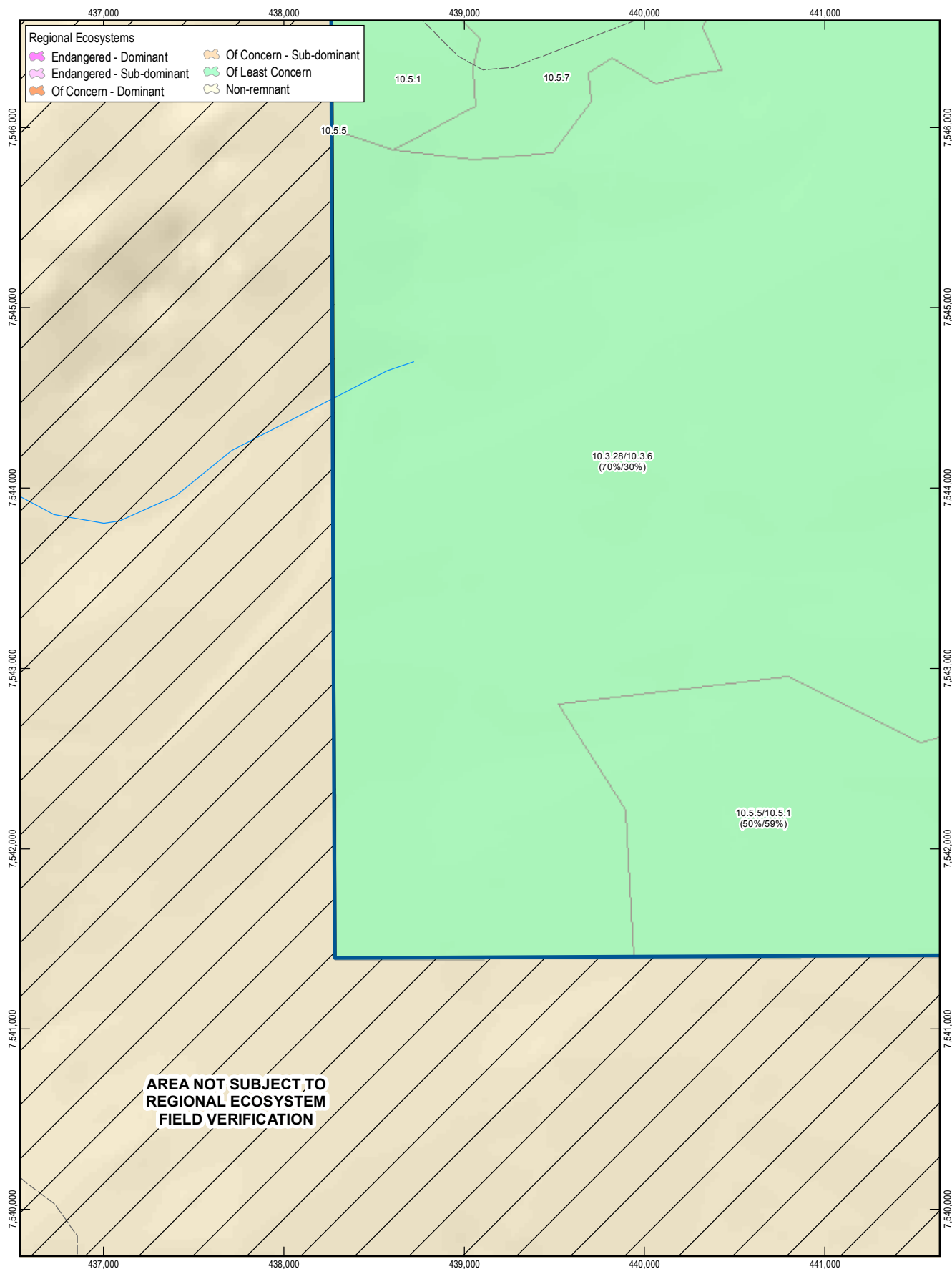


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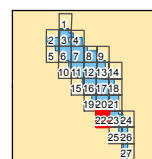
Job Number 41-25215
Revision D
Date 29-08-2012

Figure 2-4
Sheet 21 of 27

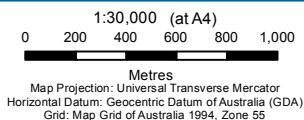


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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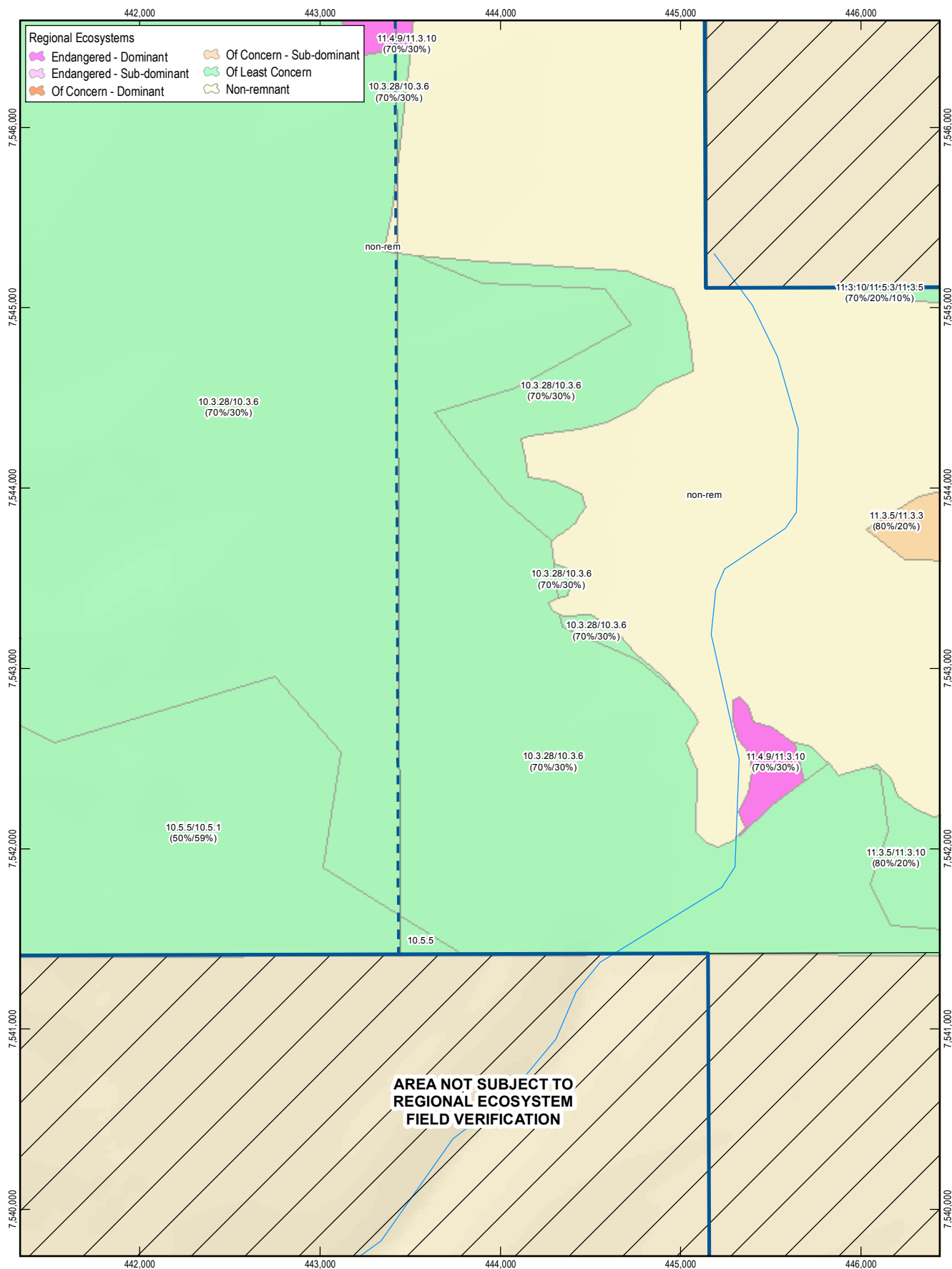
Figure 2-4
Sheet 22 of 27

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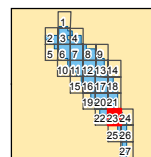
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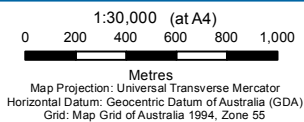


LEGEND

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|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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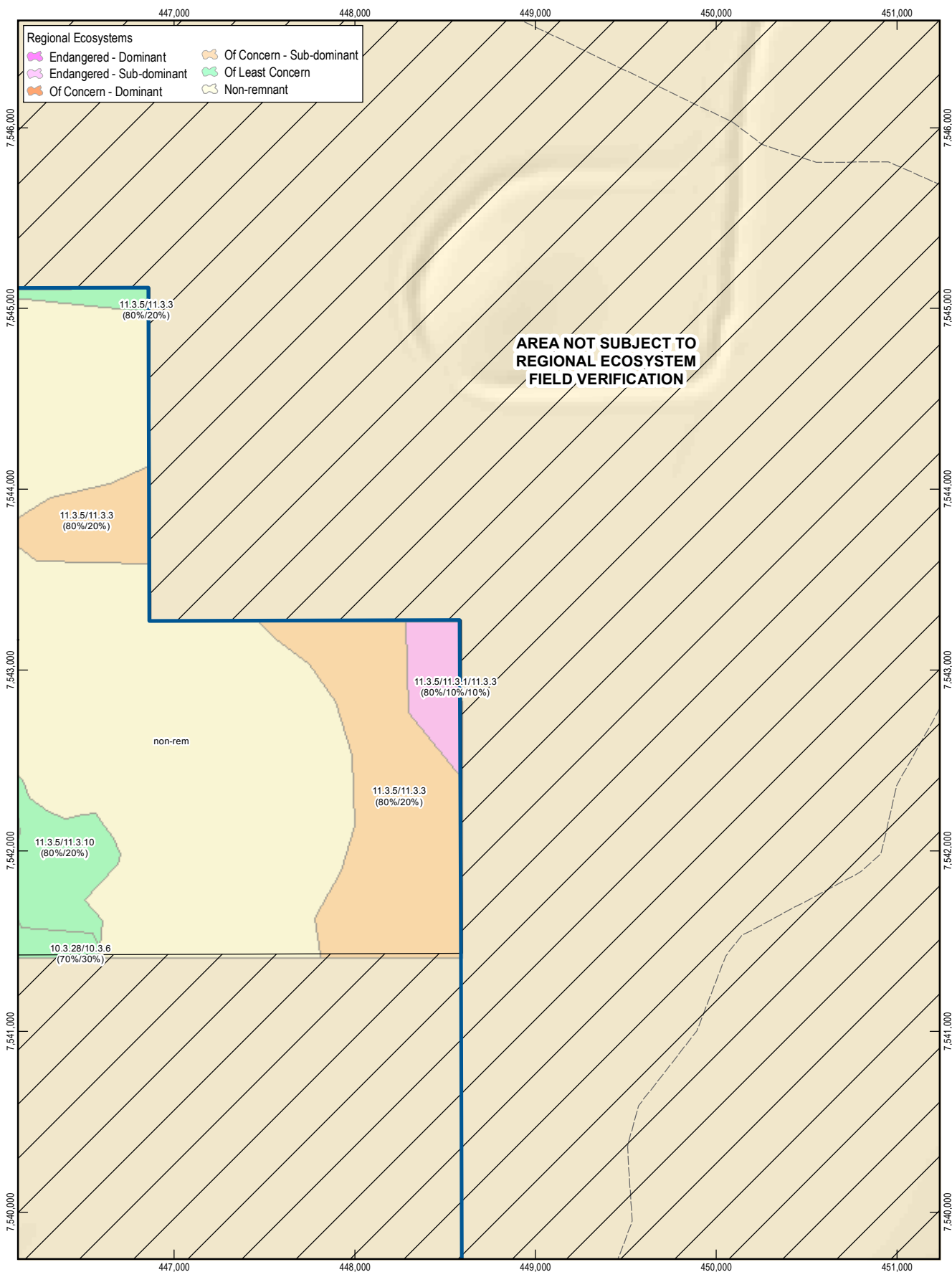
Job Number 41-25215
Revision D
Date 29-08-2012

Figure 2-4
Sheet 23 of 27

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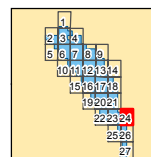
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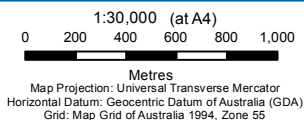


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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Job Number 41-25215
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Date 29-08-2012

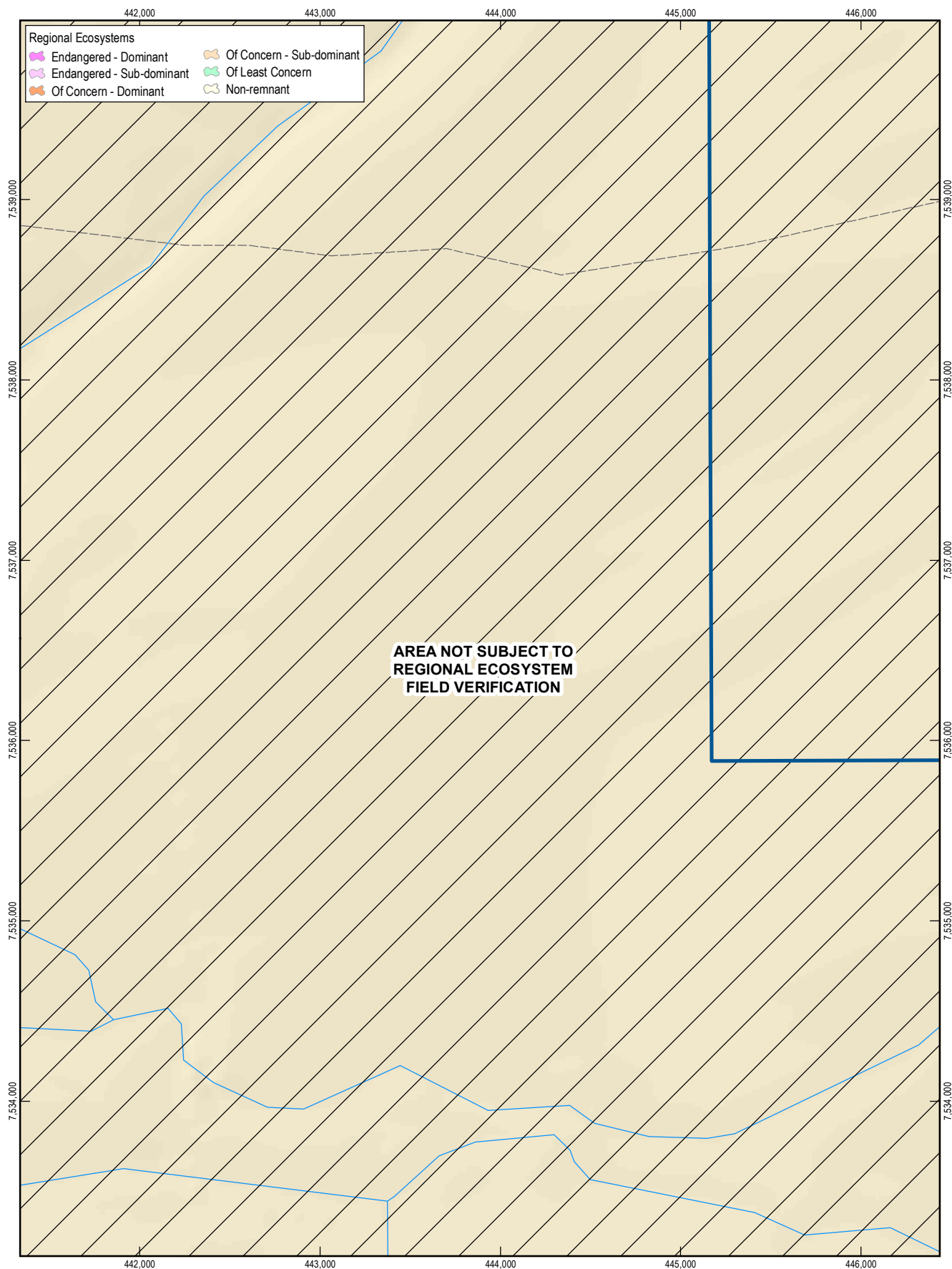
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Sheet 24 of 27

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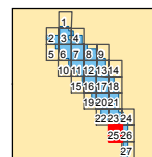
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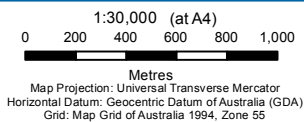


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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Regional Ecosystems
Field Verified

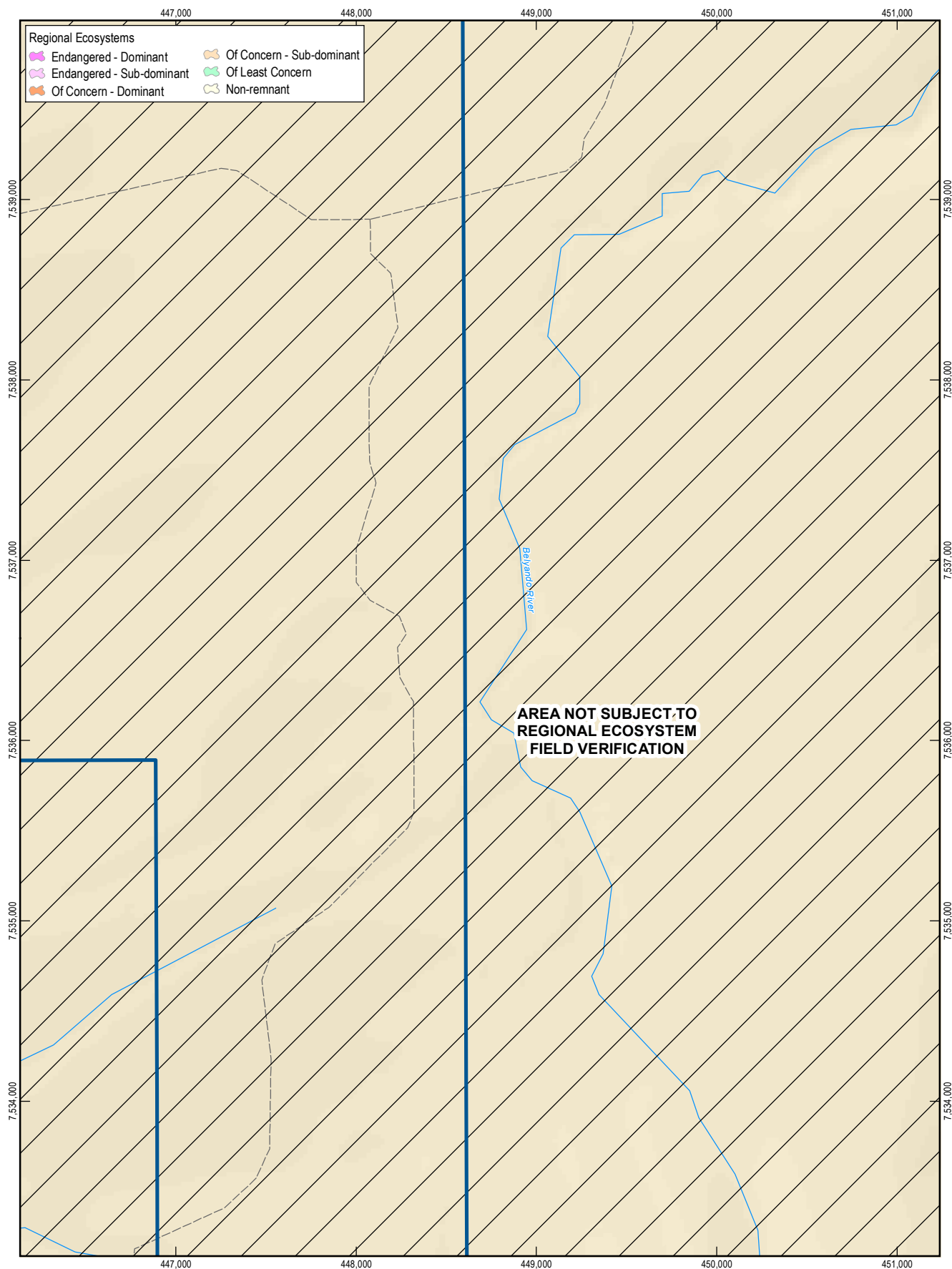
Job Number 41-25215
Revision D
Date 29-08-2012

Figure 2-4
Sheet 25 of 27

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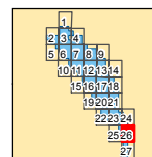
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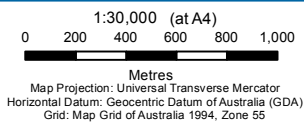


LEGEND

- | | | | |
|---------------|----------------------------|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | Mine (Offsite) | □ Airport Location |
| — Local Road | □ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | □ Mine Infrastructure Area | ■ Storage Site (Instream) | □ Industrial Area |
| — Watercourse | | ■ Storage Facility (Offstream) | □ Workers Accommodation Village |
| | | — Pipeline Network | |



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Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

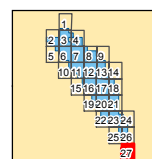
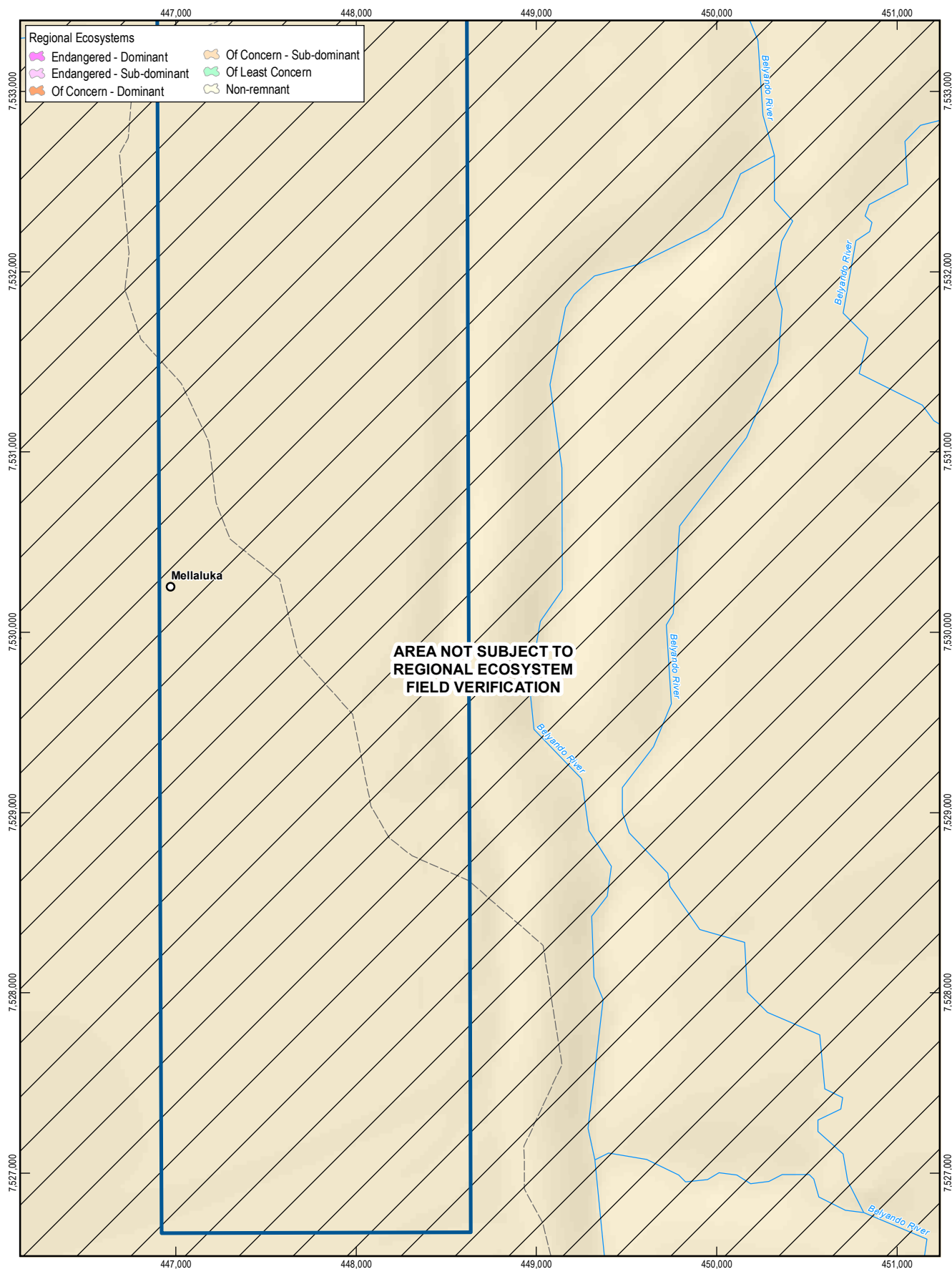
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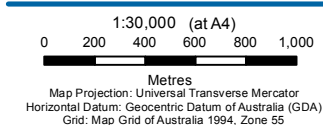
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Regional Ecosystems
Field Verified

Job Number 41-25215
Revision D
Date 29-08-2012

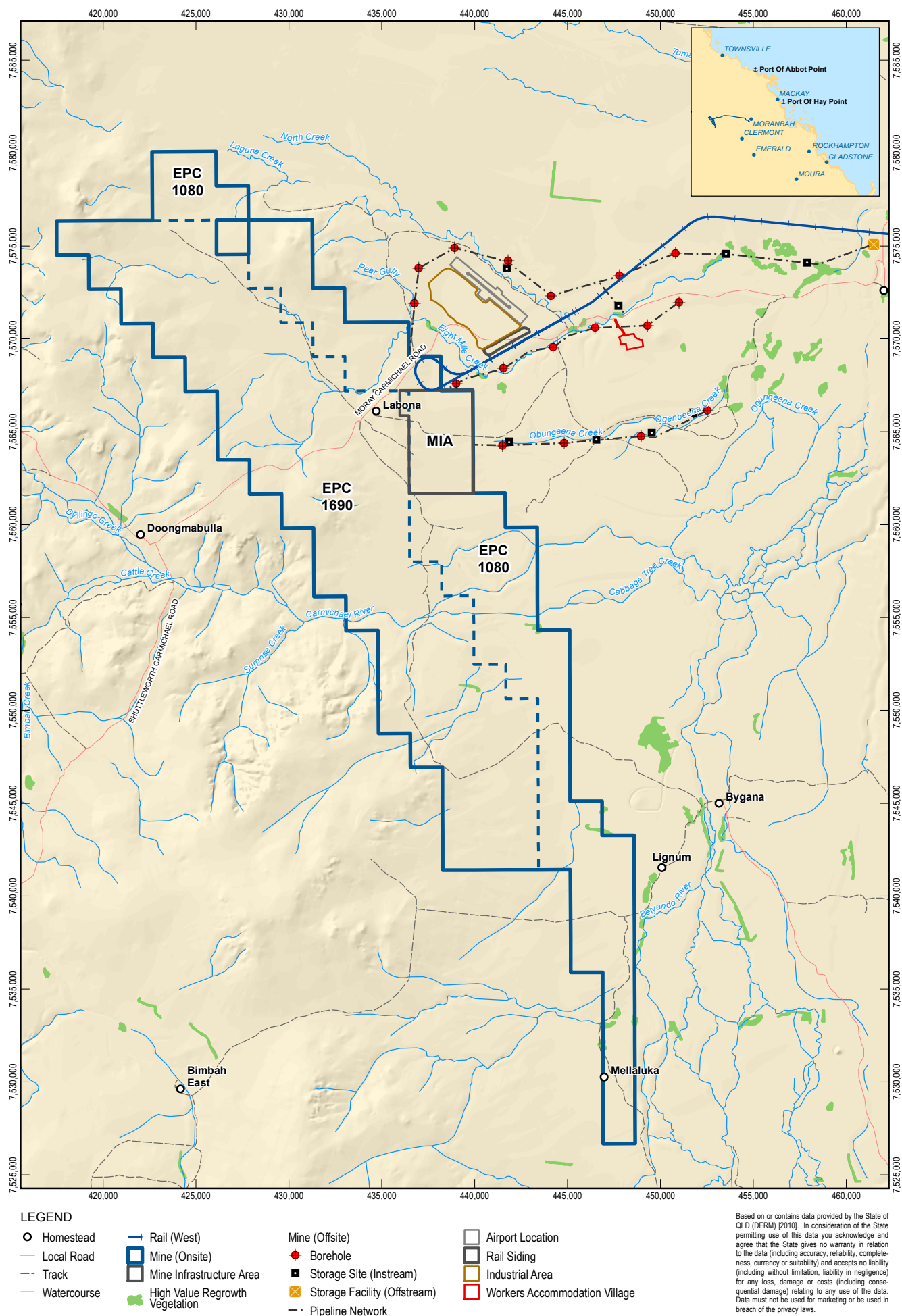
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Sheet 27 of 27

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LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- High Value Regrowth Vegetation
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project

Regrowth Vegetation

Job Number 41-25215
Revision C
Date 29-08-2012

Figure 2-5

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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); DERM: High Value Regrowth (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, CA

2.3.2 Vegetation Communities

Within the natural environment vegetation occurs in climax communities, which are units displaying a consistent species composition and structure (canopy cover and height). Vegetation communities can be described at a number of levels depending on the level of detail required (or the mapping scale it is intended to be utilised with) by focusing on the varying species composition of understorey layers, the landform and substrate that a community usually occurs on (e.g. hills and ranges of Palaeozoic granite), or even the geography (coastal, sub-coastal, within a certain bioregion etc.). The basic unit is the association.

An association is a climax community in which the dominant stratum (the stratum with the greatest above ground biomass) has a relatively uniform species composition and structure (Neldner *et al*, 2005). Associations can be quite broad and may encompass a number of seemingly disparate vegetation units (Sattler and Williams, 1999; Neldner, *et al*, 2005). Within the one association, vegetation clumps at different sites may have sub-dominant strata that have different characteristic species. However, in general these clumps will look similar from the outside.

For instance, two woodlands dominated by narrow-leaved ironbark, one with no other tree species present, the other having a mix of one or two subdominant tree species, could be classed as the same association. However, these woodlands can be split at a sub-association level, by considering the species composition of the sub-canopy layers, and can then be mapped at a larger scale. Sub-associations focus on the species composition of both the dominant and sub-dominant species within a community, and are more sensitive to differences in structure. Queensland REs are described at association level, and many have further sub-associations described within them (Neldner *et al*, 2005).

The alliance is the peak floristic grouping. An alliance is a group of associations whose dominant strata have the same structure but with related species composition (Neldner *et al*, 2005). For example, the alliance 'dry eucalypt woodlands/open woodlands primarily on sandplains or depositional plains' could include the associations 'ironbark woodlands on Cainozoic sand plains' and 'poplar gum open woodland on broad Quaternary alluvial plains'. At this level, members of an alliance will appear quite different, but can be readily mapped at very coarse scales (although in the case of highly distinctive associations, it may be impossible to group them at a higher level and the association and alliance may be identical).

The 'broad vegetation group' (BVG) community units developed by the Queensland Herbarium comprise a set of vegetation alliances described at increasingly coarse scales. The first grouping is at the 1:1 million scale, with 100 BVG/alliances described. At the 1:2 million scale there are 35 BVG/alliances, and these have been refined even further at the 1:5 million scale to 16 BVG/alliances. The RE unit is the basic association on which these alliances are built – REs are designed to be mapped at scales ranging from 1:100,000 and finer.

In order to provide a broad understanding of the vegetation alliances within the EPC 1690 Study Area, a unique set of seven BVGs (called Broad Vegetation Communities or BVCs for this Project) have been developed, based on the particular communities and land forms present within the EPC 1690 Study Area. These BVCs are presented in Table 2-3, and mapped in Figure 2-6. Vegetation communities within the EPC 1080 Study Area are discussed in Appendix B and illustrated in Figure 2-6 of Appendix B.

Table 2-3 Broad Vegetation Communities within the EPC 1690 Study Area (in order of area)¹

Community name	Res	Landform	Characteristic species	Sites ²	Comments
Ironbark-box grassy woodland and open woodland on grey sand plains	10.3.6a, 10.3.28, 10.5.4b, 10.5.5, 11.3.10	Level to gently undulating Tertiary sand plains, sometimes derived from alluvium (10.3.6, 10.3.28, 11.3.10). Soils are sands, sandy loams, and clay loams (the latter often duplex soils).	<i>Eucalyptus melanophloia</i> , <i>E. brownii</i> , <i>E. drepanophylla</i> , <i>Corymbia dallachiana</i> , <i>Melaleuca nervosa</i> , <i>Eremophila mitchellii</i> , <i>Acacia excelsa</i> , <i>A. sericophylla</i> , <i>Carissa ovata</i> , <i>Aristida latifolia</i> , <i>Aristida calycina</i> var. <i>praealta</i> , <i>Schizachyrium fragile</i> , <i>Eragrostis cumingii</i> .	C4, C10, C16, C17, C19, C20; Q152, Q153, Q158, Q160	Present over 15,131 ha of the EPC 1690 Study Area; the most common BVC present. Generally with high native grass species diversity.
Representative image					
Open, previously cleared areas, lacking native vegetative cover	Non-remnant	Generally located on clay plains in lower catchment positions immediately to the north (and less so to the south) of the Carmichael River.	Buffel grass (<i>Cenchrus ciliaris</i>)	No sites	Covers 5,441 ha of the EPC 1690 Study Area, primarily on the more fertile clay plains.
Representative image					

Community name	Res	Landform	Characteristic species	Sites ²	Comments
Yellow jacket and rough-leaved bloodwood shrubby low open woodland on red sand plains	10.5.1a, 10.5.1b, 10.5.1c, 10.5.1d, 10.5.8a	Level to gently undulating Tertiary sand plains, usually over deep red earths and sandy loams (10.5.1) but occasionally over paler sandy loams (10.5.8).	<i>Eucalyptus similis</i> , <i>Corymbia setosa</i> , <i>C. brachycarpa</i> , <i>C. dallachiana</i> , <i>Petalostigma banksii</i> , <i>Acacia leptostachya</i> , <i>Triodia pungens</i> , <i>Themeda triandra</i> , <i>A. latifolia</i> , <i>S. fragile</i> , <i>Panicum effusum</i> .	C2, C12, C13	Present over 2,288 ha in a discontinuous belt along the western boundary of the EPC 1690 Study Area, mostly north of the Carmichael River. Generally has good native grass species diversity and has the highest overall species diversity/site of all BVCs.
Representative image					
Tall mixed shrubland on red sand plains and over ferricrete	10.5.7a, 10.7.7a	Level to gently undulating Tertiary red sand plains, sometimes with ferricrete at shallow depth (10.7.7a). Soils are red sands and orange/brown sandy loams.	<i>Acacia leptostachya</i> , <i>A. stipuligera</i> , <i>Melaleuca nervosa</i> , <i>Comesperma pallida</i> , <i>Platysace valida</i> , <i>Calytrix microcoma</i> , <i>Keraudrenia collina</i> , <i>Grevillea pteridifolia</i> , <i>E. melanophloia</i> , <i>C. dallachiana</i> , <i>Bursaria incana</i> , <i>Heteropogon contortus</i> , <i>A. latifolia</i> , <i>Eriachne aristidea</i> , <i>Fimbristylis squarrulosa</i> .	C1, C6, C18	Present over 1,574 ha of the EPC 1690 Study Area. Generally less than 4 m tall, with occasional eucalypt/bloodwood emergents. Species diversity relatively low, but community integrity is high with no weeds noted.
Representative image					



Community name	Res	Landform	Characteristic species	Sites ²	Comments
Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains	10.3.3a, 10.3.3b, 10.3.4b, 10.4.3, 10.4.5, 10.9.3, 11.3.1, 11.4.6, 11.4.9	Level to undulating Cainozoic clay plains, generally with heavy, cracking clay soils.	<i>Acacia cambagei</i> , <i>A. harpophylla</i> , <i>Eucalyptus cambageana</i> , <i>E. brownii</i> , <i>E. mitchellii</i> , <i>Flindersia dissosperma</i> , <i>Terminalia oblongata</i> , <i>C. ovata</i> , <i>Salsola kali</i> , <i>Sporobolus actinocladius</i> , <i>A. calycina</i> var. <i>calycina</i> , <i>Eragrostis speciosa</i> , <i>Eragrostis sororia</i> , <i>Enneapogon polyphyllus</i> , <i>Alloteropsis semialata</i> , <i>Leptochloa fusca</i> , <i>Chrysopogon fallax</i> , <i>Eriochloa pseudoacrotricha</i> , <i>H. contortus</i> .	C3, C5, C11, C15, Q151, Q157	Present over 1,034 ha in relatively high quality, intact and large patches across the EPC 1690 Study Area. The Desert Uplands brigalow REs tend to be in the best condition. Relatively little pure gidgee woodland is present.
Representative image					
Woodland and low open woodland associated with laterised sandstone rises and minor pediments	10.7.2a, 10.7.3b, 10.7.4, 10.7.5, 10.7.7b, 10.9.3a	Rolling rises with skeletal soils, generally with a laterite capping and often with an abundant covering of laterised pea-gravel.	<i>Eucalyptus persistens</i> , <i>Corymbia dallachiana</i> , <i>E. thozetiana</i> , <i>Acacia shirleyi</i> , <i>Melaleuca tamariscina</i> , <i>Grevillea pteridifolia</i> , <i>A. leptostachya</i> , <i>Triodia pungens</i> .	C7, C8, Q154	Present over 409 ha of the EPC 1690 Study Area, in discontinuous patches along the western margin, mostly in the north. Characterised by very hard, stony ground, with no weeds noted.

Community name	Res	Landform	Characteristic species	Sites ²	Comments
Representative image					
Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding	10.3.13b, 10.3.14d, 11.3.25b, 11.3.25e, 11.3.27b	Watercourse banks, meander plains and flood plains. Soils are sandy alluvium.	<i>Eucalyptus camaldulensis</i> , <i>Melaleuca leucadendra</i> , <i>E. coolabah</i> , <i>Corymbia tessellaris</i> , <i>Acacia salicina</i> , <i>Lomandra longifolia</i> , <i>Dichanthium sericeum</i> , <i>C. fallax</i> , <i>Bothriochloa pertusa</i> , <i>H. contortus</i> . The vulnerable palm <i>Livistona lanuginosa</i> was found in this BVC.	C9, C14; Q150	Primarily present along the Carmichael River and Cabbage Tree Creek, in areas with shallow groundwater, and is considered to be a groundwater dependant ecosystem. Occupies 135 ha of the EPC 1690 Study Area.
Representative image					

¹ Broad vegetation communities within the EPC 1690 Study Area refer only to those that are mapped within the proposed mine site.

² C sites are comprehensive sites conducted during the wet season; Q sites are quaternary sites undertaken during both seasons – only the major Q sites where detailed species lists were recorded are included here. All sites are mapped in Figure 1-3.

2.3.3 Groundwater Dependent Ecosystems

The only groundwater dependent ecosystem (GDE) identified within the EPC 1690 Study Area is the open forest and woodland fringing the Carmichael River. Groundwater studies in this area, as detailed in the Mine Hydrogeology Report (Volume 4, Appendix R), indicate that in the wet season groundwater contributed a base flow to the channel. However, the Carmichael River is generally a 'losing watercourse', that is, channel water is lost to groundwater and the aquifer level was determined to be within a few metres of the Carmichael River channel bottom.

Given the large size of the dominant river red gums and weeping paperbarks fringing the channel (growing up to 28 m tall), the highly seasonal availability of surface water and the relatively shallow depth to groundwater, it is considered that these species are likely to have a facultative dependency on groundwater. Therefore, this fringing open forest/woodland is considered to be a GDE. Other potential GDEs within the EPC 1690 Study Area include a minor sandy ephemeral watercourse south of the Carmichael River, which is also fringed by river red gums, and the vegetation fringing Cabbage Tree Creek.

2.3.4 Flora Species Diversity

2.3.4.1 Desktop Results

Searches of relevant databases (see Appendix D) and existing reports for the area identified a broad diversity of flora species within the EPC 1690 Study Area and broader region. These investigations were combined and summarised below:

- ▶ Predicted species data:
 - Protected matters Search Tool and Environment Reporting Tool: three threatened flora species and five WONS
- ▶ Existing species records databases:
 - Wildlife Online: 962 vascular taxa of which 56 were introduced species
 - HERBRECS: 701 vascular taxa of which 38 were introduced species

A total of 13 threatened flora species were identified as being relevant to the EPC 1690 Study Area or surrounding region through desktop review. These species are discussed in Section 3.2.4 and Section 3.3.4.

2.3.4.2 Field Survey Flora Diversity

Field surveys recorded 342 plant taxa, of which 320 were native (93.5 per cent) (Appendix E). Ninety-seven of these taxa (including one introduced species) were recorded in the dry season. Overall, 54 plant families are represented in the EPC 1690 Study Area. The most species rich plant families represented in the EPC 1690 Study Area were:

- ▶ Poaceae (87 taxa)
- ▶ Fabaceae (24 taxa)
- ▶ Myrtaceae (21 taxa)
- ▶ Cyperaceae (20 taxa)

- ▶ Mimosaceae (18 taxa)
- ▶ Malvaceae (17 taxa)

One species of conservation significance was identified in the EPC 1690 Study Area – the waxy cabbage palm (*Livistona lanuginosa*), which is listed as vulnerable under both the EPBC Act and NC Act. This species was present as isolated individuals within the Carmichael River channel. This species is discussed in more detail in Section 3.2.4.

Flora field survey results for the EPC 1080 Study Area are presented in Appendix B.

2.3.5 Exotic or Weed Flora Species

A desktop review for weed and exotic flora species within the EPC 1690 Study Area and surrounding region was undertaken utilising the following resources:

- ▶ EPBC Environment Reporting Tool search results
- ▶ Queensland Herbarium specimen database (HERBRECS) search results
- ▶ DEHP Wildlife Online search results
- ▶ Biosecurity Queensland's Annual Pest Distribution Survey 2008 data and predictive maps
- ▶ IRC's Draft Pest Management Plan 2011-2015 (IRC, 2011). The draft plan lists 17 weed species that are identified as a priority for management within the LGA.

The information gathered from the above sources included predictive weed mapping information (based on climate suitability) over the region and historical confirmed records of weed species in the EPC 1690 Study Area and surrounding region. The desktop review for weed species identified 19 species of 'declared plants' under the LP Act that have been recorded or are within potentially suitable distribution. These are listed in Appendix F.

During the field surveys, 22 introduced species were recorded, of which two species are 'declared plants' under the LP Act, one of which, Parthenium weed (*Parthenium hysterophorus*), is a WONS. These species are listed in Table 2-4.

Table 2-4 Queensland declared plants recorded within the EPC 1690 Study Area

Scientific name	Common name	EPC 1690 Study Area distribution
Class 2		
<i>Parthenium hysterophorus</i>	parthenium weed	Non-remnant areas, brigalow, box woodland and within the Carmichael River, generally in very sparse clusters
<i>Opuntia stricta</i>	prickly pear	Brigalow patches



2.4 Terrestrial Fauna

2.4.1 Fauna Habitats

Eight broad fauna habitat types were described across the EPC 1690 Study Area. The general characteristics of these broad habitat types are summarised in Table 2-5 and discussed further below. The spatial distribution of fauna habitats (analogous to vegetation community mapping) at the EPC 1690 Study Area is presented in Figure 2-6. Fauna habitats within the EPC 1080 Study Area are discussed in Appendix B and illustrated in Figure 2-6 of Appendix B.

Table 2-5 Fauna habitat types at EPC 1690 Study Area

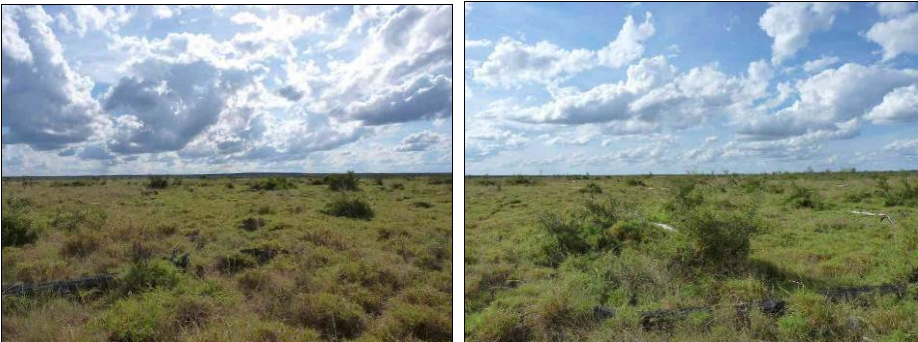
Broad habitat type	General characteristics	Representative photos
Ironbark-box grassy woodlands and open woodlands on grey sand plains 'Ironbark-box woodland'	Most widespread fauna habitat type at EPC 1690 Study Area Typically comprised of sparse canopy layer, sparse to absent shrub layer and ground layer of native (less often introduced) grasses Forage resources for folivorous mammals, nectarivorous mammals and birds, granivores, insectivorous mammals, reptiles and birds, and grazing mammals Predators including birds of prey, snakes and dingos Shelter resources include occasional hollows in mature eucalypts (density dependent on age of woodland and tree species), log piles, dense ground cover Percentage of trees with hollows observed along 50 m transect* = 16 per cent (n=24 transects) Ephemeral waterways and drainage lines often associated with habitat type – permanent water present occasionally in form of farm dams and troughs	 Photos taken at EPC 1690 Study Area during Autumn 2011 survey (April 2011)

Broad habitat type	General characteristics	Representative photos
Yellow jacket and rough leaved bloodwood shrubby low open woodland on red sand plains 'Shrubby low woodland'	More prevalent in western part of EPC 1690 Study Area Habitat characteristics similar to ironbark-box woodland habitat, however occasionally denser shrub layer, and different suite of native grasses Percentage of trees with hollows observed along 50 m transect* = 17 per cent (n=4 transects)	
Photos taken at EPC 1690 Study Area during Autumn 2011 survey (April 2011)		
Tall mixed shrubland on red sand plains over ferricrete 'Tall mixed shrubland'	More prevalent in western part of EPC 1690 Study Area Sparse to dense (low) canopy Percentage of trees with hollows observed along 50 m transect* = 4 per cent (n=4 transects) Often dense shrub layer Ground layer of native grasses, although often bare ground Forage resources for nectarivorous mammals and birds, granivores and insectivores Predators including birds of prey, snakes Ephemeral waterways and drainage lines often associated with habitat type – permanent water present occasionally in form of farm dams and troughs	
Photos taken at EPC 1690 Study Area during Autumn 2011 survey (May 2011)		

Broad habitat type	General characteristics	Representative photos
Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains 'Gidgee / brigalow shrubland'	Sparse to dense canopy layer Typically sparse shrub layer, with understorey of native (less often introduced) grasses Forage resources for nectarivorous mammals and birds, granivores and insectivores Predators including birds of prey, snakes and dingos Shelter resources including log piles and shed bark, defoliating bark and cracking soils few hollows Percentage of trees with hollows observed along 50 m transect* = 4 per cent (n=11 transects) Gilgais often associated with this habitat type – seasonal water source and localised habitat node	 Photos taken at EPC 1690 Study Area during Autumn 2011 survey (April 2011)

Broad habitat type	General characteristics	Representative photos
Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding 'Fringing open forest / woodland'	Restricted to riparian zone and adjacent floodplain of Carmichael River and nearby Cabbage Tree Creek Moderate to dense canopy layer Shrub layer generally lacking Dense ground cover of grasses (Iomandra in riparian zone) and occasionally weeds Sandy substrate Forage resources for folivorous mammals, nectarivorous mammals and birds, granivores, insectivorous mammals, reptiles and birds, and grazing mammals Predators including birds of prey, snakes and dingos Mature <i>Eucalyptus camaldulensis</i> support relatively high density of hollows; Other shelter resources include log piles (flood debris), and in places, dense ground cover Percentage of trees with hollows observed along 50 m transect* = 15 per cent (n=6 transects)	 Photos taken at EPC 1690 Study Area during Autumn 2011 survey (April 2011) (left) and Spring 2010 survey (November 2010) (right)
Woodland and low open woodland associated with laterised sandstone rises and minor pediments 'Low woodland (sandstone rises)'	Occurs in small area in central-west of EPC 1690 Study Area Habitat characteristics similar to ironbark-box woodland habitat, however rocky substrate may provide shelter resources for a different assemblage of small reptiles Percentage of trees with hollows observed along 50 m transect* = 25 per cent (n=4 transects)	 Photos taken at EPC 1690 Study Area during Autumn 2011 survey (April 2011)

Broad habitat type	General characteristics	Representative photos
Natural and artificial water bodies 'Natural and artificial water bodies'	Natural waterways include Carmichael River, Cabbage Tree Creek and gilgais Artificial water bodies include numerous small to large farm dams Water bodies (and adjacent vegetation) provide drinking resource for numerous animal species and breeding habitat for some (i.e. amphibians, some birds) Provide foraging habitat for water birds and wading birds Provide foraging habitat for predatory species including some birds of prey and some snakes	    Top left, top right, bottom left photos taken at EPC 1690 Study Area during Autumn 2011 survey (April / May 2011); Bottom right photo taken during Spring 2010 survey (November 2010)

Broad habitat type	General characteristics	Representative photos
Open, previously cleared areas lacking native vegetative cover ‘Open cleared land’	Large patch of cleared land occurs in central eastern part of EPC 1690 Study Area (north of Carmichael River), with several smaller patches south of the Carmichael River Typically dominated by introduced buffel grass (<i>Cenchrus ciliaris</i>) Forage resources limited, although habitat supports some granivores and insectivores, and grazing mammals Predators including birds of prey, snakes and dingos Shelter resources limited, although log piles resultant from historic clearing likely to shelter grassland reptile species	

Photos taken at EPC 1690 Study Area during Autumn 2011 survey (April 2011)

* Percentage of trees with hollows observed along 50 m transect* = number of trees with hollows / number of trees counted along 50 m transect (n = transects)



2.4.1.1 Summary of Fauna Habitat Values within EPC 1690 Study Area

Excluding cleared areas, identified fauna habitats (as depicted in Figure 2-6) at the EPC 1690 Study Area were relatively disturbance-free, and retained habitat features for an assortment of fauna species (as summarised in (Table 2-5). Despite the agricultural land use within and surrounding the EPC 1690 Study Area, in general the prevalence of weeds, introduced animals and disturbances associated with cattle (i.e. loss of vegetative cover, compaction of ground, degradation of riparian areas and waterways) was observed to be relatively low. In localised areas, the level of disturbance observed was relatively higher – for example in the vicinity of cattle water points (farm dams, some stock troughs), and parts of the riparian zone of the Carmichael River. Habitats at the site characterised by remnant vegetation retained connectivity across much of the EPC 1690 Study Area (and beyond).

While much of the EPC 1690 Study Area contains remnant vegetation, a large patch of cleared land dominates the central part of the EPC 1690 Study Area between the Carmichael River and Moray-Carmichael Road. This cleared land covers an area of approximately 5,441 ha (21 per cent of total area of EPC 1690 Study Area). Habitat values for native fauna are limited in this cleared land, due to the lack of microhabitats and the prevalence of buffel grass. Smaller fragments of cleared land occur near the eastern boundary of the EPC 1690 Study Area to the north of the Moray-Carmichael Road, and to the south of the Carmichael River. Fauna habitat values are similarly limited in these fragments. The value of these cleared areas is further limited at the eastern-most part of the EPC 1690 Study Area, where much of the landscape to the east of the EPC boundary is cleared.

Marked seasonal variability in the structure and composition of fauna habitat types was not observed across the EPC 1690 Study Area (i.e. between the spring and autumn surveys). This may be attributable to the unseasonably high rainfall preceding the Spring 2010 survey (typically this time of year would have corresponded with the end of the central Queensland 'dry' season). With respect to fauna habitats, it is considered likely that:

- ▶ Availability of forage resources for herbivorous animals (i.e. grazers, nectarivores, grainivores and folivores) likely to be seasonally variable, and driven by local climatic conditions. This may result in variable use of different habitats by resident and sedentary species during the year, and temporary occupancy in response to availability of forage resources by nomadic and migratory species
- ▶ Availability of prey for predators may change during the year in response to variable densities and diversity of herbivorous animals
- ▶ Extent of habitat for semi-aquatic species (i.e. amphibians, water birds) likely to fluctuate during year in response to rainfall. Large water bodies (i.e. some farm dams) that retain water throughout year may become localised nodes for water birds in response to regional reduction in extent of aquatic habitat
- ▶ Microhabitats may vary during year in response to climate (i.e. reduced ground cover during dry season)
- ▶ Less predictable forces such as fire and flooding may alter the availability of important habitat resources for ground-dwelling / ground-foraging animals and arboreal animals.

Fauna survey results by fauna habitat type (from comprehensive survey sites) are summarised in Section 2.4.3.



The potential value of identified habitat for conservation significant terrestrial fauna is discussed in more detail in Section 3.

2.4.1.2 Fauna Habitat Values beyond EPC 1690 Study Area including Connectivity

A review of DNR RE mapping indicates that much of the landscape surrounding the EPC 1690 Study Area retains remnant vegetation coverage. To the south and north of the EPC 1690 Study Area, this remnant vegetation coverage is almost uninterrupted for at least 15 km in each direction. Remnant vegetation occurs along the length of the western boundary of the EPC 1690 Study Area, and this persists, largely intact to the west (for at least 14 km from the north-west corner of the EPC 1690 Study Area, and at least 34 km from the south-west corner of the EPC 1690 Study Area). The landscape to the east of the EPC 1690 Study Area (including EPC 1080) has experienced more broadscale vegetation clearing, and as such, remnant vegetation coverage is more fragmented here – particularly to the east of the central part of the EPC 1690 Study Area (refer to Appendix B).

Connectivity between remnant vegetation associated with the Belyando River and the south-east part of the EPC 1690 Study Area (i.e. the eastern part of the Bygana West Nature Refuge) is maintained through a tract of slightly fragmented (though wholly connected) mapped remnant vegetation. This east-west corridor, linking vegetation associated with the Belyando River (which itself acts as a north-south corridor) through the Bygana West Nature Refuge to large tracts of remnant vegetation to the west (as well as to the north through and beyond the EPC 1690 Study Area, and to the south beyond the EPC 1690 Study Area) may allow for dispersal away from the more fragmented landscape to the east of the EPC 1690 Study Area through to the large tracts of remnant vegetation within, west, north and south of the EPC 1690 Study Area. It may also provide passage for wildlife seeking to access the river and riparian habitats as part of normal seasonal movements, or in response to variable climatic conditions.

The narrow corridor of riparian vegetation associated with Carmichael River also links through to remnant vegetation along the Belyando River. East of the EPC 1690 Study Area, this corridor passes through a largely cleared landscape for approximately 15 km before it connects with floodplain vegetation associated with the Belyando River (refer to Fauna Habitat Values beyond EPC 1080 Study Area including Connectivity, presented in Section 2.2.1.2 in Appendix B). In spite of the narrowness of this corridor in places, it is likely to facilitate east-west movement between the Belyando River and the large tracts of remnant vegetation within and to the north, west and south of the EPC 1690 Study Area. Notably, the vegetation along the Carmichael River represents an east-west linkage between the western part of the Brigalow Belt bioregion and the Desert Uplands bioregion. The Study Area occurs at the interface of these two bioregions, and connectivity between these regions is facilitated through connected remnant vegetation at and in the vicinity of the north of the Study Area, fragmented vegetation at and in the vicinity of the south of the Study Area, and along the narrow riparian strip along the Carmichael River.

2.4.1.3 Biodiversity Planning Assessment Mapping

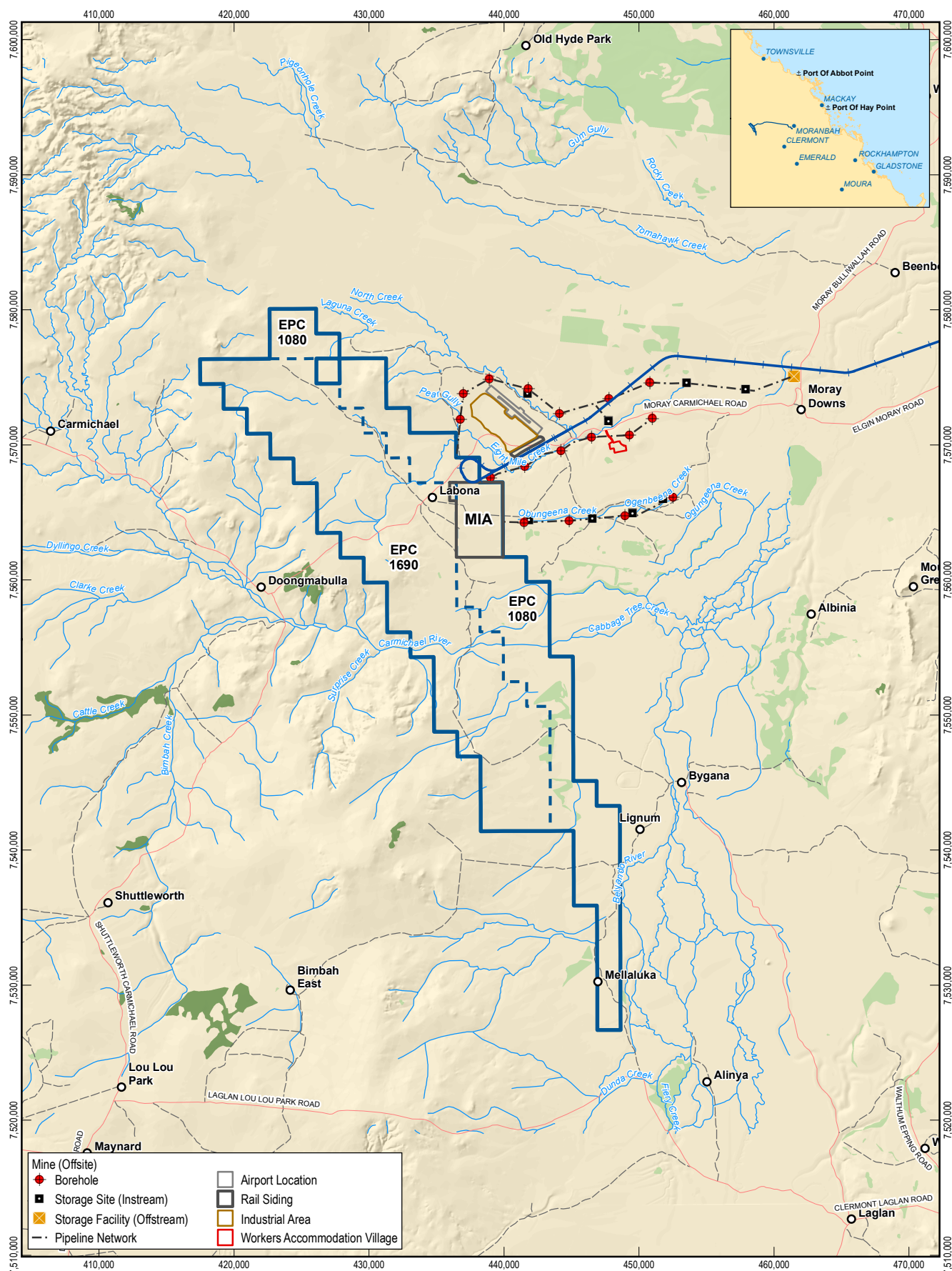
The DEHP mapping for the Brigalow Belt and Desert Uplands bioregions was reviewed to provide an indication of the quality and value of remnant vegetation within and beyond the EPC 1690 Study Area. Specifically, three BPA mapping criteria were applied to the EPC 1690 Study Area and surrounding landscape, such that the potential habitat values within and beyond the EPC 1690 Study Area could be described.

The criteria applied include:



- **Criteria B2 – Ecosystem value at regional scale.** This criterion categorises RE polygons according to the Biodiversity Status of the constituent REs (of that polygon), and their extent in Queensland's protected area estate (Environmental Protection Agency (EPA), 2002). The regional ecosystem value mapping layer was applied to the EPC 1690 Study Area and adjacent landscape (Figure 2-7). Only the 'very high' and 'high' ecosystem values were depicted in the mapping. As can be seen in Figure 2-7, a number of remnant vegetation patches considered to be regionally significant with respect to biodiversity value occur in the landscape around the EPC 1690 Study Area, while several small patches occur within the EPC 1690 Study Area (corresponding with of concern remnant vegetation at the south-east of the EPC 1690 Study Area)
- **Criteria F – Ecosystem diversity.** This criterion describes habitat complexity, based on the number and size of ecosystems and wetlands present in an area (EPA, 2002). The concepts of 'richness' (number of different ecosystems) and 'evenness' (relative abundance of ecosystems) are considered when attributing an ecosystem diversity rating to a particular area (EPA, 2002). By way of example, areas with high ecosystem diversity typically have relatively many REs and ecotones (EPA, 2002). Simpson's Diversity Index is used to determine ecosystem diversity (EPA, 2002). RE polygons categorised as being of 'very high' or 'high' ecosystem diversity are presented in Figure 2-8. As depicted in Figure 2-8, all remnant vegetation at the EPC 1690 Study Area is categorised as having very high or high ecosystem diversity. Much of the landscape to the north, west and south of the EPC 1690 Study Area is similarly ranked as having very high or high ecosystem diversity. Remnant vegetation coverage is more patchy to the east of the central part of the EPC 1690 Study Area, and thus, REs considered to be of very high or high ecosystem diversity are more fragmented at this location. However remnant vegetation ranked as having very high or high ecosystem diversity does form an east to west linkage from the Belyando River (east of the EPC 1690 Study Area) through the southern part of the EPC 1690 Study Area (i.e. within and to the south of Bygana West Nature Refuge) to the west of the EPC 1690 Study Area (where remnant vegetation coverage is extensive)
- **Criteria G – Context and connection.** This criterion is based upon the extent to which a mapped RE polygon incorporates or buffers other ecologically noteworthy areas (i.e. other remnant vegetation units and/or wetlands/waterways) (EPA, 2002). With respect to connection, remnant vegetation units that are connected to other REs are considered to be more representative of biodiversity, contribute more to a habitat network (i.e. connectivity) and exhibit greater resilience to disturbance (EPA, 2002). Much of the EPC 1690 Study Area is mapped as very high, particularly the northern and southern parts of the EPC 1690 Study Area (Figure 2-9). This very high mapped remnant vegetation continues largely uninterrupted to the north and south of the EPC 1690 Study Area, whilst to the west it is more fragmented. To the east of the central part of the EPC 1690 Study Area, large tracts of non-remnant vegetation are present and are thus not mapped under this criterion. The remnant vegetation that connects the Belyando River with the southern part of the EPC 1690 Study Area is predominantly ranked as being very high or high under Criteria G

Discussion of the BPA mapping criteria in relation to the EPC 1080 Study Area is provided in Appendix B and illustrated in Figures 2-7 to 2-9 of Appendix B.



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LEGEND

○ Homestead	— Rail (West)	Biodiversity Planning Assessment - Criteria B2
— Local Road	■ Mine (Onsite)	Ecosystem Value at Regional Level
— Track	■ Mine Infrastructure Area	Very High
— Watercourse	■ Workers Accommodation Village	High

1:400,000 (at A4)
0 2.5 5 7.5 10
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
BPA Mapping - Ecosystem
Value at Regional Level

Job Number 41-25215
Revision C
Date 29-08-2012

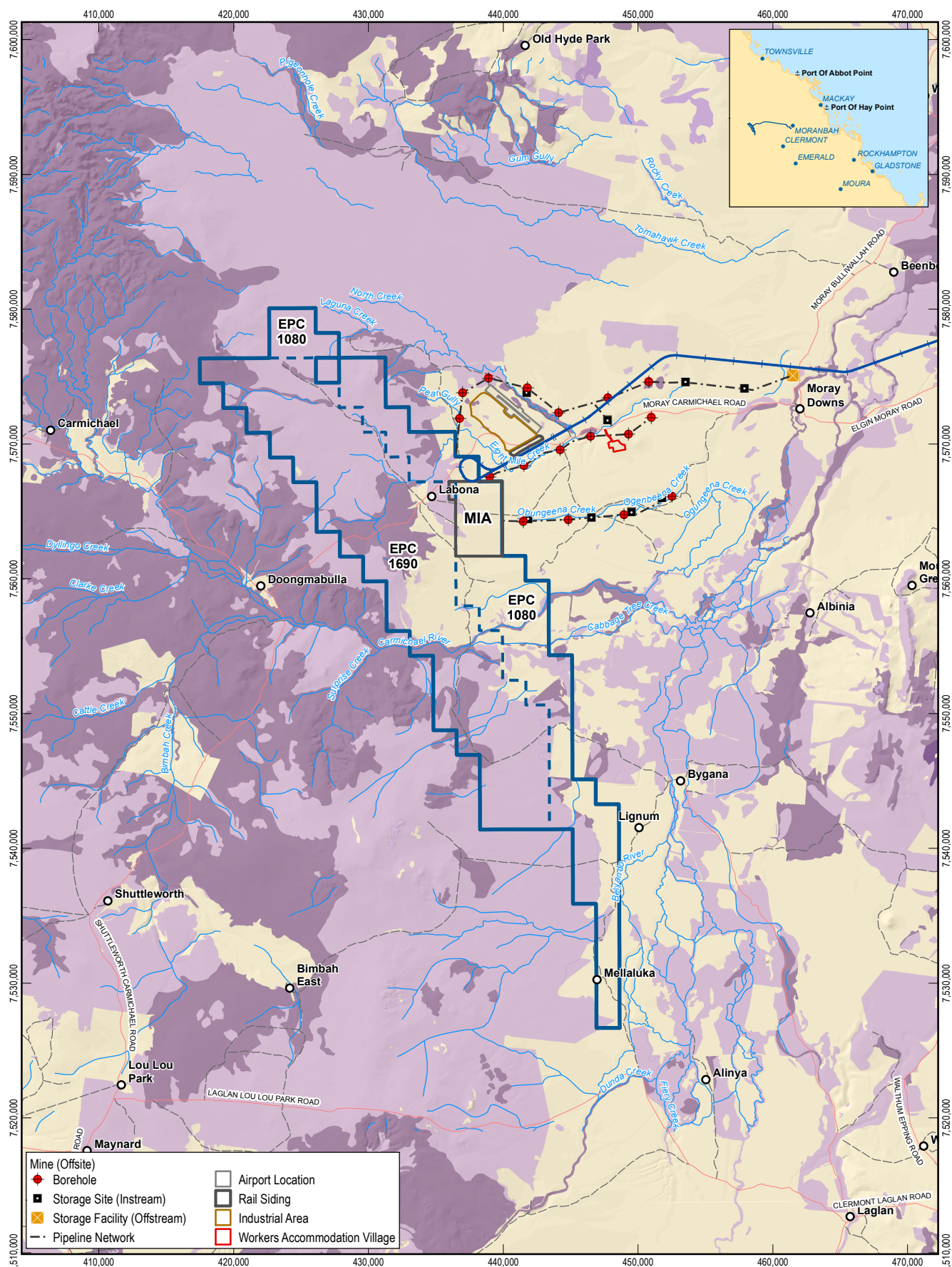
Figure 2-7

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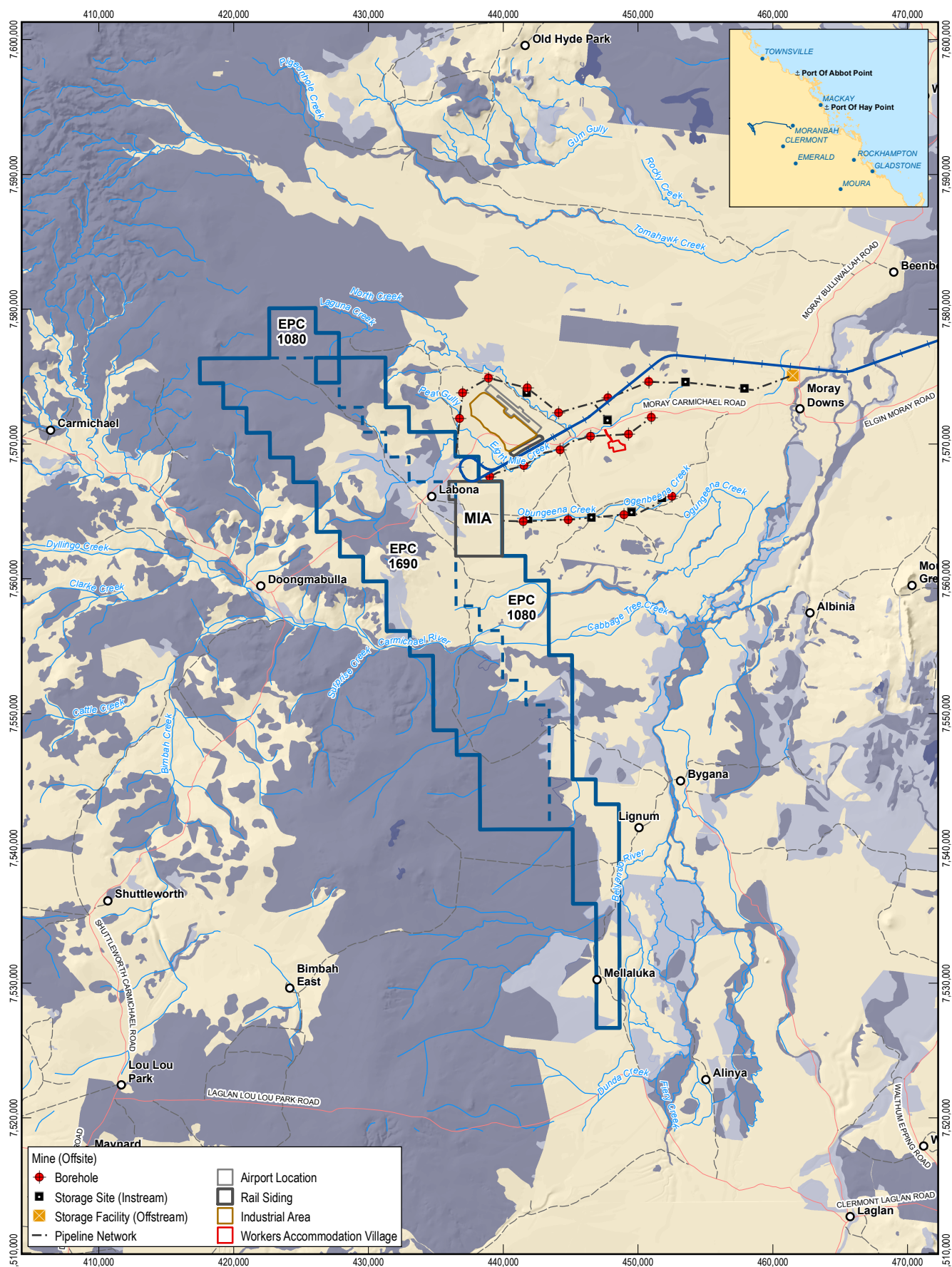
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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); DERM: Biodiversity Planning Assessment (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); Created by: BW, CA



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LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Biodiversity Planning Assessment - Criteria G
- Context and Connection
- Very High
- High

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1:400,000 (at A4)
0 2.5 5 7.5 10
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
BPA Mapping - Context and Connection

Job Number 41-25215
Revision D
Date 29-08-2012

Figure 2-9

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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); DERM: Biodiversity Planning Assessment (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); Created by: BW, CA

2.4.2 Fauna Species – Desktop Assessment Summary

Table 2-6 provides a summary of the results of the desktop assessment, with respect to terrestrial fauna species that have the potential to occur, or have been previously recorded, at the EPC 1690 Study Area.

Table 2-6 Summary of desktop assessment results – terrestrial fauna

	Protected Matters search and Environmental Reporting tool (predicted to occur)	DEHP Wildlife Online database (historically recorded)	QLD Museum specimen database (historically recorded)	Birds Australia Atlas (historically recorded)
Species diversity		17 amphibians 78 reptiles 52 mammals 207 birds	13 amphibians 40 reptiles 24 mammals 37 birds	140 birds
EPBC Act and/or NC Act threatened species	2 reptiles 1 mammal 5 birds	4 reptiles 3 mammals 6 birds	2 reptiles 2 mammals	3 birds
EPBC marine and/or migratory birds	10 migratory 11 marine	14 migratory 50 marine	2 marine	1 migratory 23 marine
Introduced/pest species	1 amphibian 5 mammals	1 amphibian 1 bird 9 mammals	1 amphibian 2 mammals	-

Consolidation of the results of the three databases from which historical terrestrial fauna species records were obtained (Wildlife Online, Queensland Museum and Birds Australia) revealed that 372 species have been previously recorded from the desktop search area, comprising:

- 18 amphibian species (17 common native species, 1 introduced species)
- 84 reptile species (79 common native species, 5 threatened species)
- 55 mammal species (43 common native species, 3 threatened species, 9 introduced species)
- 209 birds (202 common native species, 5 threatened species, 1 introduced species)

Threatened and conservation significant terrestrial fauna species (including likelihood of occurrence assessment) are discussed in more detail in Section 3.

The desktop database search results are provided in full in Appendix D.



2.4.3 Fauna Species – Field Assessment Summary

Table 2-7 provides a summary of the results of field studies across the EPC 1690 Study Area. The terrestrial fauna field survey results, including Spring 2010 survey and Autumn 2011 survey (site-specific) species lists and the total species list are provided in Appendix G. Terrestrial fauna field survey results for the EPC 1080 Study Area are provided in Appendix B.

Table 2-7 Summary of field assessment results – terrestrial fauna

		Amphibians	Reptiles	Mammals	Birds	Total
Spring 2010 survey (November 2010)	Total species	9	17	24	82	132
	Introduced species	1	-	4	-	5
	Threatened species	-	-	-	2	2
	EPBC Act migratory	-	-	-	3	3
	EPBC Act marine	-	-	-	16	16
Autumn 2011 survey (April-May 2011)	Total species	11	30	29	119	189
	Introduced species	1	-	6	1	8
	Threatened species	-	-	1	3	3
	EPBC Act migratory	-	-	-	2	2
	EPBC Act marine	-	-	-	18	18
Total (both surveys)	Total species	11	34	34	134	213
	Introduced species	1	-	6	1	8
	Threatened species	-	-	1	3	4
	EPBC Act migratory	-	-	-	3	3
	EPBC Act marine	-	-	-	22	22

Fauna diversity by fauna habitat type is summarised in Table 2-8 (Spring 2010 survey) and Table 2-9 (Autumn 2011 survey) (noting that this data only includes species records from comprehensive (i.e. trapping) survey sites).

Table 2-8 Fauna diversity by habitat type – Spring 2010 survey

	Ironbark-box woodland	Gidgee / brigalow shrubland	Low woodland (sandstone rises)	Fringing open forest / woodland
	n*=4	n=2	n=1	n=1
Amphibians	5	4	4	7
Reptiles	10	7	8	3
Mammals	15	13	11	13
Birds	53	46	27	33
Total species	83	70	50	56

*n = number of comprehensive survey sites featuring habitat type

Table 2-9 Fauna diversity by habitat type – Autumn 2011 survey

	Ironbark-box woodland	Gidgee / brigalow shrubland	Low woodland (sandstone rises)	Fringing open forest / woodland	Tall mixed shrubland	Shrubby low woodland
	n*=10	n=3	n=1	n=2	n=1	n=1
Amphibians	7	6	6	5	0	0
Reptiles	21	8	6	5	2	2
Mammals	18	12	10	14	10	4
Birds	56	29	9	21	12	23
Total species	102	55	31	45	24	29

*n = number of comprehensive survey sites featuring habitat type

Note: comprehensive surveys not undertaken in cleared land – rapid assessments and opportunistic records informed assessment of fauna diversity in this habitat type.

In both the Spring 2010 and Autumn 2011 surveys, ironbark-box woodland habitat, the most widely available habitat at the EPC 1690 Study Area, featured the highest fauna species diversity. Excluding ironbark-box woodland (for which survey effort was more than doubled in the Autumn 2011 survey), species diversity at those habitats sampled in both survey events was lower in the Autumn 2011 survey. This may have been attributable to the cooler temperatures experienced during the Autumn 2011 survey. While the different habitats at the EPC 1690 Study Area offer a suite of variable microhabitats that may support localised assemblages of more specialist species, the general faunal diversity (i.e. guilds of species) associated with the habitats at the EPC 1690 Study Area is likely to be fairly similar across the site, due to the observed relative similarity of habitat structure and composition.

2.4.3.1 Amphibians

Eleven amphibian species from three families were recorded from the EPC 1690 Study Area during field investigations (nine species during Spring 2010 survey, 11 species during Autumn 2011 survey).

No species of Commonwealth, State or regional significance were detected. One introduced species (cane toad (*Rhinella marina*)) was recorded.

The amphibian diversity was dominated by common tree frogs (genus *Litoria*) and burrowing frogs (genus *Cyclorana*) from the family Hylidae, and ground-dwelling frogs from the family Myobatrachidae (genera *Limnodynastes*, *Platypsectrum*, *Uperoleia*). Species diversity was typically higher in those habitats near waterbodies (i.e. Carmichael River, ephemeral waterways, and gilgais). The most abundant species were the ornate burrowing frog (*Platypsectrum ornatum*) (Plate 2-1), spotted grass frog (*Limnodynastes tasmaniensis*) (Plate 2-2) and cane toad.

Plate 2-1 Ornate Burrowing Frog



Plate 2-2 Spotted Grass Frog



2.4.3.2 Reptiles

A total of 34 reptiles species from seven families were recorded from the EPC 1690 Study Area during field investigations (17 species during Spring 2010 survey, 30 species during Autumn 2011 survey). No reptiles of Commonwealth, State or regional significance were detected. No introduced species were recorded.

Skinks dominated the reptile diversity, with 14 species from the family Scincidae recorded. Of these, the most commonly encountered species were *Carlia munda* (Plate 2-3) and *Ctenotus robustus*. Dragons (family Agamidae) were represented by seven species, including the abundant nobbi dragon (*Amphibolurus nobbi*), bearded dragon (*Pogona barbata*) (Plate 2-4) and frill-necked lizard (*Chlamydosaurus kingii*). Less frequently recorded reptiles included geckos (three species), snakes (six species – two pythons, three elapid snakes (including pale-headed snake (*Hoplocephalus bitorquatus*) (Plate 2-5), one colubrid snake), three monitor lizards (including freckled monitor (*Varanus tristis*) (Plate 2-6)) and one blind snake.

Plate 2-3 *Carlia munda* (November 2010)



Plate 2-4 Bearded Dragon (November 2010)



Plate 2-5 Pale-headed Snake (November 2010)



Plate 2-6 Freckled Monitor (April 2011)



2.4.3.3 Mammals

A total of 34 mammal species from 16 families were recorded from the EPC 1690 Study Area during field investigations (24 species during Spring 2010 survey, 34 species during Autumn 2011 survey). Two species of State significance were detected. The near threatened (NC Act) little pied bat (*Chalinolobus picatus*) was detected from four locations during the Autumn 2011 survey. Traces (characteristic diggings and scats) of the echidna (*Tachyglossus aculeatus*) were detected during both surveys. The echidna is listed as a special least concern species under the Queensland Nature Conservation (Wildlife) Regulation 2006. Further discussion on conservation significant species is provided in Section 3.

No mammals of Commonwealth or regional significance were detected in the EPC 1690 Study Area. Six introduced mammals were recorded from the EPC 1690 Study Area.

Anabat detection recorded 12 species of microchiropteran bat from three families. The most commonly recorded bat species were Gould's wattled bat (*Chalinolobus gouldii*) and the inland forest bat (*Vespadelus baverstocki*) (each recorded from 11 locations). Two arboreal mammal species were recorded – common brushtail possum (*Trichosurus vulpecula*) (Plate 2-7) and sugar glider (*Petaurus breviceps*). Habitat for arboreal mammals was present though much of the (mature) open woodland

habitat that characterised large parts of the EPC 1690 Study Area. Particularly notable arboreal mammal habitat occurred along the Carmichael River, where mature river red gum (*Eucalyptus camaldulensis*) trees supported a relatively large number of hollows of varying sizes.

The native ground mammal fauna was dominated by rodents (family Muridae) and kangaroos (family Macropodidae). The desert mouse (*Pseudomys desertor*) was frequently caught in Elliott traps in open ironbark woodland and native shrubland habitats in the northern part of the EPC 1690 Study Area. Infrequently recorded rodents included stripe-faced dunnart (*Sminthopsis macroura*) (Plate 2-8) delicate mouse (*Pseudomys delicatulus*) and water rat (*Hydromys chrysogaster*). Red kangaroos (*Macropus rufus*) (Plate 2-9) and eastern grey kangaroos (*Macropus giganteus*) (Plate 2-10) were commonly observed throughout the EPC 1690 Study Area, whilst the common wallaroo (*Macropus robustus*) was less frequently recorded. A rufous bettong (*Aepyprymnus rufescens*) was noted from woodland habitat near the Carmichael River during nocturnal searches in the Spring 2010 survey, while two northern brown bandicoots (*Isodon macrourus*) were caught in cage traps during the Autumn 2011 survey – one in ironbark woodland habitat in the northern part of the EPC 1690 Study Area and the other in mature riparian woodland habitat along the Carmichael River.

Plate 2-7 Common Brushtail Possum (April 2011)



Plate 2-8 Stripe-faced Dunnart (May 2011)



Plate 2-9 Red Kangaroo (April 2011)



Plate 2-10 Eastern Grey Kangaroo (May 2011)





2.4.3.4 Birds

A total of 134 bird species from 52 families were recorded from the EPC 1690 Study Area during field investigations. A number of conservation significant bird species were detected in the EPC 1690 Study Area, namely:

- ▶ One bird listed as endangered under the EPBC Act and NC Act – black-throated finch (southern) (*Poephila cincta cincta*) (Plate 2-15)
- ▶ One bird listed as vulnerable under the EPBC Act and NC Act – squatter pigeon (southern) (*Geophaps scripta scripta*) (Plate 2-16)
- ▶ One bird listed as near threatened under the NC Act – black-necked stork (*Ephippiorhynchus asiaticus*)
- ▶ Three birds listed as migratory under the EPBC Act and special least concern under the NC Act;
- ▶ Twenty-two birds listed as marine under the EPBC Act
- ▶ One bird listed as a Priority Species for the Burdekin NRM Region (under the Burdekin NRM Region Back on Track Actions for Biodiversity report (DERM, 2010a)) – black-throated finch (southern)

Further discussion on conservation significant species is provided in Section 3.

One introduced bird (mallard (*Anas platyrhynchos*)) was recorded from the EPC 1690 Study Area.

In general, the avian fauna of the EPC 1690 Study Area comprised a mix of common and widespread woodland, grassland and water birds. Honeyeaters (family Meliphagidae) were the most diverse assemblage with 15 species recorded. Nine parrot species (families Cacatuidae and Psittacidae) were recorded, including the red-tailed black-cockatoo (*Calyptorhynchus banksii*) (Plate 2-11). Eight species of flycatcher (family Dicruridae) were recorded. Seven raptor species from two families (Accipitridae and Falconidae) were observed, the most common of which was the brown falcon (*Falco berigora*) (Plate 2-12). Emus (*Dromaius novaehollandiae*) (Plate 2-13) and hooded robins (*Melanodryas cucullata*) (Plate 2-14) were observed in open woodland habitat across the EPC 1690 Study Area.

Plate 2-11 Red-tailed Black-cockatoo (April 2011)



Plate 2-12 Brown Falcon (May 2011)



Plate 2-13 Emu (November 2010)



Plate 2-14 Hooded Robin (April 2011)



Plate 2-15 Black-throated Finch (southern) (May 2011)

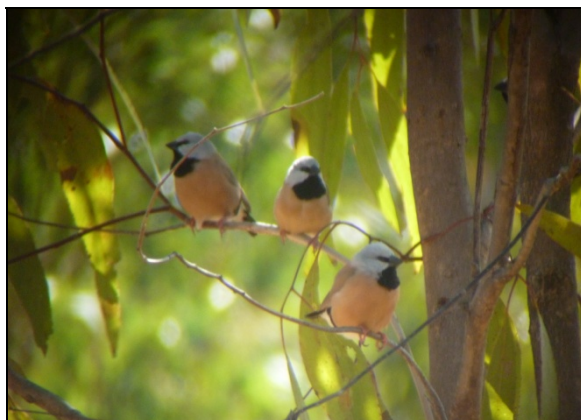


Plate 2-16 Squatter Pigeon (southern) (April 2011)



Remote cameras captured images of two threatened species (black-throated finch (southern)) and squatter pigeon (southern)), as well as some of the more abundant and widespread bird species in the EPC 1690 Study Area – namely pale-headed rosella (*Platycercus adscitus*) (Plate 2-17), apostlebird (*Struthidea cinerea*) (Plate 2-18), magpie-lark (*Grallina cyanoleuca*), and crested pigeon (*Ocyphaps lophotes*).

Plate 2-17 Pale-headed Rosella (May 2011)



Plate 2-18 Apostlebird (April 2011)



2.4.3.5 Introduced Fauna Species

Eight introduced terrestrial vertebrates were recorded from the EPC 1690 Study Area. This comprised:

- ▶ One amphibian – cane toad
- ▶ One bird – mallard
- ▶ Six mammals – dingo (*Canis lupus dingo*), cat (*Felis catus*), European rabbit (*Oryctolagus cuniculus*) (Plate 2-19), house mouse (*Mus musculus*), black rat (*Rattus rattus*) and pig (*Sus scrofa*) (Plate 2-20)

Of these species the cane toad, dingo, cat, European rabbit and pig are Class 2 Declared Animals under the LP Act. Class 2 Declared Animals are species that are established in Queensland and currently do, or potentially may, have a notable negative economic, environmental or social impact. Local governments, communities and landowners are required to manage these species under the LP Act.

Plate 2-19 European Rabbit (November 2010)



Plate 2-20 Pig (April 2011)



Cane toads were ubiquitous across all habitats, and abundant across the EPC 1690 Study Area. Based on the generalist habitat requirements of the other introduced species recorded, it is considered likely that these species would also occur through much of the EPC 1690 Study Area.

The Queensland Department of Primary Industries and Fisheries (now the Department of Agriculture, Fisheries and Forestry) produced maps indicating the distribution and abundance of a range of pest animal species. These maps were reviewed to provide further information on the likely extent of occurrence (and potential abundance) of pest species at the EPC 1690 Study Area. In the landscape in which the EPC 1690 Study Area occurs the maps indicated that:

- ▶ Cats are considered to be widespread (distribution) and common (abundance) (Department of Employment, Economic Development and Innovation (DEEDI), 2007a)
- ▶ Dogs (i.e. dingos) are considered to be widespread and common (DEEDI, 2007b)
- ▶ European rabbits are considered to be widespread and occasionally present (DEEDI, 2008a)
- ▶ Cane toads are considered to be widespread and common (DEEDI, 2008b)
- ▶ Pigs are considered to be widespread and common (DEEDI, 2008c)

The European fox (*Vulpes vulpes*) (LP Act Class 2 Declared Animal), which was not recorded during field assessments at the EPC 1690 Study Area (but has been previously recorded in the region – Wildlife Online), is also considered to be widespread and common in the region (DEEDI, 2007c).

Other introduced species that may occur at the EPC 1690 Study Area (based upon desktop assessments, and excluding livestock) include the house sparrow (*Passer domesticus*) and the feral goat (*Capra hircus*) (LP Act Class 2 Declared Animal).

2.4.3.6 Isaac Regional Council Draft Pest Management Plan Priority Species

The IRC Draft Pest Management Plan (IRC, 2011) identifies the following vertebrate animals as priority species (for management):

- ▶ Dingo/dog
- ▶ Cat



- ▶ Pig
- ▶ Canefield rat (*Rattus sordidus*) – a native species that can occur at high densities
- ▶ European rabbit
- ▶ Deer - Chital (*Axis axis*) (LP Act Class 2 Declared Animal); fallow deer (*Dama dama*) (LP Act Class 3 Declared Animal); red deer (*Cervus elaphus*) (LP Act Class 3 Declared Animal); rusa (*Cervus timoriensis*) (LP Act Class 2 Declared Animal)

The dingo, cat, pig and European rabbit were confirmed present during field studies. While considered a 'pest' species requiring management, the canefield rat is not an introduced species. It was not recorded during field studies, nor was it revealed as occurring/potentially occurring in the region surrounding the EPC 1690 Study Area through desktop assessments. Based on current known distribution, none of the four deer species listed as priority species for management are considered likely to occur at the EPC 1690 Study Area.

2.5 Threatening Processes

The landscape in which the EPC 1690 Study Area occurs has been historically, and continues to be exposed to a diverse array of threatening processes. Sattler and Williams (1999) identified the biggest threats to biodiversity in the Desert Uplands bioregion as unsustainable total grazing pressure and increasing tree clearing/pasture development. Tree clearing, high total grazing pressure and exotic species are identified as major threats to biodiversity in the Brigalow Belt bioregion (Sattler and Williams, 1999). Other threatening processes occurring in both bioregions include:

- ▶ Habitat fragmentation
- ▶ Changed fire regimes
- ▶ Changed hydrology (of waterways)
- ▶ Salinity
- ▶ Pathogens
- ▶ Firewood collection (SEWPAC, 2009a; SEWPAC, 2009b)

The Burdekin NRM 'Back on Track Actions for Biodiversity' (DERM, 2010a) report details a variety of threatening processes impacting upon priority taxa in the region. These are largely analogous to those mentioned above, and include:

- ▶ Feral animals
- ▶ Inappropriate grazing regimes
- ▶ Drainage of habitat
- ▶ Ground water extraction
- ▶ Weeds
- ▶ Altered flow regimes
- ▶ Vegetation clearing
- ▶ Site/road maintenance
- ▶ Mining



- ▶ Urban development
- ▶ Baiting
- ▶ Disease
- ▶ Road kill (DERM, 2010a)

Within the EPC 1690 Study Area, and indeed the wider landscape in which the Project Area occurs, historic and currently occurring threatening processes are largely linked to the sites' agricultural land use. Historic vegetation clearing has occurred in parts of the Project Area, likely resulting in direct mortality of flora and fauna, as well as habitat loss and habitat fragmentation. Habitat degradation associated with cattle was not prevalent at the EPC 1690 or EPC 1080 Study Areas, although riparian areas showed some limited, localised degradation (i.e. reduced vegetative cover, erosion and sedimentation). Feral animals and weeds were recorded, however high concentrations of these pests were not noted.

3. Conservation Significant Terrestrial Ecological Values

Note: The information presented from this section onwards relates to the **Project Area** (i.e. the EPC 1690 Study Area, the EPC 1080 Study Area (including the Mine offsite infrastructure)). The baseline terrestrial ecological values detailed in Section 2 (EPC 1690 Study Area) and Appendix B (EPC 1080 Study Area and the Mine offsite infrastructure) have been combined, to allow for a discussion of the conservation significant ecological values of the Project Area (Section 3 and Section 4), and an assessment of the potential impacts to these values resulting from the Project (Section 5 (Construction), Section 6 (Operation) and Section 7 (Decommissioning)).

3.1 Introduction

Conservation significant areas and species occurring within or of relevance to the Project Area include those classified as having Commonwealth, Queensland and/or regional biodiversity significance. The conservation significant terrestrial ecological values identified during desktop and field investigations of the Project Area are summarised in Table 3-1 and discussed in detail in this section.

Table 3-1 Summary of conservation significant terrestrial ecological values of Project Area

Commonwealth		
Commonwealth EPBC Act – matters of NES (controlling provisions based on referral of Project (2010/5736))		
World Heritage properties (section 12 & 15A)	No World Heritage properties within or of relevance to Project Area	Section 3.2.1
National Heritage places (section 15B & 15C)	No National Heritage places within or of relevance to Project Area	Section 3.2.2
Wetlands (Ramsar) (section 16 & 17B)	Coongie Lakes	Section 3.2.3
Listed threatened species and communities (sections 18 & 18a)	One EPBC Act listed threatened flora species recorded during field surveys in Project Area Three EPBC Act listed threatened fauna species recorded during field surveys in Project Area (a further two EPBC Act listed threatened fauna species considered likely to occur) One EPBC Act listed threatened ecological community (TEC) recorded during field surveys in Project Area	Section 3.2.4 (threatened flora) Section 3.2.5 (threatened fauna) Section 3.2.6 (TECs)
Listed migratory species (section 20 & 20A)	Three EPBC Act listed migratory species recorded during field surveys in Project Area (a further 11 EPBC Act listed migratory species considered likely to occur)	Section 3.2.7

Great Barrier Reef Marine Park (section 24B & 24C)	The Project Area is located over 300 km due west and approximately 320 km upstream of the Great Barrier Reef Marine Park. Significant overland barriers would inhibit any site attributes having an influence on the Marine Park and, as such, this is considered to be not applicable to Project Area.	Section 3.2.8
Other Commonwealth matters		
Listed marine Species	23 EPBC Act listed marine species recorded during field surveys in Project Area (15 EPBC Act listed marine species likely to occur)	Section 3.2.9
State		
Queensland VM Act		
Regional ecosystems	Approximately 28,752 ha of REs occur in Project Area (based on amended RE mapping), comprising: 267 ha of endangered REs 404 ha of concern REs 28,081 ha of least concern REs	Section 3.3.1
Regrowth vegetation	54 ha of mapped regrowth vegetation occurs in the Project Area	Section 3.3.3
Essential habitat	No mapped Essential Habitat occurs within the Project Area	Section 3.3.4
Queensland EP Act		
ESAs	No Category A ESAs are located within the Project Area. Approximately 1060 ha of Category B ESAs (endangered Biodiversity Status REs) are located within the Project Area (based on amended RE mapping). The Category C ESA of Bygana West Nature Refuge is located within the Project Area.	Section 3.3.2 Section 3.3.7
Queensland NC Act		
Threatened flora species	One NC Act-listed threatened flora species recorded during field surveys in Project Area	Section 3.3.5
Threatened fauna species	Five NC Act-listed threatened fauna species recorded during field surveys in Project Area (a further four NC Act listed threatened fauna species considered likely to occur) Five special least concern animals recorded during field surveys in Project Area (a further 11 NC Act listed special least concern species considered likely to occur)	Section 3.3.6
Protected areas	Six protected areas occur within 50 km of the Project Area: - Bygana West Nature Refuge – occurs within southern part of Project Area - Epping Forest National Park (Scientific) – approx. 45 km SE of centre of Project Area - Doongmabulla Mound Springs Nature Refuge – approx. 10 km W of Project Area	Section 3.3.7



- ▶ Bygana Nature Refuge – approx. 25 km SE of centre of Project Area
- ▶ East Top Nature Refuge – approx. 35 km SE of centre of Project Area
- ▶ Wilandspey Conservation Park – approx. 40 km NE of centre of Project Area

Regional

Burdekin Natural Resource Management (NRM) Region Back on Track Actions for Biodiversity report priority taxa

Report identifies priority vertebrate fauna taxa for the Burdekin NRM region, including:

Section 3.4.3

- ▶ 21 plants
- ▶ 8 terrestrial reptiles
- ▶ 13 terrestrial mammals
- ▶ 6 birds

3.2 Commonwealth Matters of National Environmental Significance

3.2.1 World Heritage Properties

World heritage properties are identified as a controlling provision for the Project under the EPBC Act. The Project Area is located over 300 km due west and approximately 320 km upstream of the Great Barrier Reef World Heritage Area. The Carmichael River that bisects the site flows east for approximately 20 km to its juncture with the Belyando River. From this point the Belyando River flows in a northerly direction for approximately 90 km where it joins the Suttor River. Beyond its juncture with the Belyando River, the Suttor River flows north (approximately 50 km) to the Burdekin Falls Dam (Lake Dalrymple). The Burdekin River downstream of Burdekin Falls Dam flows for approximately 160 km to its mouth at Upstart Bay near Ayr. These water courses flow through a modified landscape matrix dominated by cattle grazing, with other land uses including mining, urban and cropping. Downstream impacts to the Great Barrier Reef World Heritage Area resultant from activities at the Project Area are not expected.

The Project Area is located over 300 km south of the Wet Tropics World Heritage Area with no direct connection between the two.

3.2.2 National Heritage Places

National Heritage Places are identified as a controlling provision for the Project under the EPBC Act. In addition to the World Heritage Places, which are also listed as National Heritage Places, one other place of national heritage significance is identified.

The Tree of Knowledge and curtilage at Barcaldine is the closest National Heritage Place to the Project Area. It is located approximately 200 km south-west of the Project Area.

3.2.3 Ramsar Wetlands

The closest wetland of international importance (Ramsar Wetland) is the Shoalwater and Corio Bays Areas, approximately 380 km east of the Project Area. The SEWPAC Protected Matters Search Tool indicated that the Coongie Lakes Ramsar site in South Australia (located approximately 800 km



south-west of the Project Area) may relate to the Project as the Project Area occurs near the extreme north-east of the Cooper Creek Catchment, which drains in a south-westerly direction towards north-east South Australia (Coongie Lakes and Lake Eyre).

The hydrology assessment indicates that the Project is not within the Cooper Creek catchment. As such, the Project (Mine) will have no impact on this wetland.

3.2.4 Listed Threatened Flora

Overview

The desktop assessment indicated that four EPBC Act listed threatened flora species have been previously recorded or are predicted to occur within the desktop search extent encompassing the Project Area (as defined in Table 1-2). Of these, none were confirmed present during field surveys in the Project Area. A further seven EPBC Act listed threatened flora species were identified in the Project terms of reference for consideration in this assessment. None of these species were identified through the desktop assessment (i.e. predicted to occur or previously recorded in desktop search extent), nor were any confirmed present during field investigations.

A likelihood of occurrence assessment for EPBC Act listed threatened flora species was undertaken in accordance with the definitions outlined in Section 1.5.7. The outcomes of this assessment are presented in Table 3-2 and discussed further below.

In addition, one threatened flora species not indicated by the desktop survey or the terms of reference for the Project was located – waxy cabbage palm (*Livistona lanuginosa*), listed as vulnerable under the NC Act and the EPBC Act.

Table 3-2 Commonwealth listed threatened flora species – likelihood of occurrence

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
<i>Acacia deuteroneura</i> [^]	vulnerable	x	x	x	This taxon is only known from two locations: one 64 km north-north-east of Tambo in central-western Queensland, growing on a knoll of weathered sandstone with <i>Eucalyptus bakeri</i> (Maslin, 2001) and the other 10 km east of Malta Station on Savaltor Rosa – Tambo Road. Both locations are mapped as RE 11.10.9 which does not occur in the Project Area. Closest known location is >230 km south of the Project Area (HERBRECS, 2011).	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur
<i>Acacia ramiflora</i>	vulnerable	✓	x	x	A shrub known from the Mitchell, South and North Kennedy districts. Grows in woodland on sandstone hills (Pedley, 1978, 1987). A collection from Hughenden is from pebbly red earth in low open woodland of <i>Eucalyptus whitei</i> and <i>Triodia</i> sp. (SEWPAC, 2011c). Closest known location is 43 km to the north-east of the Project Area. Suitable habitat is present within the Project Area (in particular, REs 10.5.1, 10.5.8, 10.5.11).	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area May occur
Marlborough blue cycad [^] <i>Cycas ophiolitica</i>	endangered	x	x	x	<i>Cycas ophiolitica</i> inhabits eucalypt open forest and woodland communities with a grassy understorey. They occur on hill tops or steep slopes, at altitudes of 80-620 m above sea level. It grows on shallow, stony, red clay loams or sandy soils. (Halford, 1995a). Closest known location is over 350 km to the east-south-east of the Project Area.	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur
king blue-grass [^] <i>Dichanthium queenslandicum</i>	vulnerable	x	x	x	This taxon is typically confined to natural grasslands on the heavy black clay soils of the Central Highlands (Fletcher, 2001). Closest known population is >130 km south-east of the Project Area.	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
finger panic grass[^] <i>Digitaria porrecta</i>	endangered	x	x	x	This taxon usually occurs in natural grasslands on extensive basaltic plains, and in undulating woodlands and open forests with an underlying basaltic geology. It usually occurs on dark and fine textured soils with some degree of seasonal cracking (Leigh <i>et al</i>, 1984; Fletcher 2001; Halford, 1995b). It also persists in disturbed habitats, such as fallow paddocks, but its capability to maintain a viable population in these situations is unknown (Halford, 1995b). It commonly occurs in communities dominated by <i>Eucalyptus orgadophila</i> on hills and slopes and <i>E. tereticornis</i> and <i>E. populnea</i> in drainage lines. Closest known location is >230 km to the east and south-east of the Project Area.	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur
<i>Eriocaulon carsonii</i>	endangered	✓	WO HERBRECS	x	This species is restricted to permanent wetlands fed by natural springs in the Great Artesian Basin (Fatchen, 2000; Fensham <i>et al</i>, 2004). It has been recorded 10 km south-west of the Project Area in Doongmabulla Mound Springs Nature Refuge (HERBRECS). No mound springs are found within the Project Area.	Previously recorded in region (i.e. desktop search extent) Required habitat (artesian springs) not present in Project Area Unlikely to occur
blue devil <i>Eryngium fontanum</i>	endangered	✓	WO HERBRECS	x	A low herb only associated with mounds springs fed by the Great Artesian Basin (HERBRECS). Essential habitat for this species occurs approximately 10 km south-west of the Project Area in Doongmabulla Mound Springs Nature Refuge. However it is only known from two locations in the Barcaldine spring super-group. This system has been extensively surveyed (Fensham and Fairfax, 2003) and there is a high level of certainty that no further populations of <i>E. fontanum</i> await discovery (Fensham <i>et al</i>, 2010). No mound springs are found within the Project Area.	Previously recorded in region (i.e. desktop search extent) Required habitat (artesian springs) not present in Project Area Unlikely to occur

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
black ironbox[^] <i>Eucalyptus raveretiana</i>	vulnerable	x	x	x	Occurs in riparian woodlands on alluvial flats along creek and river banks on sandy or alluvial soils (Calvert <i>et al</i> , 2005). Closest known location is approximately 200 km to the north of the Project Area (HERBRECS, 2011).	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur
<i>Lawrenzia buchananensis</i>	vulnerable	x	WO HERBRECS	x	This species occurs in saline muds and sand dunes associated with Lake Buchanan. It is known only from a single population in a highly specific habitat at Lake Buchanan in north-central Queensland, about 170 km south-south-west of Charters Towers (DEWHA, 2008) The Project Area is geographically removed from Lake Buchanan as the lake is approximately 30 km NW of the centre of the Project Area.	Previously recorded in region Required habitat not present in Project Area Unlikely to occur
waxy cabbage palm <i>Livistona lanuginosa</i>	vulnerable	x	x	✓	This palm is endemic to the Burdekin River catchment, where it is restricted to ephemeral, sandy watercourse beds and banks (and the outskirts of the Moses spring group) (Threatened Species Scientific Committee (TSSC), 2008). It has been recorded in seven populations, with a total population extent estimated at 1, 000 mature individuals (Pettit and Dowe, 2003).	Present as isolated individuals in the Carmichael River bed. Confirmed present
northern beard heath[^] <i>Leucopogon cuspidatus</i>	vulnerable	x	x	x	Usually occurs on mountain tops on poor skeletal soils, amongst granite or serpentinite outcrops in stunted open woodlands or shrublands (Calvert <i>et al</i> , 2005). Closest known population is >190 km north-west and east of the Project Area (HERBRECS, 2011).	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
<i>Ozothamnus eriocephalus</i> [^]	vulnerable	x	x	x	This species typically grows on rocky escarpments, slopes and creek gullies in closed rainforest margins and open eucalypt forest (HERBRECS, 2011) Closest known population is >200 km north-east of the Project Area (HERBRECS, 2011).	Not previously recorded in region (i.e. desktop search extent) and required habitat not present in Project Area Unlikely to occur

Predicted to occur within approximately 50 km of Project Area: SEWPAC Protected Matters Search Tool

* Previously recorded within approximately 50 km of Project Area: desktop sources including Wildlife Online (WO) / HERBRECS

[^] Included as this species was specifically mentioned in the Project terms of reference



3.2.4.1 Listed Threatened Flora – Confirmed Present

One flora species listed as threatened under the EPBC Act was confirmed present within the Project Area – waxy cabbage palm.

Waxy cabbage palm

Waxy cabbage palm (Plate 3–1) is listed as vulnerable under the EPBC Act and NC Act. This species is restricted to ephemeral watercourses and (less often) associated flood plains of tributaries of the Burdekin River (TSSC, 2008). Waxy cabbage palm grows to 20 m tall, and is usually found in the bed and banks of watercourses, or in the vicinity of more permanent pools (SEWPAC, 2012a). The entire species is believed to be represented by only seven discrete populations, with the Carmichael River population located at the most southern extent of the species' distribution (SEWPAC, 2012a).

Habitat for this species is restricted to sandy watercourses and adjacent floodplains, with small groups often clustered around the more permanent pools (SEWPAC, 2012a). It is unclear to what extent this species is dependent on access to groundwater – there is evidence that waxy cabbage palm survives best when it is located where seasonal floods recharge soilwater (that is, within the channel itself growing in protected areas within lenses of soil with a higher soilwater storage capacity) (SEWPAC, 2012a). The species is certainly capable of benefiting from access to permanent groundwater – the nearby Moses spring group (part of the Doongmabulla Nature Refuge) has a population of approximately 25 waxy cabbage palms (of which half are mature trees) growing in Quaternary alluvium on the outskirts of a large group of mound springs. Therefore, it is likely that it is dependent on soil water being recharged by annual flood events, or through groundwater base flow.

Within the Project Area, waxy cabbage palm was restricted to the channel of the Carmichael River; where two mature individuals were observed in the fringing open forest/woodland BVC, in RE 11.3.25. Based on observations of this species abundance in the Project Area and within adjacent sections of the Carmichael River, it is estimated that the total population within the bounds of the Project Area may be up to 10 individuals.

Threatening processes listed for waxy cabbage palm (TSSC, 2008) are:

- ▶ Inappropriate fire regimes
- ▶ Trampling and grazing by stock
- ▶ Clearing for agricultural development
- ▶ Dams that affect water level and flow in the area of occurrence (listed as a potential threatening process)
- ▶ Invasive weeds (listed as a potential threatening process)

Plate 3-1 Waxy Cabbage Palm, taken at Moses Spring to the west of the Project Area



3.2.4.2 Listed Threatened Flora – May Occur

The likelihood of occurrence assessment indicated that the following EPBC Act listed threatened flora species may occur at the Project Area, based on distribution and/or presence of potentially suitable habitat:

- ▀ *Acacia ramiflora* – vulnerable EPBC Act

This species was not recorded during field surveys undertaken in the Project Area. It may occur based on its known geographic distribution and the presence of suitable habitat, namely:

- ▀ Yellow jacket and rough-leaved bloodwood shrubby low open woodland on red sand plains including areas of RE 10.5.1, 10.5.8, and/or RE 10.5.11

Refer to Table 2-3 (Table 2-3 in Appendix B) for attributes of the 'yellow jacket' vegetation community.

3.2.4.3 Listed Threatened Flora – Unlikely to Occur

The following EPBC Act listed threatened flora species were predicted to occur in the Project Area by the Protected Matters Search Tool or were identified in the Project terms of reference for consideration in this assessment. However, it is considered these species are unlikely to occur in the Project Area (as detailed in Table 3-2) based on their current known distribution and/or the lack of suitable habitat at the Project Area:

- ▀ *Acacia deuteroneura* – vulnerable EPBC Act
- ▀ *Cycas ophiolitica* – endangered EPBC Act
- ▀ *Dichanthium queenslandicum* – vulnerable EPBC Act
- ▀ *Digitaria porrecta* – endangered EPBC Act
- ▀ *Eriocaulon carsonii* – endangered EPBC Act
- ▀ *Eryngium fontanum* – endangered EPBC Act
- ▀ *Eucalyptus raveretiana* – vulnerable EPBC Act
- ▀ *Lawrencia buechananensis* – vulnerable EPBC Act
- ▀ *Leucopogon cuspidatus* – vulnerable EPBC Act
- ▀ *Ozothamnus eriocephalus* – vulnerable EPBC Act



3.2.5 Listed Threatened Fauna

Overview

The desktop assessment indicated that 14 EPBC Act listed threatened fauna species have been previously recorded or are predicted to occur within the desktop search extent encompassing the Project Area (as defined in Table 1-2). Of these, three were confirmed present during field surveys at the Project Area:

- ▶ Black-throated finch (southern) (*Poephila cincta cincta*)
- ▶ Squatter pigeon (southern) (*Geophaps scripta scripta*)
- ▶ Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory)

One additional EPBC Act listed threatened fauna species (greater long-eared bat (*Nyctophilus timoriensis*)) was identified in the Project terms of reference for consideration in this assessment. This species was not identified through the desktop assessment (i.e. predicted to occur or previously recorded in desktop search extent), nor was it confirmed present during field investigations via Anabat detection.

A likelihood of occurrence assessment for EPBC Act listed threatened fauna species was undertaken in accordance with the definitions outlined in Section 1.5.7. The outcomes of this assessment are presented in Table 3-3 and discussed further below.

Table 3-3 Commonwealth listed threatened fauna species – likelihood of occurrence

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
Reptiles						
ornamental snake <i>Denisonia maculata</i>	vulnerable	✓	WO	x	The ornamental snake's distribution is confined to the northern brigalow belt bioregion. Modelled distribution mapping for the species prepared by the Commonwealth Government indicates that the ornamental snake is known to occur or likely to occur in the landscape incorporating the Project Area (SEWPAC, 2011b). This species is typically found in areas of brigalow, riverside woodland and open forest on natural levees (SEWPAC, 2011d). Habitats featuring cracking clay and sandy substrates are known to be utilised by the species, with gilgai habitat especially favoured.	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area in acacia woodlands and riparian areas Likely to occur
yakka skink <i>Egernia rugosa</i>	vulnerable	x	WO	x	The yakka skink is endemic to dry open forests, woodlands and rocky areas of central and eastern Queensland. Modelled distribution mapping for the species prepared by the Commonwealth Government indicates that the yakka skink is known to occur or likely to occur in the landscape at and near the southern part of the Project Area (SEWPAC, 2011b). Yakka skinks live in communal burrow complexes, and often take refuge among low vegetation or under heaped dead timber, logs, and rocks and in deep rock crevices (Wilson 2005; SEWPAC, 2011e). The species occurs in a wide variety of vegetation types including poplar box (<i>Eucalyptus populnea</i>), ironbark (<i>Eucalyptus</i> spp.), brigalow (<i>Acacia harpophylla</i>), white cypress pine (<i>Callitris</i> spp.), mulga (<i>Acacia aneura</i>), bendee (<i>Acacia catenulata</i>) and lancewood (<i>Acacia</i> spp.) woodland and open forest (SEWPAC, 2011e).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project area in woodland habitats featuring ground level microhabitats Likely to occur

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
Dunmall's snake <i>Furina dunmalli</i>	vulnerable	✓	Not previously recorded	x	Dunmall's snake occurs in central and south-east Queensland – the northern limit of its known range extends between Yeppoon and the Expedition Range (DERM, 2011c). It inhabits open forest and woodland habitats. Brigalow (<i>Acacia harpophylla</i>) growing on cracking clay and loam soils on floodplains is a known habitat for the species (DERM, 2011c).	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur
brigalow scaly-foot <i>Paradelma orientalis</i>	vulnerable	x	WO QM	x	The brigalow scaly-foot inhabits a variety of open forest habitats in central and south-east Queensland. Acacia and eucalypt woodlands are known to be utilised by this species. The species has been recorded from habitats featuring substrates including cracking clays and sandy alluvium (SEWPAC, 2011f).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Current distribution mapping for species does not incorporate Project Area (SEWPAC, 2011b) Unlikely to occur
Mammals						
northern quoll <i>Dasyurus hallucatus</i>	endangered	x	QM	x	While the distribution of the northern quoll covers much of north-eastern Australia, the current range of the species has contracted considerably such that it is now thought to be restricted to six discrete areas across northern Australia (Strahan, 1995). While the species does not have highly specific habitat requirements, rocky areas associated with open woodland and open forest are considered optimal habitat for the northern quoll (Hill and Ward, 2010). The preference for rocky habitat may be related to reduced exposure to threatening processes (i.e. vegetation clearing, fire, cane toads, reduced competition with cats) and the diversity of micro-habitats available (Hill and Ward, 2010).	Previously recorded in region (i.e. desktop search extent) Preferred (rocky) habitat generally lacking at Project Area, however species also known from open woodland habitats Current distribution mapping for species does not incorporate Project Area (SEWPAC, 2011n) Unlikely to occur

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
northern hairy-nosed wombat <i>Lasiorhinus krefftii</i>	endangered	✓	WO QM	x	The northern hairy-nosed wombat is currently only known from a 300 ha area of the 3160 ha Epping Forest National Park (scientific) (located approximately 25 km south-east of the south-eastern most part of the Project Area. (SEWPAC, 2011g). The current population within the park is estimated at 138 (DERM, 2011d). Beyond the population occurring at Epping Forest National Park (scientific) (of which a small number have been translocated to a recently established nature refuge near St George), no known/confirmed populations of this species exist. No evidence of this species (i.e. burrows, scats, sightings) was found during field surveys at the Project Area. At Epping Forest National Park (scientific), habitats used by the species are characterised by brigalow (<i>Acacia harpophylla</i>) and gidgee (<i>Acacia cambagei</i>) scrub intersected by a gully supporting eucalypt woodland on a sandy substrate (SEWPAC, 2011g). The ground layer comprises a mix of native and introduced grasses (SEWPAC, 2011g). Deep sandy soils are critical for this species for burrow construction – much of Epping Forest National Park (scientific) features heavy clay soils, which preclude habitat utilisation (SEWPAC, 2011g). The northern hairy-nosed wombat grazes exclusively on perennial grasses and sedges (Strahan, 1995).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs, however Project Area is not within current known distribution of this species (i.e. Epping Forest National Park (scientific)) Unlikely to occur

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
greater bilby <i>Macrotis lagotis</i>	vulnerable	x	WO	x	The bilby was historically recorded through much of arid and semi-arid Australia however it is now restricted to desert areas of central Australia (Strahan, 1995). In Queensland the species is known from a small area between Birdsville and Boulia in the south-west of the state (Strahan, 1995). The Project Area and surrounding landscape is not within the current known distribution of the species.	Previously recorded in region (i.e. desktop search extent) Suitable habitat generally lacking, and Project Area is not within current known distribution of this species Unlikely to occur
greater long-eared bat[^] <i>Nyctophilus timoriensis</i>	vulnerable	x	x	x	The greater long-eared bat generally inhabits woodland vegetation in arid and semi-arid inland areas (Strahan, 1995). It is more typically known from south-east Australia (especially the Murray-Darling Basin), and is not known north of the Tropic of Capricorn (Strahan, 1995).	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur
koala <i>(Phascolarctos cinereus)</i>	Vulnerable (Combined populations of Qld, NSW and ACT)	x	WO	✓	In Queensland, the species contains scattered populations throughout moist forests along the coastline, subhumid woodlands in central and southern regions and within Eucalypt woodlands along watercourses within semi-arid areas further west (Melzer <i>et al</i> , 2000). The greatest density of koalas occur through central and eastern areas including the Brigalow Belt, Mitchell Grass Downs, Mulga lands and the Desert Uplands (Patterson 1996).	Previously recorded in region (i.e. desktop search extent) Suitable habitat occurs across much of the Project Area, where remnant vegetation (eucalypt woodland) persists Confirmed present – a single koala was observed in open woodland habitat in the south of the Project Area during the Spring 2011 survey

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
Birds						
red goshawk <i>Erythroriorchis radiatus</i>	vulnerable	✓	Not previously recorded	x	The red goshawk is an uncommon bird species of eastern and northern Australia. It prefers landscapes containing a mosaic of habitats including coastal and sub-coastal tall open forest, woodland and rainforest edges (Marchant and Higgins, 1993). Forests of intermediate density are particularly favoured, as are ecotones between variably dense habitats (i.e. ecotone between rainforest and sclerophyll forest) (SEWPAC, 2011h). Large bird populations (the primary prey of this species) are also an important determinant of red goshawk habitat utilisation (SEWPAC, 2011h). It generally avoids open habitats, and is only rarely encountered over agricultural land (Marchant and Higgins, 1993). Nesting occurs in tall trees within one km of permanent water, generally in open, biologically-rich forest or woodland (Marchant and Higgins, 1993). The species occurs at low densities.	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area May occur
squatter pigeon (southern) <i>Geophaps scripta scripta</i>	vulnerable	✓	WO BA	✓	The squatter pigeon is locally abundant within the northern part of its range (i.e. Brigalow Belt (North) and Desert Uplands Bioregions) (SEWPAC, 2011i). It is considered to be common in grazing country north of the Tropic of Capricorn (SEWPAC, 2011i). The species occurs in a wide range of habitats wherever there is a grassy understorey. It is often found within close proximity of water bodies (SEWPAC, 2011i).	Previously recorded in region (i.e. desktop search extent) Suitable habitat occurs across much of the Project Area, where remnant vegetation persists Confirmed present – squatter pigeons (southern) were observed on numerous occasions in open woodland habitat across the Project Area during the Spring 2010, Autumn 2011 and Spring 2011 surveys

Species	EPBC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
star finch (eastern, southern) <i>Neochmia ruficauda ruficauda</i>	endangered	✓	Not previously recorded	x	The distribution of the eastern subspecies of the star finch is poorly known, however it is restricted to eastern Queensland (and is likely to be severely fragmented (SEWPAC, 2011j). Areas of permanently occupied habitat or permanent populations have not been identified (SEWPAC, 2011j). An estimate (considered to be of low reliability) puts the extant wild population of the subspecies at 50 birds (SEWPAC, 2011j). The subspecies has disappeared from much of its former eastern and central Queensland range, with scattered records from the 1990s considered likely to be aviary escapes (Higgins <i>et al</i>, 2006). Habitat preferences include grasslands and grassy woodlands near water, sedgelands, swamps and wetlands (Higgins <i>et al</i>, 2006; SEWPAC, 2011j). The subspecies is also known from disturbed habitats including farmland (Higgins <i>et al</i>, 2006; SEWPAC, 2011j).	Not previously recorded in region (i.e. desktop search extent) Uncertainty as to whether subspecies persists in central and eastern Queensland, with lack of recent records and observed disappearance from much of former range Potentially suitable habitat occurs at Project Area Unlikely to occur
black-throated finch (southern) <i>Poephila cincta cincta</i>	endangered	✓	WO BA	✓	This sub-species has experienced a large reduction in range and population size in recent decades (SEWPAC, 2011k). It is now known from three general I areas – Townsville, Ingham and scattered sites in central Queensland. The black-throated finch typically occurs in native grasslands and woodlands along creeks and riverbanks. A mosaic of habitat types that provide sufficient foraging resources (i.e. seed) through the wet season are thought to be required by this species (SEWPAC, 2011k).	Previously recorded in region (i.e. desktop search extent) Suitable habitat occurs in open woodland habitat featuring and understorey of native grasses, where water is locally available Confirmed present – black-throated finches (southern) were observed in the southern and northern parts of the Project Area during the Autumn 2011 survey, opportunistically during site work in August/September 2011, and during the Spring 2011 survey

Species	EPBC Act status	Predicted to occur [#]	Previously recorded [*]	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
paradise parrot <i>Psephotus pulcherrimus</i>	extinct	x	WO	x	The paradise parrot has not been seen in the wild for at least 90 years (SEWPAC, 2011). It is considered to be extinct.	This species is considered to be extinct
Australian painted snipe <i>Rostratula australis</i>	vulnerable; migratory; marine	✓	Not previously recorded	x	The Australian painted snipe has a scattered distribution across eastern and northern Australia (SEWPAC, 2011m). Shallow freshwater wetlands are the main habitat for the Australian painted snipe (Marchant and Higgins, 1993). Such wetlands may include lakes, swamps, claypans, inundated / waterlogged grassland, dams, irrigated crop land and sewage ponds (Marchant and Higgins, 1993). Preferred wetland habitats boast emergent vegetation (including tussocks, grasses, sedges, rushes, reeds, cane grass and/or Melaleuca) (Marchant and Higgins, 1993). Nesting occurs amongst vegetation in or adjacent to wetlands, predominantly in south-east Australia (i.e. Murray-Darling Basin) (SEWPAC, 2011m).	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area, namely associated with large farm dams featuring emergent and bankside vegetation May occur

Predicted to occur within approximately 50 km of Project Area: SEWPAC Protected Matters Search Tool

* Previously recorded within approximately 50 km of Project Area: desktop sources including Wildlife Online (WO) / Birds Australia (BA) / Queensland Museum (QM)

^ Included as this species was specifically mentioned in the Project terms of reference



3.2.5.1 Listed Threatened Fauna – Confirmed Present

Black-throated finch (southern)

The black-throated finch (southern) is listed as endangered under the EPBC Act (and endangered under the NC Act). This small grass-finch has experienced a large decline in range in recent decades (SEWPAC, 2011k). Where it was once previously found throughout eastern and central Queensland north of the New South Wales border, it is now only known from the Townsville region and scattered sites in central Queensland (SEWPAC, 2011k). The extent of occurrence of the species (i.e. *Poephila cincta*) has declined by approximately 80 per cent since the 1980s, with the majority of this decline in the range of the endangered southern subspecies (SEWPAC, 2011k).

The black-throated finch (southern) is a predominantly sedentary (Black-throated Finch Recovery Team, 2007; DEWHA, 2009a), gregarious bird that typically forages in groups of up to 30 individuals (DEWHA, 2009a). During the breeding season (in the Townsville region breeding coincides with wet season (February to May)), only small daily movements between forage sites are made (DEWHA, 2009a). Movements of up to 3 km a day may occur during periods where forage resources are scarce (DEWHA, 2009a). Larger movements are thought to be related to periods of drought and/or when water availability is reduced (DEWHA, 2009a). It often forms loose breeding colonies, where a number of nests are made in a single tree, or in neighbouring trees (DEWHA, 2009a). The average clutch size is five, with chicks reaching sexual maturity at six months (DEWHA, 2009a).

The subspecies inhabits grassy open woodland and open forest habitats characterised by trees belonging to the genera *Eucalyptus*, *Corymbia*, *Acacia* and *Melaleuca* (SEWPAC, 2011k). Generally it occurs in habitats near watercourses or water bodies - almost all recent records of the subspecies south of the tropics have been in riparian areas (SEWPAC, 2011k). Three critical habitat resources are required to support the subspecies:

- ▶ Water sources (both natural and artificial)
- ▶ Grass seeds (a mosaic of species that provide forage throughout the year (particularly during the wet season))
- ▶ Trees that provide suitable nesting habitat (DEWHA, 2009a; SEWPAC, 2011k)

Grass species that are considered to be important forage species for the black-throated finch (southern) include *Urochloa mosambicensis*, *Enteropogon acicularis*, *Panicum decompositum*, *Panicum effusum*, *Dichanthium sericeum*, *Alloteropsis semialata*, *Eragrostis sororia* and *Themeda triandra* (DEWHA, 2009a). REs from which the subspecies has been recorded in north Queensland since 1994 (as presented in the National Recovery Plan for the Black-throated Finch Southern Subspecies (Black-throated Finch Recovery Team, 2007)) that are present at the Project Area include:

- ▶ RE 10.3.6 *Eucalyptus brownii* open woodland on alluvial plains
- ▶ RE 10.3.13 *Melaleuca fluviatilis* and/or *Eucalyptus camaldulensis* woodland along watercourses
- ▶ RE 10.3.28 *Eucalyptus melanophloia* or *E. crebra* open woodland on sandy alluvial fans
- ▶ RE 10.5.1 *Eucalyptus similis* and/or *Corymbia brachycarpa* and/or *Corymbia setosa* low open woodland to open woodland on sand plains
- ▶ RE 10.5.5 *Eucalyptus melanophloia* open woodland on sand plains

- ▶ RE 11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines
- ▶ RE 11.3.27 Freshwater wetlands

Black-throated finch (southern) at the Project Area

- ▶ No black-throated finches (southern) were detected during the Spring 2010 survey
- ▶ Black-throated finches (southern) were recorded on 27 separate occasions during the Autumn 2011 survey (some sightings may have been of the same individual or group of individuals on different days)
- ▶ Black-throated finches (southern) were recorded on three separate occasions in August and September 2011 (by an ecologist accompanying a soil assessment team at the Project Area)
- ▶ Black-throated finches (southern) were recorded on four separate occasions at and near the Project Area during the Spring 2011 survey
- ▶ Black-throated finches (southern) were recorded on nine separate occasions at and near the Project Area during a targeted black-throated finch survey carried out in May 2012 (refer to Volume 4 Appendix N3 Black-throated Finch Report for details of this survey including results and recommendations)

Black-throated finches (southern) observed at the Project Area are shown in Plate 3-2 – Plate 3-3.

Plate 3-2 Black-throated Finches (southern) observed at stock troughs near southern boundary of Bygana West Nature Refuge (April 2011)



Plate 3-3 Black-throated finches (southern) drinking at farm dam at north of Project Area (May 2011) and observed at northwest of Project Area (May 2011)



Figure 3-1 displays the locations of black-throated finch (southern) sightings from the Project Area. Habitat at these locations was typically characterised by open eucalypt (ironbark and/or box) woodland with a native grass understorey and locally available surface water, although several sightings of finches drinking from farm dams surrounded by non-remnant vegetation were made during the Spring 2011 survey. Examples of locations from which sightings at the Project Area were made are presented in Plate 3-4 – Plate 3-7.

Records obtained from the Project Area are towards the south-western extent of the subspecies' current known (i.e. post-1998) distribution.

Plate 3-4 Water sources at southern part of Project Area from which black-throated finches (southern) were observed drinking (April 2011)



Plate 3-5 Open eucalypt woodland with native grass understorey at southern part of Project Area (April 2011)

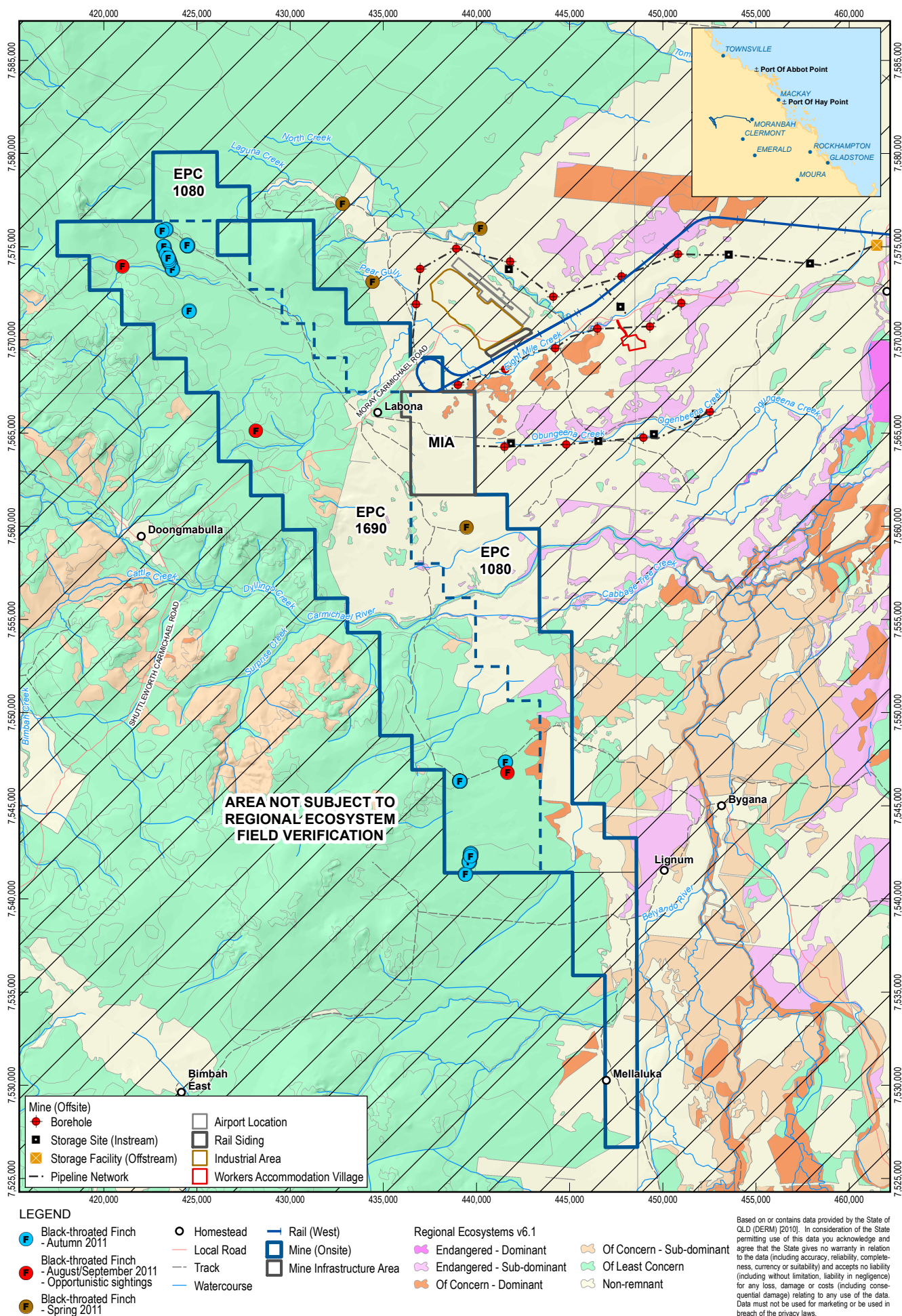


Plate 3-6 Open eucalypt woodland with native grass understorey at northern part of Project Area (May 2011)



Plate 3-7 Farm dam at northern part of Project Area (May 2011)







Full details of black-throated finch (southern) sightings are presented in Appendix H. Records from the May 2012 targeted survey are described in Volume 4 Appendix N3 Black-throated Finch Report.. In summary,

- ▶ Group size ranged from a single bird to approximately 40 birds
- ▶ Sightings were made between (approximately) 8:30 am and 6:30 pm
- ▶ Finches were typically observed drinking at dams/stock troughs, or flushed from tracks by slow moving vehicles whilst foraging on the ground
- ▶ Weather conditions when sightings were made were typically fine, warm and clear
- ▶ Black-throated finches (southern) were occasionally observed in the presence of other finch species – namely double-barred finch (*Taeniopygia bichenovii*) and plum-headed finch (*Neochmia modesta*)

Figure 3-2 provides an indication of habitat that may be utilised by the subspecies at the Project Area. Those REs from which the subspecies has been recorded in north Queensland (i.e. Brigalow Belt North and Desert Uplands) since 1994 (as presented in the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007), and that may represent potentially suitable habitat for the subspecies at the Project Area, were mapped (using the field verified RE mapping – mixed polygons containing a suitable RE were included in the mapping). The limiting factor to utilisation of this potentially suitable habitat is likely to be availability of water. Where water is present (i.e. farm dams, stock troughs, natural water bodies (i.e. gilgais, Carmichael River)) it is considered likely that the black-throated finch (southern) will be present.

Approximately 26,050 ha of remnant vegetation at the Project Area may represent potentially suitable habitat for the black-throated finch (southern).

No evidence of breeding was detected at the Project Area. However, in consideration of the largely sedentary nature of the subspecies, and the availability of suitable habitat resources, it is considered likely that the black-throated finch (southern) is breeding at the Project Area.

Those REs from which the subspecies has been recorded in north Queensland (i.e. Brigalow Belt North and Desert Uplands) since 1994 (as presented in the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007)) that may represent potentially suitable habitat for the subspecies *beyond* the Project Area, were mapped (using DNRM certified REs – mixed polygons containing suitable REs were included in the mapping) – see Figure 3-3. This map indicates that much of the remnant vegetation to the north, west and south of the Project Area may provide potentially suitable habitat for the black-throated finch (southern), based on the certified RE mapping. Little potentially suitable habitat occurs to the east of the Project Area.

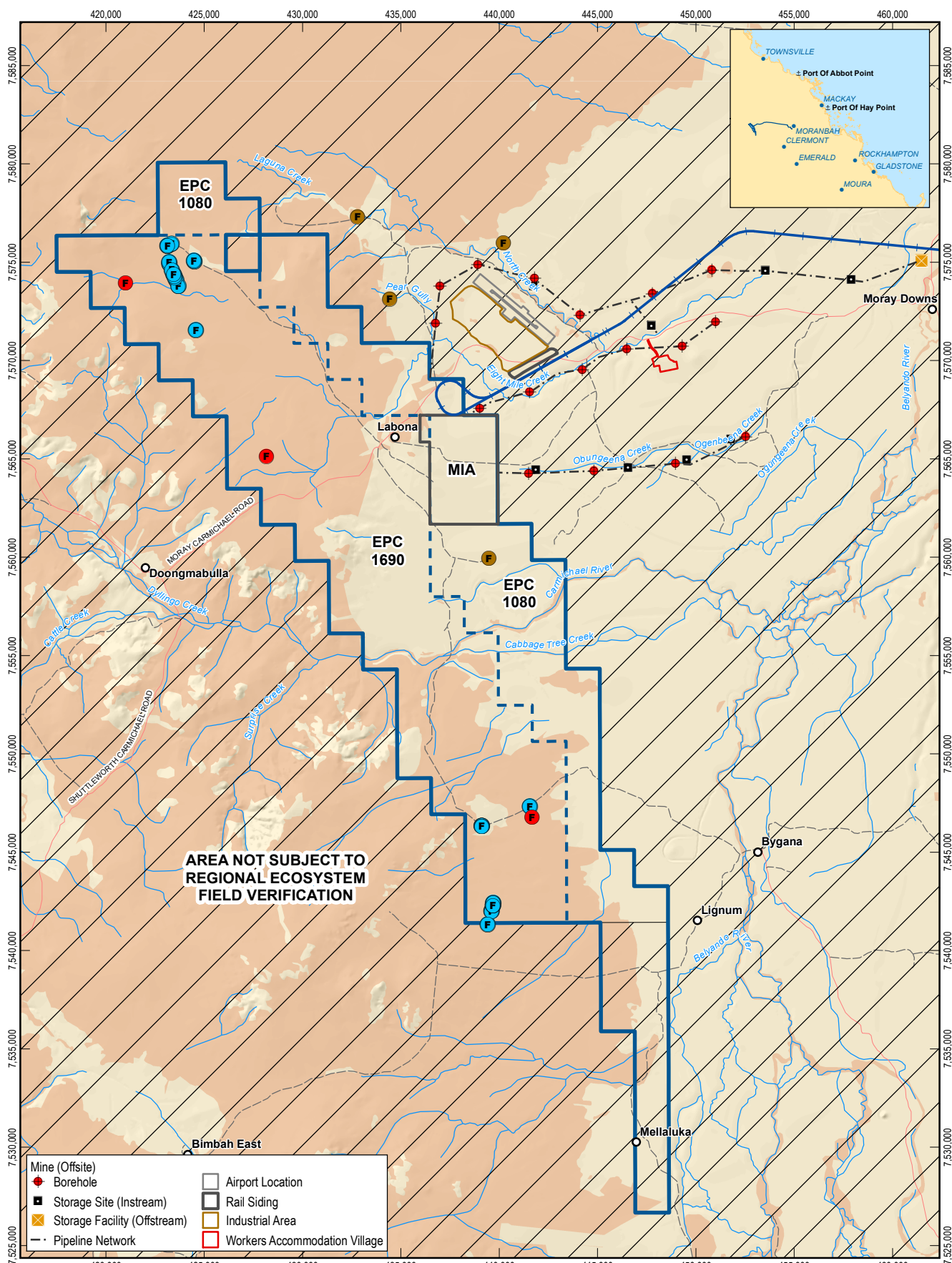
Habitat utilisation beyond the Project Area will be largely based upon the degree of connectivity/fragmentation of potential habitat patches, and the presence of the three critical habitat resources required by the subspecies (mosaic of native grasses, nesting trees and access to water). The subspecies has been recorded (post-1998) by the Black-throated Finch Recovery Team within approximately 10-20 km of the Project Area (at Doongmabulla Station) (SEWPAC, 2011k). These records, in combination with unpublished data relating to recent (2012) field assessments by Birdlife Australia in the Galilee Basin, indicate that the subspecies occurs in the wider landscape beyond the Project Area, where suitable habitat is present (discussed further in Volume 4 Appendix N3 Black-throated Finch Report). It is likely that populations in this landscape fluctuate in response to local



climatic conditions, with a 'boom-bust' cycle of rapid population increases and declines linked to seasonal rainfall (and the influence this has on the subspecies' key food source, seeding grasses).

Field surveys for the mine component of the Galilee Coal (Northern Export Facility) Project EIS, located approximately 100 km south of the Project Area, did not return any black-throated finch (southern) records (Waratah Coal Pty Ltd, 2011). However, a putative record of the subspecies from Bimblebox Nature Refuge, within the Galilee Coal (Northern Export Facility) Project (mine) study area, is described in the EIS for that project (Waratah Coal Pty Ltd, 2011). Although the record has not been confirmed in writing by Birds Australia, SEWPAC indicated to the proponent of that project that it has a high degree of confidence in the validity of the record (Waratah Coal Pty Ltd, 2011). The subspecies was not recorded during field surveys for the rail component of the Galilee Coal (Northern Export Facility) Project.

The subspecies was not detected during surveys of the proposed mine site and rail alignment for the Alpha Coal Project (Hancock Prospecting Pty Ltd, 2010).



LEGEND

- Black-throated Finch - Autumn 2011
- Black-throated Finch - August/September 2011 - Opportunistic sightings
- Black-throated Finch - Spring 2011
- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

**Potential Black-throated Finch
(southern) Habitat - Project Area**

Job Number 41-25215
Revision C
Date 05-09-2012

Figure 3-2

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Existing populations of the black-throated finch (southern) are thought to be highly fragmented (SEWPAC, 2011k). As such, the *Significant Impact Guidelines for the Endangered Black-throated Finch (southern) (Poephila cincta cincta)* (DEWHA, 2009b) define any habitat within five km of a post-1995 sighting as an 'important area' for the subspecies. The guidelines also state "that the presence of the black-throated finch (southern) at a site indicates that existing management regime is likely to be compatible with maintaining suitable habitat for the subspecies".

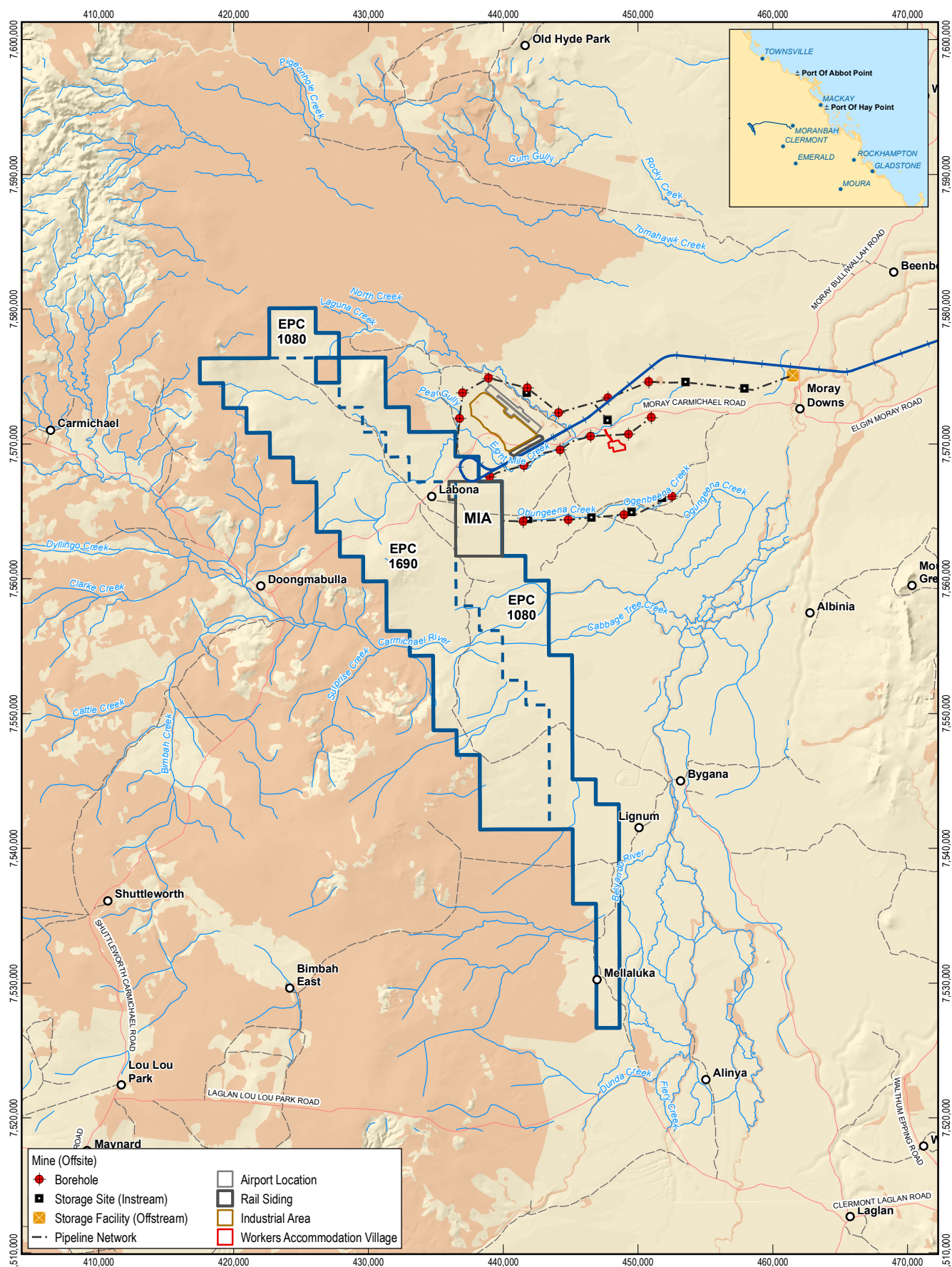
Figure 3-4 displays black-throated finch (southern) important areas at and near the Project Area. These important areas were identified by applying a 5 km buffer to sighting records from the Project Area, and selecting potential habitat (as depicted in Figure 3-2, based on those (field verified) RES from which the subspecies has been recorded in north Queensland since 1994 (as presented in the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007)) within the 5 km buffer.

The approximate extent of important areas for the subspecies in the Project Area is 21,246 ha.

Based on the (currently available) information acquired from desktop and field studies, and in consideration of the Commonwealth *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (Significant Impact Guidelines), (DEWHA, 2009c), it is considered that the Project Area supports a 'population' of the black-throated finch (southern), noting that a 'population' of an (EPBC Act) endangered species is defined in the Significant Impact Guidelines as 'the occurrence of the species in a particular area', where occurrence relates to:

- ▶ A geographically distinct regional population, or collection of local populations, or
- ▶ A population, or collection of local populations, that occurs within a particular bioregion (DEWHA, 2009c).

The Project Area is within approximately 50 km of a cluster of 'important areas' (i.e. habitat within 5 km of a post-1995 sighting) for the subspecies exhibited in the *Whole of range important areas* map presented in the black-throated finch (southern) significant impact guidelines (DEWHA, 2009b). As such it is considered that black-throated finches (southern) occurring at the Project Area represent part of a collection of local populations.



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area

Potential Black-Throated Finch (Southern) Habitat
- Based on DERM Certified Regional Ecosystems
Version 6.0b

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1:400,000 (at A4)
0 2.5 5 7.5 10
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

**Potential Black-throated Finch
(southern) Habitat - Beyond Project Area Figure 3-3**

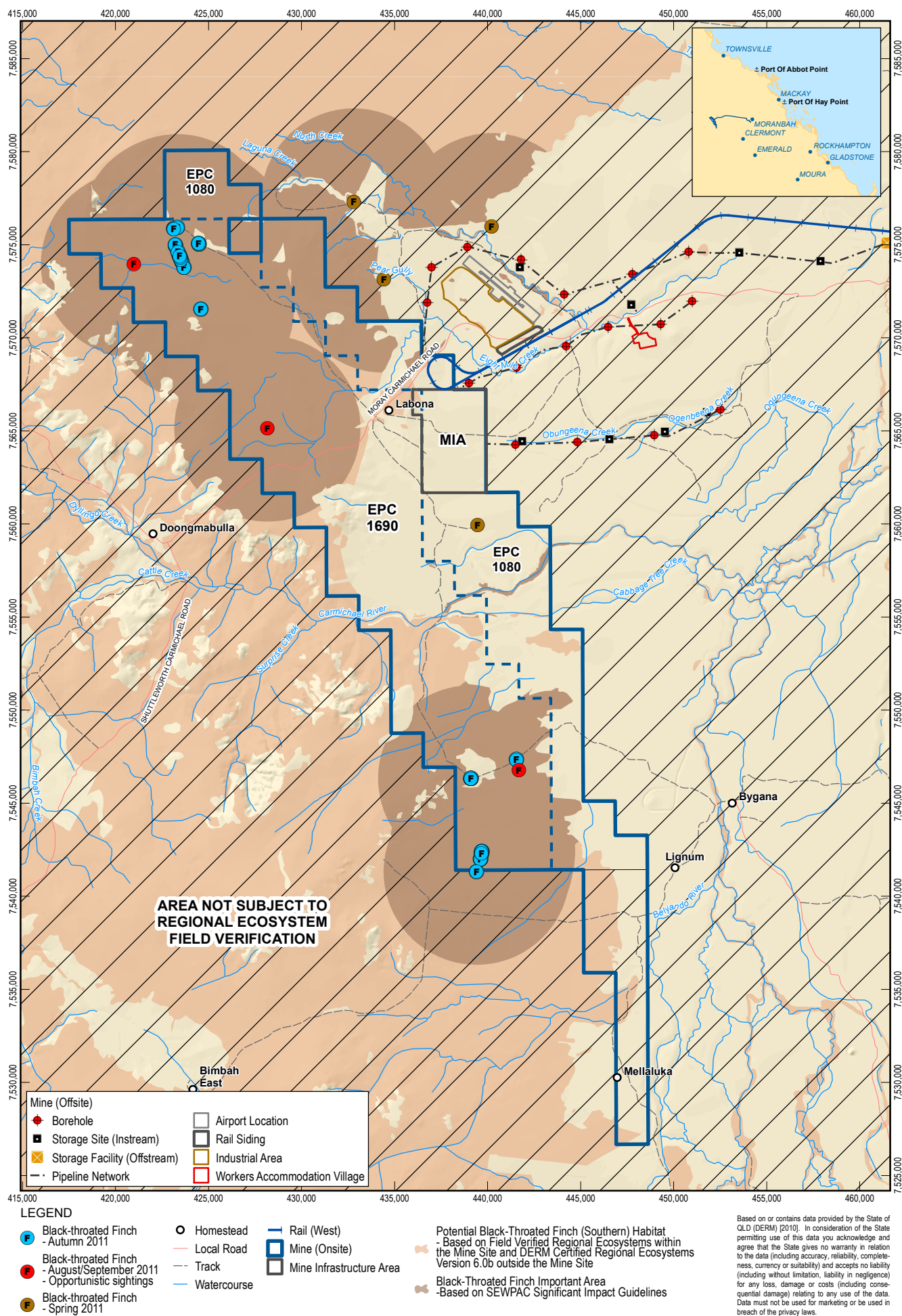
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Adani Mining Pty Ltd
 Carmichael Coal Mine and Rail Project
Black-throated Finch (southern)
Important Areas

Job Number 41-25215
 Revision B
 Date 05-09-2012

Figure 3-4

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Squatter pigeon (southern)

The squatter pigeon (southern) (vulnerable EPBC Act, NC Act) is a ground-dwelling pigeon that occurs from the dry tropics of central Queensland to the south-east of the state (SEWPAC, 2011i). The subspecies experienced a northward range contraction during the 20th Century, and is now not known to occur in New South Wales (SEWPAC, 2011i). Both the extent of occurrence and population size (estimated at 40,000 breeding birds) are considered to be stable at present (SEWPAC, 2011i). The squatter pigeon (southern) is locally abundant at some locations in the northern part of its current distribution (SEWPAC, 2011i), and is considered to be common in cattle grazed country north of the Tropic of Capricorn (SEWPAC, 2011i).

The subspecies is typically associated with open eucalypt woodland or forest habitat with a grassy understorey, particularly near water (SEWPAC, 2011i). It is less frequently encountered in disturbed areas (i.e. around roads, stockyards) (SEWPAC, 2011i). A variety of food items are taken by this ground-dwelling forager, including seeds (grass, legumes, herbs, forbs), insects and ticks (SEWPAC, 2011i).

Breeding may occur all year when conditions suit, however it is thought to be concentrated from the end of winter through to the summer months (SEWPAC, 2011i). Typically two eggs are laid in a nest (comprising a depression in the substrate) (SEWPAC, 2011i).

The three principal threats to the squatter pigeon (southern) are habitat loss associated with land clearing (for agriculture/industry), habitat degradation by grazing mammals and predation by native and introduced predators (particularly cats and foxes) (SEWPAC, 2011i).

Squatter pigeons (southern) at the Project Area

- ▶ Squatter pigeons (southern) were recorded on five occasions during the Spring 2010 survey
- ▶ Squatter pigeons (southern) were recorded on 24 occasions during the Autumn 2011 survey (some sightings may have been of the same individual or group of individuals on different days)
- ▶ Squatter pigeons (southern) were recorded on 10 occasions at and near the Project Area during the Spring 2011 survey

The subspecies was typically encountered on tracks in open eucalypt woodland habitat featuring a grassy understorey. Group size ranged from a single bird to 20 birds. Squatter pigeon (southern) distribution at the Project Area is likely to be limited by the availability of drinking water.

Full details of squatter pigeon (southern) sightings are presented in Appendix H.

Squatter pigeons (southern) observed at the Project Area are shown in Plate 3-8, while examples of habitat from which the subspecies were recorded are presented in Plate 3-9. In general, the subspecies was recorded from open woodland habitats, although it was also recorded at and near water bodies surrounded by non-remnant vegetation (in the Spring 2011 survey).

Figure 3-6 provides an indication of habitat that may be utilised by the squatter pigeon (southern) at the Project Area. Field verified REs characterised by open woodland and forest vegetation were identified and mapped. REs from land zones 7 (ironstone jump-ups) and 9 (undulating country on fine grained sedimentary rocks) were not included in the analysis as they are not considered likely to provide habitat for the subspecies. As for the black-throated finch (southern), the limiting factor to utilisation of this potentially suitable habitat is likely to be availability of water. Where water is present (i.e. farm dams, stock troughs, natural water bodies (i.e. gilgais, Carmichael River)) it is considered likely that the squatter pigeon (southern) will be present.

Plate 3-8 Squatter pigeons (southern) recorded in central part of Project Area (May 2011)

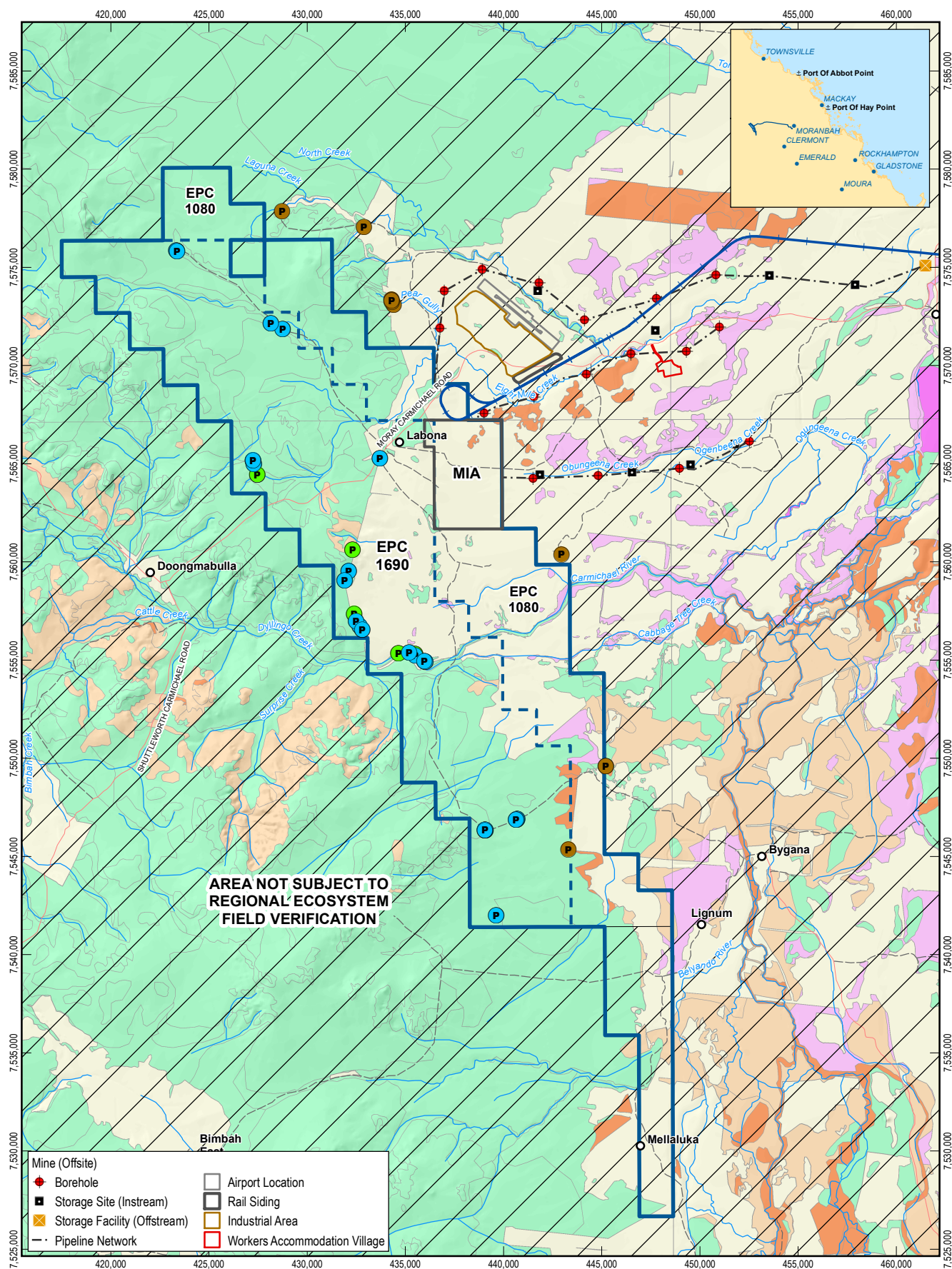


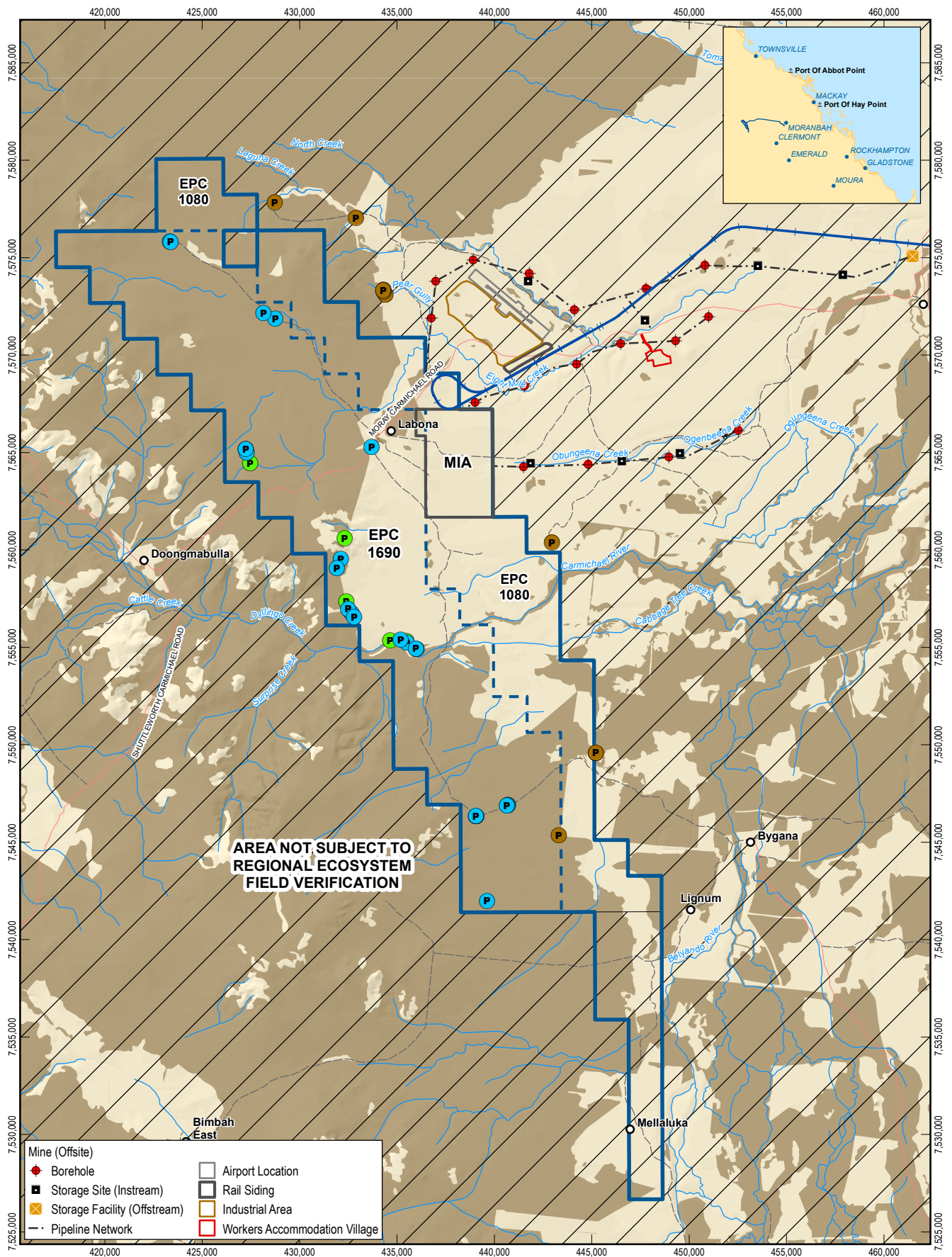
Plate 3-9 Habitat where squatter pigeons (southern) were recorded – open eucalypt woodland along ephemeral creek (April 2011) (left); Open ironbark woodland with native grass understorey (April 2011) (right)



Locations of squatter pigeon (southern) records from the Project Area are presented in Figure 3-5.

To map potential habitat for the squatter pigeon (southern) beyond the Project Area, (DNRM certified) REs characterised by open woodland and forest vegetation were identified and mapped. Potential squatter pigeon (southern) habitat beyond the Project Area is presented in Figure 3-7. The presence of potentially suitable habitat beyond the Project Area suggests that the squatter pigeon (southern) is likely to be present in much of the wider landscape (excluding to the east where non-remnant vegetation dominates the landscape). Habitat utilisation and abundance is likely to be influenced by availability of water and abundance of predators (especially cats and foxes). Predator abundance may be related to the management regime of individual properties in the landscape surrounding the Project Area.





LEGEND

- Squatter pigeon sightings - Spring 2010
- Squatter pigeon sightings - Autumn 2011
- Squatter pigeon sightings - Spring 2011
- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

Potential Squatter Pigeon (southern) Habitat
- Based on Field Verified Regional Ecosystems within
the Mine Site and DERM Certified Regional Ecosystems
Version 6.0b outside the Mine Site

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1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

**Potential Squatter Pigeon
(southern) Habitat - Project Area**

Job Number 41-25215
Revision B
Date 05-09-2012

Figure 3-6

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The squatter pigeon (southern) appeared to be common in suitable habitat at the Project Area, and is likely to be present where suitable habitat occurs in the landscape beyond the Project Area. At the subspecies level, the squatter pigeon (southern) population is considered to be stable at present, with historic declines (in the southern part of its range - New South Wales and southern Queensland) considered to have ceased (SEWPAC, 2011i). Across its range the subspecies is thought to occur as a continuous, inter-breeding population, with no single populations identified as being important for its long-term survival or recovery (SEWPAC, 2011i). With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that squatter pigeons (southern) at the Project Area are part of an 'important population' (of an EPBC Act listed vulnerable species). That is, squatter pigeons (southern) at the Project Area are not considered to be a part of a *population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*
- *Populations that are near the limit of the species range (DEWHA, 2009c)*

Based on the availability of similarly suitable habitat in the landscape surrounding the Project Area, and the stable nature of the subspecies' population at present, it is not considered that the Project Area represents *habitat critical to the survival of the (sub)species*.

Koala (Combined populations of Qld, NSW and ACT)

The Koala (combined populations of QLD, NSW and ACT) (vulnerable EPBC Act, special least concern NC Act) is a tree dwelling marsupial that has a widespread distribution in both coastal and inland environments (SEWPAC, 2012b). The koala's diet is typically restricted to foliage of *Eucalyptus spp.* or related genera. However, the diet of individual koalas is usually limited to obtaining most of their nutrition from one or a few tree species present at a site. Species-level preferences may also vary between regions or seasons (SEWPAC, 2012b). Female koalas can potentially produce up to one offspring a year, giving birth between October and May, however research indicates that breeding averages are more likely to range between 0.3-0.8/year (SEWPAC, 2012b).

Koalas occupy a range of habitats including temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated eucalypt species (SEWPAC, 2012b). In central Queensland, the species occurs in scattered populations within eucalypt woodlands generally along watercourses. Koalas in the Brigalow Belt bioregion also typically occur in low densities, estimated at 0.005 koalas/ha and have large home ranges (SEWPAC, 2012b). Over a 20 year period from 1990, estimated koala populations within the Brigalow Belt bioregion have suffered a decline of 30 to 40 per cent.

Generally, the home ranges of individual koalas can extensively overlap, however, these can be quite variable depending on the quality of the habitat and the location. Research undertaken at Blair Athol in central Queensland, approximately 140 km south-east of the Project Area, estimated home ranges at 135 ha for an individual male and 101 ha for females.

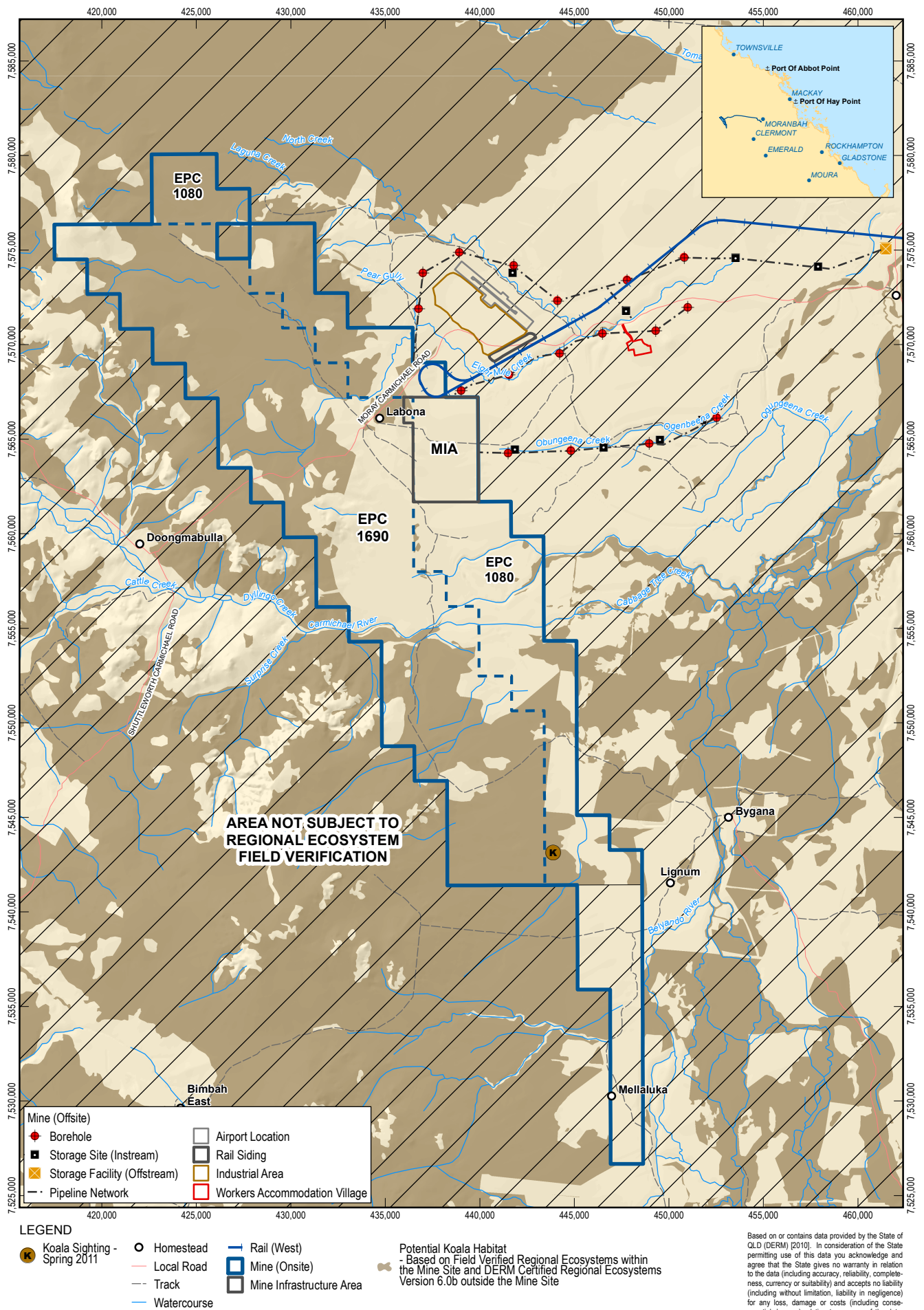


Koalas at the Project Area

No evidence of the koala was detected during the Spring 2010 and Autumn 2011 surveys. One koala was recorded on one occasion during spotlighting within the south-eastern part of the Project Area (EPC 1080 Study Area) during the Spring 2011 survey. This individual was recorded within an open eucalypt woodland environment representing the '*Ironbark-box grassy woodlands and open woodlands on grey sand plains*' habitat type within the Project Area.

- ▶ It is likely that the species occurs at low densities in remnant open eucalypt woodland across the Project Area. The Bygana West Nature Refuge in the southern part of the Project Area was proclaimed, amongst other reasons, as it contains suitable koala habitat (discussed further in Section 3.3.7.1). Furthermore, mature river red gum woodland along the Carmichael River within the '*Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding*' represents additional potential koala habitat in the Project Area. The location of the koala observed within the Project Area and an indication of potential habitat that may be utilised by this species within the Project Area is presented in Figure 3-8.
- ▶ To map potential habitat for the koala beyond the Project Area, (DERM certified) REs characterised by open eucalypt woodland and open eucalypt forest vegetation fringing watercourses were identified and mapped. Potential koala habitat beyond the Project Area is presented in Figure 3-9. The presence of potentially suitable habitat beyond the Project Area suggests that the koala is likely to be present in low densities in the wider landscape (excluding to the east where non-remnant vegetation dominates the landscape). Habitat utilisation and abundance is likely to be influenced by availability of preferred eucalypt species, abundance of predators (especially dogs), climate change and drought (SEWPAC, 2012b).
- ▶ The koala is considered to have 'scattered populations throughout Queensland' and no defined 'important populations' have been listed by SEWPAC (2012b). With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the occurrence of a koala at the Project Area defines it as part of an 'important population' (of an EPBC Act listed vulnerable species). That is, koalas at the Project Area are not considered to be a part of a *population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*
 - ▶ Key source populations either for breeding or dispersal
 - ▶ Populations that are necessary for maintaining genetic diversity, and/or
 - ▶ Populations that are near the limit of the species range (DEWHA, 2009c)

Based on the low estimated density of koalas within the Brigalow Belt and the availability of similarly suitable habitat in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species*.



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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

**Location of Koala Sightings
and Potential Habitat - Project Area**

Job Number 41-25215
Revision A
Date 05-09-2012

Figure 3-8

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3.2.5.2 Listed Threatened Fauna – Likely to Occur

The likelihood of occurrence assessment indicated that the following EPBC Act listed threatened fauna species are likely to occur at the Project Area, based on distribution (including modelled distribution (SEWPAC, 2011b)) presence of potentially suitable habitat and previous records from the region:

- ▶ Ornamental snake (*Denisonia maculata*) - vulnerable EPBC Act
- ▶ Yakka skink (*Egernia rugosa*) - vulnerable EPBC Act

Trapping for ground-dwelling reptiles, opportunistic searches and spotlighting surveys failed to detect the threatened reptiles listed above. It is recognised that these are cryptic species, and as such, failure to detect them is not indicative of their absence from the Project Area. Rather, it is considered likely that these species occur at the Project Area, based on their known distribution, the presence of suitable habitat and the fact that they have been previously recorded within approximately 50 km of the Project Area (as documented in desktop sources queried (Table 1-2)). With respect to suitable habitat, it is considered possible that the following fauna habitat types may support listed threatened reptiles (refer to Figure 2-6 (and Figure 2-6 in Appendix B) for spatial distribution of fauna habitat types at Project Area):

- ▶ *Ironbark-box grassy woodlands and open woodlands on grey sand plains* – yakka skink
 - This open woodland habitat type includes REs from land zone 3 and land zone 5. The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b) identifies woodland and open forest habitats on land zone 3 and land zone 5 as suitable habitat for the yakka skink, where ground layer microhabitats such as large hollow logs, cavities, large fallen trees, tree stumps, logs, stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes occur. Observations from the Project Area indicated that suitable ground layer microhabitats occur (in places) in this habitat type.
- ▶ *Yellow jacket and rough-leaved bloodwood shrubby low open woodland on red sand plains* – yakka skink
 - This low open woodland habitat type includes REs from land zone 5. The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b) identifies woodland and open forest habitats on land zone 5 as suitable habitat for the yakka skink, where ground layer microhabitats such as large hollow logs, cavities, large fallen trees, tree stumps, logs, stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes occur. Observations from the Project Area indicated that suitable ground layer microhabitats occur (in places) in this habitat type.
- ▶ *Gidgee and/or brigalow shrubby woodland, sometimes with Dawson's gum emergents, on clay and loam plains* – yakka skink, ornamental snake
 - This open woodland/open forest habitat type includes REs from land zone 3, land zone 4 and land zone 9. The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b) identifies woodland and open forest habitats on land zone 3, land zone 4 and land zone 9 as suitable habitat for the yakka skink, where ground layer microhabitats such as large hollow logs, cavities, large fallen trees, tree stumps, logs,



stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes occur. Observations from the Project Area indicated that suitable ground layer microhabitats occur (in places) in this habitat type.

- REs 11.4.6 and 11.4.9, which are constituents of this habitat type, are identified as suitable habitat for the ornamental snake in the *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b). Those other acacia-dominated habitat types growing on alluvial and cracking clay soils (i.e. RE 10.3.3, 10.4.3, 10.4.5, 10.9.3, 11.3.1), have been included due to the structural similarity in habitat that they provide.
- *Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding* – yakka skink, ornamental snake
 - This open woodland/open forest habitat type includes REs from land zone 3. The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b) identifies woodland and open forest habitats on land zone 3 as suitable habitat for the yakka skink, where ground layer microhabitats such as large hollow logs, cavities, large fallen trees, tree stumps, logs, stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes occur. Observations from the Project Area indicated that suitable ground layer microhabitats occur (in places) in this habitat type.
 - The *Queensland Brigalow Belt Reptiles Recovery Plan* (Richardson, 2006) identifies riverside woodland and forest as being suitable habitat for the ornamental snake.
- *Woodland and low open woodland associated with laterised sandstone rises and minor pediments* – yakka skink
 - This low open woodland habitat type includes REs from land zone 7 and land zone 9. The *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b) identifies woodland and open forest habitats on land zone 7 and land zone 9 as suitable habitat for the yakka skink, where ground layer microhabitats such as large hollow logs, cavities, large fallen trees, tree stumps, logs, stick-raked piles, large rocks and rock piles, dense ground-covering vegetation, and deeply eroded gullies, tunnels and sinkholes occur. Observations from the Project Area indicated that suitable ground layer microhabitats occur (in places) in this habitat type.

Refer to Table 2-3 (and Table 2-3 in Appendix B) for the flora attributes, and Table 2-5 for the general habitat characteristics of each habitat type listed above.

Potentially suitable habitat for these two reptiles at the Project Area is presented in Figure 3-10 (yakka skink) and Figure 3-11 (ornamental snake), based on those fauna habitat types identified from the Project Area that may provide suitable habitat resources for these two species. While 'known important habitat', as defined in the *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b) for the yakka skink may occur within mapped potentially suitable habitat, where the requisite ground layer microhabitats provide shelter habitats for colonies, targeted searches failed to detect any evidence of such colonies at the Project Area.

In the case of the ornamental snake, the limiting factor to utilisation of the potentially suitable habitat identified in Figure 3-11 is likely to be related to the density of frog populations, which in turn may be driven by the localised availability of frog breeding sites (i.e. standing water associated with gilgais, ephemeral creeks and rivers). Where gilgais occur, this habitat may



constitute 'known important habitat' for the ornamental snake, as defined in the *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* (SEWPAC, 2011b).

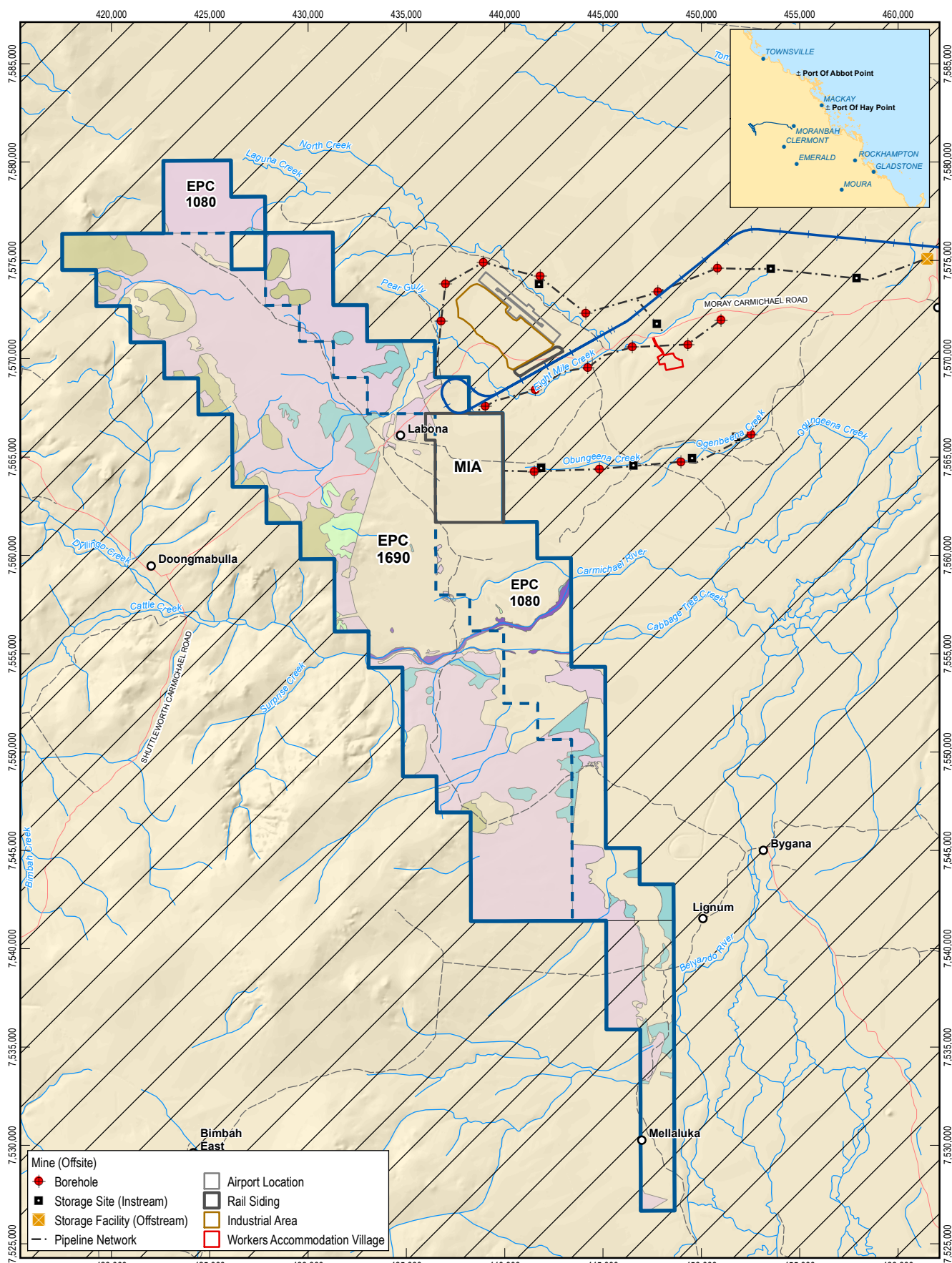
With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the Project Area supports an 'important population' of the EPBC Act listed vulnerable ornamental snake or yakka skink, in so much as:

- ▶ Neither species was detected at the Project Area during targeted surveys (survey effort presented in Table 1-6 (EPC 1690 Study Area) and Section 1.3.1 of Appendix B (EPC 1080 Study Area))
- ▶ The Project Area is not considered to constitute habitat for key source populations (breeding/dispersal), especially given the availability of similarly suitable habitat in the surrounding landscape
- ▶ The Project Area does not occur at or near the limit of either species' range

Ornamental snakes and yakka skinks, should they occur at the Project Area, are not considered to be a part of a *population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- ▶ *Key source populations either for breeding or dispersal*
- ▶ *Populations that are necessary for maintaining genetic diversity, and/or*
- ▶ *Populations that are near the limit of the species range* (DEWHA, 2009c).

Based on the fact that neither species was detected at the Project Area despite targeted surveys, and that similarly suitable habitat for both species is present in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species* for the yakka skink and ornamental snake.



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area

Potential Yakka Skink Habitat Type

- Gidgee and brigalow woodland on clay plains
- Ironbark-box grassy woodland on grey sand plains
- Low open woodland on ferricrete/laterised sandstone
- Open forest and woodland fringing streams and on flood plains
- Yellowjacket-rough leaved bloodwood open woodland on red sand plains

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0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
**Potential Yakka Skink
Habitat - Project Area**

Job Number 41-25215
Revision B
Date 29-08-2012

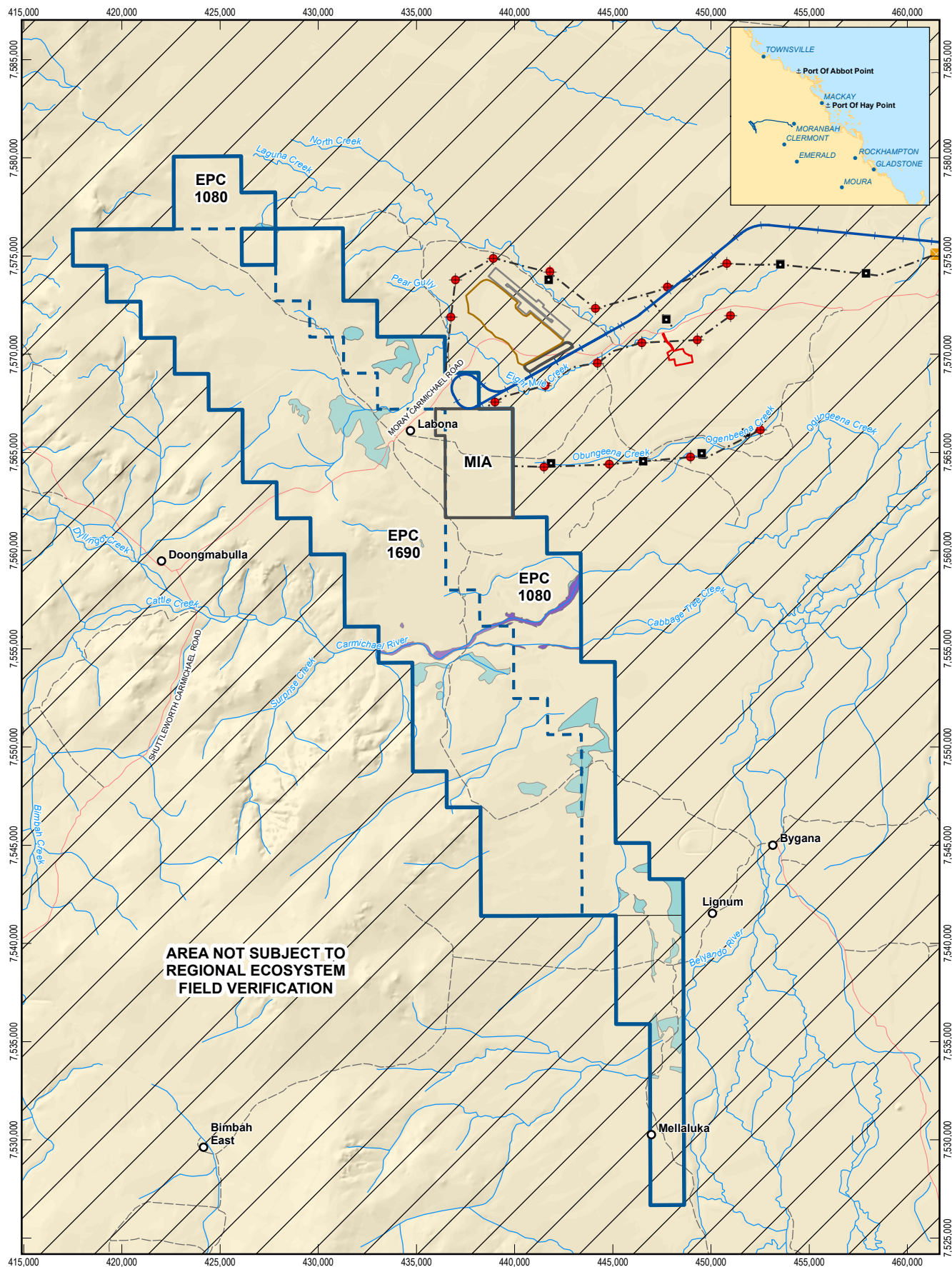
Figure 3-10

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LEGEND

- | | | | |
|---------------|---|--------------------------------|---------------------------------|
| ○ Homestead | — Rail (West) | ■ Mine (Offsite) | □ Airport Location |
| — Local Road | ■ Mine (Onsite) | ● Borehole | □ Rail Siding |
| — Track | ■ Mine Infrastructure Area | ■ Storage Site (Instream) | ■ Industrial Area |
| — Watercourse | ■ Gidgee and brigalow woodland on clay plains | ■ Storage Facility (Offstream) | ■ Workers Accommodation Village |
| | ■ Open forest and woodland fringing streams and on flood plains | — Pipeline Network | |

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
**Potential Ornamental
Snake Habitat - Project Area**

Job Number 41-25215
Revision B
Date 29-08-2012

Figure 3-11

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3.2.5.3 Listed Threatened Fauna – May Occur

The likelihood of occurrence assessment indicated that the following EPBC Act listed threatened fauna species may occur at the Project Area, based on distribution and/or presence of potentially suitable habitat:

- ▶ Red goshawk (*Erythrotriorchis radiatus*) – vulnerable EPBC Act
- ▶ Australian painted snipe (*Rostratula australis*) – vulnerable, migratory (CAMBA¹), marine EPBC Act

These species were not detected during field studies at the Project Area. They may occur based on the presence of suitable habitat (as depicted in Figure 2-6 (and Figure 2-6 in Appendix B)), namely:

- ▶ *Ironbark-box grassy woodlands and open woodlands on grey sand plains* – red goshawk (potential foraging habitat for this wide ranging species)
- ▶ *Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding* – red goshawk
- ▶ *Natural and artificial water bodies* – Australian painted snipe

Refer to Table 2-3 (and Table 2-3 in Appendix B) for the flora attributes, and Table 2-5 for the general habitat characteristics of each habitat type listed above.

With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the Project Area supports an ‘important population’ of the EPBC Act listed vulnerable red goshawk or Australian painted snipe, in so much as:

- ▶ Neither species was detected at the Project Area, nor has either species been previously recorded within 50 km of Project Area (desktop assessment (Table 1-2))
- ▶ The Project Area is not considered to constitute habitat for key source populations (breeding/dispersal), especially given the availability of similarly suitable habitat in the surrounding landscape
- ▶ The Project Area does not occur at or near the limit of either species’ range

Red goshawk and Australian painted snipe, should they occur at the Project Area, are not considered to be a part of a *population that is necessary for a species’ long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- ▶ *Key source populations either for breeding or dispersal*
- ▶ *Populations that are necessary for maintaining genetic diversity, and/or*
- ▶ *Populations that are near the limit of the species range (DEWHA, 2009c)*

Based on the fact that neither species was detected at the Project Area (nor have they been recorded with 50 km), and that similarly suitable habitat for both species is present in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species* for the red goshawk and Australian painted snipe.

¹ Agreement between the Government of Australia and the Government of the People’s Republic of China for the Protection of Migratory Birds and their Environment

3.2.5.4 Listed Threatened Fauna – Unlikely to Occur

The following EPBC Act listed threatened fauna species were predicted to occur at the Project Area by the SEWPAC Protected Matters Search Tool (or have been historically recorded from the region) however are considered unlikely to occur (as detailed in Table 3-3) based on their current known distribution and/or the lack of suitable habitat at the Project Area:

- ▀ Dunmall's snake (*Furina dunmalli*) – vulnerable EPBC Act
- ▀ Brigalow scaly-foot (*Paradelma orientalis*) – vulnerable EPBC Act
- ▀ Northern quoll (*Dasyurus hallucatus*) – endangered EPBC Act
- ▀ Northern hairy-nosed wombat (*Lasiorninus krefftii*) – endangered EPBC Act
- ▀ Greater bilby (*Macrotis lagotis*) – vulnerable EPBC Act
- ▀ Greater long-eared bat (*Nyctophilus timoriensis*) – vulnerable EPBC Act
- ▀ Star finch (eastern, southern) (*Neochmia ruficauda ruficauda*) – endangered EPBC Act
- ▀ Paradise parrot – extinct EPBC Act

3.2.6 Listed Threatened Ecological Communities

Ecological communities are naturally occurring biological assemblages that comprise a particular habitat type. TECs are ecological communities that have been assessed under the EPBC Act and assigned to one of five categories related to the status of the threat to the community, i.e. conservation dependent, vulnerable, endangered, critically endangered and extinct in the wild.

Two TECs listed under the EPBC Act were identified as having potential to occur in the Project Area from desktop results. Both TECs are classified as endangered. The TECs are as follows:

- ▀ Brigalow (*Acacia harpophylla* dominant and co-dominant)
- ▀ The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin

Only the Brigalow TEC was identified as occurring in the Project Area from field surveys. These TECs are described in more detail below.

3.2.6.1 Brigalow (*Acacia harpophylla* dominant and co-dominant)

The Brigalow TEC comprises vegetation communities dominated or co-dominated by brigalow (*Acacia harpophylla*). Within Queensland, 16 REs are described as forming part of this TEC. All of these REs are located in either the Brigalow Belt, South-East Queensland or Mulga Lands bioregions – none are located in the Desert Uplands.

The Brigalow TEC was nominated for listing under the EPBC Act because brigalow communities have undergone a severe decline since the 1940s, and now occupy 10 per cent of their former range (Department of Environment and Heritage, 2001). The main threatening process is broad scale clearing, a practice that saw massive swathes of brigalow and other acacia communities on the fertile clay plains of Central Queensland and northern New South Wales cleared over a short period. This was done primarily to create grasslands for grazing, which are now dominated by the exotic pasture grasses buffel grass and creeping bluegrass. Broad scale clearing of remnant and regrowth vegetation is now managed through legislation in Queensland. Therefore, the main threatening process for this TEC has now been removed. However, it is unlikely that the Brigalow TEC will



recover to its former state, given that the vast majority of these cleared areas are now productive grazing lands.

Of the REs listed as forming part of the TEC, only the REs 11.3.1, 11.4.8 and 11.4.9 occur within the Project Area. Ground-truthing has determined that approximately 267 ha of these REs are present within the Project Area. The majority of this brigalow is located south of the Carmichael River along the eastern boundary of the Project Area, generally within contiguous remnant vegetation with low levels of fragmentation and high levels of community integrity. The sections north of the Carmichael River are present in small, highly fragmented portions within which the community structure and species composition is generally highly modified from its natural state.

The distribution of Brigalow TEC at the Project Area is presented in Figure 3-12.

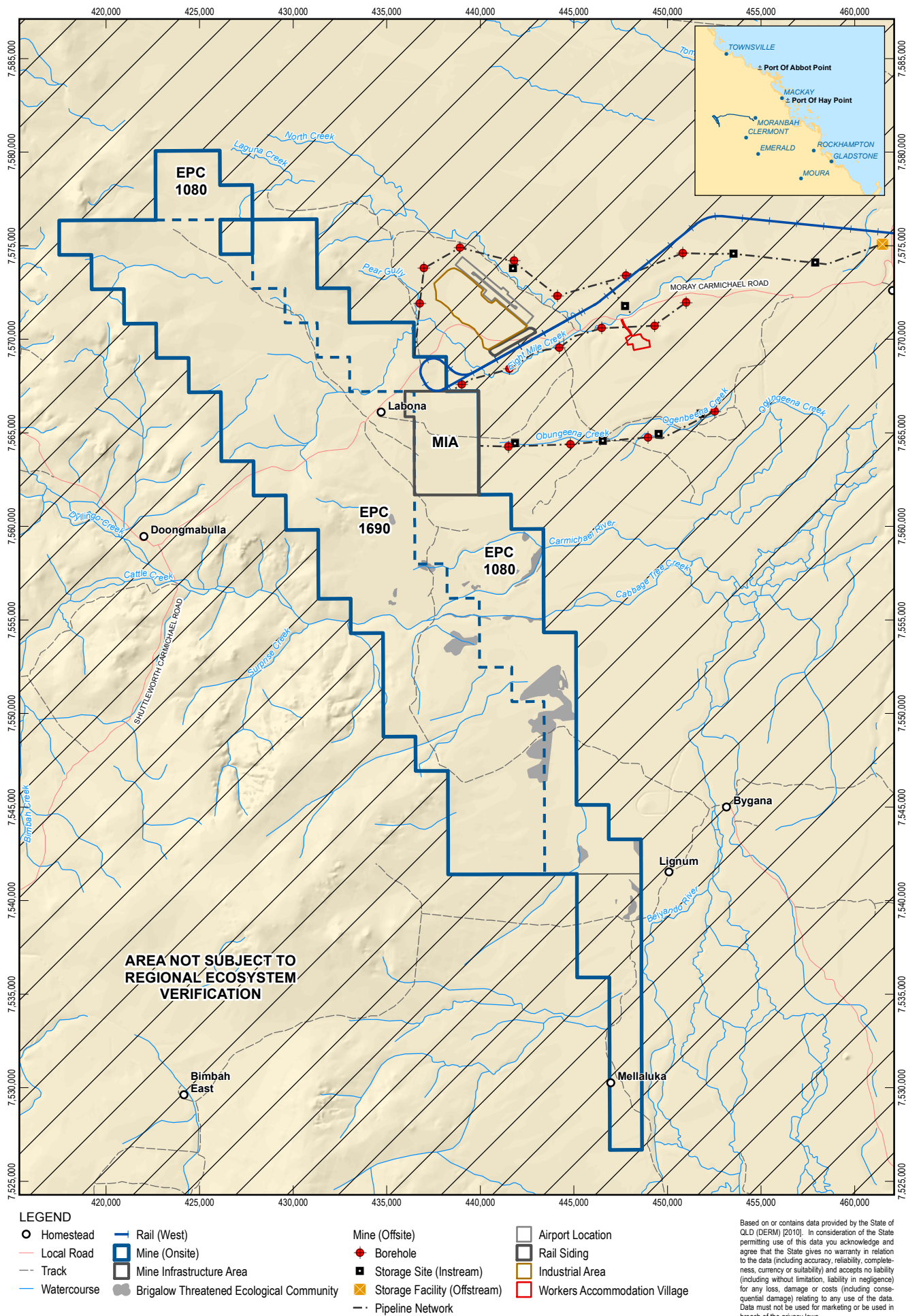
3.2.6.2 The Community of Native Species Dependent on Natural Discharge of Groundwater from the Great Artesian Basin

The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin (abbreviated to 'GAB discharge spring wetlands') TEC comprises a community of species of flora and fauna including fish, invertebrates and aquatic and terrestrial plants clustered around discharge springs emanating from the Great Artesian Basin (GAB) (Fensham *et al*, 2010). For this reason, the TEC is geographically limited to the GAB, and surveys confirmed that this TEC is not present within the Project Area. However, impacts to regional aquifers as a result of groundwater draw down have the potential to impact this TEC.

The nearest GAB discharge spring is the Doongmabulla wetland, a cluster of 11 springs located within a 4 km radius of each other along the Carmichael River, approximately 10 km upstream (west) from the western boundary of the Project Area (Fensham pers. comm., 2012). This wetland has an area of 5 ha, and contains six flora species of conservation significance, including two species known to be endemic to the Doongmabulla spring (the herb *Eryngium fontanum* and the grass *Sporobolus pamelae*). It has been given a GAB discharge spring wetland conservation ranking of 1a (the highest), based on the presence of endemic species (Fensham *et al*, 2010).

The main threatening processes for GAB discharge springs are aquifer draw down (due primarily to uncapped bores, but also to mining activities), excavation of springs, exotic flora and fauna invasion and stock damage, access by tourism, and impoundments (Fensham *et al*, 2010).

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Brigalow Threatened Ecological Community - Project Area

Job Number 41-25215
Revision B
Date 29-08-2012

Figure 3-12

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3.2.7 Listed Migratory Species

Three EPBC Act listed migratory birds were recorded from the Project Area:

- ▶ Eastern great egret (*Ardea alba*) – migratory (JAMBA², CAMBA), marine EPBC Act; special least concern NC Act
- ▶ Rainbow bee-eater (*Merops ornatus*) - migratory (JAMBA), marine EPBC; special least concern NC Act
- ▶ Satin flycatcher (*Myiagra cyanoleuca*) – migratory (Bonn³), marine EPBC Act; special least concern NC Act

The eastern great egret, rainbow bee-eater and satin flycatcher are common and widespread species. Habitat at the Project Area is likely to be used on a temporary to permanent basis by these species. As these species are common and widespread, and suitable habitat is likely to occur over much of the surrounding landscape, habitat at the Project Area for the eastern great egret, rainbow bee-eater and satin flycatcher is not considered to constitute 'important habitat' as defined in the Significant Impact Guidelines (DEWHA, 2009c), that is:

- ▶ *Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion (as defined in DEWHA, 2009c) of the population of a species, and/or*
- ▶ *Habitat that is of critical importance to the species at particular life-cycle stages, and/or*
- ▶ *Habitat utilised by a migratory species which is at the limit of the species' range, and/or*
- ▶ *Habitat within an area where the species is declining (DEWHA, 2009c)*

For information pertaining to location of species records, refer to Appendix G.

The likelihood of occurrence assessment, presented in Table 3-4 (based upon definitions outlined in Section 1.5.7), indicated that 11 additional EPBC Act listed migratory species are likely to occur at the Project Area, based on distribution, presence of potentially suitable habitat and previous records from the region. A further four EPBC Act listed migratory species, including two nominated in the Project terms of reference (spectacled monarch (*Monarcha trivirgatus*); black-faced monarch (*Monarcha melanopsis*)) may occur at the Project Area, based on distribution and presence of potentially suitable habitat. As with the three bird species detected at the Project Area, these 15 migratory species are common and widespread, and thus the Project Area is not considered to support 'important habitat' as defined in the Significant Impact Guidelines (DEWHA, 2009c) for any of these birds.

² Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment

³ Convention on the Conservation of Migratory Species of Wild Animals

Table 3-4 Commonwealth listed migratory species – likelihood of occurrence

Species	EPBC Act status	Predicted to occur #	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
common sandpiper <i>Actitis hypoleucos</i>	migratory (Bonn; CAMBA; JAMBA; ROKAMBA); marine	x	WO	X	This species is more common in northern and eastern Australia and on the west coast. Habitat preferences include shallow, pebbly, muddy or sandy edges of rivers or streams from coastal to far inland areas including dams and lakes. It is a summer migrant to Australia (Aug-May) (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
fork-tailed swift <i>Apus pacificus</i>	migratory (CAMBA; JAMBA, ROKAMBA); marine	✓	WO	X	Habitat preferences include open country from semi-deserts to coasts. Common and widespread across Australia, this species is a summer migrant to Australia (Oct-April) (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
cattle egret <i>Ardea ibis</i>	migratory (CAMBA; JAMBA); marine	✓	Not previously recorded	X	Occurs in stock paddocks, croplands, wetlands, tidal mudflats and drains. Widespread distribution in northern and eastern Australia, summer-Autumn migrant to Qld (Pizzey and Knight, 2007).	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area May occur
eastern great egret <i>Ardea modesta</i>	migratory (CAMBA; JAMBA, ROKAMBA); marine	✓	WO	✓	Inhabits shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, sewage ponds, irrigation areas and larger dams. This species is widespread throughout Australia (Pizzey and Knight, 2007).	Confirmed present at Project Area

Species	EPBC Act status	Predicted to occur #	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
sharp-tailed sandpiper <i>Calidris acuminata</i>	migratory (Bonn; CAMBA; JAMBA; ROKAMBA); marine;	x	WO	X	Inhabits tidal mudflats, saltmarshes, mangroves, shallow fresh, brackish and saline inland wetlands, floodwaters and irrigated lands. Widespread distribution, summer migrant to coastal and inland Australia (Aug-April) (Pizzey and Knight, 2007).	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area May occur
curlew sandpiper <i>Calidris ferruginea</i>	migratory (Bonn; CAMBA; JAMBA; ROKAMBA); marine	x	WO	X	Inhabits tidal mudflats, saltmarsh and saline and freshwater wetlands. Also occurs inland around ephemeral and permanent lakes, dams, waterholes and bore drains. Widespread distribution and common summer migrant to Australia (Aug-April) (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
Latham's snipe <i>Gallinago hardwickii</i>	migratory (Bonn; CAMBA; JAMBA; ROKAMBA); marine	✓	WO	X	Habitat preferences include soft wet ground or shallow water with tussocks and other green or dead growth, wet parts of paddocks or near dams, scrub or open woodland. Summer migrant to eastern Australia (arriving July-Aug) (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
white-bellied sea-eagle <i>Haliaeetus leucogaster</i>	migratory (CAMBA); marine;	✓	WO	X	Inhabits coasts, estuaries, large rivers and inland lakes. Occurs around coastal Australia and larger lakes and storages, some far inland (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur



Species	EPBC Act status	Predicted to occur #	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
white-throated needletail <i>Hirundapus caudacutus</i>	migratory (CAMBA; JAMBA, ROKAMBA); marine	✓	WO	X	Occupies airspace over forests, woodlands, farmlands, plains, lakes and favoured timbered ranges. Summer migrant to eastern Australia (Oct-April) (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
Caspian tern <i>Hydroprogne caspia</i>	migratory (CAMBA; JAMBA); marine	x	WO	X	Inhabits coastal and offshore waters, beaches, estuaries, rivers, creeks, lakes (including ephemeral lakes) some inland and waterholes. Occurs within eastern Australia and coastal WA (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
black-tailed godwit <i>Limosa limosa</i>	migratory (Bonn; CAMBA; JAMBA; ROKAMBA); marine	x	WO	X	Widespread summer migrant to eastern Australia (Sept-April), mostly on the coasts but makes use of some inland lakes. (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
rainbow bee-eater <i>Merops ornatus</i>	migratory (JAMBA); marine	✓	WO BA	✓	Inhabits open woodlands with sandy, loamy soil, riverbanks, beaches, cliffs, mangroves, rainforests and woodlands. Common and widespread distribution (Pizzey and Knight, 2007).	Confirmed present at Project Area
spectacled monarch <i>Monarcha trivirgatus</i>	migratory (Bonn); marine	x	x	X	Typically inhabits understorey of densely vegetated areas (rainforests, gullies, riparian areas). Predominantly coastal but range extends inland (Pizzey and Knight, 2007).	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area May occur

Species	EPBC Act status	Predicted to occur #	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
black-faced monarch <i>Monarcha melanopsis</i>	migratory (Bonn); marine	x	x	X	Rainforest and open forest, gullies and open woodlands (when migrating). Predominantly coastal but range extends inland (Pizzey and Knight, 2007).	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area May occur
satin flycatcher <i>Myiagra cyanoleuca</i>	migratory (Bonn); marine	✓	Not previously recorded	✓	Inhabits heavily vegetated gullies in forests, taller woodlands, trees in open country and coastal forests along eastern Australia (Pizzey and Knight, 2007).	Confirmed present at Project Area
glossy ibis <i>Plegadis falcinellus</i>	migratory (Bonn; CAMBA); marine	x	WO	X	Inhabits well vegetated wetlands, wet pastures, ricefields, floodwaters, floodplains, brackish or occasionally saline wetlands and occasionally dry grasslands. Most numerous in northern and eastern Australia (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
common greenshank <i>Tringa nebularia</i>	migratory (Bonn; CAMBA; JAMBA; ROKAMBA); marine	x	WO	X	Inhabits mudflats, estuaries, saltmarshes, lake margins, wetlands and claypans. Widespread distribution and summer migrant to Australia (Sept-April) (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur



Species	EPBC Act status	Predicted to occur #	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
marsh sandpiper <i>Tringa stagnatilis</i>	migratory (Bonn; CAMBA; JAMBA; ROKAMBA); marine	x	WO	X	Inhabits wetlands, bore drains mangroves, tidal mudflats and estuaries. Summer migrant to mainly coastal Australia (Aug-May), widespread but very scattered through inland (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur

Predicted to occur within approximately 50 km of Project Area: SEWPAC Protected Matters Search Tool

* Previously recorded within approximately 50 km of Project Area: desktop sources including Wildlife Online / Birds Australia

Bonn: Convention on the Conservation of Migratory Species of Wild Animals

CAMBA: Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment

JAMBA: Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment

ROKAMBA: Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds

Broad fauna habitat types identified from the Project Area (as displayed in Figure 2-6 (and Figure 2-6 in Appendix B)) that may be utilised by EPBC Act listed migratory species are outlined in Table 3-5.

Table 3-5 Habitats for listed migratory species

	Ironbark-box woodland	Shrubby low woodland	Tall mixed shrubland	Gidgee/brigalow shrubland	Fringing open forest / woodland	Low woodland (sandstone rises)	Open cleared land	Natural and artificial water bodies
common sandpiper								✓
fork-tailed swift*	✓	✓	✓	✓	✓	✓	✓	✓
cattle egret	✓	✓			✓		✓	✓
eastern great egret					✓			✓
sharp-tailed sandpiper								✓
curlew sandpiper								✓
Latham's snipe					✓			✓
white-bellied sea-eagle					✓			✓
white-throated needletail*	✓	✓	✓	✓	✓	✓	✓	✓
Caspian tern								✓
black-tailed godwit								✓
rainbow bee-eater	✓	✓	✓	✓	✓	✓	✓	✓
spectacled monarch					✓			
black-faced monarch					✓			
satin flycatcher					✓			
glossy ibis								✓
common greenshank								✓
marsh sandpiper								✓

*These are predominantly aerial species and may forage over the entire Project Area

3.2.8 Great Barrier Reef Marine Park

As detailed for the Great Barrier Reef World Heritage Area (3.2.1), the Project Area is located over 300 km due west and approximately 320 km upstream of the Great Barrier Reef World Heritage Area. The Carmichael River that bisects the site flows east for approximately 20 km to its juncture with the Belyando River. From this point the Belyando River flows in a northerly direction for approximately 90 km where it joins the Suttor River. Beyond its juncture with the Belyando River, the Suttor River flows north (approximately 50 km) to the Burdekin Falls Dam (Lake Dalrymple). The Burdekin River downstream of Burdekin Falls Dam flows for approximately 160 km to its mouth at Upstart Bay near

Ayr. These water courses flow through a modified landscape matrix dominated by cattle grazing, with other land uses including mining, urban and cropping.

Given the distance upstream from the coast, and the barriers in place between the Project Area and the coast, downstream impacts to the Great Barrier Reef Marine Park resultant from activities at the Project Area are not expected and further assessment has not been undertaken.

3.2.9 Other Commonwealth Matters

3.2.9.1 Listed Marine Species

A total of 23 EPBC Act listed marine species were recorded during field surveys in the Project Area (16 Spring 2010 survey, 18 Autumn 2011 survey, 17 Spring 2011 survey) (Table 3-6). The 23 marine species included three birds also listed as migratory under the EPBC Act (eastern great egret, rainbow bee-eater, satin flycatcher) (see Section 3.2.7). No threatened EPBC Act listed marine birds were recorded at the Project Area. The EPBC Act listed marine birds detected from the Project Area are widespread, common woodland and/or wetland species, and are likely to occur across the surrounding landscape wherever suitable habitat is available. The Project Area does not represent important habitat for the common and widespread birds listed as marine under the EPBC Act. Broad fauna habitat types identified from the Project Area are displayed in Figure 2-6 (and Figure 2-6 in Appendix B).

Table 3-6 Commonwealth listed marine species recorded at Project Area

Spring 2010 survey	Autumn 2011 survey	Spring 2011 survey
Richard's pipit (<i>Anthus novaeseelandiae</i>)	Richard's pipit (<i>Anthus novaeseelandiae</i>)	Richard's pipit (<i>Anthus novaeseelandiae</i>)
eastern great egret (<i>Ardea alba</i>)	eastern great egret (<i>Ardea alba</i>)	eastern great egret (<i>Ardea alba</i>)
Horsfield's bronze-cuckoo (<i>Chrysococcyx basalis</i>)	intermediate egret (<i>Ardea intermedia</i>)	intermediate egret (<i>Ardea intermedia</i>)
black-faced cuckoo-shrike (<i>Coracina novaehollandiae</i>)	Horsfield's bronze-cuckoo (<i>Chrysococcyx basalis</i>)	Horsfield's bronze-cuckoo (<i>Chrysococcyx basalis</i>)
white-bellied cuckoo-shrike (<i>Coracina papuensis</i>)	black-faced cuckoo-shrike (<i>Coracina novaehollandiae</i>)	black-faced cuckoo-shrike (<i>Coracina novaehollandiae</i>)
common koel (<i>Eudynamys scolopacea</i>)	white-bellied cuckoo-shrike (<i>Coracina papuensis</i>)	white-bellied cuckoo-shrike (<i>Coracina papuensis</i>)
dollarbird (<i>Eurystomus orientalis</i>)	spangled drongo (<i>Dicrurus bracteatus</i>)	dollarbird (<i>Eurystomus orientalis</i>)
nankeen kestrel (<i>Falco cenchroides</i>)	spotted nightjar (<i>Eurostopodus argus</i>)	nankeen kestrel (<i>Falco cenchroides</i>)
whistling kite (<i>Haliastur sphenurus</i>)	nankeen kestrel (<i>Falco cenchroides</i>)	whistling kite (<i>Haliastur sphenurus</i>)



Spring 2010 survey	Autumn 2011 survey	Spring 2011 survey
rainbow bee-eater (<i>Merops ornatus</i>)	whistling kite (<i>Haliastur sphenurus</i>)	rainbow bee-eater (<i>Merops ornatus</i>)
satin flycatcher (<i>Myiagra cyanoleuca</i>)	rainbow bee-eater (<i>Merops ornatus</i>)	satin flycatcher (<i>Myiagra cyanoleuca</i>)
Australian pelican (<i>Pelecanus conspicillatus</i>)	southern boobook (<i>Ninox novaeseelandiae</i>)	southern boobook (<i>Ninox novaeseelandiae</i>)
channel-billed cuckoo (<i>Scythrops novaehollandiae</i>)	Australian pelican (<i>Pelecanus conspicillatus</i>)	nankeen night heron (<i>Nycticorax caledonicus</i>)
forest kingfisher (<i>Todiramphus macleayi</i>)	tree martin (<i>Petrochelidon nigricans</i>)	tree martin (<i>Petrochelidon nigricans</i>)
sacred kingfisher (<i>Todiramphus sanctus</i>)	straw-necked ibis (<i>Threskiornis spinicollis</i>)	channel-billed cuckoo (<i>Scythrops novaehollandiae</i>)
silveryeye (<i>Zosterops lateralis</i>)	forest kingfisher (<i>Todiramphus macleayi</i>)	forest kingfisher (<i>Todiramphus macleayi</i>)
	sacred kingfisher (<i>Todiramphus sanctus</i>)	sacred kingfisher (<i>Todiramphus sanctus</i>)
	silveryeye (<i>Zosterops lateralis</i>)	

In addition to the 23 EPBC Act listed marine species recorded at the Project Area, 31 marine species were predicted to occur (SEWPAC Protected Matters Search Tool) and/or have been previously recorded from the desktop search extent (as defined in Table 1-2).

Table 3-7 details the likelihood of occurrence and habitat preferences for EPBC Act listed marine birds revealed through the desktop assessment (and not recorded during the field surveys). Broad fauna habitat types identified from the Project Area are displayed in Figure 2-6 (and Figure 2-6 in Appendix B). Those birds that are also listed as migratory are discussed in Table 3-4.

Table 3-7 Commonwealth listed marine birds – likelihood of occurrence

Scientific name	EPBC Act status	Predicted to occur	Previously recorded	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
brown goshawk <i>Accipiter fasciatus</i>	marine	x	WO BA	x	This species is common and widespread throughout Australia. Habitat preferences include open forests, woodlands, scrublands and farmlands (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
magpie goose <i>Anseranas semipalmata</i>	marine	✓	Not previously recorded	x	Distribution of this species extends up to 300 km from the coast in eastern and northern Australia. Habitat preferences include large seasonal wetlands and well vegetated dams with rushes and sedges; wet grasslands and floodplains (Pizzey and Knight, 2007).	Not previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area May occur
shining bronze-cuckoo <i>Chalcites lucidus</i>	marine	x	WO	x	Habitat preferences include rainforests, forests, woodlands and gardens. Distribution throughout eastern Australia (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
black-eared cuckoo <i>Chalcites osculans</i>	marine	x	WO	x	Inhabits dried woodlands, scrublands, mallee, mulga, saltmarsh and riverside thickets. Uncommon distribution through inland and drier coastal environments (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
red-capped plover <i>Charadrius ruficapillus</i>	marine	x	WO	x	Inhabits inland and coastal habitats including broad beach areas and bare margins of saline wetlands and lakes. Widespread distribution (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur

Scientific name	EPBC Act status	Predicted to occur	Previously recorded	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
whiskered tern <i>Chlidonyias hybrida</i>	marine	x	WO	x	Habitat preferences include vegetated and open wetlands, saline lakes, irrigated areas and saltfields. Migrates to northern Australia in autumn-winter (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
silver gull <i>Chroicocephalus novaehollandiae</i>	marine	x	WO BA	x	Inhabits waters near the coast and extends far inland, town lakes, gardens, sewage ponds, sports fields. Common and widespread distribution (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
cicadabird <i>Coracina tenuirostris</i>	marine	x	WO BA	x	Inhabits canopy of rainforests, eucalypt forests, woodlands, paperbarks and mangroves. Distribution across coastal northern and eastern Australia (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
stubble quail <i>Coturnix pectoralis</i>	marine	x	WO BA	x	Inhabits cereal crops and stubbles, overgrown pastures, grasslands with thistles and weedy margins of wetlands. Occurs in eastern Australia and southern Queensland and can move far inland (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
wandering whistling-duck <i>Dendrocygna arcuata</i>	marine	x	WO	x	Habitat preferences include well vegetated lagoons and swamps, flooded grasslands, river margins, and well-vegetated large dams. Occurs in tropical and subtropical northern Australia (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur



Scientific name	EPBC Act status	Predicted to occur	Previously recorded	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
little egret <i>Egretta garzetta</i>	marine	x	WO; BA	x	Inhabits tidal mudflats, saltmarshes, mangroves and freshwater wetlands. Common and widespread (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
white-throated nightjar <i>Eurostopodus mystacalis</i>	marine	x	WO BA	x	Inhabits bare ground on dry ridges with groundcover microhabitats, coastal heath, forests, woodlands and wallum country. Occurs along coastal eastern Australia (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
gull-billed tern <i>Gelochelidon nilotica</i>	marine	x	WO	x	Inhabits fresh, brackish wetlands, beaches, mudflats, inland swamps, lakes, grasslands and agricultural areas. Summer migrant to Australia, widespread distribution (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
black-winged stilt <i>Himantopus himantopus</i>	marine	x	WO BA	x	Inhabits fresh and brackish swamps, shallow river or lake margins, dams, saltmarshes and estuaries. Widespread within suitable habitat (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
red-necked avocet <i>Recurvirostra novaehollandiae</i>	marine	x	WO	x	Inhabits estuaries, tidal mudflats, swamps and lakes, and claypans. Widespread but irregular in southern Australia. Mostly uncommon visitor to parts of northern Australia (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur

Scientific name	EPBC Act status	Predicted to occur	Previously recorded	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
Australian white ibis <i>Threskiornis molucca</i>	marine	x	WO	x	Inhabits wetlands, irrigated areas, dam margins, floodplains, tidal mudflats, pasture and orchards. Widespread in east, north-east and west Australia (Pizzey and Knight, 2007).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
# Predicted to occur within approximately 50 km of Project Area: SEWPAC Protected Matters Search Tool						
* Previously recorded within approximately 50 km of Project Area: desktop sources including Wildlife Online / Birds Australia						

3.3 State Matters of Conservation Significance

3.3.1 Regional Ecosystems

The occurrence of REs within the Project Area is discussed in Section 2.3.1.

Table 2-2 (and Table 2-2 in Appendix B) details each RE description, location and area calculation within the Project Area (EPC 1690 and EPC 1080, respectively). Field verified RE mapping is presented in Figure 2-4 (and Figure 2-4 in Appendix B).

3.3.2 Environmentally Sensitive Areas

There are no Category A ESAs within the Project Area. Seven REs with an endangered biodiversity status, which are classified as Category B ESAs are present within the Project Area from field verification (10.4.3, 10.9.3, 11.3.1, 11.4.5, 11.4.6, 11.4.8 and 11.4.9).

Table 2-2 (and Table 2.2 in Appendix B) details each RE within the Project Area including those with an endangered biodiversity status classified as Category B ESAs.

The Bygana West Nature Refuge, located within the Project Area is also classified as a Category C ESA.

3.3.3 Mapped Regrowth Vegetation

Mapped regrowth vegetation regulated under the VM Act within the Project Area is discussed in Section 2.3.1 (and Section 2.1.1 of Appendix B).

The regrowth mapping within the Project Area is provided as Figure 2-5 (and Figure 2-5 of Appendix B).

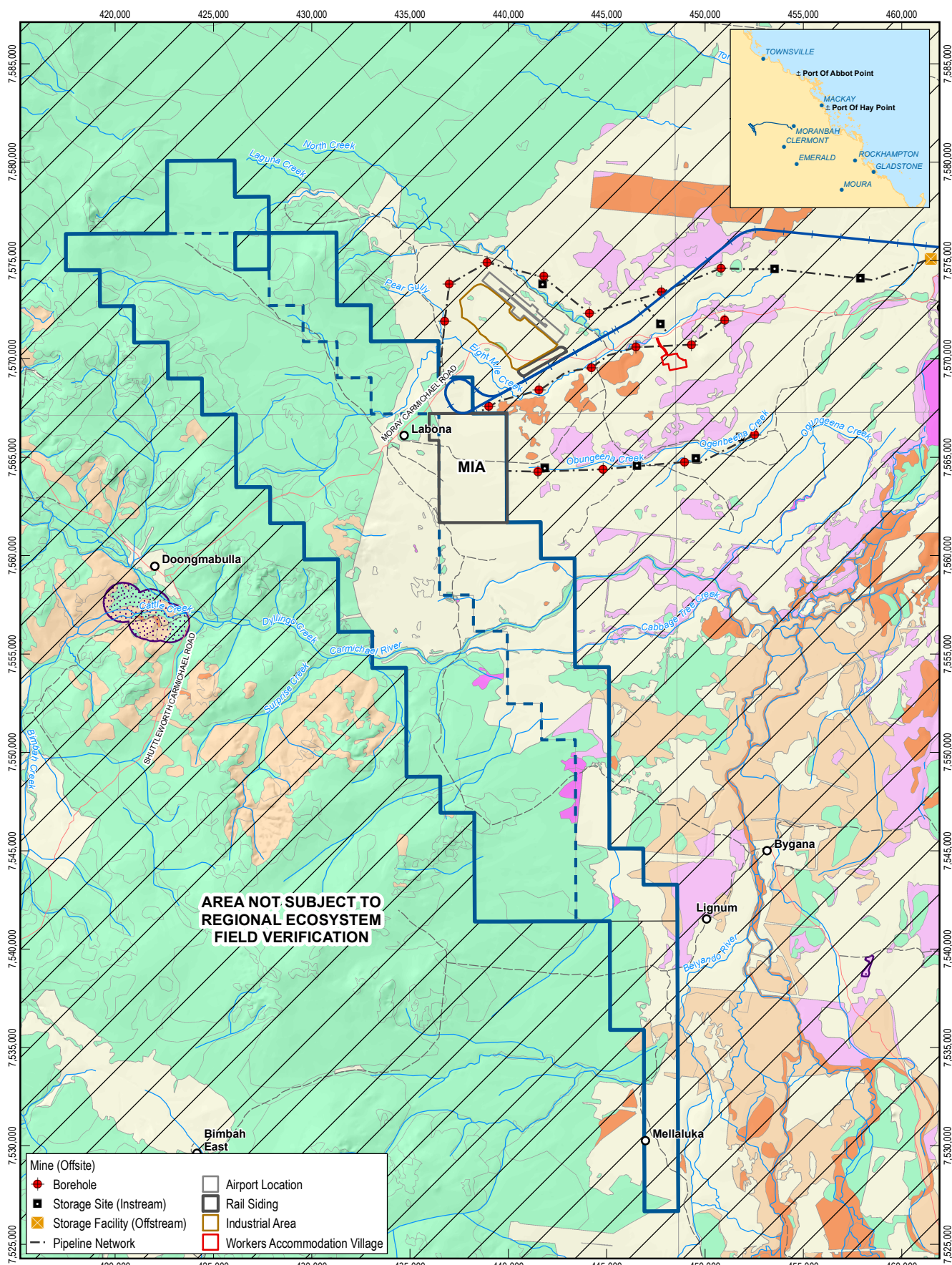
3.3.4 Essential Habitat

No DNR mapped Essential Habitat occurs within the Project Area. Essential Habitat for nine NC Act listed species occurs within 50 km of the Project Area (details summarised in Table 3-8). Essential Habitat patches mapped in the landscape surrounding the Project Area are presented in Figure 3-13.

Table 3-8 Essential Habitat within 50 km of Project Area

Species	EPBC Act / NC Act status	Approximate distance of Essential Habitat patch from centre of Project Area	Approximate co-ordinate of centre of Essential Habitat Patch
Plants			
blue devil <i>Eryngium fontanum</i>	endangered / endangered	13 km south-west	55K 420528, 7558194
<i>Hydrocotyle dippleura</i>	not listed / vulnerable	13 km south-west	55K 420528, 7558194

Species	EPBC Act / NC Act status	Approximate distance of Essential Habitat patch from centre of Project Area	Approximate co-ordinate of centre of Essential Habitat Patch
<i>Myriophyllum artesium</i>	not listed / endangered	13 km south-west	55K 420528, 7558194
<i>Sclerolaena everistiana</i>	not listed / not listed (previously rare)	12 km south-west	55K 421660, 7557939
<i>Sporobolus pamelae</i>	not listed / endangered	13 km south-west	55K 420528, 7558194
<i>Sporobolus partimpatens</i>	not listed / near threatened	13 km south-west	55K 420528, 7558194
Reptiles			
<i>Ctenotus capricorni</i>	not listed / near threatened	38 km south-east	55K 457971, 7540142
Mammals			
northern hairy nosed wombat <i>Lasiorhinus krefftii</i>	endangered / endangered	50 km south-east	55K 465465, 7529837
little pied bat <i>Chalinolobus picatus</i>	not listed / near threatened	40 km north-west	55K 399857, 7591300



LEGEND

- | | | | |
|---------------|----------------------------|----------------------------------|------------------------------------|
| ○ Homestead | — Rail (West) | ✿ VMA Essential Habitat | Field Verified Regional Ecosystems |
| — Local Road | ■ Mine (Onsite) | ✿ VMA Essential Regrowth Habitat | ✿ Endangered - Dominant |
| — Track | ■ Mine Infrastructure Area | | ✿ Endangered - Sub-dominant |
| — Watercourse | | | ✿ Of Concern - Dominant |
| | | | ✿ Of Concern - Sub-dominant |
| | | | ✿ Of Least Concern |
| | | | ✿ Non-remnant |

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

**Essential Habitat in the Landscape
Surrounding the Project Area**

Job Number 41-25215
Revision B
Date 29-08-2012

Figure 3-13

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3.3.5 State Listed Threatened Flora

Overview

The desktop assessment indicated that 11 NC Act listed threatened flora species have been previously recorded or are predicted to occur within the desktop search extent encompassing the Project Area (as defined in Table 1-2). Of these, none were confirmed present during field surveys in the Project Area. A further six NC Act listed threatened flora species were identified in the Project terms of reference for consideration in this assessment. None of these species were identified through the desktop assessment (i.e. predicted to occur or previously recorded in desktop search extent). One species, the waxy cabbage palm, listed as threatened under the NC Act, but not identified in the desktop review, was confirmed present in the Project Area.

A likelihood of occurrence assessment for NC Act listed threatened flora species was undertaken in accordance with the definitions outlined in Section 1.5.7. The outcomes of this assessment are presented in Table 3-9 and discussed further below.

Table 3-9 State listed threatened flora - likelihood of occurrence

Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
<i>Acacia deuteroneura</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species				
<i>Aristida burraensis</i>	near threatened	x	WO	x	Restricted to Burra Range, on sandstone in <i>Eucalyptus similis</i> woodland (Sharp and Simon, 2002). <i>Eucalyptus similis</i> woodland is common in Project Area on red soils within RE 10.5.1. REs 10.5.1, 10.7.3, 10.7.4, and 10.7.7 are all listed as habitat for this taxon. However, the Burra Range is approximately 160 km north of the Project Area. Closest known location is >125 km north-west of the Project Area (HERBRECS 2011).	Previously recorded in region (i.e. desktop search extent). Current known distribution does not incorporate Project Area Potentially suitable habitat is present in the Project Area in the form of RE 10.5.1, 10.7.3, 10.7.4 and 10.7.7 Unlikely to occur
<i>Cadetia collinsii</i>	near threatened	x	WO	x	Restricted to Cape York Peninsula in rainforest on the coastal side of ranges (Jones <i>et al</i>, 2010). This record is over a thousand kilometres away from its known range and is an error that has been confirmed with Queensland Herbarium.	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area Unlikely to occur
<i>Marlborough blue cycad</i> <i>Cycas ophiolitica</i>	endangered	Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species				
<i>king blue-grass</i> <i>Dichanthium queenslandicum</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species				
<i>finger panic grass</i> <i>Digitaria porrecta</i>	near threatened	Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species				
<i>Eriocaulon carsonii</i>	endangered	Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species				



Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
blue devil <i>Eryngium fontanum</i>	endangered		Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species			
black ironbox <i>Eucalyptus raveretiana</i>	vulnerable		Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species			
<i>Fimbristylis vagans</i>	near threatened	x	WO	x	The only records for this species are for far south-eastern Queensland - this species has been recorded near Chinchilla in the Darling Downs district, growing in moist places on sandy soil (Integrated Botanical Information System, 2011). This appears to be an erroneous record (confirmed with Queensland Herbarium).	Not previously recorded in region (i.e. desktop search extent) and current known distribution does not incorporate Project Area. Unlikely to occur
<i>Hydrocotyle dipleura</i>	vulnerable	x	WO HERBRECS	x	A water plant associated with mounds springs fed by the Great Artesian Basin. This species is only found near Aramac, Clermont and Eulo (Bean and Henwood, 2003). It grows on the flat dried-out margins of artesian springs in highly saline sands or clay soils (Bean and Henwood (2003) as cited in Bean and Mayhew (2009)). No mound springs are found within the Project Area. Closest known location is 7 km south-west of the Project Area.	Previously recorded in region (i.e. desktop search extent) Required habitat (artesian springs) not present in Project Area Unlikely to occur
<i>Lawrencia buechananensis</i>	vulnerable		Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species			
waxy cabbage palm <i>Livistona lanuginosa</i>	vulnerable		Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species			

Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
<i>Myriophyllum artesium</i>	endangered	x	WO HERBRECS	x	A water plant associated with mounds springs fed by the Great Artesian Basin. This plant can also colonise bore drains in Queensland (Fensham <i>et al</i> , 2010). No mound springs are found within the Project Area. Closest known location is 7 km south-west of the Project Area.	Previously recorded in region (i.e. desktop search extent) Required habitat (artesian springs) not present in Project Area Unlikely to occur
<i>Nesaea robertsii</i>	endangered	x	WO HERBRECS	x	A low shrub found in brigalow, gidgee and coolabah woodlands on clay/alluvium (from HERBRECS records). Suitable habitat occurs in the Project Area within REs 10.3.14, 10.4.5, 11.3.1, 11.3.3, 11.3.5 and 11.4.6. RE 10.3.4 is listed as habitat for this taxon. Closest known locations are 27 km north-west and 33 km south-west of the Project Area.	Previously recorded in region (i.e. desktop search extent) and potentially suitable habitat occurs at Project Area May occur
<i>Ozothamnus eriocephalus</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-2 (Section 3.2.4) for discussion of this species				
<i>Peripleura scabra</i>	near threatened	x	WO HERBRECS	x	An erect annual herb. Occurs in ironbark or lancewood woodland on rocky slopes, usually with skeletal soils (granite or sandstone is most common) (Calvert <i>et al</i> , 2005). Suitable habitat occurs in the Project Area within REs 10.3.28 and 10.7.3. Closest known locations are 30 km east and 36 km south-west of the Project Area.	Previously recorded in region (i.e. desktop search extent) and potentially suitable habitat occurs at Project Area May occur
<i>Sporobolus pamelae</i>	endangered	x	WO HERBRECS	x	A tussock grass endemic with mound springs fed by the Great Artesian Basin. No mound springs are found within the Project Area. Closest known location is 10 km south-west of the Project Area.	Previously recorded in region (i.e. desktop search extent) Required habitat (artesian springs) not present in Project Area Unlikely to occur



Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
<i>Sporobolus partimpatens</i>	near threatened	x	WO HERBRECS	x	A locally common grass species growing on clay pans and low dunes in a restricted zone around Lake Galilee (Simon ,2005). The Project Area is approximately 20 km to the south-west of Lake Galilee.	Previously recorded in region (i.e. desktop search extent) Required habitat (artesian springs) not present in Project Area Unlikely to occur

Predicted to occur within approximately 50 km of Project Area: SEWPAC Protected Matters Search Tool

* Previously recorded within approximately 50 km of Project Area: desktop sources including Wildlife Online / HERBRECS



3.3.5.1 State Listed Threatened Flora – Confirmed Present

Waxy cabbage palm was the only flora species listed as threatened under the NC Act to be confirmed present within the Project Area. This species is listed as vulnerable, and was observed as two mature individuals in the channel of the Carmichael River. It is discussed in Section 3.2.4.1.

3.3.5.2 State Listed Threatened Flora – Likely to Occur

No flora species listed under the NC Act are considered likely to occur.

3.3.5.3 State Listed Threatened Flora – May Occur

The following NC Act listed threatened flora species may occur at the Project Area, based on geographic distribution, previous records and habitat suitability:

- ▶ *Nesaea robertsii* - endangered NC Act
- ▶ *Peripleura scabra* – near threatened NC Act

These two species have the potential to occur in remnant vegetation at the Project Area. *Nesaea robertsii* is commonly associated with gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains. *Peripleura scabra* is commonly associated with ironbark-box grassy woodland and open woodland on grey sand plains or woodland and low open woodland associated with laterised sandstone rises and minor pediments.

3.3.5.4 State Listed Threatened Flora – Unlikely to Occur

As discussed in Section 3.2.4.3, a number of NC Act listed threatened flora species were predicted to occur at the Project Area by the Protected Matters Search Tool (or have been historically recorded from the region). Due to their current known distribution and/or the lack of suitable habitat at the Project Area, it is considered that *Aristida burraensis*, *Cadetia collinsii*, *Fimbristylis vagans*, *Hydrocotyle dipleura*, *Myriophyllum artesium*, *Sporobolus pamela*, and *Sporobolus partimpatens* are unlikely to occur at the Project Area.

3.3.6 State Listed Threatened Fauna

Overview

The desktop assessment indicated that 19 NC Act listed threatened fauna species have been previously recorded or are predicted to occur within the desktop search extent encompassing the Project Area. Of these, five were confirmed present during field surveys in the Project Area:

- ▶ Black-throated finch (southern)
- ▶ Squatter pigeon (southern)
- ▶ Black-necked stork (*Ephippiorhynchus asiaticus*)
- ▶ Cotton pygmy-goose (*Nettapus coromandelianus*)
- ▶ Little pied bat (*Chalinolobus picatus*)

An additional NC Act listed threatened fauna species (greater long-eared bat (*Nyctophilus timoriensis*)) was identified in the Project terms of reference for consideration in this assessment. This species was not identified through the desktop assessment (i.e. predicted to occur or previously recorded in desktop search extent), nor was it confirmed present during field investigations.



A likelihood of occurrence assessment for NC Act listed threatened fauna species was undertaken in accordance with the definitions outlined in Section 1.5.7. The outcomes of this assessment are presented in Table 3-10 and discussed further below.

Table 3-10 State listed threatened fauna – likelihood of occurrence

Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
Reptiles						
<i>Ctenotus capricorni</i>	near threatened	x	WO	x	This species is has a restricted distribution in western central Queensland. It is known from semi-arid sandy areas featuring spinifex associated with shrub land / woodland (Wilson and Swan, 2008).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Known distribution does not encompass Project Area Unlikely to occur
ornamental snake <i>Denisonia maculata</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
yakka skink <i>Egernia rugosa</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
Dunmall's snake <i>Furina dunmalli</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
brigalow scaly-foot <i>Paradelma orientalis</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
golden-tailed gecko <i>Strophurus taenicauda</i>	near threatened	x	QM	x	The golden-tailed gecko occurs through south-east and coastal central Queensland – most records of this species are from the Brigalow Belt Bioregion. It inhabits open woodland habitats – namely dry sclerophyll woodland featuring a mix of ironbarks (<i>Eucalyptus spp.</i>), brigalow (<i>Acacia harpophylla</i>) and cypress pine (<i>Callitris spp.</i>)	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Known distribution does not encompass Project Area Unlikely to occur

Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
Mammals						
little pied bat <i>Chalinolobus picatus</i>	near threatened	x	WO	x	The little pied bat is located through central Queensland and into north-west New South Wales. In central-western Queensland this species reaches its greatest relative abundance in riverine open forest communities (Churchill, 2008). A variety of woodland and open forest habitats are utilised by this species (Churchill, 2008). Roosting habitat includes tree hollows, caves and abandoned buildings and mines (Churchill, 2008).	Previously recorded in region Suitable habitat occurs at Project Area Confirmed present – this species was detected (via Anabat) from four locations at Project Area during Autumn 2011 and Spring 2011 surveys
northern hairy-nosed wombat <i>Lasiorhinus krefftii</i>	endangered	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
greater bilby <i>Macrotis lagotis</i>	endangered	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
greater long-eared bat <i>Nyctophilus timoriensis</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
Birds						
black-necked stork <i>Ephippiorhynchus asiaticus</i>	near threatened	x	WO	✓	The black necked-stork occurs throughout eastern and central Queensland, and across much of northern Australia. It favours habitats featuring wetlands, swamps and riverine areas (Marchant and Higgins, 1990). It occasionally occurs in woodland and grassland habitats (Marchant and Higgins, 1990). Nesting usually occurs at the top of tall trees (Marchant and Higgins, 1990).	Previously recorded in region (i.e. desktop search extent) Suitable habitat occurs at Project Area Confirmed present – this species was observed at farm dams in the Project Area during the Spring 2010, Autumn 2011 and Spring 2011 surveys

Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
red goshawk <i>Erythrorhynchus radiatus</i>	endangered	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
squatter pigeon (southern) <i>Geophaps scripta scripta</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
square-tailed kite <i>Lophoictinia isura</i>	near threatened	x	WO BA	x	This species is patchily distributed through much of coastal Australia, extending inland through central Queensland (Marchant and Higgins, 1993). In inland areas the square-tailed kite generally occurs along timbered watercourses. This species occasionally forages in open habitats but is more generally restricted to woodland and forest habitats supporting high numbers of passerines (a key food source) (Marchant and Higgins, 1993).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
black-chinned honeyeater <i>Meliphreptus gularis</i>	near threatened	x	WO	x	The black-chinned honeyeater occurs through much of eastern, northern and central Australia. It inhabits eucalypt woodlands and open forests, especially where box and ironbark species are present (Higgins <i>et al</i> , 2001). In arid and semi-arid areas the black-chinned honeyeater is often associated with riparian and littoral areas (Higgins <i>et al</i> , 2001).	Previously recorded in region (i.e. desktop search extent) Potentially suitable habitat occurs at Project Area Likely to occur
star finch (eastern, southern) <i>Neochmia ruficauda ruficauda</i>	endangered	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				

Species	NC Act status	Predicted to occur [#]	Previously recorded*	Recorded at Project Area	Habitat preferences and known distribution	Likelihood of occurrence
cotton pygmy-goose <i>Nettapus coromandelianus</i>	near threatened	✓	Not previously recorded	✓	The cotton pygmy-goose occurs in eastern and central Queensland. It is an almost entirely aquatic species, with a preference for deep, permanent fresh water bodies (Marchant and Higgins, 1990). Habitats featuring floating and submerged vegetation interspersed with open water are favoured (Marchant and Higgins, 1990).	Not previously recorded in region (i.e. desktop search extent) Suitable habitat occurs at Project Area Confirmed present – this species was observed at farm dams in the Project Area during the Spring 2011 survey
black-throated finch (southern) <i>Poephila cincta cincta</i>	endangered	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
paradise parrot <i>Psephotus pulcherrimus</i>	extinct in the wild	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
Australian painted snipe <i>Rostratula australis</i>	vulnerable	Also listed under EPBC Act - refer to Table 3-3 (Section 3.2.5) for discussion of this species				
# Predicted to occur within approximately 50 km of Project Area: SEWPAC Protected Matters Search Tool						
* Previously recorded within approximately 50 km of Project Area: desktop sources including Wildlife Online (WO) / Birds Australia (BA) / Queensland Museum (QM)						

3.3.6.1 State Listed Threatened Fauna – Confirmed Present

Five NC Act listed threatened fauna species were recorded from the Project Area. The black-throated finch (southern) and squatter pigeon (southern) (both listed under the EPBC Act) are discussed in Section 3.2.5.1.

Black-necked Stork

This species was observed at farm dams at and near the Project Area during the Spring 2010, Autumn 2011 and Spring 2011 surveys.

The black-necked stork is widely distributed across northern and eastern Australia. It is generally associated with aquatic habitats including wetlands, lakes, dams, rivers, tidal flats and estuaries. It may also forage in nearby grassland and open woodland habitats. A large nest, which is often used over a series of successive breeding seasons, is constructed in a large tree, generally near water.

A number of large farm dams at the Project Area, in addition to the Carmichael River, are likely to provide habitat for the black-necked stork. Beyond the Project Area, farm dams, waterways associated with the Doongmabulla Springs to the west of the Project Area, and the Belyando River (into which the Carmichael River flows to the east of the Project Area) are likely to provide habitat for this species.

Cotton pygmy-goose

This species inhabits coastal and inland waterways typified by large expanses of relatively deep water featuring floating and emergent macrophytes. Large farm dams, inland lakes, swamps and backwaters on large rivers provide such habitat for the cotton pygmy-goose.

As reported in Appendix B, this species was noted on six occasions at the EPC 1080 Study Area during the Spring 2011 survey, at dams in and near the eastern part of the Project Area. Larger dams featuring macrophyte growth within the Project Area, and in the surrounding landscape, are likely to provide habitat for this species.

Little Pied Bat

The little pied bat was detected (via Anabat) at four locations during the Autumn 2011 survey. Six calls attributed to this species were recorded by an Anabat detector in melaleuca and eucalyptus woodland fringing the Carmichael River (Fauna Comprehensive Site 10) on the night of 15 April 2011. One call was recorded from the same habitat type along the Carmichael River at Fauna Comprehensive Site 11 on the night of 16 April 2011. The species was recorded from eucalypt woodland habitat at the south of the Project Area (Fauna Comprehensive Sites 13 and 16) on 8 April 2011 (2 calls) and 7 April 2011 (4 calls) (respectively). During the Spring 2011 survey, the species was detected at one location on the night of 16 November (four calls recorded).

The little pied bat occurs through southern and central Queensland and central New South Wales. It inhabits a range of dry open woodland vegetation types throughout its range (Thompson *et al*, 2011). In more arid parts of Queensland, riverine vegetation featuring river red gum is known to be utilised by the species (Thompson *et al*, 2011). Abundance of this species in semi-arid and arid regions may increase with proximity to permanent or semi-permanent water (Thompson *et al*, 2011). The little pied bat roosts in tree hollows, building, caves and abandoned mine shafts (Churchill, 2008).

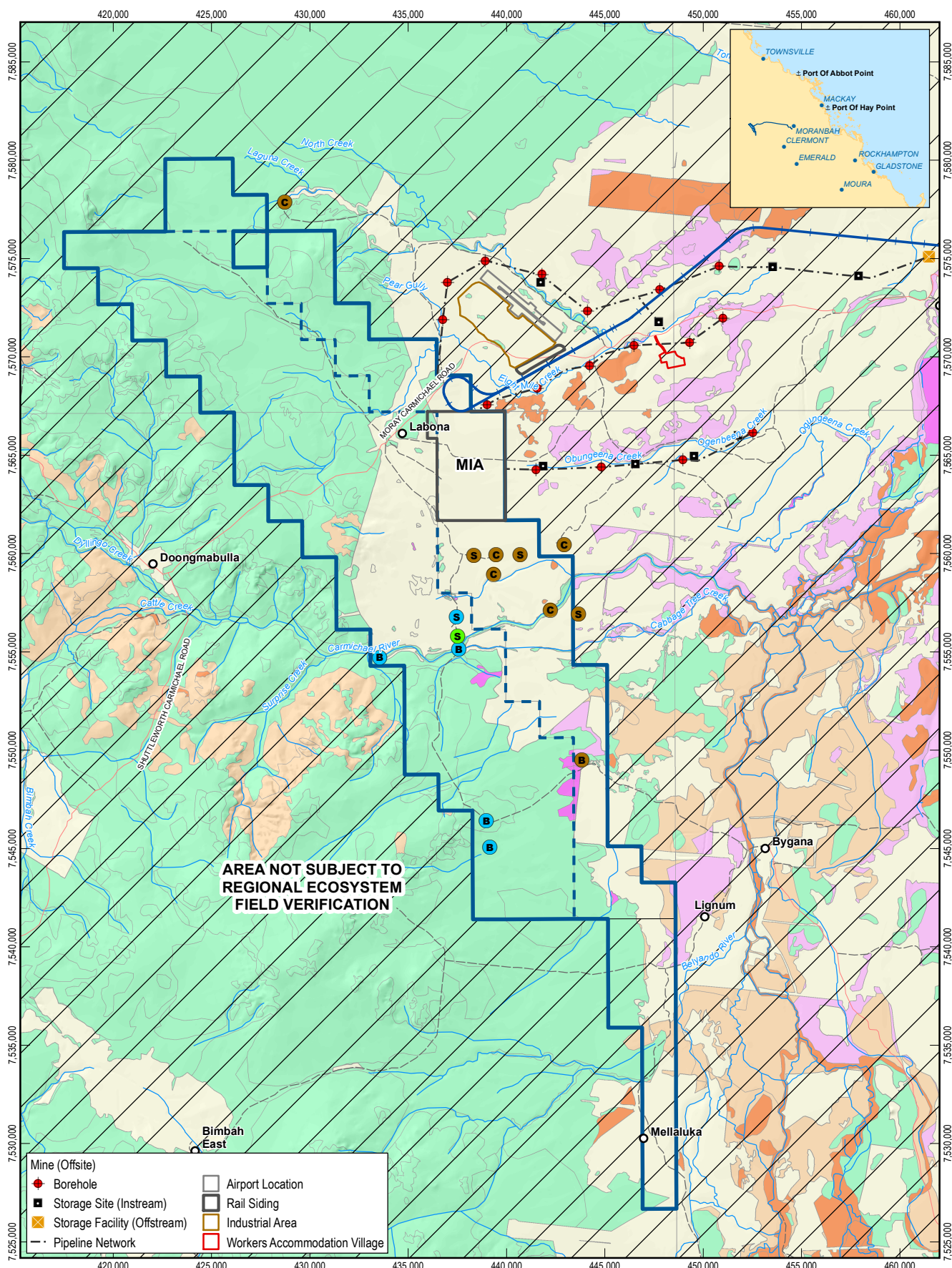


Mature (i.e. remnant) woodland featuring roosting habitat (tree hollows) at the Project Area and in the surrounding landscape is likely to support this species. This corresponds with the following habitat types at the Project Area:

- ▶ *Ironbark-box grassy woodlands and open woodlands on grey sand plains*
- ▶ *Yellow jacket and rough-leaved bloodwood shrubby low open woodland on red sand plains*
- ▶ *Tall mixed shrubland on red sand plains and over ferricrete*
- ▶ *Gidgee and/or brigalow shrubby woodland, sometimes with Dawson's gum emergents, on clay and loam plains*
- ▶ *Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding*
- ▶ *Woodland and low open woodland associated with laterised sandstone rises and minor pediments*

Large hollows were particularly prevalent in river red gum trees growing along the Carmichael River. As such, this may represent (locally) high-quality habitat for the little pied bat.

Records of the black-necked stork, cotton pygmy-goose and little pied bat from field studies at the Project Area are presented in Figure 3-14.



LEGEND

- Black-necked stork records - Spring 2010
- Black-necked stork records - Autumn 2011
- Black-necked stork records - Spring 2011

- Homestead
- Local Road
- Track
- Watercourse

- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area

- Field Verified Regional Ecosystems
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant

- Of Concern - Sub-dominant
- Of Least Concern
- Non-remnant

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

**Location of State Listed Threatened
Fauna Records - Project Area**

Job Number 41-25215
Revision B
Date 29-08-2012

Figure 3-14

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3.3.6.2 State Listed Threatened Fauna – Likely to Occur

In addition to the ornamental snake and yakka skink (discussed in Section 3.2.5.2), the following NC Act listed threatened fauna species are considered likely to occur at the Project Area, based on distribution, previous records and habitat suitability:

- ▶ Square-tailed kite (*Lophoictinia isura*) – near threatened NC Act
- ▶ Black-chinned honeyeater (*Melithreptus gularis*) – near threatened NC Act

These species have the potential to occur in remnant open woodland vegetation at the Project Area (i.e. *Ironbark-box grassy woodlands and open woodlands on grey sand plains*). Riparian and floodplain vegetation associated with the Carmichael River are likely to represent particularly ideal habitat for the square-tailed kite and black-chinned honeyeater.

3.3.6.3 State Listed Threatened Fauna – May Occur

Beyond the red goshawk and Australian painted snipe (discussed in Section 3.2.5.3), it is not considered that any other NC Act listed threatened fauna species may occur at the Project Area.

3.3.6.4 State Listed Threatened Fauna – Unlikely to Occur

As discussed in Section 3.2.5.4, a number of NC Act listed threatened fauna species were predicted to occur at the Project Area by the SEWPAC Protected Matters Search Tool (or have been historically recorded from the region). Due to their current known distribution and/or the lack of suitable habitat at the Project Area, it is considered that *Ctenotus capricorni*, golden-tailed gecko, Dunmall's snake, brigalow scaly-foot, northern hairy-nosed wombat, greater bilby, greater long-eared bat, star finch (eastern, southern) and paradise parrot are unlikely to occur at the Project Area.

3.3.6.5 State Listed Special Least Concern Fauna

Under section 34(3) of the Queensland *Nature Conservation (Wildlife) Regulation 2006*, the following animals are designated as special least concern wildlife:

- ▶ Koala (*Phascolarctos cinereus*)
- ▶ Echidna (*Tachyglossus aculeatus*)
- ▶ Platypus (*Ornithorhynchus anatinus*)
- ▶ Migratory least concern birds protected under the JAMBA, CAMBA and/or Bonn conventions

In addition to the management intent for least concern wildlife documented in the Regulation, decision makers are required to take into account the special cultural significance and the need to conserve existing populations of special least concern animals.

Traces of the echidna (distinctive diggings and scats) were noted from the central and eastern parts of the Project Area. This common, widespread habitat generalist is likely to occur across much of the Project Area, where remnant vegetation is present.

As discussed in Section 3.2.5.1, no evidence of the koala was detected during the Spring 2010 and Autumn 2011 surveys. One koala was recorded on one occasion during spotlighting within the south-eastern part of the Project Area (EPC 1080 Study Area) during the Spring 2011 survey. This individual was recorded within an open eucalypt woodland environment representing the '*Ironbark-box grassy woodlands and open woodlands on grey sand plains*' habitat type within the Project Area.



It is likely that the species occurs at low densities in remnant open eucalypt woodland across the Project Area.

The platypus is discussed in the Mine Aquatic Ecology Report (Volume 4, Appendix O1).

Three EPBC Act listed migratory species (eastern great egret (JAMBA, CAMBA), rainbow bee-eater (JAMBA), satin flycatcher (Bonn)) were recorded at the Project Area. These species are special least concern under the NC Act. An additional 11 EPBC Act listed migratory birds (and thus NC Act special least concern) are considered likely to occur at the Project Area (see Section 3.2.7).

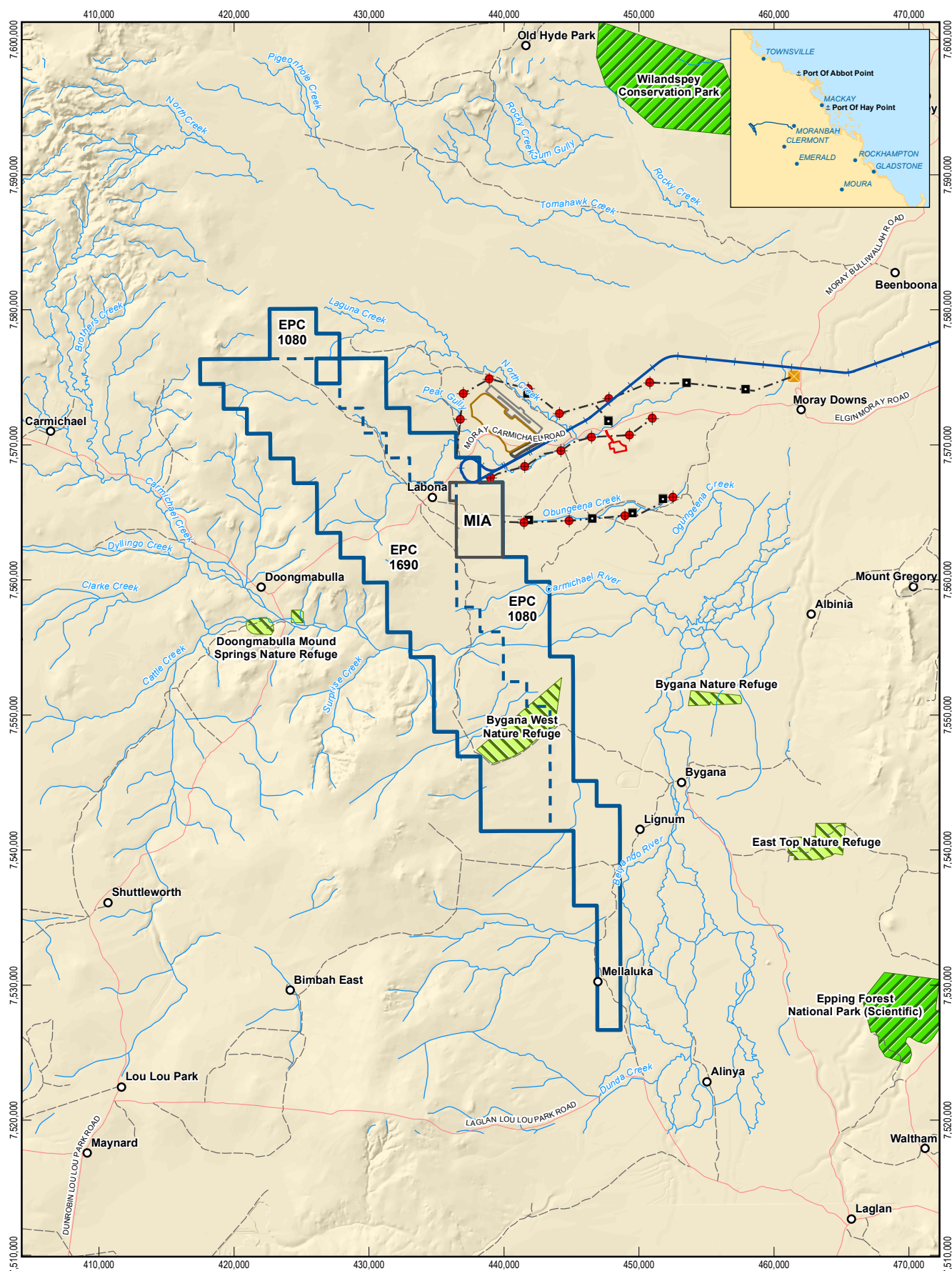
3.3.7 Protected Areas

Six protected areas occur within 50 km of the Project Area:

- ▶ Bygana West Nature Refuge – occurs within and east of southern part of Project Area
- ▶ Epping Forest National Park (Scientific) – approximately 45 km south-east of centre of Project Area
- ▶ Doongmabulla Mound Springs Nature Refuge – approximately 10 km west of centre of Project Area
- ▶ Bygana Nature Refuge – approximately 25 km south-east of centre of Project Area
- ▶ East Top Nature Refuge – approximately 35 km south-east of centre of Project Area
- ▶ Wilandspey Conservation Park – approximately 40 km north-east of centre of Project Area

These areas are listed under the *Nature Conservation (Protected Areas) Regulation 1994* (or subsequent amendments). Nature refuges are declared when a landholder and the Queensland Government enter into a conservation agreement concerning the land. National parks and conservation parks are part of the state land protected areas. All these areas are protected by the provisions of the NC Act.

The locations of protected areas with respect to the Project Area are shown in Figure 3-15.



LEGEND

- | | | | | |
|---------------|----------------------------|---------------------------------|--------------------------------|--------------------|
| ○ Homestead | — Rail (West) | ■ Protected Area | ■ Mine (Offsite) | □ Airport Location |
| — Local Road | ■ Mine (Onsite) | ■ Nature Refuge | ● Borehole | □ Rail Siding |
| — Track | ■ Mine Infrastructure Area | ■ Storage Site (Instream) | ■ Storage Facility (Offstream) | ■ Industrial Area |
| — Watercourse | — Pipeline Network | ■ Workers Accommodation Village | | |

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:400,000 (at A4)
0 2.5 5 7.5 10
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
**Protected Areas Within
50 km of Project Area**

Job Number 41-25215
Revision B
Date 29-08-2012

Figure 3-15

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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); DERM: Protected Area, Nature Refuge (2010); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: BW, CA



3.3.7.1 Bygana West Nature Refuge

The 1,487 ha Bygana West Nature Refuge extends in an approximately south-west to north-east direction across the southern part of the Project Area, to the south of the Carmichael River (see Figure 3-15). The northern border extends for approximately 8.2 km while at its widest point the nature refuge is 2.4 km.

As documented in the Queensland Nature Conservation (Protected Areas) Amendment Regulation (No. 1) 2005, Bygana West Nature Refuge is characterised by the following values:

- ▀ Contains endangered RE 11.4.6 (*Acacia cambagei* woodland on Cainozoic clay plains), which was confirmed during the field survey as present within the Project Area
- ▀ Contains endangered RE 11.4.8 (*Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains) – this RE has low representation in the protected areas estate and was not observed within the Project Area, although it may be present elsewhere in the Nature Refuge
- ▀ Contains other REs that are poorly represented in the protected area estate
- ▀ Due to its location at the boundary of the Brigalow Belt and Desert Uplands bioregions, Bygana West has potential to support high diversity of species and REs
- ▀ Contains suitable habitat for a variety of animals, including the koala – listed as vulnerable under the EPBC Act and a special least concern species under the NC Act

Field surveys within and near the Bygana West Nature Refuge revealed that the dominant vegetation community was a eucalypt woodland assemblage comprising *Eucalyptus melanophloia* and *Eucalyptus crebra* (RE 10.3.28) and *Eucalyptus brownii* (RE 10.3.6). Two small patches of low woodland, characterised by *Eucalyptus cambageana* (with *Acacia harpophylla*), and mixed *Grevillia* and *Acacia* woodland occur in the south west of the Nature Refuge. *Acacia* woodland characterised by brigalow (*Acacia harpophylla*) and gidgee (*Acacia cambagei*) occurs in the easternmost part of the Nature Refuge. The endangered RE 11.4.6 that is listed as a characteristic value of the Nature Refuge in the Queensland Nature Conservation (Protected Areas) Amendment Regulation (No. 1) 2005 occurs as part of mixed polygons in the eastern part of the Nature Refuge, and is the dominant RE in the mixed polygon at the north eastern corner of the Nature Refuge. RE 11.4.8 is mapped as occurring as a sub-dominant component of one very small mixed polygon.

Four fauna habitat types were described in the Bygana West Nature Refuge:

- ▀ *Ironbark-box grassy woodlands and open woodlands on grey sand plains* – this is the dominant habitat type and characterises most of the Nature Refuge.
- ▀ *Yellow jacket and rough-leaved bloodwood shrubby low open woodland on red sand plains* – a patch occurs at the south west corner of the Nature Refuge.
- ▀ *Tall mixed shrubland on red sand plains and over ferricrete* – a patch occurs at the south west corner of the Nature Refuge.
- ▀ *Gidgee and/or brigalow shrubby woodland, sometimes with Dawson's gum emergents, on clay and loam plains* – occurs as part of mixed vegetation polygons in eastern part of Nature Refuge.

Disturbance (i.e. weeds, erosion, and cattle degradation) was not prevalent at Bygana West Nature Refuge, although cattle grazing does occur in the Nature Refuge. Habitats were typically in good condition, and retained connectivity to remnant vegetation to the north-west, west, south and east. Fauna diversity was similar to that from other open woodland habitats in the Project Area, comprising a variety of common woodland and grassland birds, reptiles and ground-dwelling mammals. The black-throated finch (southern) and squatter pigeon (southern) were observed near the southern boundary of the nature refuge – it is likely that both species utilise habitats within the nature refuge. Koalas were not recorded within the nature refuge during field surveys, however are considered likely to occur, at low densities.

The vegetation communities, fauna habitats and fauna species diversity occurring in Bygana West Nature Refuge are characteristic of the communities and habitats observed and assessed throughout much of the southern part of the Project Area. It is considered likely that the ecological values contained within Bygana West Nature Refuge occur in the large tracts of connected remnant vegetation that connect with and extend to the west and south of the Nature Refuge beyond the Project Area.

Plate 3-10 *Eucalyptus brownii* woodland with grass understorey that typifies southern part of Bygana West Nature Refuge (April 2011)



Plate 3-11 Eucalyptus (left) and Acacia (right) woodland fringing ephemeral drainage Line – southern part of Bygana West Nature Refuge (April 2011)





3.3.7.2 Epping Forest National Park (Scientific)

Epping Forest National Park (scientific) is located outside the Project Area, being approximately 45 km south-east of the centre of the Project Area (Figure 3-15). The 2,750 ha park was gazetted in 1971. The landscape within the park is generally flat, and is characterised by a clay pan intersected by ancient and ephemeral watercourses (and associated alluvial deposits) (DERM, 2011e). Vegetation communities in sandy areas (associated with ancient watercourses) are dominated by open eucalypt woodlands, while heavy, grey non-cracking soils support acacia (brigalow and gidgee) scrub (DERM, 2011e).

The primary management intent of Epping Forest National Park (scientific) is to protect the world's largest surviving population of endangered northern hairy-nosed wombats. In 2007 the population of the species in the park was estimated at 138 (DERM, 2011e). Until the translocation of a small number of wombats offsite (post-2008), a 600 ha part of Epping Forest National Park (scientific) was the only place in the world known to support the northern hairy-nosed wombat (DERM, 2011e). In addition to the northern hairy-nosed wombat, Epping Forest National Park (scientific) supports a diversity of common fauna species (10 amphibians, 43 reptiles, 25 mammals, 127 birds). Three other threatened fauna species have been recorded from the park – squatter pigeon (southern), yakka skink and ornamental snake.

3.3.7.3 Doongmabulla Mound Springs Nature Refuge

Doongmabulla Mound Springs Nature Refuge is located outside the Project Area, being approximately 10 km west of the Project Area (see Figure 3-15). The nature refuge consists of two discrete sections (separated east-west by a gap of approximately 1.4 km). The total area of the nature refuge is 280 ha.

As documented in the Nature Conservation (Protected Areas) Amendment Regulation (No. 5) 2000, Doongmabulla Mound Springs Nature Refuge is characterised by the following values:

- Contains significant artesian springs
- Supports the largest Australian populations of the plants *Eryngium fontanum* (endangered – EPBC Act; NC Act) and *Sporobolus pamela* (endangered – NC Act)
- Supports the endangered plant *Eriocaulon carsonii* (near artesian springs).

Remnant vegetation is mapped as occurring within and surrounding the Doongmabulla Mound Springs Nature Refuge. This remnant vegetation extends in a largely intact tract to the north, south and west of the nature refuge. Remnant vegetation extends eastwards from the nature refuge to the Project Area.

3.3.7.4 Bygana Nature Refuge

The 331 ha Bygana Nature Refuge is located outside the Project Area, being approximately 25 km south-east of the centre of Project Area (see Figure 3-15). The south-west corner of the nature refuge is approximately 0.4 km east of the Belyando River. The nature refuge is dominated by an of concern RE mixed polygon comprising three floodplain vegetation assemblages, namely:

- RE 11.3.5: *Acacia cambagei* woodland on alluvial plains (VM Act least concern)
- RE 11.3.3: *Eucalyptus coolabah* woodland on alluvial plains (VM Act of concern)
- RE 11.3.10: *Eucalyptus brownii* woodland on alluvial plains (VM Act least concern)



The Bygana Nature Refuge retains connectivity to the Bygana West Nature Refuge via an east-west belt of remnant vegetation that is bisected by the Belyando River to the immediate west of Bygana Nature Refuge.

3.3.7.5 East Top Nature Refuge

The 875 ha East Top Nature Refuge is located outside the Project Area, being approximately 35 km south-east of the centre of Project Area (see Figure 3-15). It is approximately nine km east of the Belyando River. The nature refuge is dominated by an endangered RE mixed polygon comprising four floodplain vegetation assemblages, namely:

- ▀ RE 11.3.5: *Acacia cambagei* woodland on alluvial plains (VM Act least concern)
- ▀ RE 11.3.3: *Eucalyptus coolabah* woodland on alluvial plains (VM Act of concern)
- ▀ RE 11.3.1: *Acacia harpophylla* and/or *Casuarina cristata* open forest on alluvial plains (VM Act endangered)
- ▀ RE 11.3.10: *Eucalyptus brownii* woodland on alluvial plains (VM Act least concern)

The least concern RE 11.3.7 (*Corymbia* spp. woodland on alluvial plains (sandy soils)) is also present in several small areas within the nature refuge.

The East Top Nature Refuge retains connectivity to the Project Area via a belt of remnant vegetation along an unnamed watercourse to the north of the nature refuge, which in turn links to a larger area of remnant vegetation (including that encompassing the Bygana Nature Refuge). Remnant vegetation west of the Bygana Nature Refuge connects with remnant vegetation in the southern part of the Project Area (at the Bygana West Nature Refuge).

3.3.7.6 Wilandspey Conservation Park

The 5,200 ha Wilandspey Conservation Park (formerly Wilandspey Environmental Park) is located approximately 40 km north-east of the centre of Project Area (see Figure 3-15). Sandy Creek flows through the park to the Belyando River. Mapped remnant vegetation is dominated by the of concern RE 11.4.6 (*Acacia cambagei* woodland on Cainozoic clay plains). Other of concern and endangered REs in the park include:

- ▀ RE 11.3.3: *Eucalyptus coolabah* woodland on alluvial plains (VM Act of concern)
- ▀ RE 11.4.5: *Acacia argyrodendron* woodland on Cainozoic clay plains (VM Act of concern)
- ▀ RE 11.4.8: *Eucalyptus cambageana* woodland to open forest with *Acacia harpophylla* or *A. argyrodendron* on Cainozoic clay plains (VM Act endangered)

A narrow tract of remnant vegetation to the west and south-west of Wilandspey Conservation Park links to a more extensive block of (least concern) remnant vegetation to the south-west, which extends to and occurs within the northern part of the Project Area.

3.4 Regional Matters of Conservation Significance

3.4.1 Department of Environment and Heritage Protection Biodiversity Planning Assessment Mapping

The DEHP BPA mapping, including an overview of regional values, is discussed in Section 2.4.1 (and Section 2.2.1 of Appendix B).

3.4.2 Biodiversity Planning Assessment Expert Panel Reports

Two expert panel reports are of relevance to the Project Area:

- ▶ Brigalow Belt North Landscape Expert Panel Report (EPA, 2008)
- ▶ Desert Uplands Flora, Fauna and Landscape Expert Panel Report (EPA, 2005)

Noteworthy ecological features described in the Brigalow Belt North report of relevance to the Project Area include:

- ▶ A corridor that runs from the Denham Range (approximately 235 km east of the Project Area in the Brigalow Belt bioregion) to the Great Dividing Range (west of the Project Area in the Desert Uplands bioregion) through the Bygana West Nature Refuge (this is mentioned in Section 2.4.1)

Noteworthy ecological features described in the Desert Uplands report of relevance to the Project Area include:

- ▶ Several REs which have special biodiversity values in some instances (dependent variably on condition/position in landscape/patch size) – namely RE 10.3.6, 10.5.1 and 10.3.29. The occurrence of these REs in the Alice Tableland sub-region is notable as they contribute to a biogeographically significant landscape (high species turnover, refuge and disjunction), and contribute to north-south connectivity through the Desert Uplands (associated with the Great Dividing Range). A number of species associated with these REs were recorded from the Project Area including hooded robin (*Melanodryas cucullata*), Australian bustard (*Ardeotis australis*), bush stone-curlew (*Burhinus grallarius*), brown tree creeper (*Climacteris picumnus*), grey-crowned babbler (*Pomatostomus temporalis*), black-throated finch (southern), squatter pigeon (southern), black-necked stork, rufous bettong (*Aepyprymnus rufescens*), desert mouse (*Pseudomys desertor*), inland forest bat (*Vespadelus baverstocki*), common brushtail possum and little pied bat
- ▶ The Doongmabulla Springs (located approximately 10 km south-west of the Project Area) – an area of concentration of flora with biogeographic interest
- ▶ Riparian regional ecosystems associated with large river systems. These function as important flora and fauna refuges (relatively higher nutrient availability, better moisture balance, well developed vegetation)

3.4.3 Burdekin Natural Resource Management Region Priority Taxa

The Burdekin NRM 'Back on Track Actions for Biodiversity' report (the 'Back on Track report') (DERM, 2010a) identifies priority species in the Burdekin NRM region, details the regional threatening processes impacting upon these species, and proposes a range of actions to address regional threats. Priority taxa are identified through the DEHP Back on Track species prioritisation framework, in consultation with a range of stakeholders from the region. The document seeks to guide priority species conservation in the region over the next five years.

Six priority plant species and eight priority vertebrate fauna species listed in the Back on Track report have been historically recorded in the desktop search extent for the Project Area (as defined in Table 1-2). Of these, one species – black-throated finch (southern) was recorded during field surveys at the Project Area. Table 3-11 details ‘Back on Track’ species of relevance to the Project Area, including their regional-specific threats (as documented in the Back on Track report), and whether the species are likely to occur at the Project Area.

Table 3-11 Back on Track priority taxa of relevance to Project Area

Species	Threats and threat impact (sourced from DERM, 2010a)	Species likelihood of occurrence at Project Area
Plants		
<i>Eriocaulon carsonii</i>	Feral animals (pigs) – habitat loss Inappropriate grazing regimes – loss and/or removal of individuals Drainage of habitat – habitat loss Ground water extraction – habitat loss Weeds (exotic ponded pasture species) – competition	Unlikely to occur (see Section 3.2.4)
<i>Eryngium fontanum</i>	Feral animals (pigs) – habitat loss Inappropriate grazing regimes – habitat loss Drainage of habitat – habitat loss Ground water extraction – habitat loss Weeds (exotic ponded pasture species) – habitat loss	Unlikely to occur (see Section 3.2.4)
<i>Eucalyptus raveretiana</i>	Inappropriate grazing regimes – habitat degradation Weeds (rubber vine, exotic pasture species) – habitat degradation Feral animals (pigs) – habitat degradation	Unlikely to occur (see Section 3.2.4)
<i>Hydrocotyle dippleura</i>	Lack of information in the region – inappropriate management	Unlikely to occur (see Section 3.3.5)
<i>Lawrenzia buechananensis</i>	Inappropriate grazing regimes – loss and/or removal of individuals Feral animals (pigs) – loss and/or removal of individuals	Unlikely to occur (see Section 3.2.4)
<i>Myriophyllum artesium</i>	Inappropriate grazing regimes – habitat degradation Feral animals (pigs) – habitat degradation Flow regime – habitat degradation Drainage of habitat – habitat degradation	Unlikely to occur (see Section 3.3.5)
Reptiles		
ornamental snake	Clearing of vegetation – habitat loss	Likely to occur
<i>Denisonia maculate</i>	Feral animals (cane toads, pigs) - loss and/or removal of individuals, competition	(see Section 3.2.5.2)



Species	Threats and threat impact (sourced from DERM, 2010a)	Species likelihood of occurrence at Project Area
yakka skink <i>Egernia rugosa</i>	Inappropriate fire regimes – habitat loss Inappropriate grazing regimes – habitat loss Site maintenance – habitat degradation Feral animals (cats, foxes) – loss and/or removal of individuals Road maintenance – habitat loss	Likely to occur (see Section 3.2.5.2)
brigalow scaly-foot <i>Paradelma orientalis</i>	Clearing of vegetation – habitat loss Inappropriate fire regimes – habitat loss Inappropriate grazing regimes – habitat loss Feral animals (cats) – loss and/or removal of individuals	Unlikely to occur (see Section 3.2.5)
Mammals		
northern quoll <i>Dasyurus hallucatus</i>	Feral animals (cane toads, wild dogs, cats) - loss and/or removal of individuals, competition Urban development – habitat loss Baiting – loss and/or removal of individuals Inappropriate fire regimes – habitat degradation Road kill – loss and/or removal of individuals	Unlikely to occur (see Section 3.2.5)
northern hairy-nosed wombat <i>Lasiorhinus krefftii</i>	Small population size – limited capacity to reproduce Inappropriate fire regimes – habitat loss Macropods – competition Disease – loss and/or removal of individuals Weeds (buffel grass) – habitat degradation	Unlikely to occur (see Section 3.2.5)
Birds		
red goshawk <i>Erythrotriorchis radiatus</i>	Inappropriate fire regimes – habitat degradation Clearing of vegetation – habitat loss Inappropriate grazing regimes – habitat degradation Drainage of habitat – loss of food resources Weeds – habitat degradation	May occur (see Section 3.2.5.3)

Species	Threats and threat impact (sourced from DERM, 2010a)	Species likelihood of occurrence at Project Area
black-throated finch (southern) <i>Poephila cincta cincta</i>	Inappropriate grazing regimes – habitat degradation Urban development – habitat loss Inappropriate fire regimes – habitat degradation Mining – habitat degradation Collectors – loss and/or removal of individuals Feral animals (cats) – loss and/or removal of individuals Weeds – habitat degradation	Confirmed present (see Section 3.2.5.1)
Australian painted snipe <i>Rostratula australis</i>	Weeds (exotic ponded pasture species) – habitat loss Inappropriate grazing regimes – habitat degradation Feral animals (pigs) – habitat degradation Drainage of habitat – habitat degradation Flow regime – habitat loss	May occur (see Section 3.2.5)

The region-specific impacts for those Back on Track species confirmed present or with the potential to occur at the Project Area (i.e. likely to occur, may occur) will be considered as part of the Project impact assessment.



4. Summary of Existing Terrestrial Ecological Values of Project Area

A combined desktop and field assessment was undertaken to describe the existing terrestrial ecological values of the Project Area. Key findings from this assessment (EPC 1690 and EPC 1080 Study Areas) are summarised below. These key findings will form the focus of the impact assessment, with mitigation measures presented to alleviate potential impacts on these values.

- ▶ Remnant vegetation coverage occurs over approximately 60 per cent (28,752 ha) of the Project Area. Where remnant vegetation occurs, a more complex assortment of habitat resources is available for fauna when compared with open cleared land.
- ▶ Habitat values for native fauna are limited in cleared land, due to the lack of microhabitats and the dominant occurrence of buffel grass. Other fragments of cleared land occur near the eastern boundary of the Project Area to the north of the Moray-Carmichael Road, and to the south of the Carmichael River. Fauna habitat values are similarly limited in these fragments. The value of these cleared areas is further limited at the eastern-most part of the Project Area where much of the landscape to the east is cleared.
- ▶ The remnant vegetation at the Project Area retains connectivity to large tracts of remnant vegetation to the north-east, north, west, south and south-east of the Project Area. A large fragment of cleared land dominates much of the central part of the Project Area between the Carmichael River and the Moray-Carmichael Road.
- ▶ Connectivity between remnant vegetation associated with the Belyando River and the south-east part of the Project Area (i.e. the eastern part of the Bygana West Nature Refuge) is maintained through a tract of slightly fragmented (though wholly connected) mapped remnant vegetation. This (potential) east-west corridor, linking vegetation associated with the Belyando River (which itself acts as a (potential) north-south corridor) through the Bygana West Nature Refuge to large tracts of remnant vegetation to the west (as well as to the north through and beyond the Project Area, and to the south beyond the Project Area) may represent a conduit for the regional movement of wildlife. A narrow corridor of vegetation along the Carmichael River may also facilitate east-west movement between the Belyando River and large tracts of remnant vegetation to the west, within and beyond the Project Area.
- ▶ The DEHP BPA mapping indicated that some remnant vegetation within and surrounding the Project Area is of regional *ecosystem value*, while much of this remnant vegetation is ranked as having very high or high *ecosystem diversity* and (ecosystem) *context and connection*.
- ▶ Seven broad vegetation communities/fauna habitat types were identified based on the particular vegetation communities and land forms present within the Project Area.
- ▶ A total of 36 field verified REs were identified within the Project Area, 22 from the Desert Uplands and 14 from the Brigalow Belt bioregions.
- ▶ The EPBC Act listed TEC, Brigalow (*Acacia harpophylla* dominant and co-dominant), was identified as present at the Project Area from field surveys. The presence of this TEC was recorded from the occurrence of REs 11.3.1, 11.4.8 and 11.4.9 within the Project Area.



Approximately 267 ha of these REs are present within the Project Area, predominantly south of the Carmichael River.

- ▶ Approximately 1,060 ha of Category B ESAs (endangered Biodiversity Status REs), recorded from the occurrence of seven RE types (10.4.3, 10.9.3, 11.3.1, 11.4.5, 11.4.6, 11.4.8 and 11.4.9) are located within the Project Area (based on amended RE mapping).
- ▶ The Project Area supports a diversity of flora species – consolidated desktop search results for the region (i.e. the desktop search extent) revealed 962 vascular plant taxa have been previously recorded from the database Wildlife Online and 701 vascular taxa plant have been previously recorded from the HERBRECS database. A total of 374 vascular plant taxa were recorded during field studies at the Project Area comprising 348 native and 26 introduced taxa. Of the 27 introduced taxa species, five are declared WONS (parkinsonia, parthenium weed, prickly pear, rubber vine and velvety tree pear) and these same five species are also declared weeds under the LP Act.
- ▶ One threatened flora species listed under the EPBC Act and NC Act was recorded within the Project Area from field surveys – waxy cabbage palm (*Livistona lanuginosa*). Two individuals of this species were observed, restricted to the bed of the Carmichael River. One EPBC Act listed threatened flora species, *Acacia ramiflora*, has the potential to occur at the Project Area (based on suitability of habitat, previous records from region, current known distribution). Two threatened flora species listed under the NC Act, *Nesaea robertsii* and *Peripleura scabra*, have the potential to occur at the Project Area (based on suitability of habitat, previous records from region and current known distribution).
- ▶ The Project Area contains a range of fauna habitat types that have broadly similar habitat structure but the value of these habitats for wildlife varies based on the specific forage and shelter resources present in each habitat type. Ironbark-box woodland was the most widespread fauna habitat type at the Project Area. This habitat provides resources for a diversity of common fauna (and limited number of threatened species), as compared to the limited value of cleared land which dominates much of the central and eastern parts of the Project Area (most notably, between the Carmichael River and the Moray-Carmichael Road).
- ▶ In general, across the Project Area, disturbance to fauna habitats from cattle, weeds and feral animals was observed to be low. These disturbances were mainly observed in cleared areas between the Carmichael River and the Moray-Carmichael Road and in the eastern part of the Project Area, and adjacent to existing developed areas such as farm houses, stock yards and internal tracks including water way crossings.
- ▶ The Project Area supports a diversity of fauna species. Consolidated desktop search results for the region revealed 372 species have been previously recorded. A total of 232 fauna species were recorded during field studies at the Project Area (213 species recorded during Spring 2010 and Autumn 2011 surveys at EPC 1690 Study Area; 173 species recorded during Spring 2011 survey at EPC 1080 Study Area).
- ▶ The vast majority of fauna species recorded from the Project Area were common, widely distributed species. A limited number of introduced fauna species were recorded and with the exception of the cane toad, introduced animals were observed to occur at relatively low densities.
- ▶ Two threatened birds and one mammal listed under the EPBC Act were recorded; black-throated finch (southern), squatter pigeon (southern) and the koala. Both bird species appeared to be



locally common where suitable habitat was present at the Project Area. The koala is likely to occur at low densities in suitable habitat across the Project Area. Potential habitat occurring within and beyond the Project Area for these species was identified. Two additional EPBC Act listed threatened fauna species are considered likely to occur at the Project Area (based on suitability of habitat, previous records from region and current known distribution). Potential habitat for these species (yakka skink, ornamental snake) was identified.

- ▶ Three common EPBC Act listed migratory bird species (eastern great egret, rainbow bee-eater, satin flycatcher) were recorded at the Project Area. In addition to these, 15 EPBC Act listed migratory bird species not recorded during field studies have the potential to occur at the Project Area. Habitats at the Project Area are not considered likely to support important assemblages of, or important habitat for, migratory species.
- ▶ No DNR mapped essential habitat occurs at the Project Area, although a number of areas (for a variety of species) occur in the landscape around the Project Area.
- ▶ Three threatened fauna species listed under the NC Act (in addition to the two birds also listed under the EPBC Act (black-throated finch (southern) and squatter pigeon (southern)) were recorded – black-necked stork, cotton pygmy-goose and little pied bat. Potential habitat occurring within the Project Area for these species was identified. An additional four threatened fauna species listed under the NC Act (in addition to those also listed under the EPBC Act) have the potential to occur at the Project Area (based on suitability of habitat, previous records from region and current known distribution).
- ▶ Five NC Act-listed special least concern fauna species were recorded at the Project Area (the three EPBC Act listed migratory birds mentioned above, as well as echidna and koala).
- ▶ One fauna species was observed (Spring 2011 survey at EPC 1080 Study Area – refer Appendix B) beyond its currently described range –the snake *Antairosepens warro*. This species is known from north-east Queensland and Cape York.
- ▶ One protected area occurs within the Project Area. Bygana West Nature Refuge, at the southern part of the Project Area, was dominated by ironbark-box woodland, although smaller patches of three other vegetation communities/fauna habitat types were recorded within its boundary. It forms part of a (potential) east-west vegetation corridor. Two threatened species were recorded along its southern boundary (black-throated finch (southern) and squatter pigeon (southern) – both species, as well as the koala and little pied bat, are likely to utilise habitats within the Nature Refuge.
- ▶ One priority fauna species described in the Burdekin NRM 'Back on Track Actions for Biodiversity' report (DERM, 2010a) was recorded at the Project Area (black-throated finch (southern)). A further four priority fauna species described in this report have the potential to occur at the Project Area.

The Doongmabulla wetland and GAB spring complex, located approximately 10 km to the west of the Project Area upstream along the Carmichael River, is a regionally important site. Records exist for six flora species and one fauna species of conservation significance, of which three are endangered under the EPBC Act, five are endangered under the NC Act, one is vulnerable under the NC Act, and one is near threatened under the NC Act. Two of the flora species are endemic to the Doongmabulla wetland.



5. Potential Impacts and Mitigation Measures — Construction Phase

5.1 Introduction

This impact assessment has been structured to address impacts associated with the construction activities listed below. Full details about the construction phase of the Project are provided in the Project Description (refer to Volume 2, Section 2).

The construction phase of the Project (Mine) will involve the following activities:

- ▶ Development of onsite Mine Infrastructure Area (MIA) – predominantly occurs within non-remnant vegetation (based on field-verified RE mapping)
- ▶ Development of offsite mine infrastructure which includes:
 - Development of an industrial precinct – predominantly occurs within non-remnant vegetation (based on DNRM certified RE mapping)
 - Development of an airport – predominantly occurs within non-remnant vegetation
 - Development of a workers accommodation village – wholly occurs within non-remnant vegetation
 - Development of water supply infrastructure – predominantly occurs within non-remnant vegetation (based on DNRM certified RE mapping)

It is important to note that the construction phase as described and assessed here does not incorporate any activities related to the actual extraction and subsequent handling of the coal resource, inclusive of preliminary activities such as pre-stripping of vegetation in open cut blocks. There will be a time overlap in construction phase activities and operation phase activities. Impacts associated with the operation phase of the project are discussed in Section 6.

The locations of the MIA and the offsite infrastructure are presented in Figure 5-1.

In terms of construction activities that may impact on the environment, it is understood that:

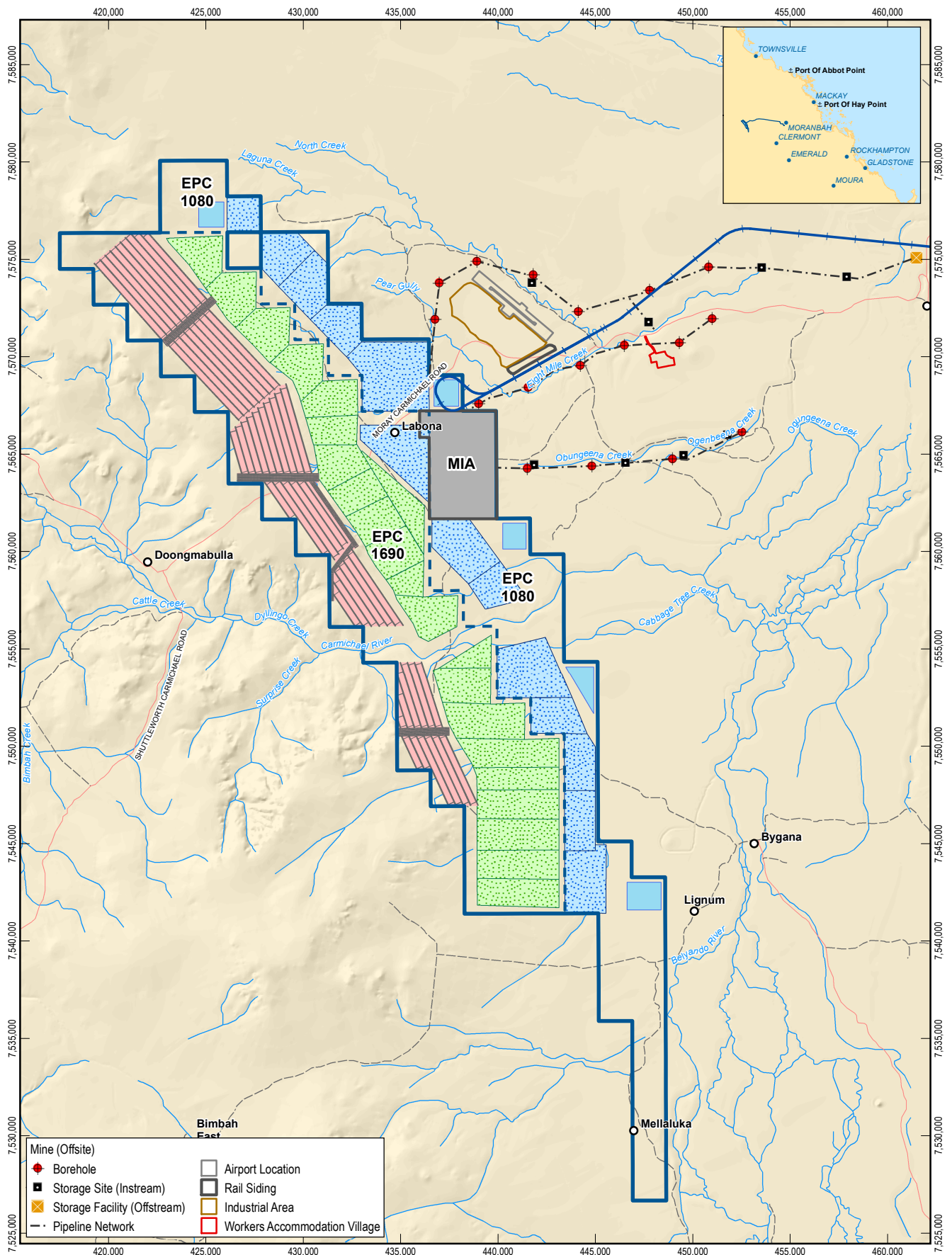
- ▶ All water leaving construction areas will be captured and treated prior to discharge and/or reuse
- ▶ Water required for construction will be sourced from a number of water supplies including offsite from surface water extraction from the Belyando River, North Creek and Obungeena Creek, Belyando River flood harvesting, in-stream storages and groundwater (Hyder Consulting, 2012)
- ▶ Sanitation for construction crews will be treated to A standard and recycled onsite/removed from site for disposal at an authorised sewage treatment facility

The potential construction phase impacts (as identified in Figure 5-2) on terrestrial ecological values have been considered, and appropriate management and mitigation measures proposed, to ameliorate identified impacts, as set out below:

- ▶ Vegetation clearing
 - Loss of vegetation and fauna habitat (including loss of roosting, foraging and breeding areas)
 - Fauna mortality
 - Habitat fragmentation



- Habitat degradation through erosion of topsoils, dust deposition on plants and water resources
- ▶ Disturbance of surface watercourses
 - Loss of habitat and water resources for terrestrial species
 - Alteration/degradation of water resources that terrestrial species depend on
- ▶ Introduction or exacerbation of feral animal and weed species
 - Competition with native species, predation of native species, and habitat degradation (presence and prevalence of pest and weed species)
- ▶ Alteration to air quality and noise environments (i.e. altered exposure to disturbance)
 - Disturbance to breeding, roosting and foraging behaviours



Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

LEGEND

- | | | | |
|---------------|----------------------------|-------------------------|--------------------------|
| ○ Homestead | — Rail (West) | Operation Phase | ■ Open Cut Blocks |
| — Local Road | ■ Mine (Onsite) | ■ Underground Mine Area | ■ Out of Pit Waste Dumps |
| — Track | ■ Mine Infrastructure Area | ■ Water Management Dams | |
| — Watercourse | ■ Construction Phase | — Underground Mine Plan | |

1:275,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
**Indicative Mine Plan -
Areas of Impact**

Job Number	41-25215
Revision	B
Date	29-08-2012

Figure 5-1

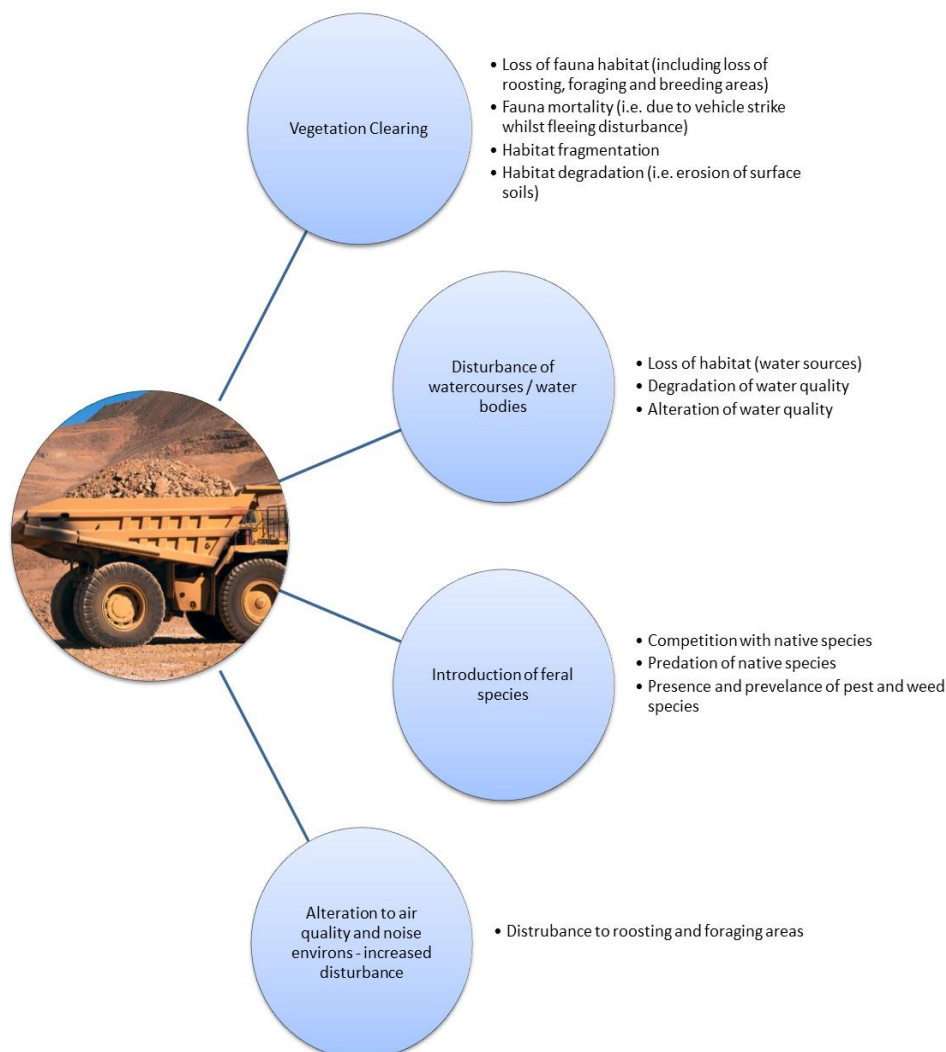
G:\41\25215\GIS\Maps\IMXD\400_Ecology\41-25215_4001_rev_b.mxd

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Data Source: DME: EPC 1690 (2010); EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); Adani Pty Ltd: Indicative Mine Plan/Infrastructure (2012). Created by: BW, CA

Figure 5-2 Conceptual Diagram of Potential Construction Phase Impacts



5.2 Vegetation Clearing

5.2.1 Overview

The majority of the MIA and offsite infrastructure occurs in cleared areas typified by non-remnant vegetation, with the exception of 24 ha of remnant vegetation located at the north-western most part of the MIA footprint and 86 ha located within areas associated with offsite infrastructure. Field studies at the Project Area indicated that cleared land had relatively low terrestrial ecological value, and supported a lower diversity of flora and fauna species than more complex habitats featuring remnant vegetation. Cleared areas were generally not found to provide a suite of habitat resources for conservation significant terrestrial ecological values (i.e. threatened species, migratory species, TECs etc.), although black-throated finch (southern) and squatter pigeon (southern) sightings were made at water bodies surrounded by non-remnant vegetation, during the Spring 2011 survey.

Notwithstanding the limited value of cleared land for many species, such areas do support some common plant and animal species, and as such, clearing of land in these areas, and especially more

complex areas of remnant vegetation, should be managed to minimise impacts to local flora and fauna. Such management should also seek to minimise impacts to adjacent and downstream habitats (i.e. water bodies that may provide habitat for terrestrial fauna species including drinking resources for threatened species). Impacts that may occur as a result of land clearing during the construction phase include:

- ▶ Loss of vegetation and fauna habitat (including roosting, foraging and breeding areas)
- ▶ Fauna mortality
- ▶ Habitat fragmentation
- ▶ Erosion of surface soils

5.2.2 Loss of Vegetation and Fauna Habitat

5.2.2.1 Potential Impacts

Remnant and non-remnant vegetation is proposed to be cleared during the Project construction phase. Approximately 24 ha of remnant vegetation and 1,921 ha of non-remnant vegetation is proposed to be cleared for construction of the MIA, and approximately 86 ha of remnant vegetation and 3,227 ha of non-remnant vegetation (including 9 ha of high value regrowth vegetation) is proposed to be cleared for construction of the offsite infrastructure.

Regional Ecosystems

The mapped remnant vegetation located within the MIA and offsite infrastructure areas to be impacted by construction comprises a number of mixed polygon REs within the Desert Uplands bioregion and the Brigalow Belt bioregion. REs located within the MIA have been field verified however, REs within the offsite infrastructure have not been verified through ground-truthing and therefore the extent of clearing for these RE types have been calculated based on DNRM's certified RE mapping (Version 6.1). Within the offsite infrastructure area, REs 10.4.3, 11.3.1, 11.4.5 and 11.4.9 (covering an area of 6 ha) are classified as Category B ESAs and RE 11.3.1 (covering an area < 1 ha) is a constituent RE of the Brigalow TEC. As the area of impact to these REs during the construction phase is minimal compared to impacts during the mine operation phase, further discussion of the impacts of clearing these vegetation types is contained within Section 6.3.

The proposed clearing extent of each RE within the offsite infrastructure area is provided in Table 5-1.

Table 5-1 REs impacted during construction of the MIA and offsite infrastructure

RE	VM Act Status	Biodiversity Status	Short Description	Area of Impact
Desert Uplands				
10.3.3	Least concern	No concern at present	<i>Acacia harpophylla</i> and/or <i>Eucalyptus cambageana</i> low open woodland to open woodland on alluvial plains	4 ha
10.3.4	Least concern	Of concern	<i>Acacia cambagei</i> low open woodland to low woodland on alluvial plains	14 ha
10.3.6	Least concern	No concern at present	<i>Eucalyptus brownii</i> open woodland on alluvial plains	11 ha



RE	VM Act Status	Biodiversity Status	Short Description	Area of Impact
10.3.28	Least concern	No concern at present	<i>Eucalyptus melanophloia</i> or <i>E. crebra</i> open woodland on sandy alluvial fans	17 ha
10.4.3	Least concern	Endangered	<i>Acacia harpophylla</i> and/or <i>Eucalyptus cambageana</i> open woodland on Cainozoic lake beds	< 1 ha
10.4.5	Least concern	Of concern	<i>Acacia cambagei</i> low woodland on Cainozoic lake beds	3 ha
10.5.5	Least concern	No concern at present	<i>Eucalyptus melanophloia</i> open woodland on sand plains	2 ha
Brigalow Belt				
11.3.1	Endangered	Endangered	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	< 1 ha
11.3.25	Least concern	Of concern	<i>Eucalyptus tereticornis</i> or <i>E. camaldulensis</i> woodland fringing drainage lines	< 1 ha
11.3.37	Least concern	No concern at present	<i>Eucalyptus coolabah</i> fringing woodland on alluvial plains	< 1 ha
11.4.5	Of concern	Endangered	<i>Acacia argyrodendron</i> woodland on Cainozoic clay plains	6 ha
11.4.9	Endangered	Endangered	<i>Acacia harpophylla</i> shrubby open forest to woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	< 1 ha
11.4.11	Of concern	Of concern	<i>Dichanthium sericeum</i> , <i>Astrebla</i> spp. and patchy <i>Acacia harpophylla</i> , <i>Eucalyptus coolabah</i> on Cainozoic clay plains	53 ha
Total remnant				110 ha
Non-remnant				5,149 ha

High Value Regrowth

Approximately 9 ha of high value regrowth vegetation that is mapped within the offsite infrastructure area will be impacted by clearing for the construction phase of the Project. High value regrowth that is mapped within the offsite infrastructure areas are mapped as containing endangered REs. Within the workers accommodation village footprint, this regrowth vegetation (approximately 6 ha) comprises mixed polygon RE type 11.4.11/11.4.9/11.4.5. Within the water infrastructure areas, there are a number of small patches of regrowth vegetation (totalling approximately 3 ha) that represent mixed polygons containing RE types 11.3.3/11.3.1, 11.4.11/11.4.5 and 11.4.5/11.4.6/11.4.8.

Fauna Habitat

Remnant vegetation to be cleared for construction of the MIA and offsite infrastructure is categorised into the following four vegetation communities / fauna habitat types:

- Open grassland, previously cleared areas, lacking native vegetative cover



- ▮ Ironbark-box grassy woodlands and open woodlands on grey sand plains – within the MIA and offsite infrastructure area (airport and water supply infrastructure)
- ▮ Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains – within offsite infrastructure area (industrial precinct and water supply infrastructure)
- ▮ Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding – within offsite infrastructure area (water supply infrastructure)

Clearing of remnant vegetation for the construction phase will result in the loss of areas of potentially suitable habitat for the following conservation significant species that have been confirmed present or are considered likely to occur within the Project Area:

- ▮ Black-throated finch (southern) (confirmed present at Project Area) – loss of approximately 24 ha of potential habitat within the MIA and 6 ha within the offsite infrastructure
- ▮ Squatter pigeon (southern) (confirmed present at Project Area) – loss of approximately 24 ha of potential habitat within the MIA and 6 ha within the offsite infrastructure
- ▮ Koala (confirmed present at Project Area) – loss of approximately 24 ha of potential habitat within the MIA and 6 ha within the offsite infrastructure
- ▮ Yakka skink (likely to occur at Project Area) – loss of approximately 24 ha of potential habitat in the MIA and 33 ha within the offsite infrastructure
- ▮ Ornamental snake (likely to occur at Project Area) – loss of approximately 0 ha of potential habitat within the MIA and 27 ha within the offsite infrastructure
- ▮ Little pied bat (confirmed present at Project Area) – loss of approximately 24 ha of potential habitat within the MIA and 33 ha within the offsite infrastructure
- ▮ Black-necked stork (confirmed present at Project Area) – loss of approximately 6 ha of potential habitat within the MIA and 0 ha within the offsite infrastructure
- ▮ Cotton pygmy-goose (confirmed present at Project Area) – loss of approximately 6 ha of potential habitat within the MIA and 0 ha within the offsite infrastructure
- ▮ Square-tailed kite (likely to occur at Project Area) – loss of approximately 24 ha of potential habitat within the MIA and 6 ha within the offsite infrastructure
- ▮ Black-chinned honeyeater (likely to occur at Project Area) – loss of approximately 24 ha of potential habitat within the MIA and 6 ha within the offsite infrastructure
- ▮ Echidna (confirmed present at Project Area) – loss of approximately 24 ha of potential habitat within the MIA and 33 ha within the offsite infrastructure
- ▮ Rainbow bee-eater (confirmed present at Project Area) – loss of approximately 1,945 ha of potential habitat within the MIA and 3,313 ha within the offsite infrastructure
- ▮ The eastern great egret and the satin flycatcher (confirmed present at Project Area) and nine additional migratory species (considered likely to occur at Project Area) have 0 ha of potential habitat impacted by the clearing of vegetation for the MIA and offsite infrastructure. Potential habitat for two predominantly aerial migratory birds that are likely to occur exists within the construction phase footprint:
- ▮ Fork-tailed swift (likely to occur at Project Area) – loss of approximately 1,945 ha of potential habitat within the MIA and 3,313 ha within the offsite infrastructure; White-throated needletail



(likely to occur at Project Area) – loss of approximately 1,945 ha of potential habitat within the MIA and 3,313 ha within the offsite infrastructure

Habitat loss will be localised during the construction phase, and will occur in a fragmented part of the local landscape. As larger areas of habitat for these species will be affected by the mine operations, further discussion of the impacts of the loss of these habitat types is provided in Section 6.3. The loss of riparian habitats associated with the construction of pump sites and associated pipelines in the riparian zones of North Creek, Obungeena Creek, Eight Mile Creek and Belyando River will have highly localised impacts. Construction areas for water supply pipeline corridors, including laydown areas and stockpiles, will be located within the pipeline corridor, where possible, to minimise vegetation clearing related impacts. Additionally, the pipeline right of way within the riparian zone of Belyando River and North Creek will be reduced, where possible, to minimise impacts to vegetation communities. This habitat loss, in addition to any loss in the riparian zones of North Creek and Obungeena Creek where pipelines are proposed to intersect these waterways, is unlikely to represent a major impediment to movement of fauna along the riparian corridors along the affected waterways. The riparian vegetation along North Creek, Obungeena Creek and North Creek is not considered to represent a locally important corridor in this landscape.

In addition to conservation significant species, these vegetation communities provide habitat features for a variety of common woodland bird, reptile and mammal species. These habitat types and vegetation communities are prevalent within the wider landscape. Potential impacts to threatened species and mitigation measures as a result of habitat loss are further discussed in Section 5.3.2.

Clearing of non-remnant vegetation on previously cleared land will reduce the localised extent of habitat for some animals including a range of common ground-dwelling reptiles, macropods and cleared land birds. The reduction in the extent of this habitat is considered to be of negligible significance due to its prevalence in the wider landscape as well as its low habitat value and extensive modification. Nevertheless, clearing should be minimised to the areas required for construction to minimise impacts on animals in this habitat, as well as to maintain a buffer between construction areas and areas of more significant habitat where possible.

One small farm dam (approximately 6 ha in size) will be lost as a result of construction of the MIA. This dam is a shallow scrape that has a seasonally fluctuating water level, and does not feature aquatic or riparian vegetation. While the dam is likely to represent a localised water source for fauna, potentially including threatened species such as the black-throated finch (southern), squatter pigeon (southern) and black-necked stork, water is readily available from other farm dams throughout the surrounding agricultural landscape. The temporary draining of eight small instream farm dams (on each of North Creek and Obungeena Creek), to allow for expansion of these storages, will represent a temporary loss of what is a locally abundant resource. The water resource will be available post-expansion, when the enlarged dams refill after inflows following rainfall.

5.2.2.2 Management and Mitigation

Where land clearing is required during construction, the following management and mitigation measures are recommended:

- ▶ The extent of land clearing is to be restricted to the minimal amount necessary for the construction of the MIA and offsite infrastructure and wherever possible, existing cleared areas are to be utilised. Where infrastructure must cross watercourses, locations where riparian vegetation is already disturbed should be preferentially selected, or, if not possible, the



construction footprint in these areas should be minimised and large habitat trees should be retained

- ▶ The extent of vegetation clearing must be clearly identified on construction plans and in the field. Areas that must not be cleared or damaged are to also be clearly identified on construction plans and in the field. Clearing extents are to be communicated to construction supervisors
- ▶ Pre-clearance surveys will be undertaken in areas identified as potential habitat for threatened species, prior to commencement of clearing. In areas where these surveys indicate the presence of habitat features observed to (or with the potential to) provide habitat for these species, a fauna-spotter catcher will be engaged to accompany clearing crews
- ▶ Any additional construction areas, such as site offices, construction stockpile locations, machinery/equipment laydown areas and storages are to be located where possible within existing cleared or disturbed areas
- ▶ As soon as possible after cleared areas such as laydown areas and site offices are no longer required and are not within the proposed mine footprint, rehabilitation will commence. This rehabilitation will involve vegetating disturbed areas to a state consistent with the adjacent landscape, in consideration of limitations associated with buffers relating to fire management. As these temporary construction disturbance areas will be sited in existing cleared areas (i.e. pasture), rehabilitation will involve revegetating using species that characterise the surrounding pasture
- ▶ Unavoidable loss of vegetation and fauna habitat will be offset in accordance with relevant Queensland and Commonwealth policies, as detailed in the Project Offset Strategy. As some vegetation loss will be off-lease, offsetting requirements under the VM Act will be triggered

5.2.2.3 Summary

Clearing of land during the construction phase of the Project is proposed to result in a loss of approximately 110 ha of remnant vegetation and approximately 5,149 ha of non-remnant vegetation. Loss of remnant vegetation associated with the operation phase is assessed in Section 6.3. The loss of non-remnant vegetation areas is not likely to have any significant impact on native fauna as this type of habitat is widely available throughout the region.

5.2.3 Fauna Mortality

5.2.3.1 Potential Impacts

Vehicles and machinery used to undertake land clearing have the potential to lead to direct mortality of fauna in the event that individuals are struck. Those animals that are unable to disperse away from areas under active clearing are also particularly susceptible to injury or death. This includes amphibians, reptiles, small ground-dwelling mammals, arboreal mammals and nocturnal species that are inactive during daylight hours. Other potential causes of mortality include animals becoming trapped in excavations, and carrion eaters (some raptors) being struck when feeding on road kill.

Fauna mortality will result in a local reduction in the abundance of some less mobile species. Species present in the habitat types that will be affected by construction phase activities, including those that will be cleared, are predominantly common, widespread species, with potential for a small number of conservation significant species to also utilise these habitats. Given the landscape context in which the Project occurs, and in particular, the availability of similar habitat types in the local region, this loss is not considered likely to adversely affect the biodiversity values of this landscape.



The management and mitigation measures outlined below will seek to reduce fauna mortality to the greatest extent possible.

5.2.3.2 Management and Mitigation

Management and mitigation measures to reduce the potential for fauna mortality as a result of land clearing activities include:

- ▀ Pre-clearance surveys will be undertaken in areas identified as potential habitat for threatened species, prior to commencement of clearing. In areas where these surveys indicate the presence of habitat features observed to (or with the potential to) provide habitat for these species, a fauna-spotter catcher will be engaged to accompany clearing crews. Pre-demarcated habitat features identified during the pre-clearance survey will be thoroughly checked by the fauna spotter-catcher prior to clearing. Provision for the relocation of fauna will be made prior to the commencement of clearing
- ▀ Vegetation clearing will be undertaken in a sequential manner to allow more mobile fauna species the opportunity to disperse away from clearing areas
- ▀ Procedures in the event that an animal is injured will be developed. Given the distance to the nearest veterinary practitioner, this will most likely involve euthanasia so as to avoid unnecessary suffering. Adani will have a suitably authorised and trained practitioner present on site to assess, and where necessary, euthanize injured animals
- ▀ Vehicles will be required to stay on pre-determined routes
- ▀ All vehicles and plant will adhere to site rules relating to speed limits. Speed limits will be clearly signposted so as to minimise the potential for road kill
- ▀ Any road kill will be dragged to the edge of the road immediately and subsequently removed as quickly as practicable to reduce potential for scavengers to be struck
- ▀ Where practical, temporary fencing will be erected around excavations to exclude mobile animals from vegetation clearing areas
- ▀ Work areas will be checked for fauna that may have become trapped before work commences each day
- ▀ In instances where an animal/animals have entered active construction areas, the site Environmental Manager will be immediately informed. An assessment of whether the animal is at risk of harm and/or poses a threat to construction personnel will be made by the Environmental Manager (or their delegate). Where possible, the animal will be encouraged to disperse out of/away from the construction area. Where the animal is not able to disperse away, a professional fauna spotter-catcher will be engaged
- ▀ If any pits/trenches are to remain open after daily site works have been completed, they will be securely covered by an impenetrable barrier, if possible, or fauna ramps (e.g. log ramps or wooden planks) will be put in place to provide a potential means of escape for trapped fauna
- ▀ Site inductions are to include education regarding the local fauna of the site and protocols to be implemented if fauna are encountered

5.2.3.3 Summary

Fauna mortality will occur during the construction phase; however, given the habitat types that will be affected and its availability in the surrounding landscape, this localised loss of animals is not



considered to represent an adverse impact to the region's biodiversity values. Direct mortality of fauna, and in particular conservation significant species, during the construction phase of the Project, is expected to be reduced should the protocols outlined above be implemented.

5.2.4 Habitat Fragmentation

5.2.4.1 Potential Impacts

The MIA and offsite infrastructure are located in a locally fragmented landscape. Vegetation clearing at this localised scale may reduce the capacity of some less mobile fauna to move between habitats (including within cleared areas typified by non-remnant vegetation) that will be severed by the construction of facilities. This is particularly relevant to small, ground-dwelling fauna such as amphibians, reptiles and small ground-dwelling and arboreal mammals. Given that the construction of these facilities will occur in discrete footprints, and not represent a lengthy (linear) barrier between habitats, it is not considered likely that fauna movement at a landscape (regional) scale will be significantly affected.

5.2.4.2 Management and Mitigation

Management and mitigation measures to reduce the impact of habitat fragmentation to local fauna populations include:

- ▶ Landscape permeability will be retained where possible. Where fencing is required around cleared areas, it will be designed such that fauna can move through it (excluding those instances where fenced areas seek to protect fauna from threats such as trenches). Consideration will be given to avoiding the use of barbed wire on the top strand of wire fences
- ▶ Vegetation clearing will be undertaken in a sequential manner to allow more mobile fauna species the opportunity to disperse away from clearing areas

5.2.4.3 Summary

Habitat fragmentation associated with construction of the MIA and offsite infrastructure will be localised and will largely affect common animals that utilise this modified habitat. The area is already fragmented as a result of historic land clearing associated with the current land use of cattle grazing.

5.2.5 Habitat Degradation

5.2.5.1 Potential Impacts

Vegetation clearing has the potential to facilitate erosion (water and wind). This can have a localised impact on species and habitat suitability by reducing the quality and abundance of refuges, microhabitats and food availability through the smothering of native vegetation with sediment.

Earthworks will result in dust emissions. Excessive dust settling on vegetation could also suppress vegetation growth by limiting the photosynthesis potential of plants in close proximity to the construction area (Nanos and Ilias, 2007). Plants with dust on leaves may also be less palatable as a food source for animals. Dust deposition associated with earthwork activities will generally occur relatively close to areas of disturbance and hence, plants within 50 m – 100 m of construction activities may be affected by dust. As construction activities are temporary, effects will be short lived, and rainfall will generally remove dust from plants. Dust suppression will be used to control dust and this will reduce the extent of vegetation affected by dust.



Given that the construction phase activities will occur in a fragmented and disturbed part of the local landscape, edge effects are not expected to significantly detract from the value of habitats characterised by remnant vegetation that will be cleared.

Where vegetation clearing occurs on floodplains and near drainage lines, erosion may cause sedimentation of waterways, potentially degrading downstream aquatic and riparian habitats (see Section 5.3 and Mine Aquatic Ecology Report Volume 4, Appendix O1).

5.2.5.2 Management and Mitigation

Management of erosion and sedimentation in and adjacent to cleared areas will be undertaken in accordance with erosion and sediment controls set out in the Mine Environmental Management Plan (Volume 2, Chapter 13) and Environmental Management Plan (Offsite infrastructure) (Volume 2 Section 14). This plan will identify all practices to be implemented prior to, during, and post-construction. The management approach to erosion and sediment control actions will include:

- ▶ Diversion of clean stormwater around disturbed areas, with scour protection as required to address any associated modifications in drainage paths
- ▶ Sediment fences and other sediment control devices, in particular in areas near earthworks, watercourses and key stormwater flow paths, will be installed and maintained
- ▶ All soil or mulch stockpiles will be located away from watercourses and key stormwater flow paths to limit potential for transport of these substances into the watercourses via runoff
- ▶ Design of stockpiles will consider soil properties to ensure side-slope stability and minimise susceptibility to failure due to erosion risk
- ▶ Dust suppression activities will be undertaken where appropriate and managed in accordance with the recommendations outlined in the Mine Air Quality Report (Volume 4, Appendix S)
- ▶ Areas will be stabilised as soon as practicable after disturbance
- ▶ Stormwater control works to be installed as soon as practicable in the construction of onsite and offsite infrastructure

Further details relating to the management of erosion is presented in the Mine Land Chapter (Volume 2, Chapter 4). Further details relating to management of dust is presented in the Mine Air Quality Report (Volume 4, Appendix S).

5.2.5.3 Summary

Controls are available for management of erosion and dust and these will be implemented at all stages of the construction phase. Given the suite of management actions that will be undertaken, the impacts of erosion on vegetation and fauna habitats within, adjacent to and downstream of the footprints of the construction phase infrastructure, are expected to be low.

5.3 Disturbance of Water Resources

5.3.1 Overview

Construction activities will include removal of one farm dam, and potential disturbance to aquatic habitats associated with ephemeral creeks in the area. These include North Creek, Obungeena Creek and Eight Mile Creek. Existing farm dams on North Creek and Obungeena Creek will also be expanded which will result in temporary draining of these water storages.



Potential impacts arising from construction activities on aquatic ecology values are discussed in the Mine Aquatic Ecology Report (Volume 4, Appendix O). Disruption to these aquatic habitats has the potential to impact terrestrial ecological values through the localised reduction in availability and quality of drinking resources and foraging habitat, and potentially changes to riparian habitats in downstream watercourses due to changes in water quality and flow regimes. In particular, impacts realised from disturbance of water resources may include:

- ▶ Change in/loss of aquatic habitat utilised by terrestrial species – specifically waterbirds and species using water bodies as a drinking resource
- ▶ Degradation/alteration of water quality resulting in in-situ and downstream impacts to riparian habitats (refer to Mine Water Quality Report (Volume 4, Appendix Q))

5.3.2 Loss of Habitat for Terrestrial Species

5.3.2.1 Potential Impacts

Construction of the MIA and offsite infrastructure, and specifically the water supply infrastructure, is proposed to result in the loss of one farm dam and draining of several dams on ephemeral creeks so that these can be enlarged. These aquatic habitats are anthropogenic and occur in disturbed areas with minimal fringing vegetation. The main value of these dams for fauna is for drinking water and the dams may also be utilised by some threatened bird species including the black-throated finch (southern), squatter pigeon (southern) and black-necked stork as well as commonly occurring listed migratory species. As most natural waterbodies in the Project Area are ephemeral, farm dams can become important in dry periods.

The planning and concept design for offsite water supply infrastructure has aimed to avoid areas of high value aquatic habitat where possible by avoiding riparian habitat, referrable wetlands and gilgais.

There are a number of similar dams throughout the local area and the loss of one dam, and temporary loss of several other dams (while these are enlarged) is unlikely to cause any significant impact on native animals occurring in the region. With respect to the expansion of dams on North Creek and Obungeena Creek, habitat loss will only be of a temporary nature during the construction phase and similar habitats that exist in the surrounding landscape that could provide temporary alternative water sources for these species.

Further impacts relating to impacts relating to the loss of habitat associated with surface water courses and water bodies are detailed within the Mine Aquatic Ecology Report (Volume 4, Appendix O1).

5.3.2.2 Management and Mitigation

The loss of the small farm dam within the MIA footprint is an unavoidable impact of the construction phase of the Project but will be offset by construction of new water storage dams. Management of the removal of this water body and other management and mitigation strategies to minimise the impacts on aquatic environments are outlined in the Mine Water Quality Report (Volume 4, Appendix Q) and Mine Aquatic Ecology Report (Volume 4, Appendix O1). The loss of dams on North and Obungeena Creek will be temporary whilst these are expanded during the construction phase, and will be negated by the wide availability of similar habitats in the surrounding landscape. In the event that there is a shortage of water resources in the landscape at the time of construction, temporary water tanks can be provided for native terrestrial species.



5.3.2.3 Summary

The impacts to terrestrial flora and fauna associated with changes to aquatic habitats are expected to be highly localised, temporary (notwithstanding permanent loss of one small farm dam), and in the landscape context, limited, post-mitigation (Aquatic Ecology Report (Volume 4, Appendix O1)). Specific mitigation measures, beyond those detailed above, and those encompassed with the Mine Water Quality Report (Volume 4, Appendix Q) and Mine Aquatic Ecology Report (Volume 4, Appendix O1), are not required.

5.3.3 Water Quality and Hydrological Changes

5.3.3.1 Potential Impacts

Construction activities near ephemeral water courses may result in alteration/degradation of water quality. Such changes to water quality may reduce the suitability of aquatic and riparian habitats for terrestrial species.

The most significant potential contaminant during construction is suspended solids, arising from erosion of disturbed areas. Even without erosion control, it is unlikely that the quantities of suspended solids that might enter surface waters would degrade water quality to the extent that it became unusable for terrestrial animals. Given the dynamic nature of the climate in the region, and modified state of some habitats in the landscape, it is likely that animals will have some degree of tolerance to water carrying elevated sediment loads during and after rainfall events. Additionally, there are a number of other farm dams and watercourses within the local area that provide alternative water resources for terrestrial animals.

Other potential sources of water contamination are:

- ▶ Untreated or partly treated sewage. Nutrients could cause eutrophication and algal outbreaks which may be toxic or unpalatable to animals and bacteria could cause animals to become sick. It is not proposed to discharge either untreated or treated sewage to any surface waters.
- ▶ Spills of hydrocarbons could make water unpalatable to terrestrial animals, and, depending on quantities, toxic. Controls proposed in relation to storage and handling of fuels, oils and other chemicals are detailed in the Mine Environmental Management Plan (Volume 2, Chapter 13).

5.3.3.2 Management and Mitigation

Management of surface water quality during the construction of the MIA and offsite infrastructure is extensively detailed in the Mine Water Quality Report (Volume 4, Appendix Q). The measures proposed to manage impacts to aquatic ecological values, as detailed in the Mine Aquatic Ecology Report (Volume 4, Appendix O1), will also reduce impacts to terrestrial species, with regards to aquatic habitat quality.

5.3.3.3 Summary

Management of surface water (as outlined in the Mine Water Quality Report (Volume 4, Appendix Q)) and aquatic ecological values (as outlined in the Mine Aquatic Ecology Report (Volume 4, Appendix O1)) will seek to minimise adverse impacts to the water quality of water courses within and downstream of the construction footprints of the MIA and offsite infrastructure. Any impacts to terrestrial flora and fauna associated with water quality alteration/degradation are expected to be highly localised and, as alternative aquatic habitat is available in the local landscape context, limited. With mitigation measures in place, impacts are considered to be low.



5.4 Introduction and Proliferation of Weeds and Feral Species

5.4.1 Overview

Pest and feral species may disrupt ecosystems by outcompeting and replacing native species, thus altering ecosystem diversity and potentially disrupting ecosystem function. A total of 27 introduced flora taxa were recorded from the Project Area, five of which are declared as WONS and declared weeds under the LP Act. Eight introduced fauna species comprising six mammals, one bird and one amphibian were also recorded during field studies.

5.4.2 Potential Impacts

Increased movement of people, vehicles, machinery, vegetation waste and soil may facilitate the spread of weeds at and near the Project Area. Five WONS that are also declared plants under the LP Act (parkinsonia (*Parkinsonia aculeata*), parthenium, prickly pear, velvety tree pear (*Opuntia tomentosa*) and rubber vine (*Cryptostegia grandiflora*)) are known to occur at the Project Area. Despite the fact that 27 introduced plant species were recorded, weeds were not found to be abundant across much of the Project Area. Increasing the prevalence of weeds at the Project Area (and potentially beyond to the surrounding landscape), may reduce the quality of habitats for some flora and fauna species, particularly by replacing native plants.

It is a characteristic of many weeds that seeds can rapidly germinate and plant growth is also rapid. Vegetation clearing and soil disturbance allows seeds present in soil to germinate. Germination and plant growth for weeds is typically faster than for native species and this can lead to increased weed levels in disturbed areas and affect the ability for native vegetation to re-establish.

There is also significant potential for weeds, either as seeds or other plant propagules, to be introduced to sites attached to dirty vehicles and equipment or to be contained in soil or seed mixes brought to the site. This can lead to increased levels of weeds already present on the site, or infestation by new weeds.

Food waste produced by human settlements may provide additional resources for feral animals such as pigs, rats, mice, cats and dogs. These animals, confirmed as present within the Project Area, may increase in abundance should easier access to forage resources be provided. Increased availability of water due to sediment ponds and water storages is beneficial to pest animals.

An increase in the prevalence of these animals may adversely impact native fauna in that it may lead to:

- ▶ Increased competition for resources
- ▶ Increased predation of native species by introduced animals
- ▶ Habitat degradation including pig damage of riparian areas and erosion caused by rabbit burrowing

There is also potential for pest animals such as ants to be introduced to sites through importation of vehicles, equipment, soils and similar media.



5.4.3 Management and Mitigation

Pest and feral species spread, and the potential for introduction of new feral species, will require management during the construction phase of the Project. An integrated suite of actions should be developed to manage pest species, including:

- ▶ Waste management measures incorporated into Environmental Management Plans should include containment of food scraps in securely sealed containers
- ▶ Vegetation and soil waste should not be moved to areas of lower weed infestation
- ▶ Pest animal occurrence will be monitored during construction. If increased densities of pest animals are observed, or new pest animals are identified, humane pest controls will be implemented to manage numbers
- ▶ Weed mapping will be undertaken prior to commencement of construction. Mapping will cover the whole site but be particularly focused at high risk locations, such as areas of black soil so that weed hotspots can be identified. Baseline field surveys of identified hotspots within and near construction areas will be undertaken prior to commencement of construction. Weed control will be undertaken in areas that are very heavily infested or where WONS or Class 1 or 2 weeds declared under the LP Act are present prior to disturbance
- ▶ Weed levels will be monitored in areas adjacent to construction activities and any areas that are rehabilitated after construction. Monitoring will be undertaken annually during construction, with results to be considered in terms of baseline information (collected prior to construction) and with reference to appropriate control (reference) sites. If significant infestations of any weeds occur, or if WONS or Class 1 or 2 weeds declared under the LP Act, weed control measures will be implemented. Weed control measures will be based on Queensland Department of Agriculture, Forestry and Fisheries and Isaac Regional Council advice. Ongoing monitoring of weed infestation associated with construction activities will occur through the operational weed management program
- ▶ All vehicles, equipment and materials brought onto site will be certified as free of weeds and weed seeds and carry a weed hygiene declaration. Records are to be kept of compliance with this requirement. Adani will install a weed wash down facility onsite
- ▶ Soil stripped and stockpiled from areas containing known weed infestations will be stored separately and are not to be moved to areas free of weeds
- ▶ Construction staff will not bring domestic animals to the Project Area

5.4.4 Summary

Implementation of the proposed mitigation strategies will minimise the potential for pest plants and animals to increase in abundance at and near the Project Area or for new pest plants and animals to be introduced. Regular, standardised monitoring is proposed to be a core component of the successful implementation of these measures, with weed or pest control to be undertaken at the earliest opportunity if monitoring reveals a new pest plant or animal introduction or a significant increase in abundance.



5.5 Fauna Behavioural Disruption

5.5.1 Overview

Habitat degradation and behavioural disruption may arise as a result of increased vehicular activity and a change in disturbance types at the Project Area. Habitat degradation and associated behavioural disruption may result from increased dust mobilisation and increased exposure to noise, light and vibration.

5.5.2 Potential Impacts

Construction activity at and near the construction zone associated with the MIA and offsite infrastructure may disrupt local fauna roosting, breeding and foraging activities, largely as a result of increased exposure to light, noise, dust, vehicles and people. Animals may also become more vulnerable to predation, because of increased light making it easier for predators to locate prey or noise levels making it harder for prey to detect approaching predators.

There is limited native habitat (i.e. remnant vegetation) in and around construction areas for native animals, and most animals occurring in the MIA and offsite infrastructure construction zones are common and generally tolerant to some disturbance. Furthermore, threatened species such as the black-throated finch (southern) and squatter pigeon (southern) are known to inhabit areas exposed to anthropogenic disturbance (peri-urban Townsville including directly adjacent to military training areas in the case of the former; numerous towns in central Queensland for the latter). Animals may exhibit initial fright behaviour, and will either adapt to the disturbance levels, or move away from the areas of activity into similar habitat that is extensively available in the adjacent landscape. Breeding activity is less likely to be associated with non-remnant vegetation; however, remnant areas will need to be checked as part of pre-clearing surveys.

5.5.3 Management and Mitigation

Management and mitigation measures to reduce disruption to fauna behaviour during construction activities include:

- Pre-clearing surveys for active breeding sites
- Use of directional lighting where possible
- Restriction of movement of vehicles and humans to construction areas
- Dust suppression as discussed in Section 5.2.5 – dust impacts will be managed in accordance with the recommendations outlined in the Mine Air Quality Report (Volume 4, Appendix S)

5.5.4 Summary

Noise, light and general construction activity will disturb animals in the vicinity of construction areas, and animals will either habituate or move away. Dust may also affect quality of plant health and palatability. Construction activities generally do not take place close to sensitive habitats and impacts on significant biodiversity values are not expected. Implementation of the mitigation measures listed above will seek to prevent/reduce exposure to these potentially disruptive activities.



6. Potential Impacts and Mitigation Measures — Operation Phase

6.1 Introduction

This impact assessment (i.e. Section 6) has been structured to address impacts associated with the operation phase activities listed below. Full details about the staged operations of the proposed Mine are provided in the Project Description (refer to Volume 2, Section 2). It is important to note that some preliminary activities associated with the operation phase (i.e. stripping of vegetation prior to open-cut mining) will occur simultaneously with activities defined as occurring within the construction phase (as outlined in Section 5).

The operation phase of the Project (Mine) is proposed to involve the following activities:

- Underground mining through staged development with subsidence of mined areas of up to approximately 7.5 m expected to occur
- Open cut mining through staged development and rehabilitation of pits over the duration of the Mine life
- Management of overburden through development and rehabilitation of waste areas over the duration of the Mine life
- Development and maintenance of clean water diversion drains through the mining lease to avoid mine affected area
- Establishment and maintenance of a 500 m buffer from each bank of the Carmichael River, with establishment of a flood levee bordering the outer edge of the 500 m buffer zone adjacent to the proposed open cut mines
- Establishment of sediment ponds (water management dams) to receive dirty water from mining operations
- Diversion of Eight Mile Creek
- Operation of the offsite infrastructure, comprising the operation of the workers accommodation village, airport, industrial area and offsite water supply infrastructure, including:
 - Pumping of water from North Creek and the Belyando River during peak flow periods
 - In-stream river extractions on North and Obungeena Creeks
 - Pumping of local groundwater reserves in the Moray Downs property, outside of the active mining leases

The indicative locations of the underground mining area, open cut mining area (blocks), out of pit waste dumps, water management dams, areas potentially exposed to subsidence (i.e. those areas above the underground Mine), and areas not to be subjected to operation phase activities, are presented in Figure 5-1.

It is understood that:

- Staged, non-sequential operation of the Mine is proposed to occur over 90 years, incorporating
 - Underground mining in the west of the Project Area

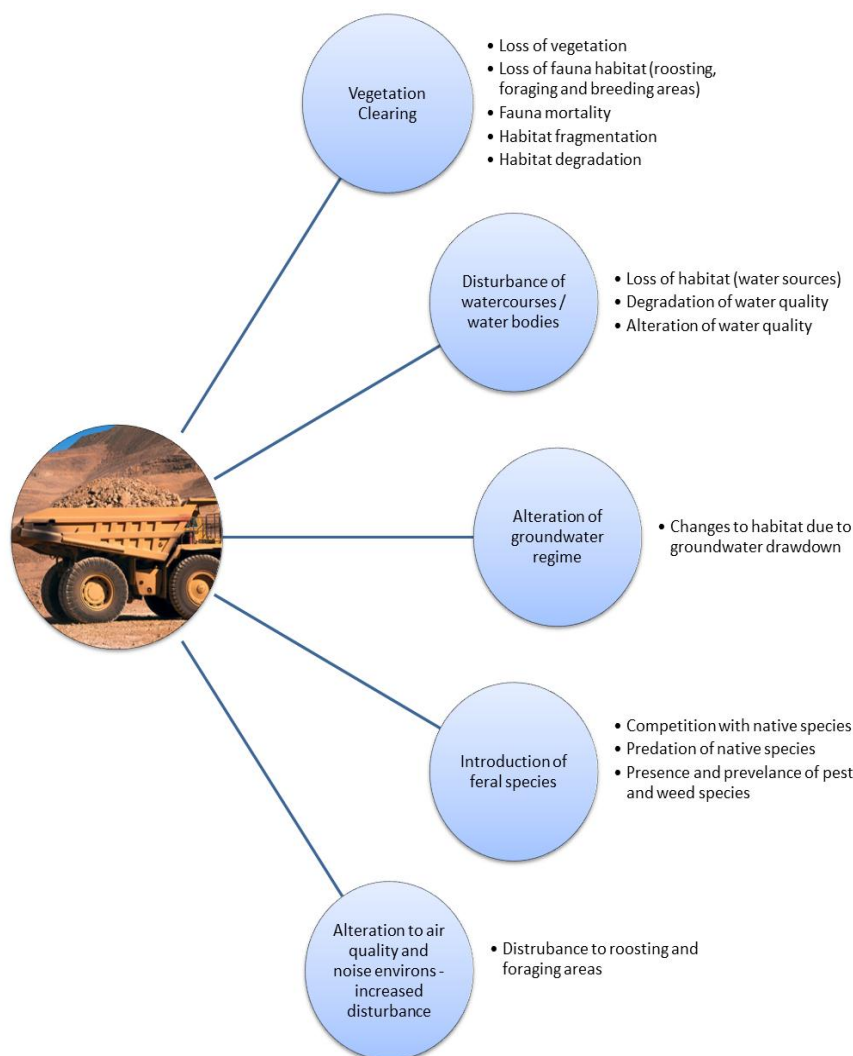


- Open cut mining in the middle of the Project Area
- Overburden disposal (out of pit waste dumping) and water management dams in the east of the Project Area
- ▶ Discharges to surface water will occur under conditions of an Environmental Authority and will involve discharges from sediment ponds when rainfall exceeds the design capacity of those ponds and controlled discharges of mine affected water when sufficient dilution is available to address salinity levels.
- ▶ Access to the southern part of the Project Area will be achieved via one point, a spanned bridge across the Carmichael River
- ▶ Rain water captured within the Mine footprint will be stored, treated and reused
- ▶ Sewage waste from the operational workforce will be treated in a packaged plant to an A standard and all effluent will be recycled onsite

The potential operation phase impacts (as identified in Figure 6-1) to terrestrial ecological values have been considered, and appropriate management and mitigation measures proposed, to ameliorate identified impacts, as listed below:

1. Clearing of land (vegetation clearing)
 - Loss of vegetation
 - Loss of fauna habitat
 - Fauna mortality
 - Habitat fragmentation
 - Habitat degradation
2. Disturbance of surface watercourses
 - Loss of water resources utilised by terrestrial species
 - Alteration/degradation of water quality in water resources utilised by terrestrial species
3. Alteration in groundwater regime
 - Changes to habitat due to groundwater drawdown
4. Proliferation of weeds and feral animals species
 - Competition with native species, predation of native species, and habitat degradation (presence and prevalence of pest and weed species)
5. Increased disturbance to habitats
 - Disturbance to breeding, roosting and foraging areas and behaviours
 - Habitat alteration associated with subsidence

Figure 6-1 Conceptual Diagram of Potential Operation Phase Impacts



6.2 Overview – Management of Operation Phase Impacts

6.2.1 Management Approach

The overarching objective of the approach to managing operation phase impacts will be to contribute to the maintenance and enhancement of the biodiversity values of the landscape in which the Project Area occurs. Given that unavoidable impacts will be a significant component of this phase of the Project, strategies to maintain and enhance the value and function of habitats that will not be subject to direct impacts (i.e. land clearing) both within the Project Area, and at offsite (offset) locations, will form a key aspect of the approach to minimising the impacts of the Project. In addition to the identification and management of these areas, targeted research and monitoring will be undertaken to inform the management of ecological values in-situ as well as in the broader region (i.e. the Galilee Basin).

It is important to note that, while this section deals with the overall impacts of clearing associated with the proposed mining activities, impacts will be staged over the 90 year mine life. The management



strategies detailed in this section will be implemented in accordance with staged operations of the Mine. Importantly, this staged implementation allows for an adaptive management⁴ approach to be taken whereby monitoring and targeted research will allow for continuous improvement in the management and mitigation approach.

A combined onsite management and offsite land procurement (offsetting) approach will be employed to address the impacts that will arise through the operation phase of the Project. In summary, this approach will involve a combination of the following actions:

- ▀ Measures will be implemented that will seek to prevent or minimise avoidable impacts on the terrestrial ecological values of the Project Area. These will include management actions relating to habitat degradation, fauna mortality and fauna behavioural disruption
- ▀ Land within the Project Area that will not be subject to land clearing throughout the life of the mine will be managed for biodiversity with a focus on maintaining and where possible enhancing in-situ habitat values and local landscape habitat function. Areas not to be cleared featuring remnant vegetation (i.e. parts of the northern and southern extents of the Project Area; Carmichael River corridor (south of river)) will be protected and enhanced where possible, whilst areas featuring non-remnant vegetation (i.e. south eastern part of Project Area; Carmichael River corridor north of river) will be actively managed with a view to re-establishing remnant vegetation status over time
- ▀ Vegetation and habitats occurring within unmined tracts of land that will be mined in future stages of the operation phase will be managed to maintain their ecological values and function until such time that they will be developed. Measures will be implemented to reduce the impacts of vegetation clearing on fauna in these areas, namely through encouraging/facilitating dispersal away from areas to be cleared, to suitable habitat in the surrounding local landscape
- ▀ Land above the underground mining footprint that will be subject to subsidence impacts will be actively managed. Given uncertainties about how subsidence will influence vegetation communities/fauna habitats in these areas, an adaptive management approach underpinned by rigorous monitoring will be implemented
- ▀ Rehabilitation of areas post-mining (i.e. spoil dumps, open cut pits) will be undertaken, with a view to revegetating these areas as quickly as possible following completion of activities. Opportunities to revegetate areas such that they provide habitat features for local fauna will be realised where possible. At the very least, measures to facilitate fauna movement in the local landscape (especially east-west) should be considered when rehabilitating disturbed areas
- ▀ Identification, procurement and management of land offsite, to realise a biodiversity objective of no-net-loss, will occur. This should focus on land near the Project Area (namely, within the Moray Downs property), as well as in the adjacent landscape. These areas should be identified and subsequently managed in consideration of their capacity to contribute to, and where possible enhance the biodiversity values of the region. Identification and management of these areas

⁴ Adaptive management:

- Management under uncertainty
- An iterative process, with feedback via monitoring
- Hypothesis driven / information driven
- Revision and updating of management and monitoring over time based on new information and changed goals



should seek to maintain and where possible enhance habitat availability (in particular, for threatened species), habitat condition, habitat resilience and habitat function (including contribution to local and regional connectivity)

- ▶ Targeted research and monitoring, prior to the commencement of operations, and for the duration of the operation phase, will be undertaken to inform the management strategies listed above, underpin an adaptive management approach, as well as contribute to the conservation of biodiversity values in the wider region (i.e. the Galilee Basin)

Key issues that will require considered management through the staged operation phase of the Project include:

- ▶ Loss of and disturbance to conservation significant remnant vegetation (endangered and of concern REs; category B ESAs)
- ▶ Loss of and disturbance to threatened ecological communities
- ▶ Loss of and disturbance to vegetation, habitats and species associated with the Bygana West Nature Refuge
- ▶ Loss of and disturbance to habitat for threatened species, including species recorded from the Project Area (waxy cabbage palm, black-throated finch (southern), squatter pigeon (southern), koala, black-necked stork, cotton pygmy-goose, little pied bat), and threatened species that are likely to occur at the Project Area
- ▶ Loss of and disturbance to habitat for common flora and fauna in the local landscape
- ▶ Mortality of animals during Project activities
- ▶ Disruption to ecosystem function in the local landscape – namely east-west connectivity

It is proposed that measures to manage impacts to biodiversity be enshrined within an overarching ecological management strategy, that makes reference to the key measures and approaches outlined in documents including the:

- ▶ Mine and Offsite Environmental Management Plans
- ▶ Project Offset Strategy
- ▶ Project Rehabilitation Plan
- ▶ Species-specific management plans – prepared for conservation significant species that will require targeted management

Detailed design of and subsequent implementation of the management measures proposed above will require collaboration between a range of stakeholders, including Adani, government, scientists and other community or non-government organisations (i.e. conservation groups, natural resource management organisations etc.). A major aspect of this will be the continual acquisition of information through ongoing research and monitoring, focussing on the ecological values to be managed at varying scales of impact (localised to landscape).

As unavoidable impacts are an inherent aspect of this Project, given that its operations are entirely related to the locality of the coal resource within the mining lease, offsets will form a substantial component of the impact management approach. Whilst all reasonable efforts will be made to minimise impacts to flora and fauna values within the operation phase footprint, vegetation loss, fauna



habitat loss and fauna mortality will occur. An overview of the offset strategy that will direct the identification and procurement of offsets for the Project is provided below.

6.2.2 Overview of Offset Strategy for Operation Phase

Commonwealth and State government offset requirements will be addressed in relation to proposed vegetation clearing, amongst other impacts, for the Project. Offsetting requirements under the following policies will need to be met:

- ▶ SEWPAC: *EPBC Act Environmental Offsets Policy* (October 2012)
- ▶ DEHP: *Queensland Biodiversity Offsets Policy* (QBOP) - a specific-issue offsets policy under the Queensland Government Environmental Offset Policy (QGEOP) that will apply to vegetation clearing and other biodiversity impacts occurring within the proposed mining leases
- ▶ DEHP: *Policy for Vegetation Management Offsets* (PVMO) – a specific-issue offsets policy under QGEOP to achieve vegetation management offset requirements necessary or desirable to achieve the purpose of the VM Act. This will apply to vegetation clearing outside of the proposed mining leases

Any impacts to protected matters of NES, as listed under the EPBC Act, which are associated with the Project (Mine), have been identified. Offset options for each impact to protected matters of NES are to be discussed with reference to the offset requirements set out in the SEWPAC Environmental Offsets Policy (October 2012). This has been undertaken, and is presented in the Project Offset Strategy (Volume 1, Chapter 8).

At a State level, the purpose of the QBOP is to increase the long-term protection and viability of Queensland's biodiversity. This is achieved by limiting residual impacts from development on areas possessing state significant biodiversity values. These biodiversity values are defined in Appendix 1 of the QBOP and include endangered or of concern RES, essential habitat, high value regrowth containing an endangered or of concern RE or regrowth essential habitat and watercourses (creek, stream, river or watercourse which appears on the vegetation management remnant watercourse map).

Biodiversity offsets will be required when a project has demonstrated to the regulator that all practical and reasonable efforts have been taken to avoid and minimise impacts on State significant biodiversity values but a residual impact remains on one or more of these values. The delivery of a biodiversity offset strategy may, in some instances, be able to be combined with offsets under Commonwealth legislation.

The Project falls within the definition of a level 1 mining activity as listed under chapter 5 of the EP Act. Therefore, any residual impacts associated with the Project on State significant biodiversity values would trigger a biodiversity offset obligation under QBOP. The Queensland SP Regulation prescribes Level 1 mining activities as 'not assessable development', exempt from offset obligations triggered by the VM Act, which are imposed in respect of development approvals. However, offsets under the PVMO will be required for impacts relating to the Mine offsite infrastructure located outside of the Project mining lease area(s).

Unavoidable (staged) loss of vegetation and the fauna habitat it provides will be offset in accordance with Queensland and Commonwealth policies. The overall objective of offsets is for the maintenance, and where at all possible, enhancement of the local biodiversity values as identified in this baseline



report. Identification of offsets will seek to realise opportunities to enhance local and regional biodiversity values, for example, through the procurement and management of areas that contribute to corridors in the region. Furthermore, these areas should be identified and managed with a view to achieving a 'no net loss' of local biodiversity values, in consideration of the types of vegetation that will be cleared, the conservation status of flora and fauna species they provide habitat for, and the function they have in contributing to ecological processes in the landscape (i.e. connectivity, resilience etc.). The management of offset areas will seek to improve the quality and function of vegetation and habitats, through identification and management of the threatening process with the potential to adversely affect species in these areas. Management of offset areas should be undertaken in accordance with the Project's overarching ecological management framework, to be embedded in the Mine and Offsite Environmental Management Plans.

Project Offset Strategy

The Project Offsets Strategy (Volume 1, Chapter 8) will demonstrate measures to offset the residual impacts associated with the Project. The offset strategy identifies the Commonwealth and State significant biodiversity values and the area of each being impacted. All biodiversity values that require offsetting are outlined in the Project Offset Strategy (Volume 1, Section 8) and Volume 4 Appendix AH Draft Offsets Strategy.

This strategy provides a framework for the identification of measures designed to provide regional biodiversity benefits, where onsite impacts cannot be avoided. Such measures include a combination of the identification and procurement of offsite land to be managed for conservation purposes and investment in ecological research in the landscape in which the Project Area occurs. The final offset package is likely to require a combination of direct and indirect offsets, offset payments and offset transfers. Opportunities to co-locate offsets for ecological values that have similar broad requirements (i.e. conservation significant species with similar habitat requirements) will be realised where possible.

The process of obtaining required offsets for the Project will be undertaken through a staged approach coinciding with the staged mining operations. Offsets will be provided for each mining operation stage where vegetation clearing will be required. Currently, the indicative stages of offset delivery are as follows:

- ▶ Stage 1: 2013 - 2027
- ▶ Stage 2: 2028 - 2047
- ▶ Stage 3: 2048 - 2110

Procuring direct offsets will focus in the first instance on land within the Moray Downs property, and will include areas of remnant vegetation to be managed, and where possible, enhanced, and areas of non-remnant vegetation to be managed and rehabilitated to provide ecological services including provision of habitat where previously habitat values were limited. For additional direct offsets, areas recognised as possessing 'high conservation value' within the Galilee Basin Offset Strategy (prepared by the Queensland Government) will be assessed

Targeted research and monitoring will form a part of the overall offset strategy, as indirect offsets. This will be undertaken to provide additional information on species and habitats (within and near the Project Area) that will be the focus of management efforts, and will occur prior to and throughout the operation phase. Research will contribute to the understanding of species and ecological processes in the Galilee Basin, in recognition of the intensification of land use across this region, and will allow



for the adaptive management of offset areas. These ecological studies will be undertaken in accordance with strategic research directives provided by Commonwealth and State government agencies.

Preliminary investigations relating to the availability of suitable offsets have revealed that offsets required by the Commonwealth (for matters of NES) are likely to be available wholly within the Moray Downs property, whilst offsets required by the State will likely need to be procured across multiple lots, including the Moray Downs property. This excludes one of concern RE, which, due to limited availability in the Desert Uplands Bioregion (<50 ha mapped as available for offsets), may not be able to be directly offset within this Bioregion, but may be able to be directly offset in the adjacent Bioregion (Ecofund, 2012). The actual suitability of these potential offset areas will require further investigation, including ecological equivalency surveys, and the application of appropriate offset ratios by the Commonwealth government. The final package of offsets is expected to be completed in 2013, once in-principle support of the strategy has been received from the Commonwealth and State.

6.3 Vegetation Clearing

6.3.1 Overview

Mine operations at the Project Area will require vegetation clearing across the open cut mine footprint, spoil disposal areas and mine water management dams. Note that vegetation clearing is not required over the underground mine footprint and the effects of subsidence are discussed in Section 6.7.4.

Open cut mining is proposed to be staged over the life of the mine. Consequently vegetation clearing will not occur in a single event, but rather is proposed to be staged to correspond with the sequential development of coal mining.

Whilst recognising that vegetation clearing is proposed to be staged, and that at any particular point over the life of the mine, some areas may retain the existing vegetation coverage, and other areas may be under active rehabilitation, the assessment below considers the clearing of all vegetation proposed to occur within the indicative mining (operation) footprint (Figure 5-1) over the life of the Mine. It should be noted that all calculations presented are approximate and based upon digitisation of the preliminary Mine plan (as at December 2011).

Potential impacts arising from vegetation clearing associated with Mine operations may include:

- ▶ Loss of vegetation, including threatened ecological communities and endangered and of concern regional ecosystems
- ▶ Loss of fauna habitat (roosting, shelter, foraging, breeding) for native fauna including conservation significant fauna
- ▶ Fauna mortality
- ▶ Habitat fragmentation, reduction in connectivity and reduced capacity for fauna dispersal
- ▶ Habitat degradation
- ▶ Disruption to fauna behavioural patterns from noise and activity



6.3.2 Loss of Vegetation

6.3.2.1 Potential Impacts

Potential impacts arising from vegetation clearing for mining operations include the following categories:

- ▶ Loss of TECs
- ▶ Loss of Category B ESAs
- ▶ Loss of endangered REs
- ▶ Loss of of concern REs
- ▶ Loss of least concern REs
- ▶ Loss of high value regrowth
- ▶ Loss of vegetation – Bygana West Nature Refuge
- ▶ Loss of vegetation communities
- ▶ Loss of vegetation – flora species and habitat, including least concern species and species of conservation significance

Each of the abovementioned categories are described in further detail in the following paragraphs.

Loss of Threatened Ecological Communities

One TEC, Brigalow (*Acacia harpophylla* dominant and co-dominant), was identified in the Project Area from field surveys. The presence of this TEC within the Project Area is described in Section 3.2.6. REs comprising this TEC are located within the proposed mining footprint and will be impacted by clearing for the operation of the Mine. The REs present within the Project Area that form part of this TEC are listed in Table 6-1. The table details information relating to the expected clearing impact area within the operational footprint, and the current extent of these REs across the Brigalow Belt bioregion and within the subregions in which the Project is located. The current bioregional extent of each RE, as of 2006, is the latest publicly available figure and this was obtained from the Queensland government (DERM 2010b). Column five in the table expresses the proposed clearing area of each RE for mining operations as a percentage of the subregional extent. This provides a basic quantitative assessment of likely impact on each RE. In addition, the final column provides the current extent of each RE in the protected area estate, which includes National Parks, State Forests, Timber Reserves and Conservation Parks within the bioregion.

An approximate area of 267 ha of Brigalow TEC is located within the mining footprint. Of that, approximately 195 ha (73 per cent) of the TEC will be cleared. The TEC to be directly impacted represents 0.28 per cent of that available within the Belyando Downs subregion (Table 6-1). The proportional loss of Brigalow TEC will be relatively small in the context of its subregional extent, and offsets will be secured and managed to maintain, protect and where possible enhance local biodiversity values. The localised loss of Brigalow TEC at the Project Area is not considered likely to adversely impact upon the biodiversity values of the region.

The 72 ha (27 per cent) of TEC remaining within the mining footprint is proposed to be retained and not cleared for mining operations, although some areas may be subject to subsidence from underground mining activities (discussed in Section 6.7.4).



Table 6-1 Approximate areas of impact for threatened ecological community REs

RE	VM Act status	Short description ¹	Area of impact ²	Area of RE remaining ³	Bioregion current extent ⁴	Subregion ⁵ current extent ⁴	% ⁶	Protected area estate (% of bioregion current extent) ⁷
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)								
11.3.1	E	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	46 ha	11 ha	80,806 ha	9,333 ha	0.49	10,195 ha (12.62)
11.4.8	E	<i>Eucalyptus cambageana</i> open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	< 1 ha	0 ha	71,568 ha	29,066 ha	<0.01	7033 ha (9.83)
11.4.9	E	<i>Acacia harpophylla</i> shrubby open forest to woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	149 ha	61 ha	96,182 ha	30,725 ha	0.49	8617 ha (8.96)
Total			195 ha	72 ha	248,556 ha	69,124 ha	0.28	25,845 ha (10.39)

¹ From REDD (Queensland Herbarium, 2011)

² Areas are approximations only as calculated based on ground-truthed RE mapping

³ Approximate area of RE within the Project Area that will not be cleared for mining operation, however some parts of this area may be subject to subsidence

⁴ Figures calculated from DERM 2010b: 'current extent' as of 2006

⁵ Each REs current extent within the subregions where the Project is located.

⁶ % = proposed clearing area in subregion

⁷ Protected area estate = national park, conservation park, nature conservation areas, state forest, timber and forest reserves within the bioregion (Accad *et al* 2008).

Loss of Category A and B Environmentally Sensitive Areas

No Category A ESAs are located within the mining footprint.

Six field verified REs with a biodiversity status of endangered are located within the mining footprint. These six REs are classified as Category B ESAs and are proposed to be directly impacted through the clearing of vegetation for the operation of the Mine. The seventh RE, with a biodiversity status of endangered, is only located within the offsite infrastructure and impacts to this RE are outlined in Section 5.2.2. The REs classified as Category B ESAs within the mining footprint are listed in Table



6-2. This table lists the estimated area of direct impact for each Category B RE, the amount of RE within the Project Area that is proposed not to be directly impacted, the current extent of the Category B REs across the bioregion and subregions within which the Project is located, and the current extent of the Category B REs within protected areas.

Approximately 1,054 ha of area classified as Category B ESA is located within the mining footprint. Of that, approximately 820 ha (78 per cent) is proposed to be cleared for Mine operations. The Category B ESAs to be directly impacted represents 0.73 per cent of that available within the two subregions intersected by the Project (comprising the Alice Tableland subregion for the Desert Uplands REs, and the Belyando Downs subregion for the Brigalow Belt REs) (Table 6-2). The 234 ha (22 per cent) of Category B ESA remaining within the mining footprint is proposed to be retained and not be directly impacted by clearing activities for mining operations, although some areas may be subject to subsidence from underground mining activities (discussed in Section 6.7.4).

Table 6-2 Approximate areas of impact for Category B ESA REs

RE	VM Act status	Bio diversity status	Short description	Area of impact	Area remaining	Bioregion current extent ¹	Subregion ² current extent ¹	% ³	Protected area estate (% of bioregion current extent) ⁴
10.4.3	LC	E	<i>Acacia harpophylla</i> and/or <i>Eucalyptus cambageana</i> open woodland on Cainozoic lake beds	468 ha	77 ha	18,118 ha	5,313 ha	8.81	0 ha (0%)
10.9.3	LC	E	<i>Acacia harpophylla</i> and/or <i>Eucalyptus cambageana</i> open woodland to woodland on Mesozoic sediments	23 ha	69 ha	13,726 ha	11,834 ha	0.19	35 ha (0.25%)
11.3.1	E	E	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on alluvial plains	46 ha	11 ha	80,806 ha	9,333 ha	0.49	10,195 ha (12.62%)
11.4.6	OC	E	<i>Acacia cambagei</i> woodland on Cainozoic clay plains	134 ha	16 ha	34,718 ha	26,074 ha	0.51	9,339 ha (26.90%)
11.4.8	E	E	<i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	< 1 ha	0 ha	71,568 ha	29,066 ha	<0.01	7,033 ha (9.83%)
11.4.9	E	E	<i>Acacia harpophylla</i> shrubby open forest to woodland with <i>Terminalia oblongata</i> on Cainozoic clay plains	149 ha	61 ha	96,182 ha	30,725 ha	0.49	8,617 ha (8.96%)
Total				820 ha	234 ha	315,118 ha	112,345 ha	0.73	35,219 ha (11.18%)

¹ Figures calculated from DERM 2010b: 'current extent' as of 2006

² Each REs current extent within the subregions where the Project is located.

³ % = proposed clearing area in subregion

⁴ Protected area estate = national park, conservation park, nature conservation areas, state forest, timber and forest reserves within the bioregion (Accad *et al* 2008).



As the Category B ESAs present within the mining (operation) footprint are also classified as regional ecosystems, assessment of the impacts of clearing of these areas is provided below

Loss of Endangered Regional Ecosystems

Approximately 267 ha of endangered (VM Act status) REs are located within the mining footprint. Of this area, approximately 195 ha (73 per cent) of the endangered REs located within the mining footprint are proposed to be cleared. The remaining 72 ha (27 per cent) is proposed to be retained and not be directly impacted by clearing activities for mining operations, although some areas may be subject to subsidence from underground mining activities (discussed in Section 6.7.4).

The area to be cleared comprises three endangered RE types (11.3.1, 11.4.8 and 11.4.9) which are all located from the Brigalow Belt bioregion (Belyando Downs subregion) within the mining footprint of the Project Area. These endangered REs form brigalow vegetation communities and are constituents of the Brigalow TEC as well as Category B ESAs (discussed above). RE (11.4.8) covers an area of less than 1 ha within the Project Area and is proposed to be wholly removed by vegetation clearing for Mine operations.

Table 6-3 details the proposed impact of mining operations on each endangered RE within the mining footprint. All endangered REs that are to be cleared in the mining footprint are represented by current extents of greater than 70,000 ha within the Brigalow Belt bioregion, and more than 8.5 per cent of the current extent of each RE located within the protected area estate.

All endangered REs listed in Table 6-3 are proposed to be impacted by vegetation clearing. However, clearing of these RE types will result in a less than one half of one per cent impact to the current extent of each RE type within the Belyando Downs subregion. Given the relatively low proportional loss of these REs, relative to their bioregional and subregional extents, and in consideration of the fact that the loss will be offset, the localised loss of endangered remnant vegetation is not considered likely to result in long term adverse impact on the biodiversity values of the region. The loss of endangered REs at the Project Area is unlikely to adversely impact landscape-scale processes such as movement of species, as the endangered remnant vegetation present is typified by small, generally isolated patches adjacent to or surrounded by non-remnant vegetation. In addition to in-situ management and protection of vegetation, offsetting the loss of this vegetation should consider opportunities to enhance connectivity of remnant vegetation characterised by endangered REs in the local landscape.

Table 6-3 Endangered REs and expected clearing impacts

REs	Proposed clearing area	Bioregion current extent ¹	Subregion ² current extent ¹	% ³ impact	Protected area estate (% of bioregion current extent) ⁴
11.3.1	46 ha	80,806 ha	9,333 ha	0.49	10,195 ha (12.62%)
11.4.8	< 1 ha	71,568 ha	29,066 ha	<0.01	7,033 ha (9.83%)
11.4.9	149 ha	96,182 ha	30,725 ha	0.49	8,617 ha (8.96%)
Total	195 ha	248,556 ha	69,124 ha	0.28	25,845 ha (10.39%)

¹ Figures calculated from DERM 2010b: 'current extent' as of 2006.

² each REs current extent within the subregions where the Project is located.

³ % = proposed clearing area in subregion.

⁴ Protected area estate = national park, conservation park, nature conservation areas, state forest, timber and forest reserves within the bioregion (Accad *et al* 2008).

Loss of Of Concern Regional Ecosystems

Approximately 345 ha of of concern (VM Act status) RE is located within the mining footprint. Approximately 169 ha (49 per cent) of the of concern (VM Act status) REs located within the mining footprint is proposed to be directly impacted through vegetation clearing. This area is made up of one of concern RE from the Desert Uplands bioregion, RE 10.7.4, and two of concern REs from the Brigalow Belt bioregion, REs 11.3.3 and 11.4.6. RE descriptions are detailed in Table 2-2. No EPBC Act listed TECs are associated with these RE types. However, RE 11.4.6 is classified as a Category B ESA as its biodiversity status is endangered.

Table 6-4 details the proposed impact of mining operations on each of concern RE within the mining footprint. The table details information relating to the expected clearing impact area within the operational footprint, and the current extent of these REs across the bioregion and subregions in which the Project is located. REs 11.4.6 and 11.7.4 are proposed to be most impacted by vegetation clearing for the operation of the Mine with 0.51 per cent and 0.40 per cent of the current extent of these REs within the subregion respectively being cleared. RE 10.7.4 has a current bioregional extent of less than 7,500 ha, of which 69 per cent of the total bioregional extent lies within the Alice Tableland subregion, where the Project is located.

As for endangered remnant vegetation, given the relatively low proportional loss of these REs, relative to their bioregional and subregional extents, and in consideration of the fact that the loss will be offset (including active management of offset areas for the maintenance, and where possible, enhancement of local biodiversity values), the localised loss of of concern remnant vegetation is not considered likely to result in long term adverse impact on the biodiversity values of the region. The loss of of concern REs at the Project Area is unlikely to adversely impact landscape-scale processes such as movement of species, as the of concern remnant vegetation to be cleared is typified by a combination of small patches and the edges of larger patches. In addition to in-situ management and protection of vegetation, offsetting the loss of this vegetation should consider opportunities to enhance connectivity of remnant vegetation characterised by endangered REs in the local landscape.

Table 6-4 Of Concern REs and expected clearing impacts

REs	Proposed clearing area	Bioregion current extent ¹	Subregion ² current extent ¹	% ³ impact	Protected area estate (% of bioregion current extent) ⁴
10.7.4	21 ha	7351 ha	5192 ha	0.40	250 ha (3.40%)
11.3.3	14 ha	281,347 ha	65,960 ha	0.02	6604 ha (2.35%)
11.4.6	134 ha	34,718 ha	26,074 ha	0.51	9339 ha (26.90%)
Total	169 ha	323,416 ha	97,226 ha	0.17	16,193 ha (5.01%)

¹ Figures calculated from Accad et al 2008: 'current extent' as of 2005.

² each REs current extent within the subregions where the Project is located.

³ % = proposed clearing area in subregion.

⁴ Protected area estate = national park, conservation park, nature conservation areas, state forest, timber and forest reserves within the bioregion.

Loss of Least Concern Regional Ecosystems

The majority of remnant vegetation within the Project Area is mapped as least concern REs. These REs are considered to have a relatively stable conservation status as a least concern RE is classified as having more than 30 per cent of its pre-clearing extent remaining and more than 10,000 ha of remnant vegetation remaining.

Approximately 28,029 ha of least concern remnant vegetation is located within the mining footprint. A total of 21 least concern RE types, 16 within the Desert Uplands bioregion and five in the Brigalow Belt bioregion, are proposed to be cleared for mining operations. This equates to a total removal of approximately 12,223 ha (44 per cent) of least concern RE within the mining (operation) footprint over the lifespan of the Mine. The loss of least concern vegetation for the operation of the Mine is proposed to occur sequentially over the lifespan of the Mine as new mining pits are developed and existing pits closed and rehabilitated. Table 6-5 lists the least concern REs within the mining operation footprint and expected clearing impact areas.

Three least concern REs, 10.3.6, 10.3.28 and 10.5.5 within the Project Area are subject to the greatest impact from the loss of vegetation as all three REs are subject to a loss of 2,000 ha or more. RE 10.3.28 is proposed to be impacted the most with an approximate area of 4,020 ha to be cleared for Mine operation. These three RE types are broadly characterised as *Eucalyptus brownii* or *Eucalyptus melanophloia* open woodlands which are the dominant vegetation types within the Project Area. Vegetation loss of between 100 ha and 900 ha is proposed to occur in seven RE types. The remaining 11 RE types are proposed to be impacted by the removal of approximately 100 ha or less.

Given that the current conservation status of these REs is least concern, the staged loss of this vegetation is not considered to represent a substantial impact to regional biodiversity values. Least concern vegetation (as defined under the VM Act) is not required to be offset under Queensland offset policies. However, the staged clearing of large areas of least concern remnant vegetation will represent a substantial loss in the local availability of habitat for flora and fauna. It is possible that landscape scale processes such as connectivity will be affected by the removal of this vegetation. Both Commonwealth and State offset policies require habitat for listed threatened species to be offset, and the QBOP also requires connectivity to be offset. This is summarised in Section 6.2.2, and discussed in more detail in the Project Offset Strategy (Volume 1, Chapter 8). Impacts to fauna species resultant from vegetation clearing are discussed in detail in Section 6.3.3.

Table 6-5 Least Concern REs and Expected Clearing Impacts

RE	Proposed clearing area	RE	Proposed clearing area
Desert Uplands bioregion			
10.3.3	87 ha	10.5.1	488 ha
10.3.4	87 ha	10.5.4	43 ha
10.3.6	2251 ha	10.5.5	3757 ha
10.3.12	134 ha	10.5.7	213 ha
10.3.14	10 ha	10.7.2	15 ha
10.3.28	4020 ha	10.7.5	5 ha
10.4.3	468 ha	10.7.7	200 ha
10.4.5	121 ha	10.9.3	22 ha
Brigalow Belt bioregion			
11.3.5	64 ha	11.3.27	17 ha
11.3.7	35 ha	11.5.3	9 ha
11.3.10	180 ha		
Total	12,223 ha		

Loss of High Value Regrowth

Of the 45 ha of high value regrowth vegetation that is mapped within the mining footprint, approximately 6 ha located within open cut blocks is proposed to be cleared. This regrowth vegetation is mapped as containing least concern REs, representing RE types 11.3.28a/11.3.6a. The 39 ha of high value regrowth remaining within the mining footprint is proposed to be retained and not be directly impacted by clearing activities for mining operations, although some areas may be subject to subsidence from underground mining activities (discussed in Section 6.7.4).

The VM Act regulates the clearing of regrowth vegetation. Authorised mining activities are exempt from the requirement to undertake clearing of high value regrowth in accordance with the DNRM Regrowth Vegetation Code in order to be lawful. However, high value regrowth vegetation loss may need to be considered under the QBOP.

The small loss of small patches of highly fragmented regrowth vegetation at the Project Area is unlikely to adversely affect local or regional biodiversity values. The unavoidable loss of this vegetation will be considered as part of the delivery of offsets for the Project.

Loss of Vegetation – Bygana West Nature Refuge

The Bygana West Nature Refuge covers an area of 1,487 ha and is wholly contained within the mining footprint. Vegetation clearing for mining operations within the Bygana West Nature Refuge will result in the direct loss of approximately 1,301 ha of the remnant vegetation in the nature refuge, an 88 per cent loss of its total vegetation coverage. The remaining 186 ha of the nature refuge within the Mine (operation) footprint may be exposed to subsidence as a result of underground mining activities.



The Bygana West Nature Refuge contains ecological values that are relatively free of disturbance, and therefore represents a locally noteworthy habitat feature in the local landscape. The ecological values that characterise the Nature Refuge include endangered REs, connectivity to adjacent remnant vegetation and regional connectivity with other protected areas, relatively high species diversity and a range of woodland habitats that are relatively disturbance free. Ecological values of the Bygana West Nature Refuge are discussed in more detail Section 3.3.7.

These values will be individually offset under Federal and/or Queensland offset policies.

Land in the local landscape can be procured and managed to offset the loss of vegetation and habitats in the Nature Refuge, given that the characteristic vegetation assemblages occurring within Bygana West occur in the wider landscape adjacent to the Project Area. This is particularly applicable to areas to the west of Bygana West Nature Refuge (within and west of the Moray Downs property) and areas to the south of the Nature Refuge (within and south of the Project Area).

Protection and enhancement of habitats along the Carmichael River corridor may contribute to offsetting loss of connectivity as well as other values, especially given that this enhancement would involve management of similar vegetation assemblages (namely ironbark-box woodland) and similar ecological values (habitat for common and threatened species, east-west connectivity). Offsets have been identified that will aim to protect, maintain and, where possible, enhance the condition and function of areas in the local landscape, such that the localised loss of the relatively disturbance-free, intact remnant vegetation in Bygana West Nature Refuge does not result in a reduction in the biodiversity values of the local landscape.

Loss of Vegetation – Flora Species and Flora Habitat

EPBC Act and NC Act threatened flora species

The only flora species of conservation significance confirmed present during the field surveys, waxy cabbage palm, is restricted to the Carmichael River channel. A total of 17 ha of *potentially suitable habitat* within the fringing open forest/woodland vegetation community, in RE 11.3.25 will be subject to vegetation clearing. In addition, 2 ha of potentially suitable habitat located above the underground mine may be exposed to subsidence. The Carmichael River channel, which represents known habitat for this species, will not be directly disturbed, nor will it be undermined, and a buffer is to be established. Therefore, there will be no clearing or loss of habitat for this species.

The footprint for mining operations may contain potentially suitable habitat for three flora species that may occur at the Project Area, as determined through the likelihood of occurrence assessment. None of these species were confirmed present during field surveys of the Project Area. The three species are:

- ▶ *Acacia ramiflora* (vulnerable EPBC Act; not listed NC Act) - may occur within Project Area
- ▶ *Nesaea robertsii* (not listed EPBC Act; endangered NC Act) – may occur within Project Area
- ▶ *Peripleura scabra* (not listed EPBC Act; near threatened NC Act) – may occur within Project Area

It is likely that potentially suitable habitat for these species will be removed through sequential vegetation clearing for the operation of the mine over the lifespan of the mine. Outcomes of the likelihood of occurrence assessment and potential habitat requirements for each species are detailed further within Sections 3.2.4 and Section 3.3.5.

Least concern flora species and vegetation communities

Sequential vegetation clearing for the operation of the Mine over its lifespan is proposed to involve the loss of habitat for the flora populations present. Overall, clearing for the mining footprint is proposed



to involve the loss of approximately 12,587 ha (44 per cent) of remnant vegetation within the Project Area.

Excluding the waxy cabbage palm, all plants recorded at the Project Area are relatively common in the local landscape and at a bioregional scale. All vegetation communities, whether characteristic of the Brigalow Belt bioregion or Desert Uplands bioregion, are considered to be relatively common throughout their respective bioregions, although it is important to note that historical vegetation clearing has been far more extensive in the Brigalow Belt bioregion. Stark variation in the plant composition within the regional ecosystems types were not observed as they transitioned between bioregions, generally from communities' representative of the Brigalow Belt in the east to communities more characteristic of the Desert Uplands in the west of the Project Area. Vegetation clearing in the Project Area was predominantly in the east (i.e. within the Brigalow Belt), while vegetation in the west was largely intact (i.e. within the Desert Uplands bioregion).

The clearing of these vegetation communities during staged mining operations will involve the sequential yet permanent loss of these areas as breeding habitat for least concern flora species. The localised loss of vegetation communities featuring common and widespread least concern flora species at the Project Area is unlikely to adversely impact landscape-scale biodiversity values or availability of these species and communities in the wider region. Locally, there is potential for many of these species to be re-established through species rehabilitation and offsets of the RE constituents of vegetation communities.

6.3.2.2 Management and Mitigation

In response to unavoidable clearing of native vegetation, the following management and mitigation measures are recommended:

- ▀ Non-remnant areas within the Project Area that are to remain unmined should be rehabilitated and managed (including monitoring) with the objective being to gradually achieve regrowth and remnant status to vegetation communities that are associated with similar land zones in the local landscape. This active management should occur to contribute to the maintenance of ecological values of the local landscape in which the Project Area occurs, though it is recognised that cleared lands are generally seeded with exotic pastures and restoration of a native ground cover may be difficult to achieve, or a very long term outcome. Areas where such management could occur include along the Carmichael River corridor (north of the Carmichael River), in the eastern part of EPC 1080 (south and south east of the MIA), and at the southern part of EPC 1080 where no development is proposed to occur. A component of this active management should be the removal of cattle, or the implementation of ecologically sensitive grazing strategies
- ▀ The ecological values within the buffer area surrounding the Carmichael River are to be enhanced through a revegetation and active vegetation and habitat management program. The program will focus on providing habitat for key threatened species, and on providing east-west connectivity. A monitoring program will be implemented to monitor success of the revegetation and enhancement program as well as presence and utilisation by fauna, including threatened fauna. Results of monitoring of the revegetation program may be relevant to rehabilitation and also management of offset areas on Moray Downs and adjacent properties
- ▀ The extent of vegetation clearing is to be restricted to the minimal amount necessary for mining operations. Areas that must not be cleared or damaged are to be clearly identified on operation plans and in the field. Clearing extents are to be communicated to all necessary personnel involved



- ▶ During mining operations, sequential clearing will be adopted in order to minimise the ongoing total area of impact through clearing
- ▶ Vegetation clearing operations are to be supervised to monitor compliance of vegetation clearing with the defined clearing extents
- ▶ Unavoidable (staged) loss of vegetation will be offset in accordance with Commonwealth and Queensland policies, with the objective of maintaining, and where at all possible, enhancing the local biodiversity values identified in this baseline report. Identification of offsets will seek to realise opportunities to enhance local and regional biodiversity values, for example, through the procurement and management of areas that contribute to corridors in the region. Furthermore, these areas should be identified with a view to achieving a 'no net loss' of local biodiversity values, in consideration of the types of vegetation that will be cleared, and the conservation status of those vegetation communities. Section 6.2.2 provides an overview of the proposed offset strategy for the Project
- ▶ As soon as possible after disturbed areas (cleared areas, open cut pits, out of pit waste dumps etc.) are no longer required, rehabilitation will commence. This is to include, but not be limited to, measures including the reinstatement of soil profiles, including topsoil, and revegetation using flora species of local provenance that are suitable for the reinstated soil and geomorphology. Management of previously disturbed land will occur in accordance with the Project Rehabilitation Management Plan. This plan will detail how disturbed land will be managed and rehabilitated, including (but not limited to) details about seed collection, flora regeneration and landscape architecture (i.e. topography), monitoring and adaptive management of rehabilitated areas. The objective of land rehabilitation should be to return disturbed areas to a vegetated state as quickly as possible after disturbance has ceased. In addition to monitoring and adaptive management of rehabilitated areas, opportunities for targeted rehabilitation activities that seek to enhance local biodiversity values should be identified and realised. These may include providing vegetated linkages across rehabilitation areas to larger areas of remnant vegetation, and provision of habitat resources for local fauna species
- ▶ The Rehabilitation Management Plan is to specify techniques for managing cleared vegetation and topsoil where this is to be used in rehabilitation.

6.3.2.3 Summary

The operation phase of the Mine is expected to result in the disturbance of approximately 12,586 ha of remnant vegetation. In addition to the area of remnant vegetation required to be disturbed, an additional 7,321 ha of non-remnant vegetation (approximate) will be cleared through the operation phase. In accordance with the proposed development of the coal resource, open cut mining and associated vegetation clearing will occur sequentially throughout the mining footprint over the life of the Mine. Due to the operational layout of the Mine, much of the western half of the Project Area will not be cleared. The parts of the Project Area where vegetation clearing is not proposed to occur contain both remnant (approximately 16,055 ha, 56 per cent of remnant vegetation within the mining footprint) and non-remnant vegetation (approximately 6,824 ha). However, some of these areas not impacted by clearing may be subject to subsidence as a result of underground mining (discussed in Section 6.7.4).

The loss of vegetation within the footprint for the proposed mining operations will impact upon an EPBC Act listed TEC and a number of Queensland listed categories of ecological importance, including Category B ESAs, endangered and of concern regional ecosystems, regrowth vegetation



and the Bygana West Nature Refuge. Relevant legislative approvals will be required before the removal of these features, and appropriate offsetting obligations will be addressed. A summary of the loss of vegetation for the operation of the Mine is presented in Table 6-6.

Vegetation clearing is proposed to occur sequentially throughout the life of the Mine. With active management, the ecological values within each area will be maintained (such that these do not deteriorate over time) until such time that staged mining is to occur. Generally, the staged yet permanent loss of remnant vegetation for mining operations is proposed to have an acceptable impact on the REs located within the operational footprint of the Mine, given the proportional losses that will occur in the context of subregional and regional vegetation extents. Less than one per cent of the current (2006) subregional RE extent for all endangered and of concern REs impacted by the Project is proposed to be lost as a result of vegetation clearing.

In addition to onsite measures to minimise avoidable impacts to vegetation as well as manage and enhance areas that will not be subject to vegetation clearing, the loss of TECs and endangered and of concern REs, and the ecological (i.e. fauna habitat) values provided by remnant vegetation, will be offset via the identification, procurement and management of suitable areas in the surrounding landscape, most notably on the Moray Downs property. The overarching objective of this onsite and offsite management will be to maintain, and where opportunities exist, enhance the biodiversity values of the landscape in which the Project occurs.

Through the implementation of management actions within the Project Area, in combination with the procurement and management of offsets (offsite), long-term, irreversible impacts to regional biodiversity values associated with conservation significant vegetation are not expected to occur.

Table 6-6 Summary of loss of vegetation categories impacted for mine operations

Category	Proposed area of to be cleared
Endangered RE	195 ha
Of concern RE	169 ha
Least concern RE	12,223 ha
(Total remnant vegetation)	12,587 ha
Brigalow TEC	195 ha
Category B ESA	820 ha
Regrowth vegetation	9 ha
Bygana West Nature Refuge (remnant vegetation)	1,301 ha

6.3.3 Loss of Fauna Habitat

6.3.3.1 Potential Impacts

Loss of Habitat – General Native Fauna

The mining footprint will require vegetation clearing over the life of the proposed Mine, encompassing open cut blocks, out of pit waste dumps and water management dams with a total area of 19,907 ha. This includes 12,587 ha of remnant vegetation (approximately 44 per cent of remnant vegetation in



the Project Area) and 7,321 ha of non-remnant vegetation. Table 6-7 summarises habitat loss associated with vegetation clearing, by fauna habitat type.

Table 6-7 Fauna Habitats – areas to be cleared of vegetation in Project Area

Fauna habitat type	Area to be cleared over life of mine			Total
	Open cut blocks	Out of pit waste dumps	Water management dams	
Ironbark-box grassy woodlands and open woodlands on grey sand plains 'Ironbark-box woodland'	7,196 ha	3,046 ha	350 ha	10,592 ha
Yellow jacket and rough leaved bloodwood shrubby low open woodland on red sand plains 'Shrubby low woodland'	61 ha	191 ha	0 ha	252 ha
Tall mixed shrubland on red sand plains over ferricrete 'Tall mixed shrubland'	273 ha	34 ha	0 ha	307 ha
Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains 'Gidgee / brigalow shrubland'	659 ha	628 ha	64 ha	1351 ha
Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding 'Fringing open forest / woodland'	3 ha	14 ha	0 ha	17 ha
Woodland and low open woodland associated with laterised sandstone rises and minor pediments 'Low woodland (sandstone rises)'	64 ha	3 ha	0 ha	67 ha
Open, previously cleared areas lacking native vegetative cover 'Open cleared land'	2,610 ha	4,155 ha	556 ha	7,321 ha

The staged loss of these habitats, over the life of the mine, will reduce the local availability of foraging, breeding and shelter resources for a wide diversity of fauna (as identified in this report). As mining operations will be staged with progressive clearing, mobile species may be able to disperse



into uncleared parts of the Project Area, and to retained areas around the edge of the mining lease and along the Carmichael River or disperse away from the Project Area to similar habitats that occur in the landscape to the north, west and south of the Project Area. Active habitat management in these areas will seek to facilitate and promote dispersal away from clearing areas.

It is important to note that large parts of the Project Area will not be exposed to vegetation clearing during staged operations of the Mine. Table 6-8 provides a summary of the fauna habitat areas that are not proposed to be affected by vegetation clearing. In total, 16,033 ha of land characterised by fauna habitats featuring remnant vegetation will not be cleared, although 7,767 ha of this may be exposed to subsidence impacts (discussed in Section 6.7.4).

Table 6-8 Fauna Habitats - areas not to be cleared of remnant vegetation in Project Area

Fauna habitat type	Land not proposed to be cleared (outside of mine footprint)	Land not proposed to be cleared (above underground mine) – will be exposed to subsidence	Total
Ironbark-box grassy woodlands and open woodlands on grey sand plains 'Ironbark-box woodland'	6,182 ha	4,721 ha	10,903 ha
Yellow jacket and rough leaved bloodwood shrubby low open woodland on red sand plains 'Shrubby low woodland'	1,310 ha	987 ha	2,297 ha
Tall mixed shrubland on red sand plains over ferricrete 'Tall mixed shrubland'	275 ha	1039 ha	1,313 ha
Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains 'Gidgee / brigalow shrubland'	726 ha	157 ha	883 ha
Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding 'Fringing open forest / woodland'	287 ha	2 ha	289 ha
Woodland and low open woodland associated with laterised sandstone rises and minor pediments 'Low woodland (sandstone rises)'	89 ha	258 ha	347 ha

6.3.4 Loss of Habitat – EPBC Act Listed Fauna

Black-throated Finch (Southern)

The EPBC Act (and NC Act) listed endangered black-throated finch (southern) was recorded at the Project Area (Section 3.2.5.1, Table 3-3). Details relating to black-throated finch (southern) at the Project Area are presented in Section 3.2.5.1 and Volume 4 Appendix N3 (Black-throated Finch Report). The proposed mining footprint to be cleared over the life of Mine operations incorporates 11,419 ha of the 26,044 ha identified as potential habitat for the black-throated finch (southern) at the Project Area (based on field verified REs, as displayed in Figure 3-2). This comprises:

- ▶ 7,764 ha of potential habitat in areas to be progressively cleared for open cut blocks over the life of the mine
- ▶ 3,361 ha of potential habitat in areas to be progressively cleared for out of pit waste dumps
- ▶ 294 ha of potential habitat in areas to be cleared for mine water management dams

Figure 3-4 presents the 'important areas' for the black-throated finch (southern) at the Project Area. These areas, as defined in the Black-throated Finch (southern) Significant Impact Guidelines (DEWHA, 2009b), represent potential habitat (based on field verified REs) within 5 km of post-1995 (i.e. Project field survey) sightings of the subspecies. A total of 9,862 ha of the 21,222 ha of identified black-throated finch (southern) important areas (as displayed in Figure 3-4) is proposed to be impacted by vegetation clearing over the life of the Mine. This comprises:

- ▶ 6,808 ha of important areas in areas to be progressively cleared for open cut blocks over the life of the mine
- ▶ 2,845 ha of important areas in areas to be progressively cleared for out of pit waste dumps
- ▶ 209 ha of important areas in areas to be cleared for mine water management dams

A 'population' of an (EPBC Act) endangered species is defined in the Significant Impact Guidelines as 'the occurrence of the species in a particular area', where occurrence relates to:

- ▶ *A geographically distinct regional population, or collection of local populations, or*
- ▶ *A population, or collection of local populations, that occurs within a particular bioregion* (DEWHA, 2009c).

The Project Area is within approximately 50 km of a cluster of 'important areas' (i.e. habitat within 5 km of a post-1995 sighting) for the subspecies exhibited in the *Whole of range important areas* map presented in the black-throated finch (southern) significant impact guidelines (DEWHA, 2009b). As such, it is likely that the population at the Project Area is part of a collection of local populations.

In light of information available at the time of preparation of this impact assessment, unavoidable vegetation clearing and resultant habitat loss (pre-management and mitigation) is considered to constitute a significant impact on the black-throated finch (southern), as a result of the (staged) loss of 9,862 ha of potential habitat within identified 'important areas' for the subspecies within the mining footprint.

Given that the habitat loss (pre-management and mitigation) is considered to constitute a significant impact to the black-throated finch (southern), an extensive, integrated suite of actions will be implemented, such that the habitat loss (post-management and mitigation) does not:

- ▶ *Lead to a long-term decrease in the size of a population*
- ▶ *Reduce the area of occupancy of the species*



- ▶ *Fragment an existing population into two or more populations*
- ▶ *Adversely affect habitat critical to the survival of a species*
- ▶ *Disrupt the breeding cycle of a population*
- ▶ *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- ▶ *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*
- ▶ *Introduce disease that may cause the species to decline, or*
- ▶ *Interfere with the recovery of the species* (DEWHA, 2009c).

The management and mitigation measures proposed to alleviate the unavoidable impacts associated with the staged loss of potential habitat within important areas for the black-throated finch (southern), such that a significant impact on the subspecies is not realised, are presented in Section 6.3.4.1. An assessment of the residual impact to the subspecies, against the significant impact criteria (for EPBC Act listed endangered species) listed above, is presented in Section 6.3.4.2

Squatter Pigeon (Southern)

The EPBC Act (and NC Act) listed vulnerable squatter pigeon (southern) was frequently recorded at the Project Area (Section 3.2.5.1, Figure 3-5). The proposed mining footprint to be cleared over the life of Mine operations incorporates 12,391 ha of the 29,716 ha of identified as potential habitat for the squatter pigeon (southern) (based on field verified REs, as identified in Figure 3-6). This comprises:

- ▶ 8,115 ha of potential habitat in areas to be progressively cleared for open cut blocks over the life of the mine
- ▶ 3,861 ha of potential habitat in areas to be progressively cleared for out of pit waste dumps
- ▶ 414 ha of potential habitat in areas to be cleared for mine water management dams

Loss of habitat for the squatter pigeon (southern) is proposed to be staged, in accordance with the staged development of the operational components of the Mine. Despite the fact that large areas of potential squatter pigeon (southern) habitat will be retained at the Project Area, an overall reduction in the local availability of habitat for the subspecies will occur during the operation phase of the Project. It is possible that the subspecies may disperse away from the developed parts of the Project Area, either to suitable habitat within other parts of the Project Area, or to potentially suitable habitat in the landscape to the north, west and south of the Project Area (as presented in Figure 3-7). Preservation and enhancement of the corridor along the Carmichael River may compensate for some of the habitat loss, and facilitate dispersal of the subspecies in the local landscape.

The provision of surface water in the eastern part of the Project Area (water management dams) may provide additional localised access to drinking water for the subspecies.

The squatter pigeon (southern) appeared to be common in suitable habitat at the Project Area, and is likely to be present where suitable habitat occurs in the landscape beyond the Project Area. At the subspecies level, the squatter pigeon (southern) population is considered to be stable at present, with historic declines (in the southern part of its range - New South Wales and southern Queensland) considered to have ceased (SEWPAC, 2011i). Across its range the subspecies is thought to occur as a continuous, inter-breeding population, with no single populations identified as being important for its long-term survival or recovery (SEWPAC, 2011i). With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that squatter pigeons (southern) at the Project Area are part of

an 'important population' (of an EPBC Act listed vulnerable species). That is, squatter pigeons (southern) at the Project Area are not considered to be a part of a *population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- ▶ *Key source populations either for breeding or dispersal*
- ▶ *Populations that are necessary for maintaining genetic diversity, and/or*
- ▶ *Populations that are near the limit of the species range (DEWHA, 2009c)*

Based on the availability of similarly suitable habitat in the landscape surrounding the Project Area including grazing land characterised by open grassy woodlands, and the stable nature of the subspecies' population at present, it is not considered that the Project Area represents *habitat critical to the survival of the* (sub)species. Whilst local habitat availability will be reduced through staged mining operations, this loss is not considered to constitute a significant impact to an EPBC Act listed vulnerable species.

The management and mitigation measures proposed to alleviate the unavoidable impacts associated with the loss of potential habitat for the squatter pigeon (southern) are presented in Section 6.3.4.1. Residual impacts, post management and mitigation, are summarised in Section 6.3.4.2.

Koala

The EPBC Act listed vulnerable koala was recorded at the Project Area (Section 3.2.5, Figure 3-8). Whilst only one koala was observed during field surveys, and in consideration of the fact that the species is likely to be present in this landscape at low densities, much of the eucalypt woodland vegetation at the Project Area represents potentially suitable habitat. The proposed mining footprint to be cleared over the life of Mine operations incorporates 10,609 ha of the 21,801 ha of identified as potential habitat for the koala (based on field verified REs, as identified in Figure 3-8). This comprises:

- ▶ 7,199 ha of potential habitat in areas to be progressively cleared for open cut blocks over the life of the mine
- ▶ 3,060 ha of potential habitat in areas to be progressively cleared for out of pit waste dumps
- ▶ 350 ha of potential habitat in areas to be cleared for mine water management dams

Habitat loss and fragmentation is a major threat to the koala (SEWPAC, 2012b). The loss of habitat considered suitable for the koala is proposed to be staged, in accordance with the staged development of the operational components of the Mine. Despite the fact that large areas of potential koala habitat will be retained at the Project Area, an overall reduction in the local availability of habitat for the species will occur during the operation phase of the Project. It is possible that the species may disperse away from the developed parts of the Project Area, either to suitable habitat within other parts of the Project Area, or to potentially suitable habitat in the landscape to the west and south, or riparian areas to the east of the Project Area (as presented in Figure 3-9). Preservation and enhancement of the habitat corridor along the Carmichael River may compensate for some of the habitat loss, and facilitate dispersal of the species in the local landscape.

The koala is considered to have 'scattered populations throughout Queensland' and no defined 'important populations' have been listed by SEWPAC (2012). With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the occurrence of a koala at the Project Area defines it as part of an 'important population' (of an EPBC Act listed vulnerable species). That is, koalas at the Project Area are not considered to be a part of a *population that is necessary for a*



species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:

- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*
- *Populations that are near the limit of the species range (DEWHA, 2009c)*

Based on the low estimated density of koalas within the Brigalow Belt and the availability of similarly suitable habitat in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species*. Whilst local habitat availability will be reduced through staged mining operations, this loss is not considered to constitute a significant impact to an EPBC Act listed vulnerable species.

The management and mitigation measures proposed to alleviate the unavoidable impacts associated with the loss of potential habitat for the koala are presented in Section 6.3.4.1. Residual impacts, post management and mitigation, are summarised in Section 6.3.4.2.

Yakka Skink

The EPBC Act (and NC Act) listed vulnerable yakka skink was not recorded at the Project Area, however is considered likely to occur based on the suitability of habitat, previous records from the region, and the species' known distribution (Section 3.2.5.2). The mining footprint that is proposed to be cleared over the life of Mine operations incorporates 12,282 ha of the 27,027 ha of identified potential habitat for the yakka skink (based on field verified REs, as identified in Figure 3-10). This comprises:

- 7,987 ha of potential habitat in areas to be progressively cleared for open cut blocks
- 3,881 ha of potential habitat in areas to be progressively cleared for out of pit waste dumps
- 414 ha of potential habitat in areas to be cleared for mine water management dams

While vegetation clearing and associated loss of potential yakka skink habitat is proposed to be staged, an overall reduction in the localised extent of potential habitat for this species (which occurs naturally at low abundance, and disperses across the landscape) will occur as a result of the Project's operation phase (approximately 45 per cent of the identified potential habitat at the Project Area).

With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the Project Area supports an 'important population' of the EPBC Act listed vulnerable yakka skink, in so much as:

- The species was not detected at the Project Area during targeted surveys (survey effort presented in Table 1-7 (EPC 1690 Study Area) and Section 1.3.1 of Appendix B (EPC 1080 Study Area))
- The Project Area is not considered to constitute habitat for key source populations (breeding/dispersal), especially given the availability of similarly suitable habitat in the surrounding landscape
- The Project Area does not occur at or near the limit of the species' range

Yakka skinks, should they occur at the Project Area, are not considered to be a part of a *population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*



- Populations that are near the limit of the species range (DEWHA, 2009c).

Based on the fact that the species was not detected at the Project Area despite targeted surveys, and that similarly suitable habitat for the species is present in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species* for the yakka skink. Whilst local habitat availability will be reduced through staged mining operations, this loss is not considered to constitute a significant impact to an EPBC Act listed vulnerable species.

The management and mitigation measures proposed to alleviate the unavoidable impacts associated with the loss of potential habitat for the yakka skink are presented in Section 6.3.4.1. Residual impacts, post management and mitigation, are summarised in Section 6.3.4.2.

Ornamental Snake

The EPBC Act (and NC Act) listed vulnerable ornamental snake was not recorded at the Project Area, however is considered likely to occur based on the suitability of habitat, previous records from the region, and the species' known distribution (Section 3.2.5.2). The mining footprint that is proposed to be cleared over the life of Mine operations incorporates 1,368 ha of the 2,540 ha of identified potential habitat for the ornamental snake (based on field verified REs, as identified in Figure 3-11). This comprises:

- 663 ha of potential habitat in areas to be progressively cleared for open cut blocks
- 642 ha of potential habitat in areas to be progressively cleared for out of pit waste dumps
- 64 ha of potential habitat in areas to be cleared for mine water management dams

While vegetation clearing and associated loss of potential ornamental snake habitat will be staged, an overall reduction in the localised extent of potential habitat for this species is proposed to occur as a result of the Project's operation phase (approximately 54 per cent of the identified potential habitat at the Project Area).

With respect to the Significant Impact Guidelines (DEWHA, 2009c), it is not considered that the Project Area supports an 'important population' of the EPBC Act listed vulnerable ornamental snake, in so much as:

- The species was not detected at the Project Area during targeted surveys (survey effort presented in Table 1-7 (EPC 1690 Study Area) and Section 1.3.1 of Appendix B (EPC 1080 Study Area))
- The Project Area is not considered to constitute habitat for key source populations (breeding/dispersal), especially given the availability of similarly suitable habitat in the surrounding landscape
- The Project Area does not occur at or near the limit of the species' range

Ornamental snakes, should they occur at the Project Area, are not considered to be a part of a *population that is necessary for a species' long-term survival and recovery, including populations identified as such in recovery plans, and/or that are:*

- Key source populations either for breeding or dispersal*
- Populations that are necessary for maintaining genetic diversity, and/or*
- Populations that are near the limit of the species range (DEWHA, 2009c).*

Based on the fact that the species was not detected at the Project Area despite targeted surveys, and that similarly suitable habitat for the species is present in the landscape surrounding the Project Area, it is not considered that the Project Area represents *habitat critical to the survival of the species* for



the ornamental snake. Whilst local habitat availability will be reduced through staged mining operations, this loss is not considered to constitute a significant impact to an EPBC Act listed vulnerable species.

The management and mitigation measures proposed to alleviate the unavoidable impacts associated with the loss of potential habitat for the ornamental snake are presented in Section 6.3.4.1. Residual impacts, post management and mitigation, are summarised in Section 6.3.4.2.

EPBC Act Listed Threatened Fauna Species – May Occur

The regional extent of potentially suitable habitat for two EPBC Act listed vulnerable birds (red goshawk, Australian painted snipe), that may occur at the Project Area based on the presence of suitable habitat and known distribution, will be reduced. Potentially suitable habitat for these species will still be present at the Project Area during the Mine's operation phase, and occurs in the surrounding landscape.

EPBC Act Listed Migratory Species

Land clearing for the Project's operation phase will reduce the local availability of habitat resources for the three EPBC Act listed migratory birds confirmed present at the Project Area (eastern great egret, rainbow bee-eater and satin flycatcher) (Section 3.2.7). The staged loss of potential habitat for these species within the Mine operations area (open cut blocks, out of pit waste dumps and water management dams) is as follows:

- ▶ Rainbow bee-eater (confirmed present at Project Area) – progressive loss of approximately 19,917 ha of potential habitat
- ▶ Eastern great egret (confirmed present at Project Area) – progressive loss of approximately 34 ha of potential habitat
- ▶ Satin flycatcher (confirmed present at Project Area) – progressive loss of approximately 17 ha of potential habitat
- ▶ Common sandpiper (likely to occur at Project Area) – progressive loss of approximately 17 ha of potential habitat
- ▶ Fork-tailed swift (likely to occur at Project Area) – progressive disturbance to approximately 19,917 ha of potential habitat – this species is predominantly aerial and thus habitat disturbance relates to overfly foraging habitat
- ▶ Curlew sandpiper (likely to occur at Project Area) – progressive loss of approximately 17 ha of potential habitat
- ▶ Latham's snipe (likely to occur at Project Area) – progressive loss of approximately 34 ha of potential habitat
- ▶ White-bellied sea-eagle (likely to occur at Project Area) – progressive loss of approximately 34 ha of potential habitat
- ▶ White-throated needletail (likely to occur at Project Area) – progressive disturbance to approximately 19,917 ha of potential habitat – this species is predominantly aerial and thus habitat disturbance relates to overfly foraging habitat
- ▶ Caspian tern (likely to occur at Project Area) – progressive loss of approximately 17 ha of potential habitat



- ▶ Black-tailed godwit (likely to occur at Project Area) – progressive loss of approximately 17 ha of potential habitat
- ▶ Glossy ibis (likely to occur at Project Area) – progressive loss of approximately 17 ha of potential habitat
- ▶ Common greenshank (likely to occur at Project Area) – progressive loss of approximately 17 ha of potential habitat
- ▶ Marsh sandpiper (likely to occur at Project Area) – progressive loss of approximately 17 ha of potential habitat

The eastern great egret, rainbow bee-eater and satin flycatcher are widely distributed species. Habitat at the Project Area is likely to be used on a temporary to permanent basis by these species. As these species are widespread, and suitable habitat is likely to occur over much of the surrounding landscape, habitat at the Project Area for the eastern great egret, rainbow bee-eater and satin flycatcher is not considered to constitute 'important habitat' as defined in the Significant Impact Guidelines (DEWHA, 2009c), that is:

- ▶ *Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion (as defined in DEWHA, 2009c) of the population of a species, and/or*
- ▶ *Habitat that is of critical importance to the species at particular life-cycle stages, and/or*
- ▶ *Habitat utilised by a migratory species which is at the limit of the species' range, and/or*
- ▶ *Habitat within an area where the species is declining (DEWHA, 2009c).*

Whilst local habitat availability will be reduced through staged mining operations, this loss is not considered to constitute a significant impact to EPBC Act listed migratory species.

The eleven migratory species that were not recorded at the Project Area but are considered likely to occur are similarly widespread and abundant, with suitable habitat widely available in the landscape in which the Project Area occurs. The localised (staged) loss of potentially suitable habitat is not considered to constitute a significant impact to these species.

Loss of Habitat – NC Act Listed Fauna

The local availability of habitat for the near threatened little pied bat and the special least concern koala and echidna will reduce through the staged loss of woodland habitats as mining progresses. Preservation and enhancement of the corridor along the Carmichael River may compensate for some of this loss, and potentially facilitate dispersal of these species in the local landscape.

Impacts to the near threatened black-necked stork and cotton pygmy-goose will be limited, as the removal of surface water in parts of the Project Area may be offset by the construction of a number of water management dams at the east of the Project Area.

The regional extent of potentially suitable habitat for two near-threatened bird species (square-tailed kite, black-chinned honeyeater), considered likely to occur at the Project Area, will be reduced. Neither of these species was recorded at the Project Area. Potentially suitable habitat for these species will still be present at the Project Area during the Mine's operation phase, and occurs in the surrounding landscape.

The loss of potential habitat for these species within the Mine operations area (open cut blocks, out of pit waste dumps and water management dams) is as follows:



- ▶ Little pied-bat (confirmed present at Project Area) – progressive loss of approximately 12,562 ha of potential habitat
- ▶ Black-necked stork (confirmed present at Project Area) – progressive loss of approximately 45 ha of potential habitat
- ▶ Cotton pygmy-goose (confirmed present at Project Area) – progressive loss of approximately 45 ha of potential habitat
- ▶ Echidna (confirmed present at Project Area) – progressive loss of approximately 12,586 ha of potential habitat
- ▶ Square-tailed kite (likely to occur at Project Area) – progressive loss of approximately 10,609 ha of potential habitat
- ▶ Black-chinned honeyeater (likely to occur at Project Area) – progressive loss of approximately 10,609 ha of potential habitat

Areas of impact for NC Act listed species that are also protected under the EPBC Act are detailed under loss of habitat – EPBC Act listed fauna.

6.3.4.1 Management and Mitigation

General Native Fauna

Where (staged) vegetation clearing is required for open cut blocks, out of pit waste dumps and water management dams, in accordance with staged development of the Mine, the following management and mitigation measures will be undertaken:

- ▶ Management of remnant vegetation at the Project Area on land that is yet to be mined, or is to remain unmined (including areas at the northern and southernmost parts of the Project Area), will be undertaken in accordance with the Project's overarching ecological management framework, to be embedded in the Mine Environmental Management Plan. This framework will detail how land not subject to direct impacts (i.e. vegetation clearing) will be managed (including details relating to land use (cattle grazing), vegetation management, rehabilitation, weed and pest animal management, fencing and fire management), such that the terrestrial ecological values (including habitat quality and function) of such areas are maintained, and where possible, enhanced. This strategy will make reference to the relevant environmental management actions outlined in the Mine Environmental Management Plan
- ▶ Further to the above, suitable non-remnant areas within the Project Area that are to remain unmined through the life of this Project will be rehabilitated and managed as part of the overall offset strategy, with the objective being to gradually achieve remnant status that is consistent with the vegetation communities (and associated fauna habitats) that are associated with similar land zones in the local landscape. Areas where such management could occur include along the Carmichael River corridor (north of the Carmichael River), in the eastern part of EPC 1080 (south and south east of the MIA), and at the southern part of EPC 1080 where no development is proposed to occur
- ▶ Vegetation clearing for discrete phases of the Project operations will be undertaken in a manner that maximises the potential for fauna to disperse away from habitats within the clearing footprint, to adjacent areas, including onsite and offsite (offset) areas that are being actively managed for biodiversity outcomes. For example, prior to clearing, any opportunities to reduce the relative quality of habitats in a discrete clearing footprint whilst simultaneously enhancing the values of



nearby habitats which may act as a sink for dispersing animals, will be realised. Such management may include gradually reducing the availability of surface water in the clearing footprint whilst simultaneously providing more of this resource in areas of (nearby) alternative habitat. The management of cattle (i.e. stocking rates) may also be considered for this purpose. Vegetation clearing within the clearing footprint should be undertaken sequentially, in a manner that encourages animals to disperse towards adjacent habitats that will remain intact. To facilitate this further, corridors between proposed clearing areas and habitats that will be managed for biodiversity should be maintained and enhanced, or where they do not occur, should be provided through targeted revegetation actions. The actual implementation of this recommended approach will need to be underpinned by onsite research, with its efficacy to be monitored and adaptively managed such that the overall objective of not-net-loss of regional biodiversity values is achieved

- ▶ The extent of vegetation clearing is to be restricted to the minimal amount necessary for the development of each applicable operational component of the Mine
- ▶ The extent of vegetation clearing is to be clearly identified on construction plans and in the field. Areas that must not be cleared or damaged are to also be clearly identified on construction plans and in the field. Clearing extents are to be communicated to all necessary construction supervisors
- ▶ Pre-clearance surveys will be undertaken in areas identified as potential habitat for threatened species, prior to commencement of clearing. In areas where these surveys indicate the presence of habitat features observed to (or with the potential to) provide habitat for these species, a fauna-spotter catcher will be engaged to accompany clearing crews. Habitat features identified during the pre-clearance survey will be thoroughly checked by fauna spotter-catcher prior to clearing. Provision for the relocation of fauna will be made prior to the commencement of clearing
- ▶ Unavoidable (staged) loss of vegetation and the fauna habitat it provides will be offset in accordance with Commonwealth and Queensland policies, with the objective of maintaining, and where possible, enhancing the local biodiversity values identified in this baseline report such that local biodiversity values are not irreversibly affected in the long term. Identification of offsets will seek to realise opportunities to enhance local and regional biodiversity values, for example, through the procurement and management of areas that contribute to corridors in the region. Furthermore, these areas should be identified and managed with a view to achieving a 'no net loss' of local biodiversity values, in consideration of the types of vegetation that will be cleared and the conservation status of fauna species they provide habitat for. The management of these areas will seek to improve the quality and function of habitats, through identification and management of the threatening process with the potential to adversely affect fauna in these habitats, and should be undertaken in accordance with the Project's overarching ecological management framework, to be embedded in the Mine and Offsite Environmental Management Plans. This framework will detail how land not subject to direct impacts (i.e. vegetation clearing) including offset areas will be managed (including details relating to land use (cattle grazing), vegetation management, rehabilitation, weed and pest animal management, fencing and fire management), as well as what targeted research and monitoring is required to inform this management, such that the terrestrial ecological values of these areas are maintained, and where possible, enhanced. This strategy will make reference to the relevant environmental management actions outlined in the Mine and Offsite Environmental Management Plans
- ▶ As soon as possible after disturbed areas (cleared areas, open cut pits, out of pit waste dumps etc.) are no longer required, rehabilitation will commence. This is to include, but not be limited to,



measures including the reinstatement of soil profiles, including topsoil, and revegetation using flora species of local provenance that are suitable for the reinstated soil and geomorphology. Management of previously disturbed land will occur in accordance with the Mine Rehabilitation Management Plan. This plan will detail how disturbed land will be managed and rehabilitated, including (but not limited to) details about seed collection, flora regeneration, landscape architecture (i.e. topography), monitoring and adaptive management of rehabilitated areas. The objective of land rehabilitation should be to return disturbed areas to a vegetated state as quickly as possible after disturbance has ceased. In addition to monitoring and adaptive management of rehabilitated areas, opportunities for targeted rehabilitation activities that seek to enhance local biodiversity values should be identified and realised. These may include providing vegetated linkages across rehabilitation areas to larger areas of remnant vegetation, and provision of habitat resources within rehabilitated areas for local fauna species

Conservation Significant Fauna

It is recognised that, in spite of the recommended management and mitigation measures detailed above, unavoidable loss of fauna habitat will occur. This will include loss of habitat for a number of conservation significant species known to occur at the Project Area, including:

- ▀ Threatened species: black-throated finch (southern), squatter pigeon (southern), koala, black-necked stork, cotton pygmy-goose, little pied bat
- ▀ EPBC Act listed migratory birds
- ▀ The NC Act special least concern echidna and koala

It is proposed that additional field studies be undertaken to determine the presence of individuals, populations/colonies and/or important habitat areas for threatened species, including those species that are considered likely to occur at the Project Area that were not detected during baseline field surveys for the EIS (i.e. yakka skink, ornamental snake). Specific details of such studies regarding the black-throated finch (southern) are presented below. With respect to managing impacts in discrete clearing footprints during staged mining operations, targeted studies will be undertaken no more than one year prior to clearing, such that the management approaches are based upon information that is current.

The findings of such studies will be incorporated into Species Specific Management Plans for these animals (black-throated finch (southern), squatter pigeon (southern), koala, brigalow reptiles), and the outcomes will be directly linked to the overarching ecological management framework for the Project imbedded within the Mine and Offsite Environmental Management Plans, as well as the Project Offsets Strategy and the Mine Rehabilitation Plan.

The Project Offset Strategy will address the unavoidable loss of habitat for conservation significant fauna resultant from Mine operations. This strategy will provide a framework for the identification of measures designed to maintain regional biodiversity values, where onsite impacts cannot be avoided. Such measures will include the identification and procurement of offsite land to be managed for conservation purposes, and investment in ecological research in the landscape in which the Project Area occurs.

Black-throated Finch (Southern)

Loss of habitat for the black-throated finch (southern) will occur in stages, in accordance with the staged development of the operational components of the Mine. Management actions will seek to maintain and where possible enhance habitats in unmined parts of the Project Area, as well as in



offset areas, to encourage dispersal away from areas that will be cleared for staged mine operations. Offsets for black-throated finch (southern) habitat will be provided and an offsets strategy has been prepared that identifies suitable offsets on the Moray Downs property adjacent to the Project Area.

It is expected that, with active management of habitats, including removal of threatening processes and complementary habitat enhancement, the subspecies will disperse away from the developed parts of the Project Area, either to suitable habitat within other parts of the Project Area, or to potentially suitable habitat in the landscape to the north, west and south of the Project Area (see Figure 3-3), including areas procured and managed as offsets.

Further studies (discussed below) will be required prior to clearing to inform the identification and management of habitats that will be managed and conserved, such that the potential for successful dispersal is maximised. This dispersal to, and subsequent persistence at adjacent habitat areas will require targeted monitoring, such that the efficacy of the management of these areas, including their capacity to support and maintain displaced populations of animals including black-throated finches (southern) can be established.

Given uncertainties relating to the distribution, abundance and actual on-ground habitat characteristics of vegetation identified as potential habitat in the landscape surrounding the Project Area, targeted, long-term monitoring will be required to determine the efficacy of management actions in onsite and offsite (offset) areas. This will include research into population dynamics of black-throated finch (southern) in these habitats and the surrounding local landscape. Adaptive management will be applied to these managed habitats (onsite and at offset sites), with the results of monitoring studies incorporated into the measures implemented in these areas. Should this monitoring indicate that habitats being managed for local biodiversity are not be achieving desired outcomes (i.e. not providing habitat for displaced animals from the mine), additional actions will be undertaken to enhance offset habitat with a view to minimising long-term impacts to local fauna populations.

Onsite enhancement of the areas that currently do not provide suitable habitat for the black-throated finch (southern) may compensate for some of the habitat loss, and facilitate east-west dispersal of the subspecies. The provision of surface water in the eastern part of the Project Area (water management dams) may provide additional localised access to drinking water for the subspecies.

Management and monitoring of impacts to the black-throated finch (southern) will seek to contribute to the recovery of the subspecies, as per the objectives of the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007). The onsite and offsite (offset areas) habitat management and complementary research program to be implemented will be informed by the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007), and developed in consultation with relevant stakeholders (i.e. Black-throated Finch Recovery Team, Commonwealth and State governments, natural resource management groups, landholders etc.). Examples of recovery actions, documented in the *National Recovery Plan for the Black-throated Finch Southern Subspecies* (Black-throated Finch Recovery Team, 2007), to be incorporated into the Species Specific Management Plan (on and offsite (offset areas)) for the subspecies, may include:

- ▶ Investigate breeding requirements and threats to key breeding areas (Action 1.1)
- ▶ Investigate feeding and other habitat requirements (Action 1.2)
- ▶ Undertake targeted surveys (to identify habitat) (Action 2.4)
- ▶ Secure selected sites for conservation (Action 3.1)



- ▶ Address threats on grazing lands (Action 3.2)
- ▶ Monitor management effectiveness (Action 3.3)
- ▶ Determine suitability of birds in captivity for a reintroduction project (Action 4.1)

To inform the development of the black-throated finch (southern) Species Specific Management Plan, and contribute to the detailed design and implementation of management and mitigation measures (including management of offset areas) recommended here, it is proposed that the following be undertaken, such that the habitat values for the subspecies are maintained, and where possible enhanced, in the local landscape; and the management of areas for biodiversity onsite (in the Project Area) and offsite (in offset areas) contributes to the recovery actions for the black-throated finch (southern).

- ▶ Development and implement a long term monitoring program to gain a better understanding of the population size, seasonal movements and key habitat areas used by the black-throated finch (southern). The monitoring program and surveys will be developed and conducted by a combination of on-site environmental officers, consultants and research organisations. Monitoring will include surveys and data from surrounding properties and landscapes, and detailed information on water sources, vegetation composition and seasonal variation in habitat use. This can then refine the habitat mapping and models using more sophisticated and detailed spatial analysis methods. Such mapping would help refine the proposed Project Offset Strategy to ensure the best possible habitat is protected and maintained for the species
- ▶ Conduct further survey to identify whether there are breeding sites within the Project Area and broader landscape, as these will be the most important components of the black-throated-finch (southern) biology that will result in the persistence and conservation of the subspecies in any proposed onsite and offsite (offset) areas to be managed for biodiversity. Whilst no nests have been found to date it is considered likely that nesting occurs in the Project Area; these may consist of small pockets of suitable ephemeral wet season habitat such as sandy drainage lines and/or *Eucalyptus camaldulensis* / *Melaleuca* spp. complexes found embedded within REs 10.5.5, 10.3.6 and 10.5.1. If and where breeding sites are recorded from within proposed clearing footprints during surveys prior to the staged clearing of discrete parts of the Project Area, information obtained during studies on the breeding biology of the subspecies in the local landscape will be reviewed to inform when clearing should occur. Clearing should be undertaken as soon as possible after the completion of black-throated finch (southern) breeding (i.e. chick fledging), thus maximising the time between the commencement of clearing and the next breeding season (during which time birds would have dispersed away from the clearing footprint)
- ▶ Determine the context of the Project Area habitat and population within the broader landscape and regional population through survey and habitat assessments as per the Significant Impact Guidelines for the black-throated finch (southern). It is expected that the population is larger than currently identified and spread across the surrounding landscape to the north, west and south. A strategic assessment, i.e. Bioregional Plan, and/or a conservation plan for the Galilee Basin region would help achieve this, and though this is a responsibility for SEWPAC, such an exercise could be facilitated by Adani and other groups with adjacent mineral interests in the Galilee Basin

Furthermore, with specific regard to providing offsets for the loss of black-throated finch (southern) habitat, the following should be considered:

- ▶ The Project Offset Strategy will be based on securing “like for like” habitat. The Project Offset Strategy will include enhancement of habitat, and mitigation of any habitat loss via the careful



conservation management of offset areas (i.e. reduced or no grazing, control of exotic pasture grass species, control of feral predators such as cats and foxes via innovative means such as reduced dingo control, raised watering troughs). This would be integrated with proposed research programs, where the most effective means to rehabilitate or enhance black-throated finch (southern) habitat are tested and used in on-going management

- ▶ The Project Offset Strategy will integrate at a landscape scale and form part of a network of landscape linkages across the eastern Desert Uplands region and to other known locations for black-throated finch (southern) populations and habitat. Project offsets will be of secure conservation land tenure, and will include programs for long term management and monitoring. Innovative options should be considered such as possible management partnerships of offset land through public and/or private partnership arrangements with well-established conservation organisations such as BirdLife Australia, Australian Wildlife Conservancy or Bush Heritage

Squatter Pigeon (Southern)

Conservation and survival of the squatter pigeon (southern) is identified as requiring a focus on maintenance and restoration of habitat and reducing predator related mortality (SEWPAC, 2011i). For the Project, the management of impacts to the subspecies will focus on maintenance and management of habitat for the species locally and regionally through the overarching ecological management strategy, inclusive of management of avoidable operation phase impacts, management of habitats onsite, procurement and management of offsets, and implementation of relevant measures detailed in the Mine and Offsite Environmental Management Plans.

In addition to the measures outlined above, species specific mitigation and management measures may include:

- ▶ Management of water sources created as part of the operation of the Project (water management dams) that may be suitable source of drinking water for the subspecies. If created water sources are not considered suitable for use by the species, compensatory water resources will be provided in nearby parts of the Project Area
- ▶ Monitoring of changes to the habitat values of the Carmichael River corridor to allow for adaptive management (i.e. enhancement, weed management) to maintain the function that the corridor provides for species dispersal and habitat resources
- ▶ Monitoring of fox and cat populations in the Project Area and implementation of an eradication program if necessary (applicable to all ground-dwelling fauna including black-throated finch (southern))

Koala

Habitat loss is considered a major impact to the koala (SEWPAC, 2012b). The Project Area occurs within Koala District C of the Queensland Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006—2016 (EPA, 2006)). Little research has been conducted in this area and there is a lack of data relating to koala populations, habitats and the impacts of development (EPA, 2006). The management of impacts to the koala and loss of habitat as a result of Mine operations will seek to enhance species knowledge and conservation initiatives as per the National Koala Conservation and Management Strategy 2009-2014 (NRMMC, 2009) and future recovery plans for the koala. Mitigation strategies will be guided by actions detailed within the National Koala Conservation and Management Strategy 2009-2014 and will focus on developing and implementing an onsite and offsite habitat management and research program in collaboration with relevant stakeholders (i.e. Commonwealth and State governments, natural resource management groups,



landholders etc.). Species specific management and research items to be included in the Project Species Specific Management Plan (on and offsite) for the koala (under the overarching ecological management framework may include:

- Onsite and offsite research of koala populations, densities and habitats as this is a relatively unknown area for this species. Data gathered will be incorporated into the Commonwealth and State database of koala population distribution, density and habitat mapping data
- Development and implementation of ongoing monitoring programs of koala populations and habitats encompassing the Project Area and surrounding region, to research impacts of development on low density populations
- Onsite and offsite (offset areas) management of koala habitat in areas of preferred habitat types including ironbark-box grassy woodlands and fringing riparian vegetation communities. The aim is to improve the condition of habitats within and surrounding the Project Area, reduce fragmentation, and encourage connectivity and dispersal
- Monitoring of pest dog populations in the Project Area and implementation of a control program if necessary

Yakka Skink

Key threats for the yakka skink include habitat loss and degradation, and predation and destruction of habitat by feral species (in particular cats and foxes) (SEWPAC, 2011b). Additional field studies will be required to determine the presence of individuals and/or populations/colonies as the species was not detected during surveys, but is considered likely to occur. In the event the species is detected, a Species Specific Management Plan will be developed to manage impacts of the Project. The findings of the additional studies would inform the management approaches detailed in the Species Specific Management Plan, however, measures will focus on maintaining or enhancing suitable habitats (i.e. in offset areas) and managing the prevalence of predators in the area. Species specific mitigation and management measures may include:

- Establishment of microhabitat features preferred by the species (e.g. rock piles, logs) in actively managed onsite and offsite (offset) areas that have suitable core habitat features to enhance the values of existing potential habitat
- Identification of the locations of suitable microhabitats existing in actively managed onsite and offsite (offset) areas for the purposes of maintaining the habitat values for the species
- Monitoring of fox and cat populations in the Project Area and implementation of a control program if necessary
- Engaging a fauna spotter/catcher to check areas of suitable habitat identified through pre-clearance surveys immediately prior to ground disturbance. In the event individuals/colonies are detected, they will be relocated to suitable habitat in offset areas

Ornamental Snake

Factors that are considered likely to contribute to the decline of ornamental snake populations include habitat loss as a result of clearing, habitat degradation as a result of grazing and fragmentation, alteration of landscape hydrology associated with gilgai environments, alteration of water quality, predation by feral species and contact with cane toads (SEWPAC, 2011d). Additional targeted field studies will be required to determine the presence of individuals and/or populations/colonies as the species was not detected during EIS surveys. If detected, a Species Specific Management Plan will be developed to manage potential impacts. The findings of the studies will inform the management



approaches in the Species Specific Management Plan, however, similar to the yakka skink, measures will focus on maintaining or enhancing suitable habitats and managing the prevalence of predators in the local area, namely within offset areas. Species specific mitigation and management measures may include:

- ▀ Identification of the locations of suitable microhabitats existing in actively managed onsite and offsite (offset) areas for the purposes of maintaining the habitat values for the species throughout operation of the mine and providing potential areas for relocation, if individuals are found during pre-disturbance checks of mined areas
- ▀ Implementation of sediment and erosion controls during operation of the mine
- ▀ Engaging a fauna spotter/catcher to check areas of suitable habitat identified through pre-clearance surveys immediately prior to ground disturbance. In the event individuals/colonies are detected, they will be relocated to suitable habitat in offset areas
- ▀ Monitoring of feral species populations in the Project Area and implementation of a control program if necessary
- ▀ Monitoring of gilgai areas within the Project Area and changes that may occur as a result of hydrological changes
- ▀ Implementation of a water quality monitoring program to assist in guiding erosion and sediment control during the operation of the mine

Migratory Birds and NC Act Listed Black-necked Stork and Cotton Pygmy-goose

For this Project, the management of impacts to the species will focus on maintenance and management of habitat for the species locally and regionally through the overarching ecological management strategy. Measures relating to management of impacts to migratory and other protected bird species include:

- ▀ Management of the water supply and raw water dams created during the operation of the mine such that migratory birds can utilise these habitats. If required, compensatory water resources will be provided in nearby parts of the Project Area
- ▀ Weed and pest animal monitoring and management within the Project Area
- ▀ Monitoring of species populations during breeding months to gain an understanding of the species' use of the area on a local scale. Further mitigation and management measures can be developed if important breeding activities are recorded

Little Pied Bat and Echidna

The overarching ecological management strategy will provide opportunity for enhancement of suitable habitats for these species. Specific to the little pied bat, monitoring and management of the Carmichael River corridor will allow for adaptive management of the corridor that provides resources and facilitates dispersal of the species. Management will also include maintenance and enhancement of mature woodland areas occurring in actively managed onsite and offsite (offset) areas in order to provide ongoing habitat suitability.

6.3.4.2 Summary

General Fauna

Over the life of the Mine, vegetation clearing will reduce the local availability of habitat for a diverse range of common fauna species. Management actions seeking to avoid or reduce impacts will be implemented, under the guidance of key strategies including the ecological management framework, species specific management plans and the Mine and Offsite Environmental Management Plans. Standardised monitoring and auditing of the application and performance of management and mitigation strategies will be undertaken, with corrective actions implemented where required.

Despite the proposed management actions detailed above, unavoidable impacts to fauna habitat are proposed to arise as a result of land clearing, most notably habitat loss. Where these unavoidable impacts cannot be satisfactorily managed/mitigated onsite, offsets will be provided in accordance with Commonwealth and State policies.

Conservation Significant Fauna

Aside from the black-throated finch (southern) (discussed below), the Project Area is not considered to support an 'important population' or 'habitat critical to the survival' (as defined in the Significant Impact Guidelines (DEWHA, 2009c)) of any EPBC Act listed threatened fauna species (i.e. squatter pigeon (southern) (recorded at Project Area), koala (recorded at Project Area), ornamental snake (likely to occur at Project Area), yakka skink (likely to occur at Project Area), red goshawk (may occur at Project Area), Australian Painted Snipe (may occur at Project Area). Thus, habitat loss resultant from vegetation clearing is not considered to constitute a 'significant impact' to these species. As for general fauna, where unavoidable impacts (i.e. habitat loss) cannot be satisfactorily managed/mitigated onsite, offsets will be provided in accordance with Commonwealth and State policies. Further studies at and near the Project Area will assist in informing the implementation of the offsets strategy with respect to threatened species.

The Project Area is not considered to support 'important habitat' (as defined in the Significant Impact Guidelines (DEWHA, 2009c)) for EPBC Act listed migratory species (refer to Section 3.2.7), and thus, vegetation clearing (and associated habitat loss) is not considered to constitute a 'significant impact' to these birds.

Impacts to the NC Act listed near threatened little pied bat, black-necked stork, cotton pygmy-goose, and special least concern echidna and koala are proposed to be managed to the greatest extent possible via the mechanisms outlined above, and offset where unavoidable impacts occur. In consideration of the proposed management and offsetting strategy proposed, it is not anticipated that localised, staged habitat loss will adversely impact upon the conservation status of these widely distributed species.

Black-throated Finch (southern)

Without management, unavoidable staged loss of potential habitat within identified black-throated finch (southern) 'important areas' represents a significant impact to the subspecies. In recognition of this, all reasonable steps will be taken to maintain and where possible enhance the value and function of habitats for the black-throated finch (southern) in the local landscape in which the Project Area occurs, through maintenance of suitable habitats (that will not be cleared of vegetation) within the Project Area and management and enhancement of potential habitat in the adjacent landscape (i.e. at offset areas within and near Moray Downs). The development of the management approaches will be informed by targeted research programs relating to the population dynamics and ecology of the



subspecies in the region, and will be adaptively managed based on the findings of on-going monitoring and research throughout the Project.

An assessment of the residual impact against the Commonwealth Significant Impact Guidelines (DEWHA, 2009c) significant impact criteria for an endangered species is summarised below.

► *Lead to a long-term decrease in the size of a population*

Unavoidable loss of habitat associated with staged vegetation clearing during Mine operations has the potential to result in a long-term decrease in the size of the black-throated finch (southern) population in the landscape in which the Project Area occurs. Offsets will be procured in recognition of this unavoidable staged loss. Measures to manage and where possible enhance areas of potential black-throated finch (southern) habitat at offset areas, as well as rehabilitate non-habitat areas to a state where they provide habitat in the long-term in offset areas, will be a fundamental component of the approach to reducing impacts on the subspecies.

This management and enhancement of areas that provide potential habitat for the black-throated finch (southern) will be undertaken with the objective of improving the suitability and quality of habitats available to the subspecies in the local landscape. Habitat management for the black-throated finch (southern) will be underpinned by targeted, ongoing research, which will contribute to the understanding of the subspecies' ecology in the local landscape.

Given that suitable offsets are available at and near the Project Area, the local availability of habitat resources can be maintained through a combination of management and enhancement of existing areas of potential habitat, and rehabilitation and management of cleared areas to provide potential habitat in the long-term. As such, it is expected that there will be a minimal or largely neutral long-term effect on the black-throated finch (southern) population in the local landscape in which the Project Area occurs.

► *Reduce the area of occupancy of the species*

Unavoidable loss of potential habitat, including potential habitat within identified black-throated finch (southern) 'important areas', associated with staged vegetation clearing during Mine operations has the potential to reduce the area of occupancy of the subspecies. As stated above, a significant commitment to managing and enhancing habitats near the Project Area in offset areas will occur. The commitment to this objective is intended to minimise the potential for a reduction in the area of occupancy of the black-throated finch (southern) to occur as a result of the Project.

► *Fragment an existing population into two or more populations*

Staged vegetation clearing has the potential to sever or disrupt black-throated finch (southern) movement across the local landscape. Given that the availability of potentially suitable habitat for the black-throated finch (southern) to the east of the Project Area is extremely limited, it is not considered that the Project will fragment an existing black-throated finch (southern) population into two or more populations. The management of unmined land at the Project Area, and land in offset areas in the local landscape will seek to maintain and where possible enhance opportunities for localised movements of fauna, including the black-throated finch (southern). It should be noted that mining operations within the Project Area are not considered likely to represent a barrier to the dispersal of the subspecies, given its mobility and occurrence in a highly dynamic landscape where movements in response to climatic variability occur.

► *Adversely affect habitat critical to the survival of a species*



Habitat critical to the survival of a species refers to areas that are necessary:

- *for activities such as foraging, breeding, roosting or dispersal*
- *for the long-term maintenance of the species*
- *to maintain genetic diversity and long term evolutionary development, or*
- *or the reintroduction of populations or recovery of the species (DEWHA, 2009c)*

Unavoidable vegetation clearing will result in the staged loss of potential habitat, including potential habitat within identified black-throated finch (southern) 'important areas'. These habitat areas contain foraging and roosting resources for the subspecies, and may contain breeding habitat. Despite this, it is not considered that the potential habitat at the Project Area is 'critical to the survival' of the black-throated finch (southern), as it is not an isolated population and is likely a component of a continuous larger population in the eastern Desert Uplands and across the Galilee Basin. Given this context, it is unlikely that the habitats of the Project Area are critical for the long-term maintenance of the subspecies, the maintenance of genetic diversity and long-term evolutionary development of the subspecies, or the reintroduction of populations or recovery of the subspecies. The Black-throated Finch Recovery Plan does not identify areas of critical habitat for the subspecies. No habitat for the black-throated finch (southern) is listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

► *Disrupt the breeding cycle of a population*

Clearing of vegetation for staged mining operations has the potential to disrupt the breeding cycle of black-throated finches (southern) in the local landscape. Breeding sites at the Project Area have not been located, but are likely to exist. A component of the targeted research will be to identify potential and actual breeding sites within the mine operations footprint, as well as identify the availability of this habitat in offset areas within and adjacent to Moray Downs, and in the surrounding local landscape. The objective of these studies will be to identify breeding habitats in the local landscape, and in particular, key sites for enhancement, management and protection.

In addition to the ongoing protection of identified breeding sites, management and enhancement of potential breeding habitat will focus on offset areas in the local landscape, in consideration of the staging of proposed clearing operations. This habitat will be actively managed prior to clearing to improve its suitability as breeding habitat for the subspecies, thereby providing a local alternative to potential breeding habitat in the clearing footprint.

With the implementation of the measures detailed here, disruptions to the breeding cycle of the black-throated finch (southern) are expected to be minimised to the greatest extent possible. Disruption to breeding behaviour from noise and dust related to increased activity at the Project Area will be monitored, however given that the black-throated finch (southern) persists and breeds in semi-urban parts of Townsville, these anthropogenic disturbances may not markedly alter breeding behaviour in habitats near mining operations.

► *Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

This criterion is addressed above with respect to:

- *Lead to a long-term decrease in the size of a population*
- *Reduce the area of occupancy of the species*
- *Disrupt the breeding cycle of a population*



The management of habitats in the local landscape will seek to maintain the local black-throated finch (southern) population, through the maintenance of existing areas of potential habitat in unmined parts of the Project Area, and the management and enhancement of potential habitat in offset areas on and near Moray Downs. This approach will seek to minimise the potential for a localised decline in the subspecies.

- ▶ *Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*

Habitat degradation by weeds and pest animals are identified threatening processes to the black-throated finch (southern). Baseline studies for the Project indicated that weeds and pest animals are not prevalent at the Project Area, and thus, all attempts to minimise the potential for the proliferation of weeds and pest animals that do occur will be made, as will dedicated efforts to prevent the introduction of additional introduced plants and animals.

The Mine and Offsite Environmental Management Plans will contain stringent protocols relating to weeds and pest animals. These protocols will be implemented to minimise the potential for weeds and pest animals occurring at the Project Area to proliferate, as well as reduce likelihood of new species being introduced to the Project Area. In addition to these protocols, active management of potential black-throated finch (southern) habitat will include identification and where required management and control of weeds and pest animals, where these degrade the quality of the habitat. The objective of this management will be to reduce the exposure of black-throated finches (southern) in these habitats to threatening processes, thereby increasing the habitat quality of areas at and near the Project Area.

- ▶ *Introduce disease that may cause the species to decline*

Disease is not a recognised threat to the black-throated finch (southern). It is not considered that activities associated with the Project will facilitate the spread of disease which will impact upon local bird assemblages, including the black-throated finch (southern).

- ▶ *Interfere with the recovery of the species*

The Black-throated Finch Recovery Plan details five specific recovery action objectives, namely:

1. Identify and quantify threats
2. Quantify distribution and abundance
3. Protect and enhance habitat
4. Investigate the potential for captive birds contributing to a re-introduction project
5. Increase public awareness

Whilst it is acknowledged that the staged vegetation clearing for the Project will cause a localised loss of potential habitat for the black-throated finch (southern), the proposed approach to managing this loss will seek to maintain the availability of habitat for the subspecies in the local landscape. Research and monitoring will inform the management of impacts to the subspecies, provide substantial information on the ecology of the subspecies in the Galilee Basin, and will contribute to the understanding of how recovery actions for the subspecies can be developed and implemented throughout central Queensland. As such, it is not considered that the activities associated with the Project will interfere with the recovery of the subspecies, and in fact, significant opportunities to contribute to the subspecies recovery will be realised as a result of the targeted management (and associated research) implemented as part of the Project.



In summary, while a substantial area of actual and potential habitat will be cleared over the life of the Mine, provision of offsets at the local level, supported by monitoring and research activities that increase overall knowledge about the ecology of the black-throated finch (southern) and improve understanding of how to mitigate impacts to the subspecies, will compensate for the localised onsite loss associated with staged mining operations. Staged clearing will occur over the 90 year life of the Mine, thereby allowing for adaptive management to be implemented, underpinned by site-specific information about the ecology of the black-throated finch (southern). In undertaking a committed, long-term land management and research program focussing on maintaining and, where possible, enhancing the habitat values and ecosystem functions required for the persistence of the black-throated finch (southern) in and near the Project Area, the residual impact of the unavoidable loss of habitat resultant from stage mine operations will be reduced, such that impacts realised will not be significant on the subspecies.

6.3.5 Fauna Mortality

6.3.5.1 Potential Impacts

As discussed in Section 5.2.3 for the construction phase of the Project, fauna mortality will occur as a result of staged operations of the mine. The scale of operational impacts as compared with those likely to occur during the construction phase is relatively greater, given the extent of the activities that will occur during the operation phase.

Vehicles and machinery used to undertake land clearing have the potential to lead to direct mortality of fauna in the event that individuals are struck. Those animals that are unable to disperse away from areas under active clearing are also susceptible to injury or death. This includes amphibians, reptiles, small ground-dwelling mammals, arboreal mammals and nocturnal species that are inactive during daylight hours. Other potential causes of mortality include animals becoming trapped in excavations, and carrion eaters (some raptors) being struck when feeding on road kill.

Mortality from haul trucks is likely to be minimal as these will be operating in open cut areas where animals are unlikely to be present. Coal is to be transported to the central MIA via a network of conveyors.

Fauna mortality will result in a local reduction in the abundance of some less mobile species. The habitat types that will be affected by operation phase activities, including those that will be cleared, support an array of common, widespread species, as well as potentially providing resources for a small number of conservation significant species. Given the landscape context in which the Project occurs, and in particular, the availability of similar habitat types in the local region, this loss is not considered likely to adversely affect the biodiversity values of this landscape. The management and mitigation measures outlined below will seek to reduce fauna mortality to the greatest extent possible. Furthermore, the management and mitigation measures proposed to address habitat loss, including management of habitats onsite and offsite for local biodiversity, will seek to alleviate potential impacts to animals dispersing away from clearing areas. In particular, enhancement of these areas (through identification and removal of threatening processes and provision of habitat resources) will seek to improve the quality and function of these habitats, such that they can act as a temporary or permanent sink for animals displaced from cleared areas.



6.3.5.2 Management and Mitigation

Management and mitigation measures to reduce the potential for fauna mortality as a result of operation phase activities include:

- ▶ Vegetation clearing for discrete phases of the Project operations will be undertaken in a manner that maximises the potential for fauna to disperse away from habitats within the clearing footprint, to adjacent areas, including onsite and offsite (offset) areas that are being actively managed for biodiversity outcomes. For example, prior to clearing, any opportunities to reduce the relative quality of habitats in a discrete clearing footprint whilst simultaneously enhancing the values of nearby habitats which may act as a sink for dispersing animals, should be realised. Such management may include gradually reducing the availability of surface water in the clearing footprint whilst simultaneously providing more of this resource in other areas. The management of cattle (i.e. stocking rates) may also be considered for this purpose. Vegetation clearing within the clearing footprint should be undertaken sequentially, in a manner that encourages animals to disperse towards adjacent habitats that will remain intact. To facilitate this further, corridors between proposed clearing areas and habitats that will be managed for biodiversity should be maintained and enhanced, or where they do not occur, should be provided through targeted revegetation actions. The actual implementation of this recommended approach will need to be underpinned by onsite research, with its efficacy to be monitored and adaptively managed such that the overall objective of not-net-loss of regional biodiversity values is achieved
- ▶ Pre-clearance surveys will be undertaken in areas identified as potential habitat for threatened species, prior to commencement of clearing. In areas where these surveys indicate the presence of habitat features observed to (or with the potential to) provide habitat for these species, a fauna-spotter catcher will be engaged to accompany clearing crews. Pre-demarcated habitat features identified during the pre-clearance survey will be thoroughly checked by fauna spotter-catcher prior to clearing. Provision for the relocation of fauna will be made prior to the commencement of clearing
- ▶ Procedures in the event that an animal is injured will be developed. Given the distance to the nearest veterinary practitioner, this will most likely involve euthanasia. Adani will engage a suitably-qualified and licensed practitioner to be present on site to assess, and where necessary, euthanize injured animals
- ▶ Vehicles will be required to stay on pre-determined routes
- ▶ All vehicles and plant will adhere to site rules relating to speed limits. Speed limits will be clearly signposted so as to minimise the potential for road kill.
- ▶ Any road kill will be dragged to the edge of the road immediately and subsequently removed as quickly as practicable to reduce potential for scavengers to be struck
- ▶ Where practical, temporary fencing will be erected around excavations to exclude mobile animals from vegetation clearing areas
- ▶ Work areas will be checked for fauna that may have become trapped before work commences each day
- ▶ In instances where an animal/animals have entered active construction areas, the site environmental manager will be immediately informed. An assessment of whether the animal is at risk of harm and/or poses a threat to construction personnel will be made by the environmental manager (or their delegate). Where possible, the animal will be encouraged to disperse out



of/away from the construction area. Where the animal is not able to disperse away, a professional fauna spotter-catcher will be engaged

- ▶ If any pits/trenches are to remain open after daily site works have been completed, they will be securely covered by an impenetrable barrier, if possible, or fauna ramps (e.g. log ramps or wooden planks) will be put in place to provide a potential means of escape for trapped fauna
- ▶ Site inductions are to include education regarding the local fauna of the site and protocols to be undertaken if fauna are encountered

6.3.5.3 Summary

The proposed mitigation measures detailed above seek to reduce the incidence of fauna mortality resultant from staged vegetation clearing during the operation phase of the Project. Nonetheless, it is anticipated that fauna mortality will occur, particularly for those cryptic and/or less mobile animals that may not be detected by the fauna spotter-catcher prior to or during vegetation clearing activities.

6.3.6 Habitat Fragmentation

6.3.6.1 Potential Impacts

Given the approximately north-south orientation of the mine, and the length of the proposed footprint (approximately 45 km), the proposed mining activity has the potential to disrupt east-west flora and fauna movement in the landscape.

Large tracts of non-remnant vegetation occur over much of the central part of the Project Area between the Carmichael River and the Moray-Carmichael Road, and much of the eastern part of the Project Area (where the MIA, offsite infrastructure, some out of pit waste dumps and some water management dams are to be located). This cleared land extends beyond the Project Area – much of the landscape to the east of the Project Area is cleared land, featuring non-remnant vegetation. As such, the potential for east-west dispersal across the landscape through much of the central part of the Project Area, notwithstanding the narrow strip along the Carmichael River, is limited by the presence of large tracts of non-remnant land within and to the east of the Project Area.

A north-east-to-west corridor, associated with connected tracts of remnant vegetation within and to the north-east and west of the Project Area may be fragmented by staged mining operations at the northern part of the Project Area. Similarly, proposed mining operations in the southern part of the Project Area will disrupt a belt of remnant vegetation that extends from west of the Project Area, through the Project Area (at the Bygana West Nature Refuge) to the east towards the floodplain of the Belyando River.

Staged mining will also disrupt north-south movement through the Project Area. Remnant vegetation coverage is extensive in the landscape to the west, north west and south west of the Project Area, and so, north-south habitat fragmentation resultant from Mine operations will be less disruptive to landscape scale flora and fauna movement, as compared with east-west movement.

The barrier that will be created by operation activities associated with the mine has the potential to limit the ability of flora and fauna to disperse across the landscape. This is particularly applicable to habitats at the north and south of the Project Area, that retain some degree of connectivity to larger tracts of vegetation to the east and west in the adjacent landscape, as well as the narrow east-west strip of vegetation associated with the Carmichael River. Opportunities to alleviate the fragmentation caused by the mine will be realised through targeted onsite habitat management and the identification, procurement and management of offsite (offset) areas. The identification and



management of these areas will seek to maintain and enhance local biodiversity values and will consider the function of these areas in the local landscape including how they contribute to connectivity.

6.3.6.2 Management and Mitigation

Management and mitigation measures to reduce the impact of habitat fragmentation to local fauna populations include:

- ▶ The ecological values within the buffer area surrounding the Carmichael River are to be enhanced through a revegetation and active vegetation and habitat management program.
- ▶ Management of land within the Project Area (in consideration of the Project's staged operations, and including areas that are not within the mine footprint, unmined areas that will be mined at a later stage of operations, areas above the underground mine and rehabilitated areas) will be undertaken so as to maximise opportunities for localised flora and fauna dispersal in the Project Area. This will include the management and enhancement of existing areas that provide connectivity (where these do not occur within the mine footprint) within and beyond the Project Area, as well as the creation of corridors between habitats where this is possible
- ▶ The identification of offsets should take into consideration how these areas will contribute to landscape scale habitat function (including east-west connectivity). Given that east-west connectivity is likely to be disrupted at the north and south of the Project Area, the strategic procurement and subsequent management of offsets in the landscape adjacent to these parts of the Project Area may alleviate the barrier effect caused by mining operations. This will be achieved through managing and where possible enhancing these areas such that they provide a conduit for fauna movement 'around' the northern and southern parts of the Project Area, thereby allowing for east-west movement in the localities to be maintained. Whilst the connectivity between habitats adjacent to the northern and southern parts of the mine will be more circuitous (less direct) than it is currently, enhancement of habitats (such as provision of habitat resources, management of/removal of threatening processes) in strategically procured offset in these areas should contribute to the maintenance of east-west movement in these specific localities
- ▶ Where fencing is required around cleared areas or along the mine boundary, it will be designed to provide access to fauna around and/ or through the fencing, except where fenced areas seek to protect fauna from threats such as actively mined areas. Barbed wire will not be used on the top strand of wire fences unless necessary for security or to control cattle
- ▶ Post-disturbance rehabilitation should seek to identify and create conduits for movement within and beyond the Project Area. These corridors should link to existing areas that are likely to facilitate flora and fauna dispersal in the landscape

6.3.6.3 Summary

Mine operations may reduce the ability for fauna to disperse across the landscape – this is more likely in the northern and southern parts of the Project Area where potential north-east-to-west/east-to-west fauna movement is likely to occur through the Project Area. Offset identification will take into consideration procurement of areas near the north and south of the Project Area, that can be managed for, amongst other things, providing a conduit for east-west movement around the Project Area.



6.3.7 Habitat Degradation

6.3.7.1 Potential Impacts

The staged clearing of native vegetation throughout the Mine's operational life may result in the degradation of adjacent and downstream habitats. The potential impacts of habitat degradation, with respect to the Project's construction phase, are discussed in Section 5.2.5. Given the larger extent of land to be cleared as a result of mining operations, the spatial extent of potential degradation is relatively larger.

Edge effects may occur where remnant vegetation is exposed to a distinct ecotone associated with areas under active mining operations (or early stages of rehabilitation post-mining). Such effects may include increased exposure to noise, light, dust, wind, weeds and introduced animals. Exposure to any or some of these effects may alter habitat composition (i.e. reduced flora diversity and simplified flora structure) and quality (i.e. reduced availability of forage resources, increased exposure to predators) at the ecotone, thereby potentially changing species diversity in the altered habitat. Where edge effects degrade or simplify habitat at the edge, it is possible the species diversity and habitat utilisation in this edge habitat will be reduced.

Earthworks will result in dust emissions. Excessive dust settling on vegetation could also suppress vegetation growth by limiting the photosynthesis potential of plants in close proximity to the construction area (Nanos and Ilias, 2007). Plants with dust on leaves may also be less palatable as a food source for animals. Dust deposition associated with earthworks activities will generally occur relatively close to areas of disturbance and hence, plants within 50 m – 100 m of construction activities may be affected by dust. As construction activities are temporary, effects will be short lived, and rainfall will generally remove dust from plants. Dust suppression will be used to control dust and this will reduce the extent of vegetation affected by dust. Dust emissions from vehicles and plant travelling on unsealed roads will have localised impacts on vegetation and water bodies near these transport routes. Dust suppression will be used to control dust on these roads.

Following extraction, coal will be processed and stockpiled in preparation for transport to port. Dust deposition may affect the physiology of plants as a result of increasing leaf temperatures and reducing photosynthesis (referenced in Chaston and Doley, 2006). Coal dust and overburden dust were found to affect plant functioning (leaf temperature) in an experimental situation where high dust loads were applied (Chaston and Doley, 2006). The experiment also indicated that the type of dust is related to impacts on leaf function, with fine dusts having impacts at much lower loads than dusts associated with mining activities where high dust loads are needed to cause an impact (Chaston and Doley, 2006). The authors concluded that dusts associated with mining activities will potentially impact plant physiology in instances where high dust loads may be deposited – typically within the immediate vicinity of the dust source (i.e. coal stockpile, overburden stockpile) (Chaston and Doley, 2006).

Impacts to flora from coal dust may occur where vegetation is growing immediately adjacent to stockpiles. Long term exposure to coal dust may result in changes to vegetation communities immediately adjacent to coal stockpiles, which may in turn alter habitat type and quality for fauna

Impacts to habitats adjacent to and downstream of clearing areas will be managed such that habitat degradation is limited in its extent and magnitude. This will largely be undertaken in accordance with protocols established in the Mine and Offsite Environmental Management Plans (including monitoring requirements).



6.3.7.2 Management and Mitigation

The management and mitigation measures described for habitat degradation due to land clearing in the construction phase of the Project (i.e. construction of the MIA, airport and workers accommodation village) are largely applicable to land clearing and resultant habitat loss in the operation phase of the Project (refer to Section 5.2.5), and include:

- ▶ Management of erosion and sedimentation in and adjacent to cleared areas will be undertaken in accordance with protocols outlined in the Mine and Offsite Environmental Management Plans. This plan will include practices to be implemented prior to, during, and post-construction to minimise the potential for erosion to occur, including (but not limited to) timing of land clearing activities, sediment and erosion control measures to be implemented, performance criteria and corrective actions. Monitoring and reporting protocols will be detailed within this plan, and responsible parties for implementing the plan's actions should be identified
- ▶ Where land clearing occurs near or within ephemeral waterways, this will be primarily undertaken during low flow periods, to minimise the likelihood of erosion and sediment mobilisation during and after rainfall events
- ▶ A fundamental component of the management of onsite and offsite (offset) areas that are to be managed for biodiversity will relate to reducing exposure to, and minimising the impacts of habitat degradation including edge effects. This will be undertaken through implementation of weed and pest animal management, erosion management and dust management. These measures are included in the Mine and Offsite Environmental Management Plans. Further to this, consideration should be given to the creation of vegetated buffers around any critical habitat areas that are retained, where these areas occur directly adjacent to impact footprints. These buffers could comprise relatively fast growing trees of local provenance that could be strategically planted to provide a buffer between impact areas and managed habitat. Provisions for fauna movement through these buffers (i.e. from impact footprints, to adjacent habitat areas), would need to be factored into their design.

Further details relating to the management of erosion is presented in the Mine Land Chapter (Volume 2, Chapter 4). Further details relating to management of dust is presented in the Mine Air Quality Report (Volume 4, Appendix S).

6.3.7.3 Summary

Vegetation clearing and other operation phase activities (i.e. vehicle movements on unsealed roads) has the potential to result in habitat degradation of adjacent and downstream habitats. Actions seeking to manage these potential indirect impacts will be implemented. Standardised monitoring and auditing of the application and performance of management and mitigation strategies is proposed to be undertaken, with corrective actions implemented where required.

6.4 Loss of Water Resources used by Terrestrial Species

6.4.1 Potential Impacts

Mine operations and the operation of the offsite water supply infrastructure will result in the sequential alteration to and loss of water courses (i.e. ephemeral creeks and associated riparian habitat) and water bodies (i.e. farm dams, pools and billabongs in and adjacent to water courses, cattle water points). This loss will affect terrestrial flora and fauna that utilise riparian and aquatic habitats,



including riparian and aquatic vegetation, water birds, amphibians and terrestrial fauna that rely on surface water as a drinking resource.

Over staged development of the Mine, the local availability of surface water will be reduced, although new water sources are proposed to be created via water management dams at the eastern part of the Project Area. Also, areas overlying the proposed underground mining area are expected to be subject to subsidence. Water will accumulate in subsidence depressions, creating new surface water resources. Unless impacting on the safety of underground workings, these water resources will not be drained, but rather kept to support the ecological values of the system

Terrestrial habitats associated with aquatic systems (i.e. riparian vegetation) are proposed to be lost from some ephemeral creek lines within the mining footprint, although the riparian strip along the Carmichael River is proposed to be protected and enhanced.

With respect to the operation of the offsite water supply infrastructure, fluctuating or prolonged lowering of water levels within the constructed water supply dams and instream storages on Obungeena Creek and North Creek or during periods of flood harvesting may alter habitat availability for terrestrial species including conservation significant fauna species. Increased capacity of the existing water storage dams may mean that water is available for longer periods, although these dams will not necessarily be kept full as water is to be transferred to the mine raw water storage dam. As both North Creek and Obungeena Creek become unconfined channels downstream of the water harvesting area, loss of downstream pools due to the increased water extraction is not expected to be significant.

Impacts to surface water quality, including downstream impacts may occur where the geomorphology of waterways is altered, or where sediment and/or contaminants are mobilised during construction activities and enter waterways during and after rainfall.

With respect to terrestrial flora and fauna, loss and alteration of aquatic habitats will reduce the localised availability of habitat, including riparian areas for vegetation associated with water courses (and the fauna habitat these provide), as well as the drinking and foraging habitat provided by standing water bodies. The creation of water bodies associated with mine operations may compensate for this loss to some extent, whilst habitat alteration associated with subsidence may result in the creation of localised aquatic systems which would provide habitat for fauna and (aquatic) flora. The offset management approach will include provision of water resources in identified habitat areas.

Potential impacts to aquatic fauna and flora species are discussed in the Min Aquatic Ecology Report (Volume 4, Appendix O1). Potential impacts to water quality are addressed in the Mine Water Quality Report (Volume 4, Appendix Q).

6.4.2 Management and Mitigation

Notwithstanding unavoidable impacts (i.e. loss of habitat where open cut blocks and out of pit waste dumps are to occur), a comprehensive suite of management actions will be implemented to reduce, and where possible, avoid adverse impacts to aquatic systems that may provide habitat values for terrestrial species. The Mine Water Quality Report (Volume 4, Appendix Q) outlines the recommended strategies for managing impacts to water quality and surface waterways during the Project's operation phase, while the measures outlined to manage aquatic systems (as presented in the Mine Aquatic Ecology Report (Volume 4, Appendix O1)) are also generally applicable to the mitigation of impacts to aquatic habitats in terms of the values they provide for terrestrial species. The



management of areas onsite (outside the mine footprint) and offsite (offset areas) will seek to maintain and enhance the values of habitats for flora and fauna, including aquatic systems and the resources they provide.

Management of potential impacts associated with operation of the offsite water supply infrastructure will include:

- ▶ Develop operational procedures for flood harvesting, to maintain a small volume of water in dams on Obungeena and North Creek being pumped dry
- ▶ Consider whether fringing vegetation can be established at some water storages created for the Project. This will depend on the ability to maintain raw water quality
- ▶ Identify strategic locations to provide additional water resources in offset areas

6.4.3 Summary

The loss and alteration of surface water courses and water bodies will be managed to the best extent possible, however over the life of the Mine, unavoidable impacts (i.e. loss of standing water bodies and some riparian habitats associated with ephemeral creeks) will occur. New water bodies will be created as part of the development (i.e. water management dams and subsidence areas) – these may provide habitat and resources for terrestrial species, thereby reducing the impact of some unavoidable loss of habitat. Habitat management at onsite and offsite areas will include management and where possible enhancement of aquatic systems.

A comprehensive suite of management and mitigation measures, relating to the maintenance and protection of aquatic systems (where impacts to water quality can be managed and potentially avoided), is detailed in the Mine Water Quality Report (Volume 4, Appendix Q).

6.5 Alteration of Groundwater Regime

The existing groundwater regime of the Project Area will be altered by dewatering of the proposed pits and underground mine tunnels, as detailed in the Mine Hydrogeology Report (Volume 4 Appendix R). Groundwater levels in the vicinity of the Carmichael River are currently within a few metres of the surface level and hence accessible to vegetation, and the key structural species defining the riparian vegetation community of the Carmichael River do have a facultative (i.e. partial or seasonal) dependency on groundwater. The riparian vegetation provides key habitat to the waxy cabbage palm (*Livistona lanuginosa*) which is a groundwater obligate species. This species is listed as vulnerable under the provisions of the Commonwealth EPBC Act and Queensland NCA. The species is not known to be conserved within any conservation tenure. Owing to the facultative and obligate nature of the species defining the riparian vegetation, the vegetation along the Carmichael River is considered to be a groundwater dependent ecosystem (GDE).

The degree of groundwater alteration has been identified in the Mine Hydrogeology Report (Volume 4 Appendix R) to be reliant on a number of factors, including underlying geology, soil type, proximity of proposed works to the Carmichael River and the proposed staging of the mining operations. The greatest impacts on groundwater have been identified in the groundwater model as not occurring until approximately 60 years into the operational life of the mine. As also identified in the modelling report, the impacts are cumulative, but not necessarily in a linear progression, with relative little change in groundwater regimes in the initial phases of the project but changes increasing more significantly in the latter stages of operation.



The groundwater model indicates that drawdown of the groundwater table over the length of the Carmichael River will be highly variable. At its greatest extent of operations and development, after approximately 60 years (of a ninety year mine life), drawdowns of up to between 30 to 60 m have been predicted for the groundwater table in the vicinity of the Carmichael River. This results in a decrease (on average) in river baseflow of 7 per cent (approximately 1,000 m³/day). Alterations of watercourse base flows above 5 per cent are generally considered to be ecologically significant and could be expected to have an adverse impact on aquatic and riparian ecosystem health.

Doongmabulla spring is a regionally significant wetland located within the groundwater catchment affected by the mine (but is approximately 10 km to the west of the mine lease). The Mine Hydrogeology Report (Volume 4 Appendix R) includes a detailed assessment of the likely extent of the lowering of the groundwater table in the vicinity of this Great Artesian Basin (GAB) spring which features a Commonwealth listed Threatened Ecological Community (TEC). The model identifies a maximum potential drawdown of up to 0.12 m in the groundwater.

The degree of drawdown on the groundwater at two non-GAB springs was also assessed, with the modelling identifying a potential drawdown of between 0.7 to 0.8 m during operation and 5 m post closure at Mellaluka Springs located approximately 10 km from the lease. The Mine Hydrogeology Report (Volume 4 Appendix R) does identify that there is poor information on these springs, and that these predicted impacts may reduce subject to further investigation effects from.

6.5.1 Potential Impacts

The 30 to 60 m groundwater predicted model drawdown (unmitigated) will fluctuate seasonally as a result of mine requirements and seasonal weather conditions. Drawdown in itself does not indicate the degree of potential impact on the riparian ecosystem health, but rather it is the impact of the drawdown on the baseflow of the watercourse. In the context of this project the groundwater model has identified that baseflow of the Carmichael River will be reduced by 7 per cent at the greatest operational/development extent of the mine. This baseflow reduction equates to a loss of approximately 1,000 m³/day in flow. It should be noted that baseflow does not include only visible surface flow, but includes the down gradient movement of water through the river bed.

While the riparian vegetation is tolerant of extended zero flow/low flow events, the reduction in baseflow by up to 7 per cent may extend the length of the zero flow events, and also reduce the number of low flow events, to a point at which even tolerant species will respond adversely. Reduced groundwater levels will have an impact on the duration and volumes of high flow connection between groundwater and river flows at other times of the year. These are the flow events that are critical to the maintenance of the waxy cabbage palm and important to riparian vegetation in general.

It would be expected that the most vulnerable species to short term adverse impacts would be the populations of waxy cabbage palm which are obligate dependent on a seasonal groundwater/surface connection to stimulate flowering, fruiting and thus general population maintenance. Unlike the other characterising species of the riparian areas (river red-gums and paperbarks), these palms have a root ball which does not extend more than several metres in diameter and are unable to access ground water that falls below this shallow zone. While though these species may persist for a number of years with no groundwater/surface connection, in the absence of any mitigation measures it must be considered that these species will be lost as part of the riparian landscape of the Carmichael River in the middle part of the operational life of the mine .

The maximum impact on baseflow is expected to occur well into the operational life of the mine with the most quantifiable impacts expected after approximately 60 years on other general riparian



vegetation. The river red-gums have a marked propensity for persistence under drought conditions, but after prolonged years of baseflow reductions it is anticipated that visible mortality in mature trees will be apparent for certainly paperbarks (which are less drought tolerant than river red-gum) initially, and then river red-gums (from approximately 60 years onwards). This would not be an evenly distributed mortality in the riparian community as it has been indicated in the groundwater modelling that billabongs are still likely to persist along the Carmichael River and these areas will become refugial areas for the riparian vegetation that is currently typical of the river.

The cumulative impacts (without mitigation measures) of reduced base flow as a result of drawdown of the ground water table of groundwater dependent ecosystems include:

- ▶ Reductions and probably loss of the populations of the vulnerable (both EPBC Act and NC Act) waxy cabbage palm (*Livistona lanuginosa*) along the Carmichael River in the mid- term operational life of the mine (from 45 years onwards).
- ▶ Progressive mortality of characterising riparian species in the middle to latter parts of the operational life of the mine (after 60 years) beginning with less deeply rooted individuals (and species), and continuing to more persistent species such as river red-gums in the latter part of the mine life.
- ▶ Retreat of current characterising riparian vegetation to refugial areas such as billabongs and areas of runoff/drainage from mine pits where water is likely to persist as a result of anthropocentric drainage works.
- ▶ General reduction in river bank/watercourse stability in areas of riparian mortality with expected higher incidents of river bank slumping and general erosion during high flow flood events.
- ▶ Changes in riverbank vegetation composition as canopies are lost, creating conditions favourable to the introduction of grasses, forbs, a number of which may be weed species opportunistically recruiting into these areas.
- ▶ General alteration of environmental flow and instream conditions for aquatic macrophytes, with a high potential for reductions in the populations of these species.
- ▶ A general loss of breeding, roosting and foraging riparian habitat for fauna utilising the riparian community.

The groundwater modelling for the Project indicates that the GAB-fed Doongmabulla springs may have a maximum potential drawdown of approximately 0.12 m in 60 years into the operation of the mine.

In response to Coal Seam Gas (CSG) proposals, recent assessments of the potential for impacts of these operations on GAB springs have been carried out by DNRm and the Queensland Water Commission. These assessments have identified that drawdowns of over 0.2 m are considered to be potentially significant to the ecology and maintenance of the GAB springs. Predicted drawdowns at all springs in the Doongmabulla system are between 0.05m and 0.12 m, less than 0.2 m throughout the operational period with the majority of predicted impacts lower than 0.05 m. The predicted drawdown potential at the Doongmabulla springs is within this level considered to be potentially significant and will occur approximately 60 years into the life of the mine.

Given the current state of knowledge of the groundwater interactions and ecology of the springs, the level of impact in the short to medium term is deemed to be insignificant. Monitoring of the springs and groundwater interactions in the initial development stages of the mine as a priority ongoing management action will enable better refinement and understanding of the relationship between the



groundwater and mound springs ecology. In the longer term, while the predicted drawdowns are less than that currently regarded as having a potential adverse impact on GAB springs, management measures may be derived during the course of the monitoring program to enable any potential threat to ameliorated during the latter operational phases of the mine (i.e. beyond 60 years).

Drawdowns at the Mellaluka springs (a non GAB system) have been identified in the model at up to 0.8 m (approximately) at around 60 years into the life of the mine. These springs are approximately 10 km outside the mining lease area and are within a grazing area where these springs are used as stock watering points. Ecological survey of these springs has not been undertaken and the groundwater model is based on limited geological information in this area. Further investigations are therefore required to firstly assess the significance of this impact and then to determine appropriate mitigation and management measures. as mining does not occur in this area until the later stages of the proposed mine, adequate time is available to undertake this work.

There are 21 licenced groundwater bores used for irrigation and stock watering, with a further 25 registered (but not licenced) within a 10 km radius of the lease (including within the lease). For the most part little or no impact is predicted at licenced bores, with less than 0.05 m of drawdown predicted at 14 of the 21 licenced bores. Minor impacts of 0.1 m are predicted for five bores, with one bore exceeding 1 m drawdown. One of the licenced bores was unable to be assessed. Of the 25 registered bores of which 15 are outside the lease. Drawdowns are predicated to be less than 1 m for the 13 of these (and not regarded as significant), with only two bores where drawdown exceeds 1 m. The 10 bores within the lease potentially will have very large drawdowns, and it has been indicated that these would be decommissioned. Further bores (up to 17) may be drilled into local Triassic to Quaternary aquifers to provide an offsite water supply within the Belyando River catchment.

The operation of the groundwater borefields associated with the offsite water supply infrastructure may result in a reduction in groundwater baseflow to surface water flows in the Belyando Rivers and associated tributaries. Seventeen offsite water supply bores are likely to be drilled into, which are considered to have a more productive groundwater flow (Hyder Consulting, 2012). Based on preliminary modelling and anticipated aquifer parameters, assuming a 10-year extraction period with cone of influence of 2 km radius, drawdown is expected to range between 0.5 and 2.5 m. The distance between the bores is designed to be greater than 2 km to reduce any cumulative drawdown (Hyder Consulting, 2012).

The impact of the drawdowns on the base flow of the Belyando River is not considered significant. The Belyando River has a very large catchment, with a high degree of hydraulic connectivity through the (predominantly) Quaternary alluvium maintaining the base flow. Localised impacts may include very slight increases in periods of low flow/zero flow, but these are likely to be undetectable, and certainly not expected to be outside the tolerance of the riparian vegetation of this system to assimilate. In itself, the operations of the groundwater borefields will not result in zero flow/low flow scenarios, but will be a cumulative impact reflecting current seasonal conditions.

Further impacts are included within Volume 4 Appendix R Mine Hydrogeology Report and Volume 4 Appendix O1 Mine Aquatic Ecology Report.

6.5.2 Management and Mitigation

The primary impacts of the operation of the mine on general groundwater dependent ecosystems will not be possible to quantify until at least into the mid operational life of the mine, possibly up to 60



years. Some aspects, such as mortality of the waxy cabbage palm, may be more apparent earlier than this timeframe.

As these impacts are not predicted to occur until later in the proposed mine life, initial actions will be based on furthering understanding of the ecological and groundwater/surface water characteristics of the Carmichael River and springs. This in turn will allow refinement of impact predictions and development of more detailed management measures.

The following actions are therefore proposed to infill information gaps as identified above in the early phases of the proposed mine. These are primarily monitoring protocols that include:

- ▶ A detailed “ecological features” map will be made for the Carmichael River. This should identify the priority management areas including identifying the locations of waxy cabbage palms, riparian composition and health, locations of billabongs (and their associated aquatic features), areas of connectivity/disconnection with the groundwater based on the modelling, gaining/losing areas of the river relative to the groundwater, as a minimum.
- ▶ Permanent CORVEG primary monitoring plots and transects (the latter over at least 100 m) should be established at regular intervals along the river for the purpose of establishing a riparian community health baseline. In the initial development/operational phases of the mine monitoring of the plots should be seasonal, reflecting high flow/low flow variability in the Carmichael River (twice annually). A minimum of 10 years of such monitoring would be used to identify the natural variability of the community. This monitoring should continue into the mid operational life of the mine, and increase to a quarterly frequency when the mine is at its fullest development/operational extent (60 years).
- ▶ Monitoring of the health of individual waxy cabbage palms should be undertaken on the same basis of the CORVEG plots. Cabbage palms are able to be transplanted, and where practical and feasible advice should be sought from the relevant agency at the time to transplant as many of these possible to other locations within the local provenance should there be evidence of stress that can be directly related to reductions in river base flows. If possible, this should be done in partnership with a university or the Queensland Herbarium.
- ▶ Vegetation monitoring should be undertaken having regard to groundwater monitoring/base flow monitoring. Locations for monitoring bores should be chosen with respect to selected environmental features along the Carmichael River (such as billabongs, particular riparian communities, areas with waxy cabbage palm) to enable more meaningful interpretation of potential direct interactions between these features and the groundwater.
- ▶ Monitoring the base river flow, including the establishment of gauging stations, should be undertaken in areas of particular ecological interest. Flow data should be monitored on an ongoing basis prior to construction, during operation and post operation upstream, downstream and within the Project Area.
- ▶ Additional investigations into the Doongmabulla spring are required to quantify the potential future impact on the spring of projected groundwater drawdown. These investigations should include detailed flora surveys, geological studies and development of an ongoing modelling and monitoring program.
- ▶ Any reintroduction of surface or groundwater back into the Carmichael River should be considered with respect to water quality, location of reintroduction, the priority environmental features for maintenance along the river (as per the “ecological features” map), channel porosity, etc. with the intent that should this water be introduced to the channel, it will be in a location



where it will remain in the channel (and thus contribute to environmental flows downstream, and not be immediately lost to groundwater).

- ▶ Undertaking detailed monitoring of groundwater levels and surface water flows at the Carmichael and Belyando Rivers prior to construction, during operation and post operation upstream, downstream and within the Project Area to measure changes to groundwater and surface flows.
- ▶ Undertaking a continuous baseline monitoring program encompassing surface flow features both upstream and downstream of the borefield, in conjunction with nearby bore extraction yields and associated drawdown records.

Further management and mitigation measures are included within Volume 4 Appendix R Mine Hydrogeology Report and Volume 4 Appendix O1 Mine Aquatic Ecology Report.

6.5.3 Summary

The likely impacts from aquifer drawdown on the Carmichael River are proposed to increase progressively as Mine development moves south, and maximum drawdown is not expected until the Mine is approximately 60 years into the mines operational 90 year life. Drawdown along the Carmichael River is expected to result in decrease of the river baseflow by approximately 7 per cent (1,000 m3/day) at this time. This is expected to have cumulative impacts on the ecology of the GDE along the river, which (in the absence of mitigation measures) will probably result in loss of the population of the waxy cabbage palm in the early/mid term of the mine operational life, and a change in the riparian species composition and characteristics. Ultimately, the billabongs along the river may become refugial areas, with the current riparian communities contracting to areas where base flows remain sufficient for this community to persist.

Impacts on the Doongmabulla springs complex are deemed not be significant, however ongoing monitoring and study is required to definitely confirm the predictions of the modelling outcomes. Similarly, information on the other springs is lacking, and it would be preferable that the monitoring/studies for the Doongmabulla springs should be extended to the Mellaluka springs.

6.6 Introduction and Proliferation of Pests and Feral Species

6.6.1 Overview

Pest and feral species may disrupt ecosystems by outcompeting and replacing native species, thus altering ecosystem diversity and potentially disrupting ecosystem function. A total of 27 introduced flora taxa were recorded from the Project Area, five of which are declared as WONS and declared weeds under the LP Act. Eight introduced fauna species comprising six mammals, one bird and one amphibian were also recorded during field studies.

6.6.1.1 Potential Impacts

Increased movement of people, vehicles, machinery, vegetation waste and soil may facilitate the spread of weeds at and near the Project Area. Five WONS that are also declared plants under the LP Act (parkinsonia (*Parkinsonia aculeata*), parthenium, prickly pear, velvety tree pear (*Opuntia tomentosa*) and rubber vine (*Cryptostegia grandiflora*)) are known to occur at the Project Area. Despite the fact that 27 introduced plant species were recorded, weeds were not found to be abundant across much of the Project Area. Increasing the prevalence of weeds at the Project Area



(and potentially beyond to the surrounding landscape), may reduce the quality of habitats for some flora and fauna species, particularly by replacing native plants.

It is a characteristic of many weeds that seeds can rapidly germinate and plant growth is also rapid. Vegetation clearing and soil disturbance allows seeds present in soil to germinate. Germination and plant growth for weeds is typically faster than for native species and this can lead to increased weed levels in disturbed areas and affect the ability for native vegetation to re-establish.

There is also significant potential for weeds, either as seeds or other plant propagules, to be introduced to sites attached to dirty vehicles and equipment or to be contained in soil or seed mixes brought to the site. This can lead to increased levels of weeds already present on the site, or infestation by new weeds.

Food waste produced by human settlements may provide additional resources for feral animals such as pigs, rats, mice, cats and dogs. These animals, confirmed as present within the Project Area, may increase in abundance should easier access to forage resources be provided. Increased availability of water due to sediment ponds and water storages is beneficial to pest animals.

An increase in the prevalence of these animals may adversely impact native fauna in that it may lead to:

- ▀ Increased competition for resources
- ▀ Increased predation of native species by introduced animals
- ▀ Habitat degradation including pig damage of riparian areas and rabbit burrows causing erosion

There is also potential for pest animals such as ants to be introduced to sites through importation of vehicles, equipment, soils and similar media.

6.6.1.2 Management and Mitigation

An integrated suite of actions will be incorporated into the Mine and Offsite Environmental Management Plans, and be implemented throughout the operational life of the Mine to manage weeds and pest species. These actions will include:

- ▀ Waste management measures incorporated into environmental management plans should include containment of food scraps in securely sealed containers
- ▀ Vegetation and soil waste will not be moved to areas of lower weed infestation
- ▀ Pest animal occurrence will be monitored at onsite and offsite habitat management areas. If increased density of pest animals is observed, or new pest animals are identified, humane pest controls will be implemented manage numbers
- ▀ Weed mapping will be undertaken prior to commencement of construction for each phase of staged Project operations. Mapping will cover the whole site but be particularly focused at high risk locations, such as areas of black soil so that weed hotspots can be identified. Baseline field surveys of identified hotspots within and near each development area will be undertaken prior to commencement of activities (i.e. vegetation clearing) at the area. Weed control will be undertaken in areas that are very heavily infested or where WONS or Class 1 or 2 weeds declared under the LP Act are present prior to disturbance
- ▀ Weed levels will be monitored in areas adjacent to construction activities, in onsite and offsite habitat management areas and any areas that are rehabilitated after construction. Monitoring will be undertaken annually, with results to be considered in terms of baseline information (collected



prior to construction) and with reference to appropriate control (reference) sites. If significant infestations of any weeds occur, or if WONS or Class 1 or 2 weeds declared under the LP Act, weed control measures will be implemented. Weed control measures will be based on Queensland Department of Agriculture, Forestry and Fisheries and Isaac Regional Council advice

- ▶ All vehicles, equipment and materials brought on to the site will be certified as free of weeds and weed seeds and carry a weed hygiene declaration. Records are to be kept of compliance with this requirement
- ▶ Soil stripped and stockpiled from areas containing known weed infestations will be stored separately and are not to be moved to areas free of weeds
- ▶ Personnel will not bring domestic animals to the Project Area

6.6.1.3 Summary

Rigorous implementation of the proposed mitigation strategies, should assist in minimising the potential for pest plants and animals to increase in abundance at and near the Project Area. Regular, standardised monitoring will be a core component of the successful implementation of these plans, with corrective actions (including targeted eradication) to be undertaken at the earliest opportunity after monitoring reveals a new pest plant or animal outbreak.

6.7 Altered Exposure to Disturbance

6.7.1 Overview

Cattle grazing is the current land use at the Project Area and in the surrounding landscape. The Project will result in a change to the land use of the Project Area and immediate surrounds. Exposure to disturbance will be increased due to the greater level of activity at the Project Area, and the higher human population at and near the Project Area.

6.7.2 Fauna Behavioural Disruption

6.7.2.1 Potential Impacts

The higher intensity of land use at and near disturbed areas associated with Mine operations may disrupt local fauna behaviour, largely as a result of increased exposure to light, noise, dust, vehicles and people. Behavioural disruption may be direct (i.e. increased susceptibility to predation due to increased noise reducing prey vigilance, or increased light increasing prey detectability) or indirect (i.e. habitat degradation reducing local resource availability therefore increasing foraging dispersal distances for fauna). Given that the Project Area is currently exposed to some disturbance (as it is a working cattle property), the suite of species that occur exhibit a degree of disturbance tolerance. The black-throated finch (southern) and squatter pigeon (southern) are known to inhabit areas exposed to anthropogenic disturbance (peri-urban Townsville including directly adjacent to military training areas in the case of the former; numerous towns in central Queensland for the latter).

Animals may exhibit initial fright behaviour in response to the increased intensity of disturbance at the Project Area, and will either adapt to the disturbance levels, or move away from the areas of activity into similar habitat that is extensively available in the adjacent landscape. Dispersal will be facilitated by active management and where possible enhancement of habitats occurring onsite (outside the mine footprint) and offsite (offset areas).



The Noise and Vibration Report for the Project (Volume 4, Appendix U) states that negative impacts to fauna from noise associated with operations of the Project are unlikely to occur.

6.7.2.2 Management and Mitigation

Mitigation and management of potential disruption to fauna behaviour during Mine operations will be analogous to the measures detailed for the construction phase of the Project (Section 5.2.5.2), albeit on a larger scale over a more prolonged period of time, and include:

- ▶ Directional lighting will be used where lighting is required in operational areas, where light spill has the potential to adversely affect adjacent areas of habitat
- ▶ Dust suppression as discussed in Section 6.3.7.2 – dust impacts will be managed in accordance with the recommendations outlined in the Mine Air Quality Report (Volume 4, Appendix S)
- ▶ Regular maintenance of construction machinery and plant will be undertaken to minimise unnecessary noise

6.7.2.3 Summary

Throughout the operation phase of the Project, habitats adjacent to mined areas and related infrastructure will be exposed to disturbance. Implementation of the mitigation measures referenced to and listed above will seek to prevent/reduce exposure to these potentially disruptive activities and processes.

6.7.3 Changes to Fire Regime

6.7.3.1 Potential Impacts

Increased human activity may alter the fire regime of the local landscape, either deliberately through the need to manage bushfire risk, or through the accidental ignition of bushfires. Accidental or uncontrolled fires may have more pronounced impacts upon vegetation (and habitat) within and adjacent to the Project Area.

6.7.3.2 Management and Mitigation

Fire management strategies should be outlined in the Mine and Offsite Environmental Management Plans, and these will be implemented for all phases of the Project. As well as documenting protocols and actions for preventing accidentally-lit fires, the plan will outline how fuel loads will be monitored and maintained across the Project Area, as well as in offsite (offset) areas being managed for biodiversity. Ecological considerations will be incorporated into the development of this plan and response procedures developed.

6.7.3.3 Summary

Implementation of a fire management protocols will reduce the potential for destructive high intensity fires to disturb habitats at and near the Project Area.

6.7.4 Changes to Habitat Structure – Subsidence

6.7.4.1 Potential Impacts

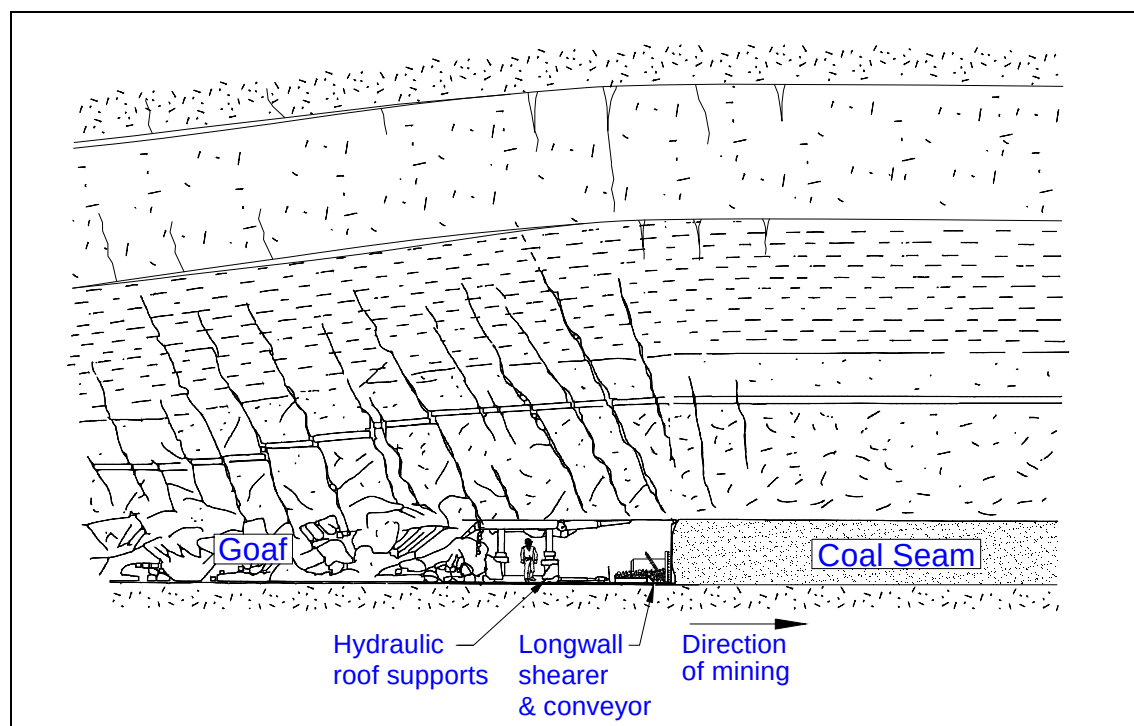
Subsidence is predicted to occur above the underground mining area. This may alter the local topography above underground mining areas and, in the long term, alter surface hydrology patterns and vegetation assemblages.



Subsidence is likely to occur in two stages, as first the AB1 seam and then the D1 seam is mined. The total depth of subsidence once both seams have been mined has been estimated to be up to 7.5 m. As subsidence depends on a range of geological and geotechnical factors, there is likely to be some variation from this estimate and subsidence is unlikely to be even across the footprint of the mining area.

The pattern of subsidence will follow the layout of the underground mine; thus for a longwall mine, subsidence creates a series of parallel troughs above the longwall panels, with the main headings and drifts not being subsided. Subsidence occurs as mining progresses, as shown in Figure 6-2. The time lag between mining and subsidence depends on geotechnical and geological conditions, but is typically in the order of months rather than years.

Figure 6-2 Conceptual diagram of subsidence



Ecological impact type

Potential environmental impacts of subsidence include:

- ▶ Alterations in surface topography leading to changes in surface drainage patterns. For example, the bed profiles of streams may be affected by the subsidence profile. The underground mining footprint is traversed by minor ephemeral streams with small sub-catchments. Most of these flow roughly perpendicular to the longwall panel and subsidence trough orientation. As these streams are quite small and ephemeral, when flowing, the streams are likely to empty into the subsidence troughs and result in ponding at the surface, within some of the troughs. Higher points may become drier as surface water is diverted away from them.
- ▶ Alteration to below-ground geological profiles resulting in changes to sub-surface drainage patterns. The root zones of vegetation may be affected by the changes to sub-surface flow conditions resulting from subsidence. Altered hydrology may result in areas of wetter or drier

conditions for plants. Affected vegetation may fall over, become less stable, or more gradual impacts may occur in line with changes in water availability to root systems.

- Tension cracks may form in the ground surface. The width and depth of tension cracks will depend on the underlying geology and also the speed at which subsidence occurs. As subsidence will be staged, this may reduce the formation of tension cracking, but such cracking may further alter surface and/or sub-surface water flows and result in a direct loss of vegetation and/or pre-existing habitat features in some areas.

As a result of these effects, the nature of vegetation communities over underground mining areas may change over time. Taller trees may fall over (in areas of tension cracking for example), or gradually die due to the physical or hydrological changes. Shrubs and grasses are generally less likely to be affected by the physical changes of subsidence; however, changes in hydrology may lead to progressive changes in the nature of vegetation, as water tolerant species colonise the base of troughs and more drought tolerant species colonise the ridges above the pillars. During this transition, there will also be significant potential for weed invasion to occur, as weeds may be better able to take advantage of the changed conditions.

Areas to be impacted and impact significance

The surface topography within the Project Area consists of low-lying and gently sloping plains of generally less than 2 per cent gradient. The Carmichael River is the most significant watercourse in the area, in the southern part of the mining lease area, and the proposed longwalls have been set back from the River such that the closest longwall is approximately 500 m away.

The areas of land to be potentially subject to the impacts of subsidence have been estimated by calculating those areas that sit directly beneath the underground mine area. In total, this equates to an area of 7,765 ha. These areas have been broken down by vegetation community/RE and fauna habitat type/potential habitat for threatened species and are presented in **Table 6-9**, Table 6-10 and Table 6-11.

Table 6-9 Approximate areas of vegetation potentially to be impacted by subsidence

Community type	Approximate area (ha) to be potentially impacted by subsidence
Remnant vegetation	
10.3.14	14
10.3.28	515
10.3.3	64
10.3.4	20
10.3.6	542
10.4.3	6
10.4.5	46
10.5.1	1279
10.5.2	22
10.5.4	39



Community type	Approximate area (ha) to be potentially impacted by subsidence
Remnant vegetation	
10.5.5	3721
10.5.7	20
10.5.8	46
10.7.2	116
10.7.3	9
10.7.4	67
10.7.5	5
10.7.7	584
10.9.3	47
Total	7162 ha
Non-remnant vegetation	
Total	603 ha
Total remnant and non-remnant	7765 ha

By far the largest RE areas that could be impacted by subsidence are 10.5.5 and 10.5.1; both are open *Eucalyptus* woodlands on sand plains, classified as least concern under the VM Act. Impacts are also likely to smaller areas of 10.7.7, 10.3.6 and 10.3.28. (*Melaleuca* shrubland and open *Eucalyptus* woodlands, all classified as least concern).

None of the above are considered vegetation communities that are under threat (i.e. not classified as of concern); furthermore, each is abundant and typical of the wider Project Area and regional environment (bioregion). It is considered that effects to individual REs will be unlikely to be significant in terms of their distribution and conservation status at a local or bioregional level.

Table 6-10 Approximate areas of fauna habitat potentially to be impacted by subsidence

Fauna Habitat Type	Approximate area (ha) to be potentially impacted by subsidence
Ironbark-box grassy woodland and open woodland on grey sand plains	4,721
Yellow jacket and rough-leaved bloodwood shrubby low open woodland on red sand plains	987
Tall mixed shrubland on red sand plains and over ferricrete	1,039
Gidgee/brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains	157



Fauna Habitat Type	Approximate area (ha) to be potentially impacted by subsidence
Woodland and low open woodland associated with laterised sandstone rises and minor pediments	258
Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding	2
Open, previously cleared areas, lacking native vegetative cover	603
Total	7,765 ha

The ironbark-box grassy and open woodland community is the dominant habitat type most likely to be subject to the impacts of subsidence, with a large area of tall mixed shrubland also likely to be affected. Both habitat types occur on largely free-draining sandy soils, and therefore changes to surface hydrology as a result of subsidence may not affect the general composition of this community, though the redistribution of the micro-topography may alter the distribution of species within these communities.

The lower densities of trees within the open woodlands and their scattered configuration across the underground mine area as a whole mean that whilst some large trees will ultimately be lost to subsidence (due to instability and/or root zone drying or wetting), an abundance of similar trees will be less affected or not affected at all in other, comparable adjacent areas (unaffected by subsidence). Furthermore, assuming conditions remain suitable for tree growth overall, the recolonisation of affected areas should begin to offset the shorter-term losses of trees.

It is considered that the ground stratum vegetation, including grasses and shrubs, are less likely to be affected by subsidence being shallow-rooted and less vulnerable to instability. Again, it is more likely that changes will occur to the plant species compositions within areas of subsidence, with localised senescence of some patches, and a change from more xeric species to those associated with ponded surface water areas, for example, sedges and rushes. In the medium to longer-term, within an evolving and dynamic environment, species more able to tolerate changes to hydrological conditions (where areas become wetter or drier) are likely to prevail over those that are highly susceptible to the changes that may result from localised subsidence. A potentially adverse effect of such change may be the prospect of the establishment of weed species, including exotic pasture grasses that can rapidly colonise and seed in areas of soil perturbation.

Overall, whilst changes to habitat structure (such as areas of tree loss) and species compositions are likely to result from the levels of subsidence predicted, the general (overall) functionality of the fauna habitats present across the project area is unlikely to be significantly compromised.



Table 6-11 Approximate areas of potential conservation significant species habitat potentially to be impacted by subsidence

Species	Approximate area (ha) to be potentially impacted by subsidence
EPBC Act listed threatened species – confirmed present	
Waxy cabbage palm	2
Black-throated finch (southern)	6700
Squatter pigeon (southern)	6929
Koala	4723
EPBC Act listed threatened species – likely to occur	
Yakka skink	6126
Ornamental snake	159
EPBC Act listed migratory species – confirmed present	
Great egret	2
Rainbow bee-eater	7765
Satin flycatcher	2
NC Act listed threatened species – confirmed present	
Cotton pygmy-goose	0
Black-necked stork	0
Little pied-bat	7164
NC Act listed threatened species – likely to occur	
Square-tailed kite	4721
Black-chinned honeyeater	4721

For three of the six threatened species (black-throated finch (southern), squatter pigeon (southern) and yakka skink), the vast majority (79-86 per cent) of the overall area likely to be subject to subsidence represents potentially suitable habitat. These species utilise a wide range of grassland and open woodland habitats.

For koala, over 60 per cent of the predicted impact area is potentially suitable habitat. Only very small areas of the predicted impact area represent potential habitat for ornamental snake and waxy cabbage palm. In the case of waxy cabbage palm, the species' restriction to the Carmichael River riparian corridor means that it is highly unlikely to occur in an area to be subject to subsidence.

While subsidence may occur over much, if not all, of the predicted subsidence area, the type and extent of subsidence will vary greatly in distribution and in magnitude of effect over time. Because the majority of the impact area represents known and potential habitat for four of these species, the effects of variable levels of subsidence across this area (and in turn variable impacts to the habitats upon which they rely) are likely to be reduced and result in impacts that could be locally significant, but unlikely to be significant at the wider, regional population level. The greatest impacts are likely to



be those involving the loss of historical breeding sites, where there is a high fidelity to those sites amongst species; this may be the case for black-throated finch (southern) and yakka skink (communal breeders), but is less likely to be applicable to the other threatened species present within the area.

Those species with a noted affiliation to water (black-throated finch (southern) and ornamental snake in particular) may be able to take advantage of the creation of additional ponded surface water areas as a result of subsidence. Black-throated finch (southern) requires an abundance of reliable water sources within its localised habitat ranges. Furthermore, they have been observed (during survey work) to drink from water sources in areas of cleared land or non-wooded vegetation and therefore any localised changes in habitat structure around existing or new water sources should not affect the subspecies' ability to use these water sources, so long as the requisite grassland and woodland habitats remain present within the nearby surrounds. Important habitats for ornamental snake comprise gilgais, melon-holes and/or fringing vegetation along watercourses, within brigalow or open woodland complexes. The same may apply to any increase in dead wood habitat created by fallen trees in areas of subsidence, which would be of potential benefit to species including yakka skink.

6.7.4.2 Management and Mitigation

Management and mitigation measures to reduce the impacts of subsidence to ecological features and resources will include:

- ▶ Implementation of the Subsidence Management Plan that has been produced for the Project, which allows for the offsetting of longwall panels between the seams (to reduce vertical displacement, tilt and curvature), the early diversion of small watercourses (where necessary), the packing and backfilling of tension cracking, and the regular review of subsidence management in general
- ▶ Monitoring of the effects of subsidence on key species and habitats should also be carried out by suitably qualified ecologists, with monitoring events phased and scheduled following the cessation of excavations within each longwall panel (as well as the prior establishment of pre-impact benchmark sites as necessary). The monitoring should focus on documenting resulting changes to habitat types (using indicators such as vegetation cover and plant species diversity) and fauna species use of these areas (primarily the key threatened species listed above)
- ▶ Using the data from monitoring, specific rehabilitation plans will be produced and implemented, if necessary, to act upon any identified adverse impacts to habitats or features, where these are considered to pose a threat to key habitat communities and/or threatened species populations. Key performance indicators will be developed which, if not met, will result in corrective actions to directly address any functional loss in biodiversity
- ▶ It will most likely be preferable to adaptively manage evolving habitat changes rather than attempt to rehabilitate areas to their previous condition, which would be difficult to achieve. This would include retaining surface water within areas that become subject to ponding (rather than attempting to drain these), but as these new habitats evolve, there are also likely to be specific additional enhancements that can be made to these features, such as revegetation with native planting and the collection and aggregation of fallen woody material to create habitat piles

6.7.4.3 Summary

Subsidence is highly likely, if not certain, to occur above all mined out areas, causing localised changes to topography, water flows and habitat features at the surface. These changes will be



variable across the land surface above the underground mine area, with some areas subject to greater levels and extents of subsidence than others, and over time, in line with the phased excavation of the longwall panels. Changes to vegetation communities, with some areas becoming wetter and others potentially drier, are highly likely to occur as a result.

No of concern or endangered REs occur above the underground mine area. Those REs likely to be affected are generally abundant within the region and typical of the environment of the Project Area. This also applies to the fauna habitat types associated with these REs that occur above the underground mine. Of the threatened species potentially present, koala, squatter pigeon (southern) and ornamental snake are considered to be the least susceptible to the impacts of any localised habitat changes because of their mobility, adaptability and/or use of a variety of different habitat types. Waxy cabbage palm is unlikely to be affected by subsidence because of its restriction to the Carmichael River corridor and the offset of 500 m from this feature. Impacts to black-throated finch (southern) and yakka skink, as communal breeders that may be reliant upon specific patches of habitat within the underground mine area, are considered to be less certain and predictable at this time. Pre-mining surveys will be required to identify any important areas and set benchmarks that can be monitored as subsidence progresses.

With the implementation of the mitigation measures and adaptive management approach discussed, it is considered that changes to habitat structure and consequent species usage of those habitats that will result from subsidence will be able to be managed to control the degree of impact to these resources.



7. Potential Impacts and Mitigation Measures – Decommissioning

The mining at the Project Area is scheduled to extend for approximately 90 years from 2013. There are a number of aspects of relevance to environmental management when decommissioning the Project (Mine), including:

- ▶ Rehabilitation and remediation of open cut pits and voids, and out of pit waste dumps
- ▶ Removal of industrial infrastructure, including onsite infrastructure and offsite infrastructure (including the community area, workers accommodation village, airport and water supply infrastructure)
- ▶ Details on the approach to decommissioning the mining operation are provided in Volume 1, Section 2. With respect to the potential impacts to the environment and associated mitigation for this phase, the decommissioning of the Mine will require detailed planning. Planning and subsequent development of a Project Decommissioning Environmental Management Plan should incorporate a phase of impact assessment that includes consideration of the potential impacts to the terrestrial ecosystems within, surrounding and downstream of the Project Area as they occur at the time of decommissioning, with reference to pre-mining state as described in this report

The resultant plan should consider (but not be limited to) incorporation of the following with respect to the management of habitats for terrestrial species:

- ▶ Rehabilitation and ongoing management of terrestrial systems disturbed at any stage of Mine operations to occur, with the objective of revegetating cleared areas as soon as possible after disturbance, and wherever possible, providing a suite of habitat resources for flora and fauna that replicates as closely as possible the resources available prior to the commencement of mining (as detailed in this baseline assessment of the existing terrestrial ecological values of the Project Area). A key aspect of this rehabilitation will be restoring and maintaining connectivity across the local landscape, particularly between intact habitats within and near the Project Area.
- ▶ Remediation and development of the final landform to consider drainage, erosion resistance and potential resultant change to vegetation communities (and thus fauna habitats), and surface water flows (direct and volume) in order to minimise changes to the aquatic habitats of the Carmichael River and downstream
- ▶ Rehabilitation requirements for any watercourse crossings
- ▶ Rehabilitation or re-establishment of riparian zones for watercourses
- ▶ Monitoring requirements for aquatic communities and water quality

It is recommended that at the time of decommissioning, suitably qualified ecologists are consulted during planning and implementation to provide appropriate direction on management of the terrestrial ecosystems and to incorporate the relevant policy, legislation and standards of the time.

8. Conclusion

The Project Area occurs in an agricultural landscape, where historic and current land use practices associated with cattle grazing have altered the extent, connectivity and ecological integrity of vegetation communities and the fauna habitat they provide. Remnant vegetation occurs over approximately 60 per cent of the Project Area and a total of 36 field verified REs were identified within the Project Area, 22 from the Desert Uplands and 14 from the Brigalow Belt bioregions. The Project Area contains a range of fauna habitat types that share broadly similar habitat values (based on habitat structure), but vary in their value for wildlife based on the specific forage and shelter resources they provide. Ironbark-box woodland was the most widespread fauna habitat type at the Project Area.

The DEHP BPA mapping indicated that some remnant vegetation within and surrounding the Project Area is of ecosystem value at a regional level, while much of this remnant vegetation is ranked as having very high or high ecosystem diversity and (ecosystem) context and connection. Approximately 1,060 ha of Category B ESAs (endangered Biodiversity Status REs), recorded from the occurrence of seven RE types (10.4.3, 10.9.3, 11.3.1, 11.4.5, 11.4.6, 11.4.8 and 11.4.9), were identified from the Project Area (based on field verified RE mapping). No DNRM mapped essential habitat occurs at the Project Area, although a number of patches (for a variety of species) occur in the landscape around the Project Area.

The EPBC Act listed TEC, Brigalow (*Acacia harpophylla* dominant and co-dominant), was identified as present at the Project Area during field surveys. The presence of this TEC was recorded from the occurrence of REs 11.3.1, 11.4.8 and 11.4.9 within the Project Area. Approximately 267 ha of these REs are present, predominantly south of the Carmichael River at the east of the Project Area.

One threatened flora species, listed under both the EPBC Act and the NC Act, was recorded within the Project Area from field surveys – waxy cabbage palm (*Livistona lanuginosa*). Two individuals of this species were observed in the Carmichael River channel, and it is not expected to occur elsewhere within the Project Area. One EPBC Act listed threatened flora species, *Acacia ramiflora* and two flora species listed under the Queensland NC Act, *Nesaea robertsii* and *Peripleura scabra*, may occur at the Project Area (based on suitability of habitat, previous records from region, current known distribution).

The vast majority of fauna species recorded from the Project Area were common, widely distributed species. A limited number of introduced fauna species were recorded. Notwithstanding the cane toad, introduced animals were observed to occur at relatively low densities. Two threatened birds and one mammal listed under the EPBC Act were recorded – the endangered black-throated finch (southern) (*Poephila cincta cincta*), the vulnerable squatter pigeon (southern) (*Geophaps scripta scripta*) and the vulnerable koala (*Phascolarctos cinereus*). Both bird species appeared to be locally common where suitable habitat was present at the Project Area. Potential habitat occurring within and beyond the Project Area for these species was identified. Two additional EPBC Act listed threatened fauna species, yakka skink (*Egernia rugosa*) and ornamental snake (*Denisonia maculata*), were not recorded from field studies, but are considered likely to occur at the Project Area (based on suitability of habitat, previous records from region, current known distribution).



Three common EPBC Act listed migratory bird species, eastern great egret (*Ardea alba*), rainbow bee-eater (*Merops ornatus*) and satin flycatcher (*Myiagra cyanoleuca*) were recorded at the Project Area. In addition to these, 15 EPBC Act listed migratory bird species not recorded during field studies have the potential to occur at the Project Area. However, habitats at the Project Area are not considered likely to support important assemblages of migratory species.

Three threatened fauna species listed under the NC Act (in addition to the two bird species also listed under the EPBC Act (black-throated finch (southern) and squatter pigeon (southern)) were recorded – the near threatened black-necked stork (*Ephippiorhynchus asiaticus*), cotton pygmy-goose (*Nettapus coromandelianus*) and little pied bat (*Chalinolobus picatus*). Potential habitat occurring within the Project Area for these species was identified. An additional two threatened fauna species listed under the NC Act (in addition to those also listed under the EPBC Act) are considered likely to occur at the Project Area (based on suitability of habitat, previous records from region, current known distribution).

Five NC Act-listed special least concern fauna species were recorded at the Project Area (the three EPBC Act listed migratory birds mentioned above, echidna (*Tachyglossus aculeatus*) and koala).

One protected area occurs within the Project Area. Bygana West Nature Refuge, at the southern part of the Project Area, is dominated by ironbark-box woodland, although smaller patches of three other fauna habitat types were recorded within its boundary. The land use of the nature refuge is cattle grazing. Two threatened species were recorded along its southern boundary - black-throated finch (southern) and squatter pigeon (southern). Both (sub) species are likely to utilise habitats within the Nature Refuge.

Construction phase impacts are associated with the mine infrastructure area and offsite infrastructure. These facilities will be constructed within predominantly cleared land within and to the east of eastern portion of EPC 1080. Potential impacts associated with the construction phase include:

- ▶ Vegetation clearing
- ▶ Disturbance of surface watercourses and water bodies
- ▶ Introduction of pests and feral species
- ▶ Altered exposure to disturbance

Operation phase impacts are associated with open cut mining, out of pit waste dumping, water management dams, underground mining (and potential for subsidence) and operation of offsite infrastructure. Potential impacts associated with the operation phase include:

- ▶ Vegetation clearing
- ▶ Disturbance of surface water courses and water bodies
- ▶ Alteration of groundwater regime
- ▶ Introduction of pests and feral species
- ▶ Altered exposure to disturbance

The approach to mitigating and managing operation phase impacts will include a combination of prevention or reduction of all avoidable impacts to the greatest extent possible, active management to maintain and where possible enhance habitats that will not be impacted during staged operations, and active management of areas that will be disturbed during staged mining operations such that they



retain their existing values until such time that they are disturbed. Research and monitoring will be a fundamental component of the impact management approach, with a dual objective of informing management of environmental impacts at and near the Project Area, as well as contributing to the understanding and protection of ecological values in the Galilee Basin. As unavoidable impacts are an inherent aspect of this Project, given that its operations are entirely related to the locality of the coal resource within the mining lease, offsets will form a substantial component of the impact management approach. Whilst all reasonable efforts will be made to minimise impacts to flora and fauna values within the operation phase footprint, vegetation loss, fauna habitat loss and fauna mortality will occur. The overarching objective of managing impacts during the operation phase will be to maintain and where at all possible enhance the ecological values that characterise the Project Area and the surrounding landscape, with a view to achieving no-net-loss of regional biodiversity values.

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Appendix A

Terms of Reference Cross Reference



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Terms of Reference cross reference

Terms of Reference	Section
3.3. Nature Conservation	Section
Detail the existing nature conservation that may be affected	Section 2, Section 3 and Appendix B
Flora and Fauna Surveys should address species structure, assemblage, diversity and abundance	Section 1.5
Where possible seek the involvement of the local Indigenous community to conduct field observations and survey activities, to identify the traditional and contemporary Indigenous uses of species.	Volume 1, Section 7 and Volume 4, Appendix F
Describe methodologies and standards used for flora and fauna surveys and compare them to best practice in the appendices in the EIS	Section 1.5 and Appendix B
Identify key flora and fauna indicators of ongoing monitoring	Section 5 and 6
3.3.1 Sensitive Environmental Areas	
On a map of suitable scale, identify areas in proximity to the project that are environmentally sensitive. This should include areas classified as having national, state, regional or local biodiversity significance, or flagged as important for their integrated biodiversity values	Section 2, Section 3 and Appendix B
Refer also to both Queensland and Commonwealth Government legislation and policies on threatened species and ecological communities	Section 1.4 and Section 3
Areas regarded as sensitive with respect to flora and fauna should be identified and mapped	Section 2, Section 3 and Appendix B
Sites containing high biodiversity, for example areas identified in both the Desert Uplands and Brigalow Belt North Biodiversity Planning Assessments, that are of a suitable size or with connectivity to corridors/protected areas to ensure survival in the longer term	Section 3.4
Areas of special sensitivity	Section 3
Discuss all the likely direct and indirect impacts of the project on species, communities and habitats of local, regional or national significance in sensitive environmental areas as identified above	Section 5 and 6
Cover terrestrial and aquatic environments and address any fragmentation impacts	Section 2.4.1, Appendix B, Section 5 and Section 6
Also, include human impacts and the control of any domestic animals introduced to the area	Section 5.4 and Section 6.6
Demonstrate how the project would comply with the following hierarchy. avoid impacts, mitigation through rehabilitation and restoration, replace or offset the loss of conservation value	Section 5 and Section 6
Explain why the measures above would not apply in areas where loss would occur	Section 5 and Section 6
Discuss the boundaries of the areas impacted by the project within or adjacent to an endangered ecological community, including details of footprint width	Section 5.2 and Section 6.3

Terms of Reference	Section
3.3. Nature Conservation	Section
Where the project area would impact upon a threatened community, the discussion should include reasons for the preferred alignment and the viability of alternatives	NA – applies to rail component of Project
Consider the high biodiversity values of Bygana West NR and, in accordance with mining best practice, first demonstrate ways to avoid impacting this area, second demonstrate mitigating measures and offsetting impacts relating to Bygana West Nature Refuge	Section 3.3.7.1 and Section 6.3.2
Address any actions of the project or likely impacts that require an authority under the NC Act, and/or would be assessable development for the purposes of the VM Act	Section 1.4, Section 5.2 and Section 6.3
Outline how these measures will be implemented in the overall EMP for the project	See Volume 2 Section 13
Where relevant, discuss environmental offset requirements in accordance with the <i>Queensland Government Environmental Offsets Policy</i> and take into account the applicable specific-issue offset policies	Section 5.2, Section 6.2.2 and Volume 1, Section 8
Proposals to offset unavoidable impacts to biodiversity values are to be made via use of the framework outlined in the draft Policy for Biodiversity Offsets	Section 5.2, Section 6.2.2 and Volume 1, Section 8
Describe any departure from no net loss of ecological values.	See Volume 1, Section 11
3.3.2 Terrestrial Flora	
Specifically assess any potential impacts on a Category A or B environmentally sensitive area and propose measures and impacts.	Section 2.3.1.2, Section 6.3.2, Figure 2-2 Figure 2-1 and Appendix B
Describe and assess the potential impacts of any actions of the project or likely impacts that require an authority under the NC Act and VM Act	Section 1.4, Section 5.2 and Section 6.3
Provide vegetation mapping for all relevant project sites	Section 2.3, Figure 2-3 to Figure 2-6 and Appendix B
Survey and describe terrestrial vegetation within the affected areas at an appropriate scale (max. 1:10,000),	Section 1.5, Section 2.3 and Appendix B
Vegetation surveys should be undertaken at an appropriate number of sites, and satisfying state and commonwealth requirements	Section 1.5 and Appendix B
Existing information may be used instead of new survey work, provided that the data is derived from previous surveys at the site consistent with the above methodology	Section 1.5.2
Discuss all foreseen direct and indirect impacts on vegetation and the potential level of environmental harm to the ecological values of the area	Section 5.2 and Section 6.3
Provide digital spatial data of clearing within the railway corridor in ESRI shapefile format	See Volume 3
Describe action plans for protecting rare or threatened species and vegetation identified as having high conservation value	Section 3 and Section 6.3
Weed management strategies are required for containing existing weed species and ensuring no new plants are introduced	Section 5.4 and Section 6.6



Terms of Reference	Section
3.3. Nature Conservation	Section
Measures to mitigate the impacts of the project on vegetation types identified as having high conservation values	Section 5.2 and Section 6.3
3.3.3 Terrestrial Fauna	
Describe the terrestrial and riparian fauna occurring in the areas affected by the proposal	Section 2.4, Appendix B and Section 3
The assessment of potential impact should discuss all foreseen direct and indirect effects, including direct and indirect impacts due to loss of habitat, cumulative effects and threatening processes leading to progressive loss	Section 5 and Section 6
Strategies for protecting rare or threatened species should be described	Section 5.2 and Section 6.3
Describe and assess the potential impacts of any actions of the project or likely impacts that will require an authority	Section 1.4
Provide the mitigation strategies	Section 5 and Section 6
Outline how these measures will be implemented in the EMP	Section 5, Section 6 and Volume 2, Section 13
Outline EPBC or State recovery plans for potentially affected threatened species	Section 3.2.5, Section 3.4.3
Address feral animal management strategies and practices	Section 5.4 and Section 6.6



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Appendix B

EPC 1080 Existing Terrestrial Ecological Values Report

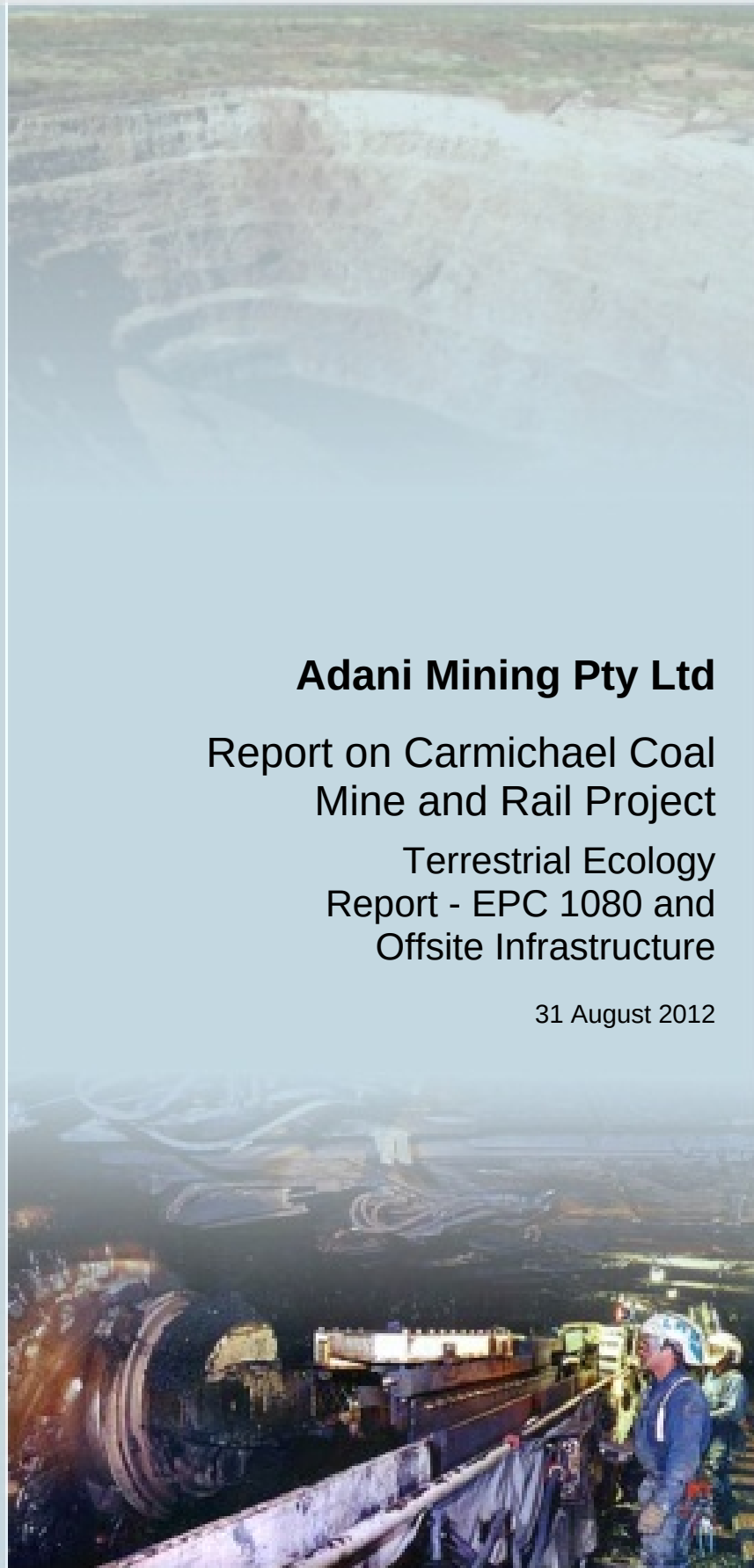


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**Report on Carmichael Coal
Mine and Rail Project**

**Terrestrial Ecology
Report - EPC 1080 and
Offsite Infrastructure**

31 August 2012





This Carmichael Coal Mine and Rail Project: Terrestrial Ecology Report – EPC 1080 (“Report”):

- 1. has been prepared by GHD Pty Ltd (“GHD”) for Adani Mining Pty Ltd;*
- 2. may only be used and relied on by Adani Mining Pty Ltd;*
- 3. must not be copied to, used by, or relied on by any person other than Adani Mining Pty Ltd without the prior written consent of GHD;*
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GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Adani Mining Pty Ltd arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report:

- were limited to those specifically detailed in section 1 of this Report;*
- did not include GHD undertaking testing at some parts of the site and did not include an assessment of seasonal variability within habitats of the EPC 1080 Study Area.*

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report (“Assumptions”).

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation and may be relied on until 12 months, after which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

Contents

Abbreviations and Glossary	vi
1. Introduction	1-1
1.1 Project Overview	1-1
1.2 Assessment Scope	1-1
1.3 Methods	1-3
1.3.1 Desktop Assessment	1-3
1.3.2 Field Surveys	1-9
1.3.3 Terrestrial Flora	1-9
1.3.4 Terrestrial Fauna	1-12
1.4 Limitations	1-18
2. Existing Environment	2-1
2.1 Terrestrial Flora	2-1
2.1.1 Regional Ecosystems and Environmentally Sensitive Areas	2-1
2.1.2 Vegetation Communities	2-21
2.1.3 Groundwater Dependant Ecosystems	2-28
2.1.4 Flora Species Diversity	2-28
2.1.5 Exotic or Weed Flora Species	2-28
2.2 Terrestrial Fauna	2-29
2.2.1 Fauna Habitats	2-29
2.2.2 Fauna Species – Field Assessment Summary	2-40
3. Summary of Existing Terrestrial Ecological Values	3-1
4. References	4-1

Table Index

Table 1-1	Summary of Desktop Sources	1-3
Table 1-2	Summary of Terrestrial Fauna Survey Methods	1-14
Table 1-3	Summary of Terrestrial Fauna Survey Effort	1-16
Table 2-1	Summary of Regional Ecosystem Mapping Changes from Ground-Truthing	2-4
Table 2-2	Regional Ecosystem Descriptions	2-7
Table 2-3	Broad Vegetation Communities within the EPC 1080 Study Area (in order of area)	22



Table 2-4	Queensland Declared Plants Recorded Within the EPC 1080 Study Area	2-28
Table 2-5	Fauna Habitat Types in EPC 1080 Study Area	2-30
Table 2-6	Summary of Field Assessment Results	2-40

Figure Index

Figure 1-1	Study Area	1-2
Figure 1-2	Terrestrial Flora Survey Sites	1-11
Figure 1-3	Terrestrial Fauna Survey Sites	1-13
Figure 1-4	Black-throated Finch (southern) Water Body Watch Survey Locations	1-17
Figure 2-1	Environmentally Sensitive Areas – DEHP Certified Mining Activities	2-2
Figure 2-2	Environmentally Sensitive Areas – Category B Field Verified	2-3
Figure 2-3	Regional Ecosystems – DEHP Certified Version 6.1	2-18
Figure 2-4	Regional Ecosystems – Field Verified	2-19
Figure 2-5	Regulated Regrowth Vegetation under the VM Act	2-20
Figure 2-6	Broad Vegetation Communities and Fauna Habitat Types	2-27
Figure 2-7	Biodiversity Planning Assessment – Ecosystem Value at a Regional Level	2-37
Figure 2-8	Biodiversity Planning Assessment – Ecosystem Diversity	2-38
Figure 2-9	Biodiversity Planning Assessment – Context and Connection	2-39

Plate Index

Plate 2-1	Ornate burrowing frog (<i>Platyplectrum ornatum</i>) (November 2011)	2-41
Plate 2-2	Spotted grass frog (<i>Limnodynastes tasmaniensis</i>) (November 2011)	2-41
Plate 2-3	<i>Antaioserpens warro</i> (November 2011)	2-41
Plate 2-4	Nobbi dragon (<i>Amphibolurus nobbi</i>) (November 2011) (right)	2-41
Plate 2-5	Freckled monitor (<i>Varanus tristis</i>) (November 2011)	2-42
Plate 2-6	Black-headed python (<i>Aspidites melanocephalus</i>) (November 2011)	2-42



Plate 2-7	Eastern-grey kangaroo (<i>Macropus giganteus</i>) (November 2011)	2-43
Plate 2-8	Common brushtail possum (<i>Trichosurus vulpecular</i>) (November 2011)	2-43
Plate 2-9	Dusky woodswallow (<i>Artamus cyanopterus</i>) (November 2011)	2-44
Plate 2-10	Wedge-tailed eagle (<i>Aquila audax</i>) (November 2011)	2-44
Plate 2-11	Double-barred finch (<i>Poephila bichenovii</i>) (November 2011)	2-44
Plate 2-12	Galah (<i>Eolophus roseicapillus</i>) (November 2011)	2-44
Plate 2-13	Cat (<i>Felis catus</i>) (November 2011)	2-45
Plate 2-14	Dingo (<i>Canis familiaris dingo</i>) (November 2011)	2-45

Appendices

- A Survey Effort and Locations
- B Additional Desktop Database Search Results
- C Flora Survey Results
- D Fauna Survey Results
- E Threatened Fauna Survey Results

Abbreviations and Glossary

Generic Terminology	
Abbreviation	Term
BOM	Bureau of Meteorology
BPA	Biodiversity Planning Assessment
BVC	Broad Vegetation Community
DERM	Former Department of Environment and Resource Management (Qld)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPA	Environmental Protection Agency
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)</i>
EPC	Exploration Permit for Coal
ESA	Environmentally Sensitive Area
ha	Hectares
Km	Kilometres
LP Act	<i>Land Protection (Pest and Stock Route Management) Act 2002 (Qld)</i>
NC Act	<i>Nature Conservation Act 1992 (Qld)</i>
NRM	Natural Resource Management
Qld	Queensland
RE	Regional Ecosystem
REDD	Regional Ecosystem Description Database
TEC	Threatened Ecological Community
VAST	Vegetation Assets, States and Transitions
VM Act	<i>Vegetation Management Act 1999 (Qld)</i>



1. Introduction

1.1 Project Overview

Adani Mining Pty Ltd (Adani) is proposing to develop a 60 million tonne (product) per annum (Mtpa) thermal coal mine in the north Galilee Basin approximately 160 kilometres (km) north-west of the town of Clermont, Central Queensland. All coal will be railed via a privately owned rail line connecting to the existing QR National rail infrastructure, and shipped through coal terminal facilities at the Port of Abbot Point and the Port of Hay Point (Dudgeon Point expansion). The Carmichael Coal Mine and Rail Project (the Project) will have an operating life of approximately 90 years.

The Project comprises of two major components:

- ▶ The Project (Mine): a greenfield coal mine over EPC1690 and the eastern portion of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including:
 - A workers accommodation village and associated facilities
 - A permanent airport site
 - Water supply infrastructure
- ▶ The Project (Rail): a greenfield rail line connecting the Mine to the existing Goonyella and Newlands rail systems to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point, respectively; including:
 - Rail (west): a 120 km dual gauge portion from the Mine site running west to east to Diamond Creek
 - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah

The Project has been declared a 'significant project' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and as such, an Environmental Impact Statement (EIS) is required for the Project. The Project is also a 'controlled action' and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2 Assessment Scope

This report focuses on the assessment of terrestrial ecology values of the proposed mine infrastructure area, out of pit waste dumps and water management dams within EPC 1080, which is located to the immediate east of EPC 1690 and the offsite infrastructure to the east of the EPC 1080. Collectively the areas of assessment are referred to herein as the 'EPC 1080 Study Area'.

The EPC 1080 Study Area is predominantly located on the Moray Downs cattle station, approximately 160 kilometres (km) northwest of Clermont. The EPC 1080 Study Area is approximately 22,027 hectares (ha), and is shown in Figure 1-1. The location of the offsite infrastructure is also displayed in this figure.



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- | | | | |
|----------------------|-------------------------|----------------|------------------|
| ○ Town | — State Road | Project (Rail) | ■ Project (Mine) |
| ⚓ Major Port | — Local Road | — Rail (West) | ■ Mine (Offsite) |
| — Other Rail Network | — Watercourse | — Rail (East) | |
| — Goonyella System | — Local Government Area | | |
| — Newlands System | | | |

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0 10 20 30 40 50

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Project Location

Job Number	41-25215
Revision	L
Date	28-08-2012

Figure: 1-1

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Data Sources: © Commonwealth of Australia (Geoscience Australia); Town, Railways, Watercourses (2007); DERM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment Optn Rev3 (2012). Created by: BW, JVC

This report presents a summary of baseline ecological values in additional areas not previously surveyed as part of ecological investigations for the Project (i.e. at EPC 1690). The baseline terrestrial ecological values summarised in both this report (EPC 1080 Study Area) and the Carmichael Coal Mine and Rail Project Mine Terrestrial Ecology Report (EPC 1690 Study Area) (hereafter, referred to as the 'Mine Terrestrial Ecology Report') have been synthesised, and a consolidated description of conservation significant ecological values of the **'Project Area'**, that is the EPC 1690 Study Area and the EPC 1080 Study Area together, is presented in the Mine Terrestrial Ecology Report. An assessment of the impacts of the Project to the existing ecological values of the Project Area, most notably to identified conservation significant values, is presented in the Mine Terrestrial Ecology Report, with potential impacts, and associated mitigation measures detailed.

1.3 Methods

This section outlines the approach to describing the existing terrestrial ecological values of the EPC 1080 Study Area. The field assessment methods are detailed below.

1.3.1 Desktop Assessment

Information relating to the terrestrial ecological values of the region was obtained from a variety of sources. Details of these sources are provided in Table 1-1.

Table 1-1 Summary of Desktop Sources

Source and name	Description of information source	Desktop Search extent	Limitations of use
DSEWPac Protected Matters Search Tool and Environmental Reporting Tool	The DSEWPac Protected Matters Search Tool identifies matters of national environmental significance (matters of NES) and other matters protected by the EPBC Act that may occur within or relate to the EPC 1080 Study Area. The tool predicts the potential presence of a species/ecological community in an area based on bioclimatic modelling, known distribution and habitat preferences. The SEWPAC Environmental Reporting Tool was also queried to provide information on invasive species that have the potential to occur, and nationally important wetlands within or near the EPC 1080 Study Area.	A point search (approximating with the centre of the EPC 1690 Study Area: - 22.041, 146.364) with a 50 km buffer was searched.	This is a predictive tool only – it does not necessarily indicate that a species/ecological community occurs in a defined area. Presence of a species/ecological community is predicted based on a combination of bioclimatic modelling, known distribution and habitat preferences. In predicting species/community presence, it allows for field survey efforts to be targeted.



Source and name	Description of information source	Desktop Search extent	Limitations of use
DSEWPaC Directory of Important Wetlands	The Directory identifies nationally important wetlands. The SEWPAC Protected Matters Search Tool (see above) lists nationally important wetlands occurring within or related to prescribed search extents.	A point search (approximating with the centre of the EPC 1690 Study Area: - 22.041, 146.364) with a 50 km buffer was searched via the SEWPAC Environmental Reporting Tool (see above).	NA - this mapping identifies the location of wetlands that satisfy at least one criterion agreed upon by the Australian and New Zealand Environment and Conservation Council (ANZECC) Wetlands Network in 1994.
DEHP Regional ecosystem (RE) mapping	The Queensland DEHP maps remnant vegetation using the RE classification system. REs are defined as 'vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil' (Sattler and Williams, 1999). REs are classified under the Queensland <i>Vegetation Management Act 1999</i> (VM Act) as being endangered, of concern or least concern.	Mapping was obtained for the EPC 1080 Study Area and the adjacent landscape in an electronic data layer for analysis in a Geographic Information System (GIS) environment.	RE mapping is informed by interpretation of landform, substrate, photo/satellite imagery and where available, field data. The mapping has undergone little or no ground-truthing in many parts of Queensland. Because of this, and the scale at which the mapping is created, RE mapping does not always accurately depict vegetation assemblages on the ground. As such, ground-truthing of REs is a fundamental aspect of field studies for ecological survey.



Source and name	Description of information source	Desktop Search extent	Limitations of use
DEHP Environmentally Sensitive Areas Map – Mining Activities	Environmentally Sensitive Areas are identified under the Queensland EP Act and represent locations with environmental values that contribute to maintaining biological diversity and integrity, have intrinsic or attributed scientific, historical or cultural heritage value, or are important in providing amenity, harmony or sense of community. Environmentally Sensitive Areas are defined and mapped as either Category A, B or C areas and impacts to each ESA category are subject to separate environmental conditions.	An area search based on EPC 1080.	Mapped information is provided as an information source only. ESAs identified on the map may require field survey and ground-truthing exercises for accuracy. Some boundaries and indicated values presented may change over time.
DEHP Regrowth vegetation mapping	Mapped 'high value regrowth vegetation' produced by DEHP.	Mapping obtained for the EPC 1080 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	Regrowth mapping is informed by statewide landcover and tree study (SLATS) foliage protective cover (FPC) and pre-clearing RE mapping. The mapping has undergone little or no ground-truthing in many parts of Queensland and as like the RE mapping does not always accurately depict on the ground characteristics As such, ground-truthing is required.
DEHP Essential habitat mapping	Essential Habitat is defined as 'vegetation in which a species that is endangered, vulnerable or near threatened under the NC Act has been known to occur' (DERM, 2011a). DERM maps Essential Habitat (and Essential Regrowth Habitat) in conjunction with remnant and regrowth vegetation mapping.	Mapping obtained for the EPC 1690 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	As Essential Habitat and Essential Regrowth Habitat mapping is underpinned by RE/regrowth mapping, the constraints associated with mapping scale and lack of ground-truthing are applicable to this information source.



Source and name	Description of information source	Desktop Search extent	Limitations of use
DEHP Wetland mapping	Various mapping layers produced by DEHP (including Wetland Protection Areas).	Mapping obtained for the EPC 1080 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	Wetlands are identified using the DEHP AquaBAMM Methodology – the on-ground values of individual wetlands identified through this methodology have not necessarily been assessed, as designation is primarily based on existing literature and expert opinion. As such, designation does not reveal the value of these systems for local flora and fauna.
DEHP Biodiversity Planning Assessment mapping – Brigalow Belt bioregion and Desert Uplands bioregion and Biodiversity Planning Assessment (BPA) expert panel reports	Identifies landscape scale biodiversity features at varying levels of significance (local, regional, state). The mapping methodology is underpinned by DEHP's remnant vegetation (i.e. RE) mapping. Expert panel reports provide information on the landscape-scale values of bioregions, and in some instances identify bioregional priority taxa.	Mapping obtained for the EPC 1080 Study Area and adjacent landscape in an electronic data layer for GIS analysis.	As BPA mapping is underpinned by RE mapping, the constraints associated with mapping scale and lack of ground-truthing is applicable to this information source.
DEHP <i>Burdekin Natural Resource Management (NRM) Region Back on Track Actions for Biodiversity</i> report (DEHP, 2010a)	This document identifies priority species in the Burdekin NRM region, details the regional threatening processes impacting upon these species, and proposes a range of actions to address regional threats. Priority taxa are identified through the DEHP Back on Track species prioritisation framework, in consultation with a range of stakeholders from the region. The document seeks to guide priority species conservation in the region over the next five years.	The document covers the entire Burdekin NRM region (in which the EPC 1690 Study Area occurs).	Some species/impacts listed in this document are not relevant to the EPC 1690 Study Area, as the Burdekin NRM region encompasses a large area of central Queensland.



Source and name	Description of information source	Desktop Search extent	Limitations of use
DEHP Wildlife Online database	The DEHP Wildlife Online database maintains a catalogue of animal and plant species records from specific localities across Queensland. As well as common species, records of animals and plants listed as threatened under the Queensland NC Act are contained within the database.	A point search (approximating with the centre of the EPC 1690 Study Area: - 22.041, 146.364) with a 50 km buffer was searched.	This database catalogues known records of species in a defined area. DEHP recommend that independent verification of records should be undertaken to inform the accuracy and completeness of information catalogued within this database (i.e. field surveys).
DEHP (Queensland Herbarium) HERBRECS specimen database	The HERBRECS database catalogues flora specimen records obtained throughout Queensland.	A rectangular area was searched, such that the diagonal extending from the approximate centre of the EPC 1690 Study Area (22.041, 146.364) to each corner was 50 kms. The co-ordinates of the search were between latitudes -21.598 and -22.512, and longitudes 145.865 and 146.837.	This database catalogues known records of species in a defined area. The age of species records may limit their value for inclusion in current studies in some instances.



Source and name	Description of information source	Desktop Search extent	Limitations of use
Queensland Museum	The Queensland Museum catalogues vertebrate fauna specimen records obtained throughout Queensland.	A rectangular area was searched, such that the diagonal extending from the approximate centre of the EPC 1690 Study Area (22.041, 146.364) to each corner was 50 kms. The co-ordinates of the search were between latitudes -21.598 and -22.512, and longitudes 145.865 and 146.837.	This database catalogues known records of species in a defined area.
Queensland Museum Data Search			The age of species records may limit their value for inclusion in current studies in some instances.
Birds Australia	Birds Australia maintains a database of bird records from across Australia.	A rectangular area was searched, such that the diagonal extending from the approximate centre of the EPC 1690 Study Area (22.041, 146.364) to each corner was 50 kms. The co-ordinates of the search were between latitudes -21.598 and -22.512, and longitudes 145.865 and 146.837.	This database catalogues known records of species in a defined area.
Bird Atlas Data			The age of species records may limit their value for inclusion in current studies in some instances.



1.3.2 Field Surveys

Field surveys were conducted to identify the existing terrestrial ecological values of the EPC 1080 Study Area and to supplement and ground-truth the information acquired from the desktop assessment (see Section 2.2.3 and 2.3.2 of Mine Terrestrial Ecology Report). The survey was undertaken over a two week period between 7 November 2011 and 18 November 2011 (the 'Spring 2011' survey). A portion in the southern extent of the EPC 1080 Study Area was not ground-truthed during the field survey effort. The area ground-truthed during field surveys is represented in Figure 1-2 and Figure 1-3.

Field surveys at the offsite infrastructure locations were not undertaken during the Spring 2011 survey. In general, offsite infrastructure locations have only been subject to desktop assessments. However, Hyder Consulting have undertaken a one-day rapid site inspection on 27 June 2012 to potential locations of offsite water supply options, including existing bores and water storages and potential sites of additional water extraction. This rapid assessment was undertaken to identify any existing environmental values, such as remnant or native regrowth vegetation and significant habitat values (Hyder Consulting, 2012).

1.3.2.1 Survey Weather Conditions

All weather data presented below was sourced from the nearest Australian Bureau of Meteorology (BOM) weather station – Clermont Airport, located approximately 150 km south east of the EPC 1080 Study Area (BOM, 2011).

In the three months leading up to the field survey (i.e. August – October 2011) 95.6 mm of rain was recorded in Clermont. During the two week field survey period in November, conditions were typically warm throughout the day with milder temperatures at night. Average minimum and maximum temperatures in Clermont were 17.8°C and 33.3°C, respectively. No rainfall events were recorded throughout the field survey period.

Weather conditions on the day of the rapid site inspection undertaken by Hyder Consulting were generally mild and dry (Hyder Consulting, 2012).

1.3.3 Terrestrial Flora

1.3.3.1 Overview

Flora surveys were undertaken during the Spring 2011 survey at 48 rapid assessment sites. Locations of terrestrial flora survey sites are presented in Figure 1-2. Coordinates for each survey site are provided in Appendix A.

Rapid assessment sites equate to a quaternary level 'CORVEG' site (i.e. follow CORVEG methodology outlined below) and include the following summarised flora survey methods:

- ▀ Plotless sampling technique
- ▀ Level of detail collected varies – at all sites, dominant species recorded
- ▀ Extensive species lists generated at a number of sites
- ▀ Regional Ecosystem (RE) verification
- ▀ Brief notes recorded on landform, geology, soils, weeds

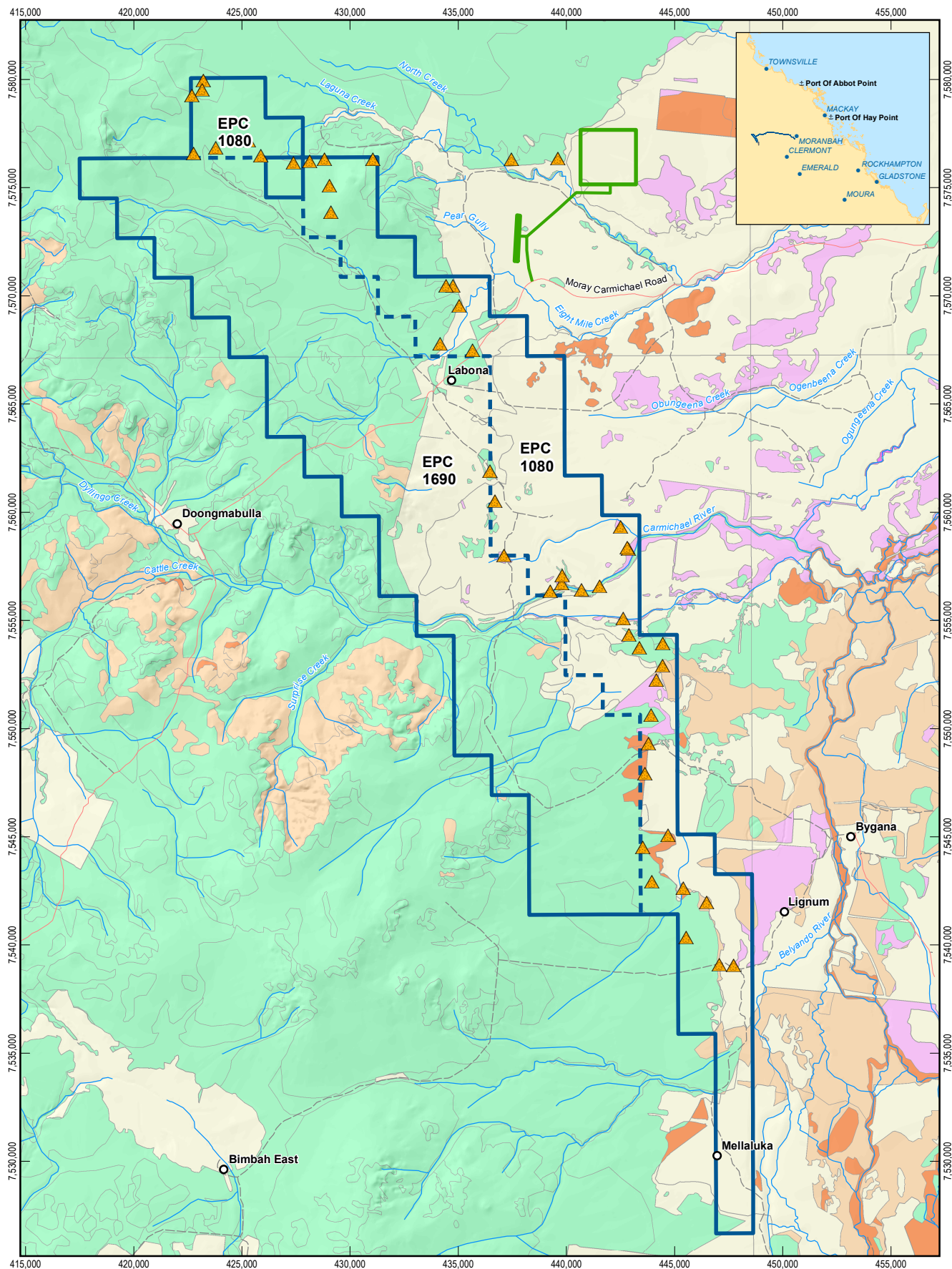


Floristic surveys were conducted using CORVEG methodologies developed by the Queensland Herbarium and outlined in *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al.*, 2005). Flora surveys were conducted in areas of remnant vegetation including mapped REs. Flora sampling methods involved the verification of REs using quaternary site assessments and site descriptions.

During the rapid site inspection, undertaken by Hyder Consulting, a meandering survey technique was performed across areas where possible offsite water infrastructure was likely to be located. Information collected included dominant flora species (native and introduced) and potentially significant values, where evident. Some disturbances were also noted from previous clearing activities (Hyder Consulting, 2012). Flora field surveys within other areas proposed for offsite infrastructure, including the workers accommodation village, industrial area and airport, have not been undertaken.

1.3.3.2 Verification of Mapped Regional Ecosystems

Regional ecosystems that appear on the Queensland Department of Environment and Heritage Protection (DEHP) Version 6.1 certified mapping for the EPC 1080 Study Area were verified at 48 quaternary level sites. Quaternary site assessments are used primarily as a record of field traverses and to verify RE/vegetation mapping. The objective of quaternary surveys (as they were undertaken for this Project) was to gather enough information to confirm and ground-truth existing or suspected vegetation community mapping, and the level of information recorded was adjusted accordingly. As a minimum, dominant species were recorded for the ecologically dominant layer (generally the tallest layer, with the exception of emergent layers). Quaternary sites were collected wherever possible when vegetation patterns were observed to have changed. Vegetation condition was also recorded at each quaternary level site using the VAST (Vegetation Assets, States and Transitions) methodology (Thackway and Lesslie, 2005). Where field verification of the DEHP certified mapping could not be undertaken, namely within the southern extent of the EPC 1080 Study Area and within the few small patches of remnant RE within the offsite infrastructure to the east, certified RE mapping was accepted and applied in these areas throughout the remainder of this report.



LEGEND

- | | | | |
|----------------|---------------|--------------------------|---------------------------|
| ○ Homestead | — Local Road | □ Mine Site | Regional Ecosystems v6.1 |
| ▲ Flora Rapid | — Track | □ Offsite Infrastructure | Endangered - Dominant |
| ▲ Survey Sites | — Watercourse | | Endangered - Sub-dominant |
| | | | Of Concern - Sub-dominant |
| | | | Of Concern - Dominant |
| | | | Of Least Concern |
| | | | Non-remnant |

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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Terrestrial Flora
Survey Sites

Job Number 41-23244
Revision A
Date 17-01-2012

Figure: 1-2

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Data Source: GHD: Flora Survey Sites (2010), Airstrip, Village, Access Road (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Road, Homestead, Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); DERM: Regional Ecosystems v6.1 (2011). Created by: BW.



1.3.4 Terrestrial Fauna

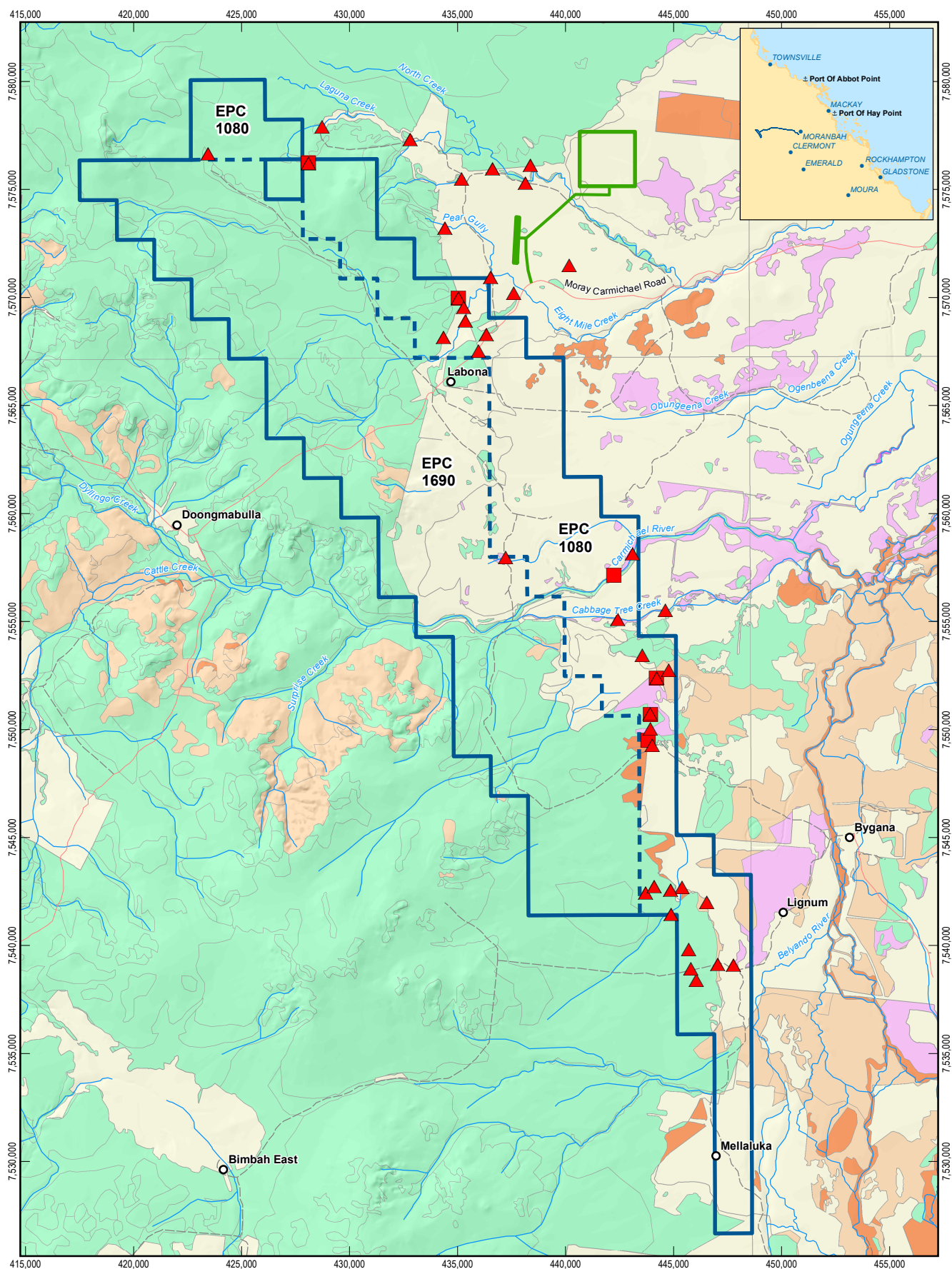
1.3.4.1 Overview

Terrestrial fauna surveys were undertaken at six comprehensive survey sites, 40 rapid assessment sites and 18 farm dams. The distribution of fauna survey sites across the EPC 1080 Study Area is presented in Figure 1-3.

Survey sites were selected to sample representative vegetation communities and fauna habitat types present in the EPC 1080 Study Area. Sites were selected using a two-step process, incorporating desktop information and ground-truthing in the field. RE mapping and aerial photography were primarily used to provide a broad indication of the diversity and distribution of habitats across the EPC 1080 Study Area to select potential survey sites. In identifying potential sites, factors considered included type of RE, representation of RE across the EPC 1080 Study Area, accessibility and presence of water bodies. The subset of sites aimed to maximise the number of sites and range of habitats to be sampled within Project timeframes, while providing adequate representation for description of the site. A total of six sites were assessed comprehensively during the survey program in addition to 40 rapid assessment locations. These represent the range of habitats within the EPC 1080 Study Area and provide spatial variation in assessment. Desktop sources were used to inform the assessment in areas where field surveys were not possible, most notably the southern extent of the EPC 1080 Study Area and within the offsite infrastructure to the east.

For the purposes of this assessment, terrestrial fauna are defined as animals that only spend limited periods of time in aquatic environments. This includes amphibians and water birds.

Terrestrial fauna survey methods employed at comprehensive and rapid survey sites are summarised in Table 1-2. Sampling effort at each comprehensive survey site is summarised in Table 1-3.



LEGEND

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|------------------------------------|---------------|--------------------------|---------------------------|
| ○ Homestead | — Local Road | □ Mine Site | Regional Ecosystems v6.1 |
| ▲ Fauna Rapid Survey Sites | — Track | □ Offsite Infrastructure | Endangered - Dominant |
| ■ Fauna Comprehensive Survey Sites | — Watercourse | | Endangered - Sub-dominant |
| | | | Of Concern - Sub-dominant |
| | | | Of Least Concern |
| | | | Of Concern - Dominant |
| | | | Non-remnant |

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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Terrestrial Fauna
Survey Sites

Job Number 41-23244
Revision A
Date 17-01-2012

Figure: 1-3

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Data Source: GHD: Flora Survey Sites (2010), Airstrip, Village, Access Road (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Road, Homestead, Watercourse (2007);

DME: EPC 1690 (2010), EPC 1080 (2011); DERM: Regional Ecosystems v6.1 (2011). Created by: BW.



Table 1-2 Summary of Terrestrial Fauna Survey Methods

Comprehensive Survey Sites	Rapid Assessment Sites	Other Areas throughout EPC 1080 Study Area
Systematic trapping (20 Elliott 'A' traps, 10 cage traps and 4 funnel trap lines)	<u>All rapid assessment sites</u>	Remote camera
Habitat assessment	Habitat assessment	Water body watches
Opportunistic search for wildlife traces	Opportunistic search for wildlife traces	Opportunistic wildlife records
Three standardised (20 minute) bird surveys	One standardised (20 minute) bird survey	
One hour of active searches for herpetofauna	Half an hour of active searches for herpetofauna	
One night (minimum) of ultrasonic bat detection (Anabat)	<u>Some rapid assessment sites</u>	
Standardised spotlighting for nocturnal fauna	One night (minimum) of ultrasonic bat detection (Anabat)	
Call-playback for owls and other nocturnal bird species	Standardised spotlighting for nocturnal fauna	
	Call-playback for owls and other nocturnal bird species	

1.3.4.2 Terrestrial Habitat Assessment

Terrestrial habitat assessments were undertaken following the same methods outlined in Section 1.6.3.3 (*Terrestrial Habitat Assessment*) of the Mine Terrestrial Ecology Report. The following parameters were recorded during habitat assessments:

- ▀ Landscape context (size, shape, connectivity or relative isolation of habitat remnants)
- ▀ Structural and floristic complexity of vegetation (i.e. tree density, canopy cover, vertical structural complexity of vegetation strata – canopy, shrub and understorey layers, ground cover)
- ▀ Structural complexity and relative heterogeneity of ground-level microhabitats (i.e. substrate type, vegetation cover, leaf litter, woody debris, presence of rocks, logs or boulders)
- ▀ Habitat features (i.e. hollows, fallen logs, rock outcrops, nests, burrows, water bodies, gilgais)
- ▀ Relative abundance of hollows and hollow-bearing (habitat) trees
- ▀ Sources of disturbance (i.e. adjacent land-uses, feral animals, predation, weed infestation)
- ▀ Presence of suitable habitat for threatened species

1.3.4.3 Systematic Trapping Surveys

Systematic trapping for small ground-dwelling fauna was undertaken at each of the six comprehensive survey sites following the methods outlined in Section 1.6.3.3 (*Systematic Trapping Surveys*) of the Mine Terrestrial Ecology Report. Fauna trapping involved a five day, four night survey of each site using cage traps, Elliott 'A' traps and funnel trap/drift fence complexes.



At each site, traps were deployed along two parallel linear transects comprising 20 Elliott 'A' traps and 10 cage traps, set within optimal microhabitats. Four funnel trap/drift fence complexes were placed at each site, set in areas with suitable microhabitat adjacent to the linear transects. Traps were set and checked each morning for four consecutive nights.

1.3.4.4 Opportunistic Surveys for Wildlife Traces

Opportunistic surveys for evidence of terrestrial fauna followed the methods outlined in Section 1.6.3.3 (*Opportunistic Surveys for Wildlife Traces*) of the Mine Terrestrial Ecology Report.

1.3.4.5 Standardised Bird Surveys

Standardised bird surveys were undertaken at each survey site using the methods recommended for surveys by Birds Australia. This involved a timed 20 minute survey of a two hectare search area by one ecologist, recording the number of birds seen or heard calling. Bird surveys were undertaken in early morning or late afternoon (avoiding the period of least activity in the middle of the day) in clear conditions. Bird surveys were undertaken at both comprehensive and rapid survey sites. A total of 90 person hours were dedicated to bird surveys within the EPC 1080 Study Area.

1.3.4.6 Diurnal Active Searches for Reptiles and Amphibians

Diurnal active searches followed the methods outlined in Section 1.6.3.3 (*Diurnal Active Searches for Reptiles and Amphibians*) of the Mine Terrestrial Ecology Report.

1.3.4.7 Nocturnal Spotlighting and Call Playback

Nocturnal spotlighting surveys were undertaken at comprehensive survey sites. Surveys involved using a combination of high-powered spotlights and head torches to search trees, shrubs and understorey habitats for arboreal mammals, ground mammals, reptiles, frogs and nocturnal birds. Additional spotlighting survey effort involved spotlighting from vehicles on roads within the EPC 1080 Study Area.

Call playback surveys were undertaken at selected comprehensive sites to detect owls and other nocturnal birds. Call playback surveys involved broadcasting the call of individual target species for two minutes. This was followed by a listening period of two minutes. A list of species featured in call playback is provided in Section 1.6.3.3 (*Nocturnal Spotlighting and Call Playback*) of the Mine Terrestrial Ecology Report.

1.3.4.8 Microchiropteran Bats

Anabat bat detectors were used to survey microchiropteran (insectivorous) bats by recording their echolocation calls. Microchiropteran bat surveys followed the methods outlined in Section 1.6.3.3 (*Microchiropteran Bats*) of the Mine Terrestrial Ecology Report.

1.3.4.9 Remote Cameras

Remote cameras were deployed for between one and five nights at sites throughout the EPC 1080 Study Area. Typically, these cameras were placed in areas likely to concentrate wildlife – for example, stock water troughs, dams, riparian habitats and fauna movement trails in dense vegetation.

1.3.4.10 Threatened Species Surveys

In general, targeted surveys for threatened species were incorporated into the sampling methodologies outlined above (i.e. ground-trapping and opportunistic searches for threatened



reptiles, Anabat detection for threatened bats). Targeted surveys for Commonwealth listed species considered likely to occur, or confirmed present at the EPC 1080 Study Area were informed by and adapted from applicable Commonwealth guidelines. Targeted threatened species surveys undertaken at the EPC 1080 Study Area were largely analogous to those identified in Table 1-4 (*Summary of Threatened Terrestrial Fauna Species Surveys Undertaken*) of the Mine Terrestrial Ecology Report. Summarised sampling methods for commonwealth listed species are listed below:

- ▶ Black-throated finch (southern) (*Poephila cincta cincta*): 70.25 person hours of water body watches (refer to Figure 1-4 and Appendix E) and slow driving traverses
- ▶ Squatter pigeon (southern) (*Geophaps scripta scripta*): slow driving traverses
- ▶ Ornamental snake (*Denisonia maculata*): funnel trapping, diurnal searches, spotlighting
- ▶ Yakka skink (*Egernia rugosa*): funnel trapping, diurnal searches, spotlighting

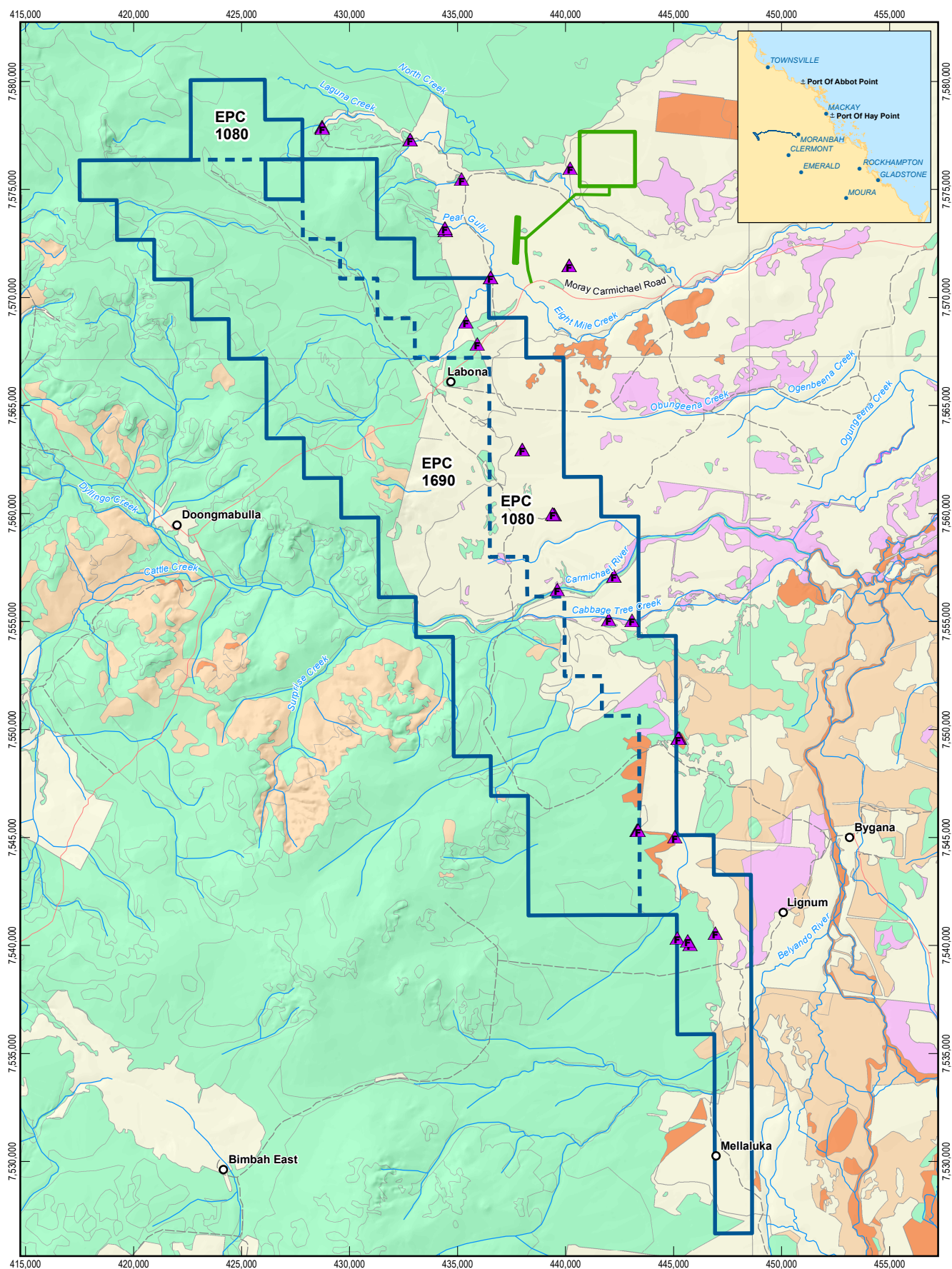
A dedicated sampling effort to detect the presence of the black-throated finch (southern) was undertaken. Water body watches were undertaken at various locations, both within and adjacent to the EPC 1080 Study Area during the field survey. The locations of these surveys are presented in Figure 1-4. A total of 70.25 person hours were invested in water body watches for black-throated finches (southern). The survey effort undertaken to assess black-throated finch (southern) presence/absence was adapted from that recommended in the 'Background Paper' to the black-throated finch (southern) significant impact guidelines (Department of Environment, Water, Heritage and the Arts (DEWHA – now SEWPaC), 2009). Namely, water source watches were carried out at a number of sites (including farm dams, natural water ways and stock troughs) throughout the EPC 1080 Study Area. Information recorded from these surveys included the location (i.e. a waypoint and a description of the habitat), number of birds seen, time of day, weather conditions and other bird species present. In addition to the targeted water body watch surveys, slow traverses of tracks (by vehicle) were undertaken, with details of any black-throated finches (southern) observed during these traverses recorded. Any additional species recorded throughout dedicated threatened species surveys have been incorporated into the results. Full details of targeted black-throated finch (southern) survey effort are presented in Appendix E.

1.3.4.11 Summary of Fauna Survey Effort

Table 1-3 summarises the terrestrial fauna survey effort. Site-specific survey effort is provided in Appendix A.

Table 1-3 Summary of Terrestrial Fauna Survey Effort

	Funnel trap	Cage trap	Elliot box trap	Anabat	Bird surveys	Opportunistic search
	No. of trap nights (no. of traps x no. of nights)			No. nights	Person hours	
Spring 2011 Survey	96	240	480	10	90	20



LEGEND

- | | | | |
|-----------------------------|---------------|--------------------------|---------------------------|
| ○ Homestead | — Local Road | ■ Mine Site | Regional Ecosystems v6.1 |
| ▲ Black Throated Finch | --- Track | ■ Offsite Infrastructure | Endangered - Dominant |
| ▲ Water Body Watch Location | — Watercourse | | Endangered - Sub-dominant |
| | | | Of Concern - Dominant |
| | | | Of Concern - Sub-dominant |
| | | | Of Least Concern |
| | | | Non-remnant |

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1:250,000 (at A4)
0 1 2 3 4 5
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Location of Black-Throated Finch
Water Body Watch Surveys

Job Number 41-23244
Revision A
Date 17-01-2012

Figure: 1-4

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DME: EPC1690 (2010), EPC1080 (2011); DERM: Regional Ecosystems v6.1 (2011). Created by: BW.



1.4 Limitations

Limitations of the survey include:

- Field surveys did not assess seasonal variability within the habitat types present in the EPC 1080 Study Area. Habitat types recorded in the EPC 1080 Study Area were identified as being comparable to those assessed for seasonal variability in previous surveys of the area immediately adjacent to (i.e. west of) the EPC 1080 Study Area (i.e. at EPC 1690). Therefore, results relating to seasonal variability in adjacent habitats were used to supplement the assessment of the EPC 1080 Study Area. In addition to this, due to the timing of surveys, flora surveys were only undertaken in the dry season. Dry season surveys are not ideal for obtaining maximum species diversity or identification of non-flowering plants when sampling. Therefore, only quaternary level flora survey assessments were undertaken within the EPC 1080 Study Area.
- The presence of recent fire within the EPC 1080 Study Area limited areas able to be accessed during the field surveys. Where possible, efforts were made to access areas recently burnt and undertake ecological assessments, however flora and fauna species diversity at burnt sites may have been reduced as a result. Desktop assessments and field assessments of similar habitats were used to supplement the assessment of the EPC 1080 Study Area where possible.
- Site access limited the survey effort to certain areas within the EPC 1080 Study Area. Some parts of the EPC 1080 Study Area were only accessible via a single route, and where access was not authorised, travel along these routes for site access was limited. Where site access could not be gained, survey effort was applied to areas with comparable values.
- The southernmost extent of the EPC 1080 was not identified as part of the Study Area at the time of undertaking the field surveys, and thus was not ground-truthed. In addition, subsequent to the field survey being undertaken, changes have been made to the location and extent of the proposed offsite infrastructure and therefore this has also not been ground-truthed, except for a rapid site inspection of offsite water infrastructure areas. Desktop assessments and field survey results of similar habitats elsewhere in the Study Area were used to supplement the assessment of these areas and describe the likely terrestrial ecology values.



2. Existing Environment

2.1 Terrestrial Flora

2.1.1 Regional Ecosystems and Environmentally Sensitive Areas

The vegetation communities within a particular bioregion associated with a combination of geology, landform and soils define the RE framework as described by Sattler and Williams (1999). A description of the RE framework is provided within Section 2.2.1 of the Mine Terrestrial Ecology Report.

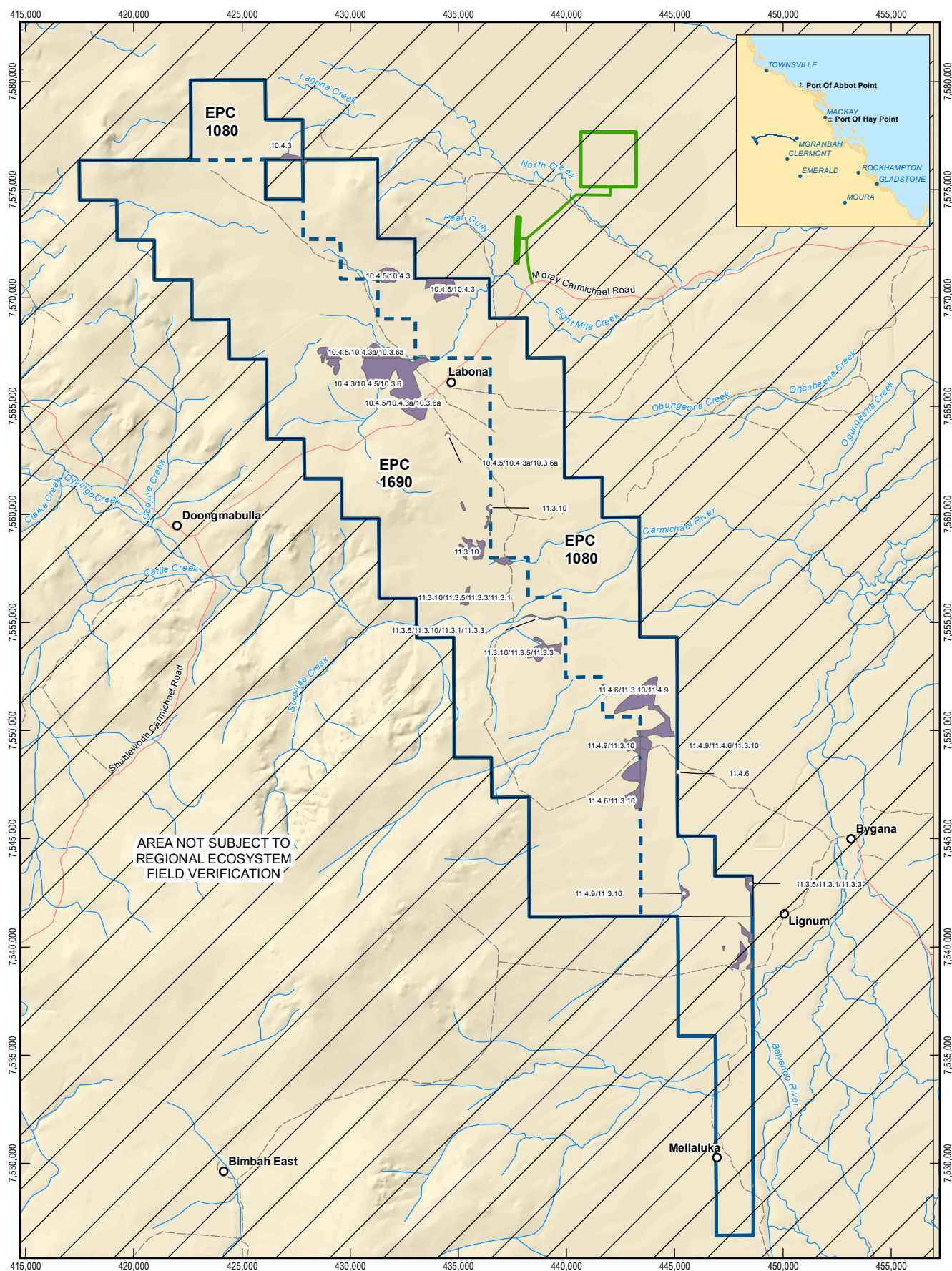
2.1.1.1 Environmentally Sensitive Areas within the EPC 1080 Study Area

Category A ESAs include national parks, conservation parks and forest reserves listed under the NC Act; the wet tropics area listed under the *Wet Tropics World Heritage Protection and Management Act 1993*; the Great Barrier Reef Region listed under the *Great barrier Reef marine Park Act 1975* and marine parks (not including general use zones) listed under the *Marine Parks Act 2004*. No category A ESAs are present within the EPC 1080 Study Area. Regional ecosystems with a biodiversity status of endangered are classified as Category B Environmentally Sensitive Areas (ESA).

The DEHP ESA Map for Mining Activities (refer to Appendix B) identifies a number of patches of Category B ESAs as occurring within the EPC 1080 Study Area. Six RE types classified as Category B ESAs (10.4.3, 11.3.1, 11.4.5, 11.4.6, 11.4.8 and 11.4.9) are mapped within the EPC 1080 Study Area and areas for offsite infrastructure. These cover an area of 838 ha, based on DEHP Version 6.1 Certified RE mapping (refer to Figure 2-1).

Field verifications of the DEHP Version 6.1 Certified RE mapping identified that five REs (10.4.3, 11.3.1, 11.4.5, 11.4.6 and 11.4.9), classified as Category B ESAs were present within the EPC 1080 Study Area including areas for offsite infrastructure. The field verified Category B ESA REs cover a total area of 318 ha and an additional 12 ha mapped (based on DEHP certified RE) that has not been field verified including the Category B ESAs within the areas for offsite infrastructure. Their location within the EPC 1080 Study Area is presented within Figure 2-2. A summarised description of these REs is provided in Table 2-2.

The Bygana West Nature Refuge located within the EPC 1080 Study Area is classified as a Category C ESA. Further discussion of the Bygana West Nature Refuge is presented in Section 3.3.5 (*Protected Areas*) of the Mine Terrestrial Ecology Report.



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine Site
- Offsite Infrastructure
- Endangered Regional Ecosystem (Biodiversity Status)

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1:250,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Environmentally Sensitive Areas
Category B Field Verified

Job Number 41-23244
Revision A
Date 18-01-2012

Figure: 2-2

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Data Source: GHD: Airstrip, Village, Access Road (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Road, Homestead, Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); DERM: Regional Ecosystems v6.1 (2011). Created by: BW.

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2.1.1.2 Regional Ecosystems in the EPC 1080 Study Area

The DEHP Certified RE mapping (Version 6.1) maps a total of 24 REs within the EPC 1080 Study Area; this comprises 10 Desert Uplands REs and 14 Brigalow Belt REs (Figure 2-3 and Table 2-2). All mapped Desert Uplands REs within the EPBC 1080 Study Area are classified by the Queensland *Vegetation Management Act 1999* (VM Act) as 'least concern', whereas the VM Act status of mapped REs from the Brigalow Belt bioregion within the EPBC 1080 Study Area include 'endangered', 'of concern' and least concern REs.

RE ground-truthing from the flora surveys identified a total of 28 REs within the EPC 1080 Study Area; 15 from the Desert Uplands and 13 from the Brigalow Belt. Flora surveys results indicated that four Desert Uplands REs mapped from the official DEHP certified RE mapping were not found to be present within the EPC 1080 Study Area. In addition, a further five Desert Uplands REs and two Brigalow Belt REs were found to be present within the EPC 1080 Study Area but not officially mapped. These changes from the latest DEHP official certified RE mapping are summarised in Table 2-1 and presented in Figure 2-4. REs within the EPC 1080 Study Area that are located south of the southern boundary of the adjacent EPC 1690 Study Area and REs located within or intersected by the offsite infrastructure have not undergone ground-truthing. The DEHP certified RE mapping has been accepted for this locations within the EPC 1080 Study Area and are depicted in Figure 2-4 by the presence of diagonal hatching. With the exception of this southern portion of the EPC 1080 Study Area and the areas for offsite infrastructure, this report will henceforth refer to the ground-truthed REs, unless otherwise indicated (by the prefix 'officially mapped').

Four ground-truthed REs were identified as present within the EPC 1080 Study Area that were not observed within EPC 1690. These comprise RE 10.3.12, 11.3.3, 11.3.7, 11.5.3. Additionally, DEHP certified REs 11.3.37, 11.4.5 and 11.4.11, within the area for offsite infrastructure, was not observed within EPC 1690. Descriptions of these REs are presented in Table 2-2.

Table 2-1 Summary of Regional Ecosystem Mapping Changes from Ground-Truthing

Bioregion	Officially mapped but not present	Present but not officially mapped
Brigalow Belt	11.4.5*, 11.4.8, 11.4.11* (3 REs)	11.3.27, 11.4.9 (2 REs)
Desert Uplands	nil	10.3.14, 10.5.1, 10.5.8, 10.7.2, 10.7.7 (5 REs)

Note:

* **Where field verifications were undertaken within the EPC 1080 during the Spring 2011 survey, officially mapped REs 11.4.5 and 11.4.11 were not observed. Both these REs are also officially mapped within the offsite infrastructure that has not been subject to field verifications.

Regional ecosystems within the EPC 1080 Study Area occur on four land zones (refer to Appendix H of the Mine Terrestrial Ecology Report for full descriptions of these units). These land zones are summarised below:

- Land zone three – represented by alluvial plains associated with the Carmichael River and its tributaries, large alluvial plains are present in the southern half of the EPC 1080 Study Area.
- Land zone four – represented by clay plains with minor gilgai micro-relief in places, present in the central and southern portions of the EPC 1080 Study Area. This land zone has been subject to large areas of clearing.



- ▶ Land zone five – represented by broad plains of red or grey sands and sandy loams, this land zone covers the majority of the northern half of the EPC 1080 Study Area.
- ▶ Land zone seven – represented by low rises of Triassic sandstone with a laterite capping and skeletal soils, present in the north of the EPC 1080 Study Area.

Land zones three and five

Land zones three and five cover the greatest area within the EPC 1080 Study Area. Land zone three has the greatest RE diversity in the EPC 1080 Study Area. This land zone is represented by 15 REs, 7 Desert Uplands REs and 8 Brigalow Belt REs, mapped from the ground-truthed RE mapping of the EPC 1080 and certified RE mapping within the southern portion of the EPC 1080 Study Area. This land zone can be divided into two main types:

- ▶ Level to gently undulating alluvial plains – nine REs in the EPC 1080 Study Area are present on alluvial plains, this includes five REs (REs 10.3.6, 10.3.28, 11.3.3, 11.3.7, 11.3.10) dominated by open forests of eucalypt species including Reid River box (*Eucalyptus brownii*), silver-leaved ironbark (*Eucalyptus melanophloia*) or coolabah (*Eucalyptus coolabah*). The remaining four REs occurring on alluvial plains (10.3.3, 10.3.4, 11.3.1, 11.3.5) are dominated by either brigalow (*Acacia harpophylla*) or gidgee (*Acacia cambagei*). These REs generally occur on clays and sandy texture contrast soils on alluvial plains.
- ▶ Fringing vegetation of river channels, creeks, drainage lines and relict channels (such as Cabbage Tree Creek) – represents five REs (10.3.12, 10.3.13, 10.3.14, 11.3.25, 11.3.27, 11.3.37). These REs are present along the Carmichael River and Cabbage Tree Creek and the Belyando River. Dominant species include river red gum (*Eucalyptus camaldulensis*), coolabah, weeping paper bark (*Melaleuca leucadendra*) and weeping tea-tree (*Melaleuca fluviatilis*).

All land zone three REs within the EPC 1080 Study Area are classified as least concern under the VM Act, with the exception of the brigalow REs 11.3.1 and 11.3.3, which are classified as endangered and of concern respectively. RE 11.3.1 also has an endangered biodiversity status and therefore is classified as a Category B ESA.

Land zone five is represented by five REs within the EPC 1080 Study Area. REs 10.5.1 and 10.5.8 are characterised as low open woodlands dominated by yellowjacket (*Eucalyptus similis*) or rough leaved bloodwood (*Corymbia setosa*) often with a moderate to dense shrub layer of acacia species. These REs are present in the northern half of the EPC 1080 Study Area. The remaining REs (10.5.4, 10.5.5, 11.5.3) occur as open woodlands on undulating plains. Ironbark and bloodwood species dominate the species composition within these REs including narrow leaf ironbarks (*Eucalyptus crebra* and *Eucalyptus drepanophylla*), silver-leaved ironbark, *Corymbia brachycarpa* and Dallachy's gum (*Corymbia dallachyana*). All land zone five REs have a least concern status under the VM Act and are no concern at present for biodiversity status.

Land zone four

Land zone four is well represented in the EPC 1080 Study Area by six RE types (10.4.3, 10.4.5, 11.4.5, 11.4.6, 11.4.9 and 11.4.11). Two of the land zone four REs within the EPC 1080 Study Area (REs 10.4.3 and 11.4.9) are dominated by brigalow open woodland to open forest, often with an emergent layer of Dawson's gum (*Eucalyptus cambageana*). Three land zone four REs within the EPC 1080 Study Area (10.4.5, 11.4.5 and 11.4.6) are woodland to low woodland dominated by gidgee or other acacia species, with RE 11.4.11 representing a grassland RE. These REs are likely



to have been more common in the area prior to European settlement. However, as clay plains are often highly suitable for improved pastures, they have generally been targeted for clearing, and as a consequence they are now poorly represented in terms of area. The REs on land zone four as a group have the highest conservation value of all of the REs within the EPC 1080 Study Area – the two Desert Uplands REs are classed as least concern under the VM Act, but the Brigalow Belt REs are classed as of concern (REs 11.4.5, 11.4.6 and 11.4.11) or endangered under the VM Act (RE 11.4.9). In addition, RE 11.4.9 is a component of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed endangered threatened ecological community (TEC) ‘Brigalow (*Acacia harpophylla* dominant and codominant)’. REs 10.4.3, 11.4.6, 11.4.9 all have an endangered biodiversity status and therefore are classed as Category B ESAs. REs 10.4.5, 11.4.5, 11.4.11 have an of concern biodiversity status.

Land zone seven

Land zone seven has the lowest representation in terms of area and RE diversity within the EPC 1080 Study Area. Land zone seven is represented by two Desert Uplands REs that are either limited to small areas within the northern portion of the EPC 1080 Study Area (10.7.7), or restricted to one small patch north of the Carmichael River (10.7.2). RE 10.7.7 is comprised of tall shrubland dominated by a mix of species, including Townsville wattle (*Acacia leptostachya*) and golden parrot tree (*Grevillea pteridifolia*). This RE had been substantially burnt by low to medium intensity fires within the EPC 1080 Study Area at time of survey. RE 10.7.2 is characterised as low open woodland dominated by *Eucalyptus persistens* with Dallachy’s gum also present. The ground layer is characterised by a mid-dense to sparse grass layer of soft spinifex (*Triodia pungens*), and a pea-gravel ‘rock mulch’ over skeletal soils.

2.1.1.3 Regulated Regrowth Vegetation

A number of small patches of high value regrowth vegetation mapped as containing least concern, of concern and endangered REs are present within the EPC 1080 Study Area. These patches are located south of Cabbage Tree Creek and within the area for offsite infrastructure and cover a total area of 35 ha. Regrowth vegetation mapping is provided as Figure 2-5.



Table 2-2 Regional Ecosystem Descriptions

RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
Desert Uplands REs				
10.3.3	least concern/ no concern at present	Occurs on alluvial plains.	Low open-woodland of <i>Acacia harpophylla</i> +/- <i>Eucalyptus cambageana</i> emergents or open-woodland of <i>Eucalyptus cambageana</i> +/- understorey of <i>Acacia harpophylla</i> over a very open tussock grassland ground layer.	Present in mixed polygon in association with alluvial plains associated with tributaries of the Carmichael River, north of the Moray-Carmichael Rd and areas associated with offsite infrastructure. Approximately 47 ha within the EPC 1080 Study Area.
10.3.4	least concern/ of concern	Occurs on heavy clay and texture contrast soils on alluvial plains.	Low open-woodland to woodland of <i>Acacia cambagei</i> with very open tussock grassland. Minor occurrences of <i>Acacia tephрина</i> woodland.	Present in mixed polygons with RE 10.3.3 north of the Moray-Carmichael Rd and with 10.3.3 and 10.3.6 within areas associated with offsite infrastructure. Approximately 101 ha within the EPC 1080 Study Area.
10.3.6	least concern/ no concern at present	Occurs on alluvial plains with clays and texture contrast soils.	<i>Eucalyptus brownii</i> open-woodland to woodland.	One of the major vegetation communities in the EPC 1080 Study Area, present on plains in large tracts contiguous with ironbark woodland. Also occurs in mixed polygons within areas associated with offsite infrastructure. Approximately 1,141 ha within the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
10.3.12	least concern/ no concern at present	Occurs on sandy alluvial terraces in the east.	Fringing and frontage <i>Corymbia plena</i> and <i>C. dallachiana</i> open-woodland, usually with <i>Aristida</i> spp. dominant in the ground layer. <i>Corymbia plena</i> dominates the canopy (18-26 m tall) usually with <i>C. dallachiana</i> co dominant. The low tree layer (3-6 m tall) is usually very sparse or more commonly there are scattered small trees including <i>Acacia coriacea</i> , <i>A. torulosa</i> and <i>Melaleuca nervosa</i> . <i>Aristida ingrata</i> usually dominates the very sparse to sparse ground layer. Other graminoids frequently present include <i>Schizachyrium fragile</i> and <i>Eriachne mucronata</i> . Commonly occurring forbs include <i>Lomandra leucocephala</i> , <i>Evolvulus alsinoides</i> , <i>Bonamia media</i> and <i>Chrysocephalum apiculatum</i> .	Present in association with box woodland and RE 10.3.6 located south of Cabbage Tree Creek. Approximately 198 ha within the EPC 1080 Study Area.
10.3.13	least concern/ of concern	Occurs mostly as narrow bands along channels and on levees with sandy to clayey soils along larger watercourses.	<i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> and/or <i>Eucalyptus camaldulensis</i> open-woodland and woodland.	Present as fringing vegetation along watercourses in the southern portion of EPC 1080 Study Area including the Carmichael River. Approximately 52 ha within the EPC 1080 Study Area.
10.3.14	least concern/ of concern	Occurs on channels, levees and flood plains with sandy to clayey soils along larger watercourses.	<i>Eucalyptus camaldulensis</i> and/or <i>E. coolabah</i> woodlands and open-woodlands on channels, levees and floodplains. <i>Acacia harpophylla</i> or <i>A. cambagei</i> may be present as clumps or scattered trees.	Not officially mapped but present along the Carmichael River and in a small patch on the Carmichael River floodplain. Approximately 7 ha within the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
10.3.28	least concern/ no concern at present	Occurs on sandy alluvial fans with yellow earth and duplex soils formed from outwash from sandstone hills.	Open-woodland to woodland of <i>Eucalyptus melanophloia</i> or <i>Eucalyptus crebra</i> . <i>Eucalyptus melanophloia</i> dominates the very sparse to sparse canopy (8-18 m tall). <i>Corymbia dallachiana</i> is occasional present in the canopy or subcanopy. A low tree layer or shrub layer are usually absent although there can be scattered small trees and shrubs present. <i>Aristida benthamii</i> , <i>Sehima nervosum</i> , <i>Digitaria brownii</i> , <i>Chrysopogon fallax</i> , <i>Enneapogon polyphyllus</i> , <i>Schizachyrium fragile</i> and <i>Eriachne mucronata</i> occur as dominants and some co dominants. Other graminoids usually present include <i>Aristida</i> spp., <i>Panicum effusum</i> , <i>Tripogon loliiformis</i> and <i>Heteropogon contortus</i> . Forbs usually present include <i>Evolvulus alsinoides</i> , <i>Rostellularia adscendens</i> , <i>Sauropus trachyspermus</i> and <i>Brunoniella australis</i> .	One of the major vegetation communities in the EPC 1080 Study Area, present on plains in large tracts contiguous with box woodland. Approximately 1881 ha within the EPC 1080 Study Area.
10.4.3	least concern/ endangered	Occurs on clay and texture contrast soils, gently undulating downs and plains on Cainozoic lake deposits.	<i>Acacia harpophylla</i> and/or <i>Eucalyptus cambageana</i> open-woodland.	Present within patches either singularly or within a mosaic with <i>A. cambagei</i> that is contiguous with ironbark-box woodland, north of the Moray-Carmichael Rd and areas associated with offsite infrastructure. Approximately 73 ha within the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
10.4.5	least concern/ of concern	Occurs on plains and gently undulating downs on Cainozoic lake deposits. Cracking clay soils, usually gilgaied, and minor areas of texture contrast soils.	<i>Acacia cambagei</i> low woodland sometimes with <i>A. harpophylla</i> . <i>Acacia cambagei</i> dominates the very sparse to sparse canopy (6-15 m tall). Other trees often present in the canopy or occur as scattered small trees include <i>Terminalia oblongata</i> and <i>Acacia harpophylla</i> . <i>Eremophila mitchellii</i> and <i>A. cambagei</i> usually dominate the very sparse large shrub layer (2-4 m tall). <i>A. cambagei</i> , <i>Eremophila deserti</i> , <i>Senna artemisioides</i> and <i>Carissa lanceolata</i> are usually common or dominant in the small shrub layer (0.5-2 m tall). <i>Enteropogon acicularis</i> , <i>Eragrostis lacunaria</i> , <i>Tripogon loliiformis</i> and <i>Oxychloris scariosa</i> or <i>Leptochloa decipiens</i> occasionally occur as dominant graminoids in the very sparse ground layer. Other graminoids often present include <i>Sporobolus actinocladius</i> , <i>Enneapogon polyphyllus</i> and <i>Paspalidium caespitosum</i> . <i>Enchylaena tomentosa</i> and <i>Sclerolaena</i> spp. are forbs usually present.	Present within a mosaic with <i>A. harpophylla</i> to the north of Moray-Carmichael Rd and areas associated with offsite infrastructure. Approximately 91 ha within the EPC 1080 Study Area.
10.5.1	least concern/ no concern at present	Occurs on deep red earths on Tertiary sand plain.	Largely <i>Eucalyptus similis</i> and/or <i>Corymbia brachycarpa</i> and/or <i>Corymbia setosa</i> low open-woodland to open-woodland. There is frequently a dense shrub layer. Small areas of <i>Eucalyptus chartaboma</i> and/or <i>E. tetradonta</i> , or <i>E. drepanophylla</i> or <i>Lysicarpus angustifolius</i> occur in the north.	Not officially mapped but present in a 'red sand plain mosaic' and found in the north of the EPC 1080 Study Area. Hosts a number of endemic and/or threatened species. Considered to have high faunal values. This RE comprises recharge zones for the Great Artesian Basin aquifers (Qld Herbarium 2009). Habitat for the vulnerable <i>Acacia ramiflora</i> (which was not found). Was affected by recent fire at time of survey. Approximately 307 ha within the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
10.5.4	least concern/ no concern at present	Occurs on sandy red and yellow earths on undulating sand plain.	Open-woodland of <i>Eucalyptus crebra</i> or <i>E. drepanophylla</i> usually with <i>Corymbia dallachiana</i> and/or <i>C. brachycarpa</i> .	Present in the north of the EPC 1080 Study Area in association with <i>E. melanophloia</i> open woodland. Approximately 162 ha within the EPC 1080 Study Area.
10.5.5	least concern/ no concern at present	Occurs on loamy red and yellow earths on undulating sand plains.	Mostly <i>Eucalyptus melanophloia</i> open-woodland with open-grassland understorey of <i>Aristida</i> spp. and/or <i>Triodia</i> spp. Occasionally present are small areas of <i>Acacia</i> <i>coriacea</i> or <i>Archidendropsis basaltica</i> or rarely grassland.	One of the most common communities within the EPC 1080 Study Area, present in large tracts contiguous with box woodland, generally in the northern half of the EPC 1080 Study Area. Habitat for <i>Acacia</i> <i>ramiflora</i> . Approximately 2,631 ha within the EPC 1080 Study Area.
10.5.8	least concern/ no concern at present	Occurs on lower slopes in gently undulating terrain with pale sandy soil.	Low open-woodland of <i>Corymbia setosa</i> sometimes with <i>Grevillea pteridifolia</i> and/or <i>Melaleuca nervosa</i> and sparse hummock grass understorey of <i>Triodia pungens</i> or low (open-) woodland of <i>Melaleuca nervosa</i> with sparse ground layer of tussock grasses.	Not officially mapped but present in one small patch on the north western boundary of the EPC 1080 Study Area in association with acacia shrubland. Approximately 3 ha within the EPC 1080 Study Area.
10.7.2	least concern/ no concern at present	Occurs on gently sloping terrain with shallow to skeletal soils usually near margins of laterised plateaus above scarps.	<i>Eucalyptus persistens</i> or <i>Corymbia dallachiana</i> or <i>E.</i> <i>socialis</i> subsp. <i>eucentrica</i> low open-woodland of usually with open hummock grassland understorey of <i>Triodia</i> spp. or open-grassland of <i>Triodia pungens</i> and/or <i>Eriachne</i> <i>mucronata</i> or <i>Amphipogon caricinus</i> .	Not officially mapped but present as low open woodland of <i>E. persistens</i> with <i>Triodia</i> <i>pungens</i> located in one small patch on a low rise in the centre west of the EPC 1080 Study Area, north of the Carmichael River. Occurs on hard, stony country with a 'mulch' of lateritic pea gravel. Approximately 4 ha within the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
10.7.7	least concern/ no concern at present	Occurs on ferricrete with skeletal soils and shallow earths often on margins of Tertiary plateaus.	Shrubland dominated by a range of <i>Acacia</i> spp., <i>Calytrix</i> spp., <i>Melaleuca</i> spp. and healthy species.	Not officially mapped but present as a mixed shrubland in the northern half of the Study Area, often contiguous with ironbark-box open woodlands. Approximately 173 ha within the EPC 1080 Study Area.
Brigalow Belt REs				
11.3.1	endangered/ endangered	Associated with Cainozoic alluvial plains which may be occasionally flooded. Landforms range from level to very gently sloping plains, alluvial flats, drainage floors, back-swamps and abandoned channels. Associated soils are predominantly deep to very deep cracking clays, sometimes with gilgai or texture contrast soils with sandy surface.	Open-forest dominated by <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> (particularly in southern parts), with or without scattered emergent <i>Eucalyptus</i> spp. such as <i>E.</i> <i>coolabah</i> , <i>E. largiflorens</i> , <i>E. populnea</i> , <i>E. orgadophila</i> , and <i>E. pilligaensis</i> . A low tree layer dominated by <i>Geijera</i> <i>parviflora</i> and <i>Eremophila mitchellii</i> is usually present. The vegetation sometimes occurs as low open-forest or woodland. Tree height generally about 11-15 m and the low tree (to tall shrub) understorey layer is between 2 and 8 m high (where present). Ground cover is generally sparse.	Present in small patches in association with other brigalow and gidgee communities, on alluvial plains in the south of the EPC 1080 Study Area. Also present in a mixed polygon along the Belyando River associated with offsite water infrastructure areas. Part of the EPBC Act Threatened Ecological Community 'Brigalow'. Approximately 8 ha within the EPC 1080 Study Area.
11.3.3	of concern/ of concern	Occurs on Cainozoic alluvial plains or levees with clay or sometimes texture contrast soils.	<i>Eucalyptus coolabah</i> woodland to open-woodland with a grassy understorey. A mid layer is often absent but scattered tree or shrub species, such as <i>E. populnea</i> , <i>Melaleuca bracteata</i> , <i>Alectryon oleifolius</i> , <i>Terminalia</i> <i>oblongata</i> (in the north) and <i>Acacia pendula</i> , <i>A. cambagei</i> , and occasionally <i>Muehlenbeckia florulenta</i> may be present. The ground layer is dominated by a range of grass and forb species depending on season, soil and management conditions. Can include small areas of grassland with scattered trees.	Present in the south of the EPC 1080 Study Area within mixed polygons with other eucalypt, brigalow and gidgee communities. Approximately 92 ha within the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
11.3.5	least concern/ of concern	Occurs on levees on alluvial plains which are rarely flooded. Associated soils are often texture contrast with sandy surfaces.	<i>Acacia cambagei</i> +/- <i>A. harpophylla</i> low woodland or open-forest sometimes clumped, on Cainozoic alluvial plains. <i>Acacia cambagei</i> dominates the canopy (8-16 m high) sometimes in association with <i>A. harpophylla</i> as a sub-dominant. <i>Eucalyptus coolabah</i> , <i>E. largiflorens</i> (subregion 35) or <i>Acacia harpophylla</i> may be present. Often <i>Eremophila mitchellii</i> is present as an open low tree layer (1.5-4 m high) or as scattered shrubs to small trees. <i>Psydrax oleifolia</i> and <i>Atalaya hemiglauc</i> a are occasionally present. A small shrub layer sometimes occurs dominated by <i>Senna artemisioides</i> with or without suckers of <i>Acacia cambagei</i> or both species may occur as scattered shrubs. The ground layer is often poorly formed except under the canopy where there is usually a very sparse cover of dominants which include <i>Paspalidium caespitosum</i> , <i>Sporobolus actinocladus</i> and <i>Brachyachne convergens</i> . Other graminoids frequently present are <i>Bothriochloa ewartiana</i> , <i>Iseilema vaginiflorum</i> , <i>Eragrostis microcarpa</i> and <i>Aristida latifolia</i> .	Present within the EPC 1080 Study Area within a mosaic of ironbark and box eucalypt species, mainly located south of the Carmichael River but also associated with fringing woodland vegetation. Approximately 456 ha within the EPC 1080 Study Area.
11.3.7	least concern/ of concern	Occurs on levees and plains formed from Quaternary alluvial deposits. Soils are usually deep uniform sands with minor areas of sandy red earths.	<i>Corymbia clarksoniana</i> , <i>C. tessellaris</i> and <i>C. dallachiana</i> tall woodland to open-woodland (12-17 m high). There is usually a low open-woodland tree layer (7-11 m high) dominated by species such as <i>Acacia salicina</i> , <i>Lysiphyllum hookeri</i> or <i>Grevillea striata</i> .	Present south of the Carmichael River in large patches that are contiguous with box woodland. Approximately 55 ha within the EPC 1080 Study Area.
11.3.10	least concern/ no concern at present	Occurs on Cainozoic alluvial plains.	<i>Eucalyptus brownii</i> grassy woodland. This unit usually occurs as woodland of <i>Eucalyptus brownii</i> . There is usually a grassy ground layer of <i>Aristida</i> spp., <i>Chloris</i> spp., <i>Fimbristylis dichotoma</i> , <i>Eriachne</i> spp., <i>Eragrostis</i> spp. and <i>Chrysopogon fallax</i> . Areas subject to less intensive grazing or on better soils contain <i>Heteropogon contortus</i> , <i>Bothriochloa bladhii</i> and <i>Chrysopogon fallax</i> .	Present in a small patches on the outer edge of the northern Carmichael River flood plain, on yellow alluvial outwash. Also present south of the Carmichael River within mixed polygons with other eucalypt, brigalow and gidgee communities. Approximately 269 ha within the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
11.3.25	least concern/ of concern	Occurs on fringing levees and banks of major rivers and drainage lines of alluvial plains throughout the region. Soils are very deep, alluvial, grey and brown cracking clays with or without some texture contrast. These are usually moderately deep to deep, soft or firm, acid, neutral or alkaline brown sands, loams or black cracking or non-cracking clays, and may be sodic at depth.	<i>Eucalyptus camaldulensis</i> or <i>E. tereticornis</i> open-forest to woodland. Other tree species such as <i>Casuarina cunninghamiana</i> , <i>E. coolabah</i> , <i>Melaleuca bracteata</i> , <i>Melaleuca viminalis</i> , <i>Livistona</i> spp. (in north), <i>Melaleuca</i> spp. and <i>Angophora floribunda</i> are commonly present and may be locally dominant. An open to sparse, tall shrub layer is frequently present dominated by species including <i>Acacia salicina</i> , <i>A. stenophylla</i> or <i>Lysiphyllum carronii</i> . Low shrubs are present, but rarely form a conspicuous layer. The ground layer is open to sparse and dominated by perennial grasses, sedges or forbs such as <i>Imperata cylindrica</i> , <i>Bothriochloa bladhii</i> , <i>B. ewartiana</i> , <i>Chrysopogon fallax</i> , <i>Cyperus dactyloides</i> , <i>C. difformis</i> , <i>C. exaltatus</i> , <i>C. gracilis</i> , <i>C. iria</i> , <i>C. rigidellus</i> , <i>C. victoriensis</i> , <i>Dichanthium sericeum</i> , <i>Leptochloa digitata</i> , <i>Lomandra longifolia</i> or <i>Panicum</i> spp..	Comprises the vegetation fringing the Carmichael River, in the form of <i>E. camaldulensis</i> open forest with <i>Melaleuca leucadendra</i> lining the actual channel, and forming woodland along the banks. Also present in a mixed polygon along the Belyando River associated with offsite water infrastructure areas. Approximately 84 ha within the EPC 1080 Study Area.
11.3.27	least concern/ of concern	Occurs in a variety of situations including lakes, billabongs, oxbows and depressions on floodplains.	Freshwater wetlands. Vegetation is variable including open water with or without aquatic species and fringing sedgeland and eucalypt woodlands.	Not officially mapped but located as a fringing open forest/woodland along Cabbage Tree Creek, just to the south of the Carmichael River (Cabbage Tree Creek is a relict stream channel formerly part of the Carmichael). Approximately 22 ha within the EPC 1080 Study Area.
11.3.37	least concern/ no concern at present	Occurs on fringing stream channels that are usually braided. Includes larger waterholes within the stream channels.	<i>Eucalyptus coolabah</i> with <i>E. camaldulensis</i> forming a distinct, but discontinuous, woodland to low woodland canopy layer (7-11 m high). Other scattered trees such as <i>Lysiphyllum gilvum</i> , <i>Melaleuca trichostachya</i> , <i>M. bracteata</i> and <i>E. populnea</i> may occur. The mid layer varies from absent to a tall shrubland dominated by species such as <i>Acacia stenophylla</i> and <i>A. salicina</i> . Ground cover is variable composed of grasses and sedges.	Present as a subdominant RE within mixed polygons along branches of the Belyando River. Approximately < 1 ha officially mapped within the offsite water infrastructure of the EPC 1080 Study Area.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
11.4.5	of concern/ endangered	Occurs on gently undulating plains formed from Cainozoic sediments. Associated soils are texture contrast with thin sandy or loamy surface horizons and strongly alkaline clay subsoils.	<i>Acacia cambagei</i> dominates the tree canopy (10-13 m high). There is a sparse to open low tree layer (7-9 m high) dominated by <i>Lysiphyllum carronii</i> , <i>Geijera parviflora</i> , <i>Acacia harpophylla</i> , and sometimes <i>A. argyrodendron</i> , <i>Terminalia oblongata</i> , and <i>Eremophila mitchellii</i> . An open shrub layer (1 m high) dominated by species such as <i>Carissa ovata</i> , <i>Capparis lasiantha</i> , <i>Eremophila deserti</i> , <i>Apophyllum anomalum</i> and <i>Alectryon diversifolius</i> is also often present. The ground layer is sparse to open and dominated by grasses.	Not observed from ground truthing within EPC 1080. 6 ha mapped within offsite infrastructure from DEHP certified mapping.
11.4.6	of concern/ endangered	Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoils. Surface or subsurface gravel is common.	Woodland to open-forest dominated by <i>Eucalyptus cambageana</i> and <i>Acacia harpophylla</i> or, sometimes in the north, <i>A. argyrodendron</i> . <i>E. thozetiana</i> is sometimes present on shallower soils. There is a moderately dense low tree layer (5 m high) layer dominated by species such as <i>Eremophila mitchellii</i> and a low shrub layer (2 m high) dominated by species such as <i>Carissa ovata</i> and <i>Geijera parviflora</i> .	Mainly located with large eucalypt woodland or brigalow patches in the south of the EPC 1080 Study Area and along the south eastern boundary. Approximately 147 ha within the EPC 1080 Study Area.
11.4.8	endangered/ endangered	Occurs on level to gently undulating plains formed from Cainozoic deposits. Associated soils are usually deep texture contrast with thin loamy or sandy surface horizons overlying strongly alkaline clay subsoils. Surface or subsurface gravel is common.	Woodland to open-forest dominated by <i>Eucalyptus cambageana</i> and <i>Acacia harpophylla</i> or, sometimes in the north, <i>A. argyrodendron</i> . <i>E. thozetiana</i> is sometimes present on shallower soils. There is a moderately dense low tree layer (5 m high) layer dominated by species such as <i>Eremophila mitchellii</i> and a low shrub layer (2 m high) dominated by species such as <i>Carissa ovata</i> and <i>Geijera parviflora</i> .	Not observed.



RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
11.4.9	endangered/ endangered	Occurs on level to gently undulating Cainozoic plains, including weathered basalt. Associated soils are predominantly moderately deep to deep cracking clays that may be brown, red-brown or grey-brown, and with much surface gravel in some areas.	Open-forest, occasionally woodland, dominated by <i>Acacia harpophylla</i> usually with a low tree mid-storey of <i>Terminalia oblongata</i> and <i>Eremophila mitchellii</i> . <i>Casuarina cristata</i> sometimes replaces <i>Acacia harpophylla</i> in the overstorey and <i>Lysiphyllum cunninghamii</i> sometimes co-dominates. Other low tree or shrub species such as <i>Alectryon diversifolius</i> , <i>Carissa ovata</i> , <i>Pittosporum spinescens</i> , <i>Ehretia membranifolia</i> , <i>Geijera parviflora</i> and <i>Flindersia dissosperma</i> may occur in the mid-storey or low shrub layer. <i>Acacia harpophylla</i> trees have been recorded as 11- 17 m high, the mid-storey layer 2- 8 m high and the low shrub layer 1-2 m high.	Not officially mapped but present within the EPC 1080 Study Area in large brigalow patches in the south of the EPC 1080 Study Area and along the south western boundary. Part of the EPBC Act Threatened Ecological Community 'Brigalow'. Approximately 97 ha within the EPC 1080 Study Area.
11.4.11	of concern/ of concern	Occurs in shallow open valleys and poorly drained Cainozoic clay plains with deep cracking clay soils.	<i>Dichanthium sericeum</i> and <i>Astrebla spp.</i> grassland with patches of low <i>Acacia harpophylla</i> or <i>Eucalyptus coolabah</i> . Grassland dominated by <i>Dichanthium sericeum</i> and forms a mosaic with clumps of <i>Acacia harpophylla</i> , <i>Lysiphyllum hookeri</i> and <i>L. carronii</i> (usually 8+/-3 m high). A wide range of other grass and forb species is usually present and may be dominant depending on seasonal conditions and management regime. Frequently occurring species include the grasses <i>Aristida leptopoda</i> , <i>A. latifolia</i> , <i>Astrebla lappacea</i> , <i>Bothriochloa erianthoides</i> , <i>Digitaria brownii</i> , <i>D. divaricatissima</i> , <i>Eriochloa crebra</i> , <i>Panicum decompositum</i> , <i>P. queenslandicum</i> , <i>Paspalidium globoideum</i> and the forbs <i>Abelmoschus ficulneus</i> , <i>Boerhavia dominii</i> , <i>Corchorus trilocularis</i> , <i>Cyperus bifax</i> , <i>Glycine latifolia</i> , <i>Hibiscus trionum</i> var. <i>vesicarius</i> , <i>Ipomoea lonchophylla</i> , <i>Phyllanthus maderaspatensis</i> , <i>Tribulus micrococcus</i> and <i>Rhynchosia minima</i> .	Not observed from ground truthing within EPC 1080. 53 ha mapped within offsite infrastructure from DEHP certified mapping.

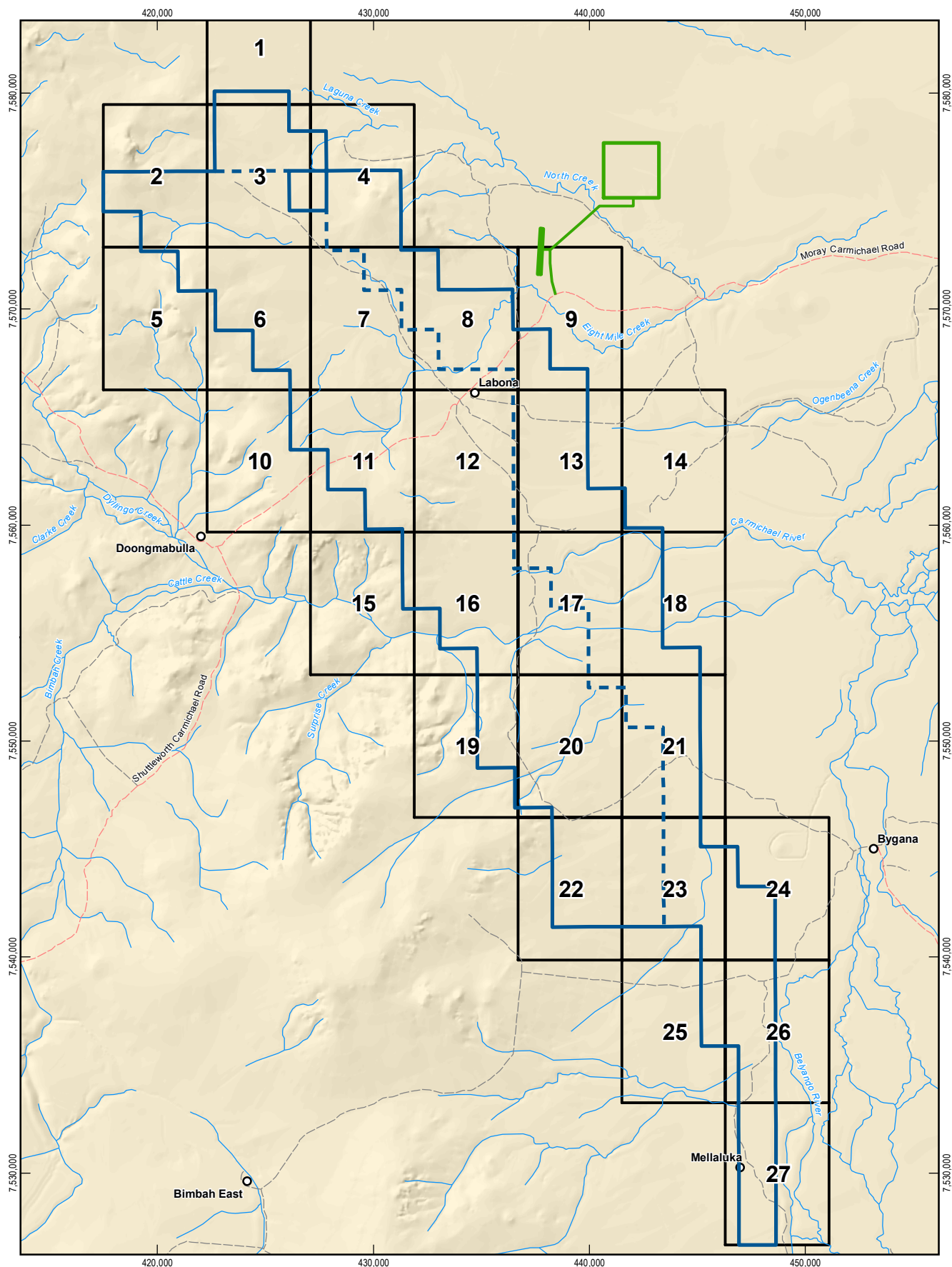


RE	VM Act class/ Biodiversity status	Land form ¹	Description ²	Comments (inc. area within EPC 1080 Study Area) ³
11.5.3	least concern/ no concern at present	Occurs on flat to gently undulating plains formed from Cainozoic sediments. Associated soils are generally deep texture contrast with thick sandy surface horizons with some deep red earths.	<i>Eucalyptus populnea</i> +/- <i>E. melanophloia</i> +/- <i>Corymbia clarksoniana</i> +/- <i>C. dallachiana</i> and occasionally <i>E. cambageana</i> or <i>E. brownii</i> dominate the tree layer (14 m median height and 11-15 m range) woodland. Localised areas may be dominated by <i>E. melanophloia</i> , occasionally <i>E. crebra</i> and other canopy species. There is generally a distinctive low tree layer (8, 6-11 m high) dominated by species such as <i>Eremophila mitchellii</i> , <i>Geijera parviflora</i> , <i>Archidendropsis basaltica</i> , <i>Erythroxylum australe</i> , <i>Cassia brewsteri</i> , <i>Ventilago viminalis</i> and occasionally <i>Allocasuarina luehmannii</i> or <i>Callitris glaucophylla</i> . A low shrub layer (2-6 m high) dominated by species such as <i>Carissa ovata</i> , <i>Erythroxylum australe</i> , <i>Capparis lasiantha</i> is also often present.	Present in the south of the EPC 1080 Study Area within mixed polygons with other eucalypt, brigalow and gidgee communities. Approximately 17 ha within the EPC 1080 Study Area.

¹ – Land form for REs as described in the Regional Ecosystem Description Database (REDD), Version 6.0b (Queensland Herbarium, 2011)

² – RE descriptions as described in the Regional Ecosystem Description Database (REDD), Version 6.0b (Queensland Herbarium, 2011)

³ – Area calculations are based on ground-truthed Res, where available, within the EPC 1080 Study Area. Where ground-truthing of REs has not been undertaken, calculations are derived from DEHP certified RE mapping



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine Site
- Offsite Infrastructure

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1:250,000 (at A4)
0 1 2 3 4 5
Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Index Map - Regional Ecosystems
DERM Certified (V6.1)

Job Number | 41-23244
Revision | B
Date | 15-03-2012

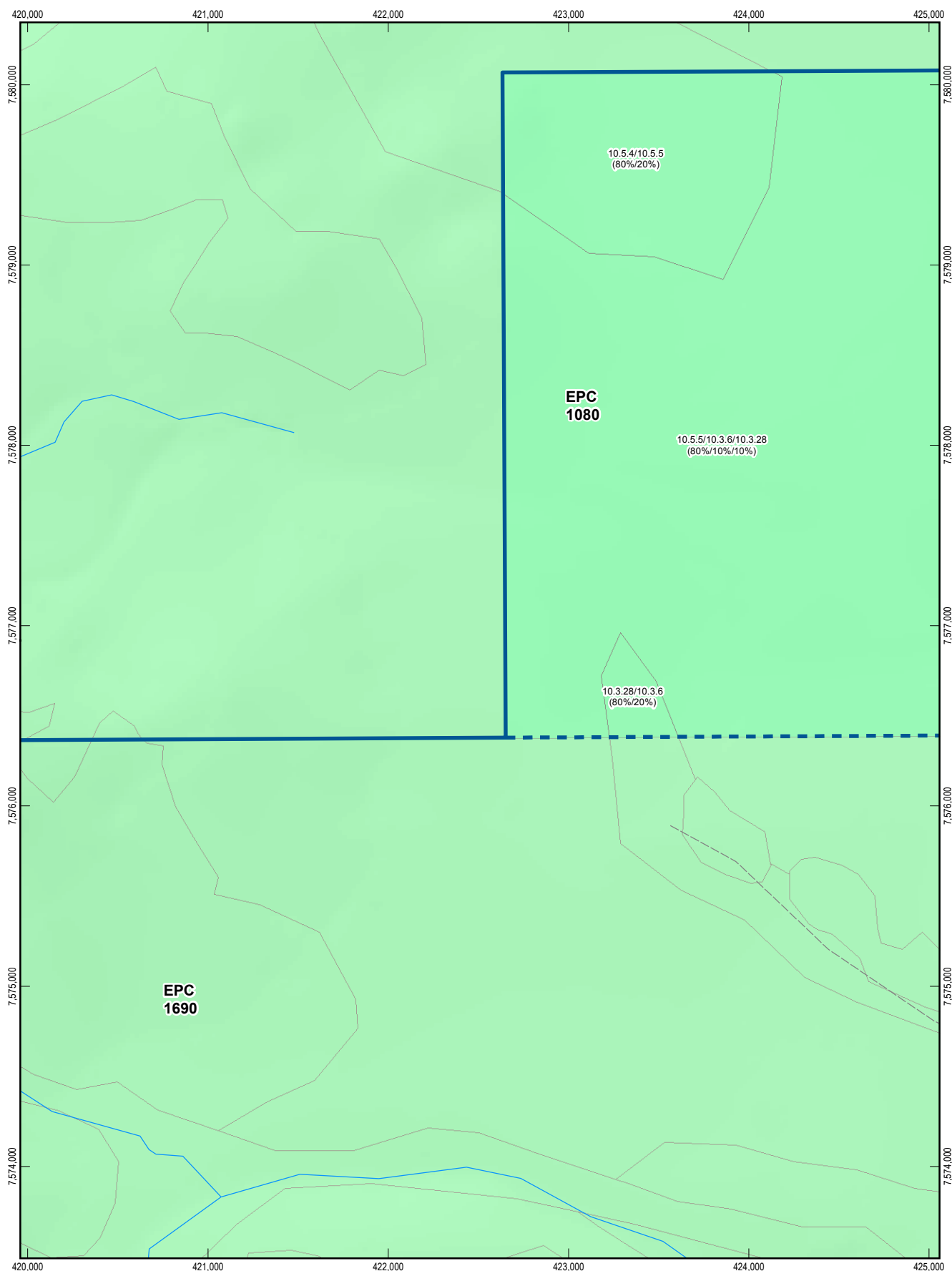
Figure 2-3

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

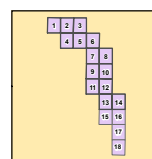
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Data Source: DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Homestead, Road, Watercourse (2007); DERM Regional Ecosystems v6.1 (2011); Created by: BW.

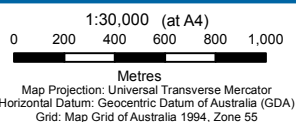


LEGEND

- Homestead
- Watercourse
- Local Road
- Track
- Mine Site
- Regional Ecosystems Certified v6.1
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Of Least Concern
- Non-remnant



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Regional Ecosystems
DERM Certified (V6.1)

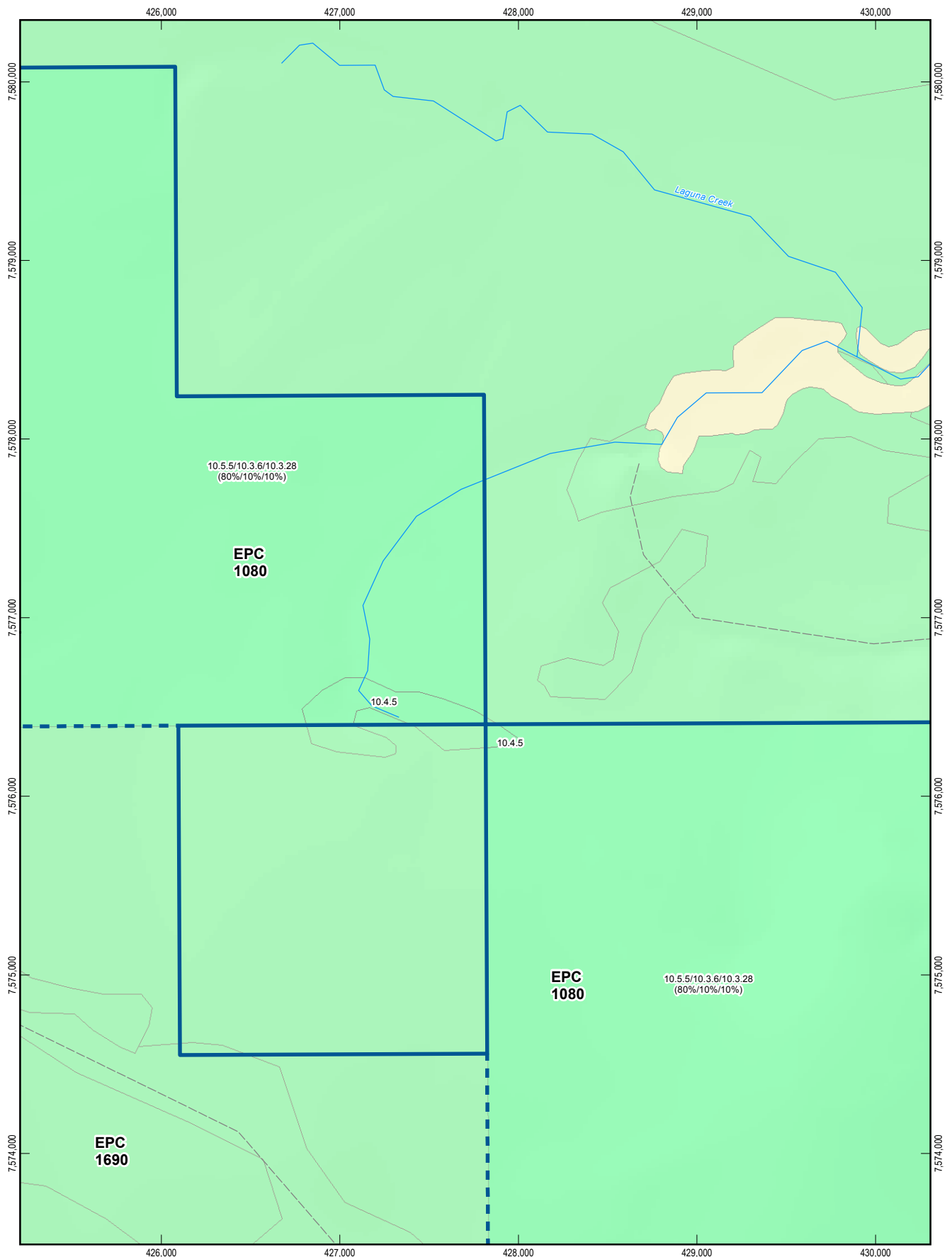
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Revision A
Date 19-01-2012

Figure 2-3
Sheet 1 of 18

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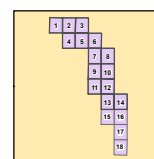
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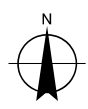
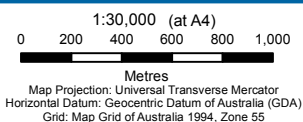


LEGEND

- Homestead
- Watercourse
- Local Road
- Track
- Mine Site
- Regional Ecosystems Certified v6.1
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Of Least Concern
- Non-remnant

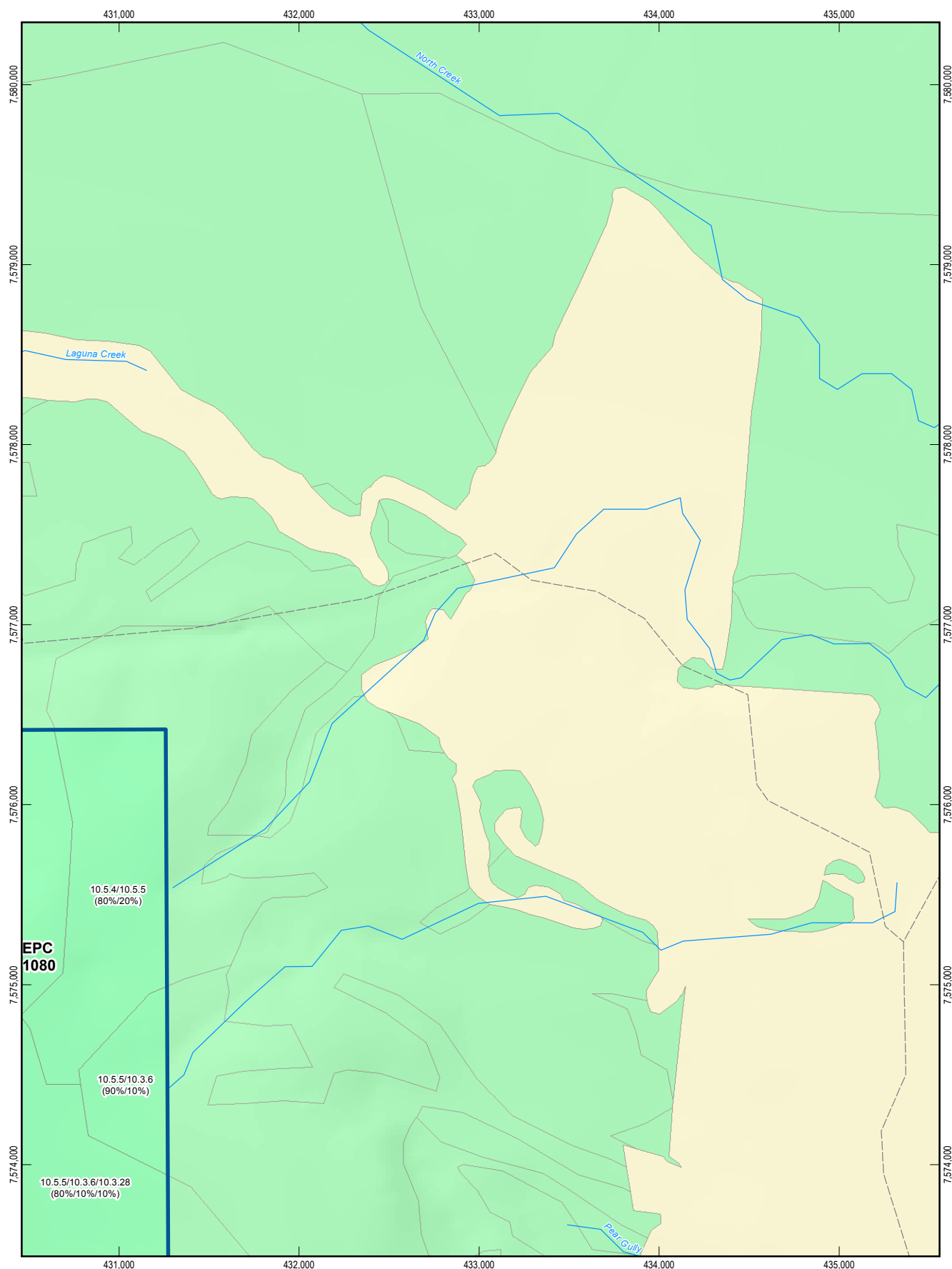


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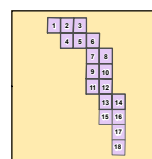
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Carmichael Coal Mine and Rail Project
Regional Ecosystems
DERM Certified (V6.1)

Job Number 41-23244
Revision A
Date 19-01-2012
Figure 2-3
Sheet 2 of 18



LEGEND

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Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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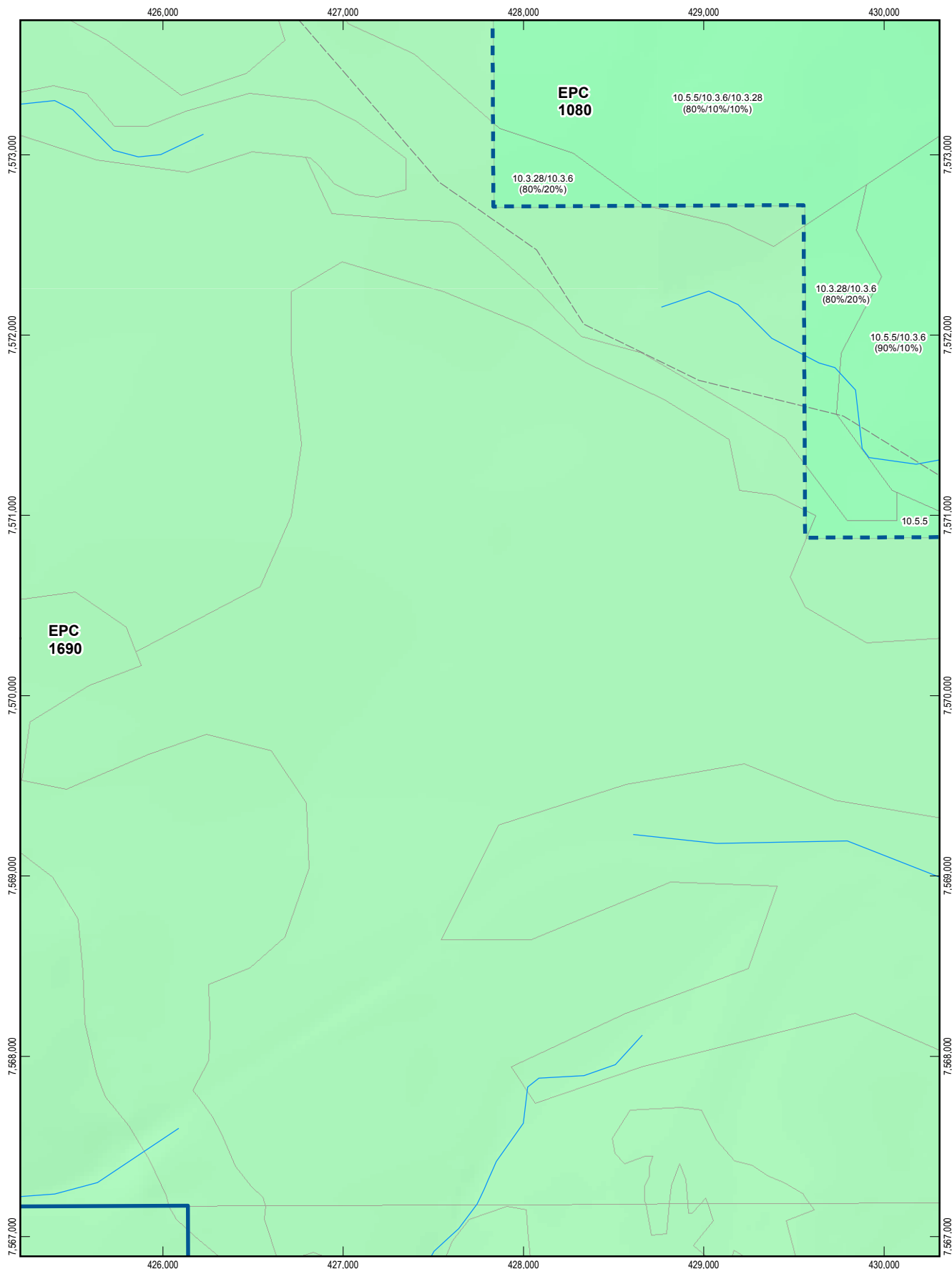
Job Number 41-23244
Revision A
Date 19-01-2012

Figure 2-3
Sheet 3 of 18

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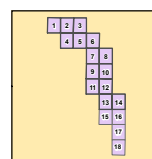
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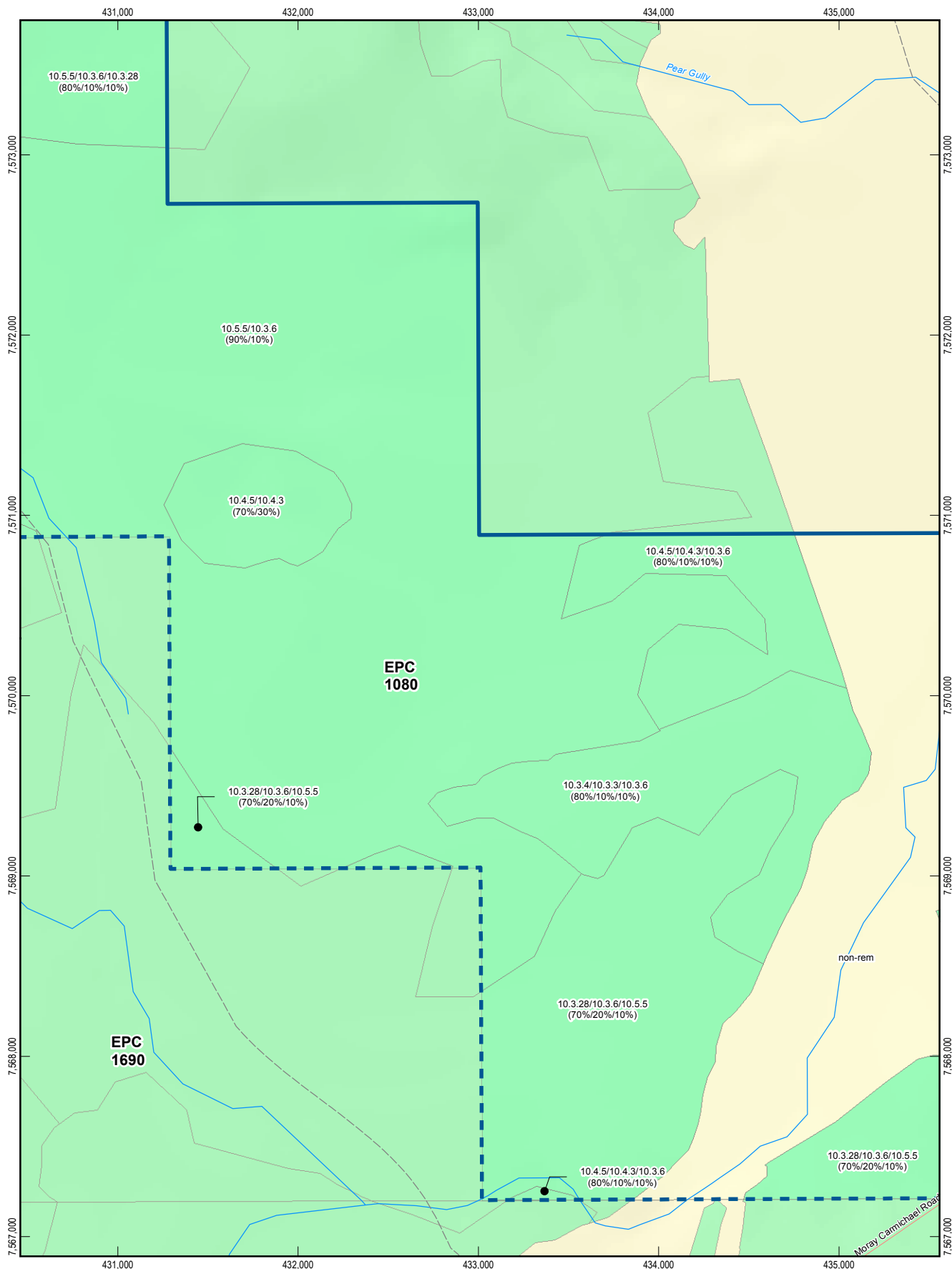
Figure 2-3
Sheet 4 of 18

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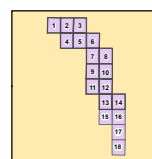
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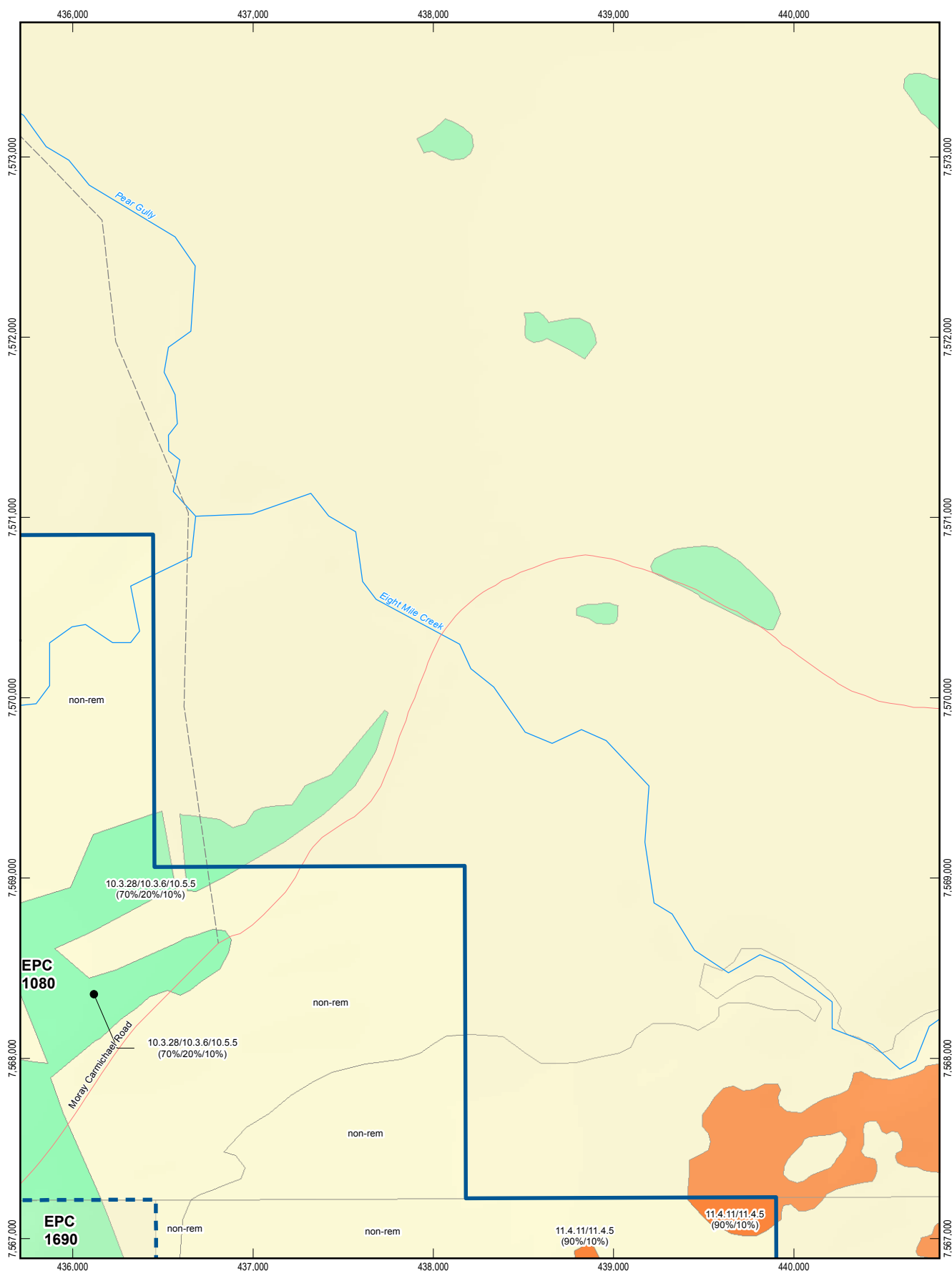
Figure 2-3
Sheet 5 of 18

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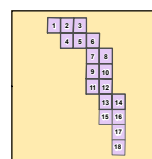
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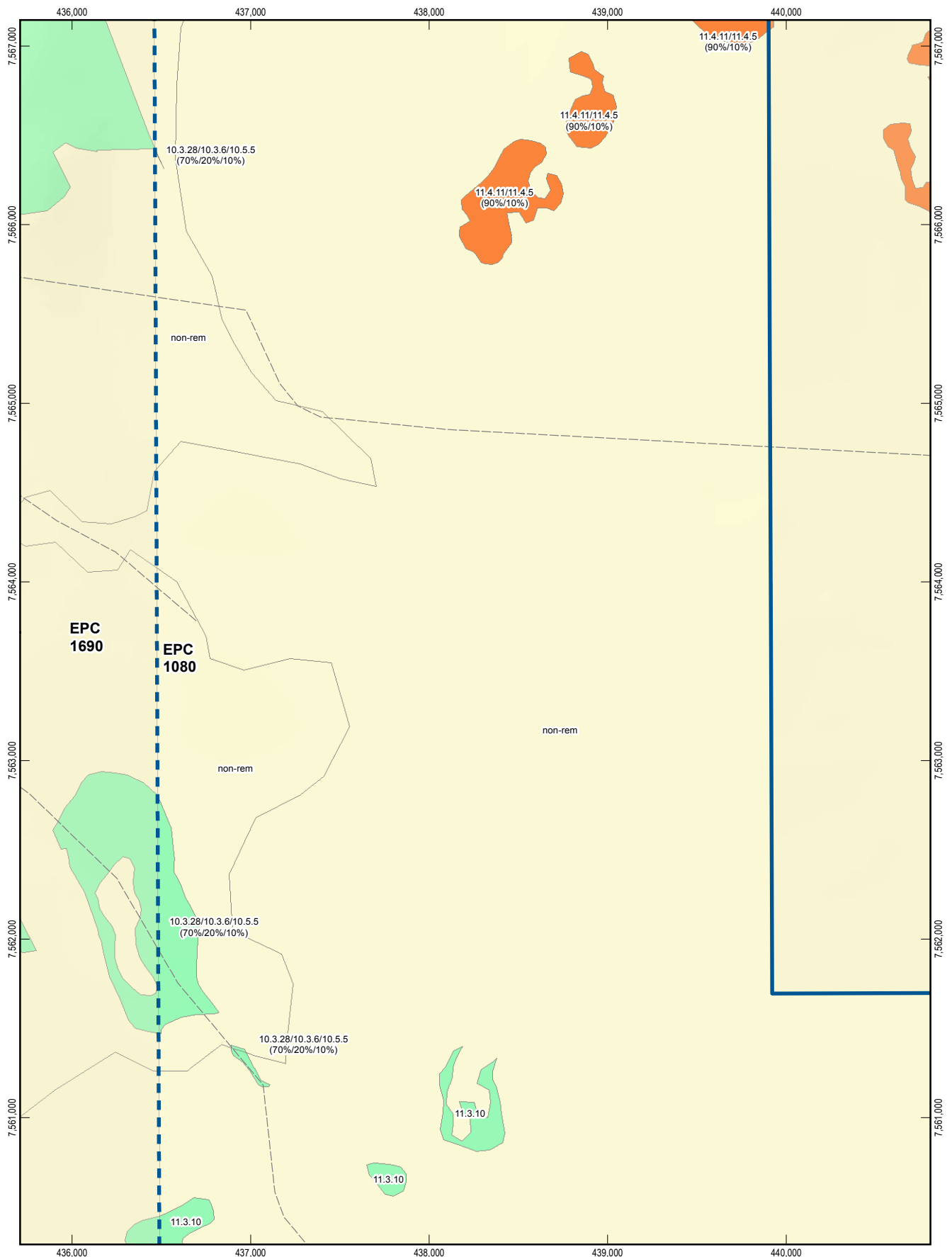
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Sheet 6 of 18

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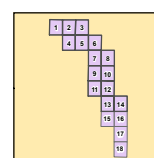
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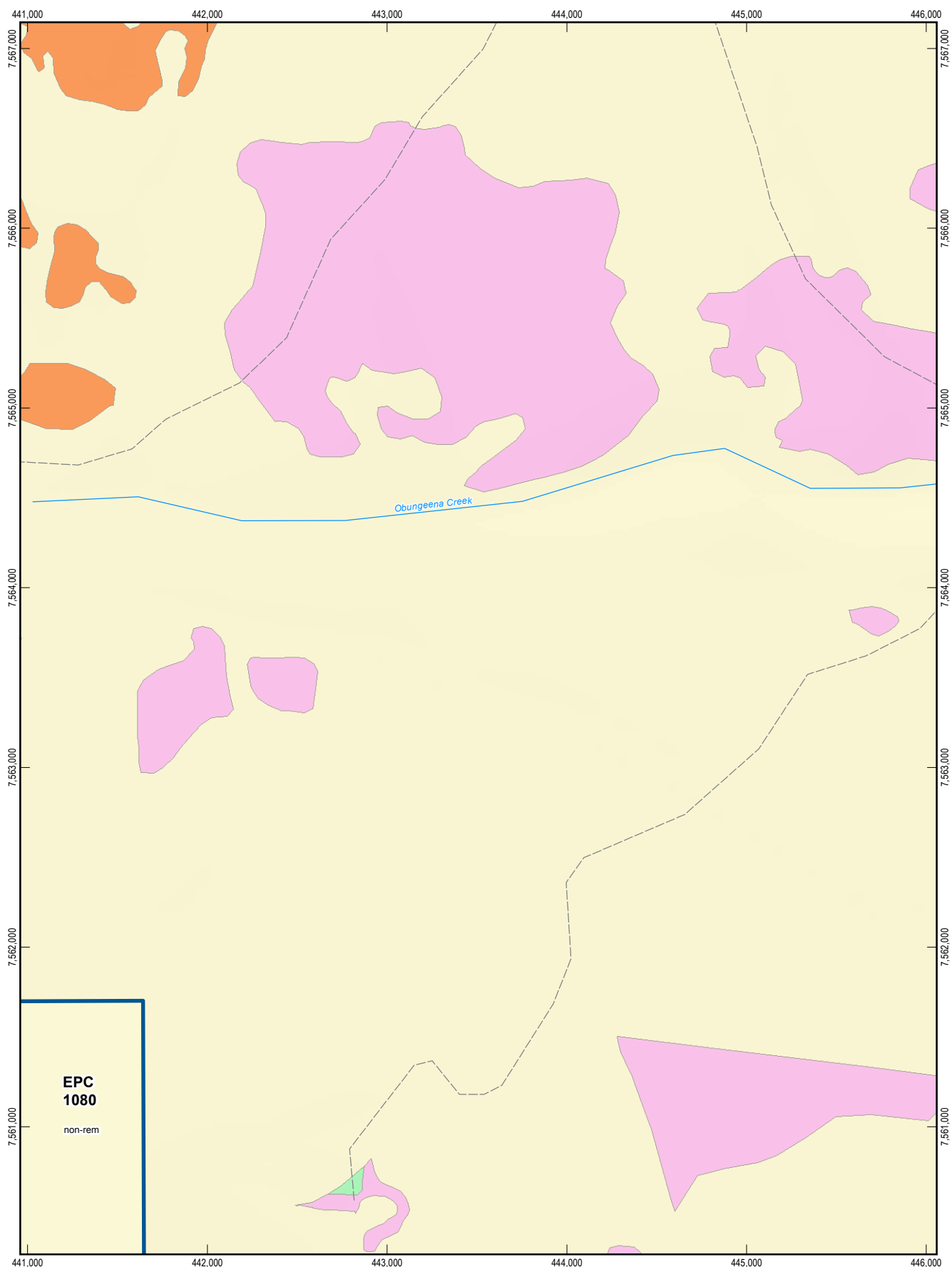
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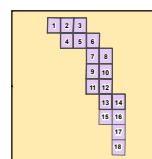
Job Number 41-23244
Revision A
Date 19-01-2012

Figure 2-3
Sheet 7 of 18



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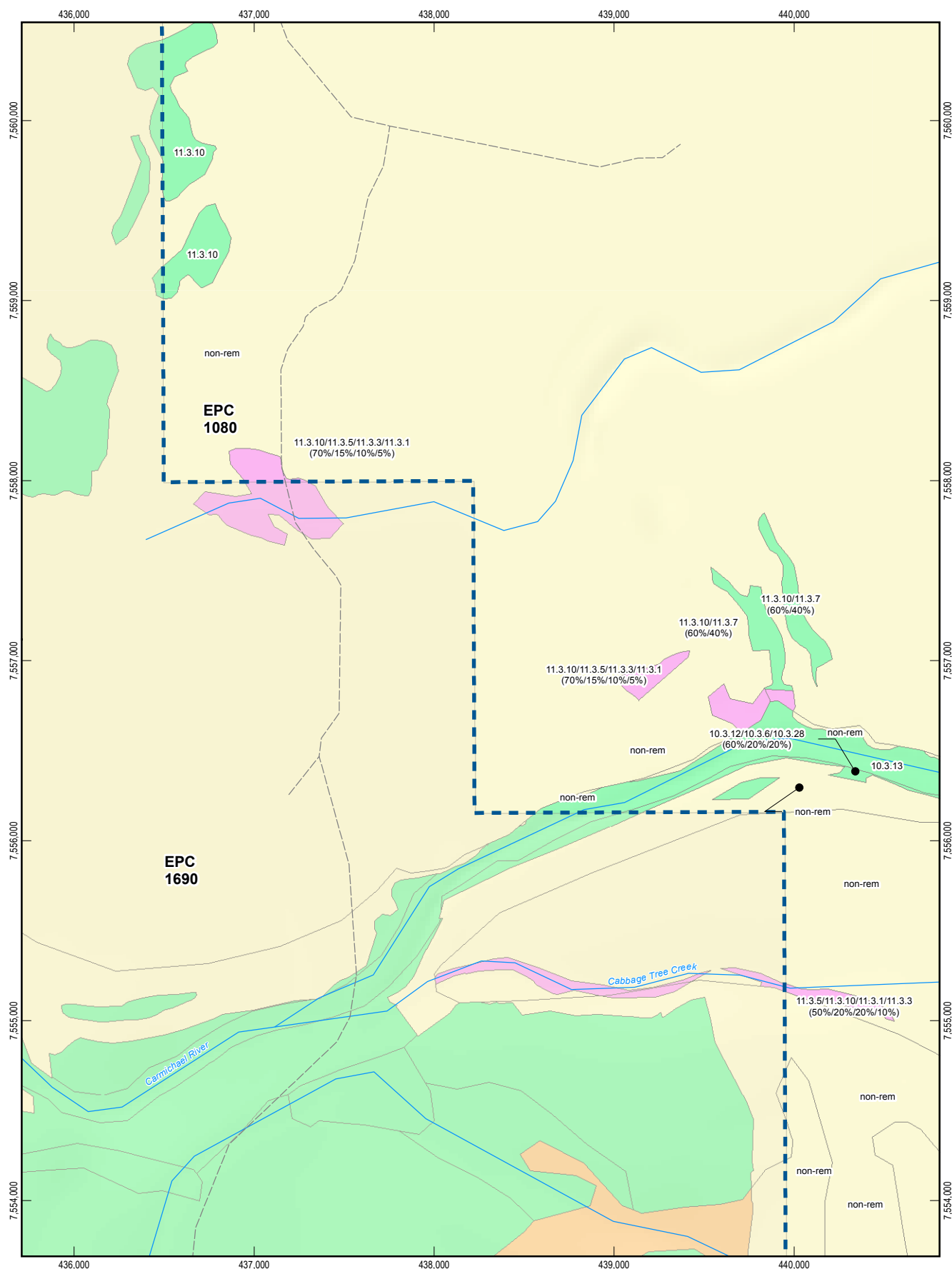
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Sheet 8 of 18

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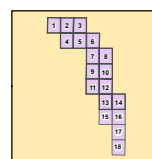
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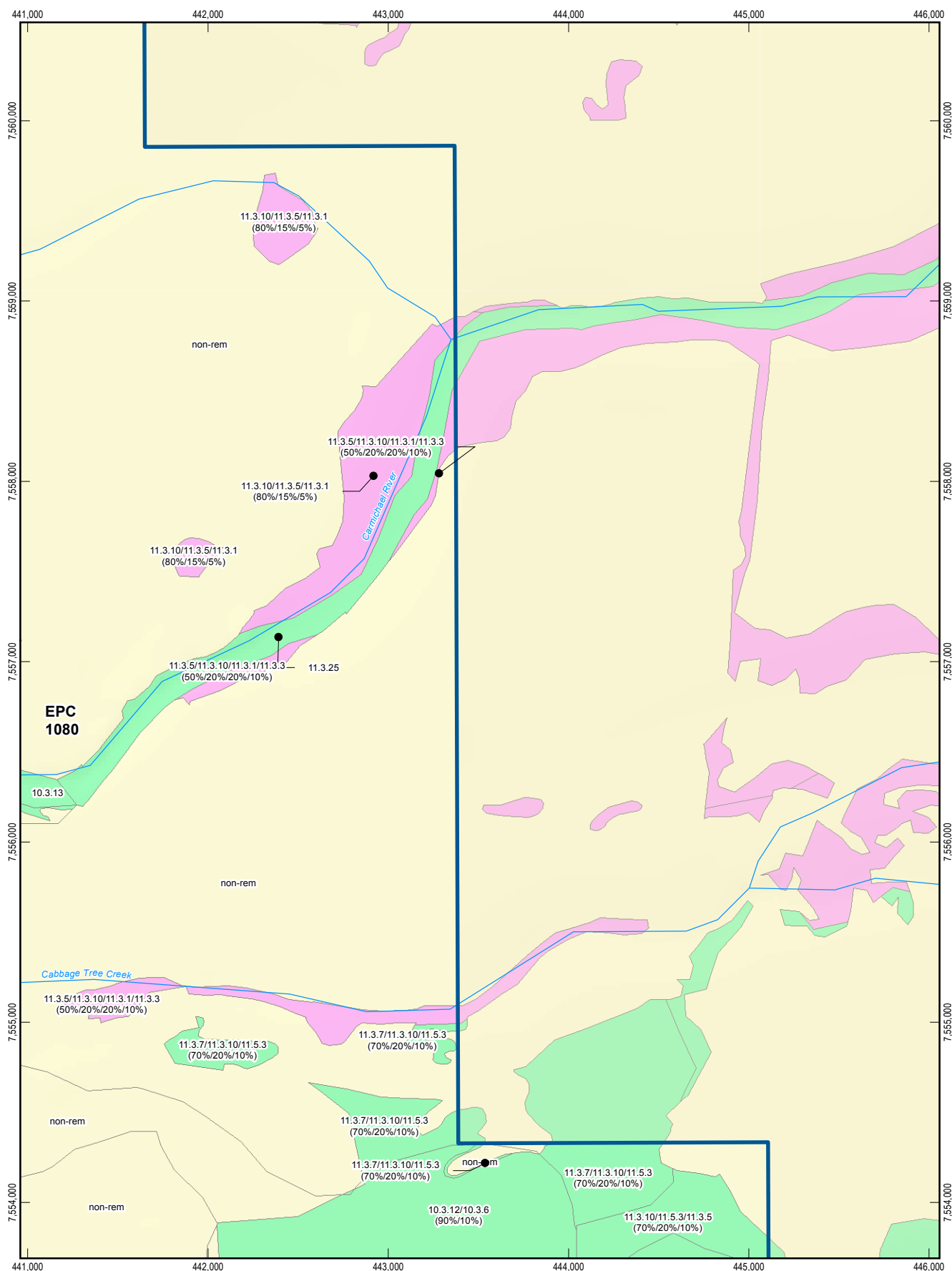
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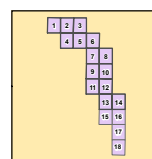
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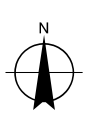
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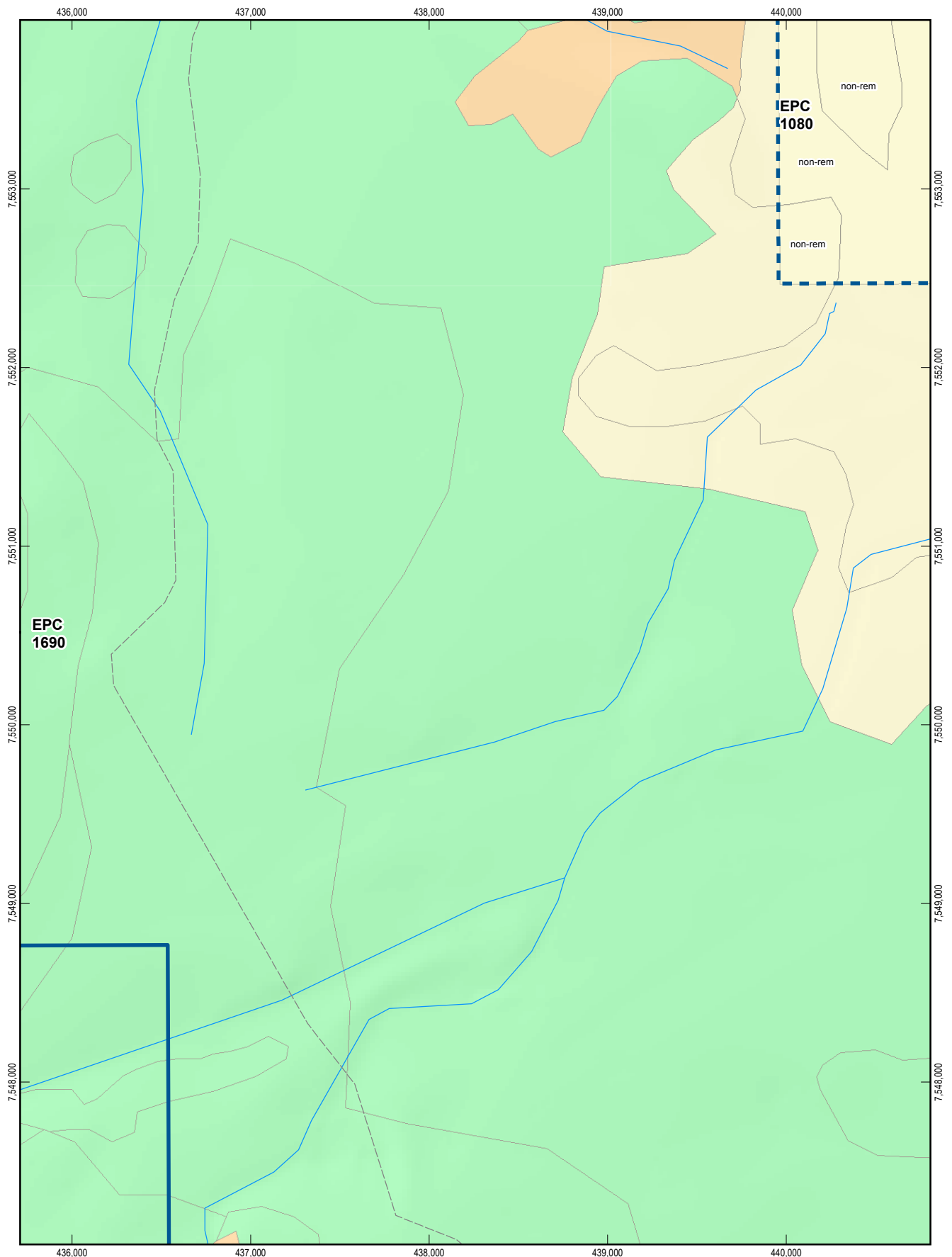
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Sheet 10 of 18

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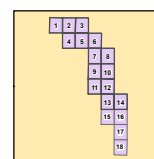
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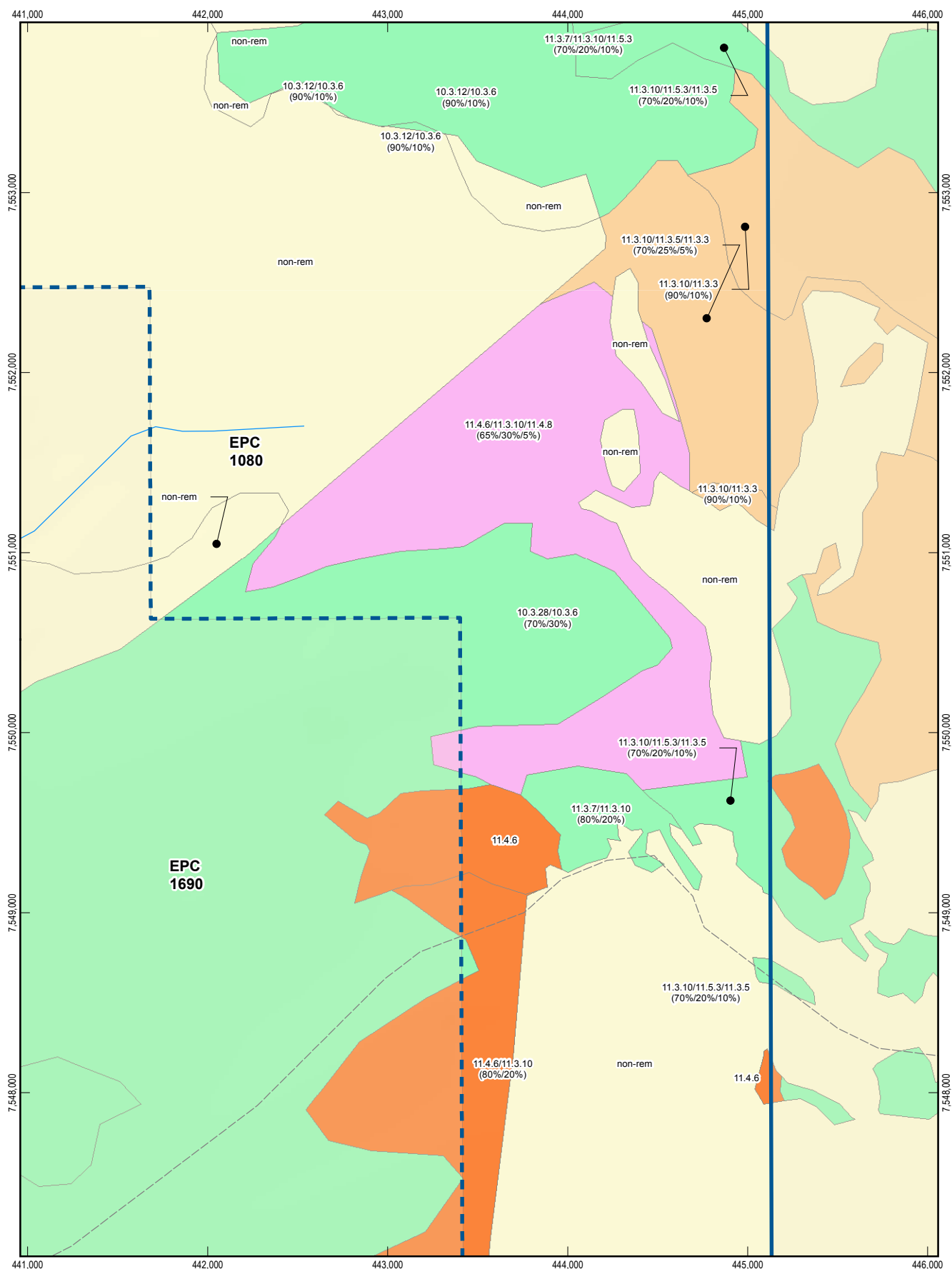
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Sheet 11 of 18

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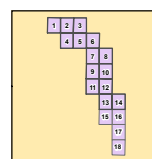
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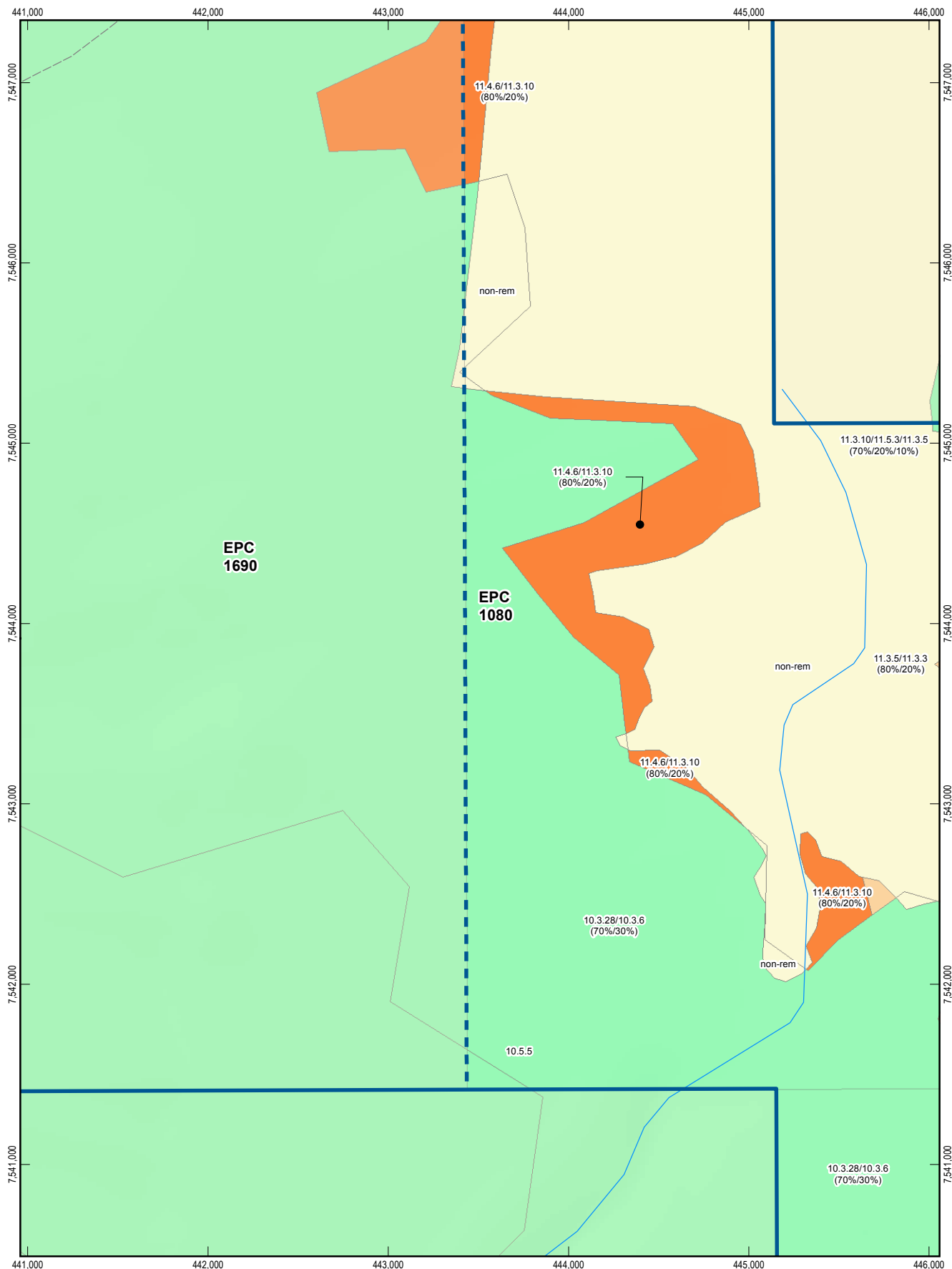
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Sheet 12 of 18

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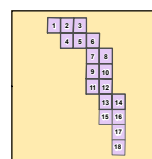
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LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine Site
- Regional Ecosystems Certified v6.1
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Of Least Concern
- Non-remnant



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Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
DERM Certified (V6.1)

Job Number 41-23244
Revision A
Date 19-01-2012

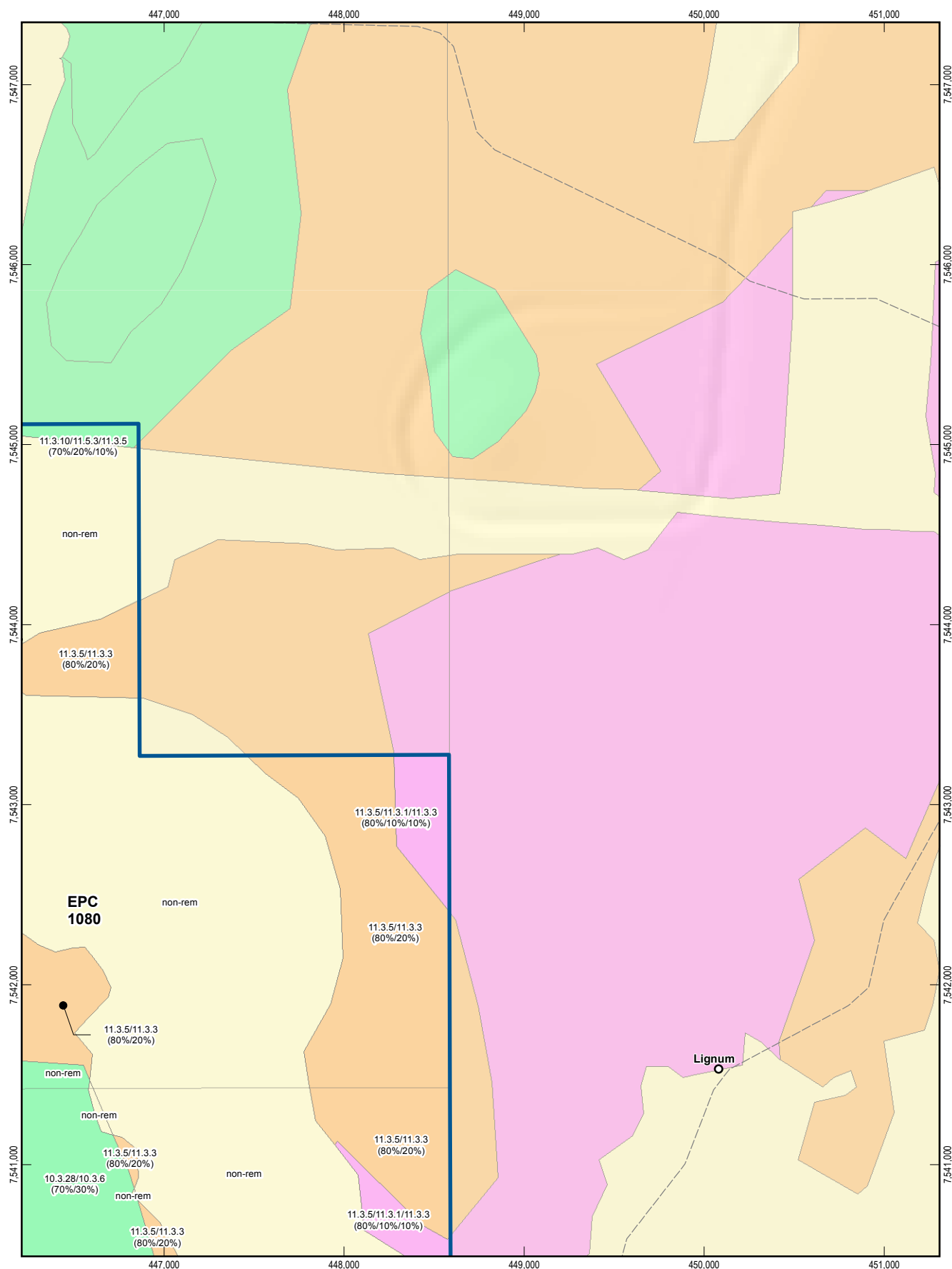
Figure 2-3
Sheet 13 of 18

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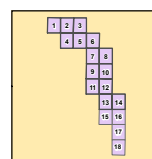
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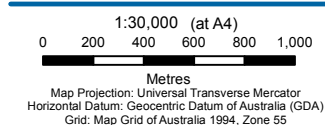


LEGEND

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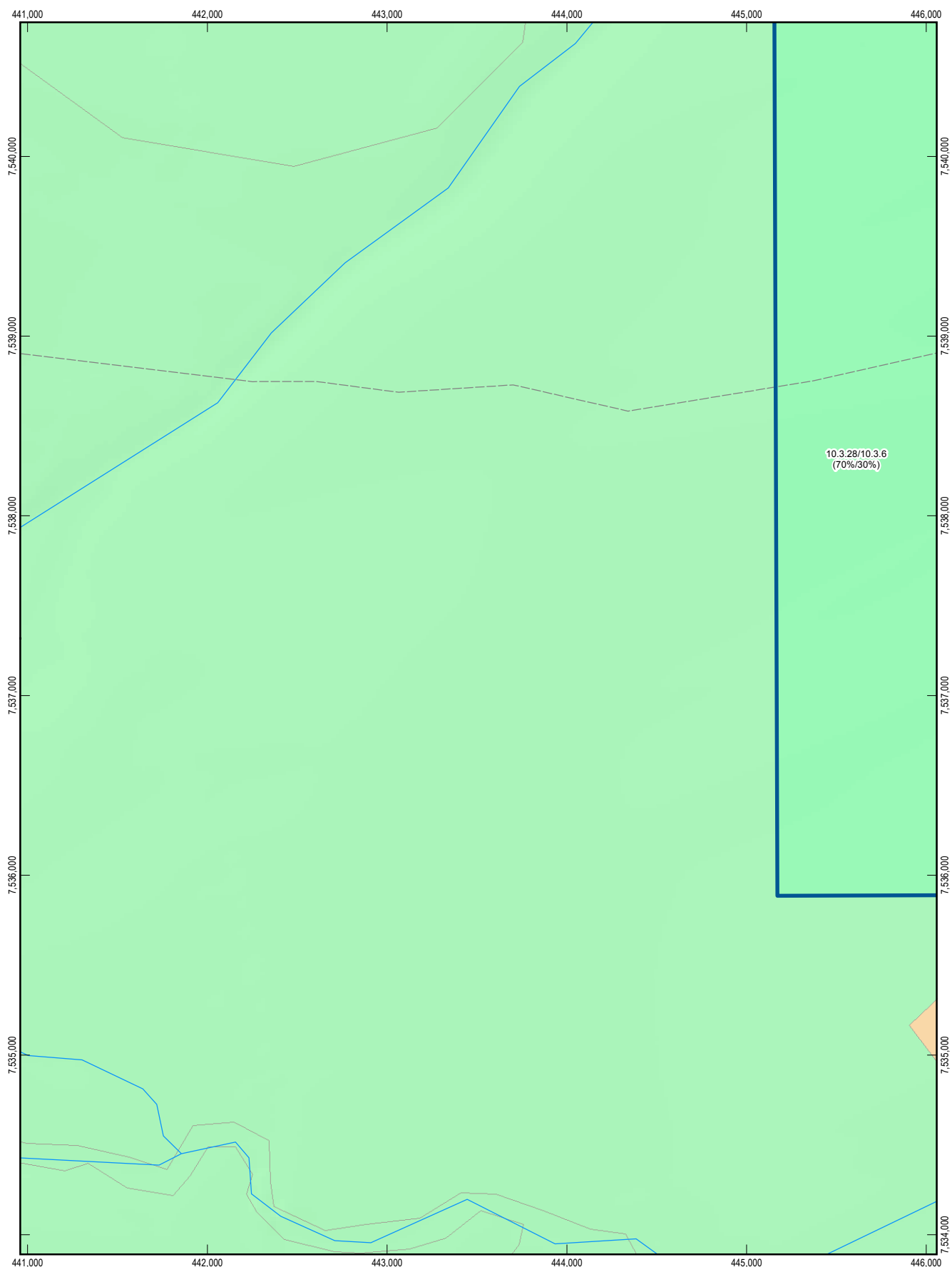
Job Number 41-23244
Revision A
Date 19-01-2012

Figure 2-3
Sheet 14 of 18

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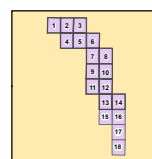
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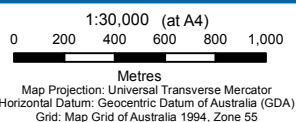


LEGEND

- Homestead
- Local Road
- Track
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- Mine Site
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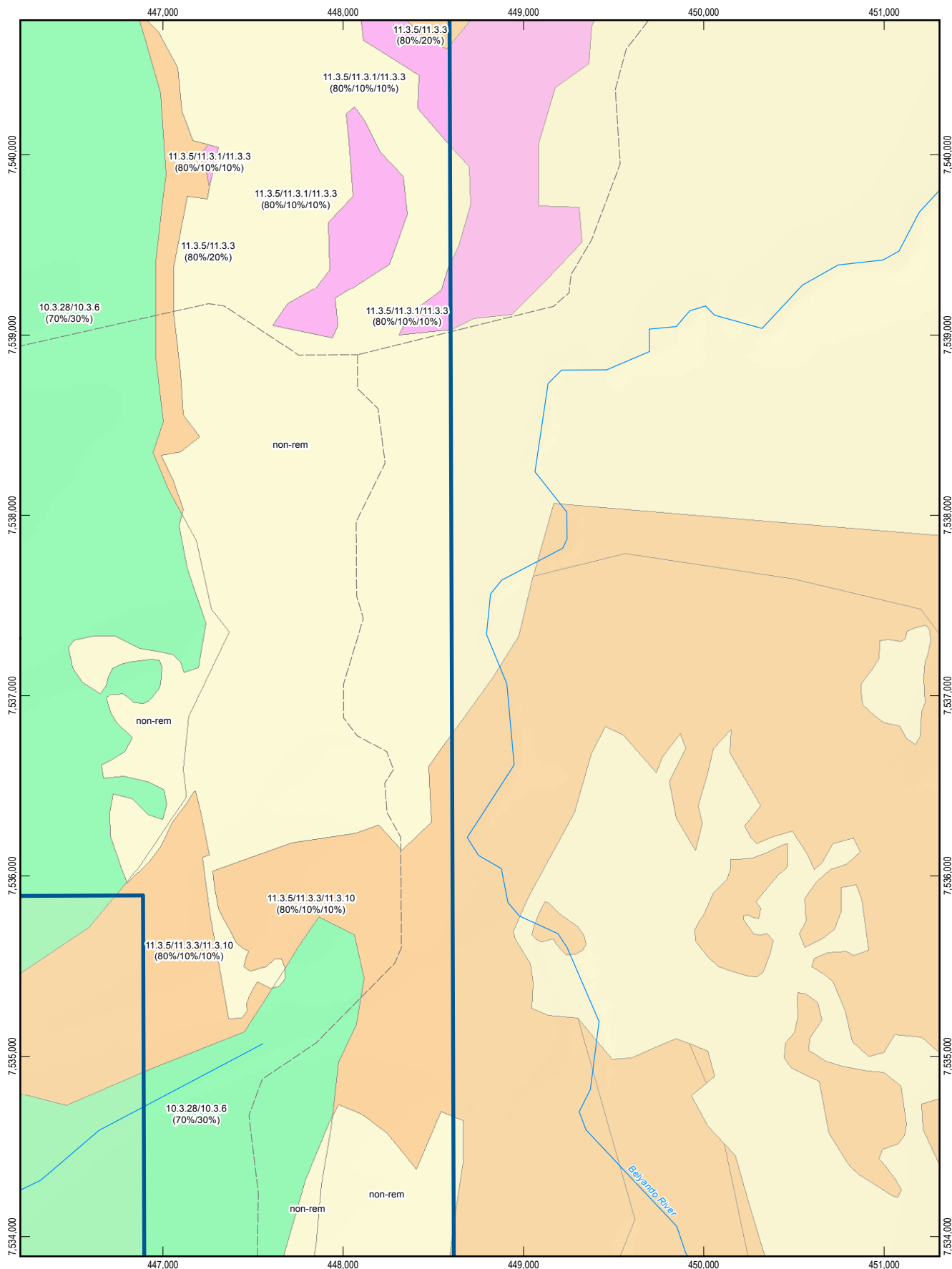
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Sheet 15 of 18

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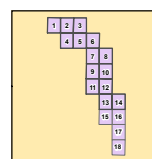
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LEGEND

- Homestead
- Watercourse
- Local Road
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- Mine Site
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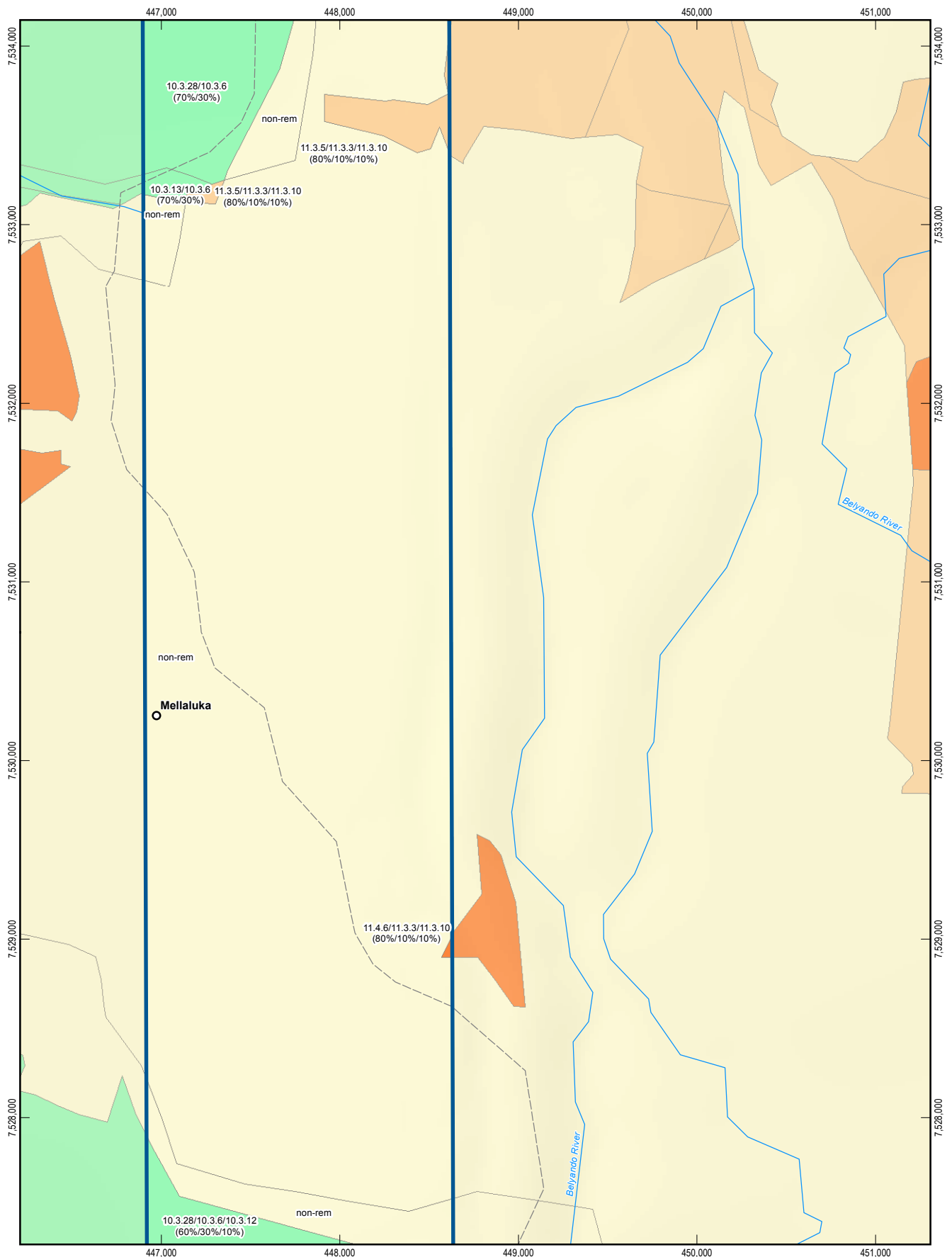


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Grid: Map Grid of Australia 1994, Zone 55

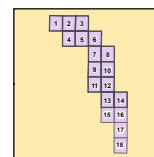
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Regional Ecosystems
DERM Certified (V6.1)

Job Number 41-23244
Revision A
Date 19-01-2012
Figure 2-3
Sheet 16 of 18



LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine Site
- Regional Ecosystems Certified v6.1
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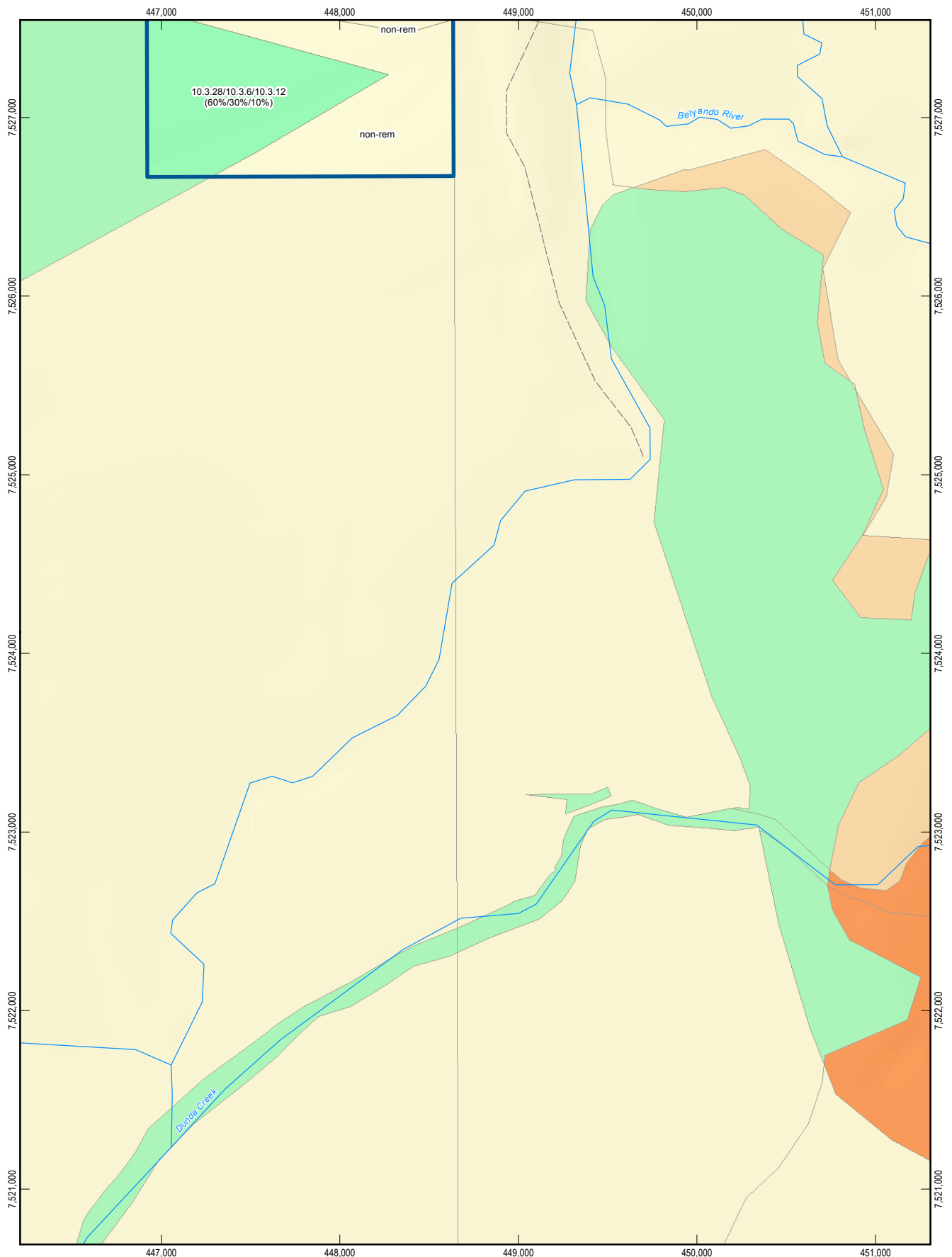
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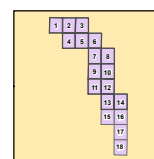
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LEGEND

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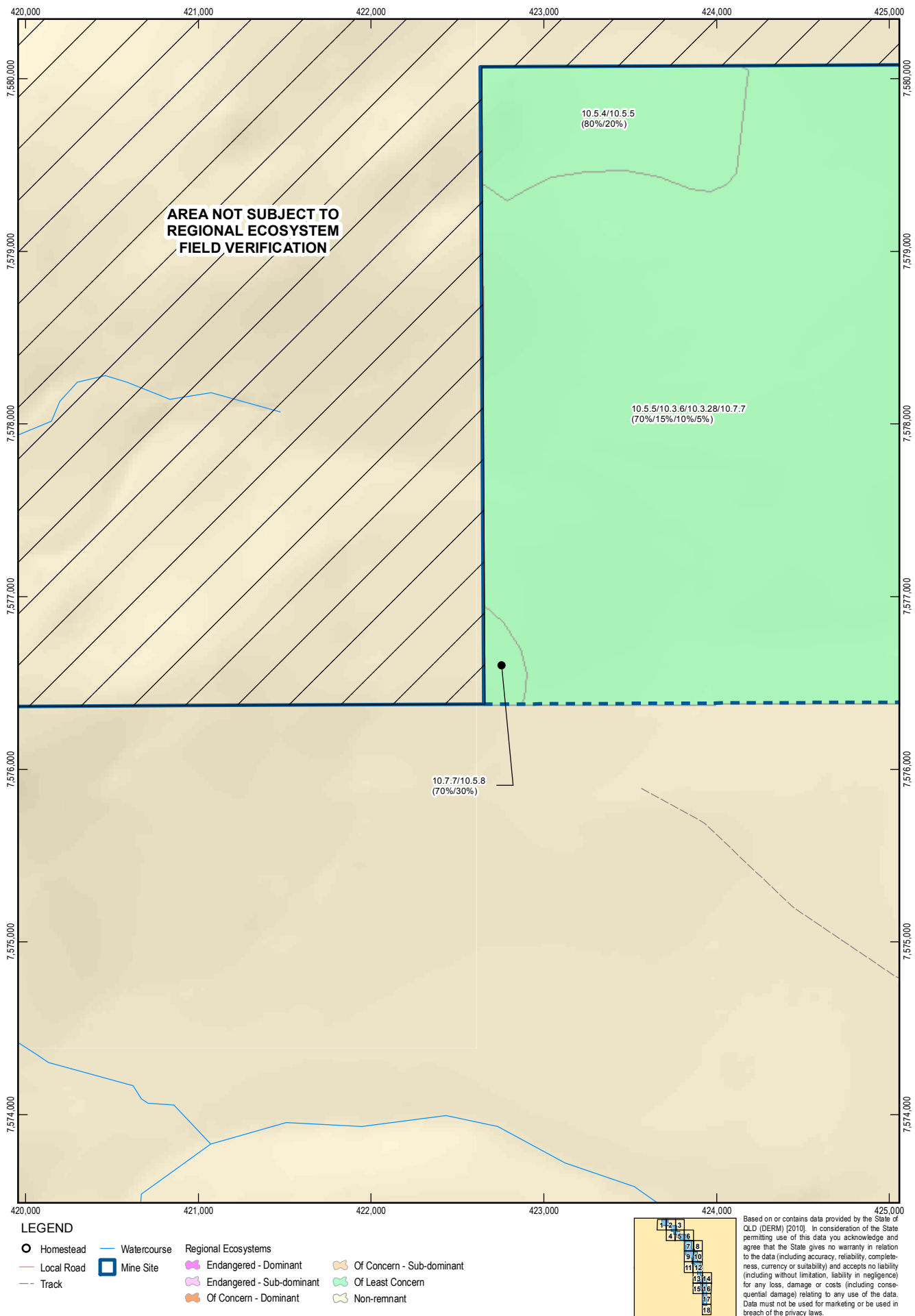
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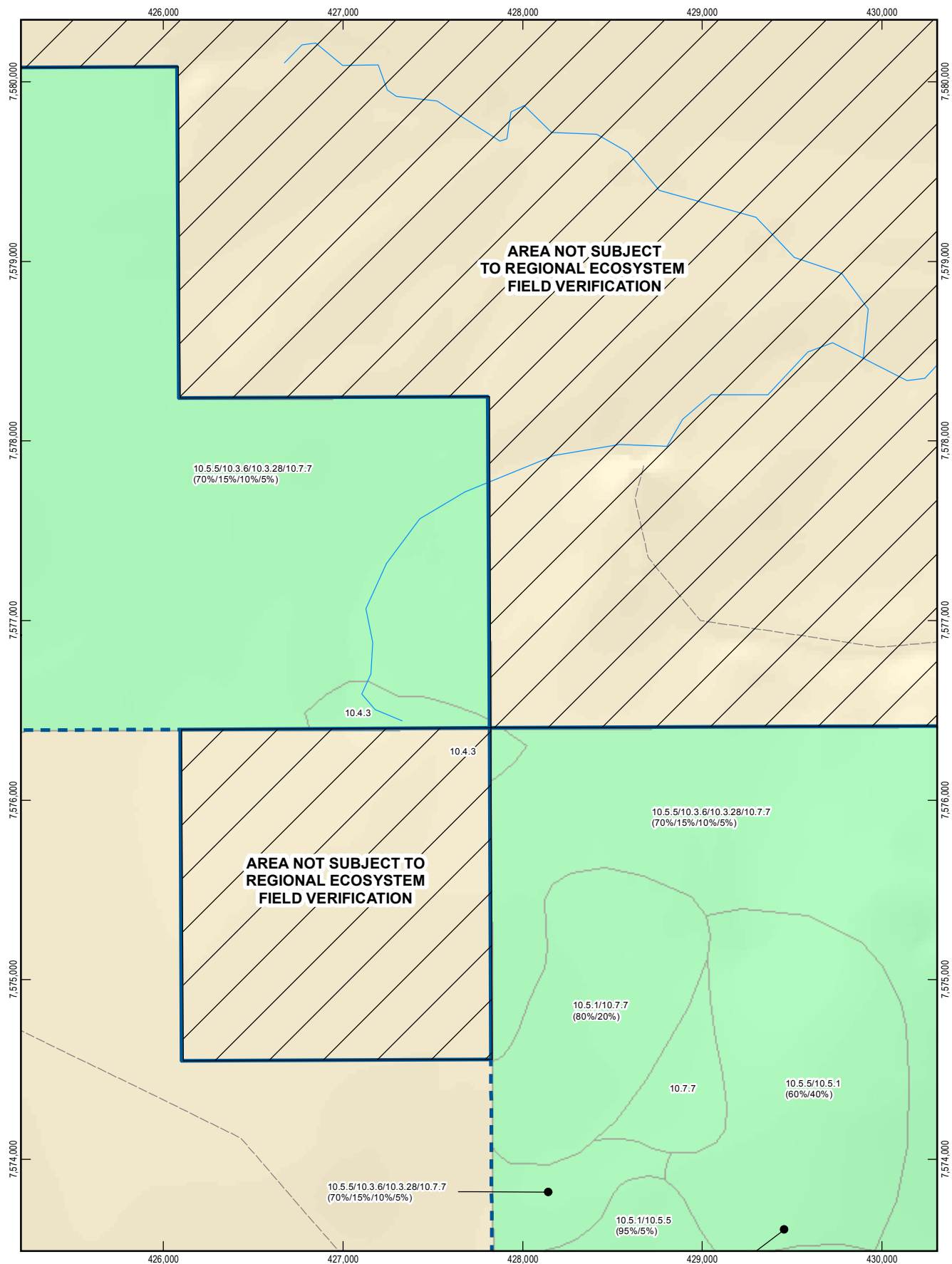
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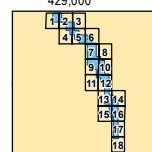
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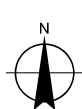
LEGEND

- | | | |
|--------------|---------------|---------------------------|
| ○ Homestead | — Watercourse | Regional Ecosystems |
| — Local Road | ■ Mine Site | Endangered - Dominant |
| — Track | | Endangered - Sub-dominant |
| | | Of Concern - Dominant |
| | | Of Concern - Sub-dominant |
| | | Of Least Concern |
| | | Non-remnant |



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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-23244
Revision A
Date 19-01-2012

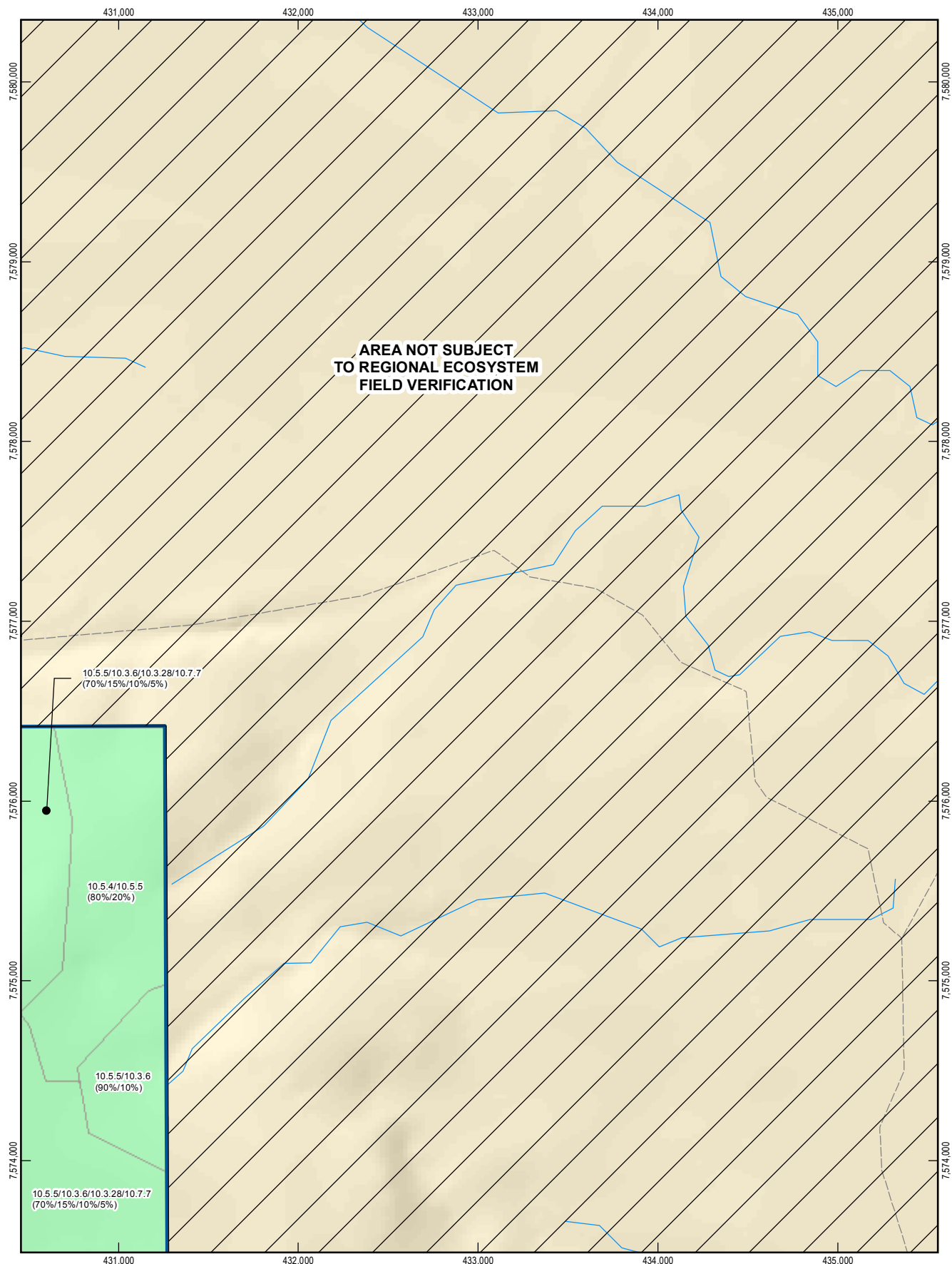
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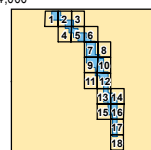
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LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine Site
- Regional Ecosystems
 - Endangered - Dominant
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Carmichael Coal Mine and Rail Project

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Job Number 41-23244
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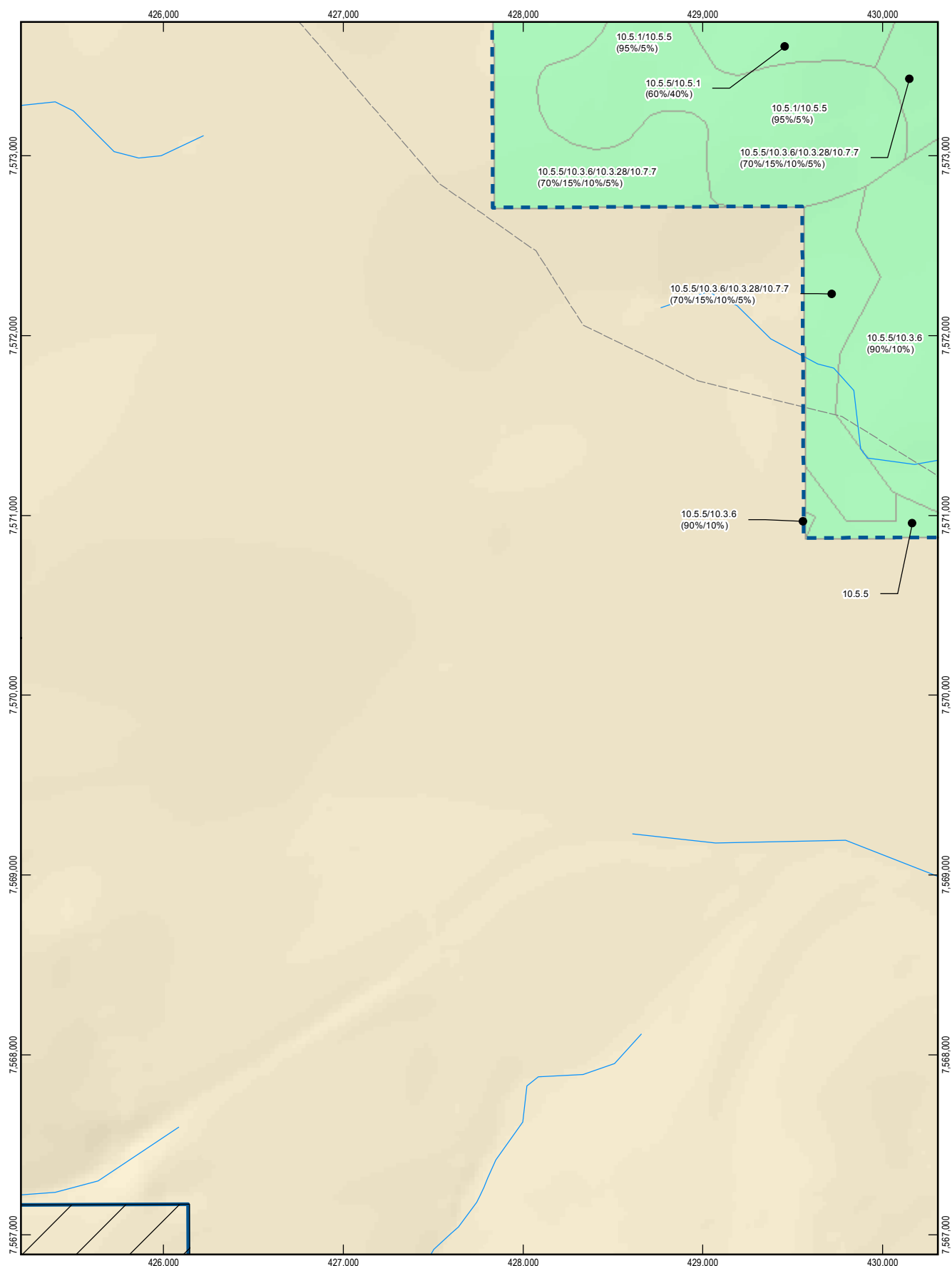
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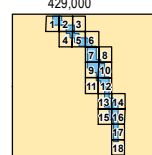
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LEGEND

- | | | |
|--------------|---------------|---------------------------|
| ○ Homestead | — Watercourse | Regional Ecosystems |
| — Local Road | □ Mine Site | Endangered - Dominant |
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Carmichael Coal Mine and Rail Project
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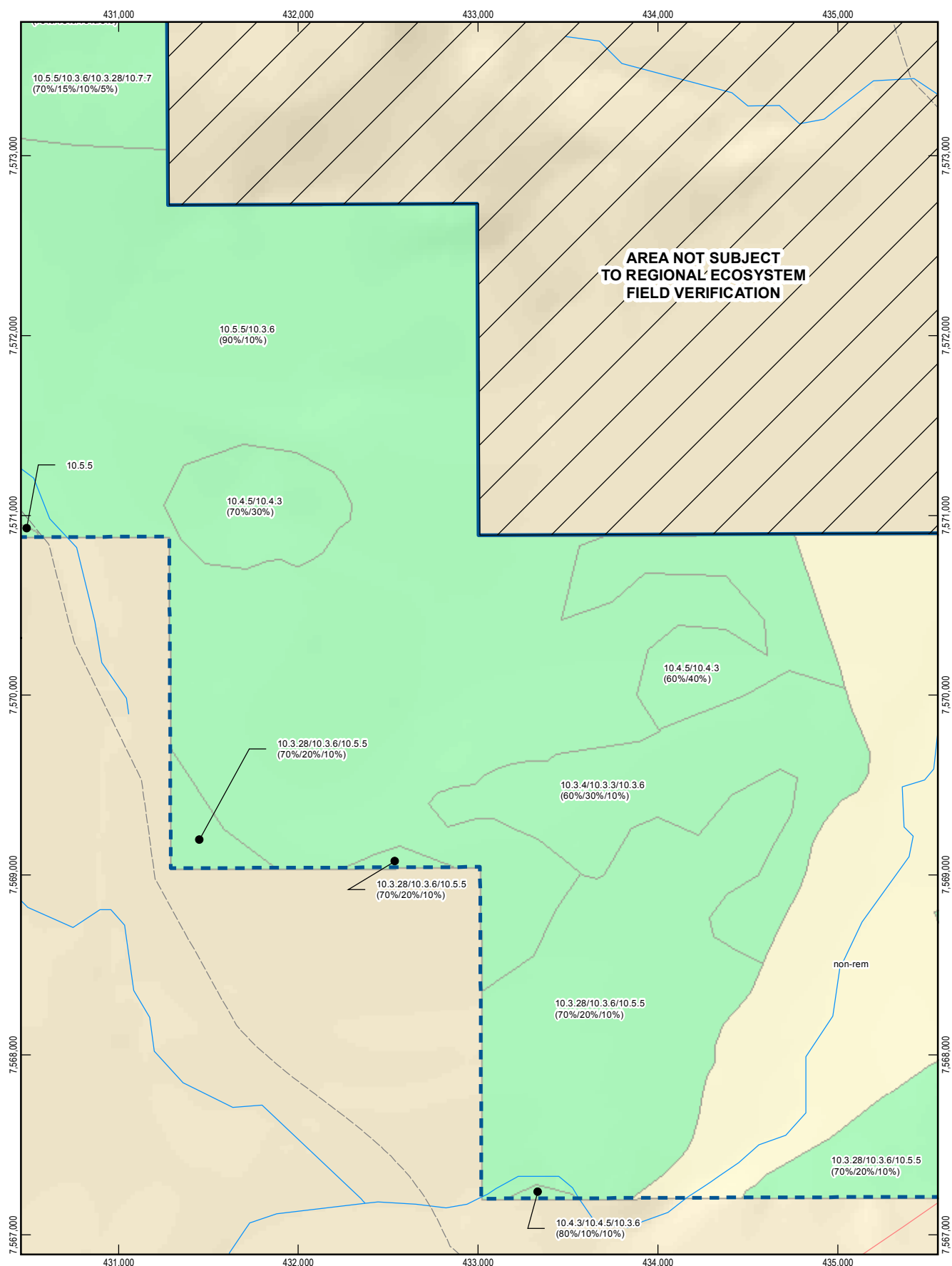
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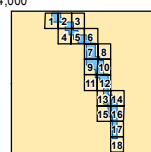
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LEGEND

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Carmichael Coal Mine and Rail Project
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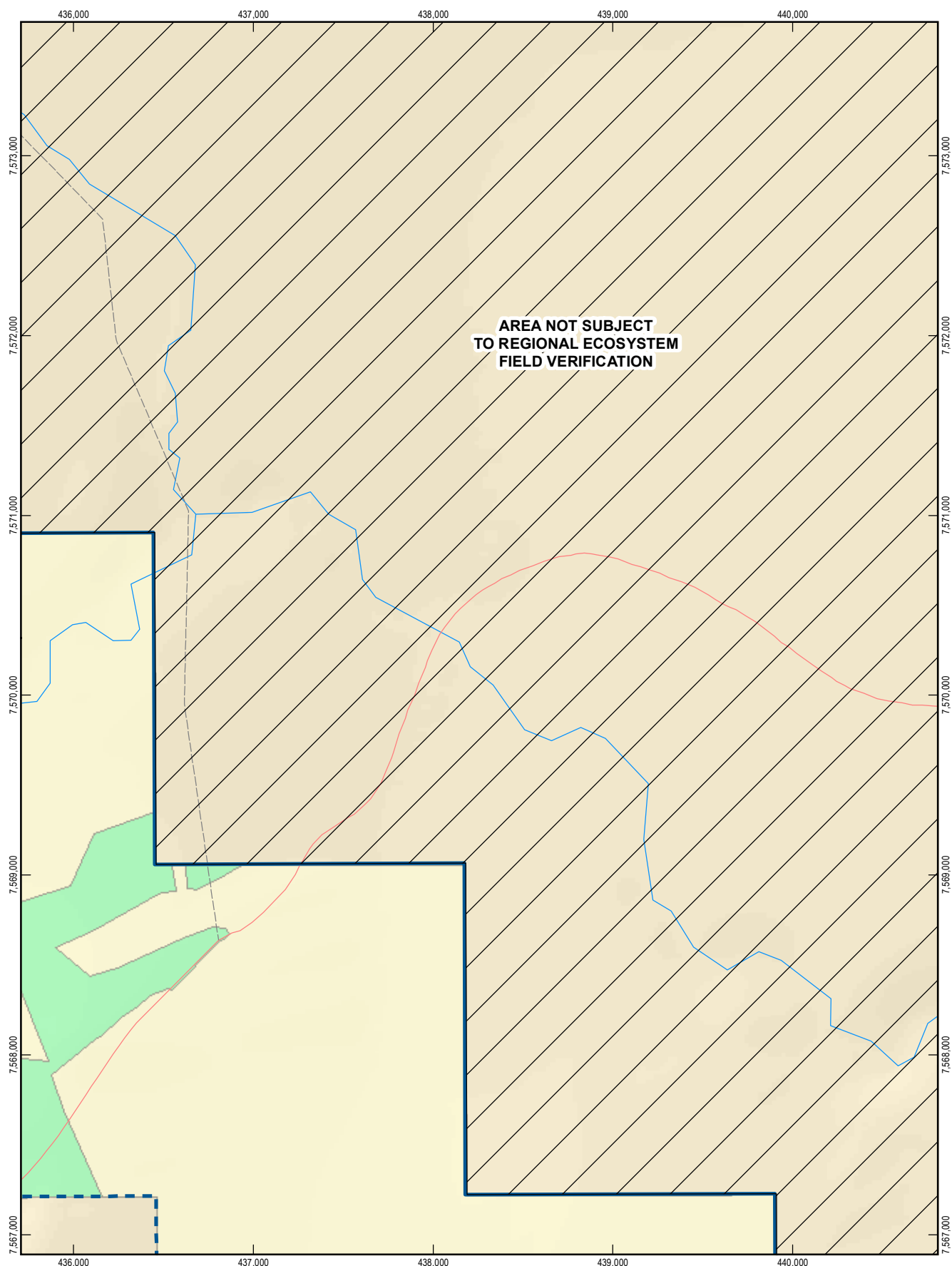
Figure 2-4
Sheet 5 of 18

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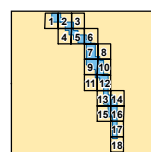
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LEGEND

- | | | |
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| | | Non-remnant |



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Metres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



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Carmichael Coal Mine and Rail Project
Regional Ecosystems
Field Verified

Job Number 41-23244
Revision A
Date 19-01-2012

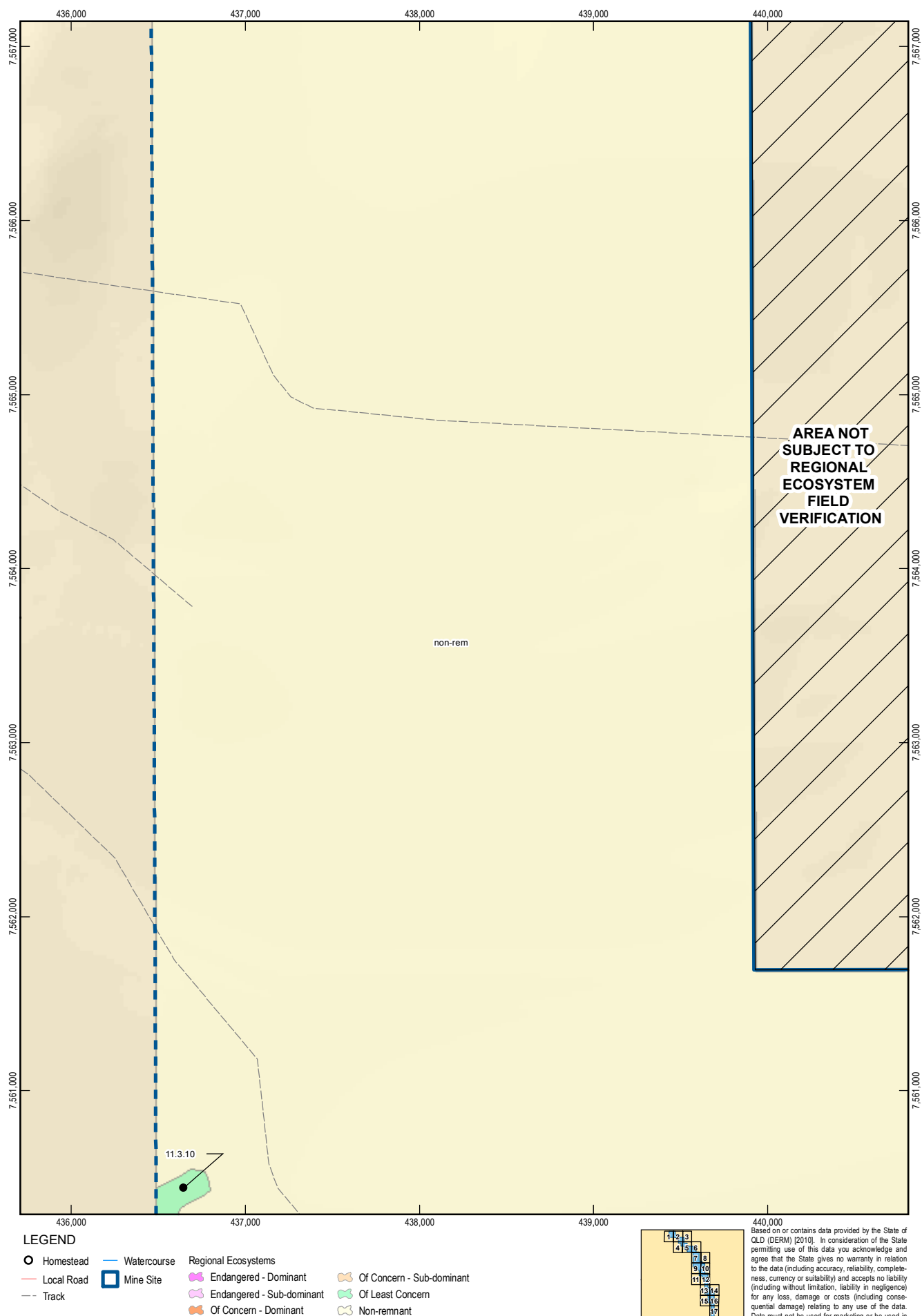
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Sheet 6 of 18

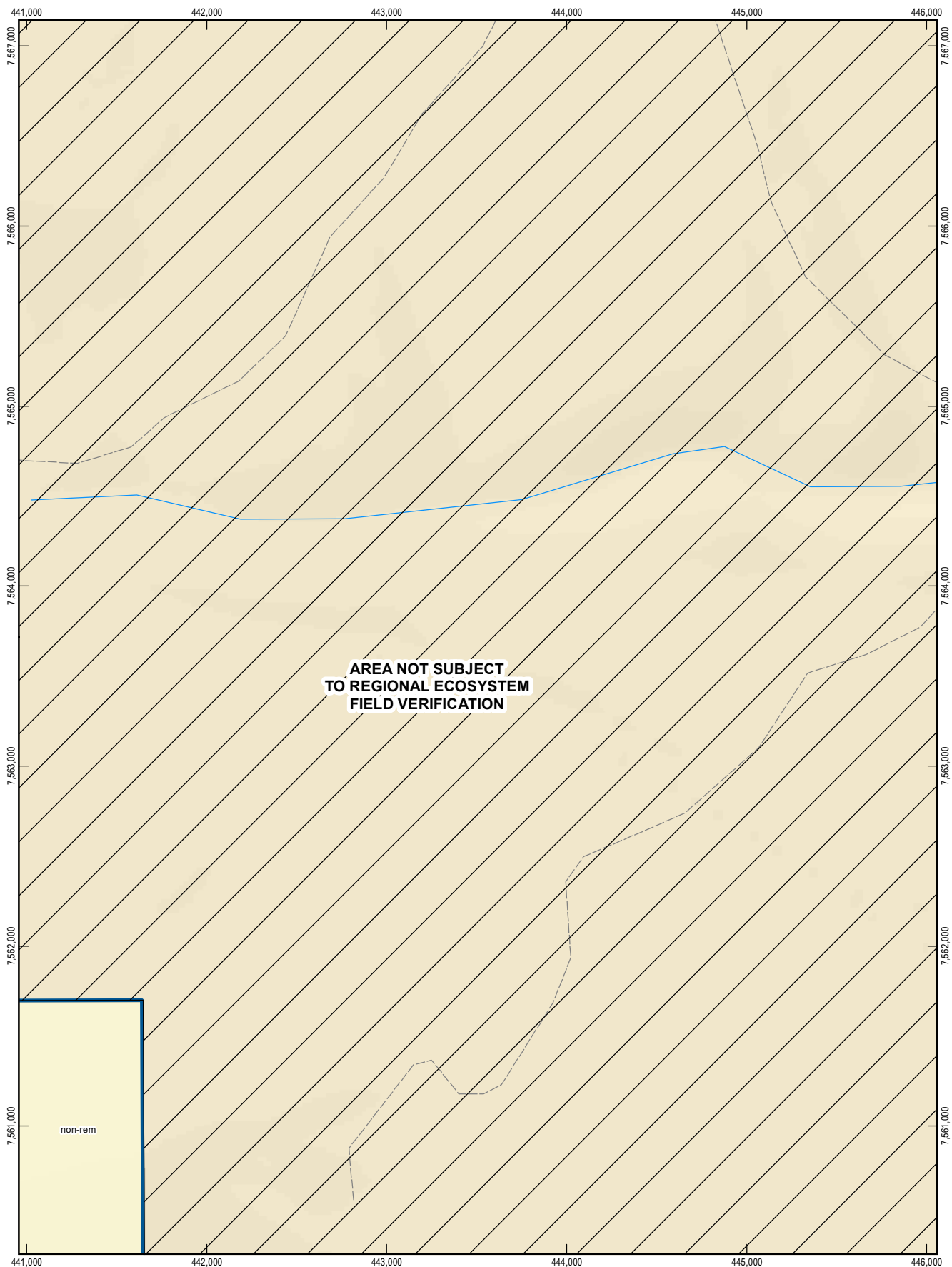
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LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine Site
- Regional Ecosystems
 - Endangered - Dominant
 - Endangered - Sub-dominant
 - Of Concern - Dominant
 - Of Concern - Sub-dominant
 - Of Least Concern
 - Non-remnant

1:30,000 (at A4)
0 200 400 600 800 1,000
Metres
Map Projection: Universal Transverse Mercator
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Carmichael Coal Mine and Rail Project
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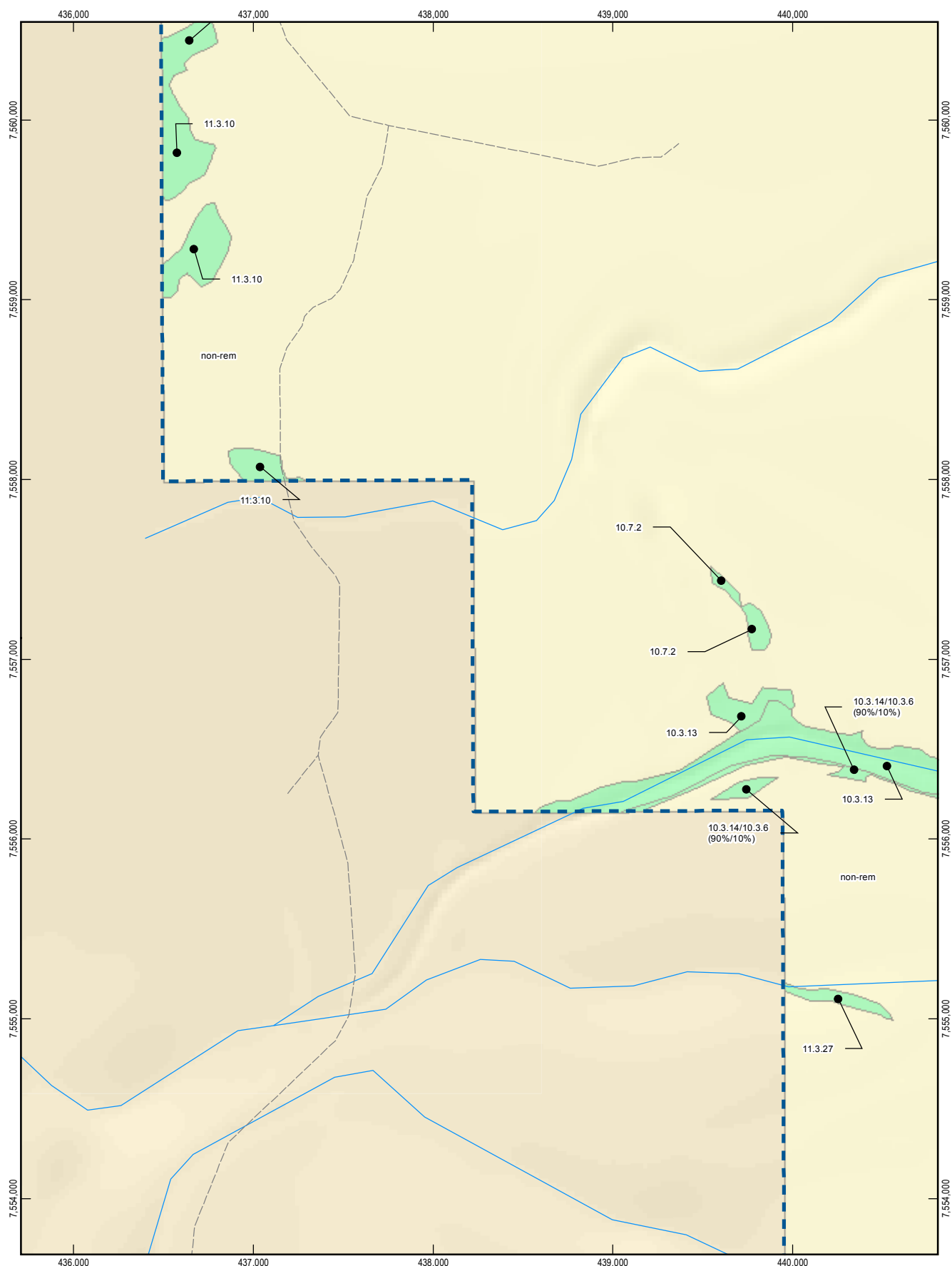
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Sheet 8 of 18

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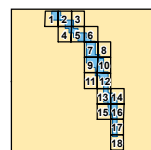
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LEGEND

- | | | |
|--------------|---------------|---------------------------|
| ○ Homestead | — Watercourse | Regional Ecosystems |
| — Local Road | ■ Mine Site | Endangered - Dominant |
| --- Track | | Endangered - Sub-dominant |
| | | Of Concern - Sub-dominant |
| | | Of Concern - Dominant |
| | | Of Least Concern |
| | | Non-remnant |



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Carmichael Coal Mine and Rail Project

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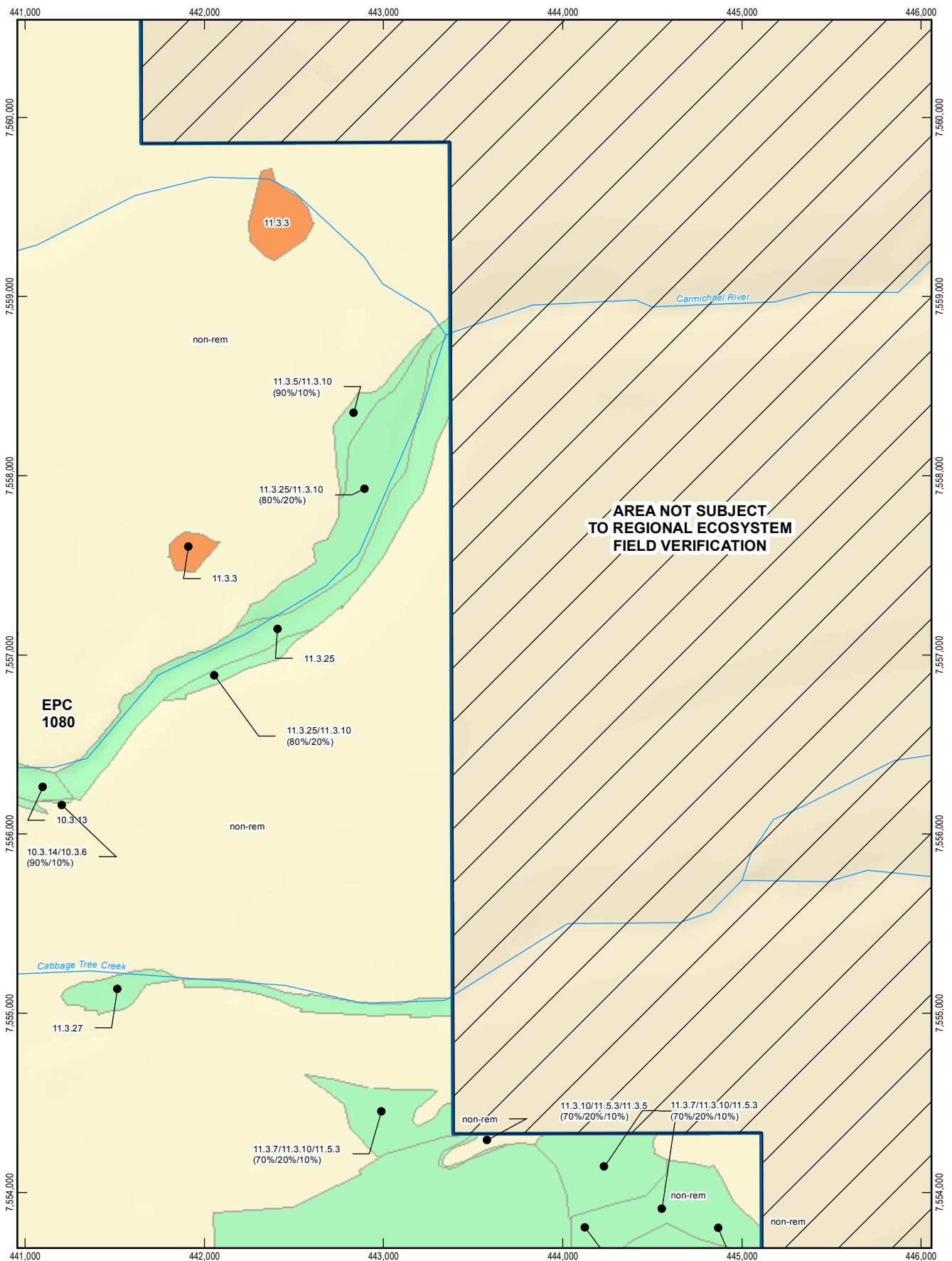
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Sheet 9 of 18

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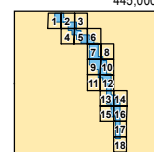
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LEGEND

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|--------------|---------------|-----------------------------|
| ○ Homestead | — Watercourse | Regional Ecosystems |
| — Local Road | ■ Mine Site | ✶ Endangered - Dominant |
| --- Track | | ✶ Endangered - Sub-dominant |
| | | ✶ Of Concern - Dominant |
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| | | ✶ Non-remnant |



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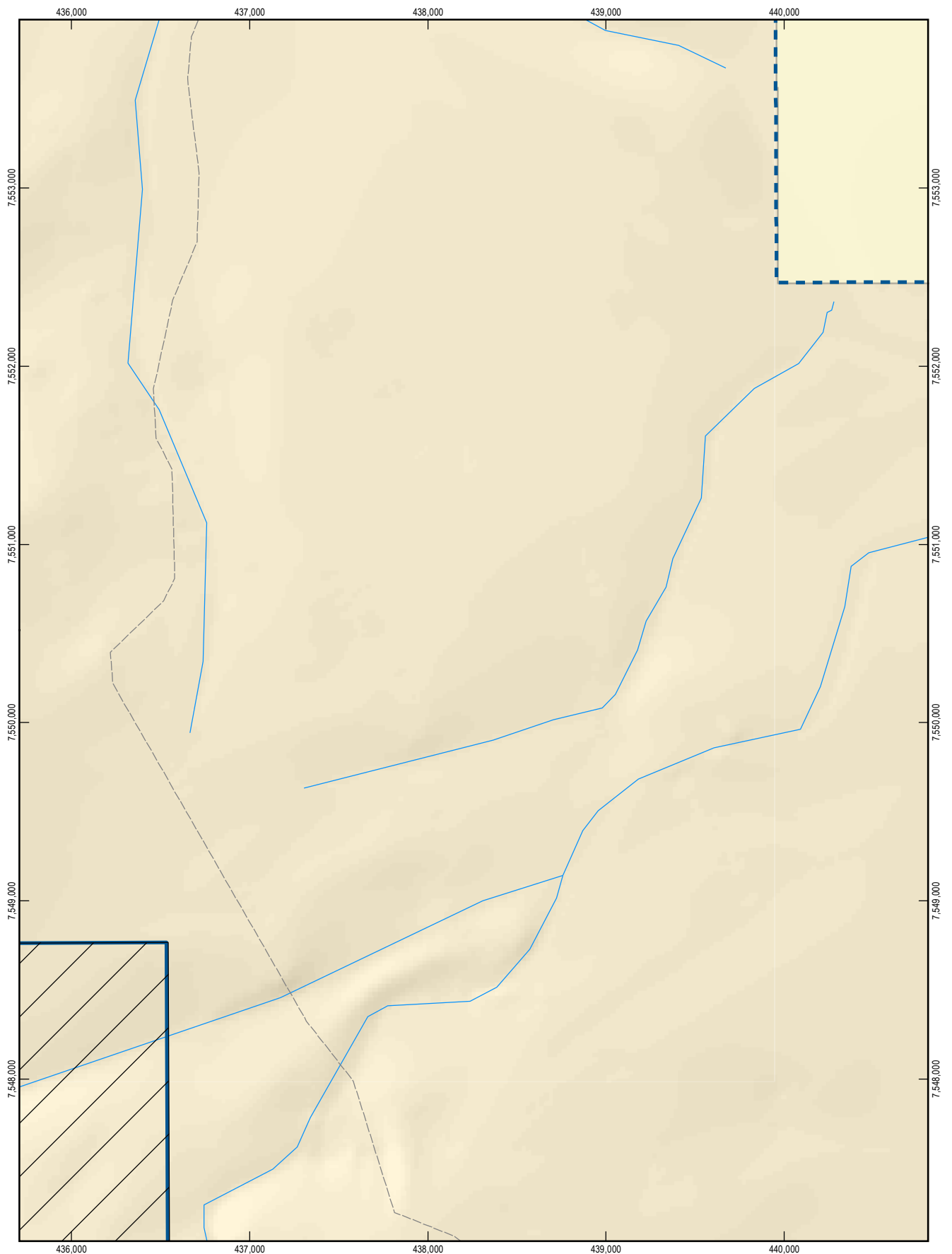
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Sheet 10 of 18

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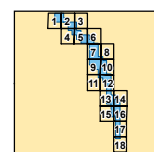
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LEGEND

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|--------------|---------------|-----------------------------|
| ○ Homestead | — Watercourse | Regional Ecosystems |
| — Local Road | ■ Mine Site | ✿ Endangered - Dominant |
| --- Track | | ✿ Endangered - Sub-dominant |
| | | ✿ Of Concern - Sub-dominant |
| | | ✿ Of Concern - Dominant |
| | | ✿ Of Least Concern |
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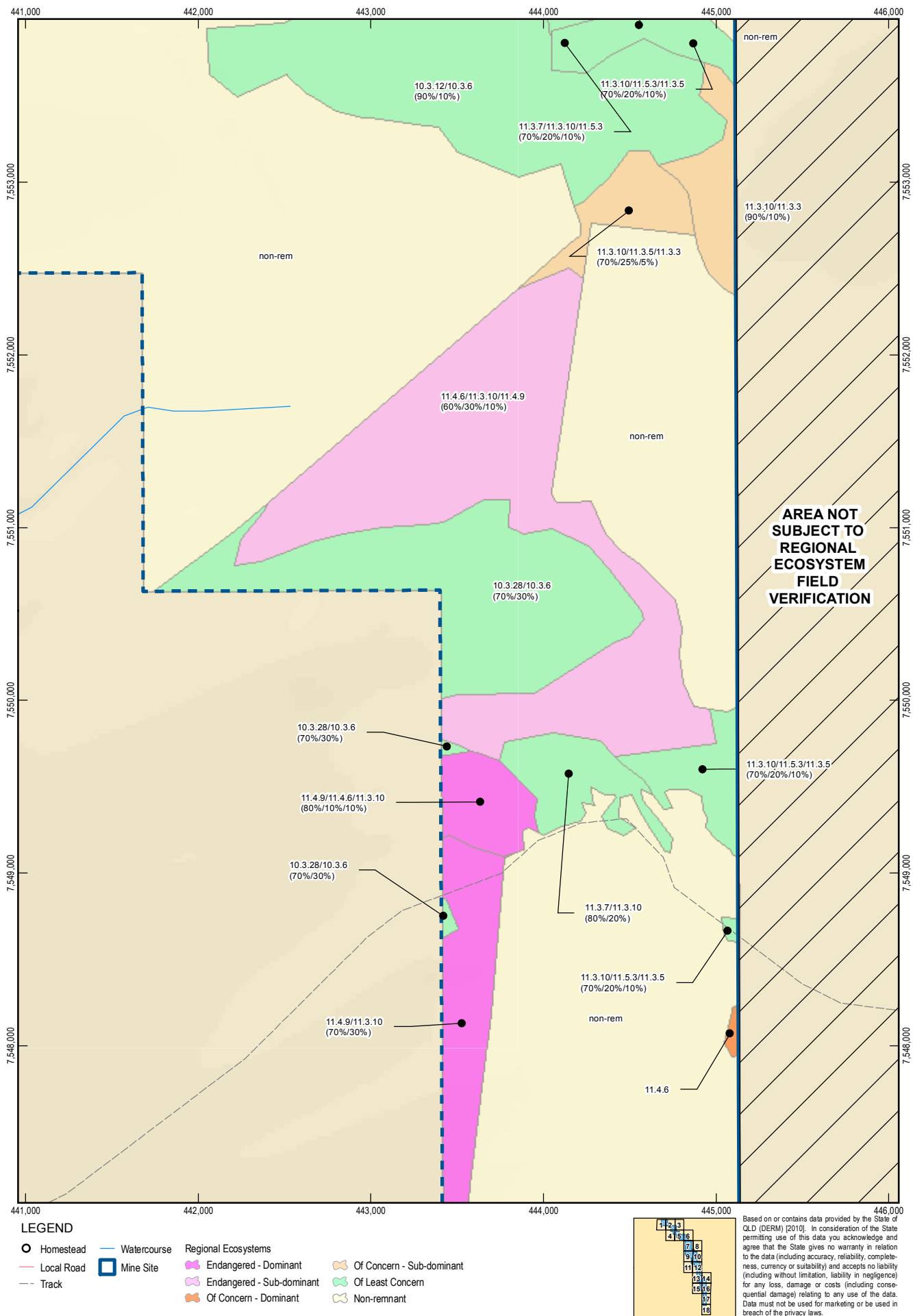
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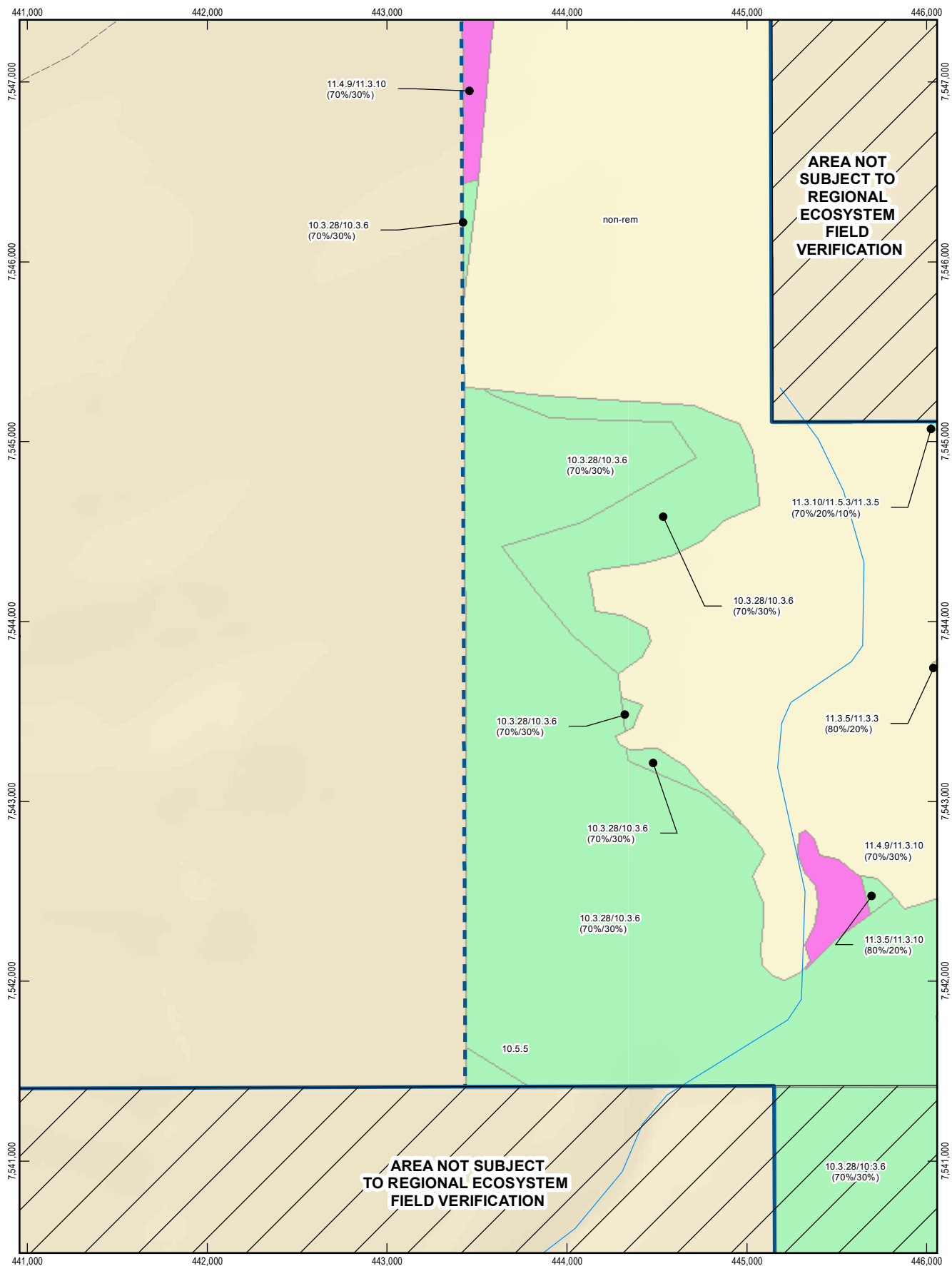
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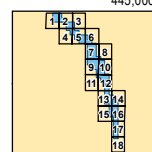
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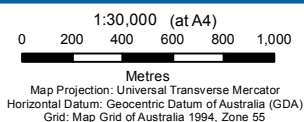


LEGEND

- Homestead
- Local Road
- Track
- Watercourse
- Mine Site
- Regional Ecosystems
 - Endangered - Dominant
 - Endangered - Sub-dominant
 - Of Concern - Dominant
 - Of Concern - Sub-dominant
 - Of Least Concern
 - Non-remnant



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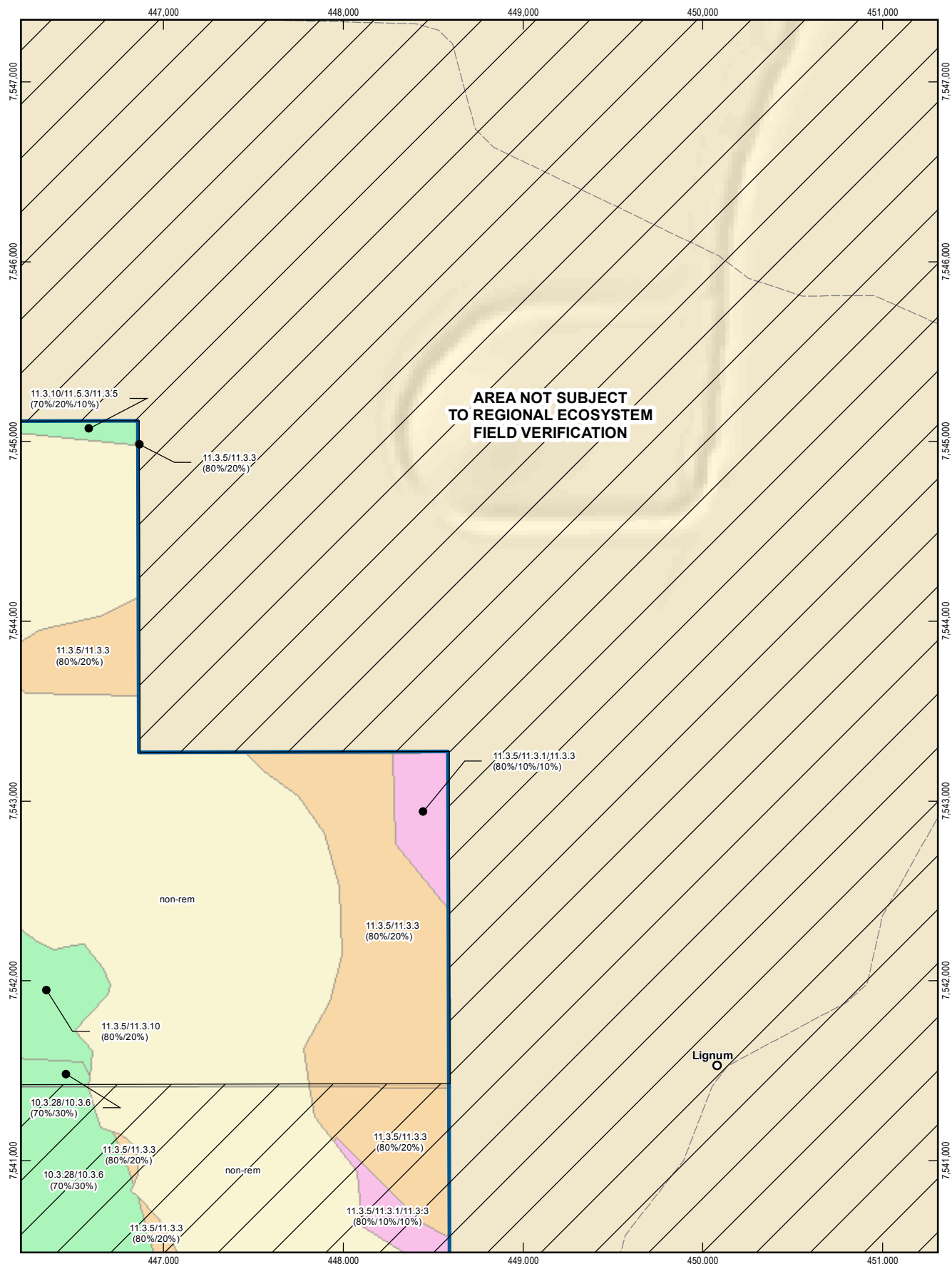
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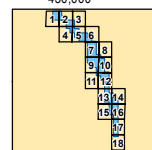
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LEGEND

- Homestead
- Local Road
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Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
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Regional Ecosystems
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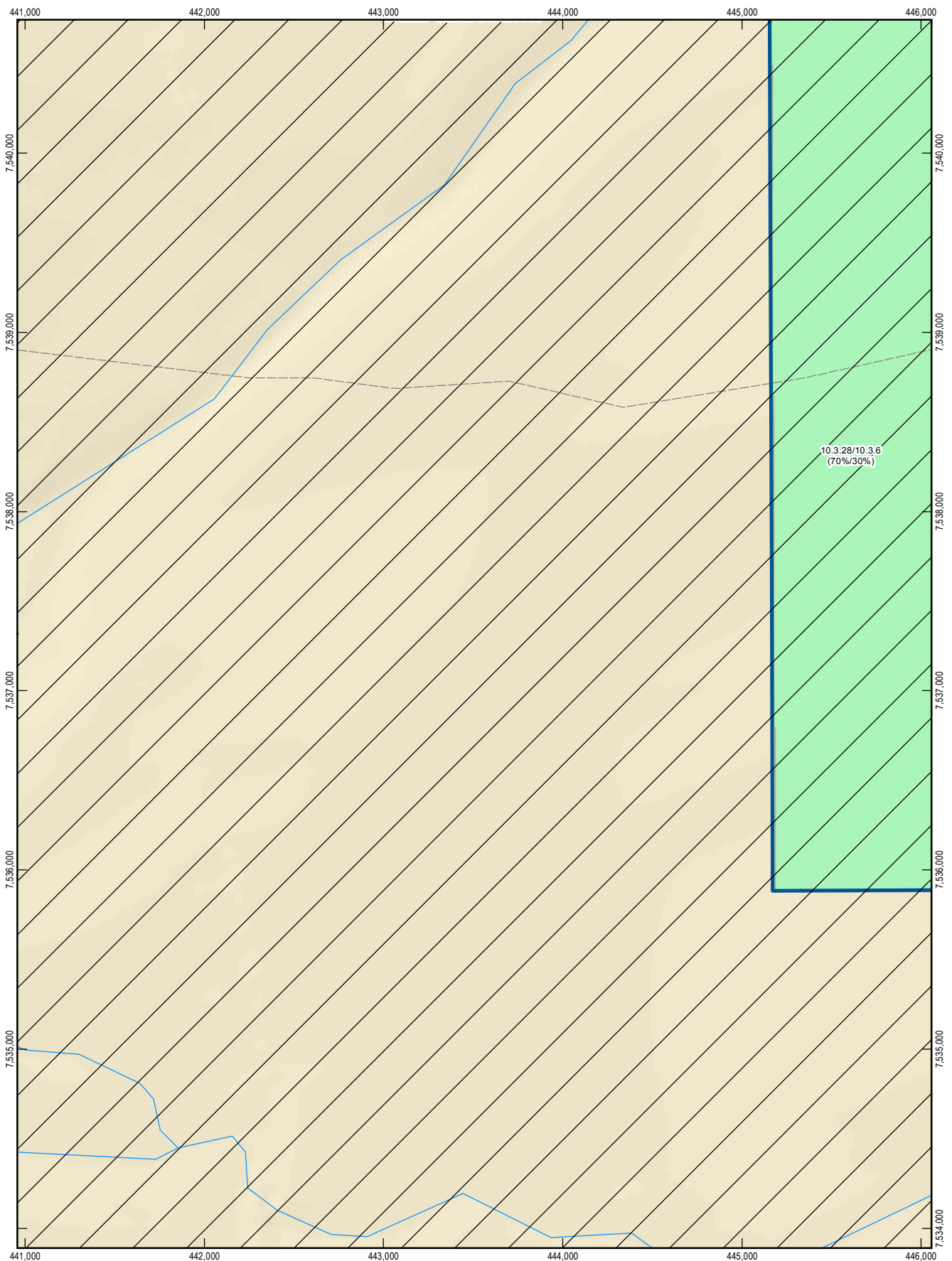
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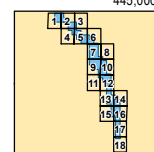
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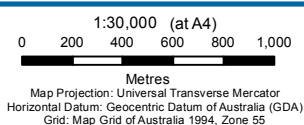


LEGEND

- | | | |
|--------------|---------------|---------------------------|
| ○ Homestead | — Watercourse | Regional Ecosystems |
| — Local Road | ■ Mine Site | Endangered - Dominant |
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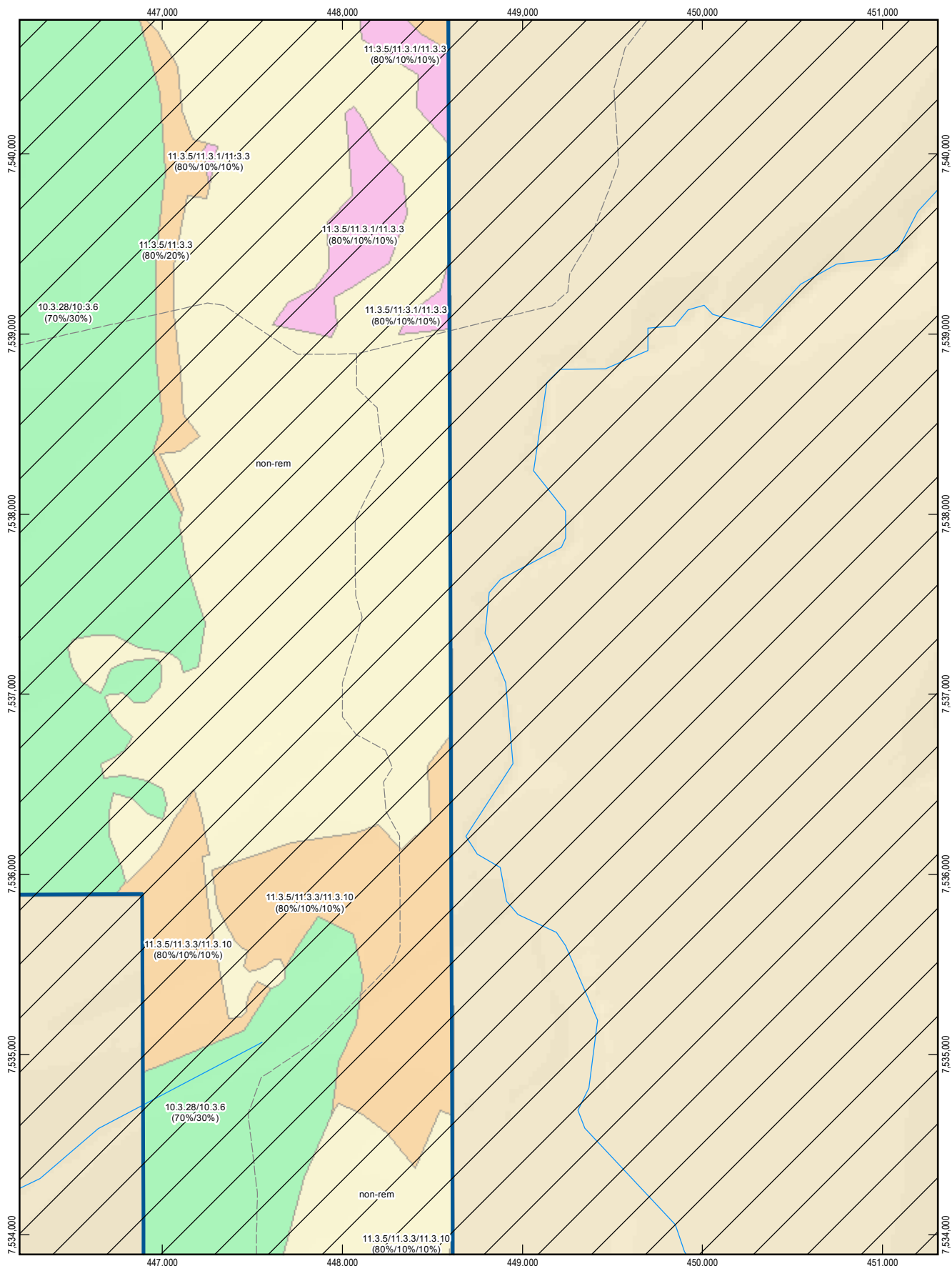
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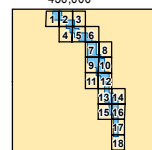
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LEGEND

- Homestead
- Local Road
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- Mine Site
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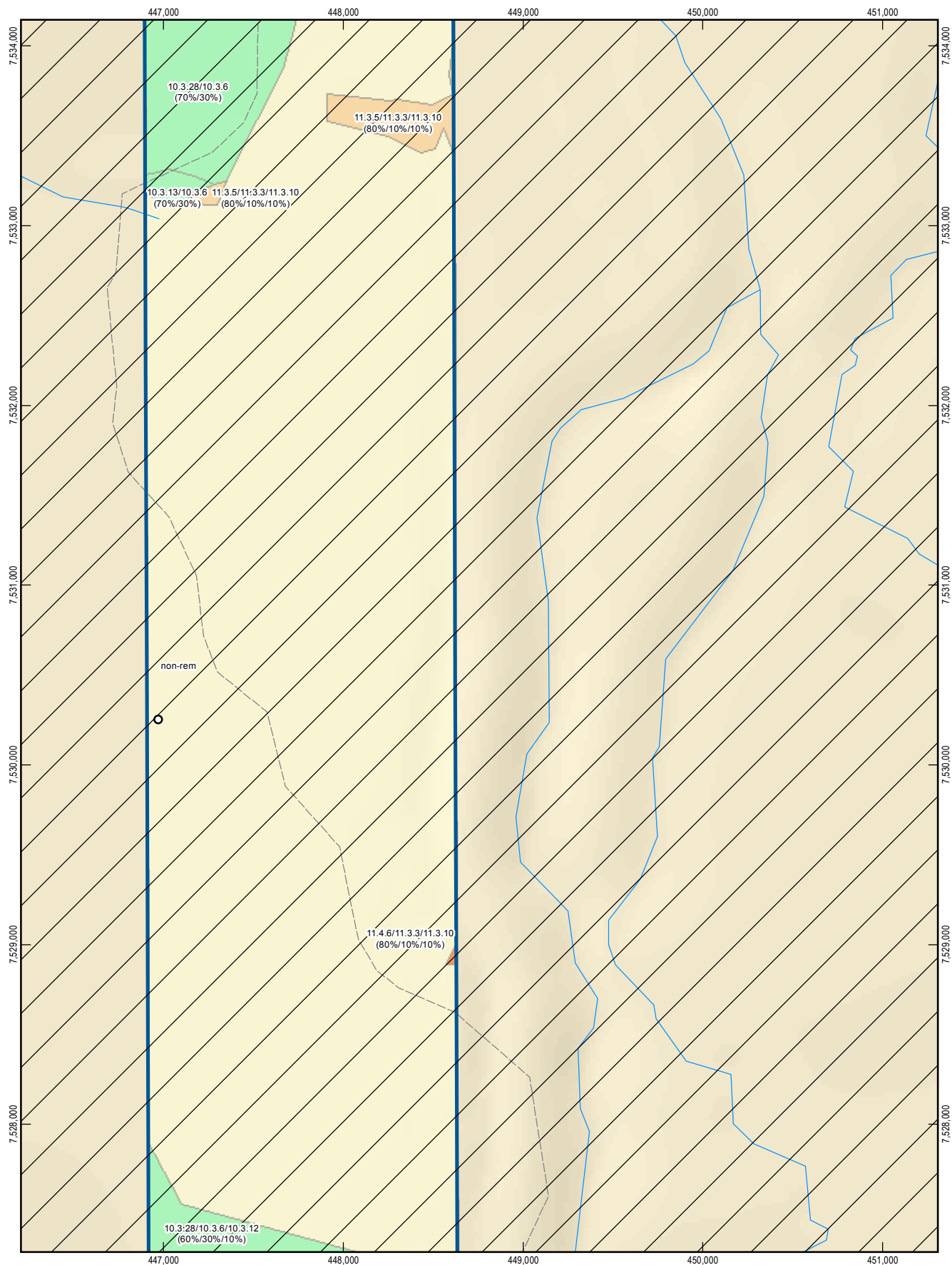
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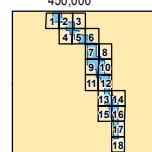
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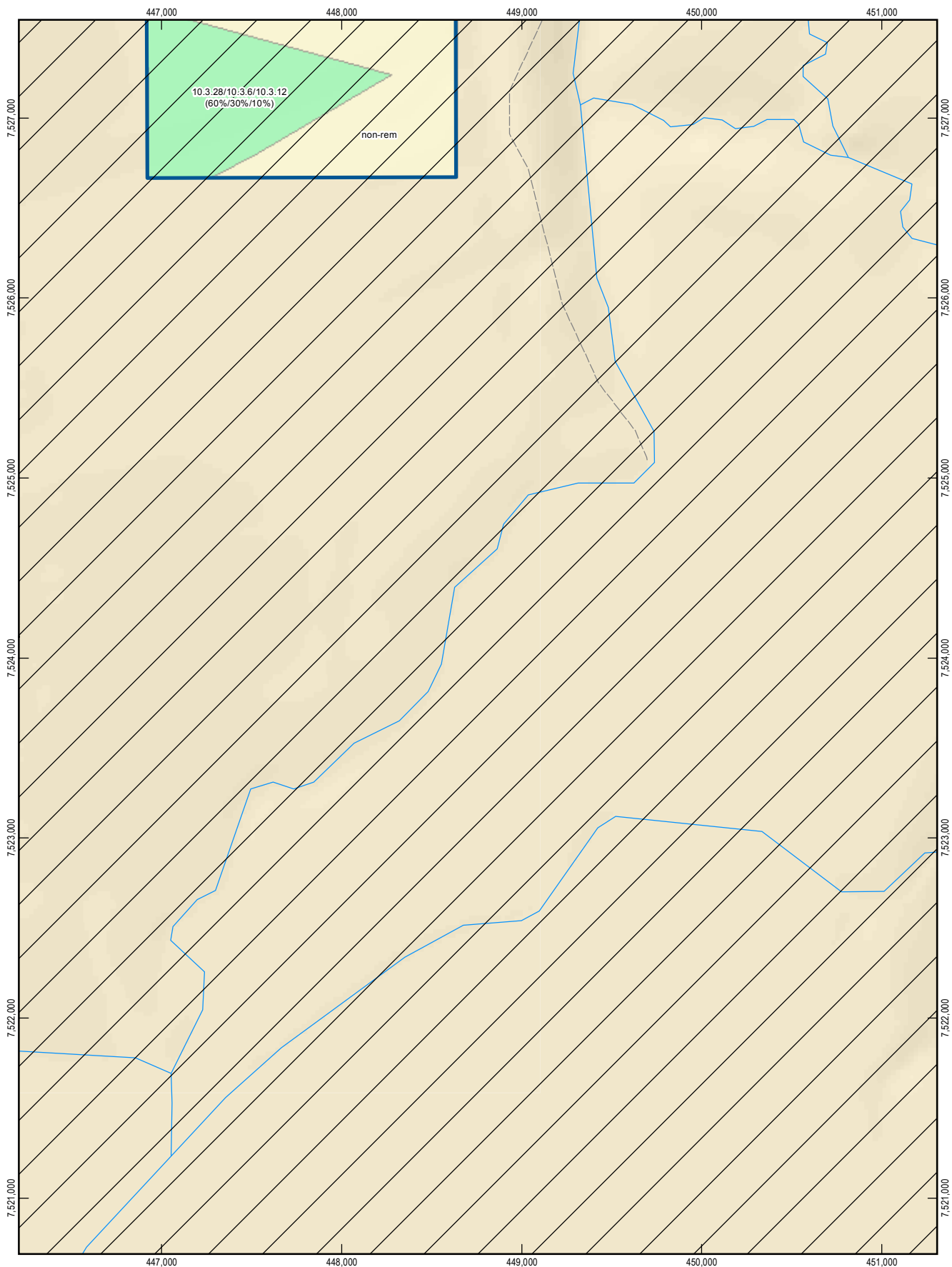
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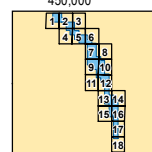
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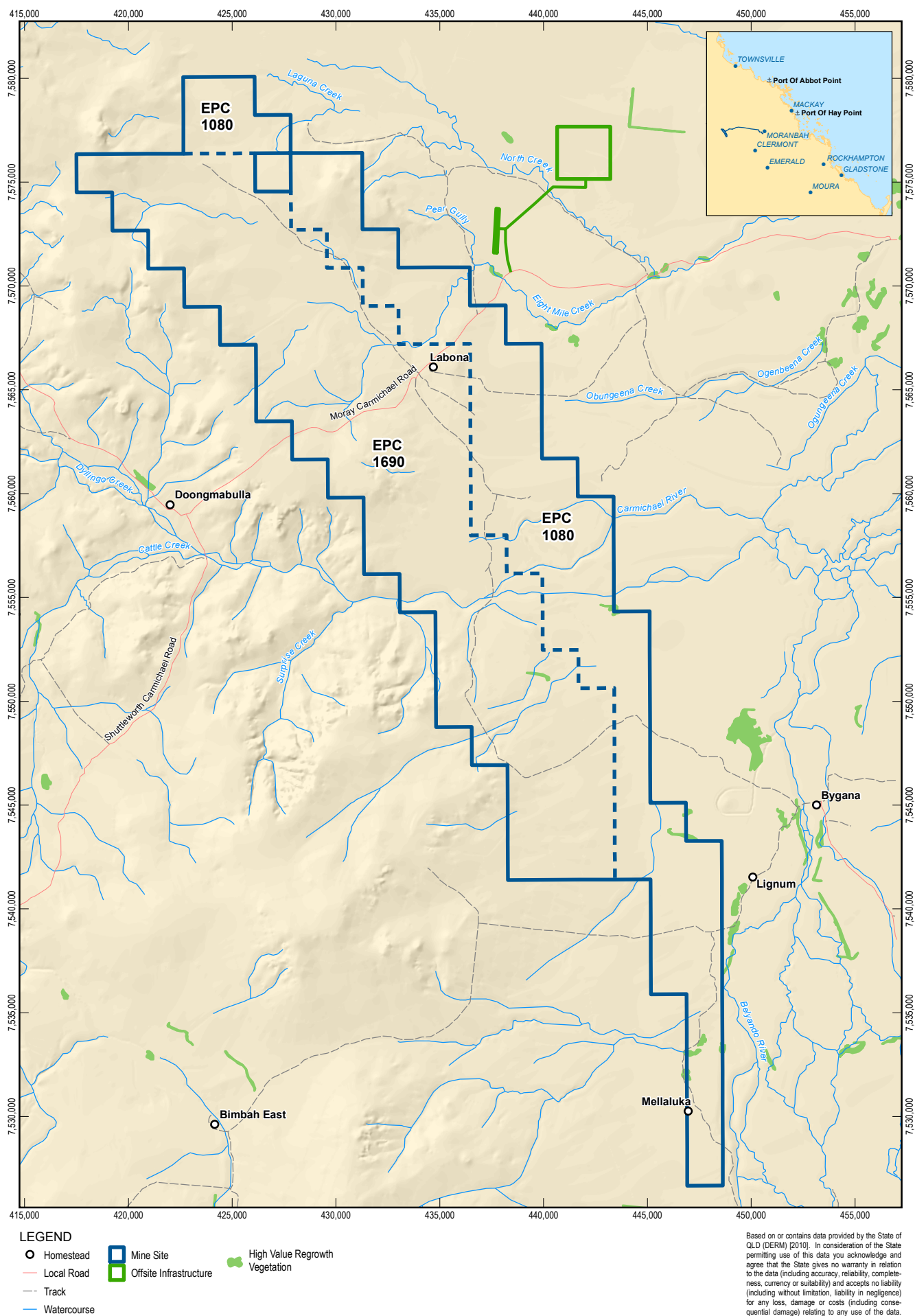
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Data Source: DME: EPC1690 (2010), EPC1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Homestead, Road, Watercourse (2007); GHD Field Verified Regional Ecosystems (2011). Created by: BW.



1:250,000 (at A4)
0 1 2 3 4 5
Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number 41-23244
Revision A
Date 18-01-2012

Regrowth Vegetation

Figure: 2-5

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Data Source: DERM: High Value Regrowth (2010), Elevation (2011); GHD: Airstrip, Village, Access Road (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Road, Homestead, Watercourse (2007);

DME: EPC1690 (2010), EPC1080 (2011). Created by: BW.



2.1.2 Vegetation Communities

Within the natural environment, vegetation occurs in climax communities, which are units displaying a consistent species composition and structure (canopy cover and height). Details of how vegetation communities are determined, associations made and vegetation alliances within the EPC 1080 Study Area is provided in Section 2.2.2 of the Mine Terrestrial Ecology Report

Seven broad vegetation communities (BVCs) have been developed based on the particular communities and land forms present for the Project Area (refer to Table 2.3 of the Mine Terrestrial Ecology Report). Vegetation present within the EPC 1080 Study Area of this report fit with the seven BVCs identified for the Project Area. Descriptions of the BVCs in association to this EPC 1080 Study Area are presented in Table 2-3, and mapped in Figure 2-6.



Table 2-3 Broad Vegetation Communities within the EPC 1080 Study Area (in order of area)

Community Name	REs	Landform ¹	Characteristic species ¹	Sites ²	Comments ³
Open grassland, previously cleared areas, lacking native vegetative cover	Non-remnant 11.4.11	Generally located on clay plains in lower catchment positions immediately to the north (and less so to the south) of the Carmichael River.	Buffel grass (<i>Cenchrus ciliaris</i>)	R19	Present over 13,893 ha, generally in the central and southern portions of the EPC 1080 Study Area. Areas are highly modified from land use practices and are subject to weed invasion. The area for offsite infrastructure is also dominated by this broad vegetation community.
Representative image 					
Ironbark-box grassy woodland and open woodland on grey sand plains	10.3.6 10.3.12 10.3.28 10.5.4 10.5.5 11.3.3 11.3.7 11.5.3 11.3.10	Level to gently undulating Tertiary sand plains, sometimes derived from alluvium (10.3.6, 10.3.28, 11.3.10). Soils are sands, sandy loams, and clay loams (the latter often duplex soils).	<i>Eucalyptus melanophloia</i> , <i>E. brownii</i> , <i>E. drepanophylla</i> , <i>Corymbia dallachiana</i> , <i>Melaleuca nervosa</i> , <i>Eremophila mitchellii</i> , <i>Acacia excelsa</i> , <i>A. sericophylla</i> , <i>Carissa ovata</i> , <i>Aristida latifolia</i> , <i>Aristida calycina</i> var. <i>praealta</i> , <i>Schizachyrium fragile</i> , <i>Eragrostis cumingii</i> .	R2, R3, R5, R6, R8, R9, R10, R11, R12, R15, R17, R18, R20, R21, R30, R31, R32, R34, R36, R39, R41, R42, R43, R47, R48	Present over 6,395 ha of the EPC 1080 Study Area and is the most common BVC (excluding cleared areas). Generally has good species diversity and is of relatively good condition



Community Name	REs	Landform ¹	Characteristic species ¹	Sites ²	Comments ³
Representative image					
Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains	10.3.3 10.3.4 10.4.3 10.4.5 11.3.1 11.3.5 11.4.5 11.4.6 11.4.9	Level to undulating Cainozoic clay plains, generally with heavy, cracking clay soils.	<i>Acacia cambagei</i> , <i>A. harpophylla</i> , <i>Eucalyptus cambageana</i> , <i>E. brownii</i> , <i>E. mitchellii</i> , <i>Flindersia dissosperma</i> , <i>Terminalia oblongata</i> , <i>C. ovata</i> , <i>Salsola kali</i> , <i>Sporobolus actinocladus</i> , <i>A. calycina</i> var. <i>calycina</i> , <i>Eragrostis speciosa</i> , <i>Eragrostis sororia</i> , <i>Enneapogon polyphyllus</i> , <i>Alloteropsis semialata</i> , <i>Leptochloa fusca</i> , <i>Chrysopogon fallax</i> , <i>Eriochloa pseudoacrotricha</i> , <i>H. contortus</i> .	R1, R4, R16, R23, R35, R37, R38, R40, R44, R45, R46	Present over 1,227 ha of the EPC 1080 Study Area, relatively large intact patches are present within the EPC 1080 Study Area. Generally, this BVC was in a relatively good condition however, grazing land use practices was evident in some areas. This BVC is susceptible to weed invasion. Small isolated mixed RE polygons representing this BVC are located within the areas for offsite infrastructure.
Representative image					



Community Name	REs	Landform ¹	Characteristic species ¹	Sites ²	Comments ³
Yellow jacket and rough-leaved bloodwood shrubby low open woodland on red sand plains	10.5.1 10.5.8	Level to gently undulating Tertiary sand plains, usually over deep red earths and sandy loams (10.5.1) but occasionally over paler sandy loams (10.5.8).	<i>Eucalyptus similis</i> , <i>Corymbia setosa</i> , <i>C. brachycarpa</i> , <i>C. dallachiana</i> , <i>Petalostigma banksii</i> , <i>Acacia leptostachya</i> , <i>Triodia pungens</i> , <i>Themeda triandra</i> , <i>A. latifolia</i> , <i>S. fragile</i> , <i>Panicum effusum</i> .	R13, R14	Present over 261 ha, within the northern portion of the EPC 1080 Study Area. Generally has high species diversity and is of good condition, however had been affected by recent low to medium intensity fire at time of survey.
Representative image					
Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding	10.3.13 10.3.14 11.3.25 11.3.27 11.3.37	Watercourse banks, meander plains and flood plains. Soils are sandy alluvium.	<i>Eucalyptus camaldulensis</i> , <i>Melaleuca leucadendra</i> , <i>E. coolabah</i> , <i>Corymbia tessellaris</i> , <i>Acacia salicina</i> , <i>Lomandra longifolia</i> , <i>Dichanthium sericeum</i> , <i>C. fallax</i> , <i>Bothriochloa pertusa</i> , <i>H. contortus</i> .	R22, R25, R26, R27, R28, R33	Present over 172 ha, primarily limited to the fringing vegetation along the Carmichael River and Cabbage Tree Creek. The presence of weeds was observed within this BVC. This BVC is also officially mapped along the Belyando River in the eastern extent of the areas for offsite infrastructure.



Community Name	REs	Landform ¹	Characteristic species ¹	Sites ²	Comments ³
Representative image					
Tall mixed shrubland on red sand plains and over ferricrete	10.7.7	Level to gently undulating Tertiary red sand plains, sometimes with ferricrete at shallow depth (10.7.7). Soils are red sands and orange/brown sandy loams.	<i>Acacia leptostachya</i> , <i>A. stipuligera</i> , <i>Melaleuca nervosa</i> , <i>Comesperma pallida</i> , <i>Platysace valida</i> , <i>Calytrix microcoma</i> , <i>Keraudrenia collina</i> , <i>Grevillea pteridifolia</i> , <i>E. melanophloia</i> , <i>C. dallachiana</i> , <i>Bursaria incana</i> , <i>Heteropogon contortus</i> , <i>A. latifolia</i> , <i>Eriachne aristidea</i> , <i>Fimbristylis squarrulosa</i> .	R7	Present over 44 ha within the north of the EPC 1080 Study Area. This BVC had been greatly affected by recent fires within the EPC 1080 Study Area. No weeds observed.
Representative image					
Low open woodland and woodland associated with laterised sandstone rises and minor pediments	10.7.2	Rolling rises with skeletal soils, generally with a laterite capping and often with an abundant covering of laterised pea-gravel.	<i>Eucalyptus persistens</i> , <i>Corymbia dallachiana</i> , <i>E. thozetiana</i> , <i>Acacia shirleyi</i> , <i>Melaleuca tamariscina</i> , <i>Grevillea pteridifolia</i> , <i>A. leptostachya</i> , <i>Triodia pungens</i> .	R29	Present over 4 ha, observed in one small location north of the Carmichael River. No weeds observed.



Community Name	REs	Landform ¹	Characteristic species ¹	Sites ²	Comments ³
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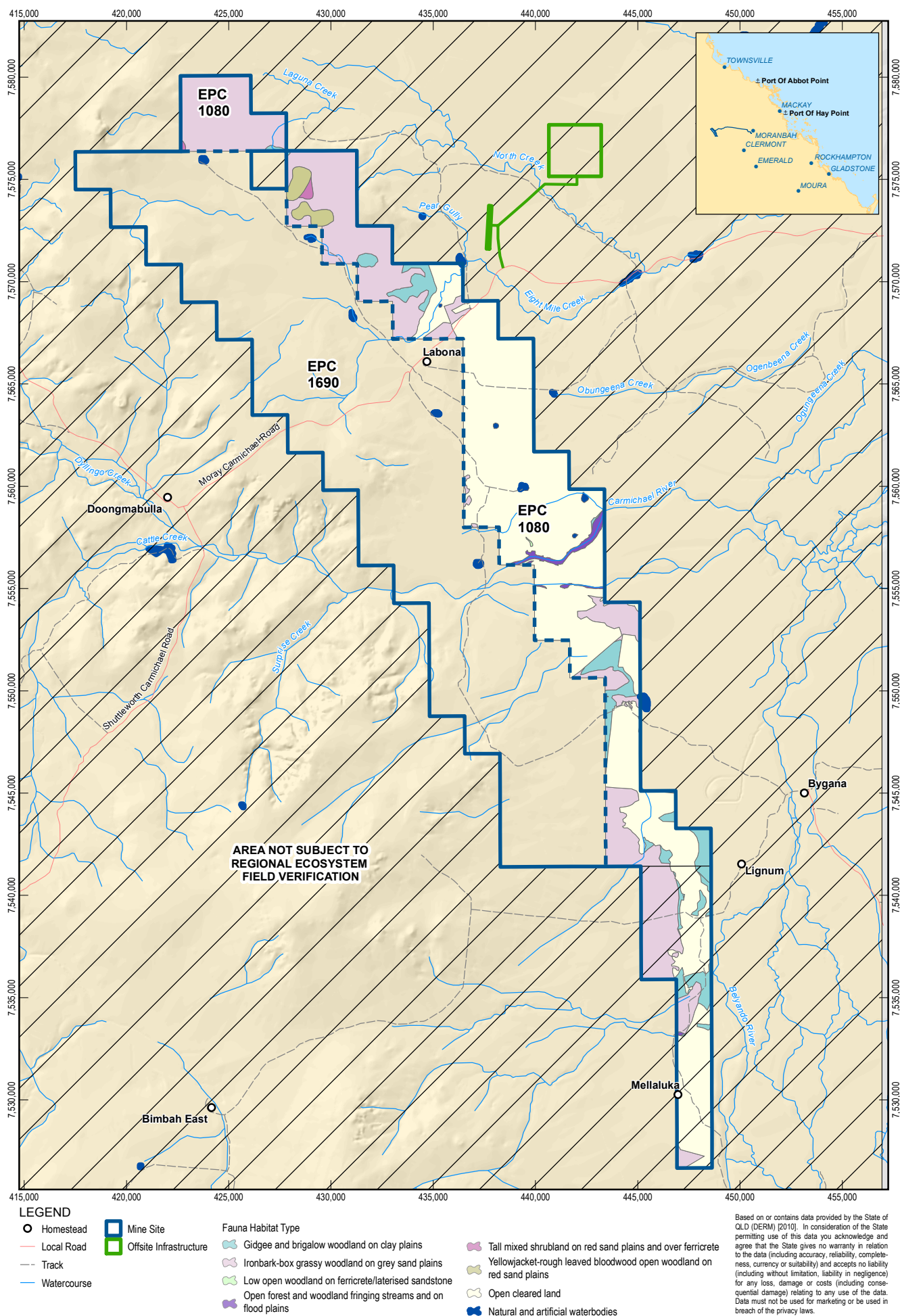
Representative image



¹ Land form description and characteristic species are as determined from Table 2-3 in the Mine Terrestrial Ecology Report, not all characteristic species were identified at sites within each BVC in the EPC 1080 Study Area.

² R sites indicate the rapid quaternary flora survey sites within EPC 1080. All sites in the EPC 1080 Study Area are mapped in Figure 1-2.

³ Area calculations relate to areas within the EPC 1080 Study Area only, including the offsite infrastructure..



Adani Mining Pty Ltd
 Carmichael Coal Mine and Rail Project
 Broad Vegetation Communities
 and Habitat Types

Job Number 41-23244
 Revision A
 Date 18-01-2012

Figure: 2-6



2.1.3 Groundwater Dependant Ecosystems

The groundwater dependant ecosystems identified within the EPC 1690 Study Area (refer to Section 2.2.3 of the Mine Terrestrial Ecology Report) are also applicable to the EPC 1080 Study Area.

An additional, groundwater dependent ecosystem of riverine fringing open forest and woodland is present along the Belyando River at and surrounding the location of the proposed Belyando River water extraction point as part of the offsite infrastructure for the Project (Mine) (Hyder, 2012).

From the rapid site inspection undertaken by Hyder Consulting, the canopy trees at this location comprise coolabah and river red gums, which are sparse to very sparsely distributed and are approximately 11-14 m tall. However, no melaleuca species were observed as present within this portion of the riparian zone (Hyder Consulting, 2012).

2.1.4 Flora Species Diversity

2.1.4.1 Desktop Results

Summarised results for the searches of relevant databases and relevant existing flora information for the EPC 1080 Study Area and surrounds is detailed within Section 2.2.3 of the Mine Terrestrial Ecology Report.

2.1.4.2 Field Survey Flora Diversity

Field surveys recorded 120 plant taxa, of which 110 were native (92 per cent) (see Appendix C). Overall, 41 plant families are represented in the EPC 1080 Study Area. The most species-rich plant families represented in the EPC 1080 Study Area at time of survey were:

- ▶ Myrtaceae (17 taxa)
- ▶ Poaceae (16 taxa)
- ▶ Mimosaceae (16 taxa)
- ▶ Asteraceae (7 taxa)

Field survey flora species diversity was reduced as a result of field survey limitations relating to survey period and site conditions as outlined in Section 1.4. Diversity of herbs, forb and grass species within the ground cover was low as a result of a lack of fertile material present for identification. Species diversity within the ground cover and shrub layers particularly within the northern half of the EPC 1080 Study Area were also reduced as a result of low to medium intensity fires that had recently burnt within the EPC 1080 Study Area.

The rapid site inspection undertaken by Hyder Consulting identified 23 common native flora species and nine introduced flora species. No threatened flora species were observed during this site inspection (Hyder Consulting, 2012). No further information on these species identified from the rapid site inspection is available.

2.1.5 Exotic or Weed Flora Species

A desktop review for weed and exotic flora species within the EPC 1080 Study Area and surrounding region is presented within Section 2.2.4 of the Mine Terrestrial Ecology Report.

During the Spring 2011 field surveys, 10 exotic introduced species were recorded, of which three species are 'declared plants' under the Queensland *Land Protection (Pest and Stock Route*



Management) Act 2002 (LP Act). The rapid site inspection undertaken by Hyder Consulting identified nine introduced flora species, of which two species are classified as ‘declared plants’.

The five species of ‘declared plants’ identified from field surveys are listed in Table 2-4. All species are also listed as Weeds of National Significance (WONS).

Table 2-4 Queensland Declared Plants Recorded Within the EPC 1080 Study Area

Scientific Name	Common Name	EPC 1080 Study Area Distribution
Class 2		
<i>Cryptostegia grandiflora</i>	rubber vine	Fringing vegetation of the Carmichael River
<i>Parkinsonia aculeata</i>	parkinsonia	Recorded near offsite infrastructure dam storage on Obungeena Creek
<i>Parthenium hysterophorus</i>	parthenium weed	Non-remnant areas, brigalow, box woodland and within the Carmichael River, generally a sparse distribution
<i>Opuntia stricta</i>	prickly pear	Multiple locations within offsite infrastructure and adjacent to water storages
<i>Opuntia tomentosa</i>	velvety tree pear	Brigalow patches

2.2 Terrestrial Fauna

2.2.1 Fauna Habitats

Six broad fauna habitat types were described across the EPC 1080 Study Area. The general characteristics of these broad habitat types are summarised in Table 2-5 and discussed further below. The spatial distribution of fauna habitats at the EPC 1080 Study Area is presented in Figure 2-6. Two additional vegetation communities were recorded within the EPC 1080 Study Area; however, they have been omitted as broad habitat types due to their limited coverage and distribution throughout the EPC 1080 Study Area.

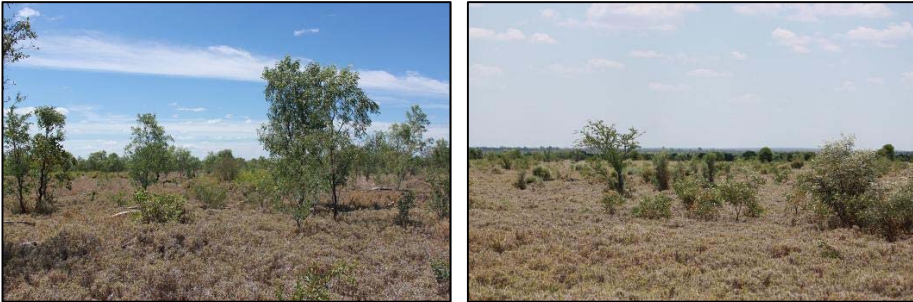
Table 2-5 Fauna Habitat Types in EPC 1080 Study Area

Broad Habitat Type	General Characteristics	Representative Photos
Ironbark-box grassy woodlands and open woodlands on grey sand plains 'Ironbark-box woodland'	Most widespread fauna habitat type at EPC 1080 Study Area This habitat type is mapped as part of a mixed vegetation community (in conjunction with the gidgee or brigalow shrubby woodland) within the offsite infrastructure Typically comprised sparse canopy layer, sparse to absent shrub layer and ground layer of native (less often introduced) grasses Some local variation within habitat type Forage resources for folivorous mammals, nectarivorous mammals and birds, granivores, insectivorous mammals, reptiles and birds, and grazing mammals Predators including birds of prey, snakes and dingos Shelter resources include occasional hollows in mature eucalypts (density dependent on age of woodland and tree species), log piles, dense ground cover Ephemeral waterways and drainage lines often associated with habitat type – permanent water present occasionally in form of farm dams and troughs	 Photos taken at EPC 1080 Study Area during November survey 2011

Broad Habitat Type	General Characteristics	Representative Photos
Yellow jacket and rough leaved bloodwood shrubby low open woodland on red sand plains 'Shrubby low woodland'	More prevalent in western part of EPC 1080 Study Area Habitat characteristics similar to ironbark-box woodland habitat, however occasionally denser shrub layer, and different suite of native grasses	
Photos taken at EPC 1080 Study Area during November survey 2011		
Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains 'Gidgee / brigalow shrubland'	This fauna habitat type is present in a number of patches in the northern, central and southern extents of EPC 1080 Mapped as part of a mixed vegetation community (in conjunction with ironbark-box grassy woodland) within the offsite infrastructure Sparse to dense canopy layer Typically sparse shrub layer, with understory of native (less often introduced) grasses Forage resources for nectarivorous mammals and birds, granivores and insectivores Predators including birds of prey, snakes and dingos Shelter resources including log piles and shed bark, defoliating bark and cracking soils; few hollows Gilgais often associated with this habitat type – seasonal water source and localised habitat node	
Photos taken at EPC 1080 Study Area during November survey 2011		



Broad Habitat Type	General Characteristics	Representative Photos
Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding 'Fringing open forest / woodland'	Restricted to riparian zone and adjacent floodplain of Carmichael River and nearby Cabbage Tree Creek within EPC 1080 Mapped as part of a mixed vegetation community (in conjunction with the gidgee or brigalow shrubby woodland) present at a proposed water pump station associated with the eastern extent of the offsite water infrastructure Moderate to dense canopy layer Shrub layer generally lacking Dense ground cover of grasses (<i>Lomandra</i> in riparian zone) and occasionally weeds Sandy substrate Forage resources for folivorous mammals, nectarivorous mammals and birds, granivores, insectivorous mammals, reptiles and birds, and grazing mammals Predators including birds of prey, snakes and dingos Mature <i>Eucalyptus camaldulensis</i> support relatively high density of hollows; Other shelter resources include log piles (flood debris), and in places, dense ground cover	 Photos taken at EPC 1080 Study Area during November survey 2011

Broad Habitat Type	General Characteristics	Representative Photos
Open grassland, previously cleared areas lacking native vegetative cover 'Open cleared land'	Large patch of cleared land occurs in central part of EPC 1080 Study Area (north of Carmichael River), with several smaller patches south of the Carmichael River Typically dominated by introduced buffel grass (<i>Cenchrus ciliaris</i>) Forage resources limited, although habitat supports some granivores and insectivores, and grazing mammals Predators including birds of prey, snakes and dingos Shelter resources limited, although log piles resultant from historic clearing likely to shelter grassland reptile species	 Photos taken at EPC 1080 Study Area during November survey 2011
Natural and artificial water bodies 'Natural and artificial water bodies'	Natural waterways include Carmichael River, Cabbage Tree Creek and gilgais Artificial water bodies include numerous small to large farm dams Water bodies (and adjacent vegetation) provide drinking resource for numerous animal species and breeding habitat for some (i.e. amphibians, some birds) Provide foraging habitat for water birds and wading birds Provide foraging habitat for predatory species including some birds of prey and some snakes	 Photos taken at EPC 1080 Study Area during November survey 2011



2.2.1.1 Summary of Fauna Habitats within EPC 1080 Study Area

Fauna habitats in the EPC 1080 Study Area were comparable with those identified in Section 2.3.1 (*Summary of Fauna Habitat Values within Study Area*) of the Mine Terrestrial Ecology Report. Similarly, with the exception of cleared areas, fauna habitats were subject to limited disturbance and retained habitat features for various species (as summarised in Table 2-5). In general, the prevalence of weeds, introduced animals and disturbances associated with cattle (i.e. loss of vegetative cover, compaction of ground, degradation of riparian areas and waterways) was observed to be relatively low. The level of disturbance observed was relatively higher in some localised areas, particularly in the vicinity of cattle water points. Habitats characterised by remnant vegetation retained connectivity across much of the EPC 1080 Study Area (and beyond).

Cleared land dominates the central part of the EPC 1080 Study Area, particularly the area between Cabbage Tree Creek (south of the Carmichael River) north to Moray-Carmichael Road) and the proposed area designated for offsite infrastructure. A large area of cleared land interspersed with patches of remnant vegetation also extends north-south along the south eastern extent of the EPC 1080 Study Area. Habitat values for native fauna are limited in areas of cleared land due to the lack of suitable microhabitats and the prevalence of buffel grass.

At the time of undertaking the field investigations, a significant area north of the Moray-Carmichael Road had been recently burnt, with some areas still smouldering. The fires had passed through areas of both remnant and non-remnant vegetation removing the ground layer of vegetation and woody debris. The reduced ground complexity in habitats that had been subject to burning would provide limited habitat for native fauna due also to the lack of microhabitats. Although habitat values in these areas were reduced at the time of assessment, ground complexity will increase in the following months as these areas recover.

DEHP certified RE mapping (version 6.1) in combination with the assignment of BVCs guided the assessment of fauna habitats within the proposed footprint of the offsite infrastructure and in the southernmost extent of the EPC 1080 Study Area in areas where field investigations had not been undertaken. In general, the southernmost extent of the EPC 1080 Study Area is comprised of both larger patches of remnant vegetation (predominantly ironbark-box woodlands), and large areas of cleared land. The offsite infrastructure is generally comprised of large areas of cleared land with small pockets of remnant vegetation (predominantly gidgee and/or brigalow shrubby woodland and ironbark-box woodlands).

Further discussion on fauna habitat values is provided in Section 2.3.1 (*Summary of Fauna Habitat Values within Study Area*) of the Mine Terrestrial Ecology Report.

2.2.1.2 Fauna Habitat Values beyond EPC 1080 Study Area including Connectivity

A review of DEHP RE Mapping (Version 6.1) indicates that the EPC 1080 Study Area contains large areas of both remnant and non-remnant vegetation. Large tracts of remnant vegetation occur in parts of the EPC 1080 Study Area north of Moray-Carmichael Road; this vegetation continues uninterrupted north for several kilometres. The sections of the EPC 1080 Study Area south of the Carmichael River do not possess similar large broadscale connectivity as the vegetation in the north. These sections do, however, lie on the eastern border of a large corridor of vegetation that extends several kilometres south.



Within the EPC 1080 Study Area itself, limited north-south connectivity exists due to the large areas of cleared land that occur from Cabbage Tree Creek and Moray-Carmichael Road. Smaller east-west vegetation corridors exist along the Carmichael River which links through to remnant vegetation along the Belyando River. East of the EPC 1080 Study Area, this corridor passes through a largely cleared landscape for approximately 15 km before it connects with floodplain vegetation associated with the Belyando River. In spite of the narrowness of this corridor in places, it has the potential to facilitate east-west movement between the Belyando River and the large tracts of remnant vegetation within, and to the north, west and south of the EPC 1080 Study Area.

Several areas south of Cabbage Tree Creek also facilitate east-west connectivity, one of these being the Bygana West Nature Refuge. The Bygana West Nature Refuge provides east-west connectivity (although slightly fragmented), linking large areas of remnant vegetation in the west to areas of vegetation associated with the Belyando River to the east.

2.2.1.3 Biodiversity Planning Assessment Mapping

The DEHP Biodiversity Planning Assessment (BPA) mapping for the Brigalow Belt and Desert Uplands bioregions was reviewed to provide an indication of the quality and value of remnant vegetation within and beyond the EPC 1080 Study Area. Specifically, three BPA mapping criteria were applied to the EPC 1080 Study Area and surrounding landscape, such that the potential habitat values within and beyond the EPC 1080 Study Area could be described.

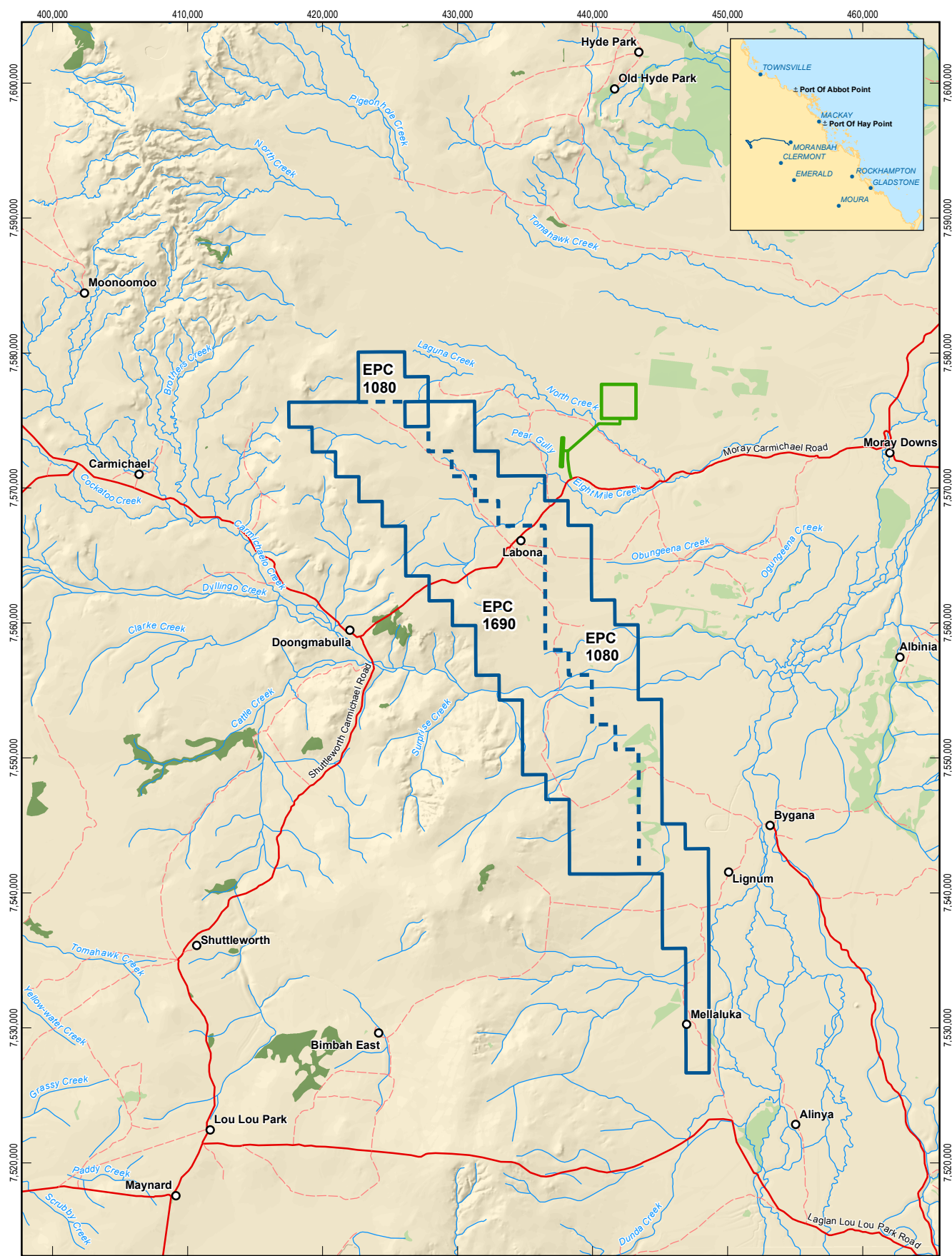
The criteria applied include:

- **Criteria B2 – Ecosystem value at regional scale.** This criterion categorises RE polygons according to the Biodiversity Status of the constituent REs (of that polygon), and their extent in Queensland's protected area estate (Queensland Environmental Protection Agency (EPA, now DEHP), 2002). The regional ecosystem value mapping layer was applied to the EPC 1080 Study Area and adjacent landscape (Figure 2-7). As identified in Figure 2-7, a number of remnant vegetation patches mapped as 'high' regional significance occur in the southern section of the EPC 1080 Study Area, mainly corresponding with the Bygana West Nature Refuge and surrounds.
- **Criteria F – Ecosystem diversity.** This criterion describes habitat complexity, based on the number and size of ecosystems and wetlands present in an area (EPA, 2002). The concepts of 'richness' (number of different ecosystems) and 'evenness' (relative abundance of ecosystems) are considered when attributing an ecosystem diversity rating to a particular area (EPA, 2002). By way of example, areas with high ecosystem diversity typically have relatively many REs and ecotones (EPA, 2002). Simpson's Diversity Index is used to determine ecosystem diversity (EPA, 2002). RE polygons categorised as being of 'very high' or 'high' ecosystem diversity are presented in Figure 2-8. As depicted in Figure 2-8, much of the remnant vegetation at the EPC 1080 Study Area is categorised as having very high or high ecosystem diversity. Much of the landscape to the north, west and south of the EPC 1080 Study Area is similarly ranked as having very high or high ecosystem diversity. Remnant vegetation coverage is more fragmented within the offsite infrastructure and within the central parts of the EPC 1080 Study Area with many parts containing large extents of non-remnant vegetation. Therefore, REs considered to be of very high or high ecosystem diversity are more fragmented or absent at these locations. Throughout the southern extent of the EPC 1080 Study Area, remnant vegetation on the western border is generally identified as having high or very high ecosystem diversity. Remnant vegetation ranked as having very high or high ecosystem diversity does form an east-to-west linkage to the



Belyando River (east of the EPC 1080 Study Area) from the southern part of the EPC 1080 Study Area via the Bygana West Nature Refuge, Carmichael River, and Cabbage Tree Creek connecting areas west of the EPC 1080 Study Area that have extensive remnant vegetation coverage to the Belyando River. An additional patch of mapped very high ecosystem diversity is located north of Moray-Carmichael Road within of concern remnant vegetation that is associated with an ephemeral watercourse.

- Criteria G – Context and connection. This criterion is based upon the extent to which a mapped RE polygon incorporates or buffers other ecologically noteworthy areas (i.e. other remnant vegetation units and/or wetlands/waterways) (EPA, 2002). With respect to connection, remnant vegetation units that are connected to other REs are considered to be more representative of biodiversity, contribute more to a habitat network (i.e. connectivity) and exhibit greater resilience to disturbance (EPA, 2002). As shown in Figure 2-9, a number of areas within the EPC 1080 Study Area are mapped as ‘high’ or ‘very high’ with respect to context and connection value. Areas mapped as having very high context and connectivity values occur predominantly in the northernmost section of the EPC 1080 Study Area and in areas south of Cabbage Tree Creek. In the southern section of the EPC 1080 Study Area, two general areas are identified as having high and very high context and connection values; these areas are related to the Bygana West Nature Refuge and remnant vegetation associated with the Belyando River. Many of these areas within the EPC 1080 Study Area, mapped as high or very high value are adjoined to large patches of remnant vegetation that occur to the west or act as corridors between patches of remnant vegetation.



LEGEND

- Homestead
- Mine Site
- Minor Road
- Track
- Watercourse
- Offsite Infrastructure
- Biodiversity Planning Assessment - Criteria B2
- Ecosystem Value at Regional Level
- Very High
- High

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:400,000 (at A4)
0 2 4 6 8 10
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

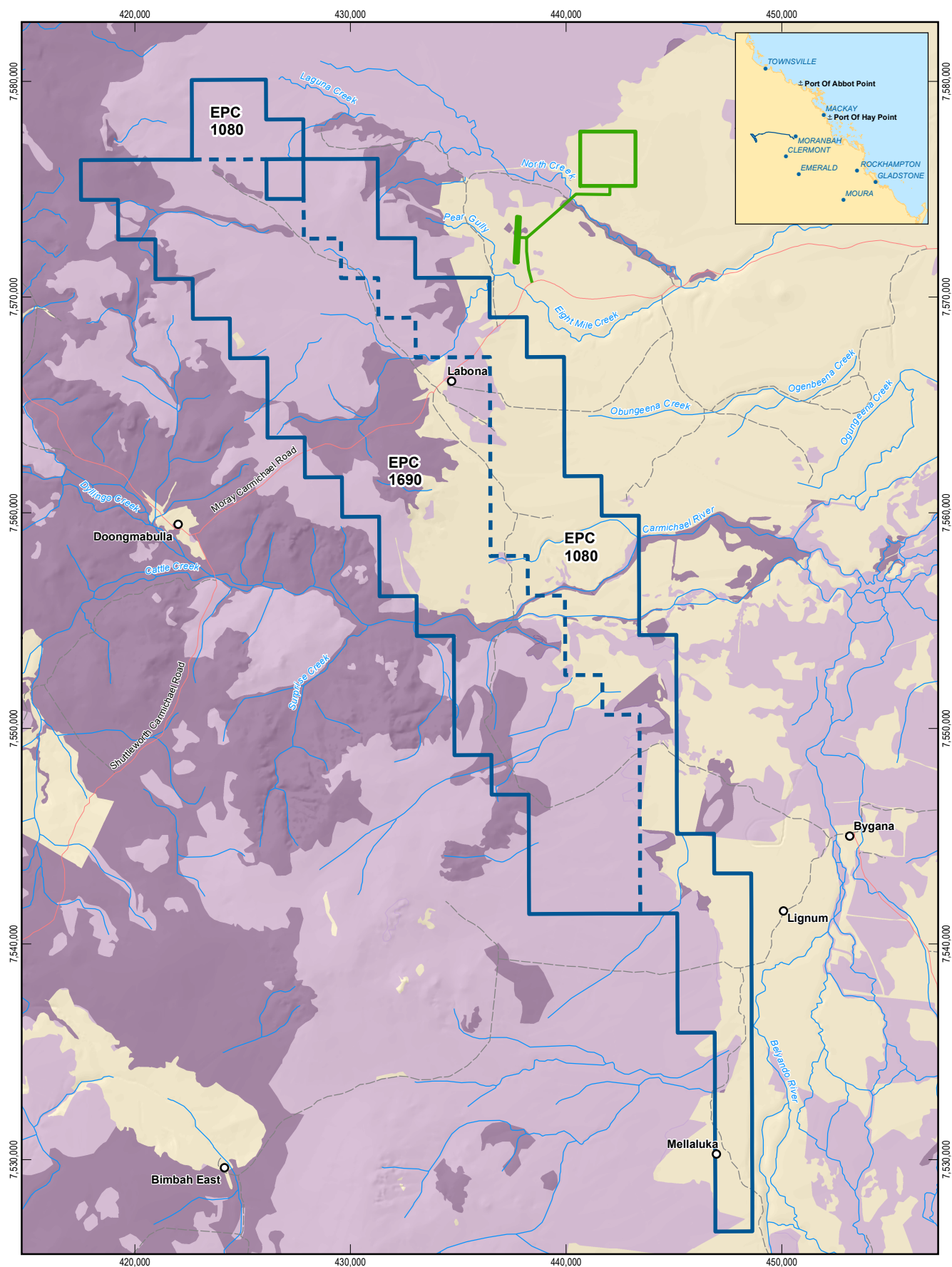


Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Biodiversity Planning Assessment
Ecosystem Value at Regional Level

Job Number 41-23244
Revision A
Date 18-01-2012

Figure: 2-7



LEGEND

- Homestead
- Mine Site
- Local Road
- Track
- Watercourse
- Offsite Infrastructure
- Biodiversity Planning Assessment - Criteria F
- Ecosystem Diversity
- Very High
- High

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1:250,000 (at A4)
0 2 4 6 8 10
Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55



Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Biodiversity Planning Assessment
Ecosystem Diversity

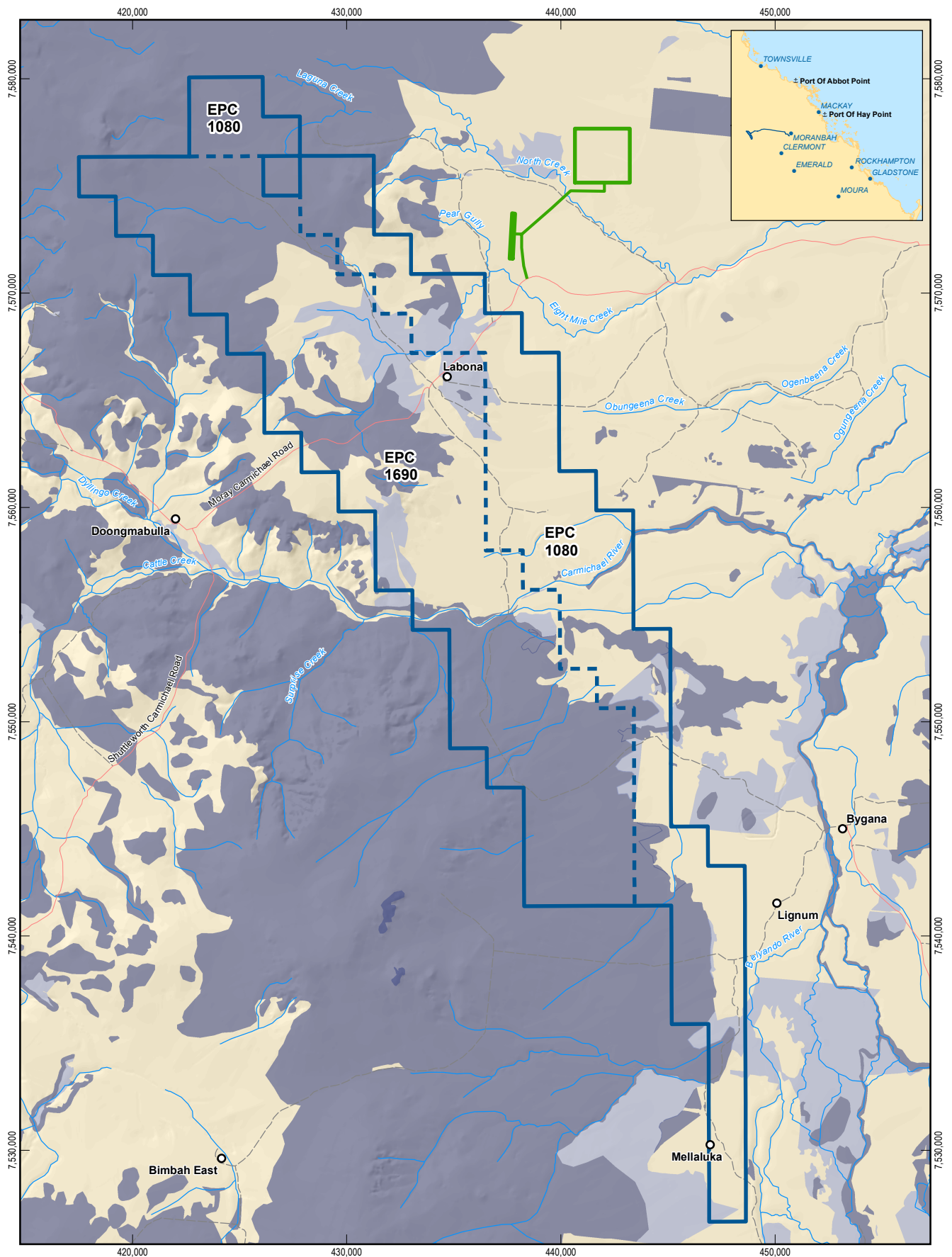
Job Number 41-23244
Revision A
Date 18-01-2012

Figure: 2-8

G:\41\23244\GIS\Maps\IMXD\400_Ecology\41-23244_476_rev_a.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

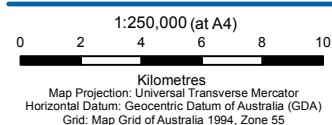
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Data Source: GHD: Airstrip, Village, Access Road (2011); DERM: Biodiversity Planning Assessment (2010), Elevation (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Road, Homestead, Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011). Created by: BW.



LEGEND

- Homestead
- Mine Site
- Offsite Infrastructure
- Local Road
- Track
- Watercourse
- Biodiversity Planning Assessment - Criteria G
- Context and Connection
- Very High
- High

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Biodiversity Planning Assessment
Context and Connection

Job Number | 41-23244
Revision | A
Date | 18-01-2012

Figure: 2-9



2.2.2 Fauna Species – Field Assessment Summary

Table 2-6 provides a summary of the results of the field survey across the EPC 1080 Study Area. The terrestrial fauna field survey results, including site specific species lists and the total species list are provided in 0.

Table 2-6 Summary of Field Assessment Results

		Amphibians	Reptiles	Mammals	Birds	Total
Spring 2011 survey (November 2011)	Total Species	5	21	24	121	171
	Introduced Species	1	-	5	1	7
	Threatened Species	-	-	1	4	5
	EPBC Act Migratory	-	-	-	3	3
	EPBC Act Marine	-	-	-	17	17

An additional 29 species were recorded in the EPC 1080 Study Area that had not previously been detected on ecological surveys of the area immediately west of the EPC 1080 Study Area (i.e. at EPC 1690 Study Area). The additional species were comprised of seven reptile, two mammals, and 20 bird species. Two of these additional species are of conservation significance. The koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) is listed as vulnerable under the EPBC Act and as special least concern under the NC Act. The cotton pygmy-goose (*Nettapus coromandelianus*) is of State significance, listed under the NC Act as near threatened. No additional species of regional significance were recorded. One additional introduced species was detected – the spotted turtle-dove (*Streptopelia chinensis*).

2.2.2.1 Amphibians

Five species from three families were recorded from the EPC 1080 Study Area during field investigations. No species of Commonwealth, State, or regional significance were detected. One introduced species, cane toad (*Rhinella marina*), was recorded.

Amphibian diversity was relatively low, dominated by common tree frogs (genus *Litoria*) from the family Hylidae. Species diversity was typically higher in those habitats near water bodies (i.e. Carmichael River and ephemeral waterways). The most abundant species were the cane toad, ornate burrowing frog (*Platypsectrum ornatum*) (Plate 2-1) and spotted grass frog (*Limnodynastes tasmaniensis*) (Plate 2-2).

Plate 2-1 Ornate burrowing frog
(*Platyplectrum ornatum*) (November 2011)

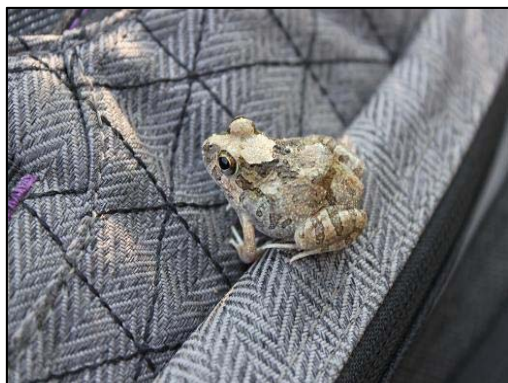


Plate 2-2 Spotted grass frog
(*Limnodynastes tasmaniensis*) (November 2011)



2.2.2.2 Reptiles

A total of 21 reptile species from seven families were recorded from the EPC 1080 Study Area during field investigations. No reptile species of Commonwealth, State, or regional significance were detected. Of note is the record of *Antaioserpens warro* (Plate 2-3) which was recorded well outside its known distribution. No introduced reptile species were recorded.

Skinks (family Scincidae) and geckos (family Gekkonidae) dominated the species diversity with five species recorded from each family. Of these families, the most abundant species recorded were the skink *Carlia pectoralis pectoralis*, and Bynoe's gecko (*Heteronotia binoei*). Dragons (family Agamidae), venomous snakes (family Elapidae), and monitors (Varanidae) were each represented by three species, including *Antaioserpens warro* (Plate 2-3), the nobbi dragon (*Amphibolurus nobbi*) (Plate 2-4), and freckled monitor (*Varanus tristis*) (Plate 2-5), respectively. Less frequently recorded species included flap-footed lizards (one species – Burton's legless lizard (*Lialis burtonis*)) and pythons (one species – black-headed python (*Aspidites melanocephalus*) (Plate 2-6).

Plate 2-3 *Antaioserpens warro* (November 2011)



Plate 2-4 Nobbi dragon (*Amphibolurus nobbi*) (November 2011) (right)



Plate 2-5 Freckled monitor (*Varanus tristis*) (November 2011)



Plate 2-6 Black-headed python (*Aspidites melanocephalus*) (November 2011)



2.2.2.3 Mammals

A total of 14 mammal species from 11 families were recorded from the EPC 1080 Study Area during field investigations. One mammal of Commonwealth significance, the koala, was recorded. One koala was detected during spotlighting surveys south of the Carmichael River during field investigations. The koala is also listed as special least concern under the Queensland Nature Conservation (Wildlife) Regulation 2006. Two additional mammals of State significance were recorded, these being the little pied bat (*Chalinolobus picatus*) and the echidna (*Tachyglossus aculeatus*). The little pied bat, listed as near threatened under the NC Act, was recorded via Anabat detectors in one location at the EPC 1080 Study Area. This species was detected in a brigalow and eucalypt woodland with shrubby understorey. Evidence (characteristic diggings and scats) of the special least concern (NC Act) echidna was detected at five locations within the EPC 1080 Study Area during field investigations. Further discussion on conservation significant species is provided in Section 3 of the Mine Terrestrial Ecology Report.

Five introduced species were recorded these being the pig (*Sus scrofa*), house mouse (*Mus musculus*), cat (*Felis catus*), dingo (*Canis familiaris dingo*), and European rabbit (*Oryctolagus cuniculus*).

Anabat detection recorded 10 species of microchiropteran bat from three families. The most commonly recorded bat species were Gould's wattled bat (*Chalinolobus gouldii*) and the inland forest bat (*Vespadelus baverstocki*), which were each recorded in at least five locations throughout the EPC 1080 Study Area.

The native ground mammal fauna was dominated by kangaroos (family Macropodidae), with four species representing this family. The eastern grey kangaroo (*Macropus giganteus*) (Plate 2-7) and red kangaroo (*Macropus rufus*) were commonly recorded throughout the EPC 1080 Study Area, whilst the spectacled hare-wallaby (*Lagorchestes conspicillatus*) was less frequently recorded. The rufous bettong (*Aepyprymnus rufescens*) was recorded in three separate locations throughout the EPC 1080 Study Area, with most sightings occurring during spotlighting surveys. Less frequently recorded native mammal fauna included the common brushtail possum (*Trichosurus vulpecular*) (Plate 2-8), water rat (*Hydromys chrysogaster*) and flying fox (unidentified species).

Plate 2-7 Eastern-grey kangaroo (*Macropus giganteus*) (November 2011)



Plate 2-8 Common brushtail possum (*Trichosurus vulpecular*) (November 2011)



2.2.2.4 Birds

A total of 121 bird species from 47 families were recorded from the EPC 1080 Study Area during field investigations. A number of conservation significant birds were detected in the EPC 1080 Study Area, namely:

- ▶ One bird listed as endangered under the EPBC Act and NC Act – black-throated finch (southern)
- ▶ One bird listed as vulnerable under the EPBC Act and NC Act – squatter pigeon (southern)
- ▶ Two birds listed as near threatened under the NC Act – black-necked stork (*Ephippiorhynchus asiaticus*) and cotton pygmy-goose
- ▶ Three birds listed as migratory under the EPBC Act and special least concern under the NC Act
- ▶ Seventeen birds listed as marine under the EPBC Act
- ▶ One bird listed as a Priority Species for the Burdekin Natural Resource Management (NRM) Region (under the Burdekin NRM Region Back on Track Actions for Biodiversity report (DERM, 2010)) – black-throated finch (southern)

Further discussion on conservation significant species is provided in Section 3 of the Mine Terrestrial Ecology Report. One introduced bird – the spotted turtle-dove was recorded from the EPC 1080 Study Area.

In general, the avian fauna of the EPC 1080 Study Area comprised a mix of common and widespread woodland, grassland and water birds. Honeyeaters (family Meliphagidae) were the most diverse assemblage with 13 species recorded. Seven species from the Artamidae family were recorded which comprises woodswallows, butcherbirds and magpies including the dusky woodswallow (*Artamus cyanopterus*) (Plate 2-9). Seven species of raptor species from two families (Accipitridae and Falconidae) were observed, including the wedge-tailed eagle (*Aquila audax*) (Plate 2-10). Bird species commonly observed throughout the EPC 1080 Study Area included the apostlebird (*Struthidea cinerea*), double-barred finch (*Poephila bichenovii*) (Plate 2-11) and galah (*Eolophus roseicapillus*) (Plate 2-12).

Plate 2-9 Dusky woodswallow (*Artamus cyanopterus*) (November 2011)



Plate 2-10 Wedge-tailed eagle (*Aquila audax*) (November 2011)



Plate 2-11 Double-barred finch (*Poephila bichenovii*) (November 2011)



Plate 2-12 Galah (*Eolophus roseicapillus*) (November 2011)



2.2.2.5 Introduced Fauna Species

Seven introduced terrestrial vertebrates were recorded from the EPC 1080 Study Area. This comprised:

- ▶ One amphibian – cane toad
- ▶ Five mammals - pig, house mouse, cat (Plate 2-13), dingo (Plate 2-14), and European rabbit
- ▶ One bird – spotted turtle-dove

Of these species, the dingo, cat, European rabbit and pig are Class 2 Declared Animals under the Queensland LP Act. Class 2 Declared Animals are species that are established in Queensland and currently do, or potentially may, have a notable negative economic, environmental or social impact. Local governments, communities and landowners are required to manage these species under the LP Act.

Plate 2-13 Cat (*Felis catus*) (November 2011)



Plate 2-14 Dingo (*Canis familiaris dingo*) (November 2011)



Cane toads were ubiquitous across all habitats, and abundant across the EPC 1080 Study Area particularly in proximity to water bodies. Based on the generalist habitat requirements of the other introduced species recorded, it is considered likely that these species would also be occur through much of the EPC 1080 Study Area (where suitable habitat occurs).

Further discussion on likely extent of occurrence (and potential abundance) of pest species is provided in Section 2.3.3.5 of the Mine Terrestrial Ecology Report.



3. Summary of Existing Terrestrial Ecological Values

A field assessment was undertaken to describe the existing terrestrial ecological values of the EPC 1080 Study Area in November 2011. An additional desktop and rapid site visit was undertaken by Hyder Consulting in June 2012 to areas relating to water infrastructure associated with the offsite infrastructure of the Project (Mine). Key findings from this assessment are summarised below. These key findings have been synthesised with those documented in the Mine Terrestrial Ecology Report, where a consolidated description of conservation significant ecological values of the Project Area (Section 3 and Section 4), and impact assessment (Section 5, Section 6 and Section 7), are presented.

- ▀ The EPC 1080 Study Area contains a range of fauna habitat types that share broadly similar habitat values (based on habitat structure), but vary in their value for fauna based on the specific forage and shelter characteristics they provide. Ironbark-box woodland and open cleared land are the most widespread fauna habitats within the EPC 1080 Study Area. Ironbark-box woodland provides habitat for a diversity of common fauna (and limited number of threatened species), as compared to the limited habitat value provided by open cleared land, which is widespread throughout the EPC 1080 Study Area between Cabbage Tree Creek and Moray-Carmichael Road and in association with the offsite infrastructure to the east.
- ▀ Fauna habitats across the EPC 1080 Study Area are, in general, subject to low disturbance from cattle, weeds and feral animals. These disturbances were predominantly observed at and limited to cattle water points and in areas of open cleared land.
- ▀ Remnant vegetation coverage occurs over approximately 44 per cent (8,177 ha) of the EPC 1080 Study Area. Where remnant vegetation occurs, more complex habitat resources are available for fauna relative to those provided by open cleared land.
- ▀ The proposed offsite infrastructure located to the east of EPC 1080 is largely dominated by the open cleared land habitat type, and thus provides limited habitat values for native fauna species. A number of small patches of remnant vegetation are present within the proposed offsite infrastructure, and are typically mapped as part of a mixed vegetation community of ironbark-box woodland in conjunction with the gidgee or brigalow shrubby woodland.
- ▀ The EPC 1080 Study Area retains large tracts of remnant vegetation north of Moray-Carmichael Road; this vegetation continues uninterrupted north for several kilometres. The sections of the EPC 1080 Study Area south of the Carmichael River do not possess similar large broadscale connectivity as the vegetation in the north. These sections do however lie on the eastern border of a corridor of vegetation that extends several kilometres south.
- ▀ Limited north-south connectivity exists within the EPC 1080 Study Area due to the large areas of cleared land that occur from Cabbage Tree Creek to the Moray-Carmichael Road. Smaller east-west vegetation corridors exist along the Carmichael River, which links through to remnant vegetation along the Belyando River.
- ▀ The DEHP BPA mapping indicated that some remnant vegetation within and surrounding the EPC 1080 Study Area is of high regional ecosystem value, as well as being identified as having high or very high ecosystem diversity.



- ▶ Seven broad vegetation communities were identified within the EPC 1080 Study Area based on the particular communities and land forms that occur within the EPC 1080 Study Area.
- ▶ A total of 28 ground-truthed REs were identified within the EPC 1080 Study Area, 15 from the Desert Uplands and 13 from the Brigalow Belt bioregions.
- ▶ The EPBC Act listed TEC, Brigalow (*Acacia harpophylla* dominant and co-dominant), was identified as present on site from field surveys. The presence of this TEC was recorded from the occurrence of REs 11.3.1 and 11.4.9 within the EPC 1080 Study Area. Approximately 105 ha of these REs are present within the EPC 1080 Study Area.
- ▶ No threatened flora species listed under the EPBC Act or NC Act were observed within the EPC 1080 Study Area during field surveys.
- ▶ Native flora species were prevalent across much of the EPC 1080 Study Area, in association with remnant vegetation. Spring 2011 field surveys identified 110 native flora taxa and 10 introduced taxa at the EPC 1080 Study Area. Hyder Consulting identified 23 native flora taxa and nine introduced flora species during a rapid site inspection of offsite water infrastructure locations. Of the introduced flora species, five are declared plants under the LP Act.
- ▶ A total of 171 vertebrate fauna species were recorded from the EPC 1080 Study Area comprising five amphibians, 21 reptiles, 24 mammals and 121 birds. Of these, five species were introduced.
- ▶ An additional 29 fauna species were recorded in the EPC 1080 Study Area that had not previously been detected on ecological surveys of the EPC 1690 Study Area to the immediate west. Two of these species are of conservation significance. The koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) is listed as vulnerable under the EPBC Act and as special least concern under the NC Act. The cotton pygmy-goose (*Nettapus coromandelianus*) is of State significance, listed under the NC Act as near threatened.
- ▶ Within the EPC 1080 Study Area, two threatened bird listed under the EPBC Act and NC Act were recorded– black-throated finch (southern) and squatter pigeon (southern). One mammal, the koala, listed under the EPBC Act was recorded. Three threatened species listed only under the NC Act were recorded, these being the little pied bat, black-necked stork and cotton pygmy-goose. Two mammals listed as special least concern under the NC Act were recorded, these being the echidna and koala.
- ▶ Three common EPBC Act listed migratory bird species (great egret, rainbow bee-eater, satin flycatcher) were recorded from the EPC 1080 Study Area. These birds are also special least concern under the NC Act.
- ▶ One species listed as a Priority Species for the Burdekin NRM Region was recorded from Spring 2011 field surveys within the EPC 1080 Study Area – black-throated finch (southern).



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Appendix A

Survey Effort and Locations

Flora Rapid Survey Effort and Locations

Fauna Comprehensive Survey Effort and Locations



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Flora Rapid Assessment Survey Site Effort – Spring 2011

Flora Rapid Survey Sites	Co-ordinates		Date of survey
	East	North	
R1	434755	7570454	8/11/2011
R2	434435	7570477	8/11/2011
R3	428134	7576236	8/11/2011
R4	427380	7576177	8/11/2011
R5	425871	7576477	8/11/2011
R6	425294	7577199	9/11/2011
R7	422766	7576594	9/11/2011
R8	423795	7576849	9/11/2011
R9	423222	7579975	9/11/2011
R10	423153	7579554	9/11/2011
R11	422688	7579288	9/11/2011
R12	428814	7576342	9/11/2011
R13	429054	7575108	9/11/2011
R14	429115	7573864	9/11/2011
R15	431049	7576322	10/11/2011
R16	435047	7569547	10/11/2011
R17	434159	7567784	10/11/2011
R18	435660	7567487	10/11/2011
R19	436476	7561902	10/11/2011
R20	436694	7560520	10/11/2011
R21	437114	7558004	10/11/2011
R22	442871	7558312	11/11/2011
R23	442814	7558368	11/11/2011
R24	442508	7559344	11/11/2011
R25	441542	7556601	11/11/2011
R26	440693	7556406	11/11/2011
R27	439788	7556709	11/11/2011
R28	439259	7556352	11/11/2011
R29	439808	7557087	11/11/2011
R30	444464	7553953	15/11/2011
R31	443376	7553752	15/11/2011
R32	442902	7554337	15/11/2011
R33	442628	7555082	15/11/2011
R34	444453	7552917	15/11/2011
R35	444157	7552243	15/11/2011
R36	443921	7550619	15/11/2011
R37	443793	7549302	15/11/2011
R38	443628	7547918	15/11/2011
R39	444699	7545077	16/11/2011
R40	445402	7542612	16/11/2011

R41	443536	7544513	16/11/2011
R42	443956	7542928	16/11/2011
R43	445538	7540350	16/11/2011
R44	447067	7539091	16/11/2011
R45	447733	7539070	16/11/2011
R46	446483	7541983	16/11/2011
R47	439609	7576368	16/11/2011
R48	437456	7576311	17/11/2011

Fauna Comprehensive Survey Site Effort – Spring 2011

Week	Site	Easting	Northing	Dates	Funnel trap	Cage trap	Elliot box trap	Anabat	Bird surveys	Opportunistic search
					No. of trap nights (no. of traps x no. of nights)			No. nights	Person hours	
1	1	435042	7569980	9-12 Nov 2011	16	40	80	9	90	20
1	2	428101	7576238	9-12 Nov 2011	16	40	80			
1	3	442237	7557125	9-12 Nov 2011	16	40	80			
2	4	437078	7566758	15-18 Nov 2011	16	40	80	4		
2	5	443934	7550694	15-18 Nov 2011	16	40	80			
2	6	443826	7549498	15-18 Nov 2011	16	40	80			



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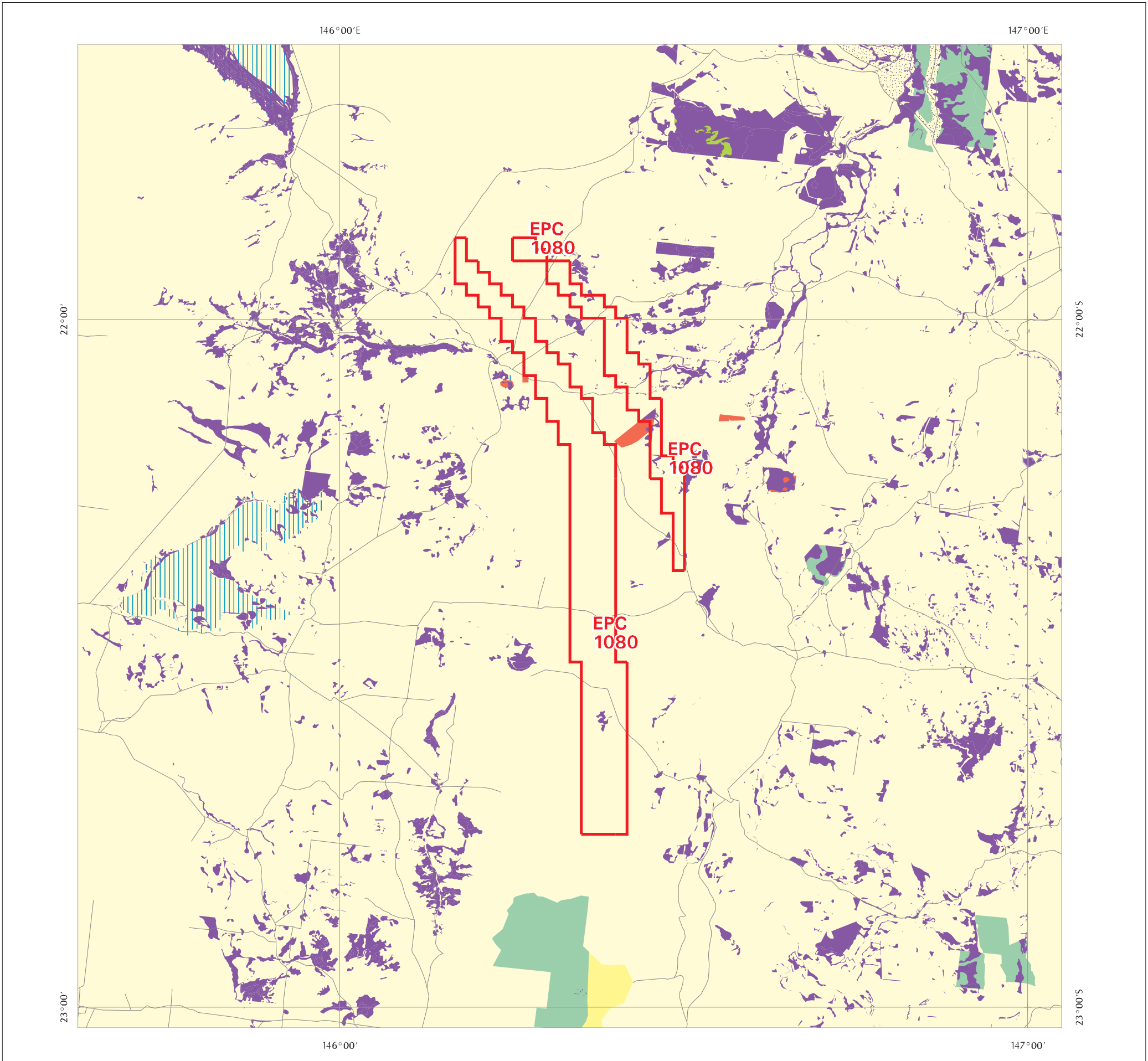
Appendix B

Additional Desktop Database Search Results

DEHP Environmentally Sensitive Areas – Mining Activities
EPC 1080



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Legend

- Selected Exploration Permit Coal
- CATEGORY A**
- National Parks
- Conservation Parks
- Forest Reserves
- Wet Tropics World Heritage Area
- Great Barrier Reef Marine Park Region
- Marine Parks other than General Use Zones
- CATEGORY B**
- World Heritage Areas
- Queensland Heritage Register Places
- Ramsar Sites
- Cultural Heritage Registered Areas and DLA's other than Stanbroke
- Special Forestry Areas
- Fish Habitat Areas
- Koala Plan
- Coordinated Conservation Areas
- Endangered Regional Ecosystems (Biodiversity Status)
- General Use Zones of Marine Parks
- Marine Plants

ENVIRONMENTALLY SENSITIVE AREAS - Mining Activities

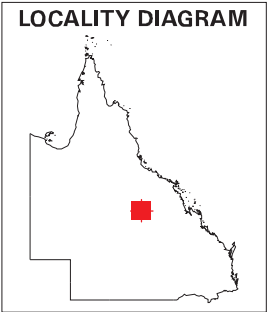
- CATEGORY C**
- Nature Refuges
- Resources Reserves
- Declared Catchment Areas
- Declared Irrigation Areas
- Drainage Areas
- River Improvement Areas
- Stanbroke DLA
- State Forests
- Timber Reserves
- Coastal Management Control Districts
- Dams and Weirs
- OTHERS**
- Roads
- Towns
- Wild River Nominated Waterways
- Wild River High Preservation Areas
- Wild River Preservation Areas
- Mahogany Glider Habitat
- Directory of Important Wetlands
- Queensland

Requested By: LAUREN.MULLER@GHD.COM
Date: 01 Dec 11 Time: 14.41.23

Centered on Tenure:
EPC 1080



Queensland
Government



0 5 10 15 20 25km

This scale bar is approximate only
Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)
This product is unprojected and is not suitable for measuring distances

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

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

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



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Appendix C

Flora Survey Results



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Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Amaranthaceae	<i>Alternanthera denticulata</i>	lesser joyweed		-	least concern	H	R24
Apocynaceae	<i>Carissa lanceolata</i>	conkerberry		-	least concern	S	R6, R16
Apocynaceae	<i>Carissa ovata</i>	currant bush		-	least concern	S	R1, R2, R3, R4, R5, R6, R16, R18, R19, R20, R21, R22, R23, R27, R28, R29, R32, R34, R35, R37, R40, R41, R42, R44, R48
Apocynaceae	<i>Parsonsia</i> sp.			-	least concern	V	R1, R23
Arecaceae	<i>Livistona australis</i>	cabbage palm		-	least concern	S	R25
Asclepiadaceae	<i>*Cryptostegia grandiflora</i>	rubbervine	Class 2 declared	-	introduced	VT	R25, R26
Asteraceae	<i>Centipeda minima</i>	spreading sneezeweed		-	least concern	H	R24
Asteraceae	<i>Chrysocephalum apiculatum</i>	common everlasting		-	least concern	H	R19
Asteraceae	<i>Chrysocephalum</i> sp.			-	least concern	H	R7
Asteraceae	<i>*Parthenium hysterophorus</i>	parthenium	Class 2 declared	-	introduced	S	R25, R28
Asteraceae	<i>Pseudognaphalium luteoalbum</i>	jersey cudweed		-	least concern	H	R24
Asteraceae	<i>Pterocaulon serrulatum</i>	ragweed		-	least concern	H	R5, R22, R26
Asteraceae	<i>*Xanthium spinosum</i>	bathurst burr		-	introduced	S	R22, R24, R25, R26
Cactaceae	<i>*Opuntia tomentosa</i>	velvet tree pear	Class 2 declared	-	introduced	S	R2, R16, R20
Caesalpiniaceae	<i>Senna artemisioides</i>	silver cassia		-	least concern	S	R18, R29, R38
Caesalpiniaceae	<i>Senna</i> sp.			-	least concern	S	R3, R4
Caesalpiniaceae	<i>Lysiphyllum carronii</i>	bauhinia		-	least concern	T	R1, R2, R16, R21, R23, R26, R27, R31, R32, R38, R44
Caesalpiniaceae	<i>Lysiphyllum hookeri</i>	pegunny		-	least concern	T	R22

Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian bluebell		-	least concern	H	R21
Campanulaceae	<i>Wahlenbergia</i> sp.			-	least concern	H	R8
Capparaceae	<i>Apophyllum anomalum</i>	warrior bush		-	least concern	S	R1, R16, R23
Capparaceae	<i>Capparis lasiantha</i>	wait-a-while		-	least concern	S	R1, R2, R3, R4, R17, R20, R23, R27, R29
Celastraceae	<i>Maytenus cunninghamii</i>	yellow-berry bush		-	least concern	S	R2, R3, R6, R10, R12, R14, R18
Chenopodiaceae	<i>Enchylaena tomentosa</i>	ruby saltbush		-	least concern	S	R13, R16, R29
Chenopodiaceae	<i>Salsola kali</i>	soft roly poly		-	least concern	S	R29
Combretaceae	<i>Terminalia oblongata</i>	yellow-wood		-	least concern	ST	R21, R23
Combretaceae	<i>Terminalia</i> sp.			-	least concern	ST	R27
Cyperaceae	<i>Carex appressa</i>	rush sedge		-	least concern	R	R27
Cyperaceae	<i>Cyperus</i> sp.			-	least concern	R	R16, R24, R25, R28
Cyperaceae	<i>Eleocharis</i> sp.			-	least concern	R	R24
Erythroxylaceae	<i>Erythroxylum australe</i>	cocaine bush		-	least concern	S	R23, R25
Euphorbiaceae	<i>Chamaesyce drummondii</i>	milkweed		-	least concern	H	R13
Fabaceae	<i>Erythrina vespertilio</i>	grey corkwood		-	least concern	ST	R8, R9, R10
Fabaceae	<i>Glycine</i> sp.			-	least concern	H	R3, R5, R6, R8, R19
Fabaceae	<i>Rhynchosia minima</i>	ryncho		-	least concern	H	R15
Fabaceae	* <i>Stylosanthes</i> sp.	stylo		-	introduced	S	R1, R2, R4, R5, R6, R9, R10, R12, R13, R14, R15, R17, R18, R19, R20, R21, R27, R29
Goodeniaceae	<i>Goodenia</i> sp.			-	least concern	S	R8
Hemerocallidaceae	<i>Dianella</i> sp.			-	least concern	R	R3, R8, R24, R26

Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Johnsoniaceae	<i>Tricoryne elatior</i>	yellow rush-lilly		-	least concern	R	R11
Juncaceae	<i>Juncus</i> sp.			-	least concern	R	R24, R25, R28
Lauraceae	<i>Cassytha</i> sp.			-	least concern	H	R11
Lomandraceae	<i>Lomandra longifolia</i>	spiny-headed mat-rush		-	least concern	R	R25, R26, R28
Loranthaceae	<i>Dendrophthoe vitellina</i>			-	least concern	epS	R24
Malvaceae	<i>Hibiscus</i> sp.			-	least concern	S	R15, R19, R39
Malvaceae	<i>Sida</i> sp.			-	least concern	S	R5, R8, R13, R25
Marsileaceae	<i>Marsilea</i> sp.			-	least concern	S	R24
Meliaceae	<i>Owenia acidula</i>			-	least concern	S	R35
Mimosaceae	<i>Acacia cambagei</i>	gidgee		-	least concern	ST	R23, R29, R34, R35, R44, R45
Mimosaceae	<i>Acacia elachantha</i>	Cowle's wattle		-	least concern	ST	R5, R6 R11
Mimosaceae	<i>Acacia excelsa</i>	ironwood		-	least concern	ST	R3, R17, R18, R20, R21, R22, R29, R39
Mimosaceae	* <i>Acacia farnesiana</i>	mimosa bush		-	introduced	ST	R4, R22, R28,
Mimosaceae	<i>Acacia harpophylla</i>	brigalow		-	least concern	ST	R1, R4, R16 , R29, R32, R34, R35, R37, R38, R40, R45, R46
Mimosaceae	<i>Acacia holosericea</i>	silver-leaf wattle		-	least concern	S	R19
Mimosaceae	<i>Acacia laccata</i>			-	least concern	S	R3, R5, R6, R7, R8, R11, R13, R15
Mimosaceae	<i>Acacia lazaridis</i>			-	least concern	S	R39, R46
Mimosaceae	<i>Acacia leiocalyx</i>	black wattle		-	least concern	S	R9
Mimosaceae	<i>Acacia leptostachya</i>	Townsville wattle		-	least concern	ST	R7, R11, R13
Mimosaceae	<i>Acacia melliodora</i>	net-veined wattle		-	least concern	S	R3, R6, R39, R42

Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Mimosaceae	<i>Acacia orthocarpa</i>	needle leaf wattle		-	least concern	S	R13
Mimosaceae	<i>Acacia salicina</i>	sally wattle		-	least concern	ST	R4, R19, R21, R22, R25, R26, R27, R28, R30, R31, R36, R38, R43, R48
Mimosaceae	<i>Acacia sericophylla</i>	wirewood		-	least concern	ST	R3, R5, R6, R8, R9, R10, R12, R13, R14, R15, R18, R41, R42, R46
Mimosaceae	<i>Acacia stipuligera</i>			-	least concern	S	R14, R17
Mimosaceae	<i>Acacia tenuissima</i>			-	least concern	S	R5, R6, R18
Myoporaceae	<i>Eremophila longifolia</i>	emu bush		-	least concern	S	R6, R17
Myoporaceae	<i>Eremophila maculata</i>	spotted emu bush		-	least concern	S	R14
Myoporaceae	<i>Eremophila mitchellii</i>	false sandalwood		-	least concern	S	R1, R2, R4, R5, R8, R9, R16, R20, R23, R29, R30, R32, R34, R35, R37, R38, R40, R41, R43, R44, R47
Myrtaceae	<i>Corymbia brachycarpa</i>	bloodwood		-	least concern	T	R25
Myrtaceae	<i>Corymbia clarksoniana</i>	Clarkson's bloodwood		-	least concern	T	R31, R36, R41, R43, R46, R47, R48
Myrtaceae	<i>Corymbia dallachiana</i>	Dallachy's gum		-	least concern	T	R8, R10, R11, R12, R14, R15, R18, R29, R31, R34, R39, R41, R42, R43, R46, R47, R48
Myrtaceae	<i>Corymbia setosum</i>	rough-leaved bloodwood		-	least concern	ST	R11, R13

Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Myrtaceae	<i>Eucalyptus brownii</i>	Brown's box		-	least concern	T	R3, R5, R9, R17, R19, R20, R21, R22, R23, R30, R32, R33, R34, R37, R38, R39, R40, R41, R42, R43, R44, R46, R47, R48
Myrtaceae	<i>Eucalyptus camaldulensis</i>	red river gum		-	least concern	T	R22, R24, R25, R26, R27, R28, R33
Myrtaceae	<i>Eucalyptus cambageana</i>	blackbutt		-	least concern	T	R1, R4, R16, R24, R25
Myrtaceae	<i>Eucalyptus coolibah</i>	coolibah		-	least concern	T	R22, R24, R25, R26, R27, R28, R33
Myrtaceae	<i>Eucalyptus crebra</i>	narrow-leaved ironbark		-	least concern	T	R5, R10
Myrtaceae	<i>Eucalyptus melanophloia</i>	silver-leaved ironbark		-	least concern		R3, R5, R6, R8, R9, R10, R12, R13, R14, R15, R18, R41, R42, R46, R15, R17, R18, R19, R20, R30, R32, R33, R39, R41, R42, R48
Myrtaceae	<i>Eucalyptus persistens</i>	mallee box		-	least concern	ST	R29
Myrtaceae	<i>Eucalyptus similis</i>	inland yellowjacket		-	least concern	ST	R13, R14
Myrtaceae	<i>Eucalyptus tereticornis</i>	forest red gum		-	least concern	T	R26
Myrtaceae	<i>Eucalyptus tessellaris</i>	moreton bay ash		-	least concern	T	R25
Myrtaceae	<i>Melaleuca fluviatilis</i>	weeping tea-tree		-	least concern	T	R25, R28
Myrtaceae	<i>Melaleuca leucadendra</i>	braod-leaved paperbark		-	least concern	T	R25, R26, R27, R28
Myrtaceae	<i>Melaleuca nervosa</i>	paperbark		-	least concern	ST	R39, R42
Oleaceae	<i>Jasminum didymum</i>	native jasmine		-	least concern	S	R21, R23
Orchidaceae	<i>Cymbidium canaliculatum</i>	black orchid		-	least concern	eH	R22, R24, R26, R27

Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Passifloraceae	<i>*Passiflora foetida</i>	stinking passionfruit		-	introduced	V	R25, R28
Phyllanthaceae	<i>Phyllanthus</i> sp.			-	least concern	S	R39
Picrodendraceae	<i>Petalostigma banksii</i>	bitterbark		-	least concern	S	R14
Picrodendraceae	<i>Petalostigma pubescens</i>	quinine berry		-	least concern	ST	R5, R18
Pittosporaceae	<i>Bursaria incana</i>	mock orange		-	least concern	ST	R15, R17, R18
Poaceae	<i>Aristida</i> spp.			-	least concern	G	R4, R5, R6, R9, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R26, R29, R30, R32, R35, R38, R40, R42,
Poaceae	<i>*Bothriochloa petusa</i>	indian bluegrass		-	introduced	G	R16, R22, R27
Poaceae	<i>Bothriochloa</i> sp.			-	least concern	G	R3, R4, R5, R6, R25
Poaceae	<i>*Cenchrus ciliaris</i>	buffel grass		-	introduced	G	R1, R2, R4, R5, R6, R12, R14, R17, R18, R19, R20, R21, R23, R29, R30, R31, R32, R33, R34, R36, R40, R44, R46, R48
Poaceae	<i>Chloris</i> sp.			-	least concern	G	R4, R21, R28
Poaceae	<i>Chloris virgata</i>	feather fingergrass		-	least concern	G	R25, R26, R27
Poaceae	<i>*Cynodon dactylon</i>	bermuda grass		-	introduced	G	R24, R25, R28
Poaceae	<i>Enneapogon</i> sp.			-	least concern	G	R31, R38
Poaceae	<i>Enteropogon</i> sp.			-	least concern	G	R1, R2, R30
Poaceae	<i>Eragrostis</i> spp.			-	least concern	G	R1, R2, R14, R16, R19, R21

Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Poaceae	<i>Heteropogon contortus</i>	black spear grass		-	least concern	G	R3, R4, R6, R9, R12, R14, R15, R16, R17, R18, R19, R29, R30, R39, R40, R41, R42, R43, R44, R46
Poaceae	<i>Heteropogon triticeus</i>	giant spear grass		-	least concern	G	R9, R21
Poaceae	<i>Leptochloa digitata</i>			-	least concern	G	R27
Poaceae	<i>Panicum</i> sp.			-	least concern	G	R3, R4, R12, R13, R14, R21, R25, R26, R27, R37, R43, R45
Poaceae	<i>Themeda triandra</i>	kangaroo grass		-	least concern	G	R3, R4, R6, R12, R14, R17, R18, R29
Poaceae	<i>Triodia pungens</i>	porcupine grass		-	least concern	G	R4, R6, R7
Polygonaceae	<i>Convolvulus</i> sp.			-	least concern	H	R8
Polygonaceae	<i>Polygonum</i> sp.			-	least concern	H	R24
Proteaceae	<i>Grevillea parallela</i>	beefwood		-	least concern	ST	R21, R43
Proteaceae	<i>Grevillea pteridifolia</i>	silky grevillea		-	least concern	ST	R7, R11
Proteaceae	<i>Grevillea striata</i>	beefwood		-	least concern	ST	R2, R5, R9, R17, R19, R20, R21, R29, R34,
Rubiaceae	<i>Psyrdrax attenuata</i>			-	least concern	S	R6
Rutaceae	<i>Citrus glauca</i>	wild lime		-	least concern	S	R20, R35
Rutaceae	<i>Flindersia dissosperma</i>	silver ash		-	least concern	ST	R4, R16, R17, R23
Rutaceae	<i>Geijera parviflora</i>	wilga		-	least concern	S	R28
Rutaceae	<i>Geijera salicifolia</i>	scrub wilga		-	least concern	S	R1, R12, R14, R16
Santalaceae	<i>Santalum lanceolatum</i>	wild plum		-	least concern	S	R5

Family	Taxon	Common Name	LP Act Status	EPBC status	NC Act Status	Life form^	Site
Sapindaceae	<i>Alectryon oleifolius</i>	western rosewood		-	least concern	ST	R18, R31
Sapindaceae	<i>Atalaya hemiglauca</i>	whitewood		-	least concern	ST	R1, R4, R21, R22, R27, R30, R31, R32, R34, R37, R44
Sapindaceae	<i>Atalaya</i> sp.			-	least concern	ST	R8

^Life form: T = tree; ST = short tree; S = Shrub; H = Herb/forb; G = Grass; R = Sedge/rush/lily; V = Vine; a = aquatic; e = epiphytic; p = parasitic

*Introduced species



Appendix D

Fauna Survey Results



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Final Fauna Species List – Spring survey 2011

Amphibians					Comprehensive Sites						Habitat Assessment	Opportunistic	Total
Family	Scientific Name	Common Name	EPBC Act	NC Act	1	2	3	4	5	6	-	-	
Amphibians													
Bufonidae	<i>Rhinella marina</i>	cane toad		Introduced							11		11
Hylidae	<i>Litoria rubella</i>	desert tree frog					1						1
Hylidae	<i>Litoria caerulea</i>	green tree frog					1				1		2
Myobatrachidae	<i>Limnodynastes tasmaniensis</i>	spotted grass frog					4						4
Myobatrachidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog					1						1
Reptiles													
Agamidae	<i>Amphibolurus burnsii</i>	Burns' dragon			2	1				1	1		5
Agamidae	<i>Amphibolurus nobbi</i>	nobbi dragon			1					2	6		9
Pythonidae	<i>Aspidites melanocephalus</i>	black-headed python				1		1					2
Scincidae	<i>Carlia munda</i>				2	8			1	3			14
Scincidae	<i>Carlia pectoralis pectoralis</i>						2	3	5	13	6		29
Scincidae	<i>Carlia vivax</i>				3								3
Scincidae	<i>Ctenotus robustus</i>	eastern striped skink				1		1		1	1		4
Agamidae	<i>Diporiphora australis</i>	tommy roundhead					3	1			6		10
Gekkonidae	<i>Gehyra catenata</i>							1					1
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko			2	1	3	4	2	4	1		17
Gekkonidae	<i>Strophurus williamsi</i>	eastern spiny-tailed gecko								1			1
Scincidae	<i>Tiliqua scincoides</i>	common blue-tongue lizard									1	1	2
Varanidae	<i>Varanus panoptes</i>	yellow-spotted monitor									1		1
Varanidae	<i>Varanus tristis</i>	freckled monitor			1	1				1			3
Pygopodidae	<i>Lialis burtonis</i>	Burton's snake lizard			1	1		1					3
Elapidae	<i>Antairoserpens warro</i>								1				1
Elapidae	<i>Pseudonaja textilis</i>	eastern brown snake									1		1
Gekkonidae	<i>Oedura castelnaui</i>	northern velvet gecko									1		1
Gekkonidae	<i>Oedura marmorata</i>	marbled velvet gecko				2					1		3
Elapidae	<i>Cryptophis boschmai</i>	carpentaria snake										1	1
Varanidae	<i>Varanus varius</i>	lace monitor										1	1
Mammals													
Potoroidae	<i>Aepyprymnus rufescens</i>	rufous bettong			1				2	6		3	12
Canidae	<i>Canis familiaris dingo</i>	dingo		Introduced							3		3
Macropodidae	<i>Lagorchestes conspicillatus</i>	spectacled hare wallaby								4		15	19
Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo							10		22	20	52
Macropodidae	<i>Macropus rufus</i>	red kangaroo							10		1		21
Muridae	<i>Mus musculus</i>	house mouse		Introduced		4	2						6
Leporidae	<i>Oryctolagus cuniculus</i>	European rabbit		Introduced						3	2		5

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Appendix E

Threatened Fauna Survey Results

Black-throated Finch Water Body Watch Survey Information

Threatened Fauna Species Records



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Black-throated Finch (southern) Water Body Watch Survey Information

Easting	Northing	Date	Time	No. person hours	Weather	BTF observed	Number	Notes
442237	7557125	9/11/2011	0815-0915	2	warm, fine	no		
439620	7556481	9/11/2011	1115-1315	2	warm, mostly fine, gentle breeze	no		
439477	7559947	9/11/2011	1450-1550	2	hot, fine	no		
437998	7562979	9/11/2011	1650-1750	2	warm, fine	no		
434438	7573135	10/11/2011	0740-0840	2	warm, gentle breeze	yes	1	One black-throated finch observed in group with double-barred finches
435391	7568883	10/11/2011	0935-1035	2	warm, fine	no		
435913	7567848	10/11/2011	1220-1320	2	hot, fine	no		
439477	7559947	10/11/2011	1740-1840	2	warm, fine	yes	1	One black-throated finch observed feeding on grass adjacent to farm dam
439477	7559947	11/11/2011	0940-1040	2	warm, hazy, light breeze	no		
437998	7562979	11/11/2011	1150-1250	2	hot, light breeze	no		
434438	7573135	11/11/2011	1615-1645	1	warm, strong breeze	no		
442237	7557125	11/11/2011	1750-1835	1.5		no		
428718	7577894	10/11/2011	0815-900	2	warm, light breeze	no		
428718	7577894	11/11/2011	0800-830	2	warm, light breeze	no		
432811	7577316	10/11/2011	0910-950	2	warm	yes	3	Three black-throated finches observed
432811	7577316	11/11/2011	0845-915	2	warm	no		
434418	7573223	10/11/2011	1105-1150	2	hot and windy	no		
434418	7573223	11/11/2011	1010-1030	2	hot	no		
436536	7570933	10/11/2011	1200-1240	2	hot	no		
436536	7570933	11/11/2011	1045-1105	2	hot	no		
440162	7571488	10/11/2011	1250-1310	2	hot	no		
440162	7571488	11/11/2011	1115-1135	2	hot	no		
435190	7575483	11/11/2011	0945-1000	2	hot	no		

443080	7555060	10/11/2011	1130-1200	1	warm, fine	no		
428731	7577860	10/11/2011	1700-1800	1	warm, fine	no		
439400	7560000	9/11/2011	0815-0915	1	warm, fine	no		
445288	7549592	15/11/2011	1040-1140	2	Warm, fine	no		
446941	7540577	15/11/2011	1245-1345	2	hot, stiff breeze	no		
442000	7555095	15/11/2011	1510-1610	2	Warm, fine	no		
445067	7545035	16/11/2011	1130-1230	2	Warm, fine	no		
443308	7545356	16/11/2011	1730-1745	0.5	fine, slight breeze	no		
445172	7540350	16/11/2011	1800-1845	1.5	fine, slight breeze	no		
445216	7549590	17/11/2011	0840-0940	2	warm, fine	no		
445216	7549590	15/11/2011	1400-1500	0.75	warm, fine	no		
443340	7545340	16/11/2011	1300-1400	2	warm, fine	no		
443362	7545330	16/11/2011	1500-1600	2	warm, fine	no		
445770	7540064	17/11/2011	0813-0913	2	warm, fine	no		
445661	7540210	17/11/2011	1640-1740	2	warm, fine	no		
440218	7575988	17/11/2011	1345-1445	2	warm, fine	yes	Approx. 40	Approx. 40 observed at farm dam. Double-barred finches also present
			Total	70.25				

Squatter Pigeon (southern) Records from Study Area

Species	Easting	Northing	Number
Squatter pigeon	432895	7577050	4
Squatter pigeon	434407	7573100	4
Squatter pigeon	434314	7573254	1
Squatter pigeon	434306	7573368	2
Squatter pigeon	434301	7573319	2
Squatter pigeon	442961	7560387	1
Squatter pigeon	443308	7545356	3
Squatter pigeon	445216	7549590	1
Squatter pigeon	445216	7549590	1
Squatter pigeon	428731	7577860	1

Koala Records from Study Area

Species	Easting	Northing	Number
Koala	443875	7543128	1

Black-necked Stork Records from Study Area

Species	Easting	Northing	Number
Black-necked stork	442237	7557125	2
Black-necked stork	439400	7560000	2
Black-necked stork	439477	7559947	2

Cotton Pygmy-goose Records from Study Area

Species	Easting	Northing	Number
Cotton pygmy-goose	442237	7557125	2
Cotton pygmy-goose	428731	7577860	1
Cotton pygmy-goose	439400	7560000	4
Cotton pygmy-goose	442939	7560446	6
Cotton pygmy-goose	439477	7559947	4

Little-pied Bat Records from Study Area

Species	Easting	Northing	Number
Little-pied bat	443826	7549498	1



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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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adani™



Appendix C

Survey Effort and Locations (EPC 1690)

Flora Survey Effort and Locations

Fauna Comprehensive Surveys Effort and Locations



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Flora Comprehensive Survey Sites EPC 1690 – Autumn Survey 2011

Site	Easting	Northing	Date of survey
C1	440019	7546522	8/04/2011
C2	437815	7547054	8/04/2011
C3	443310	7546867	9/04/2011
C4	428300	7571873	13/04/2011
C5	433000	7565775	13/04/2011
C6	427976	7563455	14/04/2011
C7	432306	7561512	14/04/2011
C8	432450	7561345	14/04/2011
C9	435149	7555257	15/04/2011
C10	439618	7553640	16/04/2011
C11	439061	7553876	16/04/2011
C12	431450	7556652	16/04/2011
C13	438834	7546347	6/03/2011
C14	435972	7554643	17/04/2011
C15	441047	7547524	7/04/2011
C16	440916	7547247	7/04/2011
C17	439018	7544963	6/04/2011
C18	425815	7568318	7/05/2011
C19	423821	7573743	7/05/2011
C20	423153	7575909	7/05/2011

Flora Rapid Assessment Survey Sites – EPC 1690

Site	Easting	Northing	Date of survey	Survey Period
Q1	443961	7550767	7/04/2011	Autumn 2011
Q2	444003	7550218	7/04/2011	Autumn 2011
Q3	443858	7549915	7/04/2011	Autumn 2011
Q4	443797	7549321	7/04/2011	Autumn 2011
Q5	443723	7549144	7/04/2011	Autumn 2011
Q6	443609	7548966	7/04/2011	Autumn 2011
Q7	443233	7548772	7/04/2011	Autumn 2011
Q8	442775	7548437	7/04/2011	Autumn 2011
Q9	440019	7546525	8/04/2011	Autumn 2011
Q10	442095	7547777	8/04/2011	Autumn 2011
Q11	437773	7547065	8/04/2011	Autumn 2011
Q12	439790	7544015	9/04/2011	Autumn 2011
Q13	439813	7543345	9/04/2011	Autumn 2011
Q14	439410	7541330	9/04/2011	Autumn 2011
Q15	440340	7542016	9/04/2011	Autumn 2011
Q16	441391	7542142	9/04/2011	Autumn 2011
Q17	443220	7542378	9/04/2011	Autumn 2011
Q18	443587	7542420	9/04/2011	Autumn 2011
Q19	443697	7542435	9/04/2011	Autumn 2011
Q20	443379	7544037	9/04/2011	Autumn 2011
Q21	443565	7547033	9/04/2011	Autumn 2011
Q22	439207	7548401	9/04/2011	Autumn 2011
Q23	440059	7549139	9/04/2011	Autumn 2011
Q24	440608	7549612	9/04/2011	Autumn 2011
Q25	441370	7550268	9/04/2011	Autumn 2011
Q26	442342	7549718	9/04/2011	Autumn 2011
Q27	442583	7548901	9/04/2011	Autumn 2011
Q28	431692	7567982	13/04/2011	Autumn 2011
Q29	426718	7573692	13/04/2011	Autumn 2011
Q30	426715	7573692	13/04/2011	Autumn 2011
Q31	425422	7574605	13/04/2011	Autumn 2011
Q32	425268	7574836	13/04/2011	Autumn 2011
Q33	424326	7575213	13/04/2011	Autumn 2011
Q34	423307	7575824	13/04/2011	Autumn 2011
Q35	423362	7575851	13/04/2011	Autumn 2011
Q36	426975	7573401	13/04/2011	Autumn 2011
Q37	427450	7572838	13/04/2011	Autumn 2011
Q38	428030	7572370	13/04/2011	Autumn 2011
Q39	428259	7571976	13/04/2011	Autumn 2011
Q40	430185	7571258	13/04/2011	Autumn 2011
Q41	430685	7570304	13/04/2011	Autumn 2011
Q42	431002	7569545	13/04/2011	Autumn 2011

Q43	431205	7568975	13/04/2011	Autumn 2011
Q44	431493	7568265	13/04/2011	Autumn 2011
Q45	432018	7567664	13/04/2011	Autumn 2011
Q46	432216	7567499	13/04/2011	Autumn 2011
Q47	432617	7567162	13/04/2011	Autumn 2011
Q48	432093	7567068	13/04/2011	Autumn 2011
Q49	433094	7563422	14/04/2011	Autumn 2011
Q50	433022	7563635	14/04/2011	Autumn 2011
Q51	433062	7563786	14/04/2011	Autumn 2011
Q52	432855	7564106	14/04/2011	Autumn 2011
Q53	430382	7563272	14/04/2011	Autumn 2011
Q54	427482	7564602	14/04/2011	Autumn 2011
Q55	427343	7564833	14/04/2011	Autumn 2011
Q56	427244	7565186	14/04/2011	Autumn 2011
Q57	426389	7567154	14/04/2011	Autumn 2011
Q58	426937	7565824	14/04/2011	Autumn 2011
Q59	426981	7565715	14/04/2011	Autumn 2011
Q60	428699	7563134	14/04/2011	Autumn 2011
Q61	429244	7563163	14/04/2011	Autumn 2011
Q62	429463	7563040	14/04/2011	Autumn 2011
Q63	430168	7563087	14/04/2011	Autumn 2011
Q64	430539	7563373	14/04/2011	Autumn 2011
Q65	430833	7563585	14/04/2011	Autumn 2011
Q66	431184	7563818	14/04/2011	Autumn 2011
Q67	431490	7563983	14/04/2011	Autumn 2011
Q68	432298	7564019	14/04/2011	Autumn 2011
Q69	433014	7562749	14/04/2011	Autumn 2011
Q70	432895	7562334	14/04/2011	Autumn 2011
Q71	432818	7562049	14/04/2011	Autumn 2011
Q72	432605	7561838	14/04/2011	Autumn 2011
Q73	432671	7561772	14/04/2011	Autumn 2011
Q74	432695	7561794	14/04/2011	Autumn 2011
Q75	432700	7561629	14/04/2011	Autumn 2011
Q76	432589	7561369	14/04/2011	Autumn 2011
Q77	432387	7557429	15/04/2011	Autumn 2011
Q78	432622	7556761	15/04/2011	Autumn 2011
Q79	432999	7556235	15/04/2011	Autumn 2011
Q80	435280	7555880	15/04/2011	Autumn 2011
Q81	436360	7555042	15/04/2011	Autumn 2011
Q82	437634	7555316	15/04/2011	Autumn 2011
Q83	437641	7555197	15/04/2011	Autumn 2011
Q84	437395	7554795	15/04/2011	Autumn 2011
Q85	437251	7554617	15/04/2011	Autumn 2011
Q86	437047	7554434	15/04/2011	Autumn 2011

Q87	436864	7554212	15/04/2011	Autumn 2011
Q88	436677	7553227	15/04/2011	Autumn 2011
Q89	436235	7551726	15/04/2011	Autumn 2011
Q90	435828	7551436	15/04/2011	Autumn 2011
Q91	436054	7550541	15/04/2011	Autumn 2011
Q92	436261	7550202	15/04/2011	Autumn 2011
Q93	436525	7549727	15/04/2011	Autumn 2011
Q94	437069	7548614	15/04/2011	Autumn 2011
Q95	437612	7547850	15/04/2011	Autumn 2011
Q96	437586	7548026	15/04/2011	Autumn 2011
Q97	436515	7549756	15/04/2011	Autumn 2011
Q98	437297	7552201	15/04/2011	Autumn 2011
Q99	438791	7552497	15/04/2011	Autumn 2011
Q100	439162	7552529	15/04/2011	Autumn 2011
Q101	439453	7552697	15/04/2011	Autumn 2011
Q102	439680	7553041	15/04/2011	Autumn 2011
Q103	439817	7553917	15/04/2011	Autumn 2011
Q104	439922	7554567	15/04/2011	Autumn 2011
Q105	439935	7554702	15/04/2011	Autumn 2011
Q106	440011	7555128	15/04/2011	Autumn 2011
Q107	439778	7555204	15/04/2011	Autumn 2011
Q108	438975	7555123	15/04/2011	Autumn 2011
Q109	438626	7555176	15/04/2011	Autumn 2011
Q110	438617	7555169	15/04/2011	Autumn 2011
Q111	432289	7557872	16/04/2011	Autumn 2011
Q112	439523	7553811	16/04/2011	Autumn 2011
Q113	439267	7553844	16/04/2011	Autumn 2011
Q114	439178	7553870	16/04/2011	Autumn 2011
Q115	439024	7553889	16/04/2011	Autumn 2011
Q116	438067	7555187	16/04/2011	Autumn 2011
Q117	437812	7555108	16/04/2011	Autumn 2011
Q118	437744	7555141	16/04/2011	Autumn 2011
Q119	437613	7555367	16/04/2011	Autumn 2011
Q120	436827	7555027	16/04/2011	Autumn 2011
Q121	436432	7554866	16/04/2011	Autumn 2011
Q122	436035	7554876	16/04/2011	Autumn 2011
Q123	432132	7558475	16/04/2011	Autumn 2011
Q124	432254	7559032	16/04/2011	Autumn 2011
Q125	434273	7556184	16/04/2011	Autumn 2011
Q126	434247	7556263	16/04/2011	Autumn 2011
Q127	435454	7556047	16/04/2011	Autumn 2011
Q128	435396	7556314	16/04/2011	Autumn 2011
Q129	430751	7555985	16/04/2011	Autumn 2011
Q130	436430	7554903	17/04/2011	Autumn 2011

Q131	435948	7554719	17/04/2011	Autumn 2011
Q132	435869	7554716	17/04/2011	Autumn 2011
Q133	425963	7568207	6/05/2011	Autumn 2011
Q134	425809	7568582	6/05/2011	Autumn 2011
Q135	425038	7570466	6/05/2011	Autumn 2011
Q136	424722	7571245	6/05/2011	Autumn 2011
Q137	424519	7571750	6/05/2011	Autumn 2011
Q138	423705	7573747	6/05/2011	Autumn 2011
Q139	423218	7574954	6/05/2011	Autumn 2011
Q140	420217	7573886	6/05/2011	Autumn 2011
Q141	419225	7573821	6/05/2011	Autumn 2011
Q142	426164	7567711	7/05/2011	Autumn 2011
Q143	423726	7573700	7/05/2011	Autumn 2011
Q144	426805	7566145	7/05/2011	Autumn 2011
Q145	425735	7568762	7/05/2011	Autumn 2011
Q146	423456	7574359	7/05/2011	Autumn 2011
Q147	424208	7572516	7/05/2011	Autumn 2011
Q148	424917	7567817	12/11/2010	Spring 2010
Q149	432532	7567237	12/11/2010	Spring 2010
Q150	437648	7555224	10/11/2010	Spring 2010
Q151	437373	7557683	10/11/2010	Spring 2010
Q152	437151	7557853	10/11/2010	Spring 2010
Q153	437111	7557604	10/11/2010	Spring 2010
Q154	432429	7561447	10/11/2010	Spring 2010
Q155	432399	7561345	10/11/2010	Spring 2010
Q156	431511	7556611	11/11/2010	Spring 2010
Q157	432329	7561128	11/11/2010	Spring 2010
Q158	430588	7563644	11/11/2010	Spring 2010
Q159	427879	7563989	12/11/2010	Spring 2010
Q160	439418	7541332	9/04/2011	Autumn 2011

Fauna Comprehensive Survey Site Effort EPC 1690 – Spring Survey November 2010

Site	Easting	Northing	Dates	Pit-fall trap	Funnel trap	Cage trap	Elliot box trap	Anabat detector	Nocturnal searches	Bird survey	Opportunistic searches
				No. traps				No. nights	Person hours		
5	430726	7570500	9-13 Nov 2010	-	-	8	20	2	1	1	1
6	432772	7567010	9-13 Nov 2010	4	8	8	20	1	1	1	1
7	430703	7563826	9-13 Nov 2010	4	8	8	20	1	1	1	1
8	432582	7561340	9-13 Nov 2010	2	10	8	20	1	1	1	1
9	437145	7557990	9-13 Nov 2010	4	8	8	20	1	1	1	1
10	437577	7555140	9-13 Nov 2010	4	8	8	20	1	1	1	1

Fauna Comprehensive Survey Site Effort EPC 1690 – Autumn Survey April / May 2011

Site	Original site number	Easting	Northing	Dates	Pit-fall trap	Funnel trap	Cage trap	Elliot box trap	Anabat detector	Nocturnal searches	Bird survey	Opportunistic searches
					No. traps				No. nights	Person hours		
1	NA	423715	7573722	4-8 May 2011	-	12	10	20	1	1	1	1
2	NA	421335	7573860	4-8 May 2011	-	12	10	20	1	1	1	1
3	NA	425450	7569650	4-8 May 2011	-	12	10	20	1	1	1	1
4	NA	427733	7563882	4-8 May 2011	4	8	10	20	1	1	1	1
5	7	430726	7570500	4-8 May 2011	-	12	10	20	1	1	1	1
6	6	432772	7567010	4-8 May 2011	4	8	10	20	1	1	1	1
7	4	430703	7563826	13-17 Apr 2011	4	8	10	20	1	1	1	1
8	5	432582	7561340	13-17 Apr 2011	2	10	10	20	1	1	1	1
9	2	437145	7557990	13-17 Apr 2011	4	8	10	20	1	1	1	1
10	1	437577	7555140	13-17 Apr 2011	4	8	5	20	1	-	1	1
11	NA	433552	7554720	13-17 Apr 2011	4	8	10	20	1	-	1	1
12	NA	437350	7554726	13-17 Apr 2011	2	10	5	25	-	-	1	1
13	NA	438973	7546405	5-9 Apr 2011	-	12	10	20	1	1	1	1
14	NA	440864	7547190	5-9 Apr 2011	-	12	10	20	1	1	1	1
15	NA	443483	7548790	5-9 Apr 2011	4	8	10	20	1	1	1	1
16	NA	439154	7545066	5-9 Apr 2011	-	12	10	20	1	1	1	1



Appendix D

Desktop Database Search Results

SEWPAC Protected Matters Search and Environmental Reporting Tool

DERM Wildlife Online

DERM HERBRECS Database

DERM Environmentally Sensitive Areas

Birds Australia Database

Queensland Museum Database



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EPBC Act Protected Matters Report

10 July 2010 10:28

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.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at <http://www.environment.gov.au/atlas> may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at

<http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>



This map may contain data which are
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Search Type: Point
Buffer: 50 km
Coordinates: -22.041,146.364



Report Contents: [Summary](#)

[Details](#)

- [Matters of NES](#)
- [Other matters protected by the EPBC Act](#)
- [Extra Information](#)

[Caveat](#)

[Acknowledgments](#)

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 - see

<http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

World Heritage Properties: None

National Heritage Places: None

Wetlands of International Significance: 1
(Ramsar Sites)

Commonwealth Marine Areas: None

Threatened Ecological Communities: 2

Threatened Species: 11

Migratory Species: 12

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. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

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. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
<u>Places on the RNE:</u>	3
<u>Listed Marine Species:</u>	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

<u>State and Territory Reserves:</u>	2
Other Commonwealth Reserves:	None
Regional Forest Agreements:	None

Details

Matters of National Environmental Significance

Wetlands of International Significance [[Dataset Information](#)]
(Ramsar Sites)

[COONGIE LAKES](#)

Within same catchment as Ramsar site

Threatened Ecological Communities [Dataset Information]	Status	Type of Presence
Brigalow (<i>Acacia harpophylla</i> dominant and co-dominant)	Endangered	Community known to occur within area
The community of native species dependent on natural discharge of groundwater from the Great Artesian Basin	Endangered	Community known to occur within area

Threatened Species [Dataset Information]	Status	Type of Presence
--	--------	------------------

Birds

Erythrorhynchus radiatus Red Goshawk	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern)	Vulnerable	Species or species habitat likely to occur within area
Neochmia ruficauda ruficauda Star Finch (eastern), Star Finch (southern)	Endangered	Species or species habitat likely to occur within area
Poephila cincta cincta Black-throated Finch (southern)	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe	Vulnerable	Species or species habitat may occur within area

Mammals

Lasiorhinus krefftii Northern Hairy-nosed Wombat, Yaminon	Endangered	Species or species habitat likely to occur within area
--	------------	--

Reptiles

Denisonia maculata Ornamental Snake	Vulnerable	Species or species habitat likely to occur within area
Furina dunmalli Dunmall's Snake	Vulnerable	Species or species habitat may occur within area

Plants

<i>Acacia ramiflora</i>	Vulnerable	Species or species habitat likely to occur within area
<i>Eriocaulon carsonii</i> Salt Pipewort, Button Grass	Endangered	Species or species habitat likely to occur within area
<i>Eryngium fontanum</i> Blue Devil	Endangered	Species or species habitat likely to occur within area

Migratory Species [Dataset Information]	Status	Type of Presence
---	--------	------------------

Migratory Terrestrial Species

Birds

<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	Migratory	Species or species habitat likely to occur within area
<i>Hirundapus caudacutus</i> White-throated Needletail	Migratory	Species or species habitat may occur within area
<i>Merops ornatus</i> Rainbow Bee-eater	Migratory	Species or species habitat may occur within area
<i>Myiagra cyanoleuca</i> Satin Flycatcher	Migratory	Species or species habitat likely to occur within area

Migratory Wetland Species

Birds

<i>Ardea alba</i> Great Egret, White Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area
<i>Gallinago hardwickii</i> Latham's Snipe, Japanese Snipe	Migratory	Species or species habitat may occur within area
<i>Nettapus coromandelianus albiguttus</i> Australian Cotton Pygmy-goose	Migratory	Species or species habitat may occur within area
<i>Rostratula benghalensis s. lat.</i> Painted Snipe	Migratory	Species or species habitat may occur within area

Migratory Marine Birds

<i>Apus pacificus</i> Fork-tailed Swift	Migratory	Species or species habitat may occur within area
<i>Ardea alba</i> Great Egret, White Egret	Migratory	Species or species habitat may occur within area
<i>Ardea ibis</i> Cattle Egret	Migratory	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Dataset Information]	Status	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose	Listed - overfly marine area	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift	Listed - overfly marine area	Species or species habitat may occur within area
Ardea alba Great Egret, White Egret	Listed - overfly marine area	Species or species habitat may occur within area
Ardea ibis Cattle Egret	Listed - overfly marine area	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe	Listed - overfly marine area	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle	Listed	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail	Listed - overfly marine area	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater	Listed - overfly marine area	Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher	Listed - overfly marine area	Species or species habitat likely to occur within area
Nettapus coromandelianus albipennis Australian Cotton Pygmy-goose	Listed - overfly	Species or species habitat may occur within area

	marine area
<i>Rostratula benghalensis s. lat.</i> Painted Snipe	Listed - Species or species habitat may overfly occur within area marine area

Places on the RNE [[Dataset Information](#)]
Note that not all Indigenous sites may be listed.

Natural

[Epping Forest National Park \(1978 Boundary\) QLD](#)
[Lake Buchanan and Catchment QLD](#)
[Wilandspey Environmental Park QLD](#)

Extra Information

State and Territory Reserves [[Dataset Information](#)]

Epping Forest National Park (Scientific), QLD
Wilandspey Conservation Park, QLD

Caveat

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

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World 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 [migratory](#) and [marine](#) provisions of the Act have been mapped.

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.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- [New South Wales National Parks and Wildlife Service](#)
- [Department of Sustainability and Environment, Victoria](#)

- [Department of Primary Industries, Water and Environment, Tasmania](#)
- [Department of Environment and Heritage, South Australia Planning SA](#)
- [Parks and Wildlife Commission of the Northern Territory](#)
- [Environmental Protection Agency, Queensland](#)
- [Birds Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [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](#)
- Other groups and individuals

[ANUcliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University](#) was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Queensland DERM Wildlife Online Database Search Results

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Animals				
Amphibians				
Bufonidae	<i>Rhinella marina</i>	cane toad	Introduced	
Hylidae	<i>Cyclorana alboguttata</i>	greenstripe frog		
Hylidae	<i>Cyclorana brevipes</i>	superb collared frog		
Hylidae	<i>Cyclorana novaehollandiae</i>	eastern snapping frog		
Hylidae	<i>Litoria caerulea</i>	common green treefrog		
Hylidae	<i>Litoria inermis</i>	bumpy rocketfrog		
Hylidae	<i>Litoria latopalmata</i>	broad palmed rocketfrog		
Hylidae	<i>Litoria nasuta</i>	striped rocketfrog		
Hylidae	<i>Litoria peronii</i>	emerald spotted treefrog		
Hylidae	<i>Litoria rothii</i>	northern laughing treefrog		
Hylidae	<i>Litoria rubella</i>	ruddy treefrog		
Limnodynastidae	<i>Limnodynastes tasmaniensis</i>	spotted grassfrog		
Limnodynastidae	<i>Neobatrachus sudelli</i>	meeowing frog		
Limnodynastidae	<i>Notaden bennettii</i>	holy cross frog		
Limnodynastidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog		
Myobatrachidae	<i>Crinia deserticola</i>	chirping froglet		
Myobatrachidae	<i>Uperoleia littlejohni</i>	Einasleigh gungan		
Reptiles				
Agamidae	<i>Amphibolurus burnsi</i>			
Agamidae	<i>Amphibolurus gilberti</i>	Gilbert's dragon		
Agamidae	<i>Amphibolurus nobbi</i>			
Agamidae	<i>Chlamydosaurus kingii</i>	frilled lizard		
Agamidae	<i>Ctenophorus nuchalis</i>	central netted dragon		
Agamidae	<i>Diporiphora australis</i>			
Agamidae	<i>Pogona barbata</i>	bearded dragon		
Boidae	<i>Antaresia maculosa</i>	spotted python		
Boidae	<i>Aspidites melanocephalus</i>	black-headed python		
Boidae	<i>Morelia spilota</i>	carpet python		
Chelidae	<i>Chelodina longicollis</i>	eastern snake-necked turtle		
Colubridae	<i>Boiga irregularis</i>	brown tree snake		
Colubridae	<i>Dendrelaphis punctulata</i>	common tree snake		
Colubridae	<i>Tropidonophis mairii</i>	freshwater snake		
Elapidae	<i>Acanthophis praelongus</i>	northern death adder		
Elapidae	<i>Demansia papuensis</i>	Papuan whip snake		
Elapidae	<i>Demansia psammophis</i>	yellow-faced whip snake		
Elapidae	<i>Demansia rimicola</i>			
Elapidae	<i>Denisonia maculata</i>	ornamental snake	Vulnerable	Vulnerable
Elapidae	<i>Furina diadema</i>	red-naped snake		
Elapidae	<i>Pseudonaja nuchalis</i>	western brown snake		
Elapidae	<i>Pseudonaja textilis</i>	eastern brown snake		
Elapidae	<i>Rhinoplocephalus boschmai</i>	Carpentaria whip snake		
Elapidae	<i>Simoselaps australis</i>	coral snake		
Elapidae	<i>Suta suta</i>	myall snake		
Elapidae	<i>Vermicella annulata</i>	bandy-bandy		
Gekkonidae	<i>Diplodactylus conspicillatus</i>	fat-tailed diplodactylus		
Gekkonidae	<i>Diplodactylus vittatus</i>	wood gecko		
Gekkonidae	<i>Gehyra catenata</i>			
Gekkonidae	<i>Gehyra dubia</i>			
Gekkonidae	<i>Gehyra variegata</i>	tree dtella		
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko		
Gekkonidae	<i>Lucasium steindachneri</i>	Steindachner's gecko		
Gekkonidae	<i>Lucasium stenodactylum</i>	crowned gecko		
Gekkonidae	<i>Nephurus asper</i>	spiny knob-tailed gecko		
Gekkonidae	<i>Oedura castelnaui</i>	northern velvet gecko		
Gekkonidae	<i>Oedura marmorata</i>	marbled velvet gecko		
Gekkonidae	<i>Oedura monilis</i>			
Gekkonidae	<i>Oedura rhombifer</i>	zig-zag gecko		
Gekkonidae	<i>Rhynchoedura ornata</i>	beaked gecko		
Gekkonidae	<i>Strophurus williamsi</i>	soft-spined gecko		
Pygopodidae	<i>Lialis burtonis</i>	Burton's legless lizard		
Pygopodidae	<i>Paradelma orientalis</i>	brigalow scaly-foot	Vulnerable	Vulnerable
Pygopodidae	<i>Pygopus schraderi</i>			
Scincidae	<i>Carlia munda</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Scincidae	<i>Carlia pectoralis</i>			
Scincidae	<i>Carlia schmeltzii</i>			
Scincidae	<i>Cryptoblepharus metallicus</i>	metallic snake-eyed skink		
Scincidae	<i>Cryptoblepharus pannosus</i>	ragged snake-eyed skink		
Scincidae	<i>Cryptoblepharus plagiocephalus sensu lato</i>			
Scincidae	<i>Cryptoblepharus virgatus sensu lato</i>			
Scincidae	<i>Ctenotus capricorni</i>		Near threatened	
Scincidae	<i>Ctenotus hebetior</i>			
Scincidae	<i>Ctenotus ingrami</i>			
Scincidae	<i>Ctenotus leonhardii</i>			
Scincidae	<i>Ctenotus pantherinus</i>			
Scincidae	<i>Ctenotus robustus</i>			
Scincidae	<i>Ctenotus strauchii</i>			
Scincidae	<i>Egernia rugosa</i>	yakka skink	Vulnerable	Vulnerable
Scincidae	<i>Egernia striolata</i>	tree skink		
Scincidae	<i>Eremiascincus fasciolatus</i>	narrow-banded sand swimmer		
Scincidae	<i>Eulamprus sokosoma</i>			
Scincidae	<i>Lerista fragilis</i>			
Scincidae	<i>Lerista punctatovittata</i>			
Scincidae	<i>Lerista timida</i>			
Scincidae	<i>Menetia greyii</i>			
Scincidae	<i>Menetia maini</i>			
Scincidae	<i>Menetia timlowi</i>			
Scincidae	<i>Morethia boulengeri</i>			
Scincidae	<i>Morethia taeniopleura</i>	fire-tailed skink		
Scincidae	<i>Proablepharus tenuis</i>			
Scincidae	<i>Tiliqua multifasciata</i>	Centralian blue-tongued lizard		
Scincidae	<i>Tiliqua scincoides</i>	eastern blue-tongued lizard		
Typhlopidae	<i>Ramphotyphlops ligatus</i>			
Varanidae	<i>Varanus gouldii</i>	sand monitor		
Varanidae	<i>Varanus mertensi</i>	Mertens' water monitor		
Varanidae	<i>Varanus panoptes</i>	yellow-spotted monitor		
Varanidae	<i>Varanus tristis</i>	black-tailed monitor		
Birds				
Acanthizidae	<i>Acanthiza apicalis</i>	inland thornbill		
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill		
Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		
Acanthizidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill		
Acanthizidae	<i>Acanthiza uropygialis</i>	chestnut-rumped thornbill		
Acanthizidae	<i>Gerygone albogularis</i>	white-throated gerygone		
Acanthizidae	<i>Gerygone fusca</i>	western gerygone		
Acanthizidae	<i>Smicrornis brevirostris</i>	weebill		
Accipitridae	<i>Accipiter cirrocephalus</i>	collared sparrowhawk		
Accipitridae	<i>Accipiter fasciatus</i>	brown goshawk		Marine
Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		
Accipitridae	<i>Aviceda subcristata</i>	Pacific baza		
Accipitridae	<i>Circus assimilis</i>	spotted harrier		
Accipitridae	<i>Elanus axillaris</i>	black-shouldered kite		
Accipitridae	<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle		Marine; Migratory (CAMBA)
Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		Marine
Accipitridae	<i>Hamirostra melanosternon</i>	black-breasted buzzard		
Accipitridae	<i>Hieraaetus morphnoides</i>	little eagle		
Accipitridae	<i>Milvus migrans</i>	black kite		
Accipitridae	<i>Lophoictinia isura</i>	square-tailed kite	Near threatened	
Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler		
Aegothelidae	<i>Aegotheles cristatus</i>	Australian owl-nightjar		
Alaudidae	<i>Mirafra javanica</i>	Horsfield's bushlark		
Anatidae	<i>Anas gracilis</i>	grey teal		
Anatidae	<i>Anas rhynchotis</i>	Australasian shoveler		
Anatidae	<i>Anas superciliosa</i>	Pacific black duck		
Anatidae	<i>Aythya australis</i>	hardhead		
Anatidae	<i>Chenonetta jubata</i>	Australian wood duck		
Anatidae	<i>Cygnus atratus</i>	black swan		
Anatidae	<i>Dendrocygna arcuata</i>	wandering whistling-duck		Marine
Anatidae	<i>Dendrocygna eytoni</i>	plumed whistling-duck		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Anatidae	<i>Malacorhynchus membranaceus</i>	pink-eared duck		
Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian darter		
Apodidae	<i>Apus pacificus</i>	fork-tailed swift		Marine; Migratory (CAMBA; JAMBA, ROKAMBA)
Apodidae	<i>Hirundapus caudacutus</i>	white-throated needletail		Marine; Migratory (CAMBA; JAMBA, ROKAMBA)
Ardeidae	<i>Ardea intermedia</i>	intermediate egret		Marine
Ardeidae	<i>Ardea modesta</i>	eastern great egret		Marine; Migratory (CAMBA; JAMBA, ROKAMBA)
Ardeidae	<i>Ardea pacifica</i>	white-necked heron		
Ardeidae	<i>Egretta garzetta</i>	little egret		Marine
Ardeidae	<i>Egretta novaehollandiae</i>	white-faced heron		
Ardeidae	<i>Ixobrychus flavicollis</i>	black bittern		
Ardeidae	<i>Nycticorax caledonicus</i>	nankeen night-heron		Marine
Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow		
Artamidae	<i>Artamus cyanopterus</i>	dusky woodswallow		
Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow		
Artamidae	<i>Artamus minor</i>	little woodswallow		
Artamidae	<i>Artamus personatus</i>	masked woodswallow		
Artamidae	<i>Artamus superciliosus</i>	white-browed woodswallow		
Artamidae	<i>Cracticus nigrogularis</i>	piebald butcherbird		
Artamidae	<i>Cracticus tibicen</i>	Australian magpie		
Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		
Artamidae	<i>Strepera graculina</i>	piebald currawong		
Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew		
Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		
Cacatuidae	<i>Cacatua pastinator</i>	western corella		
Cacatuidae	<i>Cacatua sanguinea</i>	little corella		
Cacatuidae	<i>Calyptorhynchus banksii</i>	red-tailed black-cockatoo		
Cacatuidae	<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo		
Cacatuidae	<i>Eolophus roseicapillus</i>	galah		
Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel		
Campephagidae	<i>Coracina maxima</i>	ground cuckoo-shrike		
Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		Marine
Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		Marine
Campephagidae	<i>Coracina tenuirostris</i>	cicadabird		Marine
Campephagidae	<i>Lalage leucomela</i>	varied triller		
Campephagidae	<i>Lalage sueurii</i>	white-winged triller		
Casuariidae	<i>Dromaius novaehollandiae</i>	emu		
Charadriidae	<i>Charadrius ruficapillus</i>	red-capped plover		Marine
Charadriidae	<i>Elseyornis melanops</i>	black-fronted dotterel		
Charadriidae	<i>Erythronyx cinctus</i>	red-kneed dotterel		
Charadriidae	<i>Vanellus miles</i>	masked lapwing		
Charadriidae	<i>Vanellus miles miles</i>	masked lapwing (northern subspecies)		
Charadriidae	<i>Vanellus miles novaehollandiae</i>	masked lapwing (southern subspecies)		
Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	black-necked stork	Near threatened	
Cisticolidae	<i>Cisticola exilis</i>	golden-headed cisticola		
Climacteridae	<i>Climacteris affinis</i>	white-browed treecreeper		
Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper		
Columbidae	<i>Geopelia cuneata</i>	diamond dove		
Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove		
Columbidae	<i>Geopelia striata</i>	peaceful dove		
Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon		
Columbidae	<i>Phaps chalcoptera</i>	common bronzewing		
Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern subspecies)	Vulnerable	Vulnerable
Coraciidae	<i>Eurystomus orientalis</i>	dollarbird		Marine
Corcoracidae	<i>Corcorax melanorhamphos</i>	white-winged chough		
Corcoracidae	<i>Struthidea cinerea</i>	apostlebird		
Corvidae	<i>Corvus bennetti</i>	little crow		
Corvidae	<i>Corvus coronoides</i>	Australian raven		
Corvidae	<i>Corvus orru</i>	Torresian crow		
Cuculidae	<i>Cacomantis flabelliformis</i>	fan-tailed cuckoo		Marine
Cuculidae	<i>Cacomantis pallidus</i>	pallid cuckoo		Marine
Cuculidae	<i>Cacomantis variolosus</i>	brush cuckoo		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Cuculidae	<i>Centropus phasianinus</i>	pheasant coucal		
Cuculidae	<i>Chalcites basal</i>	Horsfield's bronze-cuckoo		Marine
Cuculidae	<i>Chalcites lucidus</i>	shining bronze-cuckoo		Marine
Cuculidae	<i>Chalcites osculans</i>	black-eared cuckoo		Marine
Cuculidae	<i>Eudynamys orientalis</i>	eastern koel		
Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		Marine
Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		Marine
Estrildidae	<i>Neochmia modesta</i>	plum-headed finch		
Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		
Estrildidae	<i>Taeniopygia guttata</i>	zebra finch		
Estrildidae	<i>Poephila cincta cincta</i>	black-throated finch (white-rumped subspecies)	Endangered	Endangered
Eurostopodidae	<i>Eurostopodus argus</i>	spotted nightjar		Marine
Eurostopodidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar		Marine
Falconidae	<i>Falco berigora</i>	brown falcon		
Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		Marine
Falconidae	<i>Falco longipennis</i>	Australian hobby		
Falconidae	<i>Falco peregrinus</i>	peregrine falcon		
Falconidae	<i>Falco subniger</i>	black falcon		
Gruidae	<i>Grus rubicunda</i>	brilga		
Halcyonidae	<i>Dacelo leachii</i>	blue-winged kookaburra		
Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		
Halcyonidae	<i>Todiramphus macleayi</i>	forest kingfisher		Marine
Halcyonidae	<i>Todiramphus pyrrhopygius</i>	red-backed kingfisher		
Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		Marine
Hirundinidae	<i>Hirundo neoxena</i>	welcome swallow		
Hirundinidae	<i>Petrochelidon ariel</i>	fairy martin		
Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		Marine
Laridae	<i>Chlidonias hybrida</i>	whiskered tern		Marine
Laridae	<i>Chroicocephalus novaehollandiae</i>	silver gull		Marine
Laridae	<i>Gelochelidon nilotica</i>	gull-billed tern		Marine
Laridae	<i>Hydroprogne caspia</i>	Caspian tern		Marine; Migratory (CAMBA; JAMBA)
Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren		
Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		
Megaluridae	<i>Cincloramphus cruralis</i>	brown songlark		
Megaluridae	<i>Cincloramphus mathewsi</i>	rufous songlark		
Megaluridae	<i>Eremiornis carteri</i>	spinifexbird		
Megapodiidae	<i>Alectura lathami</i>	Australian brush-turkey		
Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater		
Meliphagidae	<i>Conopophila rufogularis</i>	rufous-throated honeyeater		
Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		
Meliphagidae	<i>Epthianura tricolor</i>	crimson chat		
Meliphagidae	<i>Lichenostomus penicillatus</i>	white-plumed honeyeater		
Meliphagidae	<i>Lichenostomus plumulus</i>	grey-fronted honeyeater		
Meliphagidae	<i>Lichenostomus virescens</i>	singing honeyeater		
Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		
Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		
Meliphagidae	<i>Manorina melanocephala</i>	noisy miner		
Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		
Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		
Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		
Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		
Meliphagidae	<i>Ramsayornis fasciatus</i>	bar-breasted honeyeater		
Meliphagidae	<i>Melithreptus gularis</i>	black-chinned honeyeater	Near threatened	
Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		Marine; Migratory (JAMBA)
Monarchidae	<i>Grallina cyanoleuca</i>	magpie-lark		
Monarchidae	<i>Myiagra inquieta</i>	restless flycatcher		
Monarchidae	<i>Myiagra rubecula</i>	leadend flycatcher		
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian pipit		Marine
Nectariniidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		
Neositidae	<i>Daphoenositta chrysoptera</i>	varied sittella		
Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		
Oriolidae	<i>Sphecotheres vieillotii</i>	Australasian figbird		
Otididae	<i>Ardeotis australis</i>	Australian bustard		
Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		
Pachycephalidae	<i>Oreocica gutturalis</i>	crested bellbird		
Pachycephalidae	<i>Pachycephala pectoralis</i>	golden whistler		
Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		
Passeridae	<i>Passer domesticus</i>	house sparrow	Introduced	
Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		Marine
Petroicidae	<i>Eopsaltria australis</i>	eastern yellow robin		
Petroicidae	<i>Melanodryas cucullata</i>	hooded robin		
Petroicidae	<i>Microeca fascians</i>	jacky winter		
Petroicidae	<i>Petroica goodenovii</i>	red-capped robin		
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		
Phalacrocoracidae	<i>Phalacrocorax carbo</i>	great cormorant		
Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant		
Phasianidae	<i>Coturnix pectoralis</i>	stubble quail		Marine
Phasianidae	<i>Coturnix ypsilophora</i>	brown quail		
Podargidae	<i>Podargus strigoides</i>	tawny frogmouth		
Podicipedidae	<i>Podiceps cristatus</i>	great crested grebe		
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe		
Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		
Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot		
Psittacidae	<i>Glossopsitta pusilla</i>	little lorikeet		
Psittacidae	<i>Melopsittacus undulatus</i>	budgerigar		
Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella		
Psittacidae	<i>Trichoglossus haematodus moluccanus</i>	rainbow lorikeet		
Psittacidae	<i>Psephotus pulcherrimus</i>	paradise parrot	Extinct	Extinct
Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	spotted bowerbird		
Rallidae	<i>Fulica atra</i>	Eurasian coot		
Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen		
Rallidae	<i>Porphyrio porphyrio</i>	purple swamphen		
Rallidae	<i>Tribonyx ventralis</i>	black-tailed native-hen		
Recurvirostridae	<i>Himantopus himantopus</i>	black-winged stilt		Marine
Recurvirostridae	<i>Recurvirostra novaehollandiae</i>	red-necked avocet		Marine
Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail		
Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail		
Scolopacidae	<i>Actitis hypoleucos</i>	common sandpiper		Marine; Migratory (Bonn; CAMBA; JAMBA; ROKAMBA)
Scolopacidae	<i>Calidris acuminata</i>	sharp-tailed sandpiper		Marine; Migratory (Bonn; CAMBA; JAMBA; ROKAMBA)
Scolopacidae	<i>Calidris ferruginea</i>	curlew sandpiper		Marine; Migratory (Bonn; CAMBA; JAMBA; ROKAMBA)
Scolopacidae	<i>Gallinago hardwickii</i>	Latham's snipe		Marine; Migratory (Bonn; CAMBA; JAMBA; ROKAMBA)
Scolopacidae	<i>Limosa limosa</i>	black-tailed godwit		Marine; Migratory (Bonn; CAMBA; JAMBA; ROKAMBA)
Scolopacidae	<i>Tringa nebularia</i>	common greenshank		Marine; Migratory (Bonn; CAMBA; JAMBA; ROKAMBA)
Scolopacidae	<i>Tringa stagnatilis</i>	marsh sandpiper		Marine; Migratory (Bonn; CAMBA; JAMBA; ROKAMBA)
Strigidae	<i>Ninox boobook</i>	southern boobook		Marine
Threskiornithidae	<i>Platalea flavipes</i>	yellow-billed spoonbill		
Threskiornithidae	<i>Platalea regia</i>	royal spoonbill		
Threskiornithidae	<i>Plegadis falcinellus</i>	glossy ibis		Marine; Migratory (Bonn; CAMBA)
Threskiornithidae	<i>Threskiornis molucca</i>	Australian white ibis		Marine
Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		Marine
Timaliidae	<i>Zosterops lateralis</i>	silvereye		Marine
Turnicidae	<i>Turnix pyrrhox</i>	red-chested button-quail		
Turnicidae	<i>Turnix velox</i>	little button-quail		
Tytonidae	<i>Tyto javanica</i>	eastern barn owl		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Mammals				
Bovidae	<i>Bos taurus</i>	European cattle	Introduced	
Canidae	<i>Canis familiaris</i>	dog	Introduced	
Canidae	<i>Canis lupus dingo</i>	dingo	Introduced	
Canidae	<i>Vulpes vulpes</i>	red fox	Introduced	
Dasyuridae	<i>Planigale maculata</i>	common planigale		
Dasyuridae	<i>Planigale tenuirostris</i>	narrow-nosed planigale		
Dasyuridae	<i>Sminthopsis macroura</i>	stripe-faced dunnart		
Dasyuridae	<i>Sminthopsis murina</i>	common dunnart		
Emballonuridae	<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail bat		
Equidae	<i>Equus caballus</i>	horse	Introduced	
Felidae	<i>Felis catus</i>	cat	Introduced	
Leporidae	<i>Oryctolagus cuniculus</i>	rabbit	Introduced	
Macropodidae	<i>Lagorchestes conspicillatus</i>	spectacled hare-wallaby		
Macropodidae	<i>Macropus dorsalis</i>	black-striped wallaby		
Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo		
Macropodidae	<i>Macropus robustus</i>	common wallaroo		
Macropodidae	<i>Macropus rufogriseus</i>	red-necked wallaby		
Macropodidae	<i>Macropus rufus</i>	red kangaroo		
Macropodidae	<i>Wallabia bicolor</i>	swamp wallaby		
Molossidae	<i>Chaerephon jobensis</i>	northern freetail bat		
Molossidae	<i>Mormopterus beccarii</i>	Beccari's freetail bat		
Molossidae	<i>Mormopterus planiceps</i>	southern freetail bat		
Molossidae	<i>Tadarida australis</i>	white-striped freetail bat		
Muridae	<i>Leggadina lakedownensis</i>	Lakeland Downs mouse		
Muridae	<i>Pseudomys delicatulus</i>	delicate mouse		
Muridae	<i>Pseudomys desertor</i>	desert mouse		
Muridae	<i>Pseudomys gracilicaudatus</i>	eastern chestnut mouse		
Muridae	<i>Pseudomys patrius</i>	eastern pebble-mound mouse		
Muridae	<i>Mus musculus</i>	house mouse	Introduced	
Peramelidae	<i>Isoodon macrourus</i>	northern brown bandicoot		
Peramelidae	<i>Macrotis lagotis</i>	greater bilby	Endangered	Vulnerable
Petauridae	<i>Petaurus breviceps</i>	sugar glider		
Petauridae	<i>Petaurus norfolcensis</i>	squirrel glider		
Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum		
Phascolarctidae	<i>Phascolarctos cinereus</i>	koala		
Potoroidae	<i>Aepyprymnus rufescens</i>	rufous bettong		
Pseudocheiridae	<i>Petauroides volans</i>	greater glider		
Pteropodidae	<i>Pteropus scapulatus</i>	little red flying-fox		
Suidae	<i>Sus scrofa</i>	pig	Introduced	
Tachyglossidae	<i>Tachyglossus aculeatus</i>	short-beaked echidna		
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat		
Vespertilionidae	<i>Chalinolobus morio</i>	chocolate wattled bat		
Vespertilionidae	<i>Chalinolobus nigrogriseus</i>	hoary wattled bat		
Vespertilionidae	<i>Nyctophilus geoffroyi</i>	lesser long-eared bat		
Vespertilionidae	<i>Scotorepens balstoni</i>	inland broad-nosed bat		
Vespertilionidae	<i>Scotorepens greyii</i>	little broad-nosed bat		
Vespertilionidae	<i>Scotorepens sanborni</i>	northern broad-nosed bat		
Vespertilionidae	<i>Vespadelus baverstocki</i>	inland forest bat		
Vespertilionidae	<i>Vespadelus finlaysoni</i>	Finlayson's cave bat		
Vespertilionidae	<i>Vespadelus troughtoni</i>	eastern cave bat		
Vespertilionidae	<i>Chalinolobus picatus</i>	little pied bat	Near threatened	
Vombatidae	<i>Lasiorhinus krefftii</i>	northern hairy-nosed wombat	Endangered	Endangered
Plants				
Ferns				
Adiantaceae	<i>Cheilanthes distans</i>	bristly cloak fern		
Adiantaceae	<i>Cheilanthes nudiusecula</i>			
Adiantaceae	<i>Cheilanthes sieberi</i>			
Azollaceae	<i>Azolla pinnata</i>	fernzy azolla		
Marsileaceae	<i>Marsilea</i>			
Marsileaceae	<i>Marsilea hirsuta</i>	hairy nardoo		
Marsileaceae	<i>Marsilea mutica</i>	shiny nardoo		
Parkeriaceae	<i>Ceratopteris thalictroides</i>			
Polypodiaceae	<i>Lecanopteris sinuosa</i>			
Thelypteridaceae	<i>Cyclosorus interruptus</i>			
Higher Dicots				
Acanthaceae	<i>Brunoniella australis</i>	blue trumpet		
Acanthaceae	<i>Dipteracanthus australasicus</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Acanthaceae	<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>			
Acanthaceae	<i>Dipteracanthus australasicus</i> subsp. <i>corynothecus</i>			
Acanthaceae	<i>Nelsonia campestris</i>			
Acanthaceae	<i>Pseuderanthemum tenellum</i>			
Acanthaceae	<i>Rostellularia adscendens</i>			
Acanthaceae	<i>Rostellularia adscendens</i> var. <i>clementii</i>			
Aizoaceae	<i>Trianthema</i> sp. (Coorabulka R.W.Purdie 1404)			
Aizoaceae	<i>Trianthema triquetra</i>	red spinach		
Aizoaceae	<i>Zaleya galericulata</i>			
Aizoaceae	<i>Zaleya galericulata</i> subsp. <i>galericulata</i>			
Amaranthaceae	<i>Achyranthes aspera</i>			
Amaranthaceae	<i>Alternanthera</i>			
Amaranthaceae	<i>Alternanthera angustifolia</i>			
Amaranthaceae	<i>Alternanthera denticulata</i> var. <i>micrantha</i>			
Amaranthaceae	<i>Alternanthera nana</i>	hairy joyweed		
Amaranthaceae	<i>Alternanthera nodiflora</i>	joyweed		
Amaranthaceae	<i>Alternanthera pungens</i>	khaki weed	Introduced	
Amaranthaceae	<i>Amaranthus</i>			
Amaranthaceae	<i>Amaranthus interruptus</i>			
Amaranthaceae	<i>Amaranthus mitchellii</i>	Boggabri weed		
Amaranthaceae	<i>Gomphrena</i>			
Amaranthaceae	<i>Gomphrena celosioides</i>	gomphrena weed	Introduced	
Amaranthaceae	<i>Gomphrena lanata</i>			
Amaranthaceae	<i>Gomphrena</i> sp. (Doongmabulla E.J.Thompson+ GAL137)			
Amaranthaceae	<i>Nyssanthus erecta</i>			
Amaranthaceae	<i>Ptilotus nobilis</i>			
Amaranthaceae	<i>Ptilotus nobilis</i> subsp. <i>nobilis</i>			
Amaranthaceae	<i>Ptilotus nobilis</i> subsp. <i>semilanatus</i>			
Amaranthaceae	<i>Ptilotus polystachyus</i>			
Apiaceae	<i>Eryngium fontanum</i>		Endangered	Endangered
Apiaceae	<i>Eryngium plantagineum</i>	long eryngium		
Apiaceae	<i>Platysace valida</i>			
Apocynaceae	<i>Alstonia constricta</i>	bitterbark		
Apocynaceae	<i>Carissa lanceolata</i>			
Apocynaceae	<i>Carissa ovata</i>	currantbush		
Apocynaceae	<i>Marsdenia viridiflora</i>			
Apocynaceae	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>			
Apocynaceae	<i>Parsonsia</i>			
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	gargaloo		
Apocynaceae	<i>Parsonsia lanceolata</i>	northern silkpod		
Apocynaceae	<i>Parsonsia leichhardtii</i>	black silkpod		
Apocynaceae	<i>Sarcostemma viminalis</i> subsp. <i>brunonianum</i>			
Apocynaceae	<i>Secamone elliptica</i>			
Araliaceae	<i>Hydrocotyle acutiloba</i>			
Araliaceae	<i>Hydrocotyle dipyleura</i>		Vulnerable	
Asclepiadaceae	<i>Sarcostemma</i>			
Asteraceae	<i>Acanthospermum hispidum</i>	star burr	Introduced	
Asteraceae	<i>Acmella grandiflora</i> var. <i>brachyglossa</i>			
Asteraceae	<i>Aster subulatus</i>	wild aster	Introduced	
Asteraceae	<i>Asteraceae</i>			
Asteraceae	<i>Blumea mollis</i>			
Asteraceae	<i>Brachyscome</i>			
Asteraceae	<i>Calotis</i>			
Asteraceae	<i>Calotis</i> sp. (Lake Buchanan J.Kemp+ 3384H)			
Asteraceae	<i>Calotis xanthosioidea</i>			
Asteraceae	<i>Camptacra barbata</i>			
Asteraceae	<i>Centipeda</i>			
Asteraceae	<i>Centipeda minima</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Asteraceae	<i>Centipeda nidiformis</i>			
Asteraceae	<i>Chrysocephalum apiculatum</i>	yellow buttons		
Asteraceae	<i>Coronidium glutinosum</i>			
Asteraceae	<i>Cyanthillium cinereum</i>			
Asteraceae	<i>Eclipta platyglossa</i>			
Asteraceae	<i>Emilia sonchifolia</i> var. <i>sonchifolia</i>		Introduced	
Asteraceae	<i>Epaltes australis</i>	spreading nutheads		
Asteraceae	<i>Flaveria trinervia</i>		Introduced	
Asteraceae	<i>Minuria</i>			
Asteraceae	<i>Minuria integerrima</i>	smooth minuria		
Asteraceae	<i>Parthenium hysterophorus</i>	parthenium weed	Introduced	
Asteraceae	<i>Peripleura arida</i>			
Asteraceae	<i>Peripleura hispidula</i> var. <i>setosa</i>			
Asteraceae	<i>Peripleura scabra</i>		Near threatened	
Asteraceae	<i>Pluchea baccharoides</i>	narrow-leaved plains bush		
Asteraceae	<i>Pluchea dentex</i>	bowl daisy		
Asteraceae	<i>Pluchea dioscoridis</i>			
Asteraceae	<i>Pluchea ferdinandi-muelleri</i>			
Asteraceae	<i>Pluchea rubelliflora</i>			
Asteraceae	<i>Pterocaulon serrulatum</i>			
Asteraceae	<i>Pterocaulon serrulatum</i> var. <i>serrulatum</i>			
Asteraceae	<i>Pterocaulon</i> sp. (Yarrowmere Station E.J.Thompson + BUC340)			
Asteraceae	<i>Pterocaulon sphacelatum</i>	applebush		
Asteraceae	<i>Senecio depressicola</i>			
Asteraceae	<i>Sphaeranthus indicus</i>			
Asteraceae	<i>Streptoglossa</i>			
Asteraceae	<i>Streptoglossa adscendens</i>	desert daisy		
Asteraceae	<i>Streptoglossa bubakii</i>			
Asteraceae	<i>Streptoglossa odora</i>			
Asteraceae	<i>Verbesina encelioides</i>	crownbeard	Introduced	
Asteraceae	<i>Vittadinia</i>			
Asteraceae	<i>Vittadinia cuneata</i>			
Asteraceae	<i>Vittadinia pustulata</i>			
Asteraceae	<i>Wedelia spilanthoides</i>			
Asteraceae	<i>Xanthium occidentale</i>		Introduced	
Bignoniaceae	<i>Pandorea pandorana</i>	wonga vine		
Boraginaceae	<i>Ehretia membranifolia</i>	weeping koda		
Boraginaceae	<i>Ehretia saligna</i>			
Boraginaceae	<i>Heliotropium cunninghamii</i>			
Boraginaceae	<i>Heliotropium curassavicum</i>	smooth heliotrope	Introduced	
Boraginaceae	<i>Heliotropium geocharis</i>			
Boraginaceae	<i>Heliotropium moorei</i>			
Boraginaceae	<i>Heliotropium ovalifolium</i>			
Boraginaceae	<i>Heliotropium peninsulare</i>			
Boraginaceae	<i>Heliotropium tenuifolium</i>			
Boraginaceae	<i>Trichodesma zeylanicum</i>			
Boraginaceae	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>			
Byttneriaceae	<i>Keraudrenia collina</i>			
Byttneriaceae	<i>Keraudrenia hookeriana</i>			
Byttneriaceae	<i>Keraudrenia integrifolia</i>			
Byttneriaceae	<i>Keraudrenia nephrosperma</i>			
Byttneriaceae	<i>Seringia corollata</i>			
Byttneriaceae	<i>Waltheria indica</i>			
Cactaceae	<i>Harrisia martini</i>		Introduced	
Cactaceae	<i>Opuntia</i>			
Cactaceae	<i>Opuntia tomentosa</i>	velvety tree pear	Introduced	
Caesalpiniaceae	<i>Cassia brewsteri</i>			
Caesalpiniaceae	<i>Chamaecrista absus</i>		Introduced	
Caesalpiniaceae	<i>Chamaecrista absus</i> var. <i>absus</i>			
Caesalpiniaceae	<i>Chamaecrista mimosoides</i>	dwarf cassia		
Caesalpiniaceae	<i>Chamaecrista nomame</i> var. <i>nomame</i>			
Caesalpiniaceae	<i>Labichea rupestris</i>			
Caesalpiniaceae	<i>Lysiphyllum</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Caesalpiniaceae	<i>Lysiphyllum carronii</i>	ebony tree		
Caesalpiniaceae	<i>Lysiphyllum hookeri</i>	Queensland ebony		
Caesalpiniaceae	<i>Petalostylis labicheoides</i>			
Caesalpiniaceae	<i>Senna</i>			
Caesalpiniaceae	<i>Senna artemisioides</i>			
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>artemisioides</i>			
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>coriacea</i>			
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>			
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>oligophylla</i>			
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>sturtii</i>			
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>zygophylla</i>			
Caesalpiniaceae	<i>Senna circinnata</i>			
Caesalpiniaceae	<i>Senna costata</i>			
Caesalpiniaceae	<i>Senna notabilis</i>			
Caesalpiniaceae	<i>Senna planitiicola</i>			
Campanulaceae	<i>Isotoma</i>			
Campanulaceae	<i>Wahlenbergia</i>			
Campanulaceae	<i>Wahlenbergia queenslandica</i>			
Campanulaceae	<i>Wahlenbergia tumidifructa</i>			
Capparaceae	<i>Apophyllum anomalum</i>	broom bush		
Capparaceae	<i>Capparis canescens</i>			
Capparaceae	<i>Capparis lasiantha</i>	nipan		
Capparaceae	<i>Capparis loranthifolia</i>			
Capparaceae	<i>Capparis mitchellii</i>			
Capparaceae	<i>Capparis umbonata</i>			
Caryophyllaceae	<i>Polycarpaea corymbosa</i>			
Caryophyllaceae	<i>Polycarpaea multicaulis</i>			
Caryophyllaceae	<i>Polycarpaea spirostylis</i> subsp. <i>compacta</i>			
Casuarinaceae	<i>Casuarina cristata</i>	belah		
Celastraceae	<i>Denhamia oleaster</i>			
Celastraceae	<i>Elaeodendron australe</i> var. <i>integrifolium</i>			
Celastraceae	<i>Maytenus cunninghamii</i>	yellow berry bush		
Chenopodiaceae	<i>Atriplex</i>			
Chenopodiaceae	<i>Atriplex lindleyi</i>			
Chenopodiaceae	<i>Atriplex lindleyi</i> subsp. <i>lindleyi</i>			
Chenopodiaceae	<i>Atriplex muelleri</i>	lagoon saltbush		
Chenopodiaceae	<i>Atriplex</i> sp. (Doongmabulla Homestead E.J.Thompson+ GAL20)			
Chenopodiaceae	<i>Chenopodium auricomum</i>			
Chenopodiaceae	<i>Chenopodium carinatum</i>	green crumbweed		
Chenopodiaceae	<i>Chenopodium cristatum</i>	crested goosefoot		
Chenopodiaceae	<i>Dissocarpus biflorus</i> var. <i>cephalocarpus</i>			
Chenopodiaceae	<i>Dissocarpus paradoxus</i>	cannonball burr		
Chenopodiaceae	<i>Dissocarpus</i> sp. (Doongmabulla E.J.Thompson+ GAL21)			
Chenopodiaceae	<i>Dysphania melanocarpa</i> forma <i>melanocarpa</i>			
Chenopodiaceae	<i>Dysphania plantaginella</i>			
Chenopodiaceae	<i>Einadia</i>			
Chenopodiaceae	<i>Einadia hastata</i>			
Chenopodiaceae	<i>Einadia nutans</i>			
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>linifolia</i>			
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>nutans</i>			
Chenopodiaceae	<i>Einadia trigonos</i>			
Chenopodiaceae	<i>Einadia trigonos</i> subsp. <i>stellulata</i>			
Chenopodiaceae	<i>Enchylaena tomentosa</i>			
Chenopodiaceae	<i>Eremophea spinosa</i>			
Chenopodiaceae	<i>Maireana</i>			
Chenopodiaceae	<i>Maireana coronata</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Chenopodiaceae	<i>Maireana dichoptera</i>			
Chenopodiaceae	<i>Maireana georgei</i>			
Chenopodiaceae	<i>Maireana microphylla</i>			
Chenopodiaceae	<i>Maireana villosa</i>			
Chenopodiaceae	<i>Rhagodia spinescens</i>	thorny saltbush		
Chenopodiaceae	<i>Salsola kali</i>			
Chenopodiaceae	<i>Sclerolaena</i>			
Chenopodiaceae	<i>Sclerolaena anisacanthoides</i>	yellow burr		
Chenopodiaceae	<i>Sclerolaena bicornis</i>			
Chenopodiaceae	<i>Sclerolaena bicornis</i> var. <i>bicornis</i>			
Chenopodiaceae	<i>Sclerolaena bicornis</i> var. <i>horrida</i>			
Chenopodiaceae	<i>Sclerolaena birchii</i>	galvanised burr		
Chenopodiaceae	<i>Sclerolaena calcarata</i>	red burr		
Chenopodiaceae	<i>Sclerolaena convexula</i>			
Chenopodiaceae	<i>Sclerolaena diacantha</i>	grey copper burr		
Chenopodiaceae	<i>Sclerolaena everistiana</i>			
Chenopodiaceae	<i>Sclerolaena glabra</i>			
Chenopodiaceae	<i>Sclerolaena lanicuspis</i>			
Chenopodiaceae	<i>Sclerolaena muricata</i>			
Chenopodiaceae	<i>Sclerolaena muricata</i> var. <i>muricata</i>			
Chenopodiaceae	<i>Sclerolaena ramulosa</i>			
Chenopodiaceae	<i>Sclerolaena tetracuspis</i>	brigalow burr		
Chenopodiaceae	<i>Sclerolaena tricuspis</i>	giant red burr		
Chenopodiaceae	<i>Tecticornia indica</i>			
Chenopodiaceae	<i>Tecticornia pergranulata</i>			
Chenopodiaceae	<i>Tecticornia pergranulata</i> subsp. <i>divaricata</i>			
Cleomaceae	<i>Cleome tetrandra</i> var. <i>tetrandra</i>			
Cleomaceae	<i>Cleome viscosa</i>	tick-weed		
Clusiaceae	<i>Hypericum gramineum</i>			
Combretaceae	<i>Terminalia</i>			
Combretaceae	<i>Terminalia oblongata</i>			
Convolvulaceae	<i>Bonamia media</i>			
Convolvulaceae	<i>Bonamia media</i> var. <i>media</i>			
Convolvulaceae	<i>Convolvulus graminetinus</i>			
Convolvulaceae	<i>Cressa</i>			
Convolvulaceae	<i>Cressa australis</i>			
Convolvulaceae	<i>Cressa cretica</i>			
Convolvulaceae	<i>Dichondra repens</i>	kidney weed		
Convolvulaceae	<i>Evolvulus alsinoides</i>			
Convolvulaceae	<i>Ipomoea</i>			
Convolvulaceae	<i>Ipomoea gracilis</i>			
Convolvulaceae	<i>Ipomoea gracilis</i> var. <i>sagittata</i>			
Convolvulaceae	<i>Ipomoea lonchophylla</i>			
Convolvulaceae	<i>Ipomoea plebeia</i>	bellvine		
Convolvulaceae	<i>Ipomoea polymorpha</i>			
Convolvulaceae	<i>Jacquemontia</i> sp. (Fairview R.W.Johnson 4026)			
Convolvulaceae	<i>Polymeria calycina</i>	pink bindweed		
Convolvulaceae	<i>Polymeria longifolia</i>	polymeria		
Convolvulaceae	<i>Polymeria marginata</i>			
Convolvulaceae	<i>Polymeria pusilla</i>			
Erythroxylaceae	<i>Erythroxylum australe</i>	cocaine tree		
Euphorbiaceae	<i>Beyeria viscosa</i>			
Euphorbiaceae	<i>Chamaesyce</i>			
Euphorbiaceae	<i>Chamaesyce coghlanii</i>			
Euphorbiaceae	<i>Chamaesyce dallachyana</i>	mat spurge		
Euphorbiaceae	<i>Chamaesyce drummondii</i>	caustic-weed		
Euphorbiaceae	<i>Chamaesyce mitchelliana</i>			
Euphorbiaceae	<i>Chamaesyce petala</i>			
Euphorbiaceae	<i>Euphorbia</i>			
Euphorbiaceae	<i>Euphorbia parvicaruncula</i>	rough-seeded spurge		
Euphorbiaceae	<i>Euphorbia stevenii</i>	bottle tree spurge		
Euphorbiaceae	<i>Euphorbia tannensis</i>			
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>			
Euphorbiaceae	<i>Microstachys chamaelea</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Fabaceae	<i>Aeschynomene indica</i>	budda pea		
Fabaceae	<i>Aphyllodium biarticulatum</i>			
Fabaceae	<i>Cajanus acutifolius</i>			
Fabaceae	<i>Cajanus marmoratus</i>			
Fabaceae	<i>Cajanus reticulatus</i> var. <i>reticulatus</i>			
Fabaceae	<i>Cajanus scarabaeoides</i>			
Fabaceae	<i>Cajanus scarabaeoides</i> var. <i>scarabaeoides</i>			
Fabaceae	<i>Crotalaria</i>			
Fabaceae	<i>Crotalaria dissitiflora</i>			
Fabaceae	<i>Crotalaria dissitiflora</i> subsp. <i>dissitiflora</i>			
Fabaceae	<i>Crotalaria medicaginea</i>	trefoil rattlepod		
Fabaceae	<i>Cullen cinereum</i>			
Fabaceae	<i>Desmodium campylocaulon</i>			
Fabaceae	<i>Desmodium filiforme</i>			
Fabaceae	<i>Desmodium muelleri</i>			
Fabaceae	<i>Gastrolobium grandiflorum</i>			
Fabaceae	<i>Glycine clandestina</i>			
Fabaceae	<i>Glycine falcata</i>			
Fabaceae	<i>Glycine tomentella</i>	woolly glycine		
Fabaceae	<i>Hovea lanceolata</i>			
Fabaceae	<i>Indigastrium parviflorum</i>			
Fabaceae	<i>Indigofera australis</i>			
Fabaceae	<i>Indigofera brevidens</i> var. <i>brevidens</i>			
Fabaceae	<i>Indigofera colutea</i>	sticky indigo		
Fabaceae	<i>Indigofera haplophylla</i>			
Fabaceae	<i>Indigofera linifolia</i>			
Fabaceae	<i>Indigofera linnaei</i>	Birdsville indigo		
Fabaceae	<i>Indigofera pratensis</i>			
Fabaceae	<i>Indigofera trita</i>			
Fabaceae	<i>Jacksonia ramosissima</i>			
Fabaceae	<i>Jacksonia rhadinoclona</i>	Miles dogwood		
Fabaceae	<i>Leptosema oxylobioides</i>			
Fabaceae	<i>Lotus cruentus</i>	red-flowered lotus		
Fabaceae	<i>Rhynchosia minima</i>			
Fabaceae	<i>Rhynchosia minima</i> var. <i>australis</i>			
Fabaceae	<i>Sesbania campylocarpa</i>			
Fabaceae	<i>Sesbania cannabina</i>			
Fabaceae	<i>Stylosanthes</i>			
Fabaceae	<i>Stylosanthes scabra</i>		Introduced	
Fabaceae	<i>Swainsona affinis</i>			
Fabaceae	<i>Swainsona swainsonioides</i>	downy swainsona		
Fabaceae	<i>Tephrosia barbatala</i>			
Fabaceae	<i>Tephrosia brachycarpa</i>			
Fabaceae	<i>Tephrosia brachyodon</i>			
Fabaceae	<i>Tephrosia filipes</i> subsp. <i>filipes</i>			
Fabaceae	<i>Tephrosia juncea</i>			
Fabaceae	<i>Tephrosia leptoclada</i>			
Fabaceae	<i>Tephrosia purpurea</i>			
Fabaceae	<i>Tephrosia purpurea</i> var. <i>sericea</i>			
Fabaceae	<i>Tephrosia</i> sp. (Copperfield River P.I.Forster PIF14768)			
Fabaceae	<i>Tephrosia</i> sp. (Lake Buchanan E.J.Thompson+ BUC2128)			
Fabaceae	<i>Tephrosia supina</i>			
Fabaceae	<i>Vigna lanceolata</i>			
Fabaceae	<i>Vigna luteola</i>	dalrymple vigna	Introduced	
Fabaceae	<i>Vigna vexillata</i> var. <i>angustifolia</i>			
Fabaceae	<i>Zornia adenophora</i>			
Fabaceae	<i>Zornia areolata</i>			
Fabaceae	<i>Zornia dyctiocarpa</i>			
Fabaceae	<i>Zornia muriculata</i>			
Gentianaceae	<i>Schenkia australis</i>			
Goodeniaceae	<i>Goodenia</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Goodeniaceae	<i>Goodenia byrnesii</i>			
Goodeniaceae	<i>Goodenia glabra</i>			
Goodeniaceae	<i>Goodenia gracilis</i>			
Goodeniaceae	<i>Goodenia grandiflora</i>			
Goodeniaceae	<i>Goodenia hederacea</i>			
Goodeniaceae	<i>Goodenia hirsuta</i>			
Goodeniaceae	<i>Goodenia lunata</i>			
Goodeniaceae	<i>Goodenia paniculata</i>			
Goodeniaceae	<i>Goodenia rosulata</i>			
Goodeniaceae	<i>Goodenia splendida</i>			
Goodeniaceae	<i>Goodenia strangfordii</i>			
Goodeniaceae	<i>Goodenia viridula</i>			
Goodeniaceae	<i>Scaevola spinescens</i>	prickly fan flower		
Haloragaceae	<i>Myriophyllum artesium</i>		Endangered	
Lamiaceae	<i>Basilicum polystachyon</i>			
Lamiaceae	<i>Clerodendrum floribundum</i>			
Lamiaceae	<i>Ocimum tenuiflorum</i>			
Lamiaceae	<i>Plectranthus parviflorus</i>			
Lamiaceae	<i>Prostanthera leichhardtii</i>			
Lamiaceae	<i>Prostanthera parvifolia</i>			
Lentibulariaceae	<i>Utricularia caerulea</i>	blue bladderwort		
Lentibulariaceae	<i>Utricularia dichotoma</i>	fairy aprons		
Lentibulariaceae	<i>Utricularia gibba</i>	floating bladderwort		
Loranthaceae	<i>Amyema maidenii</i> subsp. <i>angustifolia</i>			
Loranthaceae	<i>Amyema quandang</i>			
Loranthaceae	<i>Amyema quandang</i> var. <i>bancroftii</i>	broad-leaved grey mistletoe		
Loranthaceae	<i>Amyema quandang</i> var. <i>quandang</i>			
Loranthaceae	<i>Dendrophthoe glabrescens</i>			
Loranthaceae	<i>Diplatia grandibractea</i>			
Loranthaceae	<i>Lysiana spathulata</i> subsp. <i>parvifolia</i>			
Loranthaceae	<i>Lysiana subfalcata</i>			
Lythraceae	<i>Ammannia multiflora</i>	jerry-jerry		
Lythraceae	<i>Nesaea robertsii</i>		Endangered	
Malvaceae	<i>Abelmoschus ficulneus</i>	native rosella		
Malvaceae	<i>Abutilon</i>			
Malvaceae	<i>Abutilon arenarium</i>			
Malvaceae	<i>Abutilon calliphyllum</i>	velvet lanternflower		
Malvaceae	<i>Abutilon fraseri</i>	dwarf lantern flower		
Malvaceae	<i>Abutilon fraseri</i> subsp. <i>fraseri</i>			
Malvaceae	<i>Abutilon malvifolium</i>	bastard marshmallow		
Malvaceae	<i>Abutilon otocarpum</i>			
Malvaceae	<i>Abutilon oxycarpum</i>			
Malvaceae	<i>Abutilon oxycarpum</i> var. <i>subsagittatum</i>			
Malvaceae	<i>Gossypium australe</i>			
Malvaceae	<i>Herissantia crispa</i>			
Malvaceae	<i>Hibiscus brachychlaenus</i>			
Malvaceae	<i>Hibiscus brachysiphonius</i>			
Malvaceae	<i>Hibiscus krichauffianus</i>			
Malvaceae	<i>Hibiscus meraukensis</i>	Merauke hibiscus		
Malvaceae	<i>Hibiscus sturtii</i>			
Malvaceae	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>			
Malvaceae	<i>Hibiscus trionum</i>		Introduced	
Malvaceae	<i>Hibiscus trionum</i> var. <i>trionum</i>		Introduced	
Malvaceae	<i>Hibiscus trionum</i> var. <i>vesicarius</i>			
Malvaceae	<i>Lawrencia buchananensis</i>		Vulnerable	Vulnerable
Malvaceae	<i>Malvaceae</i>			
Malvaceae	<i>Malvastrum americanum</i>		Introduced	
Malvaceae	<i>Malvastrum americanum</i> var. <i>americanum</i>		Introduced	
Malvaceae	<i>Sida</i>			
Malvaceae	<i>Sida aprica</i>			
Malvaceae	<i>Sida aprica</i> var. <i>solanacea</i>			
Malvaceae	<i>Sida atherophora</i>			
Malvaceae	<i>Sida brachypoda</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Malvaceae	<i>Sida cordifolia</i>		Introduced	
Malvaceae	<i>Sida everistiana</i>			
Malvaceae	<i>Sida fibulifera</i>			
Malvaceae	<i>Sida filiformis</i>			
Malvaceae	<i>Sida goniocarpa</i>			
Malvaceae	<i>Sida rhombifolia</i>		Introduced	
Malvaceae	<i>Sida rohlenae</i>			
Malvaceae	<i>Sida rohlenae</i> subsp. <i>rohlenae</i>			
Malvaceae	<i>Sida</i> sp. (Aramac E.J.Thompson+ JER192)			
Malvaceae	<i>Sida</i> sp. (Charters Towers E.J.Thompson+ CHA456)			
Malvaceae	<i>Sida</i> sp. (Laglan Station L.S.Smith 10325)			
Malvaceae	<i>Sida</i> sp. (Musselbrook M.B.Thomas+ MRS437)			
Malvaceae	<i>Sida spinosa</i>	spiny sida	Introduced	
Malvaceae	<i>Sida trichopoda</i>			
Malvaceae	<i>Sida trichopoda</i> var. (Palardo S.T.Blake 7600)			
Meliaceae	<i>Owenia acidula</i>	emu apple		
Mimosaceae	<i>Acacia</i>			
Mimosaceae	<i>Acacia adsurgens</i>			
Mimosaceae	<i>Acacia argyrea</i>			
Mimosaceae	<i>Acacia argyrodendron</i>			
Mimosaceae	<i>Acacia bancroftiorum</i>			
Mimosaceae	<i>Acacia bidwillii</i>			
Mimosaceae	<i>Acacia cambagei</i>	gidgee		
Mimosaceae	<i>Acacia catenulata</i>	bendee		
Mimosaceae	<i>Acacia coriacea</i>			
Mimosaceae	<i>Acacia cowleana</i>			
Mimosaceae	<i>Acacia decora</i>	pretty wattle		
Mimosaceae	<i>Acacia dietrichiana</i>			
Mimosaceae	<i>Acacia excelsa</i>			
Mimosaceae	<i>Acacia excelsa</i> subsp. <i>excelsa</i>			
Mimosaceae	<i>Acacia farnesiana</i>	mimosa bush	Introduced	
Mimosaceae	<i>Acacia flavescens</i>	toothed wattle		
Mimosaceae	<i>Acacia galioides</i>			
Mimosaceae	<i>Acacia harpophylla</i>	brigalow		
Mimosaceae	<i>Acacia holosericea</i>			
Mimosaceae	<i>Acacia holosericea</i> var. <i>holosericea</i>			
Mimosaceae	<i>Acacia hyaloneura</i>			
Mimosaceae	<i>Acacia laccata</i>			
Mimosaceae	<i>Acacia lazaridis</i>			
Mimosaceae	<i>Acacia leptostachya</i>	Townsville wattle		
Mimosaceae	<i>Acacia longispicata</i>			
Mimosaceae	<i>Acacia melleodora</i>			
Mimosaceae	<i>Acacia microcybe</i>			
Mimosaceae	<i>Acacia multisiliqua</i>			
Mimosaceae	<i>Acacia orthocarpa</i>			
Mimosaceae	<i>Acacia oswaldii</i>	miljee		
Mimosaceae	<i>Acacia platycarpa</i>			
Mimosaceae	<i>Acacia salicina</i>	doolan		
Mimosaceae	<i>Acacia sericophylla</i>			
Mimosaceae	<i>Acacia shirleyi</i>	lancewood		
Mimosaceae	<i>Acacia simsii</i>			
Mimosaceae	<i>Acacia</i> sp. (Urandangie L.Pedley 2025)			
Mimosaceae	<i>Acacia stenophylla</i>	belalie		
Mimosaceae	<i>Acacia stipuligera</i>			
Mimosaceae	<i>Acacia tenuissima</i>			
Mimosaceae	<i>Acacia torulosa</i>			
Mimosaceae	<i>Acacia victoriae</i>			
Mimosaceae	<i>Archidendropsis basaltica</i>	red lancewood		
Mimosaceae	<i>Neptunia dimorphantha</i>			
Mimosaceae	<i>Neptunia gracilis</i> forma <i>gracilis</i>			
Molluginaceae	<i>Glinus lotoides</i>	hairy carpet weed		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Molluginaceae	<i>Mollugo cerviana</i>			
Moraceae	<i>Ficus microcarpa</i> var. <i>hillii</i>			
Myoporaceae	<i>Eremophila</i>			
Myoporaceae	<i>Eremophila bignoniiflora</i>	eurah		
Myoporaceae	<i>Eremophila deserti</i>			
Myoporaceae	<i>Eremophila latrobei</i>			
Myoporaceae	<i>Eremophila longifolia</i>	berrigan		
Myoporaceae	<i>Eremophila maculata</i>			
	<i>Eremophila maculata</i> subsp. <i>maculata</i>			
Myoporaceae	<i>Eremophila mitchellii</i>			
Myoporaceae	<i>Eremophila polyclada</i>	flowering lignum		
Myoporaceae	<i>Myoporum</i>			
Myoporaceae	<i>Myoporum montanum</i>	boobialla		
Myrtaceae	<i>Calytrix microcoma</i>			
	<i>Corymbia aparrerinja</i> - <i>C.dallachiana</i> (Benth.)			
Myrtaceae	<i>Corymbia brachycarpa</i>			
	<i>Corymbia brachycarpa</i> x <i>C.plena</i>			
Myrtaceae	<i>Corymbia clarksoniana</i>			
Myrtaceae	<i>Corymbia dallachiana</i>			
Myrtaceae	<i>Corymbia erythrophloia</i>	variable-barked bloodwood		
Myrtaceae	<i>Corymbia lamprophylla</i>			
Myrtaceae	<i>Corymbia leichhardtii</i>	rustyjacket		
Myrtaceae	<i>Corymbia papuana</i>	ghost gum		
Myrtaceae	<i>Corymbia plena</i>			
Myrtaceae	<i>Corymbia setosa</i>			
	<i>Corymbia setosa</i> subsp. <i>pedicellaris</i>			
Myrtaceae	<i>Corymbia terminalis</i>			
Myrtaceae	<i>Corymbia tessellaris</i>	Moreton Bay ash		
Myrtaceae	<i>Eucalyptus brownii</i>	Reid River box		
	<i>Eucalyptus brownii</i> - <i>E.populnea</i>			
Myrtaceae	<i>Eucalyptus camaldulensis</i>			
	<i>Eucalyptus camaldulensis</i> subsp. <i>acuta</i>			
Myrtaceae	<i>Eucalyptus cabbageana</i>	Dawson gum		
Myrtaceae	<i>Eucalyptus coolabah</i>	coolabah		
Myrtaceae	<i>Eucalyptus crebra</i>	narrow-leaved red ironbark		
Myrtaceae	<i>Eucalyptus drepanophylla</i>			
Myrtaceae	<i>Eucalyptus melanophloia</i>			
	<i>Eucalyptus melanophloia</i> - <i>E.whitei</i>			
Myrtaceae	<i>Eucalyptus microtheca</i>	coolibah		
Myrtaceae	<i>Eucalyptus persistens</i>			
Myrtaceae	<i>Eucalyptus populnea</i>	poplar box		
Myrtaceae	<i>Eucalyptus similis</i>	Queensland yellowjacket		
	<i>Eucalyptus socialis</i> subsp. <i>eucentrica</i>			
Myrtaceae	<i>Eucalyptus thozetiana</i>			
Myrtaceae	<i>Eucalyptus whitei</i>	White's ironbark		
Myrtaceae	<i>Eucalyptus xanthoclada</i>	yellow-branched ironbark		
Myrtaceae	<i>Leptospermum lamellatum</i>			
Myrtaceae	<i>Lithomyrtus microphylla</i>			
Myrtaceae	<i>Melaleuca fluviatilis</i>			
Myrtaceae	<i>Melaleuca foliolosa</i>			
Myrtaceae	<i>Melaleuca leucadendra</i>	broad-leaved tea-tree		
Myrtaceae	<i>Melaleuca linariifolia</i>	snow-in summer		
Myrtaceae	<i>Melaleuca nervosa</i>			
	<i>Melaleuca nervosa</i> subsp. <i>nervosa</i>			
Myrtaceae	<i>Melaleuca pallescens</i>			
Myrtaceae	<i>Melaleuca tamariscina</i>			
Myrtaceae	<i>Melaleuca uncinata</i>			
Myrtaceae	<i>Thryptomene parviflora</i>			
Nyctaginaceae	<i>Boerhavia burbidgeana</i>			
Nyctaginaceae	<i>Boerhavia coccinea</i>			
Nyctaginaceae	<i>Boerhavia diffusa</i>			
Nyctaginaceae	<i>Boerhavia dominii</i>			

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Nyctaginaceae	<i>Boerhavia paludosa</i>			
Nyctaginaceae	<i>Boerhavia pubescens</i>			
Oleaceae	<i>Jasminum didymum</i>			
Oleaceae	<i>Jasminum didymum</i> subsp. <i>didymum</i>			
Oleaceae	<i>Jasminum didymum</i> subsp. <i>racemosum</i>			
Oleaceae	<i>Jasminum simplicifolium</i> subsp. <i>australiense</i>			
Oleaceae	<i>Notelaea microcarpa</i>			
Oleaceae	<i>Notelaea microcarpa</i> var. <i>microcarpa</i>			
Onagraceae	<i>Ludwigia octovalvis</i>	willow primrose		
Onagraceae	<i>Ludwigia perennis</i>			
Oxalidaceae	<i>Oxalis corniculata</i>		Introduced	
Oxalidaceae	<i>Oxalis perennans</i>			
Oxalidaceae	<i>Oxalis radicata</i>			
Pentapetaceae	<i>Melhania oblongifolia</i>			
Pentapetaceae	<i>Melhania ovata</i>			
Phyllanthaceae	<i>Breynia oblongifolia</i>			
Phyllanthaceae	<i>Flueggea leucopyrus</i>			
Phyllanthaceae	<i>Phyllanthus</i>			
Phyllanthaceae	<i>Phyllanthus carpentariae</i>			
Phyllanthaceae	<i>Phyllanthus fuernrohrrii</i>			
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>			
Phyllanthaceae	<i>Phyllanthus virgatus</i>			
Phyllanthaceae	<i>Poranthera microphylla</i>	small poranthera		
Phyllanthaceae	<i>Sauropus elachophyllus</i>			
Phyllanthaceae	<i>Sauropus trachyspermus</i>			
Picrodendraceae	<i>Petalostigma banksii</i>			
Picrodendraceae	<i>Petalostigma pubescens</i>	quinine tree		
Pittosporaceae	<i>Bursaria incana</i>			
Pittosporaceae	<i>Pittosporum</i>			
Plumbaginaceae	<i>Plumbago zeylanica</i>	native plumbago		
Polygalaceae	<i>Comesperma pallidum</i>			
Polygalaceae	<i>Polygala isingii</i>			
Polygalaceae	<i>Polygala linariifolia</i>			
Polygalaceae	<i>Polygala</i> sp. (Georgetown K.R.McDonald KRM673)			
Polygalaceae	<i>Polygala</i> sp. (White Mountains M.B.Thomas+ 1738)			
Polygonaceae	<i>Muehlenbeckia florulenta</i>	lignum		
Polygonaceae	<i>Persicaria attenuata</i>			
Polygonaceae	<i>Persicaria decipiens</i>	slender knotweed		
Polygonaceae	<i>Persicaria lapathifolia</i>	pale knotweed		
Portulacaceae	<i>Calandrinia ptychosperma</i>			
Portulacaceae	<i>Portulaca australis</i>			
Portulacaceae	<i>Portulaca bicolor</i>			
Portulacaceae	<i>Portulaca filifolia</i>			
Portulacaceae	<i>Portulaca oleracea</i>	pigweed	Introduced	
Portulacaceae	<i>Portulaca oligosperma</i>			
Portulacaceae	<i>Portulaca pilosa</i>		Introduced	
Portulacaceae	<i>Portulaca pilosa</i> subsp. <i>pilosa</i>		Introduced	
Proteaceae	<i>Grevillea</i>			
Proteaceae	<i>Grevillea decora</i> subsp. <i>decora</i>			
Proteaceae	<i>Grevillea glauca</i>	bushy's clothes peg		
Proteaceae	<i>Grevillea parallela</i>			
Proteaceae	<i>Grevillea pteridifolia</i>	golden parrot tree		
Proteaceae	<i>Grevillea sessilis</i>			
Proteaceae	<i>Grevillea striata</i>	beefwood		
Proteaceae	<i>Hakea</i>			
Proteaceae	<i>Hakea leucoptera</i>			
Proteaceae	<i>Hakea leucoptera</i> subsp. <i>leucoptera</i>			
Proteaceae	<i>Hakea leucoptera</i> subsp. <i>sericipes</i>			
Proteaceae	<i>Hakea lorea</i>			
Proteaceae	<i>Persoonia falcata</i>			
Rhamnaceae	<i>Alphitonia excelsa</i>	soap tree		
Rhamnaceae	<i>Ventilago viminalis</i>	supplejack		

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Rubiaceae	<i>Dentella repens</i>	dentella		
Rubiaceae	<i>Everistia vacciniifolia</i>			
Rubiaceae	<i>Hedyotis</i>			
Rubiaceae	<i>Oldenlandia</i>			
Rubiaceae	<i>Oldenlandia galioides</i>			
Rubiaceae	<i>Oldenlandia mitrasacmoides</i>			
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> subsp. <i>mitrasacmoides</i>			
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> subsp. <i>nigricans</i>			
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> subsp. <i>trachymenoides</i>			
Rubiaceae	<i>Pogonolobus reticulatus</i>			
Rubiaceae	<i>Pomax umbellata</i>			
Rubiaceae	<i>Psydrax attenuata</i>			
Rubiaceae	<i>Psydrax attenuata</i> forma <i>megalantha</i>			
Rubiaceae	<i>Psydrax forsteri</i>			
Rubiaceae	<i>Psydrax odorata</i>			
Rubiaceae	<i>Psydrax odorata</i> forma <i>buxifolia</i>			
Rubiaceae	<i>Psydrax oleifolia</i>			
Rubiaceae	<i>Psydrax saligna</i> forma <i>saligna</i>			
Rubiaceae	<i>Spermacoce baileyana</i>			
Rubiaceae	<i>Spermacoce brachystema</i>			
Rutaceae	<i>Citrus glauca</i>			
Rutaceae	<i>Flindersia dissosperma</i>			
Rutaceae	<i>Flindersia maculosa</i>	leopardwood		
Rutaceae	<i>Geijera parviflora</i>	wilga		
Rutaceae	<i>Geijera salicifolia</i>	brush wilga		
Santalaceae	<i>Anthobolus leptomerioides</i>			
Santalaceae	<i>Exocarpos sparteus</i>	slender cherry		
Santalaceae	<i>Santalum lanceolatum</i>			
Sapindaceae	<i>Alectryon diversifolius</i>	scrub boonaree		
Sapindaceae	<i>Alectryon oleifolius</i>			
Sapindaceae	<i>Alectryon oleifolius</i> subsp. <i>elongatus</i>			
Sapindaceae	<i>Atalaya hemiglauca</i>			
Sapindaceae	<i>Atalaya salicifolia</i>			
Sapindaceae	<i>Distichostemon dodecandrus</i>			
Sapindaceae	<i>Dodonaea filifolia</i>			
Sapindaceae	<i>Dodonaea lanceolata</i> var. <i>lanceolata</i>			
Sapindaceae	<i>Dodonaea lanceolata</i> var. <i>subsessilifolia</i>			
Sapindaceae	<i>Dodonaea stenophylla</i>			
Sapindaceae	<i>Dodonaea tenuifolia</i>			
Sapindaceae	<i>Dodonaea viscosa</i>			
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>			
Scrophulariaceae	<i>Buchnera linearis</i>			
Scrophulariaceae	<i>Buchnera ramosissima</i>			
Scrophulariaceae	<i>Lindernia scapigera</i>			
Scrophulariaceae	<i>Mimulus repens</i>	creeping monkey flower		
Scrophulariaceae	<i>Peplidium</i>			
Scrophulariaceae	<i>Peplidium foecundum</i>			
Scrophulariaceae	<i>Scoparia dulcis</i>	Scoparia	Introduced	
Scrophulariaceae	<i>Stemodia glabella</i>			
Solanaceae	<i>Nicotiana forsteri</i>			
Solanaceae	<i>Nicotiana megalosiphon</i>			
Solanaceae	<i>Solanum</i>			
Solanaceae	<i>Solanum cleistogamum</i>			
Solanaceae	<i>Solanum crebrispinum</i>			
Solanaceae	<i>Solanum ellipticum</i>	potato bush		
Solanaceae	<i>Solanum esuriale</i>	quena		
Solanaceae	<i>Solanum nodiflorum</i>		Introduced	
Solanaceae	<i>Solanum parvifolium</i>			
Solanaceae	<i>Solanum parvifolium</i> subsp. <i>parvifolium</i>			
Sparrmanniaceae	<i>Corchorus</i>			
Sparrmanniaceae	<i>Corchorus tomentellus</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Sparrmanniaceae	<i>Grewia latifolia</i>	dysentery plant		
Sparrmanniaceae	<i>Grewia retusifolia</i>			
Sparrmanniaceae	<i>Triumfetta pentandra</i>		Introduced	
Stackhousiaceae	<i>Stackhousia viminea</i>	slender stackhousia		
Sterculiaceae	<i>Brachychiton populneus</i> subsp. <i>trilobus</i>			
Stylidiaceae	<i>Stylidium adenophorum</i>			
Stylidiaceae	<i>Stylidium eglandulosum</i>			
Stylidiaceae	<i>Stylidium eriorhizum</i>			
Stylidiaceae	<i>Stylidium velleioides</i>			
Thymelaeaceae	<i>Thecanthes sanguinea</i>			
Verbenaceae	<i>Verbena macrostachya</i>			
Violaceae	<i>Hybanthus</i>			
Violaceae	<i>Hybanthus enneaspermus</i>			
Zygophyllaceae	<i>Tribulopsis angustifolia</i>			
Zygophyllaceae	<i>Tribulus</i>			
Zygophyllaceae	<i>Tribulus terrestris</i>	caltrop		
Lower dicots				
Aristolochiaceae	<i>Aristolochia</i>			
Lauraceae	<i>Cassytha filiformis</i>	dodder laurel		
Lauraceae	<i>Cassytha pubescens</i>	downy devil's twine		
Nymphaeaceae	<i>Nymphaea gigantea</i>			
Papaveraceae	<i>Argemone mexicana</i>	prickly poppy	Introduced	
Papaveraceae	<i>Papaver aculeatum</i>	bristle poppy	Introduced	
Monocots				
Alismataceae	<i>Caldesia oligococca</i>			
Amaryllidaceae	<i>Calostemma luteum</i>			
Amaryllidaceae	<i>Crinum</i>			
Amaryllidaceae	<i>Crinum flaccidum</i>	Murray lily		
Asphodelaceae	<i>Bulbine bulbosa</i>	golden lily		
Commelinaceae	<i>Commelina</i>			
Commelinaceae	<i>Commelina diffusa</i>	wandering jew		
Commelinaceae	<i>Commelina lanceolata</i>			
Commelinaceae	<i>Cyanotis axillaris</i>			
Commelinaceae	<i>Murdannia graminea</i>	murdannia		
Cyperaceae	<i>Abildgaardia ovata</i>			
Cyperaceae	<i>Baumea rubiginosa</i>	soft twigrush		
Cyperaceae	<i>Bulbostylis barbata</i>			
Cyperaceae	<i>Cyperus</i>			
Cyperaceae	<i>Cyperus alterniflorus</i>			
Cyperaceae	<i>Cyperus betchei</i>			
Cyperaceae	<i>Cyperus betchei</i> subsp. <i>betchei</i>			
Cyperaceae	<i>Cyperus bifax</i>	western nutgrass		
Cyperaceae	<i>Cyperus bulbosus</i>			
Cyperaceae	<i>Cyperus concinnus</i>			
Cyperaceae	<i>Cyperus conicus</i>			
Cyperaceae	<i>Cyperus conicus</i> var. <i>conicus</i>			
Cyperaceae	<i>Cyperus dactylotes</i>			
Cyperaceae	<i>Cyperus difformis</i>	rice sedge		
Cyperaceae	<i>Cyperus exaltatus</i>	tall flatsedge		
Cyperaceae	<i>Cyperus flaccidus</i>			
Cyperaceae	<i>Cyperus flavidus</i>			
Cyperaceae	<i>Cyperus haspan</i> subsp. <i>haspan</i>			
Cyperaceae	<i>Cyperus iria</i>			
Cyperaceae	<i>Cyperus isabellinus</i>			
Cyperaceae	<i>Cyperus javanicus</i>			
Cyperaceae	<i>Cyperus laevigatus</i>			
Cyperaceae	<i>Cyperus laevis</i>			
Cyperaceae	<i>Cyperus pulchellus</i>			
Cyperaceae	<i>Cyperus rotundus</i>	nutgrass	Introduced	
Cyperaceae	<i>Cyperus sanguinolentus</i>			
Cyperaceae	<i>Cyperus squarrosus</i>	bearded flatsedge		
Cyperaceae	<i>Cyperus victoriensis</i>			
Cyperaceae	<i>Eleocharis atropurpurea</i>			
Cyperaceae	<i>Eleocharis equisetina</i>			
Cyperaceae	<i>Eleocharis pallens</i>	pale spikerush		
Cyperaceae	<i>Eleocharis plana</i>	ribbed spikerush		
Cyperaceae	<i>Fimbristylis</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Cyperaceae	<i>Fimbristylis aestivalis</i>			
Cyperaceae	<i>Fimbristylis depauperata</i>			
Cyperaceae	<i>Fimbristylis dichotoma</i>	common fringe-rush		
Cyperaceae	<i>Fimbristylis littoralis</i>			
Cyperaceae	<i>Fimbristylis macrantha</i>			
Cyperaceae	<i>Fimbristylis microcarya</i>			
Cyperaceae	<i>Fimbristylis neilsonii</i>			
Cyperaceae	<i>Fimbristylis nutans</i>			
Cyperaceae	<i>Fimbristylis rara</i>			
Cyperaceae	<i>Fimbristylis</i> sp. (Lake Buchanan V.J.Neldner+ 3362)			
Cyperaceae	<i>Fimbristylis vagans</i>		Near threatened	
Cyperaceae	<i>Fuirena ciliaris</i>			
Cyperaceae	<i>Fuirena umbellata</i>			
Cyperaceae	<i>Gahnia aspera</i>			
Cyperaceae	<i>Schoenoplectus dissachanthus</i>			
Cyperaceae	<i>Schoenoplectus erectus</i>		Introduced	
Cyperaceae	<i>Schoenoplectus laevis</i>			
Cyperaceae	<i>Schoenoplectus lateriflorus</i>			
Cyperaceae	<i>Schoenoplectus validus</i>			
Cyperaceae	<i>Schoenus falcatus</i>			
Cyperaceae	<i>Schoenus kennyi</i>			
Cyperaceae	<i>Scleria sphacelata</i>			
Cyperaceae	<i>Scleria tricuspidata</i>			
Eriocaulaceae	<i>Eriocaulon carsonii</i> subsp. <i>orientale</i>		Endangered	Endangered
Eriocaulaceae	<i>Eriocaulon cinereum</i>			
Eriocaulaceae	<i>Eriocaulon scariosum</i>			
Hemerocallidaceae	<i>Dianella longifolia</i>			
Hemerocallidaceae	<i>Dianella longifolia</i> var. <i>longifolia</i>			
Hemerocallidaceae	<i>Dianella longifolia</i> var. <i>stipitata</i>			
Hypoxidaceae	<i>Hypoxis arillacea</i>			
Johnsoniaceae	<i>Caesia chlorantha</i>			
Johnsoniaceae	<i>Tricoryne elatior</i>	yellow autumn lily		
Juncaceae	<i>Juncus polyanthemus</i>			
Juncaceae	<i>Juncus usitatus</i>			
Juncaginaceae	<i>Triglochin dubium</i>			
Juncaginaceae	<i>Triglochin multifructum</i>			
Laxmanniaceae	<i>Lomandra confertifolia</i> subsp. <i>pallida</i>			
Laxmanniaceae	<i>Lomandra leucocephala</i>			
Laxmanniaceae	<i>Lomandra leucocephala</i> subsp. <i>leucocephala</i>			
Laxmanniaceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>			
Laxmanniaceae	<i>Thysanotus</i>			
Laxmanniaceae	<i>Thysanotus tuberosus</i> subsp. <i>tuberosus</i>			
Orchidaceae	<i>Cadetia collinsii</i>		Near threatened	
Orchidaceae	<i>Cymbidium</i>			
Orchidaceae	<i>Cymbidium canaliculatum</i>			
Philesiaceae	<i>Petermannia</i>			
Poaceae	<i>Acrachne racemosa</i>			
Poaceae	<i>Alloteropsis cimicina</i>			
Poaceae	<i>Alloteropsis semialata</i>	cockatoo grass		
Poaceae	<i>Amphipogon caricinus</i>			
Poaceae	<i>Amphipogon caricinus</i> var. <i>caricinus</i>			
Poaceae	<i>Amphipogon sericeus</i>			
Poaceae	<i>Ancistrachne uncinulata</i>	hooky grass		
Poaceae	<i>Aristida</i>			
Poaceae	<i>Aristida benthamii</i>			
Poaceae	<i>Aristida benthamii</i> var. <i>benthamii</i>			
Poaceae	<i>Aristida biglandulosa</i>			
Poaceae	<i>Aristida burraensis</i>		Near threatened	
Poaceae	<i>Aristida calycina</i>			
Poaceae	<i>Aristida calycina</i> var. <i>calycina</i>			
Poaceae	<i>Aristida calycina</i> var. <i>praealta</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Poaceae	<i>Aristida helicophylla</i>			
Poaceae	<i>Aristida holathera</i>			
Poaceae	<i>Aristida holathera</i> var. <i>holathera</i>			
Poaceae	<i>Aristida hygrometrica</i>			
Poaceae	<i>Aristida inaequiglumis</i>			
Poaceae	<i>Aristida ingrata</i>			
Poaceae	<i>Aristida jerichoensis</i>			
Poaceae	<i>Aristida jerichoensis</i> var. <i>jerichoensis</i>			
Poaceae	<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>			
Poaceae	<i>Aristida latifolia</i>	feathertop wiregrass		
Poaceae	<i>Aristida leptopoda</i>	white speargrass		
Poaceae	<i>Aristida pruinosa</i>			
Poaceae	<i>Aristida queenslandica</i> var. <i>dissimilis</i>			
Poaceae	<i>Aristida sciuroides</i>			
Poaceae	<i>Arundinella nepalensis</i>	reedgrass		
Poaceae	<i>Astrebla elymoides</i>	hoop mitchell grass		
Poaceae	<i>Astrebla lappacea</i>	curly mitchell grass		
Poaceae	<i>Astrebla pectinata</i>	barley mitchell grass		
Poaceae	<i>Astrebla squarrosa</i>	bull mitchell grass		
Poaceae	<i>Austrochloris</i>			
Poaceae	<i>Austrochloris dichanthioides</i>			
Poaceae	<i>Bothriochloa bladhii</i> subsp. <i>bladhii</i>			
Poaceae	<i>Bothriochloa decipiens</i>			
Poaceae	<i>Bothriochloa decipiens</i> var. <i>cloncurrans</i>			
Poaceae	<i>Bothriochloa decipiens</i> var. <i>decipiens</i>			
Poaceae	<i>Bothriochloa erianthoides</i>	satintop grass		
Poaceae	<i>Bothriochloa ewartiana</i>	desert bluegrass		
Poaceae	<i>Bothriochloa pertusa</i>		Introduced	
Poaceae	<i>Brachyachne convergens</i>	common native couch		
Poaceae	<i>Brachyachne tenella</i>			
Poaceae	<i>Chloris</i>			
Poaceae	<i>Chloris divaricata</i> var. <i>divaricata</i>	slender chloris		
Poaceae	<i>Chloris gayana</i>	rhodes grass	Introduced	
Poaceae	<i>Chloris inflata</i>	purpletop chloris	Introduced	
Poaceae	<i>Chloris pectinata</i>	comb chloris		
Poaceae	<i>Chloris</i> sp. (Edgbaston R.J.Fensham 5694)			
Poaceae	<i>Chloris truncata</i>			
Poaceae	<i>Chloris ventricosa</i>	tall chloris		
Poaceae	<i>Chloris virgata</i>	feathertop rhodes grass	Introduced	
Poaceae	<i>Chrysopogon fallax</i>			
Poaceae	<i>Cleistochloa subjuncea</i>			
Poaceae	<i>Cymbopogon ambiguus</i>	lemon grass		
Poaceae	<i>Cymbopogon bombycinus</i>	silky oilgrass		
Poaceae	<i>Cymbopogon oblectus</i>			
Poaceae	<i>Cymbopogon refractus</i>	barbed-wire grass		
Poaceae	<i>Cynodon dactylon</i> var. <i>dactylon</i>		Introduced	
Poaceae	<i>Dactyloctenium</i>			
Poaceae	<i>Dactyloctenium aegyptium</i>	coast button grass	Introduced	
Poaceae	<i>Dactyloctenium buehnerianum</i>			
Poaceae	<i>Dactyloctenium radicans</i>	button grass		
Poaceae	<i>Dichanthium</i>			
Poaceae	<i>Dichanthium annulatum</i>	sheda grass	Introduced	
Poaceae	<i>Dichanthium fecundum</i>	curly bluegrass		
Poaceae	<i>Dichanthium sericeum</i>			
Poaceae	<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>			
Poaceae	<i>Digitaria</i>			
Poaceae	<i>Digitaria ammobila</i>	silky umbrella grass		
Poaceae	<i>Digitaria bicornis</i>			
Poaceae	<i>Digitaria breviglumis</i>			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Poaceae	<i>Digitaria brownii</i>			
Poaceae	<i>Digitaria ciliaris</i>	summer grass	Introduced	
Poaceae	<i>Digitaria divaricatissima</i>	spreading umbrella grass		
Poaceae	<i>Digitaria gibbosa</i>			
Poaceae	<i>Digitaria hystrichoides</i>	umbrella grass		
Poaceae	<i>Digitaria longiflora</i>			
Poaceae	<i>Digitaria parviflora</i>			
Poaceae	<i>Digitaria ramularis</i>			
Poaceae	<i>Echinochloa colona</i>	awnless barnyard grass	Introduced	
Poaceae	<i>Echinochloa crus-galli</i>	barnyard grass	Introduced	
Poaceae	<i>Echinochloa inundata</i>	marsh millet		
Poaceae	<i>Echinochloa turneriana</i>	channel millet		
Poaceae	<i>Elionurus citreus</i>	lemon-scented grass		
Poaceae	<i>Elymus</i>			
Poaceae	<i>Elytrophorus spicatus</i>			
Poaceae	<i>Enneapogon</i>			
Poaceae	<i>Enneapogon avenaceus</i>			
Poaceae	<i>Enneapogon gracilis</i>	slender nineawn		
Poaceae	<i>Enneapogon lindleyanus</i>			
Poaceae	<i>Enneapogon pallidus</i>	conetop nineawn		
Poaceae	<i>Enneapogon polyphyllus</i>	leafy nineawn		
Poaceae	<i>Enneapogon robustissimus</i>			
Poaceae	<i>Enneapogon truncatus</i>			
Poaceae	<i>Enneapogon virens</i>			
Poaceae	<i>Enteropogon acicularis</i>	curly windmill grass		
Poaceae	<i>Enteropogon ramosus</i>			
Poaceae	<i>Enteropogon unispiceus</i>			
Poaceae	<i>Eragrostis</i>			
Poaceae	<i>Eragrostis basedowii</i>			
Poaceae	<i>Eragrostis brownii</i>	Brown's lovegrass		
Poaceae	<i>Eragrostis confertiflora</i>			
Poaceae	<i>Eragrostis cumingii</i>			
Poaceae	<i>Eragrostis elongata</i>			
Poaceae	<i>Eragrostis falcata</i>	sickle lovegrass		
Poaceae	<i>Eragrostis lacunaria</i>	purple lovegrass		
Poaceae	<i>Eragrostis lanicaulis</i>			
Poaceae	<i>Eragrostis leptocarpa</i>	drooping lovegrass		
Poaceae	<i>Eragrostis leptostachya</i>			
Poaceae	<i>Eragrostis microcarpa</i>			
Poaceae	<i>Eragrostis parviflora</i>	weeping lovegrass		
Poaceae	<i>Eragrostis pergracilis</i>			
Poaceae	<i>Eragrostis pilosa</i>	soft lovegrass	Introduced	
Poaceae	<i>Eragrostis schultzei</i>			
Poaceae	<i>Eragrostis setifolia</i>			
Poaceae	<i>Eragrostis sororia</i>			
Poaceae	<i>Eragrostis spartinoides</i>			
Poaceae	<i>Eragrostis speciosa</i>			
Poaceae	<i>Eragrostis tenellula</i>	delicate lovegrass		
Poaceae	<i>Eriachne</i>			
Poaceae	<i>Eriachne aristidea</i>			
Poaceae	<i>Eriachne benthamii</i>			
Poaceae	<i>Eriachne mucronata</i>			
Poaceae	<i>Eriachne obtusa</i>			
Poaceae	<i>Eriachne</i> sp. (Dugald River B.K.Simon+ 3007)			
Poaceae	<i>Eriochloa</i>			
Poaceae	<i>Eriochloa australiensis</i>			
Poaceae	<i>Eriochloa crebra</i>	spring grass		
Poaceae	<i>Eriochloa pseudoacrotricha</i>			
Poaceae	<i>Eulalia</i>			
Poaceae	<i>Eulalia aurea</i>	silky browntop		
Poaceae	<i>Heteropogon contortus</i>	black speargrass		
Poaceae	<i>Hymenachne amplexicaulis</i> cv. Olive		Introduced	
Poaceae	<i>Isachne globosa</i>	swamp millet		
Poaceae	<i>Ischaemum australe</i>			
Poaceae	<i>Ischaemum australe</i> var. <i>australe</i>			
Poaceae	<i>Ischaemum australe</i> var. <i>villosum</i>			
Poaceae	<i>Iseilema membranaceum</i>	small flinders grass		

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Poaceae	<i>Iseilema vaginiflorum</i>	red flinders grass		
Poaceae	<i>Leersia hexandra</i>	swamp rice grass		
Poaceae	<i>Leptochloa</i>			
Poaceae	<i>Leptochloa decipiens</i>			
Poaceae	<i>Leptochloa decipiens subsp. asthenes</i>			
Poaceae	<i>Leptochloa decipiens subsp. decipiens</i>			
Poaceae	<i>Leptochloa digitata</i>			
Poaceae	<i>Leptochloa divaricatissima</i>			
Poaceae	<i>Leptochloa fusca</i>	brown beetle grass		
Poaceae	<i>Leptochloa fusca subsp. fusca</i>			
Poaceae	<i>Melinis repens</i>	red natal grass	Introduced	
Poaceae	<i>Oxychloris scariosa</i>	winged chloris		
Poaceae	<i>Panicum</i>			
Poaceae	<i>Panicum decompositum</i>			
Poaceae	<i>Panicum decompositum var. decompositum</i>			
Poaceae	<i>Panicum effusum</i>			
Poaceae	<i>Panicum laevinode</i>	pepper grass		
Poaceae	<i>Panicum larcomianum</i>			
Poaceae	<i>Panicum simile</i>			
Poaceae	<i>Paspalidium</i>			
Poaceae	<i>Paspalidium albobillosum</i>			
Poaceae	<i>Paspalidium caespitosum</i>	brigalow grass		
Poaceae	<i>Paspalidium constrictum</i>			
Poaceae	<i>Paspalidium distans</i>	shotgrass		
Poaceae	<i>Paspalidium globoideum</i>	sago grass		
Poaceae	<i>Paspalidium gracile</i>	slender panic		
Poaceae	<i>Paspalidium jubiflorum</i>	warrego grass		
Poaceae	<i>Paspalidium rarum</i>			
Poaceae	<i>Paspalum dilatatum</i>	paspalum	Introduced	
Poaceae	<i>Paspalum distichum</i>	water couch		
Poaceae	<i>Paspalum vaginatum</i>	saltwater couch		
Poaceae	<i>Pennisetum alopecuroides</i>	swamp foxtail		
Poaceae	<i>Pennisetum ciliare</i>		Introduced	
Poaceae	<i>Pennisetum polystachion</i>	mission grass	Introduced	
Poaceae	<i>Pennisetum setigerum</i>		Introduced	
Poaceae	<i>Perotis rara</i>	comet grass		
Poaceae	<i>Poaceae</i>			
Poaceae	<i>Pseudoraphis spinescens</i>	spiny mudgrass		
Poaceae	<i>Sacciolepis indica</i>	Indian cupscale grass		
Poaceae	<i>Sarga plumosum</i>			
Poaceae	<i>Schizachyrium fragile</i>	firegrass		
Poaceae	<i>Sehima nervosum</i>			
Poaceae	<i>Setaria dielsii</i>			
Poaceae	<i>Setaria paspalidioides</i>			
Poaceae	<i>Setaria surgens</i>			
Poaceae	<i>Sorghum bicolor</i>	forage sorghum	Introduced	
Poaceae	<i>Sporobolus</i>			
Poaceae	<i>Sporobolus actinocladus</i>	katoora grass		
Poaceae	<i>Sporobolus australasicus</i>			
Poaceae	<i>Sporobolus caroli</i>	fairy grass		
Poaceae	<i>Sporobolus contiguus</i>			
Poaceae	<i>Sporobolus coromandelianus</i>		Introduced	
Poaceae	<i>Sporobolus creber</i>			
Poaceae	<i>Sporobolus disjunctus</i>			
Poaceae	<i>Sporobolus elongatus</i>			
Poaceae	<i>Sporobolus fertilis</i>	giant Parramatta grass	Introduced	
Poaceae	<i>Sporobolus mitchellii</i>	rat's tail couch		
Poaceae	<i>Sporobolus pamela</i>		Endangered	
Poaceae	<i>Sporobolus partimpatens</i>		Near threatened	
Poaceae	<i>Sporobolus scabridus</i>			
Poaceae	<i>Sporobolus virginicus</i>	sand couch		
Poaceae	<i>Thaumastochloa pubescens</i>			
Poaceae	<i>Thellungia advena</i>	coolibah grass		
Poaceae	<i>Themeda avenacea</i>			
Poaceae	<i>Themeda triandra</i>	kangaroo grass		
Poaceae	<i>Tragus australianus</i>	small burr grass		
Poaceae	<i>Triodia</i>			
Poaceae	<i>Triodia longiceps</i>	giant grey spinifex		

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Poaceae	<i>Triodia microstachya</i>			
Poaceae	<i>Triodia mitchellii</i>	buck spinifex		
Poaceae	<i>Triodia pungens</i>			
Poaceae	<i>Tripogon loliiformis</i>	five minute grass		
Poaceae	<i>Triraphis mollis</i>	purple plumegrass		
Poaceae	<i>Urochloa</i>			
Poaceae	<i>Urochloa foliosa</i>			
Poaceae	<i>Urochloa gilesii</i>			
Poaceae	<i>Urochloa mosambicensis</i>	sabi grass	Introduced	
Poaceae	<i>Urochloa piligera</i>			
Poaceae	<i>Urochloa praetervisa</i>			
Poaceae	<i>Urochloa reptans</i>			
Poaceae	<i>Urochloa subquadripara</i>		Introduced	
Poaceae	<i>Whiteochloa airoides</i>			
Poaceae	<i>Yakirra pauciflora</i>			
Potamogetonaceae	<i>Potamogeton tricarinatus</i>	floating pondweed		
Ruppiaceae	<i>Ruppia maritima</i>	sea tassel		
Typhaceae	<i>Typha domingensis</i>			
Xanthorrhoeaceae	<i>Xanthorrhoea johnsonii</i>			

Queensland Herbarium HERBRECS Database Search Results

Family	Botanical name	NC Act Status	EPBC Act Status
Acanthaceae	<i>Brunoniella australis</i> (Cav.) Bremek.		
Acanthaceae	<i>Dipteracanthus australasicus</i> F.Muell. subsp. <i>australasicus</i>		
Acanthaceae	<i>Dipteracanthus australasicus</i> subsp. <i>corynothecus</i> (F.Muell. ex Benth.) R.M.Barker		
Acanthaceae	<i>Nelsonia campestris</i> R.Br.		
Acanthaceae	<i>Pseuderanthemum tenellum</i> (Benth.) Radlk.		
Acanthaceae	<i>Rostellularia adscendens</i> (R.Br.) R.M.Barker		
Aizoaceae	<i>Trianthema portulacastrum</i> L.	Introduced	
Aizoaceae	<i>Trianthema</i> sp. (Coorabulka R.W.Purdie 1404)		
Aizoaceae	<i>Trianthema triquetra</i> Rottb. ex Willd.		
Aizoaceae	<i>Zaleya galericulata</i> (Melville) H.Eichler		
Alismataceae	<i>Caldesia oligococca</i> (F.Muell.) Buchenau		
Amaranthaceae	<i>Alternanthera angustifolia</i> R.Br.		
Amaranthaceae	<i>Alternanthera denticulata</i> var. <i>micrantha</i> Benth.		
Amaranthaceae	<i>Alternanthera nana</i> R.Br.		
Amaranthaceae	<i>Alternanthera pungens</i> Kunth	Introduced	
Amaranthaceae	<i>Amaranthus interruptus</i> R.Br.		
Amaranthaceae	<i>Gomphrena lanata</i> R.Br.		
Amaranthaceae	<i>Gomphrena</i> sp. (Doongmabulla E.J.Thompson+ GAL137)		
Amaranthaceae	<i>Nyssanthes erecta</i> R.Br.		
Amaranthaceae	<i>Ptilotus nobilis</i> subsp. <i>semilanatus</i> (Lindl.) A.R.Bean		
Amaranthaceae	<i>Ptilotus polystachyus</i> (Gaudich.) F.Muell.		
Amaryllidaceae	<i>Calostemma luteum</i> Sims		
Amaryllidaceae	<i>Crinum</i>		
Apiaceae	<i>Daucus glochidiatus</i> (Labill.) Fisch., C.A.Mey. & Ave-Lall.		
Apiaceae	<i>Eryngium fontanum</i> A.E.Holland & E.J.Thomps.	Endangered	Endangered
Apiaceae	<i>Eryngium plantagineum</i> F.Muell.		
Apocynaceae	<i>Alstonia constricta</i> F.Muell.		
Apocynaceae	<i>Carissa lanceolata</i> R.Br.		
Apocynaceae	<i>Carissa ovata</i> R.Br.		
Apocynaceae	<i>Marsdenia viridiflora</i> R.Br. subsp. <i>viridiflora</i>		
Apocynaceae	<i>Parsonsia lanceolata</i> R.Br.		
Apocynaceae	<i>Secamone elliptica</i> R.Br.		
Araliaceae	<i>Hydrocotyle dippleura</i> A.R.Bean	Vulnerable	
Asphodelaceae	<i>Bulbine bulbosa</i> (R.Br.) Haw.		
Asteraceae	<i>Acmella grandiflora</i> var. <i>brachyglossa</i> (Benth.) R.K.Jansen		
Asteraceae	<i>Blumea mollis</i> (D.Don) Merr.		
Asteraceae	<i>Brachyscome</i>		
Asteraceae	<i>Calotis</i> sp. (Lake Buchanan J.Kemp+ 3384H)		
Asteraceae	<i>Calotis xanthosioidea</i> Domin		
Asteraceae	<i>Camptacra barbata</i> N.T.Burb.		
Asteraceae	<i>Chrysocephalum apiculatum</i> (Labill.) Steetz		
Asteraceae	<i>Eclipta platyglossa</i> F.Muell.		
Asteraceae	<i>Emilia sonchifolia</i> (L.) DC. var. <i>sonchifolia</i>	Introduced	
Asteraceae	<i>Epaltes australis</i> Less.		
Asteraceae	<i>Flaveria trinervia</i> (Spreng.) C.Mohr	Introduced	
Asteraceae	<i>Minuria integerrima</i> (DC.) Benth.		
Asteraceae	<i>Parthenium hysterophorus</i> L.	Introduced	
Asteraceae	<i>Peripleura hispidula</i> var. <i>setosa</i> (N.T.Burb.) G.L.Nesom		
Asteraceae	<i>Peripleura scabra</i> (DC.) G.L.Nesom	Near threatened	
Asteraceae	<i>Pluchea baccharoides</i> (F.Muell.) F.Muell. ex Benth.		
Asteraceae	<i>Pluchea dentex</i> R.Br. ex Benth.		
Asteraceae	<i>Pluchea dioscoridis</i> DC.		
Asteraceae	<i>Pluchea rubelliflora</i> (F.Muell.) B.L.Rob.		
Asteraceae	<i>Pterocaulon serrulatum</i> (Montrouz.) Guillaumin var. <i>serrulatum</i>		
Asteraceae	<i>Pterocaulon</i> sp. (Yarrowmere Station E.J.Thompson + BUC340)		
Asteraceae	<i>Pterocaulon sphacelatum</i> (Labill.) F.Muell.		
Asteraceae	<i>Senecio depressicola</i> I.Thomps.		
Asteraceae	<i>Sphaeranthus indicus</i> L.		
Asteraceae	<i>Streptoglossa adscendens</i> (Benth.) Dunlop		
Asteraceae	<i>Streptoglossa odora</i> (F.Muell.) Dunlop		
Asteraceae	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook.f. ex A.Gray	Introduced	
Asteraceae	<i>Vittadinia cuneata</i> DC.		
Asteraceae	<i>Vittadinia pustulata</i> N.T.Burb.		

Family	Botanical name	NC Act Status	EPBC Act Status
Asteraceae	<i>Wedelia spilanthis</i> F.Muell.		
Asteraceae	<i>Xanthium occidentale</i> Bertol.	Introduced	
Azollaceae	<i>Azolla filiculoides</i> Lam.		
Azollaceae	<i>Azolla pinnata</i> R.Br.		
Boraginaceae	<i>Ehretia membranifolia</i> R.Br.		
Boraginaceae	<i>Heliotropium curassavicum</i> L.	Introduced	
Boraginaceae	<i>Heliotropium geocharis</i> Domin		
Boraginaceae	<i>Heliotropium moorei</i> Craven		
Boraginaceae	<i>Heliotropium ovalifolium</i> Forssk.		
Boraginaceae	<i>Heliotropium peninsulare</i> Craven		
Boraginaceae	<i>Trichodesma zeylanicum</i> (Burm.f.) R.Br. var. <i>zeylanicum</i>		
Brassicaceae	<i>Rorippa dietrichiana</i> Hewson		
Brassicaceae	<i>Rorippa eustylis</i> (F.Muell.) L.A.S.Johnson		
Byttneriaceae	<i>Keraudrenia collina</i> Domin		
Byttneriaceae	<i>Keraudrenia hookeriana</i> Walp.		
Byttneriaceae	<i>Keraudrenia nephrosperma</i> Benth.		
Byttneriaceae	<i>Melochia pyramidata</i> L.	Introduced	
Byttneriaceae	<i>Waltheria indica</i> L.		
Caesalpiniaceae	<i>Cassia brewsteri</i> (F.Muell.) F.Muell. ex Benth.		
Caesalpiniaceae	<i>Labichea rupestris</i> Benth.		
Caesalpiniaceae	<i>Lysiphyllum carronii</i> (F.Muell.) Pedley		
Caesalpiniaceae	<i>Lysiphyllum hookeri</i> (F.Muell.) Pedley		
Caesalpiniaceae	<i>Senna artemisioides</i> (DC.) Randell subsp. <i>artemisioides</i>		
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>coriacea</i> (Benth.) Randell		
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i> Randell		
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>oligophylla</i> (F.Muell.) Randell		
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>sturtii</i> (R.Br.) Randell		
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>zygophylla</i> (Benth.) Randell		
Caesalpiniaceae	<i>Senna circinnata</i> (Benth.) Randell		
Caesalpiniaceae	<i>Senna costata</i> (J.F.Bailey & C.T.White) Randell		
Caesalpiniaceae	<i>Senna notabilis</i> (F.Muell.) Randell		
Caesalpiniaceae	<i>Senna planitiicola</i> (Domin) Randell		
Campanulaceae	<i>Isotoma</i>		
Campanulaceae	<i>Wahlenbergia tumidifruta</i> P.J.Sm.		
Capparaceae	<i>Apophyllum anomalum</i> F.Muell.		
Capparaceae	<i>Capparis canescens</i> Banks ex DC.		
Capparaceae	<i>Capparis lasiantha</i> R.Br. ex DC.		
Capparaceae	<i>Capparis umbonata</i> Lindl.		
Caryophyllaceae	<i>Polycarpaea corymbosa</i> (L.) Lam.		
Caryophyllaceae	<i>Polycarpaea multicaulis</i> Cowie		
Caryophyllaceae	<i>Polycarpaea spirostylis</i> subsp. <i>compacta</i> Pedley		
Casuarinaceae	<i>Casuarina cristata</i> Miq.		
Celastraceae	<i>Denhamia oleaster</i> (Lindl.) F.Muell.		
Celastraceae	<i>Maytenus cunninghamii</i> (Hook.) Loes.		
Chenopodiaceae	<i>Atriplex lindleyi</i> Moq.		
Chenopodiaceae	<i>Atriplex lindleyi</i> Moq. subsp. <i>lindleyi</i>		
Chenopodiaceae	<i>Atriplex muelleri</i> Benth.		
Chenopodiaceae	<i>Atriplex</i> sp. (Doongmabulla Homestead E.J.Thompson+ GAL20)		
Chenopodiaceae	<i>Chenopodium auricomum</i> Lindl.		
Chenopodiaceae	<i>Dissocarpus biflorus</i> var. <i>cephalocarpus</i> (F.Muell.) A.J.Scott		
Chenopodiaceae	<i>Dissocarpus paradoxus</i> (R.Br.) F.Muell. ex Ulbr.		
Chenopodiaceae	<i>Dissocarpus</i> sp. (Doongmabulla E.J.Thompson+ GAL21)		
Chenopodiaceae	<i>Dysphania melanocarpa</i> (J.M.Black) Mosyakin & Clemants forma <i>melanocarpa</i>		
Chenopodiaceae	<i>Dysphania plantaginella</i> F.Muell.		
Chenopodiaceae	<i>Einadia nutans</i> (R.Br.) A.J.Scott subsp. <i>nutans</i>		
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>linifolia</i> (R.Br.) Paul G.Wilson		
Chenopodiaceae	<i>Einadia trigonos</i> subsp. <i>stellulata</i> (Benth.) Paul G.Wilson		
Chenopodiaceae	<i>Enchylaena tomentosa</i> R.Br.		
Chenopodiaceae	<i>Eremophea spinosa</i> (Ewart & O.B.Davies) Paul G.Wilson		
Chenopodiaceae	<i>Maireana coronata</i> (J.M.Black) Paul G.Wilson		
Chenopodiaceae	<i>Maireana dichoptera</i> (F.Muell.) Paul G.Wilson		
Chenopodiaceae	<i>Maireana georgei</i> (Diels) Paul G.Wilson		
Chenopodiaceae	<i>Maireana villosa</i> (Lindl.) Paul G.Wilson		
Chenopodiaceae	<i>Rhagodia spinescens</i> R.Br.		
Chenopodiaceae	<i>Salsola kali</i> L.		
Chenopodiaceae	<i>Sclerolaena anisacanthoides</i> (F.Muell.) Domin		
Chenopodiaceae	<i>Sclerolaena bicornis</i> Lindl.		
Chenopodiaceae	<i>Sclerolaena bicornis</i> Lindl. var. <i>bicornis</i>		

Family	Botanical name	NC Act Status	EPBC Act Status
Chenopodiaceae	<i>Sclerolaena bicornis</i> var. <i>horrida</i> Domin		
Chenopodiaceae	<i>Sclerolaena birchii</i> (F.Muell.) Domin		
Chenopodiaceae	<i>Sclerolaena calcarata</i> (Ising) A.J.Scott		
Chenopodiaceae	<i>Sclerolaena convexula</i> (R.H.Anderson) A.J.Scott		
Chenopodiaceae	<i>Sclerolaena diacantha</i> (Nees) Benth.		
Chenopodiaceae	<i>Sclerolaena everistiana</i> (Ising) A.J.Scott		
Chenopodiaceae	<i>Sclerolaena glabra</i> (F.Muell.) Domin		
Chenopodiaceae	<i>Sclerolaena lanicuspis</i> (F.Muell.) F.Muell. ex Benth.		
Chenopodiaceae	<i>Sclerolaena muricata</i> (Moq.) Domin var. <i>muricata</i>		
Chenopodiaceae	<i>Sclerolaena ramulosa</i> (C.T.White) A.J.Scott		
Chenopodiaceae	<i>Sclerolaena tetracuspis</i> (C.T.White) A.J.Scott		
Chenopodiaceae	<i>Sclerolaena tricuspis</i> (F.Muell.) Ulbr.		
Chenopodiaceae	<i>Tecticornia indica</i> (Willd.) K.A.Sheph. & Paul G.Wilson		
Chenopodiaceae	<i>Tecticornia pergranulata</i> (J.M.Black) K.A.Sheph. & Paul G.Wilson		
Chenopodiaceae	<i>Tecticornia pergranulata</i> subsp. <i>divaricata</i> (Paul G.Wilson) K.A.Sheph. & Paul G.Wilson		
Chlorophyceae	<i>Chara</i>		
Chlorophyceae	<i>Lamprothamnium papulosum</i> (Wallr.) J.Groves		
Cleomaceae	<i>Cleome tetrandra</i> DC. var. <i>tetrandra</i>		
Clusiaceae	<i>Hypericum gramineum</i> G.Forst.		
Commelinaceae	<i>Commelina diffusa</i> Burm.f.		
Commelinaceae	<i>Cyanotis axillaris</i> (L.) D.Don		
Commelinaceae	<i>Murdannia graminea</i> (R.Br.) G.Brueckn.		
Convolvulaceae	<i>Bonamia media</i> (R.Br.) Hallier f. var. <i>media</i>		
Convolvulaceae	<i>Convolvulus graminetinus</i> R.W.Johnson		
Convolvulaceae	<i>Evolvulus alsinoides</i> (L.) L.		
Convolvulaceae	<i>Ipomoea</i>		
Convolvulaceae	<i>Ipomoea coptica</i> (L.) Roth ex Roem. & Schult.		
Convolvulaceae	<i>Ipomoea gracilis</i> R.Br.		
Convolvulaceae	<i>Ipomoea gracilis</i> var. <i>sagittata</i> F.Muell.		
Convolvulaceae	<i>Ipomoea lonchophylla</i> J.M.Black		
Convolvulaceae	<i>Ipomoea plebeia</i> R.Br.		
Convolvulaceae	<i>Jacquemontia</i> sp. (Fairview R.W.Johnson 4026)		
Convolvulaceae	<i>Polymeria calycina</i> R.Br.		
Convolvulaceae	<i>Polymeria longifolia</i> Lindl.		
Convolvulaceae	<i>Polymeria marginata</i> Benth.		
Convolvulaceae	<i>Polymeria pusilla</i> R.Br.		
Cucurbitaceae	<i>Cucumis melo</i> subsp. (Manfred D.Davidson 47)		
Cyperaceae	<i>Abildgaardia ovata</i> (Burm.f.) Kral		
Cyperaceae	<i>Baumea rubiginosa</i> (Spreng.) Boeck.		
Cyperaceae	<i>Bulbostylis barbata</i> (Rottb.) C.B.Clarke		
Cyperaceae	<i>Cyperus alterniflorus</i> R.Br.		
Cyperaceae	<i>Cyperus betchei</i> (Kuek.) S.T.Blake subsp. <i>betchei</i>		
Cyperaceae	<i>Cyperus bifax</i> C.B.Clarke		
Cyperaceae	<i>Cyperus bulbosus</i> Vahl		
Cyperaceae	<i>Cyperus concinnus</i> R.Br.		
Cyperaceae	<i>Cyperus conicus</i> (R.Br.) Boeck.		
Cyperaceae	<i>Cyperus dactylotes</i> Benth.		
Cyperaceae	<i>Cyperus difformis</i> L.		
Cyperaceae	<i>Cyperus exaltatus</i> Retz.		
Cyperaceae	<i>Cyperus flaccidus</i> R.Br.		
Cyperaceae	<i>Cyperus flavidus</i> Retz.		
Cyperaceae	<i>Cyperus gracilis</i> R.Br.		
Cyperaceae	<i>Cyperus haspan</i> L. subsp. <i>haspan</i>		
Cyperaceae	<i>Cyperus iria</i> L.		
Cyperaceae	<i>Cyperus isabellinus</i> K.L.Wilson		
Cyperaceae	<i>Cyperus laevigatus</i> L.		
Cyperaceae	<i>Cyperus pulchellus</i> R.Br.		
Cyperaceae	<i>Cyperus sanguinolentus</i> Vahl		
Cyperaceae	<i>Cyperus squarrosus</i> L.		
Cyperaceae	<i>Cyperus victoriensis</i> C.B.Clarke		
Cyperaceae	<i>Eleocharis equisetina</i> C.Presl		
Cyperaceae	<i>Eleocharis pallens</i> S.T.Blake		
Cyperaceae	<i>Eleocharis philippinensis</i> Svenson		
Cyperaceae	<i>Eleocharis plana</i> S.T.Blake		
Cyperaceae	<i>Fimbristylis</i>		
Cyperaceae	<i>Fimbristylis aestivalis</i> (Retz.) Vahl		
Cyperaceae	<i>Fimbristylis depauperata</i> R.Br.		
Cyperaceae	<i>Fimbristylis dichotoma</i> (L.) Vahl		

Family	Botanical name	NC Act Status	EPBC Act Status
Cyperaceae	<i>Fimbristylis littoralis</i> Gaudich.		
Cyperaceae	<i>Fimbristylis microcarya</i> F.Muell.		
Cyperaceae	<i>Fimbristylis nutans</i> (Retz.) Vahl		
Cyperaceae	<i>Fimbristylis rara</i> R.Br.		
Cyperaceae	<i>Fimbristylis</i> sp. (Lake Buchanan V.J.Neldner+ 3362)		
Cyperaceae	<i>Fuirena ciliaris</i> (L.) Roxb.		
Cyperaceae	<i>Fuirena incrassata</i> S.T.Blake		
Cyperaceae	<i>Fuirena umbellata</i> Rottb.		
Cyperaceae	<i>Lipocarpa microcephala</i> (R.Br.) Kunth		
Cyperaceae	<i>Schoenoplectus dissachanthus</i> (S.T.Blake) J.Raynal		
Cyperaceae	<i>Schoenoplectus erectus</i> (Poir.) Palla ex J.Raynal	Introduced	
Cyperaceae	<i>Schoenoplectus laevis</i> (S.T.Blake) J.Raynal		
Cyperaceae	<i>Schoenoplectus lateriflorus</i> (J.G.Gmel.) Lye		
Cyperaceae	<i>Schoenoplectus validus</i> (Vahl) A.Love & D.Love		
Cyperaceae	<i>Schoenus falcatus</i> R.Br.		
Cyperaceae	<i>Schoenus kennyi</i> (F.M.Bailey) S.T.Blake		
Cyperaceae	<i>Scleria rugosa</i> R.Br.		
Cyperaceae	<i>Scleria sphacelata</i> F.Muell.		
Cyperaceae	<i>Scleria tricuspidata</i> S.T.Blake		
Eriocaulaceae	<i>Eriocaulon carsonii</i> subsp. <i>orientale</i> R.J.Davies	Endangered	Endangered
Eriocaulaceae	<i>Eriocaulon cinereum</i> R.Br.		
Euphorbiaceae	<i>Beyeria viscosa</i> Miq.		
Euphorbiaceae	<i>Chamaesyce</i>		
Euphorbiaceae	<i>Chamaesyce coghlanii</i> (F.M.Bailey) D.C.Hassall ex P.I.Forst. & R.J.F.Hend.		
Euphorbiaceae	<i>Chamaesyce dallachyana</i> (Baill.) D.C.Hassall		
Euphorbiaceae	<i>Chamaesyce drummondii</i> (Boiss.) D.C.Hassall		
Euphorbiaceae	<i>Chamaesyce hirta</i> (L.) Millsp.	Introduced	
Euphorbiaceae	<i>Chamaesyce mitchelliana</i> (Boiss.) D.C.Hassall		
Euphorbiaceae	<i>Chamaesyce petala</i> (Ewart & L.R.Kerr) P.I.Forst. & R.J.F.Hend.		
Euphorbiaceae	<i>Euphorbia stevenii</i> F.M.Bailey		
Euphorbiaceae	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i> (A.Cunn.) D.C.Hassall		
Euphorbiaceae	<i>Microstachys chamaelea</i> (L.) A.Juss. ex Hook.f.		
Fabaceae	<i>Aeschynomene indica</i> L.		
Fabaceae	<i>Cajanus marmoratus</i> (Benth.) F.Muell.		
Fabaceae	<i>Cajanus scarabaeoides</i> (L.) Thouars var. <i>scarabaeoides</i>		
Fabaceae	<i>Crotalaria dissitiflora</i> Benth. subsp. <i>dissitiflora</i>		
Fabaceae	<i>Cullen cinereum</i> (Lindl.) J.W.Grimes		
Fabaceae	<i>Desmodium campylocaulon</i> F.Muell. ex Benth.		
Fabaceae	<i>Desmodium filiforme</i> Zoll. & Moritz		
Fabaceae	<i>Desmodium muelleri</i> Benth.		
Fabaceae	<i>Gastrolobium grandiflorum</i> F.Muell.		
Fabaceae	<i>Glycine falcata</i> Benth.		
Fabaceae	<i>Glycine</i> sp. (Laglan Station L.S.Smith 10302)		
Fabaceae	<i>Glycine tomentella</i> Hayata		
Fabaceae	<i>Hovea parvicalyx</i> I.Thomps.		
Fabaceae	<i>Indigostrum parviflorum</i> (B.Heyne ex Wight & Arn.) Schrire		
Fabaceae	<i>Indigofera colutea</i> (Burm.f.) Merr.		
Fabaceae	<i>Indigofera ewartiana</i> Domin		
Fabaceae	<i>Indigofera haplophylla</i> F.Muell.		
Fabaceae	<i>Indigofera linifolia</i> (L.f.) Retz.		
Fabaceae	<i>Indigofera linnaei</i> Ali		
Fabaceae	<i>Indigofera pratensis</i> F.Muell.		
Fabaceae	<i>Jacksonia ramosissima</i> Benth.		
Fabaceae	<i>Jacksonia rhadinoclona</i> F.Muell.		
Fabaceae	<i>Leptosema oxylobioides</i> F.Muell.		
Fabaceae	<i>Lotus cruentus</i> Court		
Fabaceae	<i>Rhynchosia minima</i> var. <i>australis</i> (Benth.) C.Moore		
Fabaceae	<i>Swainsona affinis</i> (A.T.Lee) Joy Thomps.		
Fabaceae	<i>Swainsona campylantha</i> F.Muell.		
Fabaceae	<i>Swainsona swainsonioides</i> (Benth.) A.T.Lee ex J.M.Black		
Fabaceae	<i>Tephrosia astragaloides</i> var. (Belyando Crossing E.J.Thompson+ 139)		
Fabaceae	<i>Tephrosia barbatala</i> Bosman & A.J.P.De Haas		
Fabaceae	<i>Tephrosia juncea</i> Benth.		
Fabaceae	<i>Tephrosia leptoclada</i> Benth.		
Fabaceae	<i>Tephrosia purpurea</i> var. <i>sericea</i> Benth.		
Fabaceae	<i>Tephrosia</i> sp. (Lake Buchanan E.J.Thompson+ BUC2128)		

Family	Botanical name	NC Act Status	EPBC Act Status
Fabaceae	<i>Tephrosia supina</i> Domin		
Fabaceae	<i>Vigna luteola</i> (Jacq.) Benth.	Introduced	
Fabaceae	<i>Vigna vexillata</i> var. <i>angustifolia</i> (Schumach. & Thonn.) Baker		
Fabaceae	<i>Vigna vexillata</i> var. <i>youngiana</i> F.M.Bailey		
Fabaceae	<i>Zornia adenophora</i> (Domin) Mohlenbr.		
Fabaceae	<i>Zornia areolata</i> Mohlenbr.		
Gentianaceae	<i>Schenkia australis</i> (R.Br.) G.Mans.		
Goodeniaceae	<i>Goodenia</i>		
Goodeniaceae	<i>Goodenia armitiana</i> F.Muell.		
Goodeniaceae	<i>Goodenia byrnesii</i> Carolin		
Goodeniaceae	<i>Goodenia gracilis</i> R.Br.		
Goodeniaceae	<i>Goodenia grandiflora</i> Sims		
Goodeniaceae	<i>Goodenia hirsuta</i> F.Muell.		
Goodeniaceae	<i>Goodenia lunata</i> J.M.Black		
Goodeniaceae	<i>Goodenia rosulata</i> Domin		
Goodeniaceae	<i>Goodenia splendida</i> A.E.Holland & T.P.Boyle		
Goodeniaceae	<i>Goodenia strangfordii</i> F.Muell.		
Goodeniaceae	<i>Goodenia viridula</i> Carolin		
Goodeniaceae	<i>Scaevola spinescens</i> R.Br.		
Haloragaceae	<i>Myriophyllum artesium</i> Halford & Fensham	Endangered	
Hemerocallidaceae	<i>Dianella longifolia</i> R.Br. var. <i>longifolia</i>		
Hemerocallidaceae	<i>Dianella longifolia</i> var. <i>stipitata</i> R.J.F.Hend.		
Hypoxidaceae	<i>Hypoxis arillacea</i> R.J.F.Hend.		
Johnsoniaceae	<i>Caesia chlorantha</i> F.Muell.		
Johnsoniaceae	<i>Tricoryne elatior</i> R.Br.		
Juncaceae	<i>Juncus polyanthemus</i> Buchenau		
Juncaceae	<i>Juncus usitatus</i> L.A.S.Johnson		
Juncaginaceae	<i>Triglochin dubium</i> R.Br.		
Juncaginaceae	<i>Triglochin multifructum</i> Aston		
Lamiaceae	<i>Clerodendrum floribundum</i> R.Br.		
Lamiaceae	<i>Ocimum tenuiflorum</i> L.		
Lamiaceae	<i>Plectranthus parviflorus</i> Willd.		
Lamiaceae	<i>Prostanthera parvifolia</i> Domin		
Lamiaceae	<i>Teucrium integrifolium</i> F.Muell.		
Lauraceae	<i>Cassytha filiformis</i> L.		
Laxmanniaceae	<i>Lomandra leucocephala</i> (R.Br.) Ewart subsp. <i>leucocephala</i>		
Laxmanniaceae	<i>Thysanotus</i>		
Laxmanniaceae	<i>Thysanotus tuberosus</i> R.Br. subsp. <i>tuberosus</i>		
Lentibulariaceae	<i>Utricularia caerulea</i> L.		
Lentibulariaceae	<i>Utricularia dichotoma</i> Labill.		
Lentibulariaceae	<i>Utricularia gibba</i> L.		
Loganiaceae	<i>Mitrasacme</i> sp. (Warang M.B.Thomas 1571)		
Loranthaceae	<i>Amyema maidenii</i> subsp. <i>angustifolia</i> Barlow		
Loranthaceae	<i>Amyema quandang</i> (Lindl.) Tiegh. var. <i>quandang</i>		
Loranthaceae	<i>Amyema quandang</i> var. <i>bancroftii</i> (F.M.Bailey) Barlow		
Loranthaceae	<i>Dendrophthoe glabrescens</i> (Blakely) Barlow		
Loranthaceae	<i>Diplatia grandibractea</i> (F.Muell.) Tiegh.		
Loranthaceae	<i>Lysiana spathulata</i> subsp. <i>parvifolia</i> Barlow		
Loranthaceae	<i>Lysiana subfalcata</i> (Hook.) Barlow		
Lythraceae	<i>Ammannia multiflora</i> Roxb.		
Lythraceae	<i>Nesaea robertsii</i> (F.Muell.) Koehne	Endangered	
Malvaceae	<i>Abelmoschus ficulneus</i> (L.) Wight & Arn. ex Wight		
Malvaceae	<i>Abutilon calliphyllum</i> Domin		
Malvaceae	<i>Abutilon fraseri</i> (Hook.) Hook. ex Walp. subsp. <i>fraseri</i>		
Malvaceae	<i>Abutilon malvifolium</i> (Benth.) J.M.Black		
Malvaceae	<i>Abutilon otocarpum</i> F.Muell.		
Malvaceae	<i>Abutilon oxycarpum</i> var. <i>subsagittatum</i> Domin		
Malvaceae	<i>Gossypium australe</i> F.Muell.		
Malvaceae	<i>Herissantia crispa</i> (L.) Brizicky		
Malvaceae	<i>Hibiscus brachysiphonius</i> F.Muell.		
Malvaceae	<i>Hibiscus krichauffianus</i> F.Muell.		
Malvaceae	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i> F.Muell. ex Benth.		
Malvaceae	<i>Hibiscus trionum</i> var. <i>vesicarius</i> (Cav.) Hochr.		
Malvaceae	<i>Lawrenzia buchananensis</i> Lander	Vulnerable	Vulnerable
Malvaceae	<i>Sida aprica</i> var. <i>solanacea</i> Domin		
Malvaceae	<i>Sida atherophora</i> Domin		
Malvaceae	<i>Sida brachypoda</i> F.Muell. ex A.E.Holland & S.T.Reynolds		
Malvaceae	<i>Sida cordifolia</i> L.	Introduced	
Malvaceae	<i>Sida everistiana</i> S.T.Reynolds & A.E.Holland		

Family	Botanical name	NC Act Status	EPBC Act Status
Malvaceae	<i>Sida fibulifera</i> Lindl.		
Malvaceae	<i>Sida goniocarpa</i> (F.Muell. ex Benth.) Domin		
Malvaceae	<i>Sida rhombifolia</i> L.	Introduced	
Malvaceae	<i>Sida rohlenae</i> Domin subsp. <i>rohlenae</i>		
Malvaceae	<i>Sida</i> sp. (Aramac E.J.Thompson+ JER192)		
Malvaceae	<i>Sida</i> sp. (Charters Towers E.J.Thompson+ CHA456)		
Malvaceae	<i>Sida</i> sp. (Laglan Station L.S.Smith 10325)		
Malvaceae	<i>Sida</i> sp. (Musselbrook M.B.Thomas+ MRS437)		
Malvaceae	<i>Sida spinosa</i> L.	Introduced	
Malvaceae	<i>Sida trichopoda</i> F.Muell.		
Malvaceae	<i>Sida trichopoda</i> var. (Palardo S.T.Blake 7600)		
Marsileaceae	<i>Marsilea mutica</i> Mett.		
Meliaceae	<i>Owenia acidula</i> F.Muell.		
Mimosaceae	<i>Acacia adsurgens</i> Maiden & Blakely		
Mimosaceae	<i>Acacia aneura</i> var. <i>intermedia</i> Pedley		
Mimosaceae	<i>Acacia aprepta</i> Pedley		
Mimosaceae	<i>Acacia argyrodendron</i> Domin		
Mimosaceae	<i>Acacia bidwillii</i> Benth.		
Mimosaceae	<i>Acacia cambagei</i> R.T.Baker		
Mimosaceae	<i>Acacia catenulata</i> C.T.White		
Mimosaceae	<i>Acacia cowleana</i> Tate		
Mimosaceae	<i>Acacia decora</i> Rchb.		
Mimosaceae	<i>Acacia dietrichiana</i> F.Muell.		
Mimosaceae	<i>Acacia farnesiana</i> (L.) Willd.	Introduced	
Mimosaceae	<i>Acacia flavescens</i> A.Cunn. ex Benth.		
Mimosaceae	<i>Acacia galioides</i> Benth.		
Mimosaceae	<i>Acacia holosericea</i> A.Cunn. ex G.Don var. <i>holosericea</i>		
Mimosaceae	<i>Acacia hyaloneura</i> Pedley		
Mimosaceae	<i>Acacia laccata</i> Pedley		
Mimosaceae	<i>Acacia lazaridis</i> Pedley		
Mimosaceae	<i>Acacia leptostachya</i> Benth.		
Mimosaceae	<i>Acacia melleodora</i> Pedley		
Mimosaceae	<i>Acacia microcybe</i> Pedley		
Mimosaceae	<i>Acacia multisiliqua</i> (Benth.) Maconochie		
Mimosaceae	<i>Acacia orthocarpa</i> F.Muell.		
Mimosaceae	<i>Acacia oswaldii</i> F.Muell.		
Mimosaceae	<i>Acacia platycarpa</i> F.Muell.		
Mimosaceae	<i>Acacia salicina</i> Lindl.		
Mimosaceae	<i>Acacia sericophylla</i> F.Muell.		
Mimosaceae	<i>Acacia shirleyi</i> Maiden		
Mimosaceae	<i>Acacia</i> sp. (Ronlow Park E.J.Thompson+ 61)		
Mimosaceae	<i>Acacia</i> sp. (Urlandangie L.Pedley 2025)		
Mimosaceae	<i>Acacia stenophylla</i> A.Cunn. ex Benth.		
Mimosaceae	<i>Acacia stipuligera</i> F.Muell.		
Mimosaceae	<i>Acacia tenuissima</i> F.Muell.		
Mimosaceae	<i>Acacia torulosa</i> Benth.		
Mimosaceae	<i>Acacia umbellata</i> A.Cunn. ex Benth.		
Mimosaceae	<i>Neptunia dimorphantha</i> Domin		
Molluginaceae	<i>Glinus lotoides</i> L.		
Molluginaceae	<i>Mollugo cerviana</i> (L.) Ser.		
Moraceae	<i>Ficus opposita</i> Miq.		
Myoporaceae	<i>Eremophila bignoniiflora</i> (Benth.) F.Muell.		
Myoporaceae	<i>Eremophila deserti</i> (A.Cunn. ex Benth.) Chinnock		
Myoporaceae	<i>Eremophila latrobei</i> F.Muell.		
Myoporaceae	<i>Eremophila longifolia</i> (R.Br.) F.Muell.		
Myoporaceae	<i>Eremophila maculata</i> (Ker Gawl.) F.Muell. subsp. <i>maculata</i>		
Myoporaceae	<i>Eremophila mitchellii</i> Benth.		
Myoporaceae	<i>Eremophila polyclada</i> (F.Muell.) F.Muell.		
Myoporaceae	<i>Myoporum montanum</i> R.Br.		
Myrtaceae	<i>Calytrix microcoma</i> Craven		
Myrtaceae	<i>Corymbia aparrerinja</i> K.D.Hill & L.A.S.Johnson - <i>C.dallachiana</i> (Benth.) K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia blakei</i> K.D.Hill & L.A.S.Johnson subsp. <i>blakei</i>		
Myrtaceae	<i>Corymbia brachycarpa</i> (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson x <i>C.plena</i> K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia brachycarpa</i> (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson x <i>C.setosa</i> subsp. <i>pedicellaris</i> K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia clarksoniana</i> (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson		

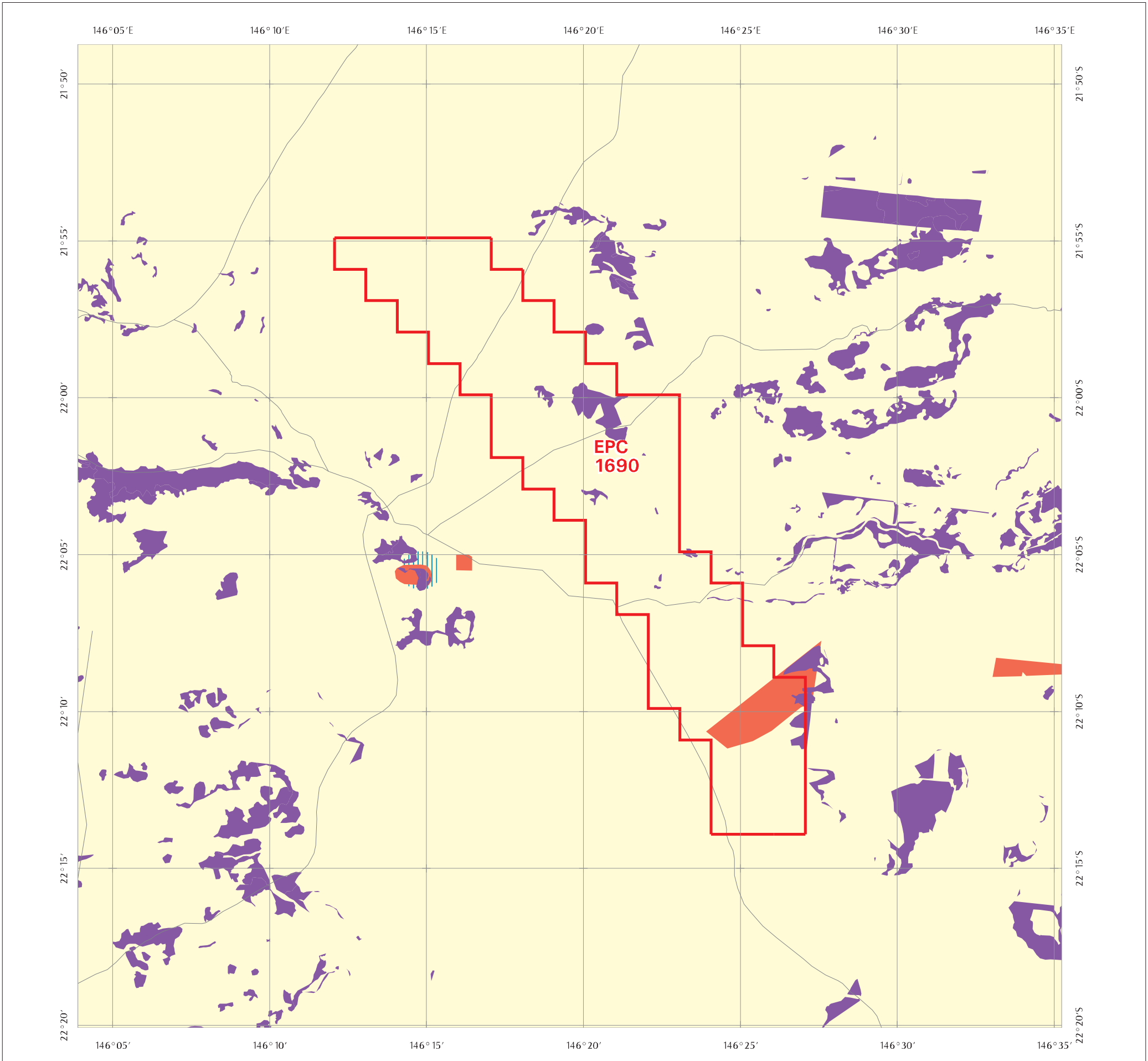
Family	Botanical name	NC Act Status	EPBC Act Status
Myrtaceae	<i>Corymbia dallachiana</i> (Benth.) K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia lamprophylla</i> (Brooker & A.R.Bean) K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia leichhardtii</i> (F.M.Bailey) K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia plena</i> K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia setosa</i> subsp. <i>pedicellaris</i> K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Corymbia terminalis</i> (F.Muell.) K.D.Hill & L.A.S.Johnson		
Myrtaceae	<i>Eucalyptus brownii</i> Maiden & Cabbage		
Myrtaceae	<i>Eucalyptus brownii</i> Maiden & Cabbage - <i>E.populnea</i> F.Muell.		
Myrtaceae	<i>Eucalyptus brownii</i> Maiden & Cabbage x <i>E.drepanophylla</i> F.Muell. ex Benth.		
Myrtaceae	<i>Eucalyptus camaldulensis</i> subsp. <i>acuta</i> Brooker & M.W.McDonald		
Myrtaceae	<i>Eucalyptus cambageana</i> Maiden		
Myrtaceae	<i>Eucalyptus coolabah</i> Blakely & Jacobs		
Myrtaceae	<i>Eucalyptus drepanophylla</i> F.Muell. ex Benth.		
Myrtaceae	<i>Eucalyptus melanophloia</i> F.Muell.		
Myrtaceae	<i>Eucalyptus melanophloia</i> F.Muell. - <i>E.whitei</i> Maiden & Blakely		
Myrtaceae	<i>Eucalyptus persistens</i> L.A.S.Johnson & K.D.Hill		
Myrtaceae	<i>Eucalyptus populnea</i> F.Muell.		
Myrtaceae	<i>Eucalyptus socialis</i> subsp. <i>eucentrica</i> (L.A.S.Johnson & K.D.Hill) Nicolle		
Myrtaceae	<i>Eucalyptus thozetiana</i> F.Muell. ex R.T.Baker		
Myrtaceae	<i>Eucalyptus whitei</i> Maiden & Blakely		
Myrtaceae	<i>Leptospermum lamellatum</i> Joy Thomps.		
Myrtaceae	<i>Lithomyrtus microphylla</i> (Benth.) N.Snow & Guymer		
Myrtaceae	<i>Melaleuca chisholmii</i> (Cheel) Craven		
Myrtaceae	<i>Melaleuca fluviatilis</i> Barlow		
Myrtaceae	<i>Melaleuca foliolosa</i> A.Cunn. ex Benth.		
Myrtaceae	<i>Melaleuca leucadendra</i> (L.) L.		
Myrtaceae	<i>Melaleuca nervosa</i> (Lindl.) Cheel		
Myrtaceae	<i>Melaleuca nervosa</i> (Lindl.) Cheel subsp. <i>nervosa</i>		
Myrtaceae	<i>Melaleuca pallescens</i> Byrnes		
Myrtaceae	<i>Melaleuca tamariscina</i> Hook.f.		
Myrtaceae	<i>Melaleuca trichostachya</i> Lindl.		
Myrtaceae	<i>Melaleuca uncinata</i> R.Br.		
Myrtaceae	<i>Thryptomene parviflora</i> (F.Muell. ex Benth.) Domin		
Nyctaginaceae	<i>Boerhavia burbridgeana</i> Hewson		
Nyctaginaceae	<i>Boerhavia dominii</i> Meikle & Hewson		
Nyctaginaceae	<i>Boerhavia paludosa</i> (Domin) Meikle		
Nyctaginaceae	<i>Boerhavia pubescens</i> R.Br.		
Nymphaeaceae	<i>Nymphaea gigantea</i> Hook.		
Oleaceae	<i>Jasminum didymum</i> subsp. <i>racemosum</i> (F.Muell.) P.S.Green		
Oleaceae	<i>Notelaea microcarpa</i> R.Br. var. <i>microcarpa</i>		
Onagraceae	<i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven		
Onagraceae	<i>Ludwigia peploides</i> subsp. <i>montevidensis</i> (Spreng.) P.H.Raven		
Onagraceae	<i>Ludwigia perennis</i> L.		
Orchidaceae	<i>Cymbidium canaliculatum</i> R.Br.		
Orchidaceae	<i>Prasophyllum</i>		
Oxalidaceae	<i>Oxalis corniculata</i> L.	Introduced	
Parkeriaceae	<i>Ceratopteris thalictroides</i> (L.) Brongn.		
Pentapetaceae	<i>Melhania oblongifolia</i> F.Muell.		
Pentapetaceae	<i>Melhania ovata</i> (Cav.) Spreng.		
Phyllanthaceae	<i>Breynia oblongifolia</i> (Muell.Arg.) Muell.Arg.		
Phyllanthaceae	<i>Flueggea leucopyrus</i> Willd.		
Phyllanthaceae	<i>Phyllanthus fuernrohrhii</i> F.Muell.		
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i> L.		
Phyllanthaceae	<i>Phyllanthus maderaspatensis</i> L. var. <i>maderaspatensis</i>		
Phyllanthaceae	<i>Phyllanthus virgatus</i> G.Forst.		
Phyllanthaceae	<i>Poranthera microphylla</i> Brongn.		
Phyllanthaceae	<i>Sauropus trachyspermus</i> (F.Muell.) Airy Shaw		
Picrodendraceae	<i>Petalostigma banksii</i> Britten & S.Moore		
Pittosporaceae	<i>Bursaria incana</i> Lindl.		
Poaceae	<i>Acrachne racemosa</i> (B.Heyne ex Roem. & Schult.) Ohwi		
Poaceae	<i>Alloterospis cimicina</i> (L.) Stapf		

Family	Botanical name	NC Act Status	EPBC Act Status
Poaceae	<i>Alloteropsis semialata</i> (R.Br.) Hitchc.		
Poaceae	<i>Amphipogon caricinus</i> F.Muell. var. <i>caricinus</i>		
Poaceae	<i>Amphipogon sericeus</i> (Vickery) T.D.Macfarl.		
Poaceae	<i>Ancistrachne uncinulata</i> (R.Br.) S.T.Blake		
Poaceae	<i>Aristida benthamii</i> Henrard var. <i>benthamii</i>		
Poaceae	<i>Aristida biglandulosa</i> J.M.Black		
Poaceae	<i>Aristida calycina</i> R.Br.		
Poaceae	<i>Aristida calycina</i> R.Br. var. <i>calycina</i>		
Poaceae	<i>Aristida calycina</i> var. <i>praealta</i> Domin		
Poaceae	<i>Aristida helicophylla</i> S.T.Blake		
Poaceae	<i>Aristida holathera</i> Domin var. <i>holathera</i>		
Poaceae	<i>Aristida hygrometrica</i> R.Br.		
Poaceae	<i>Aristida ingrata</i> Domin		
Poaceae	<i>Aristida jerichoensis</i> (Domin) Henrard var. <i>jerichoensis</i>		
Poaceae	<i>Aristida latifolia</i> Domin		
Poaceae	<i>Aristida leptopoda</i> Benth.		
Poaceae	<i>Aristida pruinosa</i> Domin		
Poaceae	<i>Aristida sciuroides</i> Domin		
Poaceae	<i>Arundinella nepalensis</i> Trin.		
Poaceae	<i>Astrebla elymoides</i> F.Muell. ex F.M.Bailey		
Poaceae	<i>Astrebla lappacea</i> (Lindl.) Domin		
Poaceae	<i>Astrebla pectinata</i> (Lindl.) F.Muell. ex Benth.		
Poaceae	<i>Astrebla squarrosa</i> C.E.Hubb.		
Poaceae	<i>Austrochloa dichanthioides</i> (Everist) Lazarides		
Poaceae	<i>Bothriochloa bladhii</i> (Retz.) S.T.Blake subsp. <i>bladhii</i>		
Poaceae	<i>Bothriochloa decipiens</i> var. <i>cloncurrans</i> (Domin) C.E.Hubb.		
Poaceae	<i>Bothriochloa erianthoides</i> (F.Muell.) C.E.Hubb.		
Poaceae	<i>Bothriochloa ewartiana</i> (Domin) C.E.Hubb.		
Poaceae	<i>Bothriochloa pertusa</i> (L.) A.Camus	Introduced	
Poaceae	<i>Brachyachne convergens</i> (F.Muell.) Stapf		
Poaceae	<i>Brachyachne tenella</i> (R.Br.) C.E.Hubb.		
Poaceae	<i>Chloris divaricata</i> R.Br. var. <i>divaricata</i>		
Poaceae	<i>Chloris inflata</i> Link	Introduced	
Poaceae	<i>Chloris pectinata</i> Benth.		
Poaceae	<i>Chloris</i> sp. (Edgbaston R.J.Fensham 5694)		
Poaceae	<i>Chloris virgata</i> Sw.	Introduced	
Poaceae	<i>Chrysopogon fallax</i> S.T.Blake		
Poaceae	<i>Cymbopogon ambiguus</i> A.Camus		
Poaceae	<i>Cymbopogon bombycinus</i> (R.Br.) Domin		
Poaceae	<i>Cynodon dactylon</i> (L.) Pers. var. <i>dactylon</i>	Introduced	
Poaceae	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Introduced	
Poaceae	<i>Dactyloctenium burchanensis</i> B.K.Simon		
Poaceae	<i>Dactyloctenium radulans</i> (R.Br.) P.Beauv.		
Poaceae	<i>Dichanthium annulatum</i> (Forssk.) Stapf	Introduced	
Poaceae	<i>Dichanthium fecundum</i> S.T.Blake		
Poaceae	<i>Dichanthium sericeum</i> (R.Br.) A.Camus subsp. <i>sericeum</i>		
Poaceae	<i>Digitaria bicornis</i> (Lam.) Roem. & Schult.		
Poaceae	<i>Digitaria breviglumis</i> (Domin) Henrard		
Poaceae	<i>Digitaria brownii</i> (Roem. & Schult.) Hughes		
Poaceae	<i>Digitaria ciliaris</i> (Retz.) Koeler	Introduced	
Poaceae	<i>Digitaria divaricatissima</i> (R.Br.) Hughes		
Poaceae	<i>Echinochloa colona</i> (L.) Link	Introduced	
Poaceae	<i>Echinochloa crus-galli</i> (L.) P.Beauv.	Introduced	
Poaceae	<i>Echinochloa inundata</i> P.W.Michael & Vickery		
Poaceae	<i>Echinochloa turneriana</i> (Domin) J.M.Black		
Poaceae	<i>Elionurus citreus</i> (R.Br.) Munro ex Benth.		
Poaceae	<i>Elytrophorus spicatus</i> (Willd.) E.G.Camus & A.Camus		
Poaceae	<i>Enneapogon avenaceus</i> (Lindl.) C.E.Hubb.		
Poaceae	<i>Enneapogon gracilis</i> (R.Br.) P.Beauv.		
Poaceae	<i>Enneapogon lindleyanus</i> (Domin) C.E.Hubb.		
Poaceae	<i>Enneapogon polyphyllus</i> (Domin) N.T.Burb.		
Poaceae	<i>Enneapogon robustissimus</i> (Domin) N.T.Burb.		
Poaceae	<i>Enneapogon truncatus</i> Kakudidi		
Poaceae	<i>Enneapogon virens</i> (Lindl.) Kakudidi		
Poaceae	<i>Enteropogon acicularis</i> (Lindl.) Lazarides		
Poaceae	<i>Enteropogon ramosus</i> B.K.Simon		
Poaceae	<i>Eragrostis basedowii</i> Jedwabn.		
Poaceae	<i>Eragrostis confertiflora</i> J.M.Black		
Poaceae	<i>Eragrostis cumingii</i> Steud.		

Family	Botanical name	NC Act Status	EPBC Act Status
Poaceae	<i>Eragrostis dielsii</i> Pilg.		
Poaceae	<i>Eragrostis elongata</i> (Willd.) J.Jacq.		
Poaceae	<i>Eragrostis falcata</i> (Gaudich.) Gaudich. ex Steud.		
Poaceae	<i>Eragrostis lacunaria</i> F.Muell. ex Benth.		
Poaceae	<i>Eragrostis lanicaulis</i> Lazarides		
Poaceae	<i>Eragrostis leptocarpa</i> Benth.		
Poaceae	<i>Eragrostis leptostachya</i> (R.Br.) Steud.		
Poaceae	<i>Eragrostis microcarpa</i> Vickery		
Poaceae	<i>Eragrostis parviflora</i> (R.Br.) Trin.		
Poaceae	<i>Eragrostis pergracilis</i> S.T.Blake		
Poaceae	<i>Eragrostis pilosa</i> (L.) P.Beauv.	Introduced	
Poaceae	<i>Eragrostis schultzei</i> Benth.		
Poaceae	<i>Eragrostis setifolia</i> Nees		
Poaceae	<i>Eragrostis sororia</i> Domin		
Poaceae	<i>Eragrostis spartinoides</i> Steud.		
Poaceae	<i>Eragrostis speciosa</i> (Roem. & Schult.) Steud.		
Poaceae	<i>Eragrostis tenellula</i> (Kunth) Steud.		
Poaceae	<i>Eriachne aristidea</i> F.Muell.		
Poaceae	<i>Eriachne benthamii</i> W.Hartley		
Poaceae	<i>Eriachne mucronata</i> R.Br.		
Poaceae	<i>Eriachne obtusa</i> R.Br.		
Poaceae	<i>Eriachne pulchella</i> Domin subsp. <i>pulchella</i>		
Poaceae	<i>Eriochloa australiensis</i> Stapf ex Thell.		
Poaceae	<i>Eriochloa crebra</i> S.T.Blake		
Poaceae	<i>Eriochloa procera</i> (Retz.) C.E.Hubb.		
Poaceae	<i>Eriochloa pseudoacrotricha</i> (Stapf ex Thell.) J.M.Black		
Poaceae	<i>Eulalia aurea</i> (Bory) Kunth		
Poaceae	<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.		
Poaceae	<i>Hymenachne amplexicaulis</i> (Rudge) Nees cv. <i>Olive</i>	Introduced	
Poaceae	<i>Isachne globosa</i> (Thunb.) Kuntze		
Poaceae	<i>Ischaemum australe</i> R.Br. var. <i>australe</i>		
Poaceae	<i>Ischaemum australe</i> var. <i>villosum</i> (R.Br.) Benth.		
Poaceae	<i>Iseilema membranaceum</i> (Lindl.) Domin		
Poaceae	<i>Iseilema vaginiflorum</i> Domin		
Poaceae	<i>Leersia hexandra</i> Sw.		
Poaceae	<i>Leptochloa decipiens</i> (R.Br.) Stapf ex Maiden subsp. <i>decipiens</i>		
Poaceae	<i>Leptochloa decipiens</i> subsp. <i>asthenes</i> (Roem. & Schult.) N.Snow		
Poaceae	<i>Leptochloa decipiens</i> subsp. <i>peacockii</i> (Maiden & Betcher) N.Snow		
Poaceae	<i>Leptochloa digitata</i> (R.Br.) Domin		
Poaceae	<i>Leptochloa fusca</i> (L.) Kunth subsp. <i>fusca</i>		
Poaceae	<i>Melinis repens</i> (Willd.) Zizka	Introduced	
Poaceae	<i>Oxychloris scariosa</i> (F.Muell.) Lazarides		
Poaceae	<i>Panicum antidotale</i> Retz.	Introduced	
Poaceae	<i>Panicum decompositum</i> R.Br. var. <i>decompositum</i>		
Poaceae	<i>Panicum effusum</i> R.Br.		
Poaceae	<i>Panicum laevinode</i> Lindl.		
Poaceae	<i>Panicum larcomanum</i> Hughes		
Poaceae	<i>Paspalidium albobillosum</i> S.T.Blake		
Poaceae	<i>Paspalidium caespitosum</i> C.E.Hubb.		
Poaceae	<i>Paspalidium constrictum</i> (Domin) C.E.Hubb.		
Poaceae	<i>Paspalidium criniforme</i> S.T.Blake		
Poaceae	<i>Paspalidium distans</i> (Trin.) Hughes		
Poaceae	<i>Paspalidium globoideum</i> (Domin) Hughes		
Poaceae	<i>Paspalidium gracile</i> (R.Br.) Hughes		
Poaceae	<i>Paspalidium jubiflorum</i> (Trin.) Hughes		
Poaceae	<i>Paspalidium rarum</i> (R.Br.) Hughes		
Poaceae	<i>Paspalum dilatatum</i> Poir.	Introduced	
Poaceae	<i>Paspalum distichum</i> L.		
Poaceae	<i>Paspalum vaginatum</i> Sw.		
Poaceae	<i>Pennisetum alopecuroides</i> (L.) Spreng.		
Poaceae	<i>Pennisetum setigerum</i> (Vahl) Wipff	Introduced	
Poaceae	<i>Perotis rara</i> R.Br.		
Poaceae	<i>Pseudoraphis spinescens</i> (R.Br.) Vickery		
Poaceae	<i>Sacciolepis indica</i> (L.) Chase		
Poaceae	<i>Sarga plumosum</i> (R.Br.) Spangler		
Poaceae	<i>Sehima nervosum</i> (Rottler) Stapf		
Poaceae	<i>Setaria paspalidioides</i> Vickery		

Family	Botanical name	NC Act Status	EPBC Act Status
Poaceae	<i>Setaria surgens</i> Stapf		
Poaceae	<i>Sorghum bicolor</i> (L.) Moench	Introduced	
Poaceae	<i>Sporobolus actinocladus</i> (F.Muell.) F.Muell.		
Poaceae	<i>Sporobolus australasicus</i> Domin		
Poaceae	<i>Sporobolus caroli</i> Mez		
Poaceae	<i>Sporobolus contiguus</i> S.T.Blake		
Poaceae	<i>Sporobolus coromandelianus</i> (Retz.) Kunth	Introduced	
Poaceae	<i>Sporobolus disjunctus</i> R.Mills ex B.K.Simon		
Poaceae	<i>Sporobolus elongatus</i> R.Br.		
Poaceae	<i>Sporobolus mitchellii</i> (Trin.) C.E.Hubb. ex S.T.Blake		
Poaceae	<i>Sporobolus pamela</i> B.K.Simon	Endangered	
Poaceae	<i>Sporobolus partimpatens</i> R.Mills ex B.K.Simon	Near threatened	
Poaceae	<i>Sporobolus scabridus</i> S.T.Blake		
Poaceae	<i>Sporobolus virginicus</i> (L.) Kunth		
Poaceae	<i>Thaumastochloa pubescens</i> (Benth.) C.E.Hubb.		
Poaceae	<i>Thellungia advena</i> Stapf ex Probst		
Poaceae	<i>Themeda avenacea</i> (F.Muell.) Maiden & Betche		
Poaceae	<i>Themeda triandra</i> Forssk.		
Poaceae	<i>Tragus australianus</i> S.T.Blake		
Poaceae	<i>Triodia longiceps</i> J.M.Black		
Poaceae	<i>Triodia microstachya</i> R.Br.		
Poaceae	<i>Triodia mitchellii</i> Benth.		
Poaceae	<i>Triodia pungens</i> R.Br.		
Poaceae	<i>Tripogon loliiformis</i> (F.Muell.) C.E.Hubb.		
Poaceae	<i>Triraphis mollis</i> R.Br.		
Poaceae	<i>Urochloa foliosa</i> (R.Br.) R.D.Webster		
Poaceae	<i>Urochloa gilesii</i> (Benth.) Hughes		
Poaceae	<i>Urochloa mosambicensis</i> (Hack.) Dandy	Introduced	
Poaceae	<i>Urochloa piligera</i> (F.Muell. ex Benth.) R.D.Webster		
Poaceae	<i>Urochloa praetervisa</i> (Domin) Hughes		
Poaceae	<i>Urochloa reptans</i> (L.) Stapf		
Poaceae	<i>Yakira pauciflora</i> (R.Br.) Lazarides & R.D.Webster		
Polygalaceae	<i>Polygala linariifolia</i> Willd.		
Polygalaceae	<i>Polygala</i> sp. (Georgetown K.R.McDonald KRM673)		
Polygalaceae	<i>Polygala</i> sp. (White Mountains M.B.Thomas+ 1738)		
Polygonaceae	<i>Persicaria attenuata</i> (R.Br.) Sojak		
Polygonaceae	<i>Persicaria decipiens</i> (R.Br.) K.L.Wilson		
Polygonaceae	<i>Persicaria lapathifolia</i> (L.) Gray		
Portulacaceae	<i>Calandrinia Ptychosperma</i> F.Muell.		
Portulacaceae	<i>Portulaca oligosperma</i> F.Muell.		
Potamogetonaceae	<i>Potamogeton tricaratus</i> F.Muell. & A.Benn. ex A.Benn.		
Proteaceae	<i>Grevillea parallela</i> Knight		
Proteaceae	<i>Grevillea sessilis</i> C.T.White & W.D.Francis		
Proteaceae	<i>Grevillea striata</i> R.Br.		
Proteaceae	<i>Hakea leucoptera</i> R.Br.		
Proteaceae	<i>Hakea leucoptera</i> subsp. <i>sericipes</i> W.R.Barker		
Proteaceae	<i>Persoonia falcata</i> R.Br.		
Rhamnaceae	<i>Alphitonia excelsa</i> (Fenzl) Benth.		
Rhamnaceae	<i>Ventilago viminalis</i> Hook.		
Rubiaceae	<i>Dentella repens</i> (L.) J.R.Forst. & G.Forst.		
Rubiaceae	<i>Oldenlandia galioides</i> (F.Muell.) F.Muell.		
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> (F.Muell.) F.Muell.		
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> subsp. <i>nigricans</i> Halford		
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> subsp. <i>trachymenoides</i> (F.Muell.) Halford		
Rubiaceae	<i>Psydrax attenuata</i> forma <i>megalantha</i> S.T.Reynolds & R.J.F.Hend.		
Rubiaceae	<i>Psydrax forsteri</i> S.T.Reynolds & R.J.F.Hend.		
Rubiaceae	<i>Psydrax oleifolia</i> (Hook.) S.T.Reynolds & R.J.F.Hend.		
Rubiaceae	<i>Psydrax saligna</i> S.T.Reynolds & R.J.F.Hend. forma <i>saligna</i>		
Rubiaceae	<i>Spermacoce baileyana</i> Domin		
Rubiaceae	<i>Spermacoce brachystema</i> R.Br. ex Benth.		
Ruppiaceae	<i>Ruppia maritima</i> L.		
Rutaceae	<i>Citrus glauca</i> (Lindl.) Burkill		
Rutaceae	<i>Flindersia dissosperma</i> (F.Muell.) Domin		
Rutaceae	<i>Flindersia maculosa</i> (Lindl.) Benth.		
Rutaceae	<i>Geijera parviflora</i> Lindl.		
Rutaceae	<i>Geijera salicifolia</i> Schott		
Santalaceae	<i>Anthobolus leptomerioides</i> F.Muell.		

Family	Botanical name	NC Act Status	EPBC Act Status
Santalaceae	<i>Exocarpos sparteus</i> R.Br.		
Santalaceae	<i>Santalum lanceolatum</i> R.Br.		
Sapindaceae	<i>Alectryon diversifolius</i> (F.Muell.) S.T.Reynolds		
Sapindaceae	<i>Alectryon oleifolius</i> subsp. <i>elongatus</i> S.T.Reynolds		
Sapindaceae	<i>Atalaya hemiglaucula</i> (F.Muell.) F.Muell. ex Benth.		
Sapindaceae	<i>Distichostemon dodecandrus</i> Domin		
Sapindaceae	<i>Dodonaea lanceolata</i> var. <i>subsessilifolia</i> J.G.West		
Sapindaceae	<i>Dodonaea stenophylla</i> F.Muell.		
Sapindaceae	<i>Dodonaea tenuifolia</i> Lindl.		
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>angustissima</i> (DC.) J.G.West		
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>spatulata</i> (Sm.) J.G.West		
Scrophulariaceae	<i>Buchnera linearis</i> R.Br.		
Scrophulariaceae	<i>Buchnera ramosissima</i> R.Br.		
Scrophulariaceae	<i>Lindernia scapigera</i> R.Br.		
Scrophulariaceae	<i>Mimulus repens</i> R.Br.		
Scrophulariaceae	<i>Peplidium</i>		
Scrophulariaceae	<i>Peplidium foecundum</i> W.R.Barker		
Scrophulariaceae	<i>Scoparia dulcis</i> L.	Introduced	
Scrophulariaceae	<i>Stemodia glabella</i> W.R.Barker		
Solanaceae	<i>Nicotiana forsteri</i> Roem. & Schult.		
Solanaceae	<i>Solanum cleistogamum</i> Symon		
Solanaceae	<i>Solanum crebrispinum</i> A.R.Bean		
Solanaceae	<i>Solanum ellipticum</i> R.Br.		
Solanaceae	<i>Solanum esuriale</i> Lindl.		
Solanaceae	<i>Solanum nodiflorum</i> Jacq.	Introduced	
Solanaceae	<i>Solanum parvifolium</i> R.Br. subsp. <i>parvifolium</i>		
Sparrmanniaceae	<i>Corchorus sidoides</i> subsp. <i>vermicularis</i> (F.Muell.) Halford		
Sparrmanniaceae	<i>Triumfetta pentandra</i> A.Rich.	Introduced	
Stackhousiaceae	<i>Stackhousia viminea</i> Sm.		
Stylidiaceae	<i>Stylidium adenophorum</i> Lowrie & Kenneally		
Stylidiaceae	<i>Stylidium velleioides</i> A.R.Bean		
Thelypteridaceae	<i>Cyclosorus interruptus</i> (Willd.) H.Ito		
Thymelaeaceae	<i>Thecanthes sanguinea</i> (F.Muell.) Rye		
Typhaceae	<i>Typha domingensis</i> Pers.		
Verbenaceae	<i>Verbena macrostachya</i> F.Muell.		
Violaceae	<i>Hybanthus enneaspermus</i> (L.) F.Muell.		
Zygophyllaceae	<i>Tribulopsis</i>		
Zygophyllaceae	<i>Tribulopsis angustifolia</i> R.Br.		



Legend

- Selected Exploration Permit Coal
- CATEGORY A**
- National Parks
- Conservation Parks
- Forest Reserves
- Wet Tropics World Heritage Area
- Great Barrier Reef Marine Park Region
- Marine Parks other than General Use Zones
- CATEGORY B**
- World Heritage Areas
- Queensland Heritage Register Places
- Ramsar Sites
- Cultural Heritage Registered Areas and DLA's other than Stanbroke
- Special Forestry Areas
- Fish Habitat Areas
- Koala Plan
- Coordinated Conservation Areas
- Endangered Regional Ecosystems (Biodiversity Status)
- General Use Zones of Marine Parks
- Marine Plants

ENVIRONMENTALLY SENSITIVE AREAS - Mining Activities

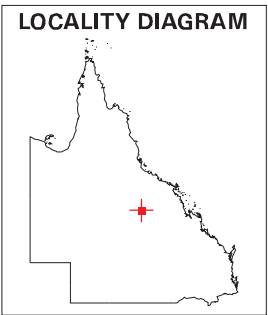
- CATEGORY C**
- Nature Refuges
- Resources Reserves
- Declared Catchment Areas
- Declared Irrigation Areas
- Drainage Areas
- River Improvement Areas
- Stanbroke DLA
- State Forests
- Timber Reserves
- Coastal Management Control Districts
- Dams and Weirs
- OTHERS**
- Roads
- Towns
- Wild River Nominated Waterways
- Wild River High Preservation Areas
- Wild River Preservation Areas
- Mahogany Glider Habitat
- Directory of Important Wetlands
- Queensland

Requested By: LAUREN.MULLER@GHD.COM
Date: 08 Dec 11 Time: 14.28.12

Centered on Tenure:
EPC 1690



Queensland
Government



This scale bar is approximate only
Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)
This product is unprojected and is not suitable for measuring distances

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

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

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

Birds Australia Database Search Results

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill		
Acanthizidae	<i>Acanthiza nana</i>	yellow thornbill		
Acanthizidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill		
Acanthizidae	<i>Acanthiza uropygialis</i>	chestnut-rumped thornbill		
Acanthizidae	<i>Gerygone albogularis</i>	white-throated gerygone		
Acanthizidae	<i>Gerygone fusca</i>	western gerygone		
Acanthizidae	<i>Smicromis brevirostris</i>	weebill		
Accipitridae	<i>Accipiter fasciatus</i>	brown goshawk		Marine
Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle		
Accipitridae	<i>Aviceda subcristata</i>	Pacific baza		
Accipitridae	<i>Circus assimilis</i>	spotted harrier		
Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		Marine
Accipitridae	<i>Hieraaetus morphnoides</i>	little eagle		
Accipitridae	<i>Lophoictinia isura</i>	square-tailed kite	Near threatened	
Accipitridae	<i>Milvus migrans</i>	black kite		
Acrocephalidae	<i>Acrocephalus australis</i>	Australian reed-warbler		
Aegothelidae	<i>Aegotheles cristatus</i>	Australian owl-nightjar		
Alaudidae	<i>Mirafra javanica</i>	Horsfield's bushlark		
Anatidae	<i>Anas gracilis</i>	grey teal		
Anatidae	<i>Anas superciliosa</i>	Pacific black duck		
Anatidae	<i>Aythya australis</i>	hardhead		
Anatidae	<i>Chenonetta jubata</i>	Australian wood duck		
Anatidae	<i>Cygnus atratus</i>	black swan		
Anatidae	<i>Dendrocygna eytoni</i>	plumed whistling-duck		
Anatidae	<i>Malacorhynchus membranaceus</i>	pink-eared duck		
Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian darter		
Ardeidae	<i>Ardea intermedia</i>	intermediate egret		Marine
Ardeidae	<i>Ardea pacifica</i>	white-necked heron		
Ardeidae	<i>Egretta garzetta</i>	little egret		Marine
Ardeidae	<i>Egretta novaehollandiae</i>	white-faced heron		
Ardeidae	<i>Nycticorax caledonicus</i>	nankeen night-heron		Marine
Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow		
Artamidae	<i>Artamus leucorhynchus</i>	white-breasted woodswallow		
Artamidae	<i>Artamus minor</i>	little woodswallow		
Artamidae	<i>Cracticus nigrogularis</i>	pied butcherbird		
Artamidae	<i>Cracticus tibicen</i>	Australian magpie		
Artamidae	<i>Cracticus torquatus</i>	grey butcherbird		
Artamidae	<i>Strepera graculina</i>	pied currawong		
Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew		
Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo		
Cacatuidae	<i>Calyptorhynchus banksii</i>	red-tailed black-cockatoo		
Cacatuidae	<i>Calyptorhynchus funereus</i>	yellow-tailed black-cockatoo		
Cacatuidae	<i>Eolophus roseicapillus</i>	galah		
Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel		
Campephagidae	<i>Coracina maxima</i>	ground cuckoo-shrike		
Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		Marine
Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		Marine
Campephagidae	<i>Coracina tenuirostris</i>	cicadabird		Marine
Campephagidae	<i>Lalage sueurii</i>	white-winged triller		
Casuariidae	<i>Dromaius novaehollandiae</i>	emu		
Charadriidae	<i>Elseyornis melanops</i>	black-fronted dotterel		
Charadriidae	<i>Vanellus miles</i>	masked lapwing		
Climacteridae	<i>Climacteris picumnus</i>	brown tree creeper		
Columbidae	<i>Geopelia cuneata</i>	diamond dove		
Columbidae	<i>Geopelia humeralis</i>	bar-shouldered dove		
Columbidae	<i>Geopelia striata</i>	peaceful dove		
Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern)	Vulnerable	Vulnerable
Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon		
Columbidae	<i>Phaps chalcoptera</i>	common bronzewing		
Corcoracidae	<i>Corcorax melanorhamphos</i>	white-winged chough		
Corcoracidae	<i>Struthidea cinerea</i>	apostlebird		
Corvidae	<i>Corvus bennetti</i>	little crow		
Corvidae	<i>Corvus coronoides</i>	Australian raven		
Corvidae	<i>Corvus orru</i>	Torresian crow		
Cuculidae	<i>Cacomantis pallidus</i>	pallid cuckoo		Marine
Cuculidae	<i>Cacomantis variolosus</i>	brush cuckoo		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Cuculidae	<i>Centropus phasianinus</i>	pheasant coucal		
Cuculidae	<i>Chalcites basalis</i>	Horsfield's bronze-cuckoo		Marine
Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		Marine
Estrildidae	<i>Neochmia modesta</i>	plum-headed finch		
Estrildidae	<i>Poephila cincta cincta</i>	black-throated finch (southern)	Endangered	Endangered
Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		
Estrildidae	<i>Taeniopygia guttata</i>	zebra finch		
Eurostopodidae	<i>Eurostopodus argus</i>	spotted nightjar		Marine
Eurostopodidae	<i>Eurostopodus mystacalis</i>	white-throated nightjar		Marine
Falconidae	<i>Falco berigora</i>	brown falcon		
Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		Marine
Falconidae	<i>Falco longipennis</i>	Australian hobby		
Gruidae	<i>Grus rubicunda</i>	brulga		
Halcyonidae	<i>Dacelo leachii</i>	blue-winged kookaburra		
Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		
Halcyonidae	<i>Todiramphus macleayii</i>	forest kingfisher		Marine
Halcyonidae	<i>Todiramphus pyrrhopygius</i>	red-backed kingfisher		
Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		Marine
Hirundinidae	<i>Petrochelidon ariel</i>	fairy martin		
Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		Marine
Laridae	<i>Chroicocephalus novaehollandiae</i>	silver gull		Marine
Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren		
Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren		
Megaluridae	<i>Cincloramphus mathewsi</i>	rufous songlark		
Megaluridae	<i>Eremiornis carteri</i>	spinifexbird		
Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater		
Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater		
Meliphagidae	<i>Lichenostomus penicillatus</i>	white-plumed honeyeater		
Meliphagidae	<i>Lichenostomus plumulus</i>	grey-fronted honeyeater		
Meliphagidae	<i>Lichenostomus virescens</i>	singing honeyeater		
Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		
Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		
Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		
Meliphagidae	<i>Philemon citreogularis</i>	little friarbird		
Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		
Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		
Meropidae	<i>Merops ornatus</i>	rainbow bee-eater		Marine; Migratory (JAMBA)
Monarchidae	<i>Grallina cyanoleuca</i>	maggie-lark		
Monarchidae	<i>Myiagra inquieta</i>	restless flycatcher		
Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian pipit		Marine
Nectariniidae	<i>Dicaeum hirundinaceum</i>	mistletoebird		
Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		
Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		
Otididae	<i>Ardeotis australis</i>	Australian bustard		
Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush		
Pachycephalidae	<i>Oreoica gutturalis</i>	crested bellbird		
Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		
Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		
Petroicidae	<i>Melanodryas cucullata</i>	hooded robin		
Petroicidae	<i>Microeca fascians</i>	jacky winter		
Petroicidae	<i>Petroica goodenovii</i>	red-capped robin		
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	little pied cormorant		
Phasianidae	<i>Coturnix pectoralis</i>	stubble quail		Marine
Phasianidae	<i>Coturnix ypsilophora</i>	brown quail		
Podargidae	<i>Podargus strigoides</i>	tawny frogmouth		
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe		
Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		
Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot		
Psittacidae	<i>Melopsittacus undulatus</i>	budgerigar		
Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella		
Psittacidae	<i>Trichoglossus haematodus</i>	rainbow lorikeet		
Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	spotted bowerbird		
Rallidae	<i>Fulica atra</i>	Eurasian coot		
Rallidae	<i>Gallinula tenebrosa</i>	dusky moorhen		
Rallidae	<i>Tribonyx ventralis</i>	black-tailed native-hen		
Recurvirostridae	<i>Himantopus himantopus</i>	black-winged stilt		Marine
Rhipiduridae	<i>Rhipidura albiscapa</i>	grey fantail		
Rhipiduridae	<i>Rhipidura leucophrys</i>	willie wagtail		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status
Strigidae	<i>Ninox novaeseelandiae</i>	southern boobook		Marine
Threskiornithidae	<i>Platalea flavipes</i>	yellow-billed spoonbill		
Threskiornithidae	<i>Platalea regia</i>	royal spoonbill		
Turnicidae	<i>Turnix pyrrhorthorax</i>	red-chested button-quail		
Tytonidae	<i>Tyto javanica</i>	eastern barn owl		

Queensland Museum Database Search Results

Family	Scientific name	Common Name	NC Act Status	EPBC Act Status
Amphibians				
Hylidae	<i>Cyclorana alboguttata</i>	green-stripe frog		
Hylidae	<i>Cyclorana brevipes</i>	superb collared-frog		
Hylidae	<i>Cyclorana novaehollandiae</i>	New Holland frog		
Hylidae	<i>Litoria inermis</i>	Peters' frog		
Hylidae	<i>Litoria latopalmata</i>	broad-palmed rocketfrog		
Hylidae	<i>Litoria nasuta</i>	striped rocketfrog		
Hylidae	<i>Litoria rothii</i>	Roth's tree-frog		
Hylidae	<i>Litoria rubella</i>	naked treefrog		
Limnodynastidae	<i>Notaden bennettii</i>	holy cross toad		
Limnodynastidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog		
Myobatrachidae	<i>Uperoleia littlejohni</i>	Littlejohn's toadlet		
Myobatrachidae	<i>Uperoleia rugosa</i>	chubby gungan		
Bufoidea	<i>Rhinella marina</i>	cane toad	Introduced	
Reptiles				
Agamidae	<i>Amphibolurus burnsi</i>	Burns' dragon		
Agamidae	<i>Amphibolurus gilberti</i>	ta ta lizard		
Agamidae	<i>Amphibolurus nobbi</i>	nobbi dragon		
Cheloniidae	<i>Chelodina longicollis</i>	eastern long-necked turtle		
Elapidae	<i>Cryptophis boschmai</i>	Carpentaria snake		
Elapidae	<i>Demansia papuensis</i>	greater black whipsnake		
Gekkonidae	<i>Diplodactylus conspicillatus</i>	fat-tailed gecko		
Gekkonidae	<i>Gehyra dubia</i>	dubious dtella		
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko		
Gekkonidae	<i>Lucasium steindachneri</i>	box-patterned gecko		
Gekkonidae	<i>Oedura castelnaui</i>	northern velvet gecko		
Gekkonidae	<i>Oedura ocellata</i>	ocellated velvet gecko		
Gekkonidae	<i>Oedura rhombifer</i>	zigzag velvet gecko		
Gekkonidae	<i>Strophurus taenicauda</i>	golden-tailed gecko	Near threatened	
Gekkonidae	<i>Strophurus williamsi</i>	eastern spiny-tailed gecko		
Pygopodidae	<i>Lialis burtonis</i>	Burton's snake lizard		
Pygopodidae	<i>Paradelma orientalis</i>	brigalow scaly-foot	Vulnerable	Vulnerable
Pygopodidae	<i>Pygopus schraderi</i>	eastern hooded scaly-foot		
Pythonidae	<i>Aspidites melanocephalus</i>	black-headed python		
Pythonidae	<i>Morelia spilota</i>	carpet python		
Scincidae	<i>Carlia munda</i>	shaded-litter rainbow-skink		
Scincidae	<i>Carlia pectoralis</i>	open-litter rainbow skink		
Scincidae	<i>Ctenotus hebetior</i>	stout ctenotus		
Scincidae	<i>Ctenotus ingrami</i>	unspotted yellow-sided ctenotus		
Scincidae	<i>Ctenotus pantherinus</i>	leopard ctenotus		
Scincidae	<i>Ctenotus robustus</i>	eastern striped skink		
Scincidae	<i>Ctenotus sp.</i>			
Scincidae	<i>Ctenotus strauchii</i>	eastern barred wedge-snout ctenotus		
Scincidae	<i>Eremiascincus fasciolatus</i>	narrow-banded sand-swimmer		
Scincidae	<i>Eulamprus sokosoma</i>			
Scincidae	<i>Lampropholis delicata</i>	garden skink		
Scincidae	<i>Lerista fragilis</i>	eastern mulch-slider		
Scincidae	<i>Lerista punctatovittata</i>	eastern robust slider		
Scincidae	<i>Menetia greyii</i>	common dwarf skink		
Scincidae	<i>Menetia maini</i>	northern dwarf skink		
Scincidae	<i>Menetia timlowi</i>	dwarf litter-skink		
Scincidae	<i>Morethia boulengeri</i>	south-eastern morethia skink		
Typhlopidae	<i>Ramphotyphlops wiedii</i>	brown-snouted blind snake		
Varanidae	<i>Varanus panoptes</i>	yellow-spotted monitor		
Varanidae	<i>Varanus tristis</i>	black-headed monitor		
Birds				
Alcedinidae	<i>Dacelo leachii</i>	blue-winged kookaburra		
Alcedinidae	<i>Dacelo novaeguineae</i>	laughing kookaburra		
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	red-backed kingfisher		
Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow		
Cacatuidae	<i>Cacatua roseicapilla</i>	galah		
Cacatuidae	<i>Calyptorhynchus banksii</i>	red-tailed black-cockatoo		
Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel		

Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		Marine
Campephagidae	<i>Lalage tricolor</i>	white-winged triller		
Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper		
Columbidae	<i>Geopelia placida</i>	peaceful dove		
Columbidae	<i>Phaps chalcoptera</i>	common bronzewing		
Corcoracidae	<i>Struthidea cinerea</i>	apostlebird		
Cracticidae	<i>Cracticus nigrogularis</i>	pied butcherbird		
Cuculidae	<i>Cuculus pallidus</i>	pallid cuckoo		Marine
Estrildidae	<i>Taeniopygia bichenovii</i>	double-barred finch		
Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater		
Meliphagidae	<i>Lichenostomus penicillatus</i>	white-plumed honeyeater		
Meliphagidae	<i>Lichenostomus virescens</i>	singing honeyeater		
Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater		
Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner		
Meliphagidae	<i>Melithreptus albogularis</i>	white-throated honeyeater		
Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird		
Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater		
Monarchidae	<i>Myiagra rubecula</i>	leaden flycatcher		
Monarchidae	<i>Seisura inquieta</i>	restless flycatcher		
Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella		
Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole		
Otididae	<i>Ardeotis australis</i>	Australian bustard		
Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler		
Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote		
Petroicidae	<i>Microeca fascians</i>	jacky winter		
Podargidae	<i>Podargus strigoides</i>	Tawny frogmouth		
Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler		
Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot		
Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella		
Ptilonorhynchidae	<i>Chlamydera maculata</i>	spotted bowerbird		
Mammals				
Bovidae	<i>Bos taurus</i>	domestic cattle	Introduced	
Dasyuridae	<i>Dasyurus hallucatus</i>	northern quoll		Endangered
Dasyuridae	<i>Sminthopsis macroura</i>	stripe-faced dunnart		
Macropodidae	<i>Lagorchestes conspicillatus</i>	spectacled hare wallaby		
Macropodidae	<i>Macropus dorsalis</i>	black-striped wallaby		
Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo		
Macropodidae	<i>Macropus robustus</i>	common wallaroo		
Macropodidae	<i>Macropus rufus</i>	red kangaroo		
Macropodidae	<i>Petrogale assimilis</i>	allied rock wallaby		
Macropodidae	<i>Wallabia bicolor</i>	swamp wallaby		
Molossidae	<i>Chaerophon jobensis</i>	northern mastiff-bat		
Molossidae	<i>Mormopterus beccarii</i>	Beccari's mastiff-bat		
Molossidae	<i>Mormopterus planiceps</i>	little mastiff-bat		
Muridae	<i>Leggadina lakedownensis</i>	Lakeland Downs mouse		
Muridae	<i>Mus musculus</i>	house mouse	Introduced	
Muridae	<i>Pseudomys delicatulus</i>	delicate mouse		
Muridae	<i>Pseudomys desertor</i>	desert mouse		
Muridae	<i>Pseudomys patrius</i>	pebble- mound mouse		
Muridae	<i>Rattus tunneyi</i>	pale field rat		
Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum		
Potoroidae	<i>Aepyprymnus rufescens</i>	rufous bettong		
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat		
Vespertilionidae	<i>Scotorepens balstoni</i>	western broad-nosed bat		
Vombatidae	<i>Lasiorhinus krefftii</i>	northern hairy-nosed wombat	Endangered	Endangered



Appendix E

Flora Survey Results (EPC 1690)



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EPC 1690 Flora Species List

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Acanthaceae	<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>	desert petunia	S	C2, C4, C10, C13, C19, C20	
Acanthaceae	<i>Nelsonia campestris</i>		H		
Acanthaceae	<i>Rostellularia adscendens</i>	pink tongues	H	C3, C10, C12, C15	
Adiantaceae	<i>Cheilanthes sieberi</i>	mulga fern	F	C3	
Amaranthaceae	<i>Achyranthes aspera</i>	chaff flower	H	C5, C11, C15, C17	
Amaranthaceae	<i>Alternanthera augustifolia</i>		H		
Amaranthaceae	<i>Alternanthera denticulata</i>	lesser joyweed	H	C13	
Amaranthaceae	<i>Alternanthera denticulata</i> var. <i>micrantha</i>	lesser joyweed	H		Y
Amaranthaceae	<i>Alternanthera nodiflora</i>	common joyweed	H	C17	
Amaranthaceae	<i>Alternanthera</i> sp.	a joyweed	H	C5, C9	
Amaranthaceae	<i>Gomphrena lanata</i>		H	C7, C13	
Amaranthaceae	<i>Ptilotus nobilis</i> subsp. <i>semilanatus</i>	yellowtails	H		Y
Apiaceae	<i>Platysace valida</i>		H	C18	Y
Apocynaceae	<i>Carissa lanceolata</i>	conkerberry	S	C19	
Apocynaceae	<i>Carissa ovata</i>	currant bush	S	C1, C2, C3, C4, C5, C9, C11, C13, C15, C16, C19, C20, Q160	
Apocynaceae	<i>Parsonsia</i> sp.		V	C2, C11, C13, C15	
Apocynaceae	<i>Sarcostemma</i> sp.	caustic vine	S	C3	
Apocynaceae	<i>Sarcostemma viminalis</i>	caustic vine	S	C5	
Areaceae	<i>Livistona lanuginosa</i>	waxy cabbage palm	T	C9	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Asteraceae	<i>*Acanthospermum hispidum</i>	starburr	H	C5, C13	
Asteraceae	<i>*Emilia sonchifolia</i>	emilia	H	C9, Q160	
Asteraceae	<i>*Parthenium hysterophorus</i>	parthenium weed	S	C9, C10, C11, C13, C16, C15, C20, Q160	
Asteraceae	<i>*Xanthium occidentale</i>	Noogoora burr	S	C9, C13	
Asteraceae	<i>Blumea saxatilis</i>		H	C1	
Asteraceae	<i>Calotis</i> sp.	burr daisy	H	C13	
Asteraceae	<i>Chrysocephalum apiculatum</i>	yellow buttons	H	C4, C12, C16,	
Asteraceae	<i>Cyanthillium cinereum</i>	vernonia	H	C9, C13	
Asteraceae	<i>Epaltes australis</i>	spreading nut heads	H	C14	
Asteraceae	<i>Olearia arguta</i> var. <i>lanata</i>		H		
Asteraceae	<i>Peripleura hispidula</i>		H	C6, C12, C17, C19	
Asteraceae	<i>Pterocaulon serrulatum</i>	ragweed	H	C15, C16, C19, C20	
Asteraceae	<i>Pterocaulon sphacelatum</i>	fruit-salad plant	H	C3, C10, C13, C17, C19	
Asteraceae	<i>Rutidosis leucantha</i>		H	C6, C13	Y
Boraginaceae	<i>Ehretia membranifolia</i>	peach bush	S	C11	
Byttneriaceae	<i>Keraudrenia collina</i>		S	C6, C7, C18	Y
Byttneriaceae	<i>Waltheria indica</i>	velvet leaf	S	C1, C2, Q160	
Cactaceae	<i>*Opuntia stricta</i>	prickly pear	S	C3, C5	
Caesalpiniaceae	<i>Chamaecrista concinna</i>		S	C4	
Caesalpiniaceae	<i>Chamaecrista longipes</i>		H	C13	
Caesalpiniaceae	<i>Chamaecrista</i> sp.		S	C1	
Caesalpiniaceae	<i>Lysiphyllum carronii</i>	red bauhinia	ST	C3, C5, C11	
Caesalpiniaceae	<i>Senna artemisioides</i>	silver cassia	S	C17	
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>alicia</i>		S	C3, Q160	Y
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>zygophylla</i>		S		Y
Caesalpiniaceae	<i>Senna costata</i>		S	C13	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Campanulaceae	<i>Wahlenbergia gracilis</i>	Australian bluebell	H	C19	
Capparaceae	<i>Apophyllum anomalum</i>	warrior bush	S	C11	
Capparaceae	<i>Capparis lasiantha</i>	nepine	S	C5, C8, C10, C11, C15	
Caryophyllaceae	<i>Polycarpaea corymbosa</i>		H	C6	
Caryophyllaceae	<i>Polycarpaea corymbosa</i> var. <i>minor</i>		H	C12, C13, C16	
Celastraceae	<i>Denhamia oleaster</i>	stiff denhamia	ST	C13	
Celastraceae	<i>Maytenus cunninghamii</i>	yellow-berry bush	S	C4, C13, C19	Y
Chenopodiaceae	<i>Dysphania glomulifera</i>	red crumbweed	H	C19	
Chenopodiaceae	<i>Dysphania glomulifera</i> subsp. <i>glomulifera</i>	red crumbweed	H		Y
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>Eremaea</i>	climbing saltbush	H		
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>nutans</i>	climbing saltbush	H		
Chenopodiaceae	<i>Enchylaena tomentosa</i>	ruby saltbush	S	C5, C11	
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	ruby saltbush	S		Y
Chenopodiaceae	<i>Maireana georgei</i>	slit-wing bluebush	H		Y
Chenopodiaceae	<i>Salsola kali</i>	soft roly poly	S	C5, C8	
Chenopodiaceae	<i>Sclerolaena diacantha</i>	grey copperburr	H	C8	Y
Chenopodiaceae	<i>Sclerolaena everistiana</i>		H		Y
Clusiaceae	<i>Hypericum gramineum</i>	small St.John's wort	H	C13	Y
Combretaceae	<i>Terminalia oblongata</i>	yellow-wood	ST	C9, C11	
Convolvulaceae	<i>Bonamia media</i>		V	C1	
Convolvulaceae	<i>Evolvulus alsinoides</i>	tropical speedwell	H	C1, C3, C4, C6, C8, C10, C12, C15, C16, C19, Q160	
Convolvulaceae	<i>Evolvulus alsinoides</i> var. <i>decumbens</i>		H		Y
Convolvulaceae	<i>Ipomoea brownii</i>		V	C11	
Convolvulaceae	<i>Ipomoea polymorpha</i>		H		
Convolvulaceae	<i>Ipomoea</i> sp.		V	C13	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Convolvulaceae	<i>Jacquemontia</i> sp.		V	C11	
Convolvulaceae	<i>Polymeria ambigua</i>		H		Y
Convolvulaceae	<i>Polymeria lanata</i>		H	C1	
Cyperaceae	<i>Bulbostylis barbata</i>	watergrass	R	C7 C12, C13, C16, C17	
Cyperaceae	<i>Cyperus betchei</i> subsp. <i>betchei</i>		R		
Cyperaceae	<i>Cyperus carinatus</i>		R		
Cyperaceae	<i>Cyperus concinnus</i> var. <i>conicus</i>	trim flat-sedge	R		Y
Cyperaceae	<i>Cyperus dactyloides</i>		R		
Cyperaceae	<i>Cyperus difformis</i>	variable flat-sedge	R		
Cyperaceae	<i>Cyperus fulvus</i>	sticky sedge	R	C3	
Cyperaceae	<i>Cyperus iria</i>	rice flat-sedge	R		
Cyperaceae	<i>Cyperus pedunculatus</i>		R		Y
Cyperaceae	<i>Cyperus</i> sp.		R	C2, C5, C10 C16	
Cyperaceae	<i>Cyperus squarrosus</i>		R	C14	
Cyperaceae	<i>Eleocharis pallens</i>	pale spike-sedge	R		
Cyperaceae	<i>Fimbristylis dichotoma</i>	common fringe-sedge	R	C17, Q160	Y
Cyperaceae	<i>Fimbristylis littoralis</i>		R		
Cyperaceae	<i>Fimbristylis oxystachya</i>		R		
Cyperaceae	<i>Fimbristylis</i> sp.		R	C13, C18	
Cyperaceae	<i>Fimbristylis squarrolosa</i>		R	C6, C7	Y
Cyperaceae	<i>Rhynchospora</i> sp.		R	C18	
Cyperaceae	<i>Schoenoplectus laevis</i>		R		
Cyperaceae	<i>Scleria brownii</i>		R	C2, C13, C19	
Erythroxylaceae	<i>Erythroxylum australe</i>	cocaine bush	S	C7	
Euphorbiaceae	<i>Chamaesyce australis</i>		H	C16, C17	
Euphorbiaceae	<i>Chamaesyce bifida</i>		S	C13	
Euphorbiaceae	<i>Euphorbia</i> sp.		H	C12	
Euphorbiaceae	<i>Euphorbia tannensis</i>		S	C1, C2	
Fabaceae	* <i>Stylosanthes scabra</i>	shrubby stylo	S	C16	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Fabaceae	* <i>Stylosanthes</i> sp.	stylo	S	C1, C2, C3, C6, C4, C5, C7, C9, C10, C11, C13, C14, C15, C17, C19, C20, Q160	
Fabaceae	<i>Crotalaria medicaginea</i>	trefoil rattlepod	H	C12, C13, C17	
Fabaceae	<i>Crotalaria montana</i>	rattlepod	H	C4, C12, C13, C20	
Fabaceae	<i>Desmodium filiforme</i>		H	C1, C4, C13, C19	
Fabaceae	<i>Galactia muelleri</i>		H	C16	
Fabaceae	<i>Galactia</i> sp.		H	C1, C20	
Fabaceae	<i>Galactia tenuiflora</i>		H	C9, C10, C12, C19, C20	
Fabaceae	<i>Galactia tenuiflora</i> var. <i>lucida</i>		H	C4, C13	Y
Fabaceae	<i>Glycine tomentella</i>	woolly Glycine	H	C1, C4, C10, C12, C13, C17, Q160	Y
Fabaceae	<i>Hovea longipes</i>	brush hovea	S	C12	
Fabaceae	<i>Indigofera colutea</i>	sticky indigo	H	C10, C20	
Fabaceae	<i>Indigofera linifolia</i>		H	C1, C2, C16, C19, C20, Q160	
Fabaceae	<i>Indigofera pratensis</i>		H	C13	
Fabaceae	<i>Indigofera</i> sp.		H	C12, C16	
Fabaceae	<i>Leptosema oxylobioides</i>		S		
Fabaceae	<i>Rhynchosia minima</i>	ryncho	H	C2, C4, C19, C20	
Fabaceae	<i>Sesbania cannabina</i> var. <i>cannabina</i>	sesbania	H		
Fabaceae	<i>Tephrosia leptoclada</i>		H	C13	
Fabaceae	<i>Vigna lanceolata</i>	Maloga bean	H	C9, C16	
Fabaceae	<i>Vigna lanceolata</i> var. <i>lanceolata</i>		H		Y
Fabaceae	<i>Zornia adenophora</i>		H	C1, C4, C16, C17	Y
Fabaceae	<i>Zornia areolata</i>		H	C13, C16	Y
Fabaceae	<i>Zornia</i> sp.		H	C10, C19, C20	
Goodeniaceae	<i>Goodenia expansa</i>		S	C6, C12	Y

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Goodeniaceae	<i>Goodenia glabra</i>		H	C1	
Goodeniaceae	<i>Goodenia hirsuta</i>		S	C13	
Goodeniaceae	<i>Goodenia rosulata</i>		S		Y
Goodeniaceae	<i>Goodenia</i> sp.		S	C2, C19, Q160	
Goodeniaceae	<i>Goodenia viridula</i>		S	C7	
Goodeniaceae	<i>Velleia macrocalyx</i>		H	C6	Y
Hemerocallidaceae	<i>Dianella</i> sp.	flax lily	R	C18, C19	
Lamiaceae	<i>Basilicum polystachyon</i>	musk basil	H		
Lamiaceae	<i>Clerodendrum inerme</i>	scrambling clerodendrum	S	C13	
Lamiaceae	<i>Clerodendrum</i> sp.		S	C13, C17	
Laxmanniaceae	<i>Lomandra longifolia</i>	spiny-headed mat-rush	R	C9	
Laxmanniaceae	<i>Thysanotus chinensis</i>	fringe lily	R	C14	
Laxmanniaceae	<i>Thysanotus</i> sp.	fringe lily	R	C16	
Loranthaceae	<i>Amyema bifurcata</i>		epS		
Loranthaceae	<i>Amyema quandang</i>	grey mistletoe	epS	C14, C15	
Loranthaceae	<i>Dendrophthoe glabrescens</i>	smooth mistletoe	epS	C1, C2, C19	
Loranthaceae	<i>Lysiana linearifolia</i>		epS	C5, C15	
Loranthaceae	<i>Lysiana subfalcata</i>		epS		
Malvaceae	* <i>Malvastrum americanum</i>	spiked malvastrum	H	C11, C13	
Malvaceae	* <i>Malvastrum americanum</i> var. <i>americanum</i>	spiked malvastrum	H		
Malvaceae	* <i>Sida cordifolia</i>	flannel weed	S	C12, C13, C17, Q160	
Malvaceae	* <i>Sida rhombifolia</i>	Paddy's lucerne	S	C10, C12, C13, C14, C16, C20, Q160	Y
Malvaceae	<i>Abutilon arenarium</i>		S	C11	Y
Malvaceae	<i>Abutilon otocarpum</i>	desert lantern	S	C13, C11	Y
Malvaceae	<i>Abutilon oxycarpum</i> var. <i>subsagittatum</i>	straggly lantern-bush	H	C3	
Malvaceae	<i>Abutilon</i> sp.		S	C3, C5	
Malvaceae	<i>Gossypium</i> sp.		S	C2	
Malvaceae	<i>Hibiscus leptocladus</i>		S		Y
Malvaceae	<i>Hibiscus</i> sp.		S	C8	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Malvaceae	<i>Hibiscus sturtii</i>		H	C14	
Malvaceae	<i>Hibiscus trionum</i>	flower-of-an-hour	S	C15	
Malvaceae	<i>Sida hackettiana</i>	spiked sida	S	C6, C10, C11, C12, C13, C16, C17, C20	
Malvaceae	<i>Sida rohlenae</i> subsp. <i>rohlenae</i>		H	C3	
Malvaceae	<i>Sida rohlenae</i> subsp. <i>rohlenae</i>	shrub sida	H		
Malvaceae	<i>Sida spinosa</i>	spiny sida	S	C1, C8, C9, C20	
Mimosaceae	* <i>Acacia farnesiana</i>	mimosa bush	S	C13	
Mimosaceae	<i>Acacia cambagei</i>	gidgee	ST	C11	
Mimosaceae	<i>Acacia caroleae</i> ?		S	C4, C10	
Mimosaceae	<i>Acacia elachantha</i>	Cowle's wattle	S	C4, C20	Y
Mimosaceae	<i>Acacia excelsa</i>	ironwood	ST	C10, C16	Y
Mimosaceae	<i>Acacia galioides</i>		S	C6, C7	
Mimosaceae	<i>Acacia harpophylla</i>	brigalow	ST	C3, C5, C15,	
Mimosaceae	<i>Acacia laccata</i>		S	C6, C4, C7, C18,	Y
Mimosaceae	<i>Acacia lazaridis</i>		S	C7	Y
Mimosaceae	<i>Acacia leptostachya</i>	Townsville wattle	ST	C4, C6, C12, C13, C18	Y
Mimosaceae	<i>Acacia melleodora</i>	net-veined wattle	S		Y
Mimosaceae	<i>Acacia orthocarpa</i>	needleleaf wattle	S	C7, C12,	Y
Mimosaceae	<i>Acacia oswaldii</i>	umbrella wattle	ST		Y
Mimosaceae	<i>Acacia platycarpa</i>	ghost wattle	ST		Y
Mimosaceae	<i>Acacia salicina</i>	Sally wattle	ST	C9, C10, C13, C16	
Mimosaceae	<i>Acacia sericophylla</i>	wirewood	ST	C1, C2, C13, C17, C19, Q160	
Mimosaceae	<i>Acacia stipuligera</i>		S	C6, C13	Y
Mimosaceae	<i>Acacia tenuissima</i>		S	C2, Q160	Y
Myoporaceae	<i>Eremophila maculata</i> subsp. <i>maculata</i>	spotted fuchsia bush	S		Y
Myoporaceae	<i>Eremophila mitchellii</i>	false sandalwood	S	C3, C5, C11, C15	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Myoporaceae	<i>Myoporum montanum</i>	western boobialla	S	C5, C8	
Myrtaceae	<i>Calytrix microcoma</i>	turkeybush	S	C6, C7	Y
Myrtaceae	<i>Corymbia brachycarpa</i>		T	C12, C13, C19	Y
Myrtaceae	<i>Corymbia clarksoniana</i>	Clarkson's bloodwood	T	C4	
Myrtaceae	<i>Corymbia dallachiana</i>	Dallachy's gum	T	C2, C4, C17, C18, C19	
Myrtaceae	<i>Corymbia plena</i>		T		
Myrtaceae	<i>Corymbia setosa</i>	rough-leaved bloodwood	ST	C1, C2, C6, C7, C13, C19	
Myrtaceae	<i>Corymbia</i> sp.			C9	
Myrtaceae	<i>Corymbia tessellaris</i>	carbeen	T	C13	
Myrtaceae	<i>Eucalyptus brownii</i>	Reid River box	T	C3, C10, C16, C20	Y
Myrtaceae	<i>Eucalyptus camaldulensis</i>	river red gum	T	C9, C13	
Myrtaceae	<i>Eucalyptus cambageana</i>	Dawson River blackbutt	T	C5, C11	
Myrtaceae	<i>Eucalyptus drepanophylla</i>	narrow-leaved ironbark	T		Y
Myrtaceae	<i>Eucalyptus melanophloia</i>	silver-leaved ironbark	T	C1 C4, C10, C17, C19, Q160	Y
Myrtaceae	<i>Eucalyptus persistens</i>	mallee box	ST	C7, C8	Y
Myrtaceae	<i>Eucalyptus similis</i>	inland yellowjacket	ST	C2, C12, C13	Y
Myrtaceae	<i>Eucalyptus thozetiana</i>	mountain yapungah	T	C8	Y
Myrtaceae	<i>Lithomyrtus microphylla</i>		S		Y
Myrtaceae	<i>Melaleuca fluviatilis</i>	weeping paperbark	T	C9	
Myrtaceae	<i>Melaleuca leucadendra</i>	weeping paperbark	T	C9	
Myrtaceae	<i>Melaleuca nervosa</i>	paperbark	ST	C12, C17, C18	
Myrtaceae	<i>Melaleuca tamariscina</i>	fine-leaved myrtle	ST		Y
Oleaceae	<i>Jasminum didymum</i>	jasmine	S	C5, C11, C13, C14	
Orchidaceae	<i>Cymbidium canaliculatum</i>	black orchid	eH	C13	
Passifloraceae	* <i>Passiflora foetida</i>	stinking passionflower	V	C9	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Pentapetaceae	<i>Melhanianthus oblongifolius</i>		S	C1, C2, C3 C5, C15, C16, C19, C20	
Phyllanthaceae	<i>Breynia cernua</i>	coffee bush	S	C13	
Phyllanthaceae	<i>Phyllanthus carpentariae</i>		S	C7, C12, C13	Y
Phyllanthaceae	<i>Phyllanthus collinus</i>		H	C2	
Phyllanthaceae	<i>Phyllanthus microcladus</i>		H		
Phyllanthaceae	<i>Phyllanthus</i> sp.		S	C7, C10	
Phyllanthaceae	<i>Phyllanthus</i> sp. aff. <i>P. herbaceus</i>		H	C16	
Phyllanthaceae	<i>Phyllanthus virgatus</i>		S	C2, C3, C4, C9, C10, C11, C12, C15, C19	
Phyllanthaceae	<i>Poranthera microphylla</i>	small poranthera	H		Y
Picrodendraceae	<i>Petalostigma banksii</i>	smooth-leaved quinine	S	C6, C7, C12	
Picrodendraceae	<i>Petalostigma pubescens</i>	bitter bark	ST	C1, C2	
Pittosporaceae	<i>Bursaria incana</i>	prickly pine	ST	C1, C13	
Pittosporaceae	<i>Bursaria</i> sp.		ST	C20	
Plumbaginaceae	<i>Plumbago zeylanica</i>	wild plumbago	S	C11	
Poaceae	* <i>Bothriochloa pertusa</i>	Indian bluegrass	G	C5, C9, C11, C13, C20	
Poaceae	* <i>Cenchrus ciliaris</i>	buffel grass	G	C2, C3, C4, C6, C8, C9, C10, C13, C19, Q160	
Poaceae	* <i>Chloris inflata</i>	purpletop Rhodes grass	G	C15	
Poaceae	* <i>Chloris virgata</i>	feathertop Rhodes grass	G	C5, C9	
Poaceae	* <i>Chrysopogon acicularis</i>	Mackie's pest	G	C19	
Poaceae	* <i>Digitaria ciliaris</i>	summer grass	G	C1, C16	
Poaceae	* <i>Echinochloa colona</i>	awnless barnyard grass	G	C9	
Poaceae	* <i>Melinis repens</i>	red Natal	G	C12	
Poaceae	<i>Alloteropsis semialata</i>	cockatoo grass	G	C3, C5, C12, C15	Y

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Poaceae	<i>Aristida calycina</i>	dark wiregrass	G	C1, C2, C13, C16, C17, Q160	
Poaceae	<i>Aristida calycina</i> var. <i>calycina</i>	dark wiregrass	G	C4, C10, C12, C13, C19, C20	
Poaceae	<i>Aristida calycina</i> var. <i>praealta</i>		G	C5, C10, C15	Y
Poaceae	<i>Aristida contorta</i>	bunched kerosene grass	G		Y
Poaceae	<i>Aristida holathera</i>	erect kerosene grass	G	C6, C7, C18, C19	Y
Poaceae	<i>Aristida holathera</i> var. <i>holathera</i>		G	C16	
Poaceae	<i>Aristida holathera/contorta</i>		G	C17	
Poaceae	<i>Aristida jerichoensis</i> var. <i>jerichoensis</i>			C16	
Poaceae	<i>Aristida jerichoensis</i> var. <i>subspinulifera</i>	Jericho wiregrass	G	C14	Y
Poaceae	<i>Aristida latifolia</i>	feathertop wiregrass	G	C1, C2, C4, C6, C10, C12, C13, C16, C17, C18, C19, C20	
Poaceae	<i>Aristida pruinosa</i>	gulf feathertop wiregrass	G	C2, C5, C7, C13, Q160	Y
Poaceae	<i>Aristida pruinosa/calycina</i>		G	C3	
Poaceae	<i>Aristida</i> sp.		G	C1	
Poaceae	<i>Arundinella nepalensis</i>	reedgrass	G	C14	
Poaceae	<i>Astrebla pectinata</i>	barley Mitchell	G		
Poaceae	<i>Bothriochloa</i> sp.	a bluegrass	G	C15	
Poaceae	<i>Chloris pectinata</i>	comb chloris	G	C5	Y
Poaceae	<i>Chrysopogon fallax</i>	golden-beard grass	G	C3, C5, C9, C10, C13, C15, C16, C17, C20	
Poaceae	<i>Chrysopogon filipes</i>	Australian vetiver	G	C12	
Poaceae	<i>Cymbopogon oblectus</i>	silkyheads	G	C7	
Poaceae	<i>Cymbopogon refractus</i>	barbed-wire grass	G	C10, C11	
Poaceae	<i>Dactyloctenium radulans</i>	button grass	G	C15	
Poaceae	<i>Dichanthium sericeum</i>	Queensland bluegrass	G	C9	
Poaceae	<i>Digitaria ammophila</i>	silky umbrella grass	G	C20	
Poaceae	<i>Digitaria brownii</i>	cotton panic grass	G	C13, C20	Y

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Poaceae	<i>Digitaria diminuta</i>		G		
Poaceae	<i>Digitaria</i> sp.		G	C1, C3, C7, C10 C17, C20	
Poaceae	<i>Enneapogon avenaceus</i>	bottle-washers	G	C19	
Poaceae	<i>Enneapogon gracilis</i>	slender bottle-washers	G	C3	
Poaceae	<i>Enneapogon lindleyanus</i>	conetop nineawn	G	C3, C5, C7, C12	
Poaceae	<i>Enneapogon polyphyllus</i>	leafy nineawn	G	C3, C5, C12, C15, C17	Y
Poaceae	<i>Enneapogon</i> sp.		G	C2, C15, C16, C19, C20	
Poaceae	<i>Enneapogon truncatus</i>		G	C16	
Poaceae	<i>Enneapogon virens</i>		G	C2	
Poaceae	<i>Enteropogon acicularis</i>	curly windmill grass	G	C11, C14, C15	Y
Poaceae	<i>Enteropogon ramosus</i>	curly windmill grass	G	C20	
Poaceae	<i>Eragrostis cumingii</i>	Cuming's lovegrass	G	C9, C20	Y
Poaceae	<i>Eragrostis elongata</i>	clustered lovegrass	G		
Poaceae	<i>Eragrostis lacunaria</i>	purple lovegrass	G	C10	Y
Poaceae	<i>Eragrostis microcarpa</i>	dainty lovegrass	G		Y
Poaceae	<i>Eragrostis sororia</i>	weeping lovegrass	G	C3, C12, C15, C16, C20, Q160	Y
Poaceae	<i>Eragrostis</i> sp.		G	C5	
Poaceae	<i>Eragrostis speciosa</i>		G	C3, C4, C16, C17	Y
Poaceae	<i>Eragrostis tenellula</i>	delicate lovegrass	G		
Poaceae	<i>Eremochloa bimaculata</i>	poverty grass	G	C6, C7, C13, C19	
Poaceae	<i>Eriachne aristidea</i>	three-awn wanderrie grass	G	C6, C12	Y
Poaceae	<i>Eriachne mucronata</i>	mountain wanderrie grass	G	C7, C13, C16, C17, C18, C19, Q160	Y
Poaceae	<i>Eriachne obtusa</i>	northern wanderrie grass	G	C2	Y
Poaceae	<i>Eriachne</i> sp.		G	C6, C10, C12	
Poaceae	<i>Eriochloa pseudoacrotricha</i>	early spring grass	G	C3, C4, C7, C8, C9, C11, C13	Y

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Poaceae	<i>Heteropogon contortus</i>	black speargrass	G	C1, C2, C3, C4, C6, C7, C10, C11, C12, C13, C14, C15, C16, C17, C19, C20, Q160	
Poaceae	<i>Imperata cylindrica</i>	blady grass	G	C9	
Poaceae	<i>Leptochloa decipiens</i> subsp. <i>peacockii</i>		G	C3	
Poaceae	<i>Leptochloa fusca</i>	small-flowered beetle-grass	G	C3	
Poaceae	<i>Leptochloa fusca</i> subsp. <i>fusca</i>	small-flowered beetle-grass	G		Y
Poaceae	<i>Leptochloa</i> sp.		G	C12	
Poaceae	<i>Oxychloris scariosa</i>		G	C5, C15	Y
Poaceae	<i>Panicum decompositum</i>	native millet	G	C8, C19, C20	
Poaceae	<i>Panicum effusum</i>	hairy panic	G	C3, C5, C7, C10, C12, C14, C18, C19, C20, Q160	
Poaceae	<i>Panicum</i> sp.		G	C2	
Poaceae	<i>Paspalidium caespitosum</i>	brigalow grass	G		Y
Poaceae	<i>Paspalidium constrictum</i>	knottybutt grass	G	C15	Y
Poaceae	<i>Paspalidium disjunctum</i>		G	C3	
Poaceae	<i>Paspalidium distans</i>	spreading panicgrass	G	C5, C8	
Poaceae	<i>Paspalidium</i> sp.		G	C9, C11	
Poaceae	<i>Perotis rara</i>	comet grass	G	C1, C10, C12, C16, C17	
Poaceae	<i>Sarga plumosum</i>	plume sorghum	G	C4	
Poaceae	<i>Schizachyrium fragile</i>	fire grass	G	C1, C2, C6, C7, C12, C18, Q160	Y
Poaceae	<i>Setaria surgens</i>	pigeon grass	G	C1, C12, C13, C16, C17	
Poaceae	<i>Sporobolus actinocladus</i>	katoora grass	G	C14, C15	Y
Poaceae	<i>Sporobolus australasicus</i>	fairy grass	G	C11	
Poaceae	<i>Sporobolus caroli</i>	fairy grass	G	C13, C15	Y
Poaceae	<i>Sporobolus scabridus</i>		G	C3, C5, C8, C15	Y
Poaceae	<i>Thaumastochloa pubescens</i>		G	C13	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
Poaceae	<i>Themeda triandra</i>	kangaroo grass	G	C1, C2, C3, C6, C19, C20, Q160	
Poaceae	<i>Tragus australianus</i>	small burrgrass	G	C15	
Poaceae	<i>Triodia pungens</i>	soft spinifex	G	C2, C4, C7, C8, C12, C18, C19	Y
Poaceae	<i>Whiteochloa airoides</i>	creeping panic	G		
Polygalaceae	<i>Comesperma pallidum</i>		S	C18	Y
Polygalaceae	<i>Polygala</i> sp. Undescribed species related to <i>P. linariifolia</i> (genus under revision)		H	C2	Y
Pontederiaceae	<i>Monochoria</i> sp.		aH	C13	
Portulacaceae	<i>Portulaca</i> sp.		H	C15	
Proteaceae	<i>Grevillea glauca</i>	bushman's clothes pegs	ST	C12	
Proteaceae	<i>Grevillea pteridifolia</i>	silky grevillea	ST	C7, C18, C19	
Proteaceae	<i>Grevillea striata</i>	beefwood	ST	C10, C13	
Proteaceae	<i>Persoonia falcata</i>	geebung	S	C12	
Rhamnaceae	<i>Alphitonia excelsa</i>	red ash	ST	C7, C12, C13, C20	
Rubiaceae	<i>Oldenlandia coerulescens</i>		H	C7, C8	
Rubiaceae	<i>Oldenlandia mitrasacmoides</i>		H	C2, C7, C10, C12, C13, C18	
Rubiaceae	<i>Oldenlandia mitrasacmoides</i> subsp. <i>trachymenoides</i>		H		Y
Rubiaceae	<i>Pomax umbellata</i>	pomax	S	C16	
Rubiaceae	<i>Psydrax attenuata</i>		S		
Rubiaceae	<i>Psydrax forsteri</i>		S		Y
Rubiaceae	<i>Psydrax</i> sp.		S	C13	
Rubiaceae	<i>Spermacoce brachystema</i>		H		Y
Rubiaceae	<i>Spermacoce</i> sp.		H	C1, C2, C3, C12, C13, C14,	

Family	Taxon	Common Name	Life form	Wet Season Site	Dry Season
				C16, C17, Q160	
Rutaceae	<i>Citrus glauca</i>	desert lime	S	C5	
Rutaceae	<i>Flindersia dissosperma</i>	leopardwood	ST	C5, C15	
Santalaceae	<i>Exocarpos cupressiformis</i>	native cherry	S	C7	
Sapindaceae	<i>Alectryon oleifolius</i>	bonaree	ST		Y
Sapindaceae	<i>Atalaya hemiglauca</i>	whitewood	ST	C3, C9, C11, C15	
Sapindaceae	<i>Distichostemon dodecandrus</i>	false hop-bush	S	C7, C12	Y
Sapindaceae	<i>Dodonaea</i> sp.	hop bush	S	C6	
Scrophulariaceae	<i>*Scoparia dulcis</i>	sweet broom	H	C9, C14	
Scrophulariaceae	<i>Buchnera ramosissima</i>	bluehearts	H	C19	Y
Scrophulariaceae	<i>Stemodia glabella</i>	smooth bluerod	H		Y
Solanaceae	<i>Solanum ellipticum</i>	potato bush	H		
Solanaceae	<i>Solanum galbinum</i>		S		Y
Solanaceae	<i>Solanum parvifolium</i> subsp. <i>parvifolium</i>		S		Y
Sparrmanniaceae	<i>Corchorus sidoides</i>	flannel weed	S	C2	
Sparrmanniaceae	<i>Corchorus sidoides</i> subsp. <i>vermicularis</i>		S		Y
Sparrmanniaceae	<i>Grewia retusifolia</i>	dog's balls	S	C2, C13, C14, C16, C19, C20	
Sparrmanniaceae	<i>Triumfetta triandra</i>		S	C17	
Stackhousiaceae	<i>Stackhousia viminea</i>	slender stackhousia	H	C4, C6, C13	Y
Stylidiaceae	<i>Stylidium</i> sp.	triggerplants	H	C19	
Violaceae	<i>Hybanthus enneaspermus</i>	spade flower	H	C16, C17	
Viscaceae	<i>Viscum articulatum</i>	leafless mistletoe	epS		

Life form: T = tree; ST = short tree; S = Shrub; H = Herb/forb; G = Grass; R = Sedge/rush/lily; V = Vine; a = aquatic; e = epiphytic; p = parasitic



Appendix F

Weeds

Summary of Desktop Weed Searches



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Species	Common Name	Status	Source
<i>Hymenachne amplexicaulis</i>	hymenachne	WoNS, Class 2 declared	ERT, Herbreces, Wildlife Online, IRC medium priority weed species
<i>Parkinsonia aculeata</i>	parkinsonia	WoNS, Class 2 declared	ERT, Biosec mapping (Highly suitable), IRC medium priority weed species
<i>Parthenium hysterophorus</i>	parthenium weed	WoNS, Class 2 declared	ERT, Herbreces, Wildlife Online, Biosec mapping (Suitable), IRC high/medium priority weed species
<i>Harrisia martini</i>	harrisia cactus	Class 2 declared	Wildlife Online, IRC medium priority weed species
<i>Opuntia tomentosa</i>	velvety tree pear	Class 2 declared	Wildlife Online
<i>Sporobolus fertilis</i>	giant Parramatta grass	Class 2 declared	Wildlife Online
<i>Pennisetum setaceum</i>	African fountain grass	Class 3 declared	Biosec mapping (High to Very High)
<i>Nassella neesiana</i>	Chilean needlegrass	WoNS, Class 1 declared	Biosec mapping (Moderate suitability to Suitable)
<i>Ziziphus mauritiana</i>	chinee apple	Class 2 declared	Biosec mapping (Suitable to Highly Suitable), IRC medium priority weed species
<i>Myriophyllum spicatum</i>	Eurasian water milfoil	Class 1 declared	Biosec mapping (High)
<i>Acacia karroo</i>	karoo thorn	Class 1 declared	Biosec mapping (High)
<i>Prosopis pallida</i>	mesquite	WoNS, Class 2 declared	Biosec mapping (Highly suitable)
<i>Bryophyllum delagoense</i>	mother of millions	Class 2 declared	Biosec mapping (Highly suitable), IRC low priority weed species
<i>Acacia nilotica</i>	prickly acacia	WoNS, Class 2 declared	Biosec mapping (Suitable), IRC high priority weed species
<i>Sesbania punicea</i>	red sesbania	Class 1 declared	Biosec mapping (High to Very High)
<i>Eichhornia crassipes</i>	water hyacinth	Class 2 declared	Biosec mapping (Highly suitable)
<i>Pistia stratiotes</i>	water lettuce	Class 2 declared	Biosec mapping (Highly suitable)
<i>Striga asiatica</i>	striga	Class 1 declared	Biosec mapping (Moderate to High)
<i>Tecoma stans</i>	yellow bells	Class 3 declared	Biosec mapping (High)

Note: Status indicated the species class as listed under the *Land Protection (Pest and Stock Route Management) Act 2002*. WoNS are Weeds of National Significance identified by the Australian Government.



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Appendix G

Fauna Survey Results (EPC 1690)

Spring 2010 Survey Fauna Species List

Autumn 2011 Survey Fauna Species List

Total Species List



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Fauna Species List EPC 1690 – Spring 2010 Survey (November 2010)

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Opportunistic - central and northern parts of study area (north of Carmichael River)
					Fauna Habitat Type						
					A	A+B	A	C	A+B	D	
Amphibians											
Bufonidae	<i>Rhinella marina</i>	cane toad	Introduced		✓	✓	✓	✓		✓	✓
Hylidae	<i>Cyclorana alboguttata</i>	green striped burrowing frog								✓	✓
Hylidae	<i>Cyclorana novaehollandiae</i>	New Holland frog									✓
Hylidae	<i>Litoria caerulea</i>	green tree frog			✓	✓	✓	✓	✓	✓	✓
Hylidae	<i>Litoria inermis</i>	bumpy rocket frog								✓	✓
Hylidae	<i>Litoria rothii</i>	Roth's tree frog				✓				✓	✓
Hylidae	<i>Litoria rubella</i>	desert tree frog					✓	✓		✓	✓
Myobatrachidae	<i>Limnodynastes tasmaniensis</i>	spotted grass frog									✓
Myobatrachidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog				✓	✓	✓		✓	✓
Reptiles											
Agamidae	<i>Amphibolurus burnsi</i>	Burns' dragon									✓
Agamidae	<i>Amphibolurus gilbertii</i>	Gilbert's dragon				✓					
Agamidae	<i>Amphibolurus nobbi</i>	nobbi dragon					✓		✓	✓	
Agamidae	<i>Pogona barbata</i>	bearded dragon			✓			✓			
Elapidae	<i>Hoplocephalus bitorquatus</i>	pale-headed snake						✓			
Elapidae	<i>Pseudonaja textilis</i>	eastern brown snake									✓
Gekkonidae	<i>Gehyra catenata</i>							✓			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Opportunistic - central and northern parts of study area (north of Carmichael River)
					Fauna Habitat Type						
					A	A+B	A	C	A+B	D	
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko				✓	✓	✓			✓
Pythonidae	<i>Antaresia maculosa</i>	spotted python						✓			
Scincidae	<i>Carlia munda</i>					✓	✓		✓	✓	
Scincidae	<i>Carlia pectoralis pectoralis</i>							✓	✓		
Scincidae	<i>Cryptoblepharus virgatus</i>	wall skink					✓				
Scincidae	<i>Ctenotus robustus</i>	eastern striped skink				✓	✓				
Scincidae	<i>Menetia greyii</i>							✓			
Scincidae	<i>Menetia timlowi</i>	Tim Low's skink							✓		
Scincidae	<i>Morethia taeniopleura</i>					✓		✓			
Varanidae	<i>Varanus varius</i>	lace monitor								✓	
Mammals											
Canidae	<i>Canis lupus</i>	dog	Introduced								✓ (scat)
Emballonuridae	<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail bat			✓	✓	✓	✓	✓	✓	✓
Leporidae	<i>Oryctolagus cuniculus</i>	European rabbit	Introduced			✓					
Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo						✓			✓
Macropodidae	<i>Macropus robustus</i>	euro									✓
Macropodidae	<i>Macropus rufus</i>	red kangaroo					✓				✓
Molossidae	<i>Chaerephon jobensis</i>	northern freetail bat			✓	✓	✓	✓		✓	✓
Molossidae	<i>Mormopterus beccarii</i>	Beccari's freetail bat			✓	✓	✓	✓	✓	✓	✓
Molossidae	<i>Mormopterus ridei</i>				✓	✓	✓	✓		✓	✓
Molossidae	<i>Mormopterus sp. 3</i>					✓	✓		✓		✓

[illegible]

[illegible]

[illegible]

[illegible]

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Opportunistic - central and northern parts of study area (north of Carmichael River)
					Fauna Habitat Type						
					A	A+B	A	C	A+B	D	
Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole				✓				✓	✓
Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush								✓	
Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler			✓	✓	✓	✓	✓		✓
Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote						✓	✓		
Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote				✓	✓		✓	✓	
Passeridae	<i>Neochmia modesta</i>	plum-headed finch					✓				
Passeridae	<i>Poephila bichenovii</i>	double-barred finch					✓	✓			
Passeridae	<i>Taeniopygia guttata</i>	zebra finch						✓	✓	✓	✓
Pelicanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		Ma							✓
Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant									✓
Phasianidae	<i>Coturnix ypsilophora</i>	brown quail			✓						
Podargidae	<i>Podargus strigoides</i>	tawny frogmouth									✓
Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler				✓			✓		✓
Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot					✓		✓		
Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella			✓	✓	✓		✓	✓	✓
Psittacidae	<i>Trichoglossus haematodus</i>	rainbow lorikeet				✓				✓	✓
Ptilonorhynchidae	<i>Chlamydera nuchalis</i>	great bowerbird				✓		✓		✓	
Sylviidae	<i>Acrocephalus stentoreus</i>	Australian reed warbler									✓
Zosteropidae	<i>Zosterops lateralis</i>	silvereye		Ma					✓		

Fauna habitat type:

A: Ironbark-box grassy woodlands and open woodlands on grey sand plains

B: Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains

C: Woodland and low open woodland associated with laterised sandstone rises and minor pediments

D: Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding

Acronyms and abbreviations:

Special LC: Special Least Concern

NT: Near threatened

V: Vulnerable

E: Endangered

Ma: Marine

Mig: Migratory

CAMBA: Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment

JAMBA: Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment

Fauna Species List EPC 1690 – Autumn 2011 Survey (April / May 2011)

					Autumn Comprehensive Survey Site number																Opportunistic*		
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	South	Central	North
Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status																			
					Fauna Habitat Type																		
					A	A	A	E	A	A+ B	A	C	A+ B	D	D	A	F	A	B	A			
Amphibians																							
Bufonidae	<i>Rhinella marina</i>	cane toad	Introduced				✓		✓		✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
Hylidae	<i>Cyclorana alboguttata</i>	green striped burrowing frog											✓	✓									
Hylidae	<i>Cyclorana novaehollandiae</i>	New Holland frog									✓							✓	✓				
Hylidae	<i>Litoria caerulea</i>	green tree frog									✓	✓	✓					✓	✓				
Hylidae	<i>Litoria inermis</i>	bumpy rocket frog									✓	✓		✓	✓								
Hylidae	<i>Litoria latopalmata</i>	broad-palmed frog													✓	✓						✓	
Hylidae	<i>Litoria rothii</i>	Roth's tree frog										✓											
Hylidae	<i>Litoria rubella</i>	desert tree frog										✓											
Myobatrachidae	<i>Limnodynastes tasmaniensis</i>	spotted grass frog								✓		✓	✓	✓	✓	✓			✓				
Myobatrachidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog							✓	✓						✓			✓				
Myobatrachidae	<i>Uperoleia rugosa</i>	chubby gungan																✓					
Reptiles																							
Agamidae	<i>Amphibolurus burnsi</i>	Burns' dragon									✓	✓										✓	✓
Agamidae	<i>Amphibolurus nobbi</i>	nobbi dragon				✓		✓		✓		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓
Agamidae	<i>Chlamydosaurus kingii</i>	frill-necked lizard																			✓		
Agamidae	<i>Ctenophorus pictus</i>	painted dragon																			✓		

					Autumn Comprehensive Survey Site number																Opportunistic*		
Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	South	Central	North
					Fauna Habitat Type																		
					A	A	A	E	A	A+ B	A	C	A+ B	D	D	A	F	A	B	A			
Charadriidae	<i>Vanellus miles</i>	banded lapwing																			✓		
Charadriidae	<i>Vanellus miles</i>	masked lapwing																			✓	✓	✓
Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	black-necked stork	NT																				✓
Ciconiidae	<i>Grus rubicundus</i>	brolga																			✓	✓	
Cisticolidae	<i>Cisticola exilis</i>	golden-headed cisticola															✓			✓	✓		
Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper							✓	✓	✓	✓	✓							✓	✓	✓	✓
Columbidae	<i>Geopelia cuneata</i>	diamond dove																				✓	✓
Columbidae	<i>Geopelia striata</i>	peaceful dove					✓								✓	✓			✓			✓	✓
Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern)	V	V								✓									✓	✓	✓
Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon																			✓	✓	✓
Corcoracidae	<i>Struthidea cinerea</i>	apostlebird								✓	✓	✓						✓	✓	✓	✓	✓	
Corvidae	<i>Corvus coronoides</i>	Australian raven											✓	✓								✓	
Corvidae	<i>Corvus orru</i>	Torresian crow																✓			✓	✓	✓
Cuculidae	<i>Cacomantis variolosus</i>	brush cuckoo																	✓		✓		
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's bronze-cuckoo		Ma													✓			✓			
Dicaeidae	<i>Dicaeum hirundinaceum</i>	mistletoebird											✓	✓		✓						✓	✓
Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		Ma																	✓	✓	
Dicruridae	<i>Grallina cyanoleuca</i>	maggie-lark							✓								✓			✓	✓	✓	✓
Dicruridae	<i>Microeca fascians</i>	jacky winter							✓							✓	✓	✓	✓	✓	✓	✓	✓

					Autumn Comprehensive Survey Site number																Opportunistic*		
Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	South	Central	North
					Fauna Habitat Type																		
					A	A	A	E	A	A+ B	A	C	A+ B	D	D	A	F	A	B	A			
Dicruridae	<i>Myiagra inquieta</i>	restless flycatcher							✓					✓			✓					✓	
Dicruridae	<i>Rhipidura fuliginosa</i>	grey fantail							✓				✓							✓		✓	✓
Dicruridae	<i>Rhipidura leucophrys</i>	willie wagtail				✓		✓	✓				✓				✓	✓		✓	✓	✓	✓
Estrildidae	<i>Poephila cincta cincta</i>	black-throated finch (southern)	E	E																	✓		✓
Falconidae	<i>Falco berigora</i>	brown falcon							✓												✓	✓	✓
Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		Ma	✓												✓				✓	✓	✓
Falconidae	<i>Falco hypoleucos</i>	grey falcon															✓					✓	
Falconidae	<i>Falco longipennis</i>	Australian hobby																				✓	
Halcyonidae	<i>Dacelo leachii</i>	blue-winged kookaburra											✓			✓				✓	✓	✓	✓
Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra													✓	✓				✓	✓	✓	✓
Halcyonidae	<i>Todiramphus macleayii</i>	forest kingfisher		Ma										✓						✓			
Halcyonidae	<i>Todiramphus pyrrhopygius</i>	red-backed kingfisher																					✓
Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		Ma																		✓	
Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		Ma																			✓
Jacaniidae	<i>Irediparra gallinacea</i>	comb-crested jacana																				✓	
Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren					✓							✓						✓		✓	✓
Maluridae	<i>Malurus leucopterus</i>	white-winged fairywren																					✓
Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren				✓	✓						✓		✓						✓	✓	✓

					Autumn Comprehensive Survey Site number																Opportunistic*		
Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	South	Central	North
					Fauna Habitat Type																		
					A	A	A	E	A	A+ B	A	C	A+ B	D	D	A	F	A	B	A			
Megaluridae	<i>Megalurus timoriensis</i>	tawny grassbird															✓						
Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater					✓	✓												✓	✓	✓	✓
Meliphagidae	<i>Lichenostomus albogularis</i>	white-throated honeyeater																				✓	
Meliphagidae	<i>Lichenostomus fuscus</i>	fuscous honeyeater																				✓	
Meliphagidae	<i>Lichenostomus plumulus</i>	grey-fronted honeyeater																				✓	
Meliphagidae	<i>Lichenostomus virescens</i>	singing honeyeater				✓	✓	✓	✓		✓					✓	✓	✓	✓		✓	✓	
Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater				✓										✓				✓		✓	
Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner			✓	✓		✓	✓					✓		✓					✓	✓	✓
Meliphagidae	<i>Manorina melanocephala</i>	noisy miner																		✓		✓	
Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater																				✓	
Meliphagidae	<i>Philemon citreogularis</i>	little friarbird																	✓		✓	✓	
Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird			✓		✓	✓			✓				✓							✓	✓
Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater															✓			✓	✓	✓	✓
Meropidae	<i>Merops ornatus</i>	rainbow bee-eater	Special LC	Mig (JAMBA); Ma													✓				✓	✓	✓
Motacillidae	<i>Anthus novaeseelandiae</i>	Richard's pipit		Ma																		✓	
Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sittella																		✓			

					Autumn Comprehensive Survey Site number																Opportunistic*		
Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	South	Central	North
					Fauna Habitat Type																		
					A	A	A	E	A	A+ B	A	C	A+ B	D	D	A	F	A	B	A			
Otididae	<i>Ardeotis australis</i>	Australian bustard																				✓	
Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush												✓					✓		✓	✓	✓
Pachycephalidae	<i>Oreoica gutturalis</i>	crested bellbird															✓						
Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler							✓				✓	✓		✓	✓	✓	✓		✓	✓	
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill								✓	✓						✓	✓		✓	✓	✓	✓
Pardalotidae	<i>Acanthiza pusilla</i>	brown thornbill														✓				✓			
Pardalotidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill			✓																		
Pardalotidae	<i>Gerygone olivacea</i>	white-throated gerygone				✓			✓				✓	✓		✓				✓		✓	✓
Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote												✓						✓		✓	
Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote					✓							✓	✓		✓		✓			✓	
Passeridae	<i>Neochmia modesta</i>	plum-headed finch																			✓		
Passeridae	<i>Poephila bichenovii</i>	double-barred finch				✓			✓					✓		✓	✓	✓	✓	✓	✓	✓	✓
Passeridae	<i>Taeniopygia guttata</i>	zebra finch																				✓	✓
Pelicanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		Ma																	✓		
Petroicidae	<i>Melanodryas cucullata</i>	hooded robin							✓												✓		
Phalacrocoracidae	<i>Phalacrocorax carbo</i>	black cormorant																				✓	
Phalacrocoracidae	<i>Phalacrocorax varius</i>	piebald cormorant																				✓	
Phasianidae	<i>Coturnix ypsilophora</i>	brown quail										✓								✓		✓	✓

					Autumn Comprehensive Survey Site number																Opportunistic*		
Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	South	Central	North
					Fauna Habitat Type																		
					A	A	A	E	A	A+ B	A	C	A+ B	D	D	A	F	A	B	A			
Podargidae	<i>Podargus strigoides</i>	tawny frogmouth									✓											✓	
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe																					✓
Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler			✓					✓								✓			✓	✓	
Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot				✓	✓	✓	✓	✓	✓			✓				✓		✓	✓	✓	
Psittacidae	<i>Glossopsitta pusilla</i>	little lorikeet																		✓		✓	
Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella						✓		✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓
Psittacidae	<i>Trichoglossus chlorolepidotus</i>	scaly breasted lorikeet																				✓	
Psittacidae	<i>Trichoglossus haematodus</i>	rainbow lorikeet																	✓		✓	✓	✓
Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	spotted bowerbird																			✓		
Rallidae	<i>Porphyrio porphyrio</i>	purple swamphen																				✓	
Strigidae	<i>Ninox novaeseelandiae</i>	southern boobook		Ma																		✓	
Sylviidae	<i>Cincloramphus cruralis</i>	brown songlark																			✓		
Sylviidae	<i>Cincloramphus mathewsi</i>	rufous songlark				✓																	✓
Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		Ma																		✓	
Zosteropidae	<i>Zosterops lateralis</i>	silveryeye		Ma																✓			

Opportunistic Records:

South: the study area south of the Carmichael River

Central: the study area between the Carmichael River and Moray Carmichael Road

North: the study area north of the Moray Carmichael Road

Fauna habitat type:

A: Ironbark-box grassy woodlands and open woodlands on grey sand plains

B: Gidgee and/or brigalow shrubby woodland and low woodland, sometimes with Dawson's gum emergents, on clay and clay loam plains

C: Woodland and low open woodland associated with laterised sandstone rises and minor pediments

D: Open forest and woodland fringing watercourses and relict stream channels, and alluvial plains subject to flooding

E: Tall mixed shrubland on red sand plains over ferricrete

F: Yellow jacket and rough leaved bloodwood shrubby low open woodland on red sand plains

Acronyms and abbreviations:

Special LC: Special Least Concern

NT: Near threatened

V: Vulnerable

E: Endangered

Ma: Marine

Mig: Migratory

CAMBA: Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment

JAMBA: Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment

Final Fauna Species List EPC 1690 - Summary

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Amphibians							
Bufonidae	<i>Rhinella marina</i>	cane toad	Introduced		✓	✓	
Hylidae	<i>Cyclorana alboguttata</i>	green striped burrowing frog			✓	✓	
Hylidae	<i>Cyclorana novaehollandiae</i>	New Holland frog			✓	✓	
Hylidae	<i>Litoria caerulea</i>	green tree frog			✓	✓	
Hylidae	<i>Litoria inermis</i>	bumpy rocket frog			✓	✓	
Hylidae	<i>Litoria latopalmata</i>	broad-palmed frog				✓	
Hylidae	<i>Litoria rothii</i>	Roth's tree frog			✓	✓	
Hylidae	<i>Litoria rubella</i>	desert tree frog			✓	✓	
Myobatrachidae	<i>Limnodynastes tasmaniensis</i>	spotted grass frog			✓	✓	
Myobatrachidae	<i>Platyplectrum ornatum</i>	ornate burrowing frog			✓	✓	
Myobatrachidae	<i>Uperoleia rugosa</i>	chubby gungan				✓	Total
					9	11	11
Reptiles							
Agamidae	<i>Amphibolurus burnsi</i>	Burns' dragon			✓	✓	
Agamidae	<i>Amphibolurus gilbertii</i>	Gilbert's dragon			✓		
Agamidae	<i>Amphibolurus nobbi</i>	nobbi dragon			✓	✓	
Agamidae	<i>Chlamydosaurus kingii</i>	frill-necked lizard				✓	
Agamidae	<i>Ctenophorus pictus</i>	painted dragon				✓	
Agamidae	<i>Diporiphora australis</i>	tommy roundhead				✓	
Agamidae	<i>Pogona barbata</i>	bearded dragon			✓	✓	
Colubridae	<i>Dendelaphis punctulata</i>	green tree snake				✓	
Elapidae	<i>Demansia psammophis</i>	yellow-faced whipsnake				✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Elapidae	<i>Hoplocephalus bitorquatus</i>	pale-headed snake			✓	✓	
Elapidae	<i>Pseudonaja textilis</i>	eastern brown snake			✓	✓	
Gekkonidae	<i>Gehyra catenata</i>				✓	✓	
Gekkonidae	<i>Gehyra dubia</i>					✓	
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's gecko			✓	✓	
Pythonidae	<i>Antaresia maculosa</i>	spotted python			✓		
Pythonidae	<i>Aspidites melanocephalus</i>	black-headed python				✓	
Scincidae	<i>Carlia munda</i>				✓	✓	
Scincidae	<i>Carlia pectoralis pectoralis</i>				✓	✓	
Scincidae	<i>Cryptoblepharus plagiocephalus</i>					✓	
Scincidae	<i>Cryptoblepharus virgatus</i>	wall skink			✓	✓	
Scincidae	<i>Ctenotus hebetior</i>					✓	
Scincidae	<i>Ctenotus pantherinus</i>	leopard ctenotus				✓	
Scincidae	<i>Ctenotus robustus</i>	eastern striped skink			✓	✓	
Scincidae	<i>Ctenotus spaldingi</i>					✓	
Scincidae	<i>Menetia greyii</i>				✓	✓	
Scincidae	<i>Menetia timlowi</i>	Tim Low's skink			✓		
Scincidae	<i>Morethia boulengeri</i>					✓	
Scincidae	<i>Morethia taeniopleura</i>				✓	✓	
Scincidae	<i>Proablepharus tenuis</i>					✓	
Scincidae	<i>Tiliqua scincoides</i>	common blue-tongue lizard				✓	
Typhlopidae	<i>Ramphotyphlops ligatus</i>	blind snake				✓	
Varanidae	<i>Varanus panoptes</i>	yellow-spotted monitor				✓	
Varanidae	<i>Varanus tristis</i>	freckled monitor				✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Varanidae	<i>Varanus varius</i>	lace monitor			✓		Total
					17	30	34
Mammals							
Canidae	<i>Canis lupus</i>	dog	Introduced		✓	✓	
Dasyuridae	<i>Sminthopsis macroura</i>	stripe-faced dunnart				✓	
Emballonuridae	<i>Saccolaimus flaviventris</i>	yellow-bellied sheath-tail-bat			✓	✓	
Felidae	<i>Felis catus</i>	cat	Introduced			✓	
Leporidae	<i>Oryctolagus cuniculus</i>	European rabbit	Introduced		✓	✓	
Macropodidae	<i>Macropus giganteus</i>	eastern grey kangaroo			✓	✓	
Macropodidae	<i>Macropus robustus</i>	euro			✓	✓	
Macropodidae	<i>Macropus rufus</i>	red kangaroo			✓	✓	
Molossidae	<i>Austronomus australis</i>	white-striped free-tail bat				✓	
Molossidae	<i>Chaerephon jobensis</i>	northern freetail-bat			✓	✓	
Molossidae	<i>Mormopterus beccarii</i>	Beccari's freetail-bat			✓	✓	
Molossidae	<i>Mormopterus ridei</i>				✓	✓	
Molossidae	<i>Mormopterus sp. 3</i>				✓		
Muridae	<i>Hydromys chrysogaster</i>	water rat			✓		
Muridae	<i>Mus musculus</i>	house mouse	Introduced		✓	✓	
Muridae	<i>Pseudomys delicatulus</i>	delicate mouse				✓	
Muridae	<i>Pseudomys desertor</i>	desert mouse				✓	
Muridae	<i>Rattus fuscipes</i>	bush rat				✓	
Muridae	<i>Rattus rattus</i>	black rat	Introduced			✓	
Peramelidae	<i>Isodon macrourus</i>	northern brown bandicoot				✓	
Petauridae	<i>Petaurus breviceps</i>	sugar glider			✓	✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Phalangeridae	<i>Trichosurus vulpecula</i>	common brushtail possum			✓	✓	
Potoroidae	<i>Aepyprymnus rufescens</i>	rufous bettong			✓		
Pteropodidae	<i>Pteropus scapulatus</i>	little red flying fox			✓		
Suidae	<i>Sus scrofa</i>	pig	Introduced		✓	✓	
Tachyglossidae	<i>Tachyglossus aculeatus</i>	echidna	Special LC		✓	✓	
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's wattled bat			✓	✓	
Vespertilionidae	<i>Chalinolobus morio</i>	chocolate wattled bat			✓	✓	
Vespertilionidae	<i>Chalinolobus picatus</i>	little pied bat	NT			✓	
Vespertilionidae	<i>Nyctophilus sp.</i>				✓	✓	
Vespertilionidae	<i>Scotorepens balstoni</i>	inland broad-nosed bat			✓	✓	
Vespertilionidae	<i>Scotorepens greyii</i> / <i>S. sanborni</i> / <i>Chalinolobus nigrogriseus</i>	little broad-nosed bat / northern broad-nosed bat / hoary wattled bat			✓		
Vespertilionidae	<i>Vespadelus baverstocki</i>	inland forest bat			✓	✓	
Vespertilionidae	<i>Vespadelus troughtoni</i>	eastern cave bat				✓	Total
					24	29	34
Birds							
Acanthizidae	<i>Smicrornis brevirostris</i>	weebill			✓	✓	
Accipitridae	<i>Accipiter cirrhocephalus</i>	collared sparrowhawk				✓	
Accipitridae	<i>Aquila audax</i>	wedge-tailed eagle				✓	
Accipitridae	<i>Haliastur sphenurus</i>	whistling kite		Ma	✓	✓	
Aegothelidae	<i>Aegotheles cristatus</i>	Australian-owlet nightjar			✓	✓	
Anatidae	<i>Anas gracilis</i>	grey teal				✓	
Anatidae	<i>Anas platyrhynchos</i>	mallard	Introduced			✓	
Anatidae	<i>Anas superciliosa</i>	Pacific black duck				✓	
Anatidae	<i>Aythya australis</i>	hardhead				✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Anatidae	<i>Chenonetta jubata</i>	Australian wood duck			✓	✓	
Anatidae	<i>Dendrocygna eytoni</i>	plumed whistling duck			✓	✓	
Anhingidae	<i>Anhinga melanogaster</i>	Australasian darter			✓	✓	
Ardeidae	<i>Ardea alba</i>	great egret	Special LC	Mig (CAMBA; JAMBA); Ma	✓	✓	
Ardeidae	<i>Ardea intermedia</i>	intermediate egret		Ma		✓	
Ardeidae	<i>Ardea pacifica</i>	white-necked heron				✓	
Ardeidae	<i>Ixobrychus flavicollis</i>	black bittern				✓	
Artamidae	<i>Artamus cinereus</i>	black-faced woodswallow				✓	
Artamidae	<i>Artamus cyanopterus</i>	dusky woodswallow				✓	
Artamidae	<i>Artamus minor</i>	little woodswallow			✓	✓	
Artamidae	<i>Artamus personatus</i>	masked woodswallow			✓	✓	
Artamidae	<i>Cracticus nigrogularis</i>	pied butcherbird			✓	✓	
Artamidae	<i>Cracticus torquatus</i>	grey butcherbird			✓	✓	
Artamidae	<i>Gymnorhina tibicen</i>	Australian magpie			✓	✓	
Burhinidae	<i>Burhinus grallarius</i>	bush stone-curlew			✓	✓	
Cacatuidae	<i>Cacatua galerita</i>	sulphur-crested cockatoo			✓	✓	
Cacatuidae	<i>Calyptorhynchus banksii</i>	red-tailed black-cockatoo				✓	
Cacatuidae	<i>Eolophus roseicapillus</i>	galah			✓	✓	
Cacatuidae	<i>Nymphicus hollandicus</i>	cockatiel			✓		
Campephagidae	<i>Centropus phasianinus</i>	pheasant coucal			✓	✓	
Campephagidae	<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		Ma	✓	✓	
Campephagidae	<i>Coracina papuensis</i>	white-bellied cuckoo-shrike		Ma	✓	✓	
Caprimulgidae	<i>Eurostopodus argus</i>	spotted nightjar		Ma		✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Casuaridae	<i>Dromaius novaehollandiae</i>	emu			✓	✓	
Charadriidae	<i>Euseyornis melanops</i>	black-fronted dotterel				✓	
Charadriidae	<i>Vanellus miles</i>	banded lapwing				✓	
Charadriidae	<i>Vanellus miles</i>	masked lapwing				✓	
Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	black-necked stork	NT		✓	✓	
Ciconiidae	<i>Grus rubicundus</i>	brolga			✓	✓	
Cisticolidae	<i>Cisticola exilis</i>	golden-headed cisticola			✓	✓	
Climacteridae	<i>Climacteris picumnus</i>	brown treecreeper			✓	✓	
Columbidae	<i>Geopelia cuneata</i>	diamond dove				✓	
Columbidae	<i>Geopelia striata</i>	peaceful dove			✓	✓	
Columbidae	<i>Geophaps scripta scripta</i>	squatter pigeon (southern)	V	V	✓	✓	
Columbidae	<i>Phaps chalcoptera</i>	common bronzewing			✓		
Columbidae	<i>Ocyphaps lophotes</i>	crested pigeon			✓	✓	
Coraciidae	<i>Eurystomus orientalis</i>	dollarbird		Ma	✓		
Corcoracidae	<i>Struthidea cinerea</i>	apostlebird			✓	✓	
Corvidae	<i>Corvus coronoides</i>	Australian raven			✓	✓	
Corvidae	<i>Corvus orru</i>	Torresian crow			✓	✓	
Cuculidae	<i>Cacomantis variolosus</i>	brush cuckoo			✓	✓	
Cuculidae	<i>Chrysococcyx basalis</i>	horsfield's bronze-cuckoo		Ma	✓	✓	
Cuculidae	<i>Eudynamys scolopacea</i>	common koel		Ma	✓		
Cuculidae	<i>Scythrops novaehollandiae</i>	channel-billed cuckoo		Ma	✓		
Dicaeidae	<i>Dicaeum hirundinaceum</i>	mistletoebird			✓	✓	
Dicruridae	<i>Dicrurus bracteatus</i>	spangled drongo		Ma		✓	
Dicruridae	<i>Grallina cyanoleuca</i>	magpie-lark			✓	✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Dicruridae	<i>Microeca fascinans</i>	jacky winter			✓	✓	
Dicruridae	<i>Myiagra cyanoleuca</i>	satin flycatcher	Special LC	Mig (Bonn); Ma	✓		
Dicruridae	<i>Myiagra inquieta</i>	restless flycatcher				✓	
Dicruridae	<i>Myiagra rubecula</i>	leaden flycatcher			✓		
Dicruridae	<i>Rhipidura fuliginosa</i>	grey fantail				✓	
Dicruridae	<i>Rhipidura leucophrys</i>	willie wagtail			✓	✓	
Estrildidae	<i>Poephila cincta cincta</i>	black-throated finch (southern)	E	E		✓	
Falconidae	<i>Falco berigora</i>	brown falcon			✓	✓	
Falconidae	<i>Falco cenchroides</i>	nankeen kestrel		Ma	✓	✓	
Falconidae	<i>Falco hypoleucos</i>	grey falcon				✓	
Falconidae	<i>Falco longipennis</i>	Australian hobby				✓	
Halcyonidae	<i>Dacelo leachii</i>	blue-winged kookaburra			✓	✓	
Halcyonidae	<i>Dacelo novaeguineae</i>	laughing kookaburra			✓	✓	
Halcyonidae	<i>Todiramphus macleayi</i>	forest kingfisher		Ma	✓	✓	
Halcyonidae	<i>Todiramphus pyrrhopygius</i>	red-backed kingfisher				✓	
Halcyonidae	<i>Todiramphus sanctus</i>	sacred kingfisher		Ma	✓	✓	
Hirundinidae	<i>Petrochelidon nigricans</i>	tree martin		Ma		✓	
Jacanidae	<i>Irediparra gallinacea</i>	comb-crested jacana				✓	
Maluridae	<i>Malurus lamberti</i>	variegated fairy-wren			✓	✓	
Maluridae	<i>Malurus leucopterus</i>	white-winged fairy-wren				✓	
Maluridae	<i>Malurus melanocephalus</i>	red-backed fairy-wren			✓	✓	
Megaluridae	<i>Megalurus timoriensis</i>	tawny grassbird				✓	
Meliphagidae	<i>Acanthagenys rufogularis</i>	spiny-cheeked honeyeater			✓		
Meliphagidae	<i>Entomyzon cyanotis</i>	blue-faced honeyeater			✓	✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Meliphagidae	<i>Lichenostomus albobularis</i>	white-throated honeyeater				✓	
Meliphagidae	<i>Lichenostomus fuscus</i>	fuscous honeyeater				✓	
Meliphagidae	<i>Lichenostomus penicillatus</i>	white-plumed honeyeater			✓		
Meliphagidae	<i>Lichenostomus plumulus</i>	grey-fronted honeyeater				✓	
Meliphagidae	<i>Lichenostomus virescens</i>	singing honeyeater			✓	✓	
Meliphagidae	<i>Lichmera indistincta</i>	brown honeyeater			✓	✓	
Meliphagidae	<i>Manorina flavigula</i>	yellow-throated miner				✓	
Meliphagidae	<i>Manorina melanocephala</i>	noisy miner			✓	✓	
Meliphagidae	<i>Meliphaga lewinii</i>	Lewin's honeyeater				✓	
Meliphagidae	<i>Myzomela obscura</i>	dusky honeyeater			✓		
Meliphagidae	<i>Philemon citreogularis</i>	little friarbird			✓	✓	
Meliphagidae	<i>Philemon corniculatus</i>	noisy friarbird			✓	✓	
Meliphagidae	<i>Plectorhyncha lanceolata</i>	striped honeyeater			✓	✓	
Meropidae	<i>Merops ornatus</i>	rainbow bee-eater	Special LC	Mig (JAMBA); Ma	✓	✓	
Motacillidae	<i>Anthus novaeseelandiae</i>	Richard's pipit		Ma	✓	✓	
Motacillidae	<i>Mirafrja javanica</i>	singing bushlark			✓		
Neosittidae	<i>Daphoenositta chrysoptera</i>	varied sitella				✓	
Oriolidae	<i>Oriolus sagittatus</i>	olive-backed oriole			✓		
Otididae	<i>Ardeotis australis</i>	Australian bustard				✓	
Pachycephalidae	<i>Colluricincla harmonica</i>	grey shrike-thrush			✓	✓	
Pachycephalidae	<i>Oreoica gutturalis</i>	crested bellbird				✓	
Pachycephalidae	<i>Pachycephala rufiventris</i>	rufous whistler			✓	✓	
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill				✓	
Pardalotidae	<i>Acanthiza pusilla</i>	brown thornbill				✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Pardalotidae	<i>Acanthiza reguloides</i>	buff-rumped thornbill				✓	
Pardalotidae	<i>Gerygone olivacea</i>	white-throated gerygone				✓	
Pardalotidae	<i>Pardalotus punctatus</i>	spotted pardalote			✓	✓	
Pardalotidae	<i>Pardalotus striatus</i>	striated pardalote			✓	✓	
Passeridae	<i>Neochmia modesta</i>	plum-headed finch			✓	✓	
Passeridae	<i>Poephila bichenovii</i>	double-barred finch			✓	✓	
Passeridae	<i>Taeniopygia guttata</i>	zebra finch			✓	✓	
Pelicanidae	<i>Pelecanus conspicillatus</i>	Australian pelican		Ma	✓	✓	
Petroicidae	<i>Melanodryas cucullata</i>	hooded robin				✓	
Phalacrocoracidae	<i>Phalacrocorax carbo</i>	black cormorant				✓	
Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	little black cormorant			✓		
Phalacrocoracidae	<i>Phalacrocorax varius</i>	pied cormorant				✓	
Phasianidae	<i>Coturnix ypsilophora</i>	brown quail			✓	✓	
Podargidae	<i>Podargus strigoides</i>	tawny frogmouth			✓	✓	
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian grebe				✓	
Pomatostomidae	<i>Pomatostomus temporalis</i>	grey-crowned babbler			✓	✓	
Psittacidae	<i>Aprosmictus erythropterus</i>	red-winged parrot			✓	✓	
Psittacidae	<i>Glossopsitta pusilla</i>	little lorikeet				✓	
Psittacidae	<i>Platycercus adscitus</i>	pale-headed rosella			✓	✓	
Psittacidae	<i>Trichoglossus chlorolepidotus</i>	scaly breasted lorikeet				✓	
Psittacidae	<i>Trichoglossus haematodus</i>	rainbow lorikeet			✓	✓	
Ptilonorhynchidae	<i>Chlamydera nuchalis</i>	great bowerbird			✓		
Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	spotted bowerbird				✓	
Rallidae	<i>Porphyrio porphyrio</i>	purple swamphen				✓	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Spring Survey (Nov 2010)	Autumn Survey (Apr-May 2011)	
Strigidae	<i>Ninox novaeseelandiae</i>	southern boobook		Ma		✓	
Sylviidae	<i>Acrocephalus stentoreus</i>	Australian reed warbler			✓		
Sylviidae	<i>Cincloramphus cruralis</i>	brown songlark				✓	
Sylviidae	<i>Cincloramphus mathewsi</i>	rufous songlark				✓	
Threskiornithidae	<i>Threskiornis spinicollis</i>	straw-necked ibis		Ma		✓	
Zosteropidae	<i>Zosterops lateralis</i>	silveryeye		Ma	✓	✓	Total
					82	119	134

Acronyms and abbreviations:

Special LC: Special Least Concern

NT: Near threatened

V: Vulnerable

E: Endangered

Ma: Marine

Mig: Migratory

CAMBA: Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment

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Appendix H

Threatened Fauna Survey Results (Project Area)

Black-throated Finch Water Body Watch Survey Information
Threatened Fauna Species Records



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Black-throated Finch (southern) Water Body Watch Survey Information – EPC 1690 (Spring 2010 and Autumn 2011 survey)

Fauna Habitat Type	Easting	Northing	Date	Time	No. person hours	Weather	BTF observed
Ironbark-box woodland	433745	7565450	10/11/2010	1700-1800	2	Fine, warm	No
Ironbark-box woodland	430703	7563826	11/11/2010	1700-1730	1	Overcast, warm	No
Ironbark-box woodland	441564	7547340	06/04/2011	1700-1800	2	Fine, warm	No
Ironbark-box woodland	439621	7541990	07/04/2011	1400-1430	1	Fine, warm	No
Ironbark-box woodland	439621	7541990	07/04/2011	1700-1800	2	Fine, warm	Yes
Ironbark-box woodland	441564	7547340	08/04/2011	1200-1230	1	Fine, warm	No
Tall mixed shrubland	439116	7546320	08/04/2011	1600-1645	1.5	Fine, warm	No
Gidgee / brigalow shrubland	443629	7548972	08/04/2011	1200-1230	1	Fine, warm	No
Ironbark-box woodland	441564	7547340	08/04/2011	1700-1745	1.5	Fine, warm	No
Ironbark-box woodland	441564	7547340	09/04/2011	1145-1215	1	Fine, warm	No
Tall mixed shrubland	439116	7546320	09/04/2011	1225-1255	1	Fine, warm	No
Ironbark-box woodland	439621	7541990	09/04/2011	1600-1700	2	Fine, warm	Yes
Ironbark-box woodland	441564	7547340	09/04/2011	1600-1700	1	Fine, warm	No
Ironbark-box woodland	431923	7559058	14/04/2011	1150-1235	1.5	Fine, warm	No
Ironbark-box woodland	438046	7555275	14/04/2011	1630-1700	1	Fine, warm	No
Ironbark-box woodland	432499	7556968	14/04/2011	1715-1800	1.5	Fine, warm	No
Low woodland (sandstone rises)	432533	7561177	15/04/2011	1210-1240	1	Fine, warm	No
Ironbark-box woodland	433745	7565450	15/04/2011	1650-1735	1.5	Fine, warm	No
Ironbark-box woodland	440020	7555126	15/04/2011	1645-1715	1	Fine, warm	No
Ironbark-box woodland	437519	7555795	16/04/2011	1140-1210	1	Fine, warm	No
Ironbark-box woodland	432499	7556968	16/04/2011	1145-1230	1.5	Fine, warm	No
Ironbark-box woodland	432001	7559030	16/04/2011	1650-1720	1	Fine, warm	No
Ironbark-box woodland	433745	7565450	16/04/2011	1715-1745	1	Fine, warm	No

Fauna Habitat Type	Easting	Northing	Date	Time	No. person hours	Weather	BTF observed
Ironbark-box woodland	433745	7565450	05/05/2011	1145-1215	1	Fine, warm	No
Ironbark-box woodland	427242	7565179	05/05/2011	1730-1800	1	Fine, cool	No
Ironbark-box woodland	430340	7563251	06/05/2011	1230-1300	1	Fine, warm	No
Ironbark-box woodland	430399	7563282	06/05/2011	1240-1310	1	Fine, warm	No
Ironbark-box woodland	430340	7563251	06/05/2011	1650-1720	1	Fine, cool	No
Ironbark-box woodland	423333	7575934	06/05/2011	1720-1740	1	Fine, warm	No
Ironbark-box woodland	431152	7568209	07/05/2011	1030-1100	1	Fine, warm	No
Ironbark-box woodland	423138	7575846	07/05/2011	1045-1115	1	Fine, warm	Yes
Ironbark-box woodland	423135	7575848	07/05/2011	1630-1730	2	Fine	Yes
Ironbark-box woodland	423234	7574920	07/05/2011	1600-1630	1	Fine, warm	Yes
Ironbark-box woodland	423138	7575846	07/05/2011	1730-1745	0.5	Fine, warm	Yes
				Total	41.5 person hours		

Black-throated finch (southern) Water Body Watch Survey Information – EPC 1080 (Spring 2011 survey)

Easting	Northing	Date	Time	No. person hours	Weather	BTF observed	Number	Notes
442237	7557125	9/11/2011	0815-0915	2	warm, fine	no		
439620	7556481	9/11/2011	1115-1315	2	warm, mostly fine, gentle breeze	no		
439477	7559947	9/11/2011	1450-1550	2	hot, fine	no		
437998	7562979	9/11/2011	1650-1750	2	warm, fine	no		
434438	7573135	10/11/2011	0740-0840	2	warm, gentle breeze	yes	1	One black-throated finch observed in group with double-barred finches
435391	7568883	10/11/2011	0935-1035	2	warm, fine	no		
435913	7567848	10/11/2011	1220-1320	2	hot, fine	no		
439477	7559947	10/11/2011	1740-1840	2	warm, fine	yes	1	One black-throated finch observed feeding on grass adjacent to farm dam
439477	7559947	11/11/2011	0940-1040	2	warm, hazy, light breeze	no		
437998	7562979	11/11/2011	1150-1250	2	hot, light breeze	no		
434438	7573135	11/11/2011	1615-1645	1	warm, strong breeze	no		
442237	7557125	11/11/2011	1750-1835	1.5		no		
428718	7577894	10/11/2011	0815-900	2	warm, light breeze	no		
428718	7577894	11/11/2011	0800-830	2	warm, light breeze	no		
432811	7577316	10/11/2011	0910-950	2	warm	yes	3	Three black-throated finches observed
432811	7577316	11/11/2011	0845-915	2	warm	no		
434418	7573223	10/11/2011	1105-1150	2	hot and windy	no		
434418	7573223	11/11/2011	1010-1030	2	hot	no		
436536	7570933	10/11/2011	1200-1240	2	hot	no		
436536	7570933	11/11/2011	1045-1105	2	hot	no		
440162	7571488	10/11/2011	1250-1310	2	hot	no		

Easting	Northing	Date	Time	No. person hours	Weather	BTF observed	Number	Notes
440162	7571488	11/11/2011	1115-1135	2	hot	no		
435190	7575483	11/11/2011	0945-1000	2	hot	no		
443080	7555060	10/11/2011	1130-1200	1	warm, fine	no		
428731	7577860	10/11/2011	1700-1800	1	warm, fine	no		
439400	7560000	9/11/2011	0815-0915	1	warm, fine	no		
445288	7549592	15/11/2011	1040-1140	2	Warm, fine	no		
446941	7540577	15/11/2011	1245-1345	2	hot, stiff breeze	no		
442000	7555095	15/11/2011	1510-1610	2	Warm, fine	no		
445067	7545035	16/11/2011	1130-1230	2	Warm, fine	no		
443308	7545356	16/11/2011	1730-1745	0.5	fine, slight breeze	no		
445172	7540350	16/11/2011	1800-1845	1.5	fine, slight breeze	no		
445216	7549590	17/11/2011	0840-0940	2	warm, fine	no		
445216	7549590	15/11/2011	1400-1500	0.75	warm, fine	no		
443340	7545340	16/11/2011	1300-1400	2	warm, fine	no		
443362	7545330	16/11/2011	1500-1600	2	warm, fine	no		
445770	7540064	17/11/2011	0813-0913	2	warm, fine	no		
445661	7540210	17/11/2011	1640-1740	2	warm, fine	no		
440218	7575988	17/11/2011	1345-1445	2	warm, fine	yes	Approx. 40	Approx. 40 observed at farm dam. Double-barred finches also present
Total				70.25 person hours				

Black-throated Finch (southern) Records at and near Project Area

Species	Easting	Northing	Date	Fauna Habitat Type	Approximate number recorded	Approx. time	Field notes
Black-throated finch	439116	7546320	05/04/2011	Tall mixed shrubland	12	1430	Weather: fine and warm; Double-barred finch and plum-headed finch also present. Observed at stock trough.
Black-throated finch	441564	7547340	07/04/2011	Ironbark-box woodland	2	1230	Weather: fine and warm. Observed at stock trough.
Black-throated finch	439701	7542420	07/04/2011	Ironbark-box woodland	6	1500	Weather: fine and warm; Double-barred finch also present. Observed in ironbark woodland.
Black-throated finch	439621	7541990	07/04/2011	Ironbark-box woodland	5	1700	Weather: fine and warm. Observed at small farm dam surrounded by ironbark woodland.
Black-throated finch	439116	7546320	08/04/2011	Tall mixed shrubland	2	1430	Weather: fine and warm; Double-barred finch also present. Observed at stock trough.
Black-throated finch	439688	7542296	08/04/2011	Ironbark-box woodland	5	1200	Weather: fine and warm.
Black-throated finch	439688	7542296	08/04/2011	Ironbark-box woodland	11	1600-1730	Weather: fine and warm.
Black-throated finch	439701	7542420	08/04/2011	Ironbark-box woodland	2	1800	Weather: fine and warm.
Black-throated finch	439116	7546320	09/04/2011	Tall mixed shrubland	8	1530	Weather: fine and warm; Double-barred finch also present. Observed at stock trough.
Black-throated finch	439688	7542296	09/04/2011	Ironbark-box woodland	3	1130	Weather: fine and warm.
Black-throated finch	439621	7541990	09/04/2011	Ironbark-box woodland	2,11,3,6	1700	Weather: fine and warm; Double-barred finch also present. Observed at small farm dam surrounded by ironbark woodland – four groups drank over 30 minute period (may have been same individuals returning).
Black-throated finch	424501	7575053	05/05/2011	Ironbark-box woodland	25-30	1130	Weather: fine and warm. Opportunistically recorded, group of 25-30 feeding on track and sheltering in nearby E. melanophloia and sapling trees. 2 black-faced woodswallows present also, wedge tail eagle observed in distance.
Black-throated finch	423582	7574081	05/05/2011	Ironbark-box woodland	8	1500	Weather: fine and warm. Opportunistic, observed feeding on track then flew into tree near track, grasses inc kangaroo grass, some black speargrass, aristida and fairy grasses.
Black-throated finch	423225	7575009	05/05/2011	Ironbark-box woodland	20	1500	Weather: fine and warm. Opportunistic, observed feeding on track and perching in adjacent E melanophloia, dense grasses surrounding track. Other birds present inc red backed fairy wrens, rufous songlark and willie wagtail.
Black-throated finch	423333	7575934	05/05/2011	Ironbark-box woodland	1	1600	Weather: fine and warm. Observed at farm dam with approx 20 double barred finches sitting in Grevillia beside dam.
Black-throated finch	423686	7573794	05/05/2011	Ironbark-box woodland	1	1600	Weather: fine and warm. Opportunistic, observed on track .
Black-throated finch	424474	7575087	06/05/2011	Ironbark-box woodland	Approx. 20	1000	Weather: fine and warm. Opportunistic, other birds present 2 x double barred finches, 1 x jacky winter, 1 x red backed fairy wren.
Black-throated finch	424589	7571559	06/05/2011	Ironbark-box woodland	10	1630	Weather: fine and warm. Observed with 7 black faced wood swallows.
Black-throated finch	423520	7574214	06/05/2011	Ironbark-box woodland	3	1700	Weather: fine and warm. Opportunistic, on and beside track.

Species	Easting	Northing	Date	Fauna Habitat Type	Approximate number recorded	Approx. time	Field notes
Black-throated finch	423433	7574435	06/05/2011	Ironbark-box woodland	3	1700	Weather: fine and warm. Feeding on track then flew into adjacent shrub.
Black-throated finch	423355	7574620	06/05/2011	Ironbark-box woodland	3	1700	Weather: fine and warm. Perched in small tree near track.
Black throated finch	423234	7574920	07/05/2011	Ironbark-box woodland	10	1600	Weather: fine and patchy cloud; No other finches, kangaroo grass, black spear grass, silver leaf ironbark woodland.
Black throated finch	423135	7575848	07/05/2011	Ironbark-box woodland	20	1600-1730	Weather: fine and patchy cloud; Many double barred finches present - dominant; also seen pale-headed rosella, willie wagtail; dam surrounded by E. brownii woodland with kangaroo grass, black spear grass.
Black-throated finch	423138	7575846	07/05/2011	Ironbark-box woodland	Approx. 35-40	1100	Weather: fine and warm. BTFs sighted drinking from dam and feeding on nearby track and adjacent grass and perching in trees surrounding dam and grass. Other birds observed, double barred finches 10, zebra finches 3 and 1 little woodswallow.
Black-throated finch	423486	7574297	07/05/2011	Ironbark-box woodland	6	1730	Weather: fine and warm. Opportunistic, observed on track.
Black-throated finch	423451	7574392	08/05/2011	Ironbark-box woodland	10	0900	Weather cloudy, opportunistic, observed on track, one black faced woodswallow also present.
Black-throated finch	439414	7541323	09/05/2011	Ironbark-box woodland	2	0830	Weather: fine and warm, windy. Observed along fenceline, feeding on grass and perching on fence/trees, E. melanophloia woodland, black speargrass present.
Black-throated finch	428166	7565143	06/09/2011	Ironbark-box woodland	13	1130	Weather: fine, temperature approximately 20°C. Observed in ironbark woodland, grass cover was dying off but contained black speargrass and soft spinifex, acacia shrub species also present. One black faced woodswallow also present.
Black-throated finch	420997	7573959	20/09/2011	Ironbark-box woodland	11	1500-1600	Weather: fine and warm. Three birds observed drinking at drilling ponds and the remainder were perching in surrounding trees and shrubs. Surrounding vegetation included E. melanophloia with a tall acacia shrub layer present also. Observed with blue faced honeyeaters, rainbow bee-eaters, willie wagtail, satin flycatcher and woodswallows.
Black-throated finch	441683	7546781	22/08/2011	Ironbark-box woodland	10	1400	Weather: fine, temperature approximately 20°C. Observed on a fenceline track and in surrounding vegetation.
Black-throated finch	434438	7573135	10/11/2011	Natural and artificial water bodies	1	0740-0840	Weather: warm gentle breeze. One black-throated finch observed in group with double-barred finches. Adjacent to non-remnant vegetation.
Black-throated finch	439477	7559947	10/11/2011	Natural and artificial water bodies	1	1740-1840	Weather: warm, fine. One black-throated finch observed feeding on grass adjacent to farm dam. Adjacent to non-remnant vegetation.
Black-throated finch	432811	7577316	10/11/2011	Natural and artificial water bodies	3	0910-0950	Weather: warm. Three black-throated finches observed. Adjacent to remnant and non-remnant vegetation.
Black-throated finch	440218	7575988	17/11/2011	Natural artificial water bodies	Approx. 40	1345-1445	Weather: warm, fine. Approx. 40 observed at farm dam. Double-barred finches also present. Adjacent to non-remnant vegetation.

Squatter Pigeon (southern) Records at and near Project Area

Species	Easting	Northing	Fauna Habitat Type	Number	Date
Squatter pigeon	432402	7557364	Ironbark-box woodland	<5	9-13/11/2010
Squatter pigeon	434658	7555343	Ironbark-box woodland	<5	9-13/11/2010
Squatter pigeon	435498	7555314	Ironbark-box woodland	<5	9-13/11/2010
Squatter pigeon	432321	7560614	Ironbark-box woodland	<5	9-13/11/2010
Squatter pigeon	427462	7564458	Ironbark-box woodland	<5	9-13/11/2010
Squatter pigeon	440703	7546900	Ironbark-box woodland	2	06/04/2011
Squatter pigeon	440672	7546880	Ironbark-box woodland	3	06/04/2011
Squatter pigeon	439623	7541990	Ironbark-box woodland	2	07/04/2011
Squatter pigeon	439059	7546344	Tall mixed shrubland	2	07/04/2011
Squatter pigeon	440644	7546868	Ironbark-box woodland	4	07/04/2011
Squatter pigeon	439059	7546344	Tall mixed shrubland	10	08/04/2011
Squatter pigeon	439078	7546330	Ironbark-box woodland	1	09/04/2011
Squatter pigeon	436020	7554929	Ironbark-box woodland	7	12/04/2011
Squatter pigeon	435974	7554937	Ironbark-box woodland	8	12/04/2011
Squatter pigeon	423338	7575851	Ironbark-box woodland	4	13/04/2011
Squatter pigeon	428144	7572149	Ironbark-box woodland	2	13/04/2011
Squatter pigeon	432116	7559540	Low woodland (sandstone rises)	20	14/04/2011
Squatter pigeon	432672	7556750	Ironbark-box woodland	4	14/04/2011
Squatter pigeon	431907	7559060	Ironbark-box woodland	5	14/04/2011
Squatter pigeon	432489	7556980	Ironbark-box woodland	3	14/04/2011
Squatter pigeon	435511	7555240	Ironbark-box woodland	1	14/04/2011
Squatter pigeon	435192	7555380	Ironbark-box woodland	2	14/04/2011
Squatter pigeon	432801	7556560	Ironbark-box woodland	7	14/04/2011
Squatter pigeon	427281	7564985	Ironbark-box woodland	3	05/05/2011
Squatter pigeon	423369	7575818	Ironbark-box woodland	6	05/05/2011
Squatter pigeon	428758	7571857	Ironbark-box woodland	-	05/05/2011
Squatter pigeon	433705	7565273	Ironbark-box woodland	-	06/05/2011
Squatter pigeon	427243	7565187	Ironbark-box woodland	8	06/05/2011
Squatter pigeon	427242	7565179	Ironbark-box woodland	12	07/05/2011
Squatter pigeon	432895	7577050	Natural and artificial water bodies	4	8/11/2011
Squatter pigeon	434407	7573100	Natural and artificial water bodies	4	11/11/2011
Squatter pigeon	434314	7573254	Natural and artificial water bodies	1	11/11/2011
Squatter pigeon	434306	7573368	Natural and artificial water bodies	2	11/11/2011
Squatter pigeon	434301	7573319	Natural and artificial water bodies	2	15/11/2011
Squatter pigeon	442961	7560387	Natural and artificial water bodies	1	14/11/2011
Squatter pigeon	443308	7545356	Ironbark-box woodland	3	16/11/2011
Squatter pigeon	445216	7549590	Natural and artificial water bodies	1	15/11/2011
Squatter pigeon	445216	7549590	Natural and artificial water bodies	1	17/11/2011
Squatter pigeon	428731	7577860	Ironbark-box woodland	1	10/11/2011

Black-necked Stork Records at and near Project Area

Species	Easting	Northing	Fauna Habitat Type	Number	Date
Black-necked stork	437519	7555795	Natural and artificial water bodies	1	9-13/11/2010
Black-necked stork	437519	7555795	Natural and artificial water bodies	2	07/05/2011
Black-necked stork	442237	7557125	Natural and artificial water bodies	2	14/11/2011
Black-necked stork	439400	7560000	Natural and artificial water bodies	2	9/11/2011
Black-necked stork	439477	7559947	Natural and artificial water bodies	2	9/11/2011

Cotton Pygmy-goose Records at and Project Area

Species	Easting	Northing	Fauna Habitat Type	Number	Date
Cotton pygmy-goose	442237	7557125	Fringing open woodland / forest	2	14/11/2011
Cotton pygmy-goose	428731	7577860	Natural and artificial water bodies	1	10/11/2011
Cotton pygmy-goose	439400	7560000	Natural and artificial water bodies	4	9/11/2011
Cotton pygmy-goose	442939	7560446	Natural and artificial water bodies	6	9/11/2011
Cotton pygmy-goose	439477	7559947	Natural and artificial water bodies	4	9/11/2011

Little Pied Bat Records at and near Project Area

Species	Easting	Northing	Fauna Habitat Type	Number	Date
Little pied bat	439154	7545066	Ironbark-box woodland	4	07/04/2011
Little pied bat	438973	7546405	Shrubby low woodland	2	08/04/2011
Little pied bat	437577	7555140	Fringing open woodland / forest	6	15/04/2011
Little pied bat	433552	7554720	Fringing open woodland / forest	1	16/04/2011
Little pied bat	443826	7549498	Gidgee and brigalow woodland	1	16/11/2011



Appendix I

Land Zone Descriptions



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Land zone 3: Quaternary alluvial systems, including floodplains, alluvial plains, alluvial fans, terraces, levees, swamps, channels, closed depressions and fine textured palaeo-estuarine deposits. Also includes estuarine plains currently under fresh water influence, inland lakes and associated dune systems (lunettes). Excludes talus slopes, colluvial deposits and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols, also with Hydrosols in higher rainfall areas.

Land zone 4: Cainozoic clay deposits, usually forming level to gently undulating plains above current alluvial systems. Excludes clay plains and downs formed in-situ on bedrock. Mainly Vertosols with gilgai microrelief, but includes small areas of thin sandy or loamy surfaced Sodosols and Chromosols.

Land zone 5: Extensive, uniform near level or gently undulating Cainozoic plains with sandy or loamy soils. Includes dissected remnants of these surfaces. Also includes plains with sandy or loamy soils of uncertain origin, and plateau remnants with deep soils usually overlying duricrust. Excludes Quaternary alluvial deposits (land zone 3), exposed duricrust (land zone 7), and soils derived from underlying bedrock (land zones 8 to 12). Soils are usually Tenosols and Kandosols, also minor deep sandy surfaced Sodosols and Chromosols. There may be a duricrust at depth.

Land zone 7: Cainozoic duricrusts formed on a variety of rock types, usually forming mesas or scarps. Includes exposed ferruginous, siliceous or mottled horizons and associated talus and colluvium, and remnants of these features, for example low stony rises on downs. Soils are usually shallow Rudosols and Tenosols, with minor Sodosols and Chromosols on associated pediments, and shallow Kandosols on plateau margins and larger mesas.

Land zone 9: Fine-grained sedimentary rocks, generally with little or no deformation, forming undulating landscapes with a broad range of fine textured soils of moderate to high fertility. Siltstones, mudstones, shales, calcareous sediments, and lithic and labile sandstones are typical rock types although minor interbedded volcanics may occur. Excludes areas of duricrust (land zone 7). Includes a diverse range of soils of moderate to high fertility, predominantly Vertosols, Sodosols, and Chromosols.

Source: Department of Environment and Resource Management, 2011.



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