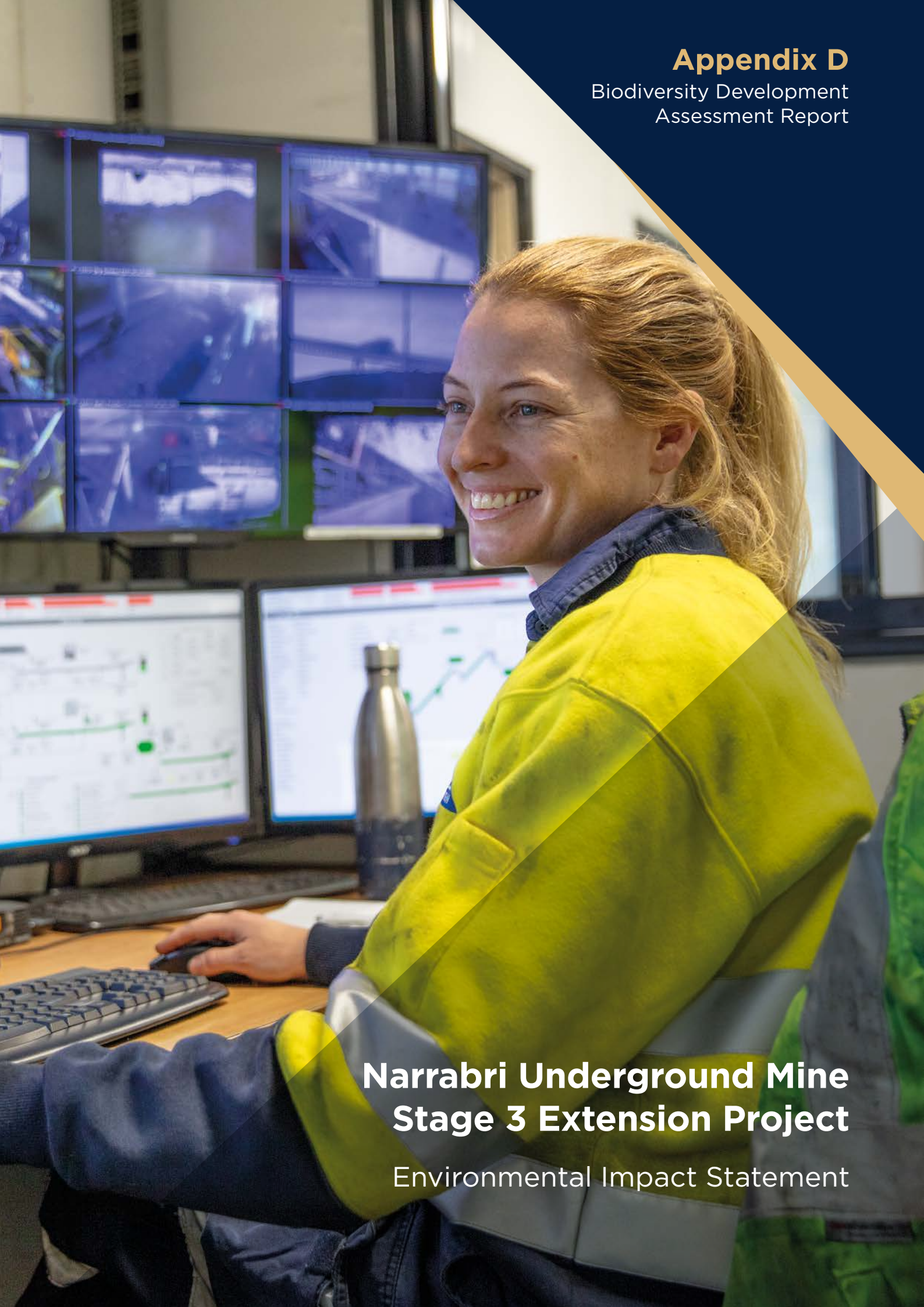


Appendix D

Biodiversity Development Assessment Report

Narrabri Underground Mine Stage 3 Extension Project

Environmental Impact Statement

NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

OCTOBER 2020
Project No. WHC-17-54
Document No. 01054663.docx

TABLE OF CONTENTS

EXECUTIVE SUMMARY ES-1

1 INTRODUCTION 1

1.1 PROJECT OVERVIEW 1
1.2 GENERAL DESCRIPTION OF THE DEVELOPMENT FOOTPRINT 7
1.3 ASSESSMENT REQUIREMENTS/APPROACH 10
1.4 STRUCTURE OF THIS ASSESSMENT 10
1.5 INFORMATION SOURCES USED IN THIS ASSESSMENT 11
1.5.1 Field Surveys 11
1.5.2 Published Databases 12
1.5.3 Local Data 12
1.5.4 BAM Credit Calculator 12

2 LANDSCAPE FEATURES 13

2.1 REGIONAL SETTING 13
2.2 NATIVE VEGETATION COVER 13
2.3 HABITAT CONNECTIVITY FEATURES 13
2.4 RIVERS AND STREAMS 13
2.5 WETLANDS 17
2.6 KARST, CAVES, CREVICES AND CLIFFS 17
2.7 AREAS OF OUTSTANDING BIODIVERSITY VALUE 17
2.8 MIGRATORY SPECIES POTENTIAL FLYWAYS 17
2.9 SITE CONTEXT COMPONENTS 17

3 NATIVE VEGETATION 18

3.1 PLANT COMMUNITY TYPES 18
3.1.1 Threatened Ecological Communities 18
3.2 PLANT COMMUNITY TYPES PERCENT CLEARED VALUE 18
3.3 VEGETATION INTEGRITY ASSESSMENT 25
3.3.1 Vegetation Zones 25
3.3.2 Patch Size 25
3.3.3 Vegetation Integrity Score 25
3.3.4 Local Data 25

4 THREATENED SPECIES 27

4.1 ECOSYSTEM CREDIT SPECIES - HABITAT SUITABILITY ASSESSMENT 27
4.1.1 Step 1: Identify Ecosystem Species for Assessment 27
4.1.2 Step 2: Assessment of the Habitat Constraints and Vagrant Species on the Subject Land 27
4.2 SPECIES CREDIT SPECIES - HABITAT SUITABILITY ASSESSMENT 30
4.2.1 Step 1: Identify Species Credit Species for Assessment 30
4.2.1.1 Review of Databases and Past Flora Surveys 30
4.2.1.2 Review of Databases and Past Fauna Surveys 36
4.2.2 Step 2: Assessment of the Habitat Constraints for Species Credit Species on the Subject Land 43
4.2.3 Step 3: Identify Candidate Species Credit Species for Further Assessment 47
4.2.4 Step 4: Determine Presence or Absence of a Candidate Species Credit Species 47
4.2.5 Step 5: Determine the Area or Count, and Location of Suitable Habitat for a Species Credit Species 51
4.2.6 Step 6: Determine the Habitat Condition within the Habitat (Species Polygon) for Species Assessed by Area 67

4.3 LOCAL DATA 67
4.4 EXPERT REPORTS 67
4.5 PRESCRIBED BIODIVERSITY IMPACT ENTITIES 67
4.5.1 Karst, Caves, Crevices and Cliffs 67
4.5.2 Rock 67
4.5.3 Human Made Structures and Non-native Vegetation 68
4.5.4 Hydrological Processes that Sustain and Interact with the Rivers, Streams and Wetlands 68
4.6 DEVELOPMENT FOOTPRINT CREDIT REQUIREMENT 68

5 AVOID AND MINIMISE IMPACTS 73

5.1 MEASURES TO AVOID AND MINIMISE IMPACTS 73
5.1.1 Site Selection 73
5.1.2 Project Design 73
5.1.3 Construction and Operation 78
5.1.4 Rehabilitation 78
5.1.5 Summary 80
5.2 IMPACT REDUCTION AREA 80
5.2.1 Plant Community Types 80
5.2.2 Ecosystem Species 83
5.2.3 Species Credit Species 85
5.2.4 Impact Reduction Credit Summary 85

6 EVALUATION OF POTENTIAL IMPACTS 88

6.1 DIRECT IMPACTS ON NATIVE VEGETATION AND HABITAT 88
6.1.1 Clearing of Native Vegetation 88
6.1.2 Clearing of Fauna Habitat 95
6.1.3 Fauna and Clearance Activities 96
6.1.4 Cumulative Impacts 97
6.2 INDIRECT IMPACTS ON NATIVE VEGETATION AND HABITAT 98
6.2.1 Mine Subsidence 98
6.2.2 Mine Subsidence Erosion and Sedimentation 101
6.2.3 Inadvertent Impacts on Adjacent Habitat or Vegetation 102
6.2.4 Impacts on Adjacent Habitat or Vegetation from a Change in Land Use Pattern (Increased Human Activity) 102
6.2.5 Reduced Viability of Adjacent Habitat Due to Edge Effects 102
6.2.6 Reduced Viability of Adjacent Habitat Due to Noise 103
6.2.7 Reduced Viability of Adjacent Habitat Due to Dust 103
6.2.8 Reduced Viability of Adjacent Habitat Due to Light Spill 104
6.2.9 Transport of Weeds and Pathogens from the Site to Adjacent Vegetation 104
6.2.10 Increased Risk of Fauna Starvation, Exposure and Loss of Shade or Shelter 105
6.2.11 Loss of Breeding Habitats 105
6.2.12 Trampling of Threatened Flora Species 105
6.2.13 Inhibition of Nitrogen Fixation and Increased Soil Salinity 105
6.2.14 Fertiliser Drift 105
6.2.15 Rubbish Dumping 105
6.2.16 Wood Collection 105
6.2.17 Bush Rock Removal and Disturbance 106
6.2.18 Increase in Predatory Species Populations 106
6.2.19 Increase in Pest Animal Populations 106
6.2.20 Increased Risk of Fire 107

6.2.21 Disturbance to Specialist Breeding and Foraging Habitat 107
6.2.22 Groundwater Dependent Vegetation 107
6.3 PRESCRIBED BIODIVERSITY IMPACTS 119
6.3.1 Impacts on Habitat Resources Other than Native Vegetation 120
6.3.2 Habitat Fragmentation 121
6.3.3 Fauna Movement 122
6.3.4 Water Quality, Water Bodies and Hydrological Processes that Sustain Threatened Species and Threatened Ecological Communities 122
6.3.5 Wind Turbines 123
6.3.6 Vehicle Strike 123
6.4 IMPACTS ON THREATENED SPECIES AND COMMUNITIES UNDER THE NSW FISHERIES MANAGEMENT ACT 1994 124
6.5 STATE ENVIRONMENTAL PLANNING POLICY (KOALA HABITAT PROTECTION) 2019 125
6.6 PILLIGA EAST STATE FOREST AND JACKS CREEK STATE FOREST 127
7 MEASURES TO MITIGATE AND MANAGE IMPACTS 128
8 IMPACT SUMMARY 138
8.1 SERIOUS AND IRREVERSIBLE IMPACTS 138
8.1.1 Introduction 138
8.1.2 Coolabah Bertya (*Bertya opponens*) 141
8.1.3 Large-eared Pied Bat and Eastern Cave Bat 147
8.1.4 Conclusion 150
8.2 IMPACTS ON NATIVE VEGETATION (ECOSYSTEM CREDITS) 150
8.3 IMPACTS ON THREATENED SPECIES (SPECIES CREDITS) 150
9 COMMONWEALTH ASSESSMENT 155
9.1 SURVEYS FOR THREATENED SPECIES AND COMMUNITIES LISTED UNDER THE EPBC ACT 155
9.1.1 Survey Scope, Timing and Methodology 155
9.1.2 Occurrence of Threatened Species and Their Habitat 156
9.1.3 Occurrence of Threatened Ecological Communities 161
9.2 IMPACTS ON THREATENED SPECIES AND COMMUNITIES LISTED UNDER THE EPBC ACT 161
9.2.1 Poplar Box Woodland Endangered Ecological Community 163
9.2.2 Coolabah Bertya 166
9.2.3 Spiny Peppercress 168
9.2.4 *Tylophora linearis* 171
9.2.5 Superb Parrot 174
9.2.6 Regent Honeyeater 178
9.2.7 Painted Honeyeater 182
9.2.8 Koala (combined populations of Qld, NSW and the ACT) 184
9.2.9 Corben's Long-eared Bat 188
9.2.10 Large-eared Pied Bat 192
9.2.11 Pilliga Mouse 195
9.2.12 Summary 200
9.3 IMPACT AVOIDANCE AND MITIGATION MEASURES FOR MATTERS OF NATIONAL SIGNIFICANCE 200
10 BIODIVERSITY OFFSET STRATEGY 207
10.1 OFFSET REQUIREMENTS 207
10.2 OFFSET RULES 207
10.3 LIKE-FOR-LIKE BIODIVERSITY CREDITS 208
10.4 VARIATION RULES 209

10.5 MINE SITE ECOLOGICAL REHABILITATION 210
10.5.1 Target Plant Community Types and Species Habitat 211
10.5.2 Rehabilitation Objectives, Criteria and Performance Indicators 213
10.5.3 Mine Site Ecological Rehabilitation Credit Calculation 213
10.5.4 Management Plan 217
10.5.5 Management Actions 217
10.5.6 Ecosystem Credits from Mine Site Ecological Rehabilitation 218
10.5.7 Species Credits from Mine Site Ecological Rehabilitation 218
10.5.8 Conclusion 220
10.6 OTHER OFFSET OPTIONS 220
10.6.1 Biodiversity Stewardship Site Investigation 220
10.6.2 Funding of a Biodiversity Conservation Action 223
10.6.3 Payments to the NSW Biodiversity Conservation Fund 223
10.6.4 Timing 223
10.7 COMMONWEALTH OFFSET 223
11 CONCLUSION 225
12 REFERENCES 226

LIST OF TABLES

Table 1 Development Footprint Phases
Table 2 Plant Community Types within the Phases of the Development Footprint
Table 3 Ecosystem Species from the BAM Credit Calculator
Table 4 Initial List of Species Credit Species for Assessment
Table 5 Previous Flora Studies in ML 1609 and Surrounds
Table 6 Previous Fauna Studies in ML 1609 and Surrounds
Table 7 Species Credit Species – Habitat Constraints Assessment
Table 8 Candidate Species Credit Species – Survey Timing
Table 9 Candidate Species Credit Species – Presence Status
Table 10 Development Footprint Ecosystem Credit Requirement
Table 11 Habitat Disturbance and Species Credit Requirement
Table 12 Summary of Measures to Avoid and Minimise Impacts on Biodiversity Values
Table 13 Plant Community Types – Impact Reduction Area
Table 14 Vegetation Integrity Score Detail – Impact Reduction Area
Table 15 Ecosystem Species from the BAM Credit Calculator – Impact Reduction Area
Table 16 Impact Reduction Credit Summary – Species Credits
Table 17 Impact Reduction Credit Summary – Ecosystem Credits
Table 18 Impact Reduction Credit Summary – Species Credits
Table 19 Native Vegetation Clearance within the Phases of the Development Footprint
Table 20 Mitigation Measures
Table 21 Monitoring Programme
Table 22 Performance and Completion Criteria

Table 23 Project Ecosystem Credit Requirements After Impact Reduction
Table 24 Project Species Credit Requirements After Impact Reduction
Table 25 EPBC Act Species and Communities Targeted for Survey
Table 26 Threatened Species Listed Under the EPBC Act Recorded During Surveys
Table 27 Threatened Ecological Communities Listed Under the EPBC Act Recorded During Surveys
Table 28 Threatened Fauna Habitat Clearance Summary
Table 29 Impact Mitigation Measures Relevant to Threatened Species and Communities Listed Under the EPBC Act
Table 30 Mine Site Ecological Rehabilitation Plant Community Type Targets
Table 31 Ecological Rehabilitation Objectives, Completion Criteria and Performance Indicators for Ecosystem Credits
Table 32 Ecological Rehabilitation Objectives, Completion Criteria and Performance Indicators for Species Credits
Table 33 Mine Site Ecological Rehabilitation Future Value of Vegetation Integrity Attributes
Table 34 Mine Site Ecological Rehabilitation Vegetation Integrity Score Detail
Table 35 Ecosystem Credits from Mine Site Ecological Rehabilitation
Table 36 Species Credits from Mine Site Ecological Rehabilitation
Table 37 Offset Requirement - Residual Ecosystem Credits
Table 38 Offset Requirement - Residual Species Credits
Table 39 Credit Requirement for Threatened Species and Communities Listed Under the EPBC Act

LIST OF FIGURES

Figure 1 Regional Location
Figure 2 Existing/Approved Narrabri Mine Indicative Underground Mining Layout
Figure 3 Existing/Approved Narrabri Mine Indicative Surface Development Footprint
Figure 4 Project General Arrangement – Indicative Underground Mining Layout
Figure 5 Project General Arrangement – Indicative Surface Development Footprint
Figure 6 Biodiversity Assessment Development Footprint
Figure 7 Impact Reduction Area Development Footprint
Figure 8 Site Map
Figure 9 Location Map
Figure 10 Aerial Photo
Figure 11 Vegetation Mapping
Figure 12 Threatened Ecological Communities
Figure 13 Vegetation Integrity Plots
Figure 14 Threatened Flora
Figure 15 Threatened Fauna - Reptiles
Figure 16a Threatened Fauna - Birds
Figure 16b Threatened Fauna – Birds
Figure 16c Threatened Fauna – Birds
Figure 17 Threatened Fauna – Mammals
Figure 18 Coolabah Bertya Habitat (Species Polygon)
Figure 19 Spiny Peppercress Habitat (Species Polygon)

Figure 20 *Tylophora linearis* Habitat (Species Polygon)
Figure 21 Pale-headed Snake Habitat (Species Polygon)
Figure 22 Glossy Black-Cockatoo Habitat (Species Polygon)
Figure 23 Koala Habitat (Species Polygon)
Figure 24 Eastern Pygmy-possum Habitat (Species Polygon)
Figure 25 Squirrel Glider Habitat (Species Polygon)
Figure 26 Large-eared Pied Bat Habitat (Species Polygon)
Figure 27 Eastern Cave Bat Habitat (Species Polygon)
Figure 28 Avoidance of Impacts on Biodiversity Values
Figure 29 Conceptual Rehabilitation Domains and Proposed Final Land Use Concepts
Figure 30 Disturbance History
Figure 31 Vegetation Mapping - Subsidence Impacts
Figure 32a Modelled Depth to Water Table
Figure 32b Groundwater Dependent Ecosystems – Atlas Mapping
Figure 32c Facultative GDEs Within AMBS Study Extent
Figure 32d Review of High Priority GDE Mapping in Water Sharing Plans
Figure 32e Groundwater Drawdown at Facultative GDEs Mapped by AMBS
Figure 32f Groundwater Drawdown at High Priority GDE Mapping in Water Sharing Plans
Figure 33 Areas Requiring Offset
Figure 34 Areas Not Requiring Assessment or Offset
Figure 35 Coolabah Bertya Landscape Distribution
Figure 36 Spiny Peppercress Landscape Distribution
Figure 37 *Tylophora linearis* Landscape Distribution
Figure 38 Superb Parrot, Regent Honeyeater and Painted Honeyeater Landscape Distribution
Figure 39 Superb Parrot Potential Habitat
Figure 40 Regent Honeyeater Potential Habitat
Figure 41 Painted Honeyeater Habitat
Figure 42 Koala Landscape Distribution
Figure 43 Corben's Long-eared Bat Landscape Distribution
Figure 44 Corben's Long-eared Bat Habitat
Figure 45 Large-eared Pied Bat Landscape Distribution
Figure 46 Pilliga Mouse Landscape Distribution
Figure 47 Pilliga Mouse Habitat

LIST OF PLATES

Plate 1 Example of Vegetation Community 1 - Pilliga Box – Buloke Woodland (Good) (PCT 88)
Plate 2 Example of Vegetation Community 1b – Derived Native Grassland (PCT 88)
Plate 3 Example of Vegetation Community 7 - Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good) (PCT 404)

Plate 4 Example of Vegetation Community 8 - White Bloodwood – Red Ironbark – Black Cypress Woodland (Good) (PCT 405)

Plate 5 Example of Vegetation Community 9 - White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good) (PCT 406)

Plate 6 Example of Vegetation Community 12a - Derived Native Grassland (PCT 55)

Plate 7 Examples of a Bore Pad Undergoing Natural Regeneration at the Existing Narrabri Mine

LIST OF ATTACHMENTS

Attachment A Peer Review Letter

Attachment B Narrabri Underground Mine Stage 3 Extension Project – Flora Survey Report

Attachment C Narrabri Underground Mine Stage 3 Extension Project – Fauna Survey Report

Attachment D1 Vegetation Integrity (Site Condition) Data (AMBS, 2020a)

Attachment D2 Vegetation Integrity Score Detail

Attachment E Threatened Flora and Fauna Species Known or Predicted to Occur in the Wider Locality

Attachment F Habitat Disturbance Areas

Attachment G1 BAM Biodiversity Credit Report – Phase 1

Attachment G2 BAM Biodiversity Credit Report (Like for Like) – Phase 1

Attachment G3 BAM Biodiversity Credit Report (Variations) – Phase 1

Attachment H1 BAM Biodiversity Credit Report – Phase 2

Attachment H2 BAM Biodiversity Credit Report (Like for Like) – Phase 2

Attachment H3 BAM Biodiversity Credit Report (Variations) – Phase 2

Attachment I1 BAM Biodiversity Credit Report – Phase 3

Attachment I2 BAM Biodiversity Credit Report (Like for Like) – Phase 3

Attachment I3 BAM Biodiversity Credit Report (Variations) – Phase 3

Attachment J1 BAM Biodiversity Credit Report – Phase 4

Attachment J2 BAM Biodiversity Credit Report (Like for Like) – Phase 4

Attachment J3 BAM Biodiversity Credit Report (Variations) – Phase 4

Attachment K1 BAM Biodiversity Credit Report – Phase 5

Attachment K2 BAM Biodiversity Credit Report (Like for Like) – Phase 5

Attachment K3 BAM Biodiversity Credit Report (Variations) – Phase 5

Attachment L1 BAM Biodiversity Credit Report – Phase 6

Attachment L2 BAM Biodiversity Credit Report (Like for Like) – Phase 6

Attachment L3 BAM Biodiversity Credit Report (Variations) – Phase 6

Attachment M BAM Biodiversity Credit Report – Impact Reduction Area

Attachment N BAM Biodiversity Credit Report – Mine Site Ecological Rehabilitation Phase 1

Attachment O BAM Biodiversity Credit Report – Mine Site Ecological Rehabilitation Phase 2

Attachment P BAM Biodiversity Credit Report – Mine Site Ecological Rehabilitation Phase 3

Attachment Q BAM Biodiversity Credit Report – Mine Site Ecological Rehabilitation Phase 4

Attachment R BAM Biodiversity Credit Report – Mine Site Ecological Rehabilitation Phase 5

Attachment S BAM Biodiversity Credit Report – Mine Site Ecological Rehabilitation Phase 6

DEFINITIONS

BAM: *the Biodiversity Assessment Method.*

BC Act: *the NSW Biodiversity Conservation Act 2016.*

BC Regulation: *the NSW Biodiversity Conservation Regulation 2017.*

Benchmarks: *quantitative measures that represent the 'best-attainable' condition, which acknowledges that native vegetation within the contemporary landscape has been subject to both natural and human-induced disturbance. Benchmarks are defined for specified variables for each Plant Community Type. Vegetation with relatively little evidence of modification generally has minimal timber harvesting (few stumps, coppicing, cut logs), minimal firewood collection, minimal exotic weed cover, minimal grazing and trampling by introduced or overabundant native herbivores, minimal soil disturbance, minimal canopy dieback, no evidence of recent fire or flood, is not subject to high-frequency burning, and has evidence of recruitment of native species.*

Biodiversity Credit Report: *the report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.*

Biodiversity Development Assessment Report (BDAR): *a report prepared by an accredited person in relation to proposed development or activity that would be authorised by a planning approval, or proposed clearing that would be authorised by a vegetation clearing approval, that:*

(a) assesses in accordance with the BAM the biodiversity values of the land subject to the proposed development, activity or clearing;

(b) assesses in accordance with the BAM the impact of proposed development, activity or clearing on the biodiversity values of that land;

(c) sets out the measures that the proponent of the proposed development, activity or clearing proposes to take to avoid or minimise the impact of the proposed development, activity or clearing; and

(d) specifies in accordance with the BAM the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values of the actions to which the biodiversity offsets scheme applies.

Biodiversity Offsets: *management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.*

Biodiversity Stewardship Agreement: *means a biodiversity stewardship agreement made under Division 2 of Part 5 of the BC Act.*

Biodiversity Stewardship Site: *means the land that is designated by a biodiversity stewardship agreement to be a biodiversity stewardship site for the purposes of the BC Act.*

Biodiversity Stewardship Site Assessment Report (BSSAR): *the report that must be prepared in accordance with the BAM and submitted as part of an application for a biodiversity stewardship agreement.*

Broad Condition State: *areas of the same Plant Community Type that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same Plant Community Type into a vegetation zone for the purpose of determining the vegetation integrity score.*

Credit Calculator: *the computer program that provides decision support to assessors and proponents by applying the BAM, in particular by using the data required to be entered and the equations in Appendix 6 and Appendix 9 to calculate the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.*

Credit Class: *the class of biodiversity credits calculated by the BAM Credit Calculator. Ecosystem Credits are determined on an assumed presence basis based on the associated Plant Community Type. Species Credits are determined for species known to occur or determined to occur by way of an expert report.*

Development Footprint: *the area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.*

Ecosystem credits: a measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.

EPBC Act: *the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.*

High Threat Exotic Plant Cover: *plant cover composed of vascular plants not native to Australia that, if not controlled, will invade and outcompete native plant species. Also referred to as high-threat weeds.*

Native Vegetation Cover: *the percentage of native vegetation cover on the subject land and the surrounding buffer area. Cover estimates are based on the cover of native woody and non-woody vegetation relative to the approximate benchmarks for the Plant Community Type, taking into account vegetation condition and extent. Native over-storey vegetation is used to determine the percent cover in woody vegetation types, and native ground cover is used to assess cover in non-woody vegetation types.*

Plant Community Type (PCT): *a NSW plant community type identified using the Plant Community Type classification system.*

Retirement of Credits: *the retirement of biodiversity credits from a biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.*

Sensitivity to Loss: *a component of the biodiversity risk weighting for an entity that considers the increased threat posed to an entity from offsetting the loss of habitat or population.*

Sensitivity to Potential Gain: *a component of the biodiversity risk weighting for an entity that considers the ability of a species to respond to improvements in habitat condition at an offset site.*

Serious and Irreversible Impacts (SAII): *impacts likely to contribute significantly to the risk of extinction of a threatened species or ecological community in NSW.*

Site-based Development: *a development other than a linear-shaped development, or a multiple fragmentation impact development.*

Species Credit Species: *are threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits.*

Species Credits: *the class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.*

Subject Land: *is land to which the BAM is applied in Stage 1 of the BAM to assess the biodiversity values of the land.*

Vegetation Class: *a level of classification of vegetation communities defined in Keith (2004). There are 99 vegetation classes in NSW.*

Vegetation Formation: *a broad level of vegetation classification as defined in Keith (2004). There are 16 vegetation formations and sub-formations in NSW.*

Vegetation Integrity (VI): *the condition of native vegetation assessed for each vegetation zone against the benchmark for the Plant Community Type.*

Vegetation Integrity (VI) Score*: the measure of Vegetation Integrity as calculated in the BAM Credit Calculator using input from plot data.*

Vegetation Zone: *a relatively homogenous area of native vegetation on a development site, land to be biodiversity certified or a biodiversity stewardship site that is the same Plant Community Type and broad condition state.*

EXECUTIVE SUMMARY

The Narrabri Mine is an existing underground coal mine operated by Narrabri Coal Operations Pty Ltd (NCOPL), a wholly owned subsidiary of Whitehaven Coal Limited. Narrabri Mine is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah in New South Wales (NSW).

NCOPL is seeking a new Development Consent under the State Significant Development provisions of Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) for the Narrabri Underground Mine Stage 3 Extension Project (the Project). The Project involves an extension to the south of the approved underground mining area within Mining Lease Application (MLA) areas 1 and 2, an extension of the mine life to 2044 and development of supporting surface infrastructure.

This Biodiversity Development Assessment Report (BDAR) was prepared in accordance with the NSW *Biodiversity Assessment Method, 2017* (BAM) under the NSW *Biodiversity Conservation Act, 2016* (BC Act) and the Secretary's Environmental Assessment Requirements (SEARs) for the Project.

NCOPL is also seeking approval for the Project under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act). The Project is to be assessed under the EPBC Act pursuant to the assessment bilateral agreement with the NSW Government. Therefore, this BDAR provides an assessment of potential impacts to EPBC Act listed threatened species and communities, applying the Biodiversity Assessment Method.

For the purpose of this BDAR, the proposed surface disturbance areas (herein referred to as the Development Footprint) have been assessed in six development phases.

Landscape Features

The Development Footprint and the general area surrounding it (herein referred to as the Subject land) is on the boundary of the Pilliga and Liverpool Plains Interim Biogeographic Regionalisation for Australia (IBRA) Subregions of the Brigalow Belt South IBRA Region. The Subject land is also within the Bugaldie Uplands and Cubbo Uplands Mitchell Landscapes.

The western portion of the Subject land consists of woodland vegetation that adjoins an extensive area of native vegetation within Jacks Creek State Forest, Pilliga East State Forest and neighbouring reserves. The land is elevated in the west of the Subject land and lower in the east. There are ephemeral drainage lines in the Subject land, but only one is named, i.e. Kurrajong Creek. Rocky outcrops occur in scattered locations.

Native Vegetation

Native vegetation on the Subject land was identified and mapped in accordance with the BAM and *BioNet Vegetation Classification*. This involved recording floristic and condition data from Vegetation Integrity Plots across the Subject land and reviewing previous vegetation mapping and ecological reports.

The Subject land consists of mostly native vegetation of the Pilliga Outwash Dry Sclerophyll Forests and Western Slopes Dry Sclerophyll Forests vegetation classes. The Plant Community Types (PCTs) that would be subject to clearance are all more widely occurring in the general landscape/region.

The Project would require the progressive and selective clearance of vegetation in relatively narrow strips (for gas drainage facilities, service boreholes and access tracks). In total, the Project would require clearance of approximately 443.6 hectares (ha) of woodland and approximately 128.3 ha of derived native grassland over a 23-year period. This means that only portions of the development footprint would be cleared at any point in time. The predominant vegetation within the proposed additional indicative surface Development Footprint is Vegetation Community 7 Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good) (PCT 404) (approximately 46%, 204.3 ha).

No threatened ecological communities listed under the BC Act occur within the Subject land or Development Footprint. One threatened ecological community listed under the EPBC Act occurs in relatively small areas of the Subject land and Development Footprint, namely the *Poplar Box Grassy Woodland on Alluvial Plains* endangered ecological community.

No threatened species listed under the NSW *Fisheries Management Act 1994* (FM Act) potentially occur in the Project area. The Lowland Darling River aquatic endangered ecological community listed under the FM Act includes the Namoi River and associated tributaries, such as the ephemeral Kurrajong Creek and Pine Creek (both of which traverse the mining leases).

Threatened Species

Threatened species surveys were conducted by AMBS Ecology and Heritage and others in consideration of the relevant State and Commonwealth survey guidelines and included targeted searches for potentially occurring threatened species and communities listed under the BC Act and the EPBC Act.

Ten 'species credit species' (as defined by the *Bionet Threatened Biodiversity Data Collection*) were determined to be present in habitat located either within or adjoining the proposed additional indicative surface Development Footprint, namely:

- Coolabah Bertya (*Bertya opponens*);
- Spiny Peppercress (*Lepidium aschersonii*);
- *Tylophora linearis*;
- Pale-headed Snake (*Hoplocephalus bitorquatus*);
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*);
- Koala (*Phascolarctos cinereus*);
- Eastern Pygmy-possum (*Cercartetus nanus*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*); and
- Eastern Cave Bat (*Vespadelus troughtoni*).

Measures to Avoid, Minimise, Mitigate and Manage Impacts

The existing/approved Stage 2 surface infrastructure along LW206 to LW209 (not yet constructed or required for the Project) would be foregone (not cleared). This area covering approximately 14.1 ha of native vegetation is referred to as an Impact Reduction Area.

Habitat would be progressively and selectively cleared, followed by progressive mine rehabilitation to re-connect habitat (ripping and seeding where necessary to supplement natural regeneration from the existing soil seed bank). NCOPL has a number of existing measures to mitigate and manage impacts on biodiversity, such as a vegetation clearance protocol, weed and pest animal control, monitoring programmes and mine rehabilitation.

Biodiversity Offset Strategy

As a result of running the BAM Credit Calculator, the Project requires a total of 12,880 ecosystem credits and 153,233 species credits (Table ES-1), after subtracting the credits from the Impact Reduction Area.

Table ES-1
Biodiversity Credit Requirements

Credit Type	Total Development Footprint^	Total Development Footprint Credits	Impact Avoidance Credits Impact Reduction Area	Remaining Credits to be Offset
Ecosystem Credits	643.8 ha of native vegetation	13,172	-292	12,880
Species Credits				
Coolabah Bertya	25,939 plants*	51,878	-	51,878
Spiny Peppercress	58.8 ha of habitat*	1,804	-	1,804
Tylophora linearis	444.4 ha of habitat*	14,391	-387	14,004
Pale-headed Snake	499 ha of habitat*	15,281	-387	14,894
Glossy Black-Cockatoo	513.9 ha of habitat*	15,619#	-387#	15,232#
Koala	514.5 ha of habitat*	15,632	-387	15,245
Eastern Pygmy-possum	413.1 ha of habitat*	13,727	-387	13,340
Squirrel Glider	308.4 ha of habitat*	8,456	-121	8,335
Large-eared Pied Bat	245.2 ha of habitat*	11,937	-	11,937
Eastern Cave Bat	151.5 ha of habitat*	6,564	-	6,564
Total Ecosystem Credits		**13,172**	**-292**	**12,880**
Total Species Credits		**155,289**	**-2,056**	**153,233**

^ Includes clearance, ponding, ETL management and potential cracking impacts.

* The species habitats overlap (i.e. the habitats are not mutually exclusive).

The methodology for mapping a species credit polygon for the Glossy Black-Cockatoo was revised since the surveys for this Project, therefore it is reasonable for the biodiversity credit requirements for the Glossy Black-Cockatoo to be reduced if NCOPL obtain an Expert Report (in accordance with the BAM) or undertake additional targeted surveys as required by DPIE.

The BAM establishes the circumstances where offsetting the impacts of development will result in no net loss of biodiversity. NCOPL is committed to satisfying the biodiversity credit requirements using offset mechanisms allowed by the NSW Biodiversity Offsets Scheme (i.e. retirement of biodiversity credits, mine site ecological rehabilitation and/or contribution to the Biodiversity Conservation Fund).

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Narrabri Mine is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah within the Narrabri Shire Council Local Government Area of New South Wales (NSW) (Figure 1). The Narrabri Mine is operated by Narrabri Coal Operations Pty Limited (NCOPL).

The Narrabri Mine comprises 20 longwall panels, Longwalls 101 to 111 and 201 to 209 (Figure 2). Longwall mining is currently being undertaken in Longwall 109, with extraction of Longwalls 101 to 108a complete. The Pit Top Area incorporates the majority of the Narrabri Mine surface infrastructure, including the box cut, coal handling and preparation plant (CHPP), run-of-mine (ROM) and product coal stockpiles, rail loop and product coal load-out infrastructure. Figure 3 shows the existing/approved indicative surface Development Footprint.

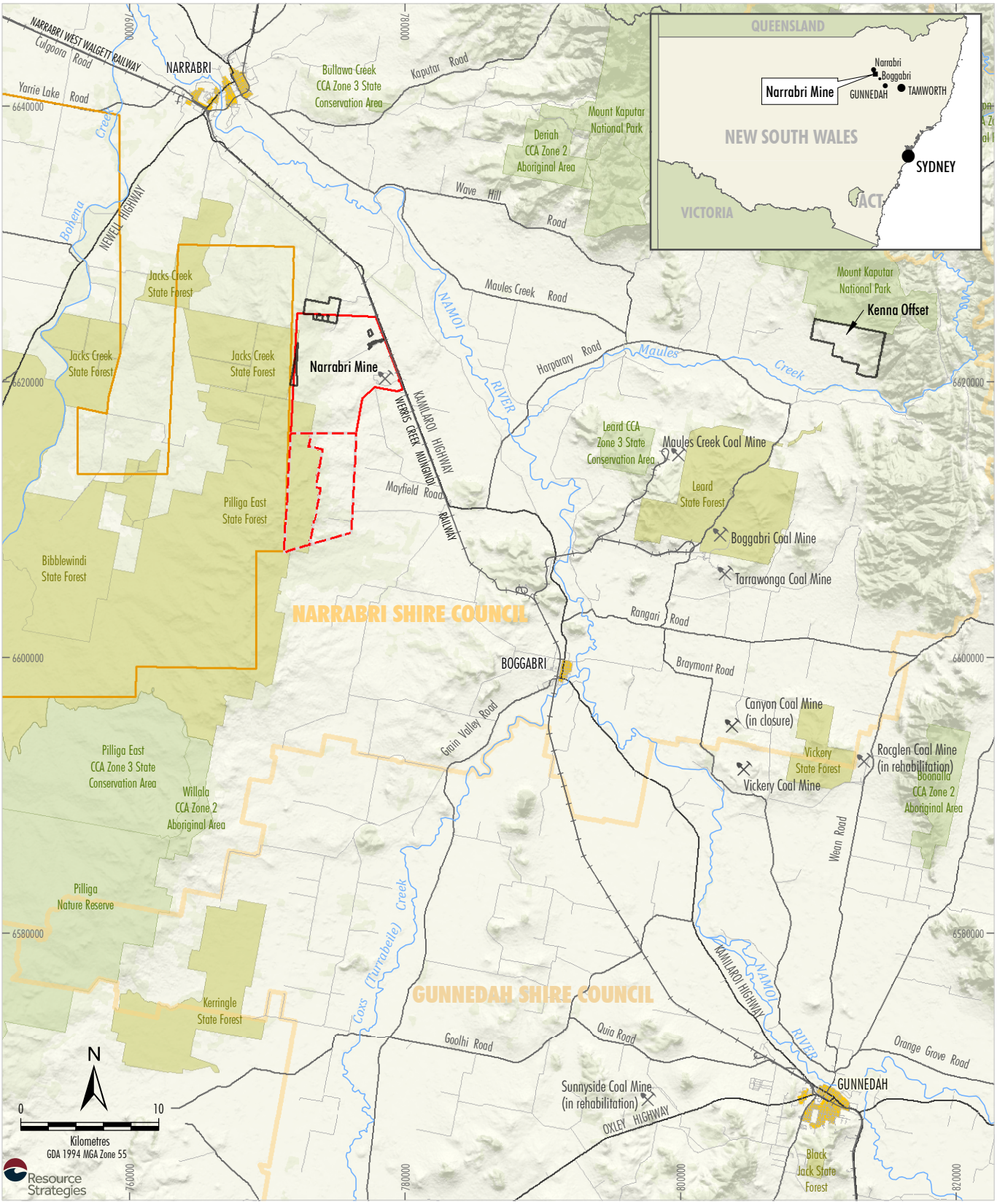
NCOPL is seeking a new Development Consent under the State Significant Development provisions of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Narrabri Underground Mine Stage 3 Extension Project (the Project). The Project involves an extension to the south of the approved underground mining area to gain access to additional coal reserves within Mining Lease Application (MLA) areas 1 and 2 (Figure 4), an extension of the mine life to 2044 and development of supporting surface infrastructure (Figure 5). ROM coal production would occur at a rate of up to 11 million tonnes per annum (Mtpa), consistent with the currently approved limit. A detailed description of the Project is provided in Section 2 in the Main Report of the Environmental Impact Statement (EIS).

This Biodiversity Development Assessment Report (BDAR) forms part of an EIS that has been prepared to accompany a Development Application made for the Project in accordance with Part 4 of the EP&A Act.

On 8 April 2019, the Project was referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (2019/8427). The referred action (the Action) does not include the components and operations of the Narrabri Coal Mine Stage 2 Longwall Project (EPBC 2009/5003). On 30 September 2019, a delegate of the Commonwealth Minister for the Department of Environment and Energy (DEE) (now Department of Agriculture, Water and the Environment [DAWE]) declared the Action to be a 'controlled action' for the purpose of the EPBC Act due to potential adverse impacts on the following controlling provisions under Part 3 of the EPBC Act:

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

The Action is to be assessed by accredited assessment under the EP&A Act. Accordingly, this document provides an assessment of those components of the Project that comprise the Action on the relevant threatened species and communities listed under the EPBC Act. The Australian Government has entered into a new bilateral assessment agreement with *New South Wales - Amending Agreement No. 1*. This agreement commenced on 24 March 2020.



Source: Geoscience Australia (2011); NSW Spatial Services (2019)

LEGEND

- Mine Site
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Local Government Boundary
- State Forest
- State Conservation Area, Aboriginal Area
- Narrabri Gas Project (Santos NSW [Eastern] Pty Ltd)
- Narrabri Mine Existing Offset Area

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Regional Location

Figure 1

Source: NCOPL (2019); NCOPL (2015); NSW Spatial Services (2019)

LEGEND

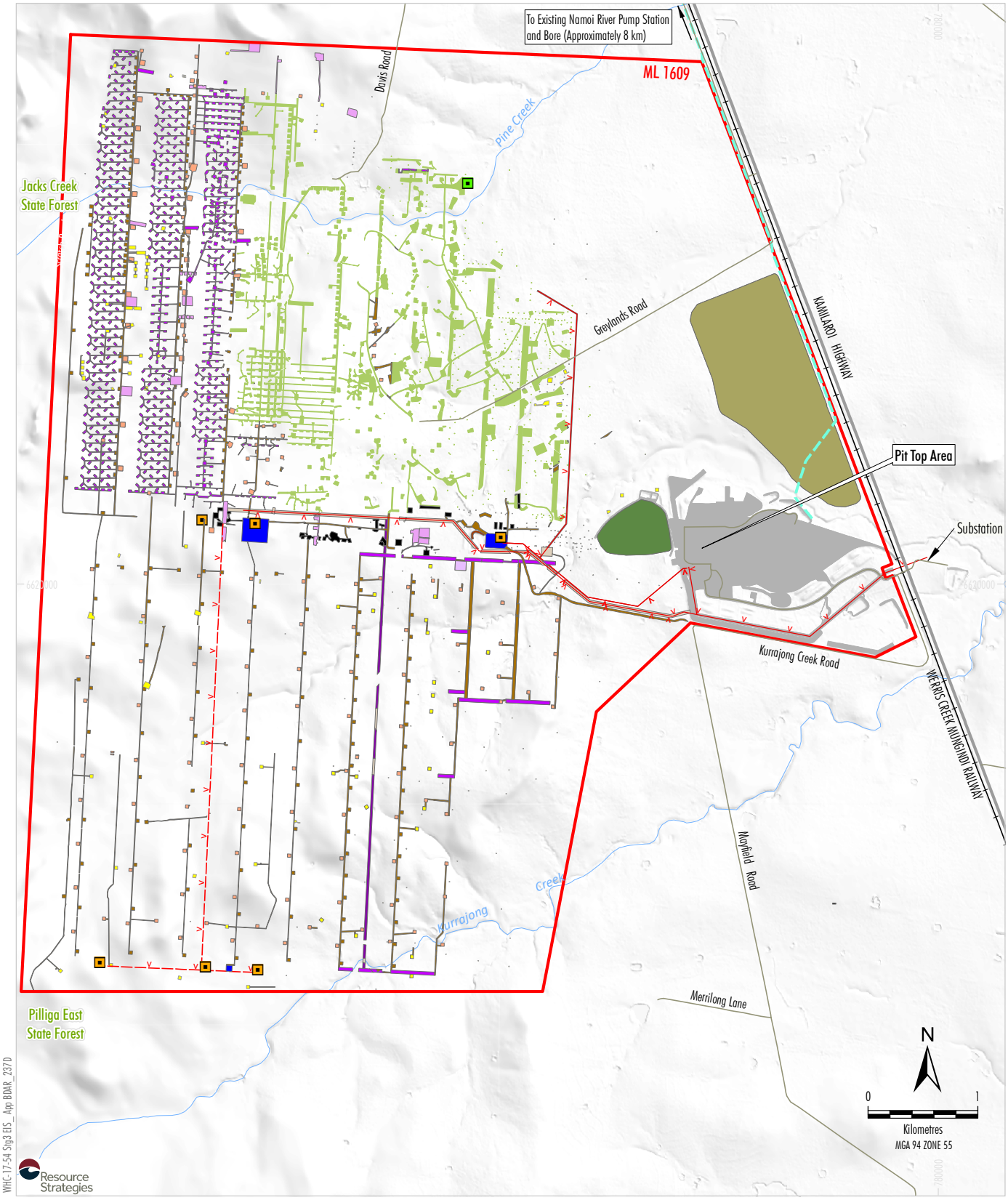
- Mining Lease (ML 1609)
- Approved Narrabri Mine
- Underground Mining Layout
- Electricity Transmission Line (Constructed)
- Electricity Transmission Line (Not Yet Constructed)
- Existing Namoi River Pipeline (Buried)
- Indicative Ventilation Complex
- Indicative Ventilation Complex - Decommissioned

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Approved Narrabri Mine
Indicative Underground Mining Layout

Figure 2



Source: NCOPL (2019); NSW Spatial Services (2019)

LEGEND

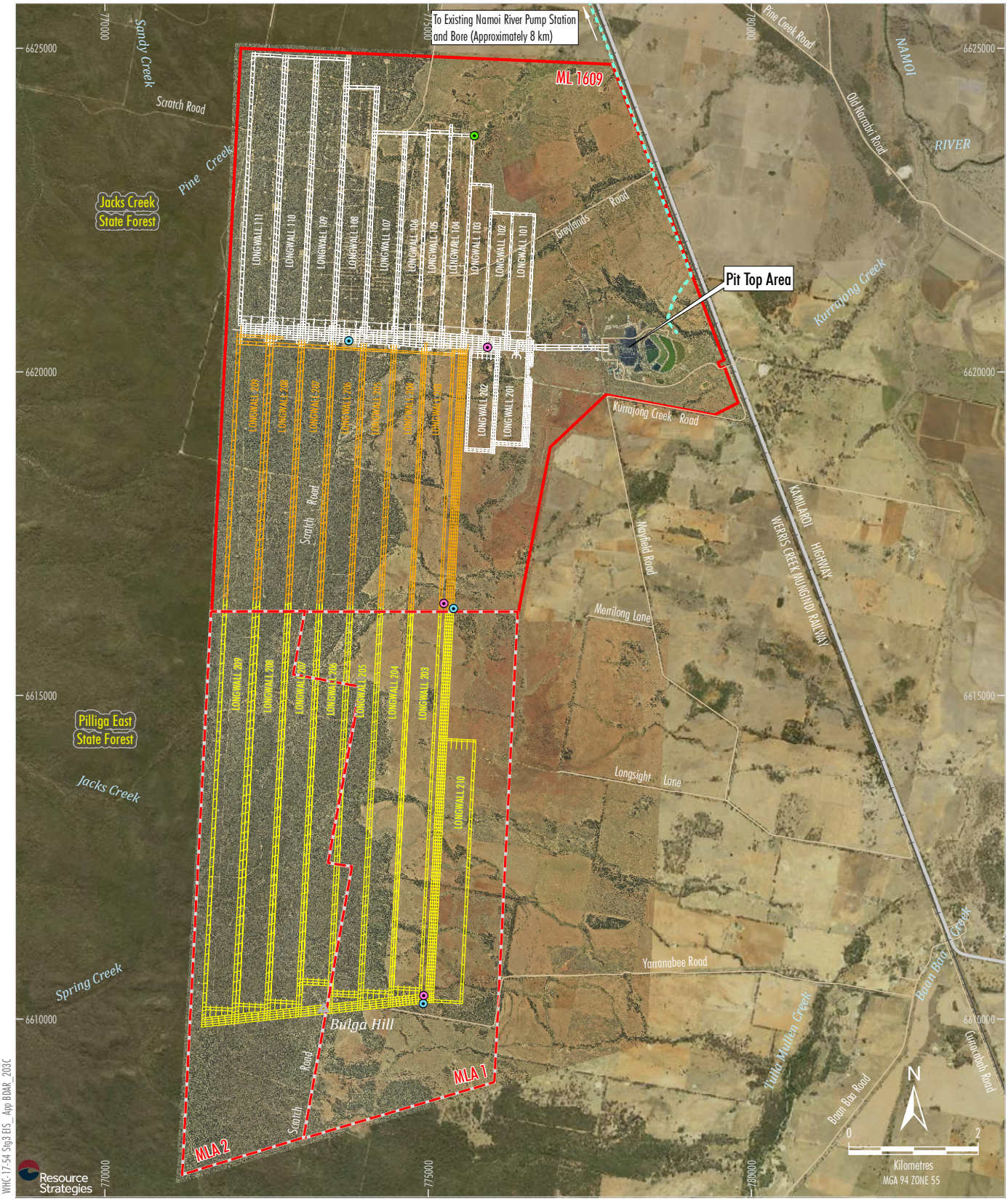
- Mining Lease (ML 1609)
- Approved Narrabri Mine
- Electricity Transmission Line (Constructed)
- Electricity Transmission Line (Not Yet Constructed)
- Existing Namoi River Pipeline (Buried)
- Indicative Ventilation Complex
- Indicative Ventilation Complex - Decommissioned
- Existing Rehabilitation and Subsidence Remediation Areas
- Reject Emplacement Area
- Additional Brine Storage Area
- Exploration Borehole
- Access Track and Post-drainage Corridor
- Bund
- Pre-conditioning Area
- SIS Pre-Drainage Borehole
- Service Borehole
- Services Corridor
- Pit Top Area Infrastructure
- Ventilation Complex
- Other

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Approved Narrabri Mine
Indicative Surface Disturbance Footprint

Figure 3



Source: NCOPL (2019); NSW Spatial Services (2019)

LEGEND

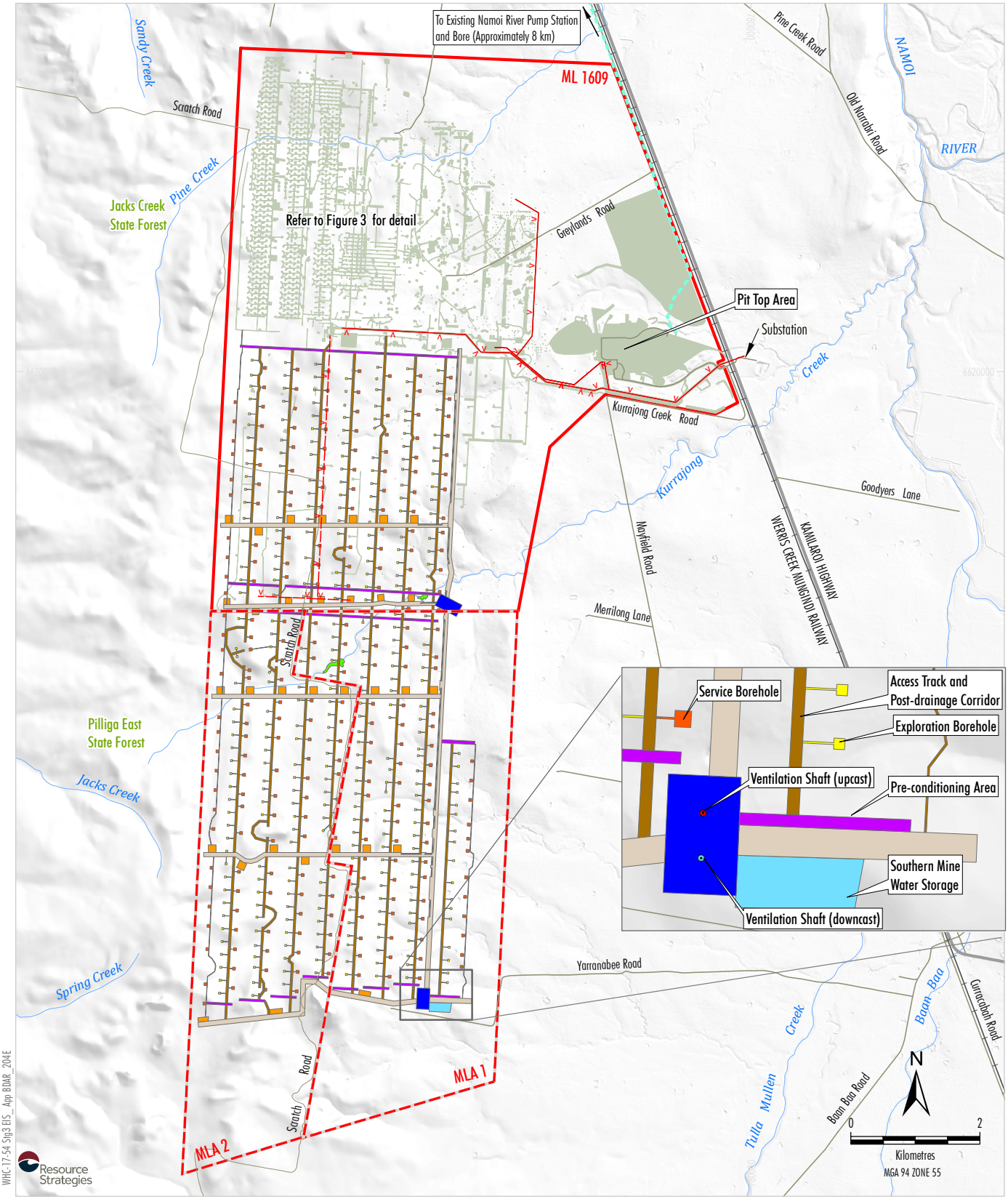
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing Namoi River Pipeline (Buried)
- Approved Underground Mining Layout
- Indicative Underground Mining Layout to be Extended for Project
- Indicative Underground Project Mining Layout
- Indicative Ventilation Complex (Downcast)
- Indicative Ventilation Complex (Upcast)
- Indicative Ventilation Complex (Upcast - Decommissioned)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Project General Arrangement - Indicative Underground Mining Layout

Figure 4



Source: NCOPL (2019); NSW Spatial Services (2019)

LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Electricity Transmission Line (Constructed)
- Electricity Transmission Line (Not Yet Constructed)
- Existing Namoi River Pipeline (Buried)
- Existing/Approved Surface Development*
- Services Corridor
- Service Borehole
- Exploration Borehole
- Access Track and Post-drainage Corridor
- Pre-conditioning Area
- Service Borehole and Power Reticulation
- Southern Mine Water Storage
- Ventilation Complex
- Farm Dam Decommissioning Works

*Excludes the Impact Reduction Area (Refer to Figure 7)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Project General Arrangement - Indicative Surface Development Footprint

Figure 5

1.2 GENERAL DESCRIPTION OF THE DEVELOPMENT FOOTPRINT

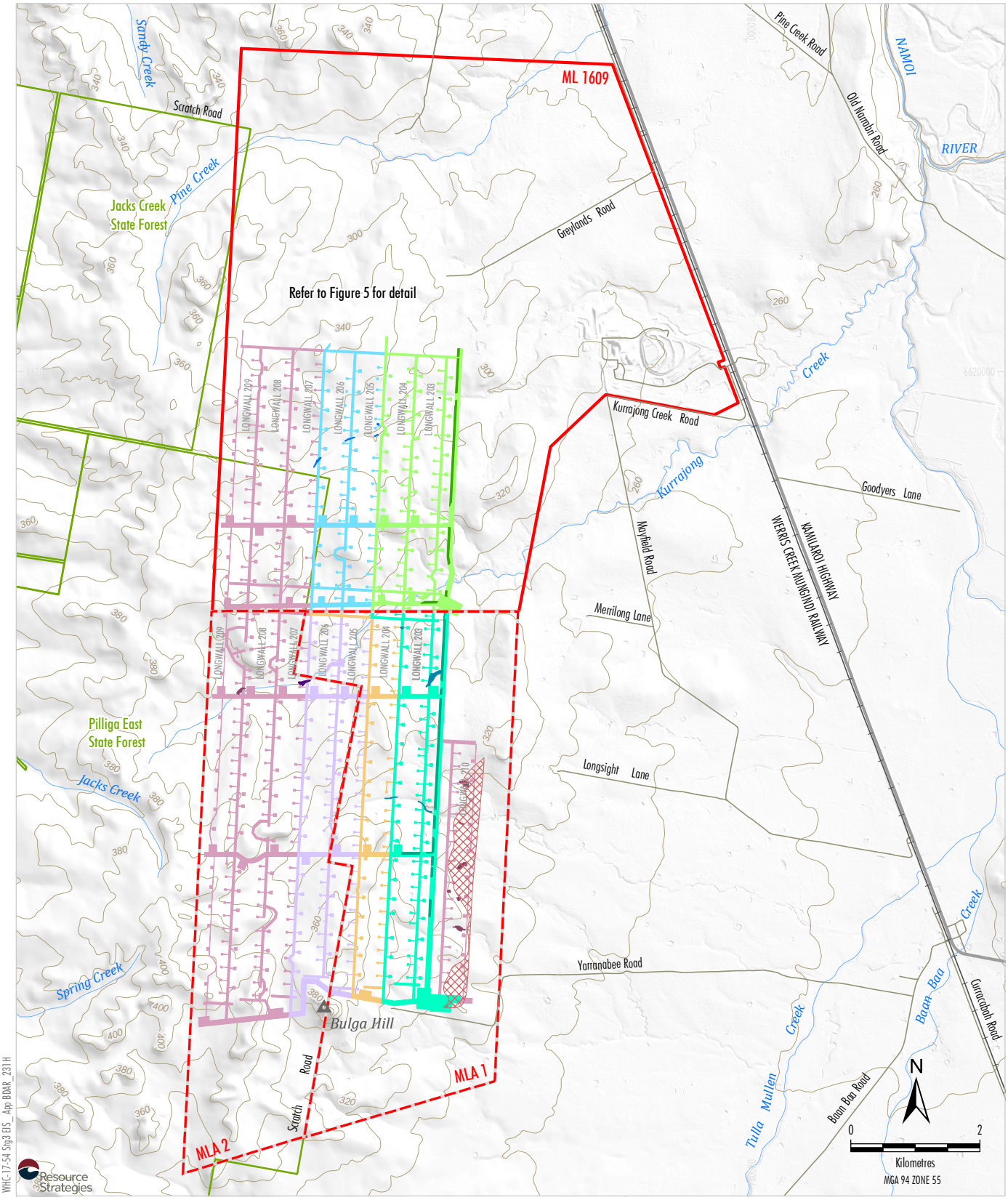
Figure 3 shows the existing/approved indicative surface Development Footprint. The existing Narrabri Mine was approved for the clearance of 210 ha of native vegetation (Brown Bloodwood / Pilliga Box Woodland, Inland Grey Box Woodland, Riparian Forest, Callitris Forest and River Red Gum) and direct and indirect impacts on the threatened flora (such as Coolabah Bertya [*Bertya opponens*]) and fauna (such as foraging habitat for the Superb Parrot [*Polytelis swainsonii*]) (Ecotone, 2009). A Biodiversity Offset Strategy was prepared to account for the area disturbed for these species, which included the establishment of on-site and off-site Biodiversity Offset Areas.

The Project involves an extension to the south of the approved underground mining area. The Development Footprint is divided into six phases for the purpose of determining the offset requirements for the Project (Table 1) (Figure 6).

Table 1
Development Footprint Phases

Development Footprint	Description
Phase 1	▪ land clearance for development of northern part of LW203 and northern part of LW204; ▪ subsidence ponding predicted by WRM Water & Environment (WRM) (2020); and ▪ partial land clearance for electricity transmission line (ETL) safety clearance.
Phase 2	▪ land clearance for development of southern part of LW203; ▪ subsidence ponding predicted by WRM (2020); and ▪ partial land clearance for ETL safety clearance.
Phase 3	▪ land clearance for development of northern part of LW205 and LW206; and ▪ subsidence ponding predicted by WRM (2020).
Phase 4	▪ land clearance for development of southern part of LW204.
Phase 5	▪ land clearance for development of southern part of LW205 and LW206; and ▪ subsidence ponding predicted by WRM (2020).
Phase 6	▪ land clearance for development of LW207, LW208, LW209 and LW210; ▪ subsidence ponding predicted by WRM (2020); and ▪ area of potential cracking (subsidence-related) impacts on trees (after Ditton Geotechnical Services, 2020).

The existing/approved Stage 2 surface infrastructure along LW206 to LW209 (not yet constructed or required for the Project) would be foregone (not cleared) (Figure 7). This area is referred to as an impact reduction area and is further described in Section 5.2.



LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- State Forest

Development Footprint Phase 1

- Land Clearance
- Electricity Transmission Line Management Area
- Predicted Subsidence Ponding

Development Footprint Phase 2

- Phase 2
- Electricity Transmission Line Management Area
- Predicted Subsidence Ponding

Development Footprint Phase 3

- Land Clearance
- Predicted Subsidence Ponding

Development Footprint Phase 4

- Land Clearance

Development Footprint Phase 5

- Land Clearance
- Predicted Subsidence Ponding

Development Footprint Phase 6

- Land Clearance
- Predicted Subsidence Ponding
- Subsidence Area 180 m Cover (Areas of Potential Cracking Impacts on Vegetation)

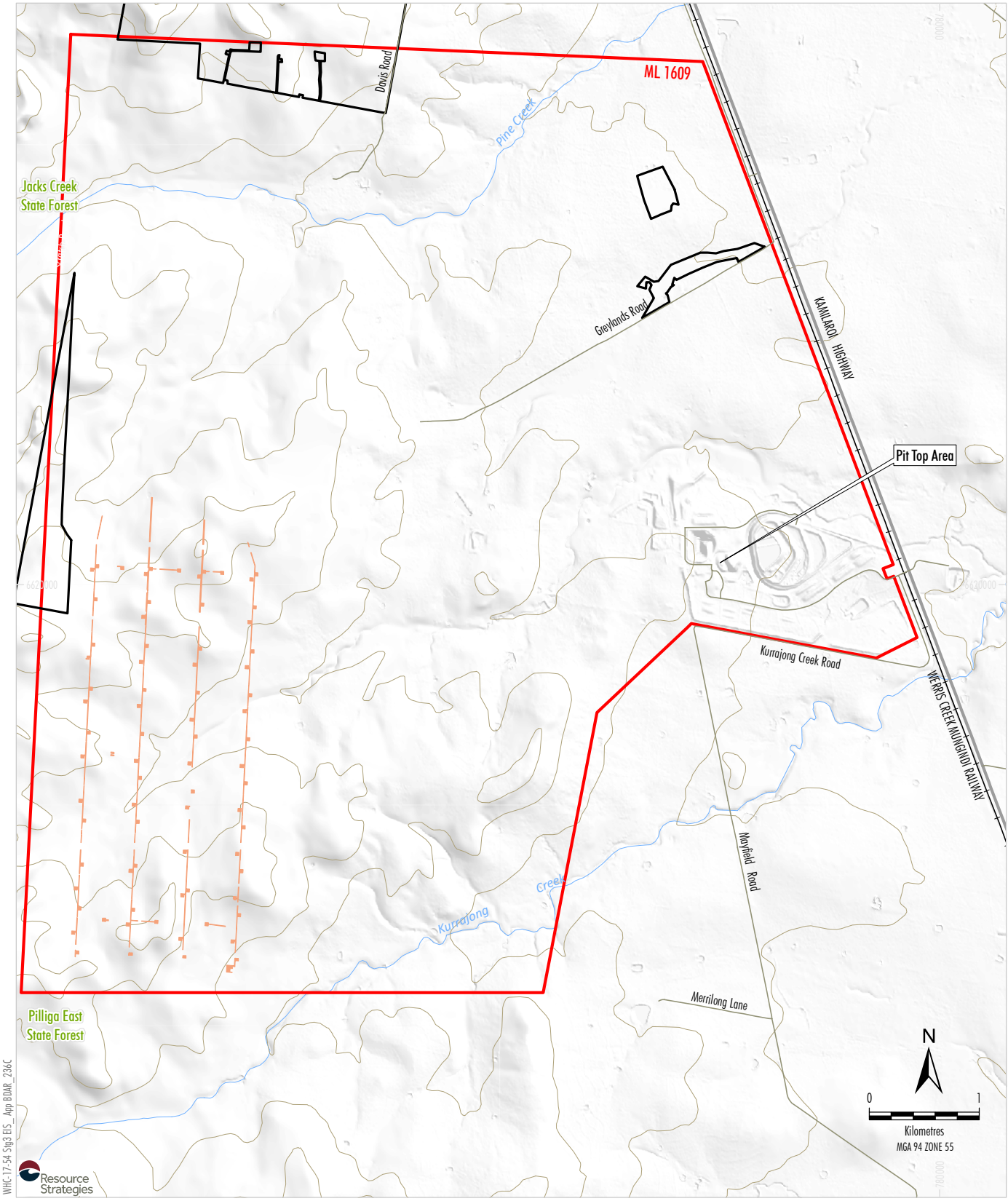
Source: NCOPL (2019); NSW Spatial Services (2019); Ditton Geotechnical Services (2020)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Biodiversity Assessment
Development Footprint

Figure 6



LEGEND

- Mining Lease (ML 1609)
- Indicative Approved Surface Development (Impact Reduction Area)
- Narrabri Mine Existing Offset Area

Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Impact Reduction Area
Development Footprint

Figure 7

1.3 ASSESSMENT REQUIREMENTS/APPROACH

This document was prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) for the EIS (including input from NSW Office of Environment and Heritage [OEH] [now BCD] and DEE [now DAWE]). The SEARs state the following requirements in regard to the biodiversity assessment:

- *an assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless OEH and DPE determine that the proposed development is not likely to have any significant impacts on biodiversity values;*
- *the BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM; [and]*
- *assessment of the likely impacts of the development on listed threatened species and communities under the Environment Protection and Biodiversity Conservation Act 1999.*

This report has also considered the general requirements of the SEARs:

- *a description of the existing environment likely to be affected by the development, using sufficient baseline data;*
- *an assessment of the likely impacts of all stages of the development, including appropriate worst-case scenarios and consideration of any cumulative impacts and taking into consideration any relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice; [and]*
- *a description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development […]*

The NSW *Biodiversity Conservation Act 2016* (BC Act) commenced in August 2017 and establishes the Biodiversity Offsets Scheme for NSW. The Project has been assessed in accordance with the *Biodiversity Assessment Method, 2017* (BAM) (OEH, 2017a) established under section 6.7 of the BC Act. The draft BAM (DPIE, 2019a) has also been considered. The Project is assessed as a State Significant Development.

This BDAR has been prepared by Jamie Gleeson (Resource Strategies), who is an accredited assessor (assessor accreditation number BAAS17080) and peer-reviewed by Dr Colin Driscoll (Hunter Eco), who is also an accredited assessor (assessor accreditation number BAAS17004). The peer review letter is provided in Attachment A.

This BDAR also reviews the potential impact of the Project on threatened species and communities listed under the NSW *Fisheries Management Act 1994*.

1.4 STRUCTURE OF THIS ASSESSMENT

The structure of the BDAR follows the requirements in Appendix 10 of the BAM (OEH, 2017a). Sections 2, 3 and 4 describe the biodiversity values relevant to the Subject land and the inputs into the BAM Credit Calculator. Sections 5, 6 and 7 describe relevant impacts and how those impacts would be avoided, minimised, mitigated and managed. Section 8 presents information on serious and irreversible impacts and a summary of the credit requirements after impacts have been avoided and/or minimised.

Additional information of EPBC Act listed threatened species and communities is provided in Section 9. However, the Action is to be assessed by accredited assessment under the EP&A Act and therefore the BAM Credit Calculation (in preceding sections) is also relevant to EPBC Act listed threatened species and communities.

The Project biodiversity offset strategy is presented in Section 10. This includes a description of mine site ecological rehabilitation as an option that NCOPL is considering.

This BDAR is structured as follows:

Section 2 Provides a description of the landscape setting and features.

Section 3 Describes the native vegetation.

Section 4 Describes the threatened species assessment.

Section 5 Provides an assessment of how potential impacts would be avoided and/or minimised.

Section 6 Presents an evaluation of potential impacts.

Section 7 Provides mitigation and management measures.

Section 8 Presents an information on serious and irreversible impacts and a summary of the credit requirements after impacts have been avoided and/or minimised.

Section 9 Provides additional information of EPBC Act listed threatened species and communities.

Section 10 Describes the biodiversity offset strategy.

Section 11 Conclusion.

1.5 INFORMATION SOURCES USED IN THIS ASSESSMENT

This BDAR has been prepared using various data sources as described below. A reference list is provided in Section 12.

1.5.1 Field Surveys

The flora and fauna survey effort for this Project was substantial and undertaken in accordance with relevant State and Commonwealth survey guidelines. In addition to the previous surveys and monitoring programmes at the operating mine site, AMBS (2020a and 2020b) (Attachments B and C) collected the relevant ecological survey data in accordance with the BAM (OEH, 2017a). Nine flora field surveys were undertaken by AMBS in June 2019, July 2019, August 2019, October 2019 and January 2020, in addition to four prior flora surveys undertaken in September 2017, October 2017, November 2017 and January 2018 by Eco Logical Australia (ELA). Seven fauna field surveys were undertaken by AMBS in June, July, August, October and December 2019 and January 2020, in addition to three prior fauna surveys undertaken in August, September, October and November 2017 and February 2018 by ELA. The methods and results of these surveys are all provided in AMBS (2020a and 2020b) (Attachments B and C).

1.5.2 Published Databases

Published databases used in this assessment include:

- *BioNet Atlas Search* (Department of Planning, Industry and Environment [DPIE], 2020a)[1];
- *BioNet Threatened Biodiversity Data Collection* last accessed on 9 October (DPIE, 2020d)[2];
- *BioNet Vegetation Classification* last accessed on 9 October (DPIE, 2020b); and
- *Directory of Important Wetlands of Australia* (DAWE, 2020a).

1.5.3 Local Data

It was not necessary to use local data or deviate from the DPIE databases (DPIE, 2020b and 2020d).

1.5.4 BAM Credit Calculator

BAM Credit Calculator (App last updated: 19/11/2019 [Version: 1.2.7.4]; BAM data last updated: 20/08/2020 [Version: 30]) was used in this assessment. The BAM Credit Calculator was applied to the six development phases (Sections 2 to 4), the Impact Reduction Area (Section 5.2) and the six phases of mine site ecological rehabilitation (Section 10.5).

[1] This website is titled 'Species Sightings Search'.

[2] This website is titled 'Profiles'.

2 LANDSCAPE FEATURES

This section provides information on the landscape features in accordance with the BAM (OEH, 2017a). The BAM (OEH, 2017a) refers to 'Subject land' as the land to which the BAM is applied to assess the biodiversity values of the land (i.e. the landscape features [Section 2], native vegetation [Section 3] and threatened species [Section 4]).

2.1 REGIONAL SETTING

The Subject land is located in Narrabri Shire Council Local Government Area (LGA) (Figure 1) within the Pilliga and Liverpool Plains Interim Biogeographic Regionalisation for Australia (IBRA) subregions of the Brigalow Belt South IBRA region (DEE, 2018) (Figure 8).

The Subject land is also within the Bugaldie Uplands and Cubbo Uplands Mitchell Landscapes (Mitchell, 2002; DPIE, 2020b) (Figure 8).

2.2 NATIVE VEGETATION COVER

Native vegetation cover is assessed on the Subject land and within a 1,500 m buffer area surrounding the outside edge of the boundary of the Development Footprint (Figure 9). The BAM (OEH, 2017a) defines 'Native Vegetation Cover' as:

> *the percentage of native vegetation cover on the subject land and the surrounding buffer area. Cover estimates are based on the cover of native woody and non-woody vegetation relative to the approximate benchmarks for the PCT, taking into account vegetation condition and extent. Native over-storey vegetation is used to determine the percent cover in woody vegetation types, and native ground cover is used to assess cover in non-woody vegetation types.*

An aerial photo of the Subject land is shown on Figure 10. The extent of native vegetation cover, as mapped by site surveys (AMBS, 2020a and 2020b) (Attachments B and C) and regional mapping (OEH, 2016b), is shown on Figure 9. A 1,500 m assessment area surrounding the Subject land is also shown on Figure 9[3]. There is approximately 81% native vegetation cover within the 1,500 m buffer area.

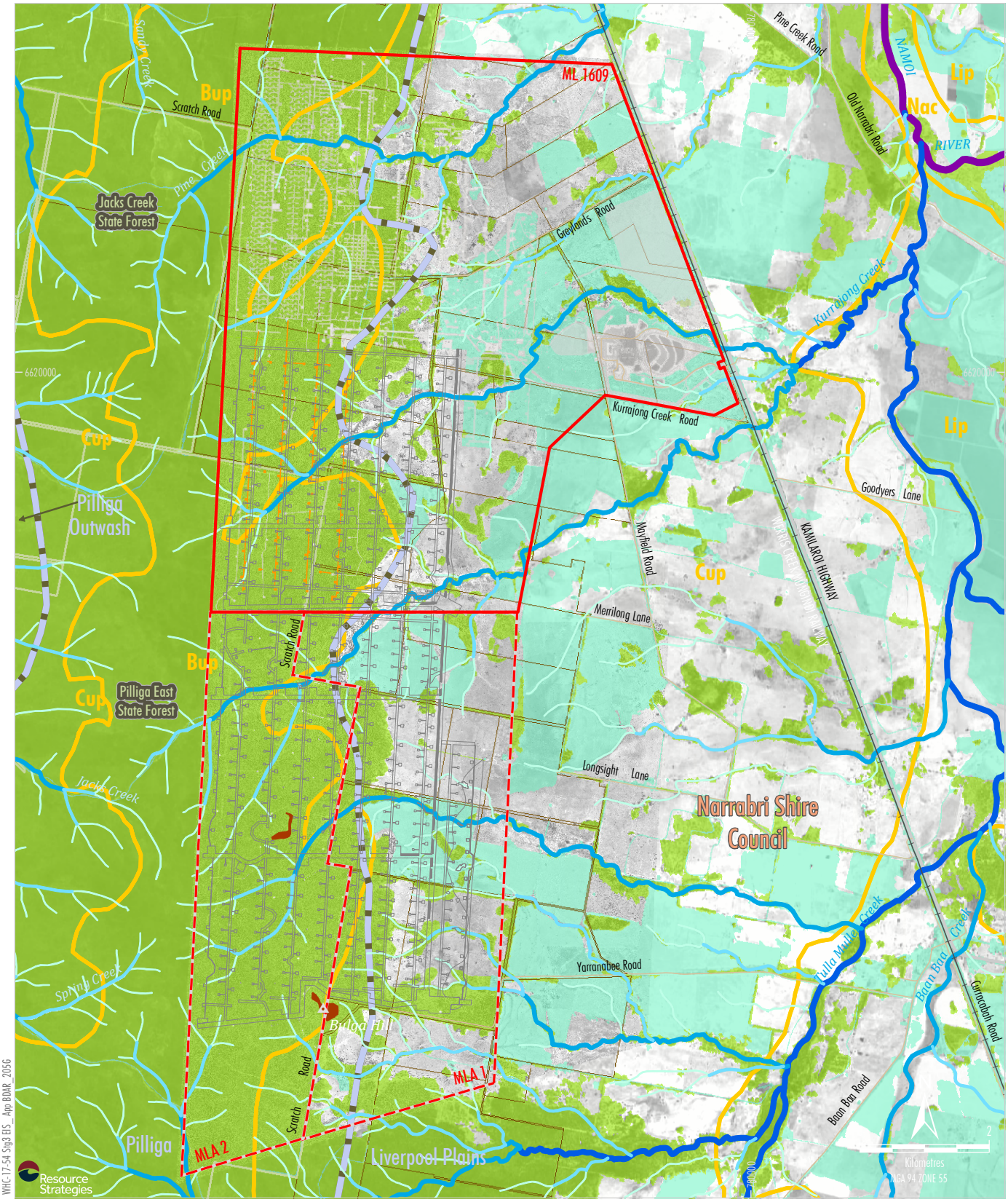
2.3 HABITAT CONNECTIVITY FEATURES

The native vegetation extent/habitat connectivity as mapped by site surveys (AMBS, 2020a and 2020b) (Attachments B and C) and regional mapping (OEH, 2016b) is shown on Figure 8. Any native vegetation on Figure 8 may facilitate the movement of one or more threatened species across their range. Land to the west of the Subject land consists of extensive native vegetation within Jacks Creek State Forest, Pilliga East State Forest and neighbouring reserves.

2.4 RIVERS AND STREAMS

Drainage features (and riparian buffer distances based on Strahler stream ordering and the BAM [OEH, 2017a]) are shown on Figure 8 from the Department of Primary Industries – Water (DPI-Water) (DPI-Water, 2020).

[3] A figure scale appropriate for the size of the 1,500 m assessment area has been selected.



Source: NCOPL (2019); NSW Spatial Services (2019)

LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)
- Development Footprint
- Bioregion IBRA Subregion Boundary
- Habitat Connectivity Area
- Non-native Vegetation
- Rocky Outcrops with Bat Habitat

Mitchell Landscapes

- Bup — Bugaldie Uplands
- Cup — Cubbo Uplands
- Lip — Liverpool Alluvial Plains
- Nac — Namoi Channels and Floodplains

Strahler Stream Order

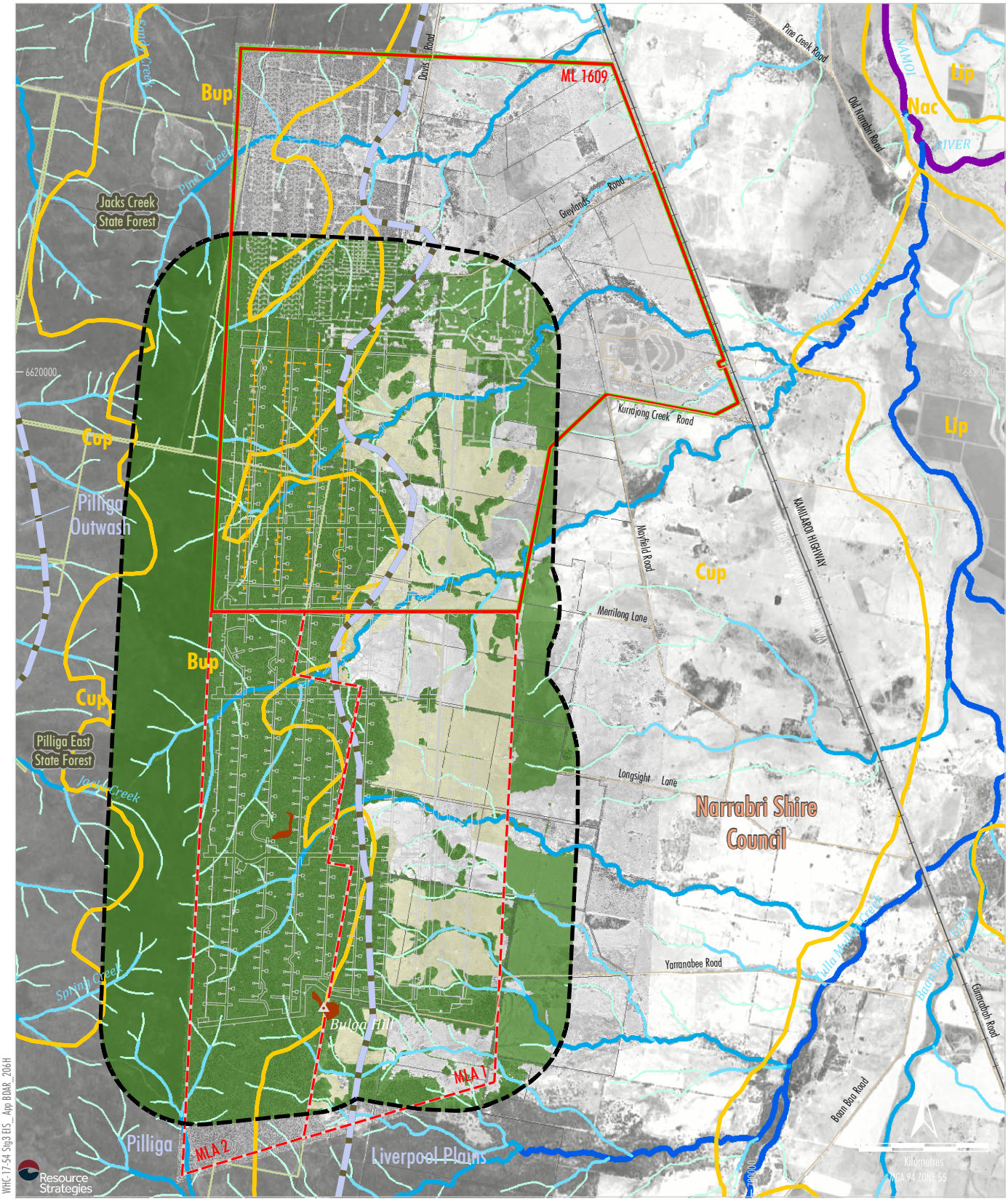
- 1st Order (Riparian Corridor Width 10 m)
- 2nd Order (Riparian Corridor Width 20 m)
- 3rd Order (Riparian Corridor Width 30 m)
- 4th Order (Riparian Corridor Width 40 m)
- 5th Order (Riparian Corridor Width 40 m)
- 9th Order (Riparian Corridor Width 50 m)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Site Map

Figure 8



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)
- Development Footprint
- 1500 m Buffer to the Development Footprint
- Bioregion IBRA Subregion Boundary
- Rocky Outcrops with Bat Habitat
- Derived Native Grassland Within the Buffer
- Woodland/Connectivity Within the Buffer

Mitchell Landscapes

- Bup — Bugaldie Uplands
- Cup — Cubbo Uplands
- Lip — Liverpool Alluvial Plains
- Nac — Namoi Channels and Floodplains

Strahler Stream Order

- 1st Order (Riparian Corridor Width 10 m)
- 2nd Order (Riparian Corridor Width 20 m)
- 3rd Order (Riparian Corridor Width 30 m)
- 4th Order (Riparian Corridor Width 40 m)
- 5th Order (Riparian Corridor Width 40 m)
- 9th Order (Riparian Corridor Width 50 m)

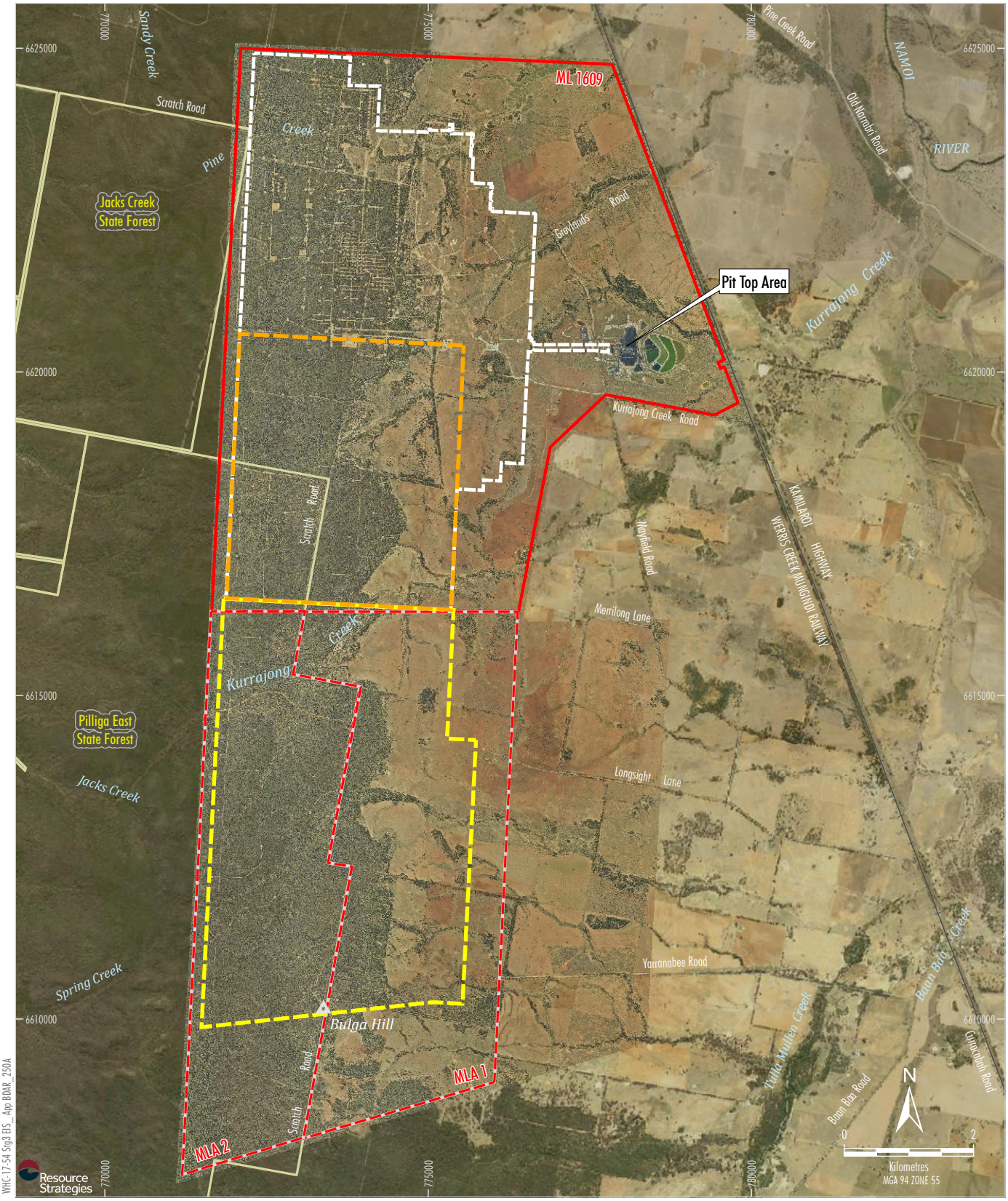
Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Location Map

Figure 9



Source: NCOPL (2019); NSW Spatial Services (2019)

LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Underground Mine Footprint
- Underground Mine Footprint to be Extended for Project
- Project Underground Mine Footprint

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Aerial Photo

Figure 10

The Project is located in the Namoi River catchment and within the tributary catchments of Kurrajong Creek, Pine Creek and Tulla Mullen Creek. These creeks are ephemeral and flow west to east across the Subject land, with flow likely occurring only during heavy rainfall events. Kurrajong Creek would be traversed by the Development Footprint (Figure 8). The Namoi River flows in a north-westerly direction approximately 3-5 km to the east of the eastern boundary of the Project area.

2.5 WETLANDS

There are no State or Commonwealth mapped wetlands on, or adjacent to, the Subject land (after DAWE, 2020a; DPIE, 2020c).

2.6 KARST, CAVES, CREVICES AND CLIFFS

Rocky outcrops with bat habitat were identified in the Subject land (Figure 8). Bulga Hill to the south of the Development Footprint that contains bat habitat was specifically avoided by the Project (Section 5.1).

2.7 AREAS OF OUTSTANDING BIODIVERSITY VALUE

There are no Areas of Outstanding Biodiversity Value listed under the NSW *Biodiversity Conservation Regulation 2017* (BC Regulation) associated with the Subject land.

2.8 MIGRATORY SPECIES POTENTIAL FLYWAYS

There are no defined potential flyways for migratory species listed under the EPBC Act that pass over the Subject land; however, migratory birds could fly over the Subject land similar to most areas in NSW, e.g. Cattle Egret (*Bubulcus ibis*), Great Egret (*Ardea alba*), Australian Painted Snipe (*Rostratula australis*), Latham's Snipe (*Gallinago hardwickii*), Common Sandpiper (*Actitis hypoleucos*), Pectoral Sandpiper (*Calidris melanotos*), Sharp-tailed Sandpiper (*Calidris acuminata*), Curlew Sandpiper (*Calidris ferruginea*), White-throated Needletail (*Hirundapus caudacutus*), Fork-tailed Swift (*Apus pacificus*), Rainbow Bee-eater (*Merops ornatus*), Satin Flycatcher (*Myiagra cyanoleuca*) and Yellow Wagtail (*Motacilla flava*) (AMBS, 2020b) (Attachment C).

2.9 SITE CONTEXT COMPONENTS

A site-based development method described in the BAM (OEH, 2017a) was applied to the Project as the Project is not eligible for the streamlined assessment modules described in the BAM (OEH, 2017a).

The extent of native vegetation cover is described in Section 2.2. The patch size relative to the vegetation zone is described in Section 3.3.2. There are no additional features required to be assessed by the SEARs.

Areas not covered by native vegetation on the Site Map (Figure 8) are cleared of native vegetation and are either exotic or bare ground. There were no notable differences between mapped vegetation extent and aerial imagery.

3 NATIVE VEGETATION

This section provides a description of the native vegetation relevant to the Development Footprint.

3.1 PLANT COMMUNITY TYPES

Plant Community Types (PCTs) on the Subject land were identified and mapped by AMBS (2020a) (Attachment B) in accordance with the BAM (OEH, 2017a) and the *BioNet Vegetation Classification* (DPIE, 2020b) (Figure 11). Detailed methods and results are provided in Attachment B.

A total of 13 PCTs were identified within the phases of the Development Footprint. The PCTs (and vegetation zones of broad condition states) within each phase of the Development Footprint are listed in Table 2. AMBS (2020a) (Attachment B) assigned the PCTs a site-specific vegetation community name as listed in Table 2.

The native vegetation in the Development Footprint predominantly comprises Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (PCT 404) (approximately 31%, 206.8 ha) and White Bloodwood – Red Ironbark – Black Cypress Woodland (PCT 405) (approximately 15%, 101.1 ha).

Within the ETL Management Area, it is assumed that trees, shrubs and regeneration would be removed for construction and maintenance of the ETL. Indirect impacts on vegetation/habitat from areas of potential ponding due to subsidence effects (WRM, 2020) (Section 6.2.1) have been conservatively assumed as a long-term loss, vegetation integrity score to zero in the BAM Credit Calculator. Similarly, the indirect impacts on vegetation/habitat to account for potential cracking impacts on trees (Section 6.2.1) has been accounted for by creating management zones and manually removing the trees from the future vegetation integrity score calculation.

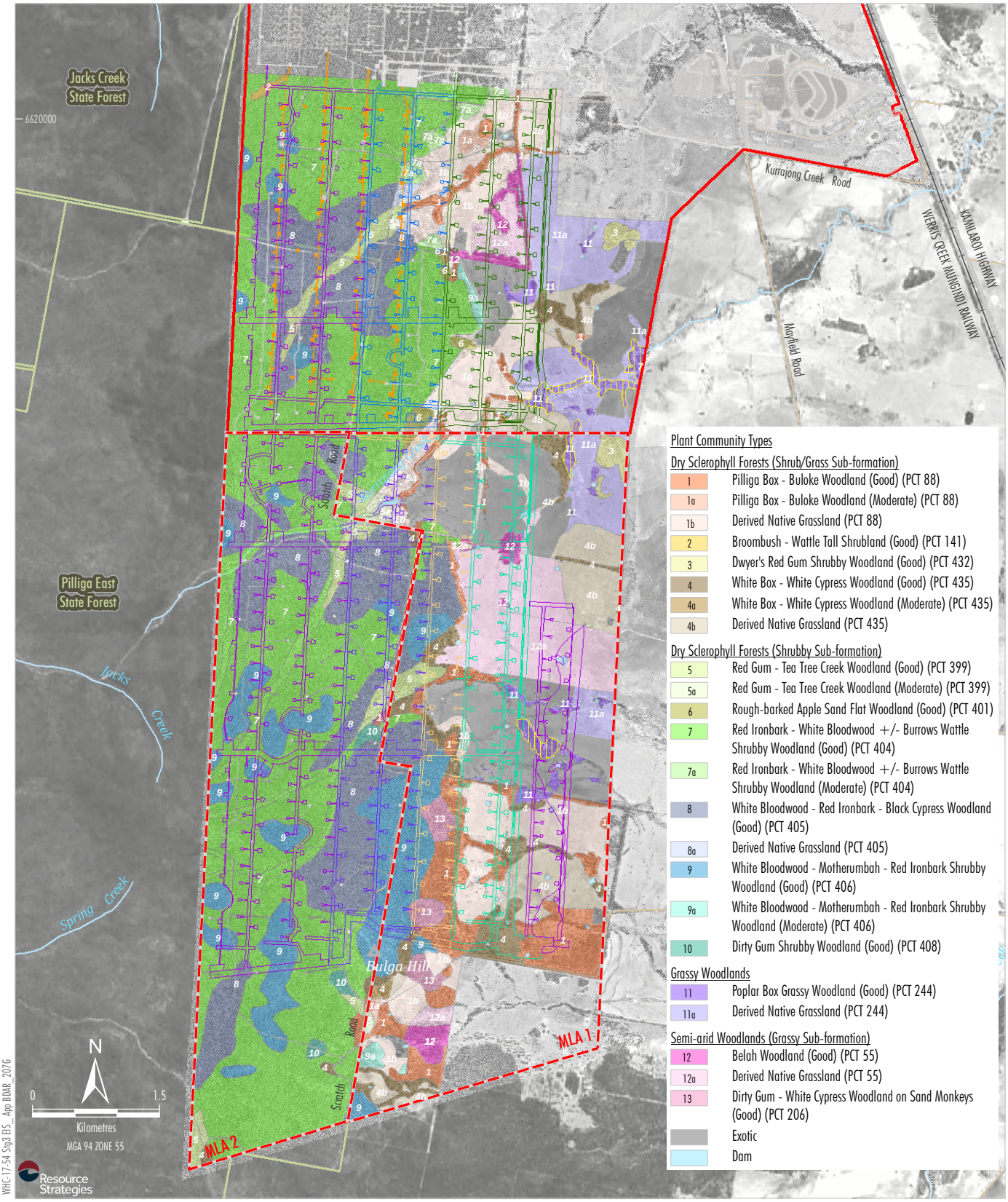
3.1.1 Threatened Ecological Communities

AMBS (2020a) (Attachment B) undertook targeted surveys for potentially occurring threatened ecological communities (TECs) listed under the BC Act or the EPBC Act. No TECs listed under the BC Act occur within the Subject land or Development Footprint. A detailed review is provided in Attachment B.

One TEC listed under the EPBC Act occurs within the Subject land or Development Footprint, namely the *Poplar Box Grassy Woodland on Alluvial Plains* endangered ecological community (Poplar Box Woodland EEC) (Figure 12). Approximately 43.1 ha of the Poplar Box Woodland EEC has been mapped in the Subject land, however only approximately 7.9 ha of the Poplar Box Woodland EEC has been mapped within the Development Footprint (AMBS, 2020a) (Attachment B).

3.2 PLANT COMMUNITY TYPES PERCENT CLEARED VALUE

The BAM (OEH, 2017a) defines 'Percent Cleared Value' as the percentage of a PCT that has been cleared as a proportion of its pre-1750 extent, as identified in the *BioNet Vegetation Classification* (DPIE, 2020b). The 'Percent Cleared Value' for each PCT is listed in Section 6.1.1. All of the PCTs are over 30% of the estimated pre-European extent except PCT 55 and PCT 244 (Section 3.2). PCTs with a percent cleared value ≥70% and <90% are those that have a high sensitivity to loss under the BAM (OEH, 2017a).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Ecological Communities

- Poplar Box Grassy Woodland on Alluvial Plains

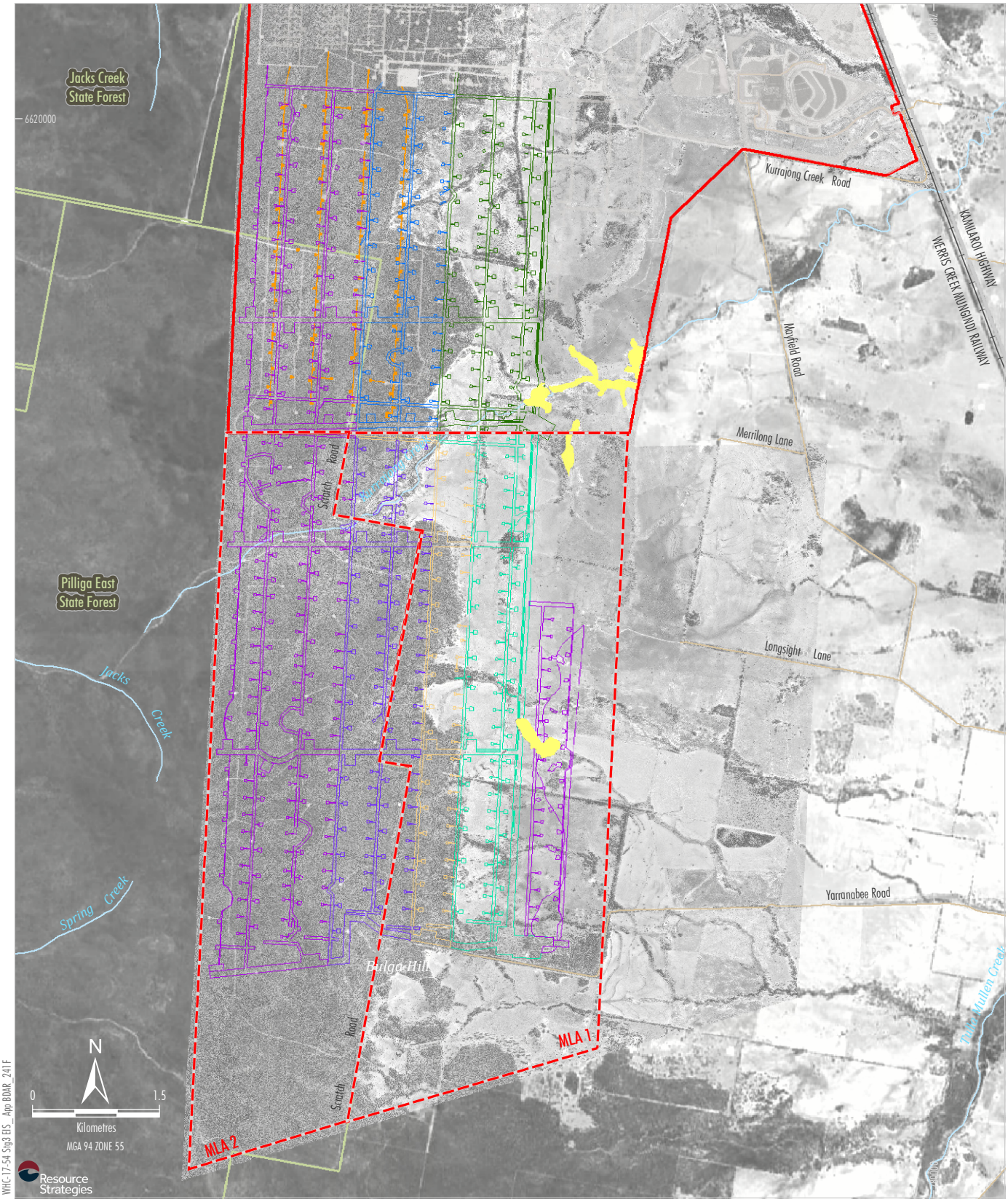
Source: NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Vegetation Mapping

Figure 11



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Ecological Communities

- Poplar Box Grassy Woodland on Alluvial Plains

Source: NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Threatened Ecological Communities

Figure 12

Table 2
Plant Community Types within the Phases of the Development Footprint

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
Dry Sclerophyll Forests (Shrub/Grass Sub-formation)																										
Pilliga Outwash Dry Sclerophyll Forests																										
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	38.4	0	2.6	41	14.2	0	0.8	15	3.6	0	3.6	2.1	2.1	3	0	3	2.6	0	5.8	8.4	63.9	0	3.4	5.8
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0.6	0.6	0	0	0
North-west Slopes Dry Sclerophyll Woodlands																										
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	9.3	0	0.7	10	2.8	0	0.2	3	0	0	0	0	0	0	0	0	4.7	0.1	5.3	10.1	16.8	0.1	0.9	5.3

Table 2 (Continued)
Plant Community Types within the Phases of the Development Footprint

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
Dry Sclerophyll Forest (Shrubby Sub-formation)																										
Western Slopes Dry Sclerophyll Forests																										
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0

Table 2 (Continued)
Plant Community Types within the Phases of the Development Footprint

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0.7	0	0.7	0	0	0	0	0	0	0	0	0	0.7	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0

Table 2 (Continued)
Plant Community Types within the Phases of the Development Footprint

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
Grassy Woodlands																										
Floodplain Transition Woodlands																										
11	Poplar Box Grassy Woodland (Good)	244	2.8[A]	0	0	2.8	3.1[B]	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3[C]	0.2	11[D]	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	16.2	0	4.4	20.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	3.3	16.2	0	4.4	3.3
Semi-arid Woodlands (Grassy Sub-formation)																										
North-west Floodplain Woodlands																										
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	2.6	0	0	2.6	21.4	0	4.2	25.6	0	0	0	1.6	1.6	0	0	0	6.7	0.4	13.5	20.6	32.3	0.4	4.2	13.5
North-west Alluvial Sand Woodlands																										
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**197.2**	**1.3**	**24.8**	**223.3**	**444.7**	**3.1**	**0**	**24.8**
Total Area (ha) Derived Native Grassland			**66.5**	**0**	**7.7**	**74.2**	**38.4**	**0**	**5.2**	**43.6**	**4.3**	**0**	**4.3**	**3.7**	**3.7**	**3**	**0**	**3**	**14**	**0.5**	**27.9**	**42.4**	**129.9**	**0.5**	**12.9**	**27.9**
Total Area (ha) Native Vegetation			**95.5**	**0.2**	**7.7**	**103.4**	**85.1**	**0.4**	**5.2**	**90.7**	**58.7**	**0.6**	**59.3**	**39.6**	**39.6**	**84.5**	**0.6**	**85.1**	**211.2**	**1.8**	**52.7**	**265.7**	**574.6**	**3.6**	**12.9**	**52.7**

Note: Highlighting in the above table is to separate the data for each phase.

[A] Approximately 2.1 ha represents the Poplar Box Woodland EEC.

[B] Approximately 1 ha represents the Poplar Box Woodland EEC.

[C] Approximately 0.7 ha represents the Poplar Box Woodland EEC.

[D] Approximately 4.1 ha represents the Poplar Box Woodland EEC.

3.3 VEGETATION INTEGRITY ASSESSMENT

Vegetation integrity is a measure of the condition of native vegetation. The vegetation integrity (site condition) plot data was independently collected by AMBS (2020a) (Attachment B). The vegetation integrity (site condition) plots used in the BAM Credit Calculator are shown on Figure 13. A total of 126 plots were used in this assessment, with the number of plots meeting or exceeding the requirements per area of each zone. The vegetation integrity (site condition) data is provided in Attachment D1.

3.3.1 Vegetation Zones

Twenty-three vegetation zones (i.e. areas of native vegetation that are the same PCT and similar broad condition states) were mapped in the Subject land (Table 2). Vegetation zones were assigned a condition class value of 'good', 'moderate' or 'derived native grassland' (Table 2). All of the PCTs recorded in the Development Footprint have a 'sensitivity to loss' value of 'low', except for PCT 55, which has a 'high' 'sensitivity to loss' and PCT 244 and 435, which have a 'very high' 'sensitivity to loss', according to the DPIE (2020b).

3.3.2 Patch Size

As described previously, land to the west of the Subject land consists of extensive native vegetation within Jacks Creek State Forest, Pilliga East State Forest and neighbouring reserves. The patch size is greater than 100 ha for each vegetation zone (Table 3).

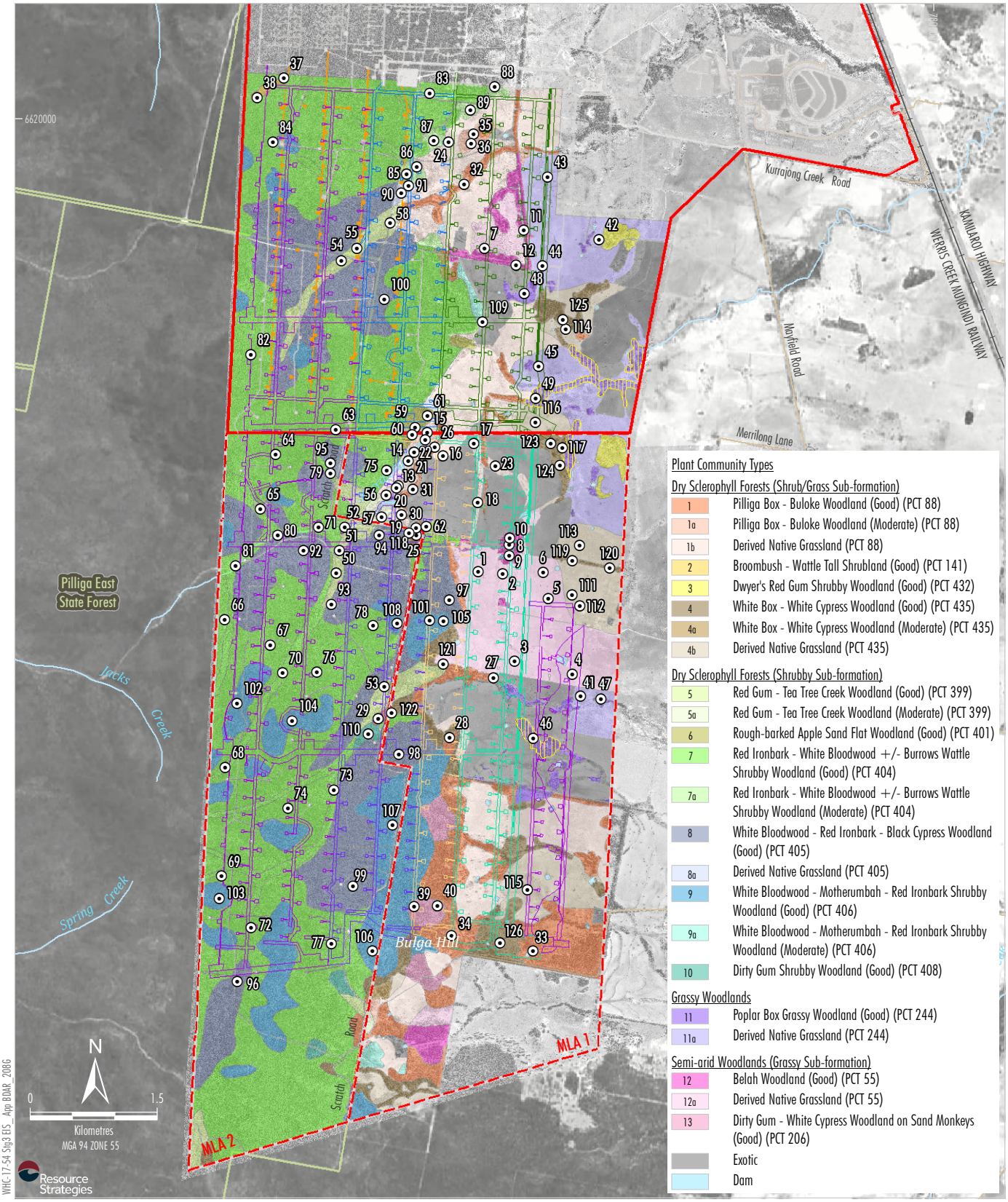
3.3.3 Vegetation Integrity Score

The BAM Credit Calculator calculates the 'composition condition score', 'structure condition score' and 'function condition score' for each vegetation zone using input from the plot data (Attachment D2). Sixteen out of 23 vegetation zones have hollow-bearing trees. Those that do not have hollow-bearing trees are either degraded woodlands in moderate condition (Vegetation Zones 1a and 5a), shrubland without hollows (Vegetation Zone 2), or derived native grassland (Vegetation Zones 4b, 8a, 11a and 12a). All PCTs (except Vegetation Zone 2) were represented in the Subject land by vegetation zones of the PCTs with hollow-bearing trees, therefore no potential candidate threatened species were excluded from the assessment based on the absence of tree hollows in these zones.

An overall score of the vegetation integrity for each vegetation zone is calculated in the BAM Credit Calculator using input from the plot data. According to the BAM Credit Calculator, all of the vegetation zones except 4b (in Phases 1 and 2) and 11a (in Phase 1) (both derived native grasslands) have a vegetation integrity score requiring an offset (Attachment D2).

3.3.4 Local Data

It was not necessary to use local data to deviate from the DPIE databases (DPIE, 2020b and 2020d).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6
- Vegetation Integrity Plots

Threatened Ecological Communities

- Poplar Box Grassy Woodland on Alluvial Plains

Source: NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Vegetation Integrity Plots

Figure 13

4 THREATENED SPECIES

Threatened species that are 'ecosystem credit species' and/or 'species credit species' are pre-determined by the DPIE in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The BAM (OEH, 2017a) states:

> *Threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection, are identified in the Threatened Biodiversity Data Collection as ecosystem credit species. Targeted survey is not required for these species.*
>
> …
>
> *Species credit species are threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits.*

4.1 ECOSYSTEM CREDIT SPECIES - HABITAT SUITABILITY ASSESSMENT

In accordance with the BAM (OEH, 2017a), assessing the habitat suitability for an ecosystem credit species involves the following steps:

Step 1: Identify threatened species for assessment; and

Step 2: Assessment of the habitat constraints and vagrant species on the Subject land.

These steps are applied below.

4.1.1 Step 1: Identify Ecosystem Species for Assessment

A total of 38 ecosystem credit species for assessment are listed in Table 3 from the BAM Credit Calculator (for one or more phases as represented by the dot in the table). Relevant databases and literature were reviewed for additional ecosystem credit species recorded in MLA 1 and/or MLA 2 and as a result, no additional species were added to Table 3. Species shaded in Table 3 are species with records in MLA 1 and/or MLA 2.

There are a number of ecosystem credit species listed in Table 3 with a high 'sensitivity to potential gain' (as defined by DPIE [2020d]) that potentially use habitat across the vegetation zones (e.g. woodland birds). The ecosystem credit calculation uses the highest 'sensitivity to potential gain' class in the credit calculation for a vegetation zone. In this case, the high 'sensitivity to potential gain' would be used in the BAM Credit Calculator to generate the ecosystem credits.

4.1.2 Step 2: Assessment of the Habitat Constraints and Vagrant Species on the Subject Land

A total of 24 threatened species listed in Table 3 have not been recorded in MLA 1 or MLA 2 and are unlikely to be relevant to the Project (i.e. the species in Table 3 that are not highlighted). The BAM (OEH, 2017a) states:

> *The assessor may opt to undertake an additional assessment of the habitat constraints on the subject land for the threatened species predicted for assessment.*

Table 3
Ecosystem Species from the BAM Credit Calculator

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Sensitivity to Potential Gain	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
		BC Act[1]	EPBC Act[2]								
Birds											
Leipoa ocellata	Malleefowl	E	V	Ecosystem	High	-	-	-	-	-	●
Falco hypoleucos	Grey Falcon	E	-	Ecosystem	Moderate	●	●	-	●	-	●
Lophoictinia isura	Square-tailed Kite	V	-	Ecosystem*	Moderate	●	●	●	●	●	●
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Ecosystem*	Moderate	●	●	●	●	●	●
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Ecosystem*	High	●	●	●	●	●	●
Circus assimilis	Spotted Harrier	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Hieraaetus morphnoides	Little Eagle	V	-	Ecosystem*	Moderate	●	●	●	●	●	●
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Ecosystem*	High	●	●	●	●	●	●
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Ecosystem*	Moderate (foraging)	-	-	●	●	●	●
Glossopsitta pusilla	Little Lorikeet	V	-	Ecosystem	High	●	●	●	●	●	●
Neophema pulchella	Turquoise Parrot	V	-	Ecosystem	High	●	●	●	●	●	●
Lathamus discolor	Swift Parrot	E	CE	Ecosystem*	Moderate	●	●	●	●	●	●
Polytelis swainsonii	Superb Parrot	V	V	Ecosystem*	Moderate (foraging)	●	●	●	●	●	●
Tyto novaehollandiae	Masked Owl	V	-	Ecosystem*	High	●	●	●	●	●	●
Ninox connivens	Barking Owl	V	-	Ecosystem*	High	●	●	●	●	●	●
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Ecosystem	High	●	●	●	●	●	●
Chthonicola sagittata	Speckled Warbler	V	-	Ecosystem	High	●	●	●	●	●	●
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Anthochaera phrygia	Regent Honeyeater	CE	CE	Ecosystem*	High	●	●	-	●	●	●

Table 3 (Continued)
Ecosystem Species from the BAM Credit Calculator

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Sensitivity to Potential Gain	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
		BC Act[1]	EPBC Act[2]								
Grantiella picta	Painted Honeyeater	V	V	Ecosystem	Moderate	●	●	●	●	●	●
Certhionyx variegatus	Pied Honeyeater	V	-	Ecosystem	Moderate	●	●	-	-	-	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Petroica boodang	Scarlet Robin	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Pachycephala inornata	Gilbert's Whistler	V	-	Ecosystem	Moderate	-	-	●	●	●	●
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Stagonopleura guttata	Diamond Firetail	V	-	Ecosystem	Moderate	●	●	●	●	●	●
Mammals											
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Ecosystem	High	●	●	●	●	●	●
Sminthopsis macroura	Stripe-faced Dunnart	V	-	Ecosystem	High	●	●	-	●	-	●
Phascolarctos cinereus	Koala	V	V	Ecosystem*	High	●	●	●	●	●	●
Macropus dorsalis	Black-striped Wallaby	E	-	Ecosystem	High	●	●	●	●	●	●
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Ecosystem*	High	-	-	●	●	●	●
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	High	●	●	●	●	●	●
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Ecosystem*	High (foraging)	-	-	●	●	●	●
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Ecosystem	High	●	●	●	●	●	●
Chalinolobus picatus	Little Pied Bat	V	-	Ecosystem	High	●	●	●	●	●	●
Pseudomys pilligaensis	Pilliga Mouse	V	V	Ecosystem	High	●	●	●	●	●	●

Note: Highlighted species are species recorded in MLA 1 and/or MLA 2.

* This species is a species credit species in specific cases as described in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d).

[1] Conservation status under the BC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; V = Vulnerable.

[3] Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

No ecosystem species were removed from the BAM Credit Calculator as the species with the highest 'sensitivity to potential gain' class were recorded in the Project area and therefore removal of any other species would not change the ecosystem credit requirement.

4.2 SPECIES CREDIT SPECIES - HABITAT SUITABILITY ASSESSMENT

Assessing the habitat suitability for a species credit species involves the following steps:

Step 1: Identify species credit species for assessment.

Step 2: Assessment of the habitat constraints for species credit species on the Subject land.

Step 3: Identify candidate species credit species for further assessment.

Step 4: Determine presence or absence of a candidate species credit species.

Step 5: Determine the area or count, and location of suitable habitat for a species credit species.

Step 6: Determine the habitat condition within the Habitat (Species Polygon) for species assessed by area.

These steps are discussed below.

4.2.1 Step 1: Identify Species Credit Species for Assessment

A total of 43 species credit species are listed in Table 4 for assessment, of which 42 are from the BAM Credit Calculator (for one or more phases as represented by the dots in the table) as required by the BAM (OEH, 2017a). Relevant databases and literature were reviewed for additional species credit species recorded in MLA 1 and/or MLA 2 and as a result, the White-throated Needletail was added to Table 4.

The White-throated Needletail[4] has been recorded in MLA 2. Although this species is listed as threatened under the EPBC Act, it is not listed as threatened under the BC Act, and therefore, is not listed in the BAM Credit Calculator.

Species shaded in Table 4 are species with records in MLA 1 and/or MLA 2. Scant Pomaderris (*Pomaderris queenslandica*) is a threatened plant that has been recorded to the south of the Development Footprint, but this species was not found in the Development Footprint, despite targeted flora surveys. Species credits species, such as Scant Pomaderris, cannot be predicted to occur by habitat surrogates.

4.2.1.1 Review of Databases and Past Flora Surveys

The following databases were reviewed for any nearby potentially relevant threatened flora species records:

- *BioNet Atlas Search* (DPIE, 2020a);
- *Atlas of Living Australia* (ALA) (2019); and
- *Protected Matters Search* (DAWE, 2020d).

[4] This species was listed under the EPBC Act on the 4 July 2019.

Table 4
Initial List of Species Credit Species for Assessment

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
		BC Act[1]	EPBC Act[2]							
Flora										
Bertya opponens	Coolabah Bertya	V	V	Species	-	-	●	●	●	●
Commersonia procumbens (syn. Androcalva procumbens)	-	V	V	Species	-	-	●	●	●	●
Cyperus conicus	-	E	-	Species	●	●	-	-	-	-
Dichanthium setosum	Bluegrass	V	V	Species	●	●	-	●	●	●
Digitaria porrecta	Finger Panic Grass	E	-	Species	●	●	-	●	-	●
Diuris tricolor	Pine Donkey Orchid	V	-	Species	-	-	●	●	●	●
Homoranthus darwinioides	-	V	V	Species	-	-	-	-	-	●
Lepidium aschersonii	Spiny Peppercress	V	V	Species	●	●	●	●	●	●
Monotaxis macrophylla	Large-leafed Monotaxis	E	-	Species	-	-	●	●	●	●
Polygala linariifolia	Native Milkwort	E	-	Species	●	●	●	●	●	●
Pomaderris queenslandica	Scant Pomaderris	E	-	Species	●	●	●	●	●	●
Pterostylis cobarensis	Greenhood Orchid	V	-	Species	-	-	●	●	●	●
Swainsona murrayana	Slender Darling Pea	V	V	Species	●	●	-	●	-	●
Swainsona sericea	Silky Swainson-pea	V	-	Species	-	-	●	●	●	●
Tylophora linearis	-	V	E	Species	●	●	●	●	●	●
Zieria ingramii	Keith's Zieria	E	E	Species	-	-	●	●	●	●
Reptiles										
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V	Species	●	●	-	-	-	-

Table 4 (Continued)
Initial List of Species Credit Species for Assessment

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
		BC Act[1]	EPBC Act[2]							
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species	●	-	●	●	●	●
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	Species	●	●	●	●	●	●
Birds										
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	●	●	●	●	●	●
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	●	●	●	●	●	●
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	Ma	Species/Ecosystem	●	●	●	●	●	●
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	●	●	●	●	●	●
Ardeotis australis	Australian Bustard	E	-	Species	●	●	-	●	●	●
Burhinus grallarius	Bush Stone-curlew	E	-	Species	●	●	●	●	●	●
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/Ecosystem	●	●	●	●	●	●
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	-	-	●	●	●	●
Lathamus discolour	Swift Parrot	E	CE	Species/Ecosystem	●	●	●	●	●	●
Polytelis swainsonii	Superb Parrot	V	V	Species/Ecosystem	●	●	●	●	●	●
Tyto novaehollandiae	Masked Owl	V	-	Species/Ecosystem	●	●	●	●	●	●
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	●	●	●	●	●	●
Hirundapus caudacutus	White-throated Needletail	-	V	Species	-	-	-	-	-	-
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/Ecosystem	●	●	-	●	●	●
Mammals										
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Species	●	-	-	-	-	-
Phascolarctos cinereus	Koala	V	V	Species/Ecosystem	●	●	●	●	●	●

Table 4 (Continued)
Initial List of Species Credit Species for Assessment

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
		BC Act[1]	EPBC Act[2]							
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species	●	●	●	●	●	●
Petaurus norfolcensis	Squirrel Glider	V	-	Species	●	●	●	●	●	●
Aepyprymnus rufescens	Rufous Bettong	V	-	Species	●	-	●	●	●	●
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species	●	●	●	●	●	●
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem	-	-	●	●	●	●
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/Ecosystem	-	-	●	●	●	●
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	●	●	●	●	●	●
Vespadelus troughtoni	Eastern Cave Bat	V	-	Species	●	●	●	●	●	●

Note: Highlighted species are species recorded in MLA 1 and/or MLA 2.

1 Conservation status under the BC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; V = Vulnerable; Ma = Marine.

3 Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

Flora studies previously undertaken in Mining Lease 1609 (ML 1609) and surrounds (Table 5) were also reviewed for any nearby potentially relevant threatened flora species records.

Table 5
Previous Flora Studies in ML 1609 and Surrounds

Surveys	Timing	Location	Reference
Flora surveys for Narrabri Underground Mine Stage 1	2005	Inside ML 1609	Ecotone Ecological Consultants (Ecotone) (2007)
Flora surveys for Narrabri Underground Mine Stage 2	2009	Inside ML 1609	Ecotone (2009) and FloraSearch (2009)
Narrabri Underground Mine ecological monitoring surveys	Between 2011 and 2019	Inside ML 1609	ELA (2012, 2013a, 2013b, 2015a, 2015b, 2015c, 2015d, 2016a, 2016c, 2017a, 2017b, 2018a, 2018b, 2018c, 2018d and 2020)
Initial flora surveys for Narrabri Underground Mine Stage 3 Extension	2016	South of ML 1609	ELA (2016b)

Attachment E provides a summary of the threatened flora species records in the locality from database and survey records. Threatened flora species records are shown on Figure 14.

A description of the previous flora studies is provided below.

Flora Surveys for Narrabri Underground Mine Stage 1

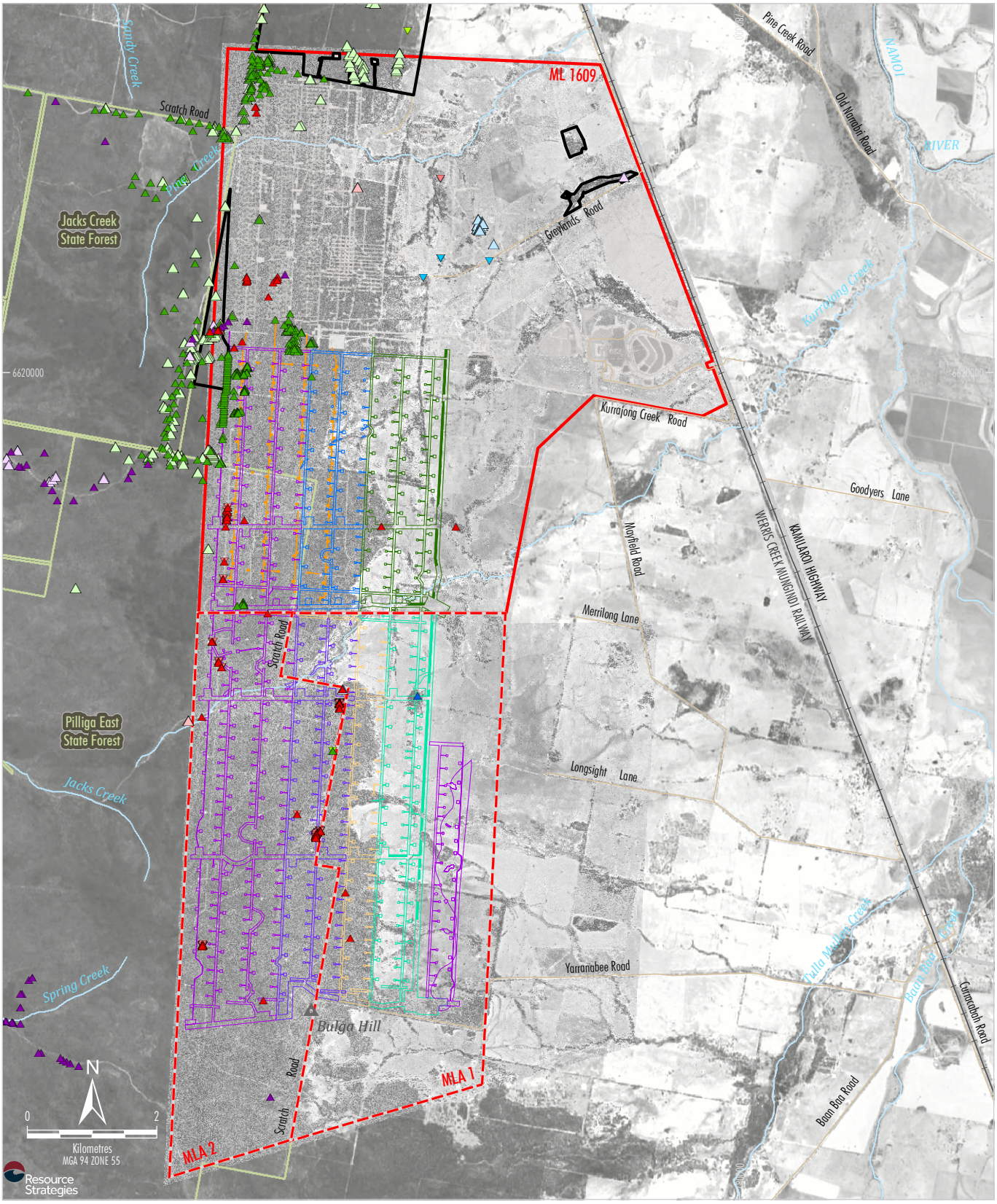
Ecotone (2007) conducted flora surveys over two days in October 2005 for the Narrabri Coal Project Stage 1. The surveys were focused on the Pit Top Area (Figure 2). The flora survey involved a traverse on foot to assess the range of floristic variation, vegetation structure and condition of the vegetation (Ecotone, 2007). Coolabah Bertya was not listed as a threatened species at the time of the survey[5]; no other threatened flora species were recorded.

Flora Surveys for Narrabri Underground Mine Stage 2

Flora surveys were undertaken over five days in January 2009 by Ecotone (2009). The surveys were conducted in select areas within ML 1609. The flora survey techniques involved 400 square metres (m^2) flora quadrats, random meanders, targeted search for threatened flora species and vegetation mapping (Ecotone, 2009). Coolabah Bertya was not listed as a threatened species at the time of the survey, no other threatened flora species were recorded.

A supplementary flora survey was undertaken in September 2009 by FloraSearch (2009). The survey involved vehicle and foot traverses within ML 1609 (FloraSearch, 2009). FloraSearch (2009) recorded a large population of Coolabah Bertya along the western and northern boundaries of ML 1609, extending into the Jacks Creek and Pilliga East State Forests and to the north of the Subject land. No other threatened flora species were recorded.

[5] Coolabah Bertya was listed on 4 December 2009.



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Flora

Survey	Monitoring	Database	
▲	▼	△	Coolabah Bertya
▲		△	Scant Pomaderris
▲	▼	△	Spiny Peppercress
▲	▼	△	Tylophora linearis

Sources:
Survey - AMBS (2019a); AMBS (2020a); ELA (2006); ELA (2016a); ELA (2019a); FloraSearch (2009)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); DPIE (2019)

Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Threatened Flora

Figure 14

Ecological Monitoring Surveys (Between 2011 and 2019)

Ongoing ecological monitoring surveys have been conducted in ML 1609 to monitor subsidence impacts on native vegetation, fauna and aquatic biota (ELA, 2012; 2013a; 2013b; 2015a; 2015b; 2015c; 2015d; 2016a; 2017a; 2018b; 2018c; 2018d and 2020). The monitoring programme is documented in the *Narrabri Mine Biodiversity Management Plan* (BMP) (ELA, 2019a). The flora survey methods included: remote sensing, woodland and riparian vegetation monitoring via flora plots and targeted threatened flora species surveys.

There are four existing offset areas within ML 1609 (Section 10). The offset areas have been subject to management activities since 2014. Management activities undertaken in the offset areas include, weed control via spraying, feral animal management via baiting and trapping and fire break maintenance.

Ecological monitoring surveys have been conducted in the existing offset areas (ELA, 2016c; 2017b and 2018a). The monitoring involves standardised plot surveys and targeted searches for threatened flora species.

The Spiny Peppercress (*Lepidium aschersonii*) and *Tylophora linearis* have been recorded during the ecological monitoring surveys (Figure 14). Coolabah Bertya is known to occur in the Narrabri Mine existing offset areas (ELA, 2016c; 2017b and 2018a).

Initial Flora Surveys for Narrabri Underground Mine Stage 3 Extension Project

Flora surveys have been conducted in an area south of ML 1609 for the Project, and preparatory exploration activities. Initial flora surveys in this area were undertaken by ELA (2016b) in June 2015 and January 2016. Two threatened flora species were recorded during the 2016 surveys, namely Coolabah Bertya and *Tylophora linearis* (Figure 14).

Other Surveys

It is noted that *Myriophyllum implicatum,* a creeping matted herb with a habitat preference for shallow wetlands, was recorded during flora surveys were undertaken for the Narrabri Gas Project (approximately 18 ha north-west of the Project) (ELA, 2016d). Potential habitat for this species (wetlands with a species composition typical for the species [DPIE, 2020d; Bell *et. al.,* 2012]) is absent from the Project area. This species is not considered further.

4.2.1.2 Review of Databases and Past Fauna Surveys

The following databases were reviewed for any nearby potentially relevant threatened fauna species records (particularly species credit species):

- *BioNet Atlas Search* (DPIE, 2020a);
- *Birdlife Australia* database search (2019);
- ALA (2019); and
- *Protected Matters Search* (DAWE, 2020d).

Fauna studies previously undertaken in ML 1609 and surrounds (Table 6) were also reviewed for any nearby potentially relevant threatened fauna species records.

Table 6
Previous Fauna Studies in ML 1609 and Surrounds

Surveys	Timing	Location	Reference
Fauna surveys for Narrabri Underground Mine Stage 1	2007	Inside ML 1609	Ecotone (2007)
Fauna surveys for Narrabri Underground Mine Stage 2	2009	Inside ML 1609	Ecotone (2009)
Narrabri Underground Mine ecological monitoring surveys	Between 2011 and 2019	Inside ML 1609	ELA (2012, 2013a, 2013b, 2015a, 2015b, 2015c, 2015d, 2016a, 2016c, 2017a, 2017b, 2018a, 2018b, 2018c, 2018d and 2020)
Initial fauna surveys for Narrabri Underground Mine Stage 3 Extension	2016	South of ML 1609	ELA (2016b)

Attachment E provides a summary of the threatened fauna species records in the locality from database and survey records. Threatened fauna species records are shown on Figures 15, 16 and 17.

A description of the previous fauna studies is provided below.

Fauna Surveys for Narrabri Underground Mine Stage 1

Ecotone (2007) conducted fauna surveys over two days in October 2005 for the Narrabri Coal Project Stage 1 Ecological Assessment. The surveys were focused on the Pit Top Area and along Kurrajong Creek (Figure 2). The survey techniques included habitat assessments, Anabat detectors, harp traps, spotlighting, call playback, diurnal bird surveys, active reptile and amphibian surveys and opportunistic observations (Ecotone, 2007). No species credit species were recorded within the Subject land during the 2005 surveys.

Fauna Surveys for Narrabri Underground Mine Stage 2

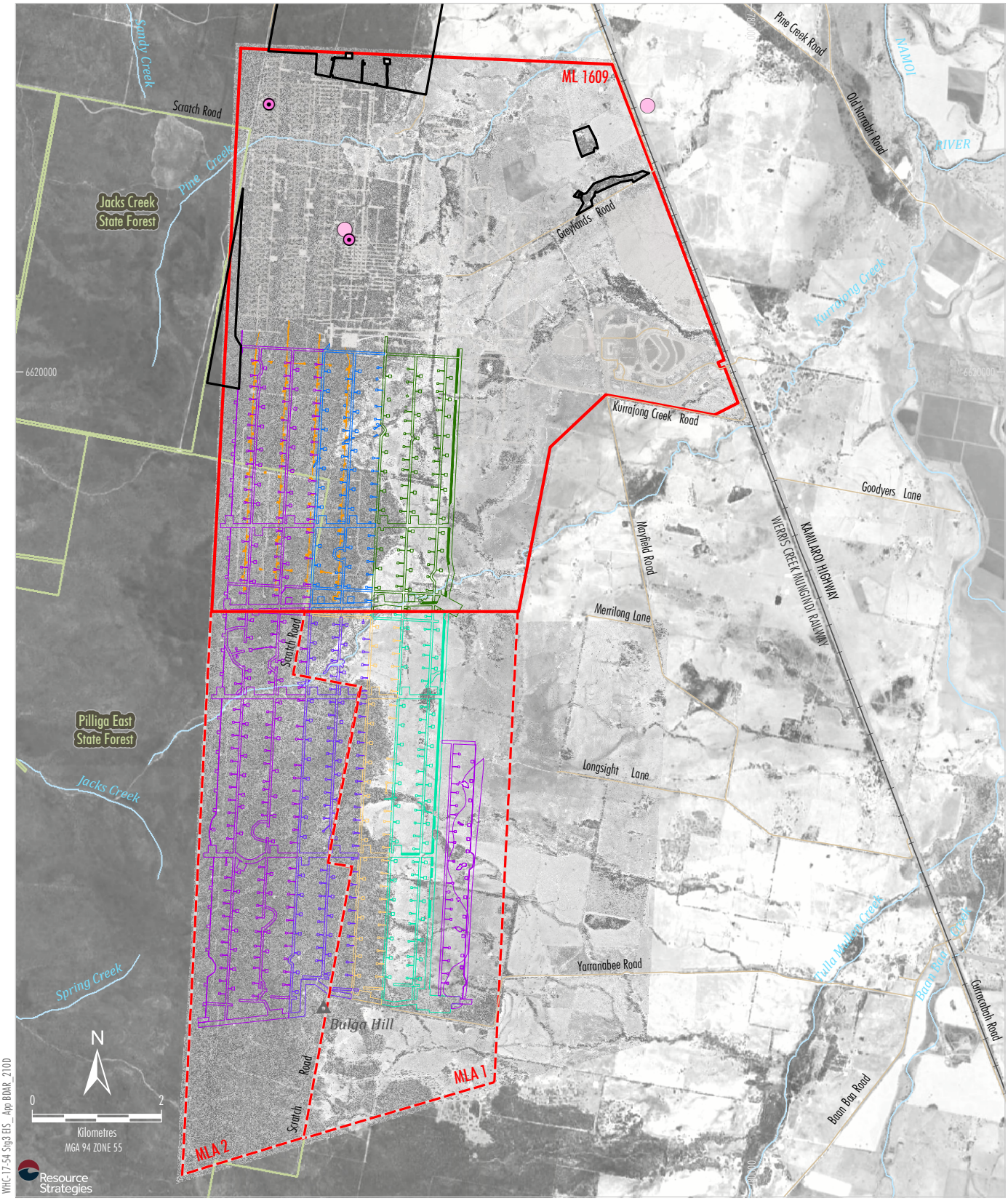
Ecotone (2009) conducted fauna surveys over five days in January 2009 within ML 1609 and over two days along the pipeline corridor. The survey techniques included habitat assessments, Elliot traps, cage traps, pitfall traps, hair funnel traps, Anabat detectors, harp traps, spotlighting, nocturnal call playback, diurnal bird surveys, active reptile and amphibian surveys, searches for signs of fauna (e.g. scats and scratches) and opportunistic observations (Ecotone, 2009).

Five threatened species credit species were identified by Ecotone (2009), namely the Pale-headed Snake (*Hoplocephalus bitorquatus*), Superb Parrot[6], Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Koala (*Phascolarctos cinereus*) and Eastern Pygmy-possum (*Cercartetus nanus*) (Figures 15, 16 and 17).

Ecological Monitoring Surveys (Between 2011 and 2019)

Ongoing ecological monitoring surveys have been conducted in ML 1609 to monitor predicted subsidence impacts on native vegetation, fauna and aquatic biota (ELA, 2012; 2013a; 2013b; 2015a; 2015b; 2015c; 2015d; 2016a; 2017a; 2018b; 2018c; 2018d and 2020). The monitoring programme is documented in the BMP (ELA, 2019a). The fauna survey methodologies employed during the monitoring included diurnal bird surveys, Koala searches, baited hair funnel traps, infra-red motion cameras, Anabat detectors, cage traps and spotlighting.

[6] In 2009, Cenwest (2009) undertook a review and describes that the site is near the northern range extremity of the Superb Parrot and it does not breed within the locality.



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

- Pale-headed Snake

Sources:
Survey - AMBS (2019b); Ecotone (2009)
Database - ALA (2019); DPIE (2019)

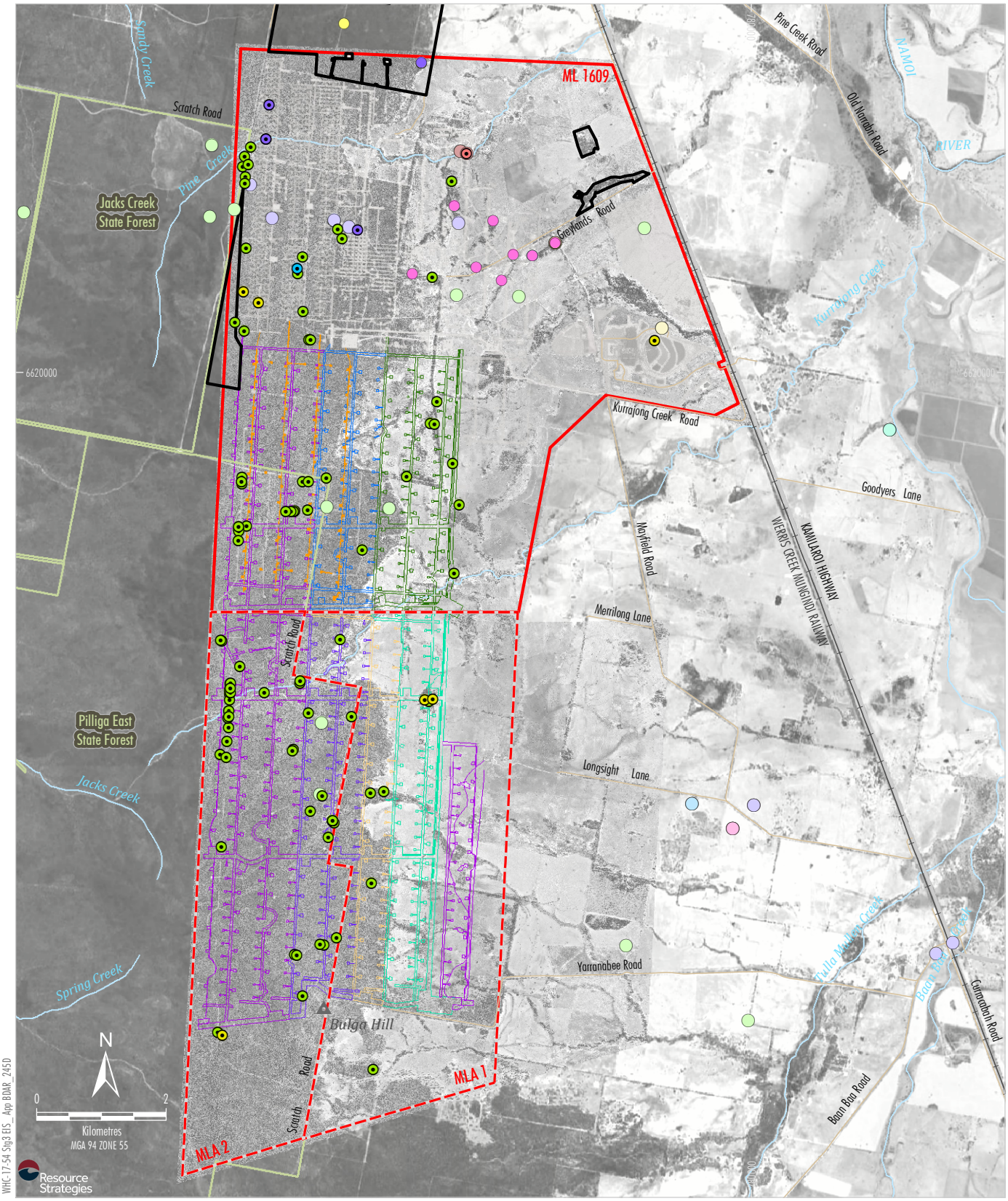
Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Threatened Fauna - Reptiles

Figure 15



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey	Monitoring	Database	
		●	Freckled Duck
●		●	Square-tailed Kite
	●	●	Spotted Harrier
	●	●	Little Eagle
●		●	Glossy Black-Cockatoo
●	●	●	Little Lorikeet
●	●	●	Turquoise Parrot
●		●	Superb Parrot

Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019)

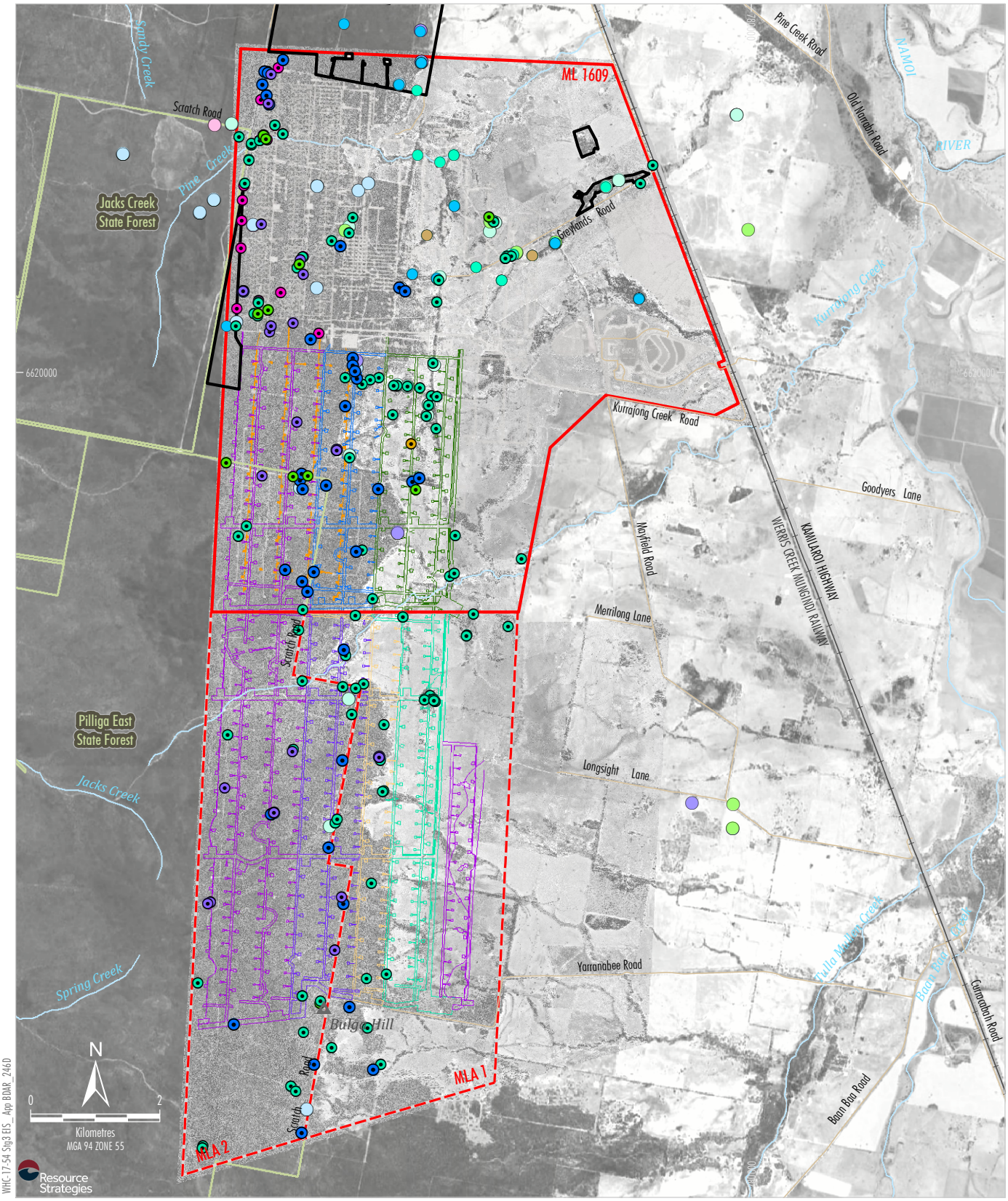
Sources:
Survey - AMBS (2019b); AMBS (2020b); Ecotone (2007); Ecotone (2009); ELA (2016a); ELA (2019b)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); BirdLife Australia (2019); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Threatened Fauna - Birds

Figure 16a



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey	Monitoring	Database	
●		●	White-throated Needletail
	●	●	Brown Treecreeper (eastern subspecies)
●	●	●	Speckled Warbler
●			Scarlet Robin
●	●	●	Grey-crowned Babbler (eastern subspecies)
●	●		Painted Honeyeater
●		●	Varied Sittella
●		●	Dusky Woodswallow

Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019)

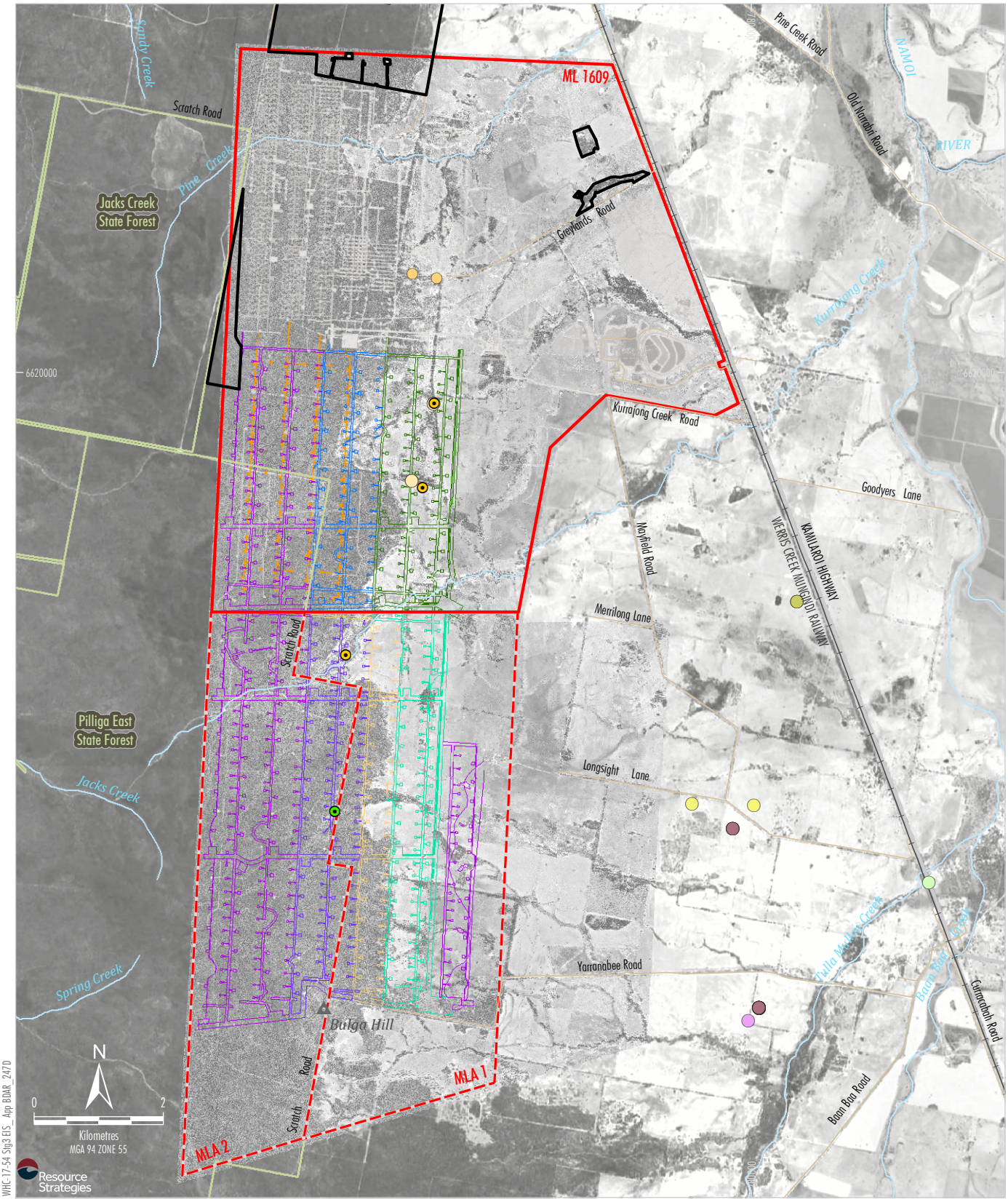
Source:
Survey - AMBS (2019b); AMBS (2020b); Ecotone (2007); ELA (2016a); ELA (2019b)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); BirdLife Australia (2019); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Threatened Fauna - Birds

Figure 16b



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey / Monitoring / Database

- Diamond Firetail
- Hooded Robin (south-eastern form)
- Australian Painted Snipe
- Black Falcon
- Black-breasted Buzzard
- Barking Owl
- Masked Owl
- White-bellied Sea-Eagle
- White-fronted Chat

Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019)

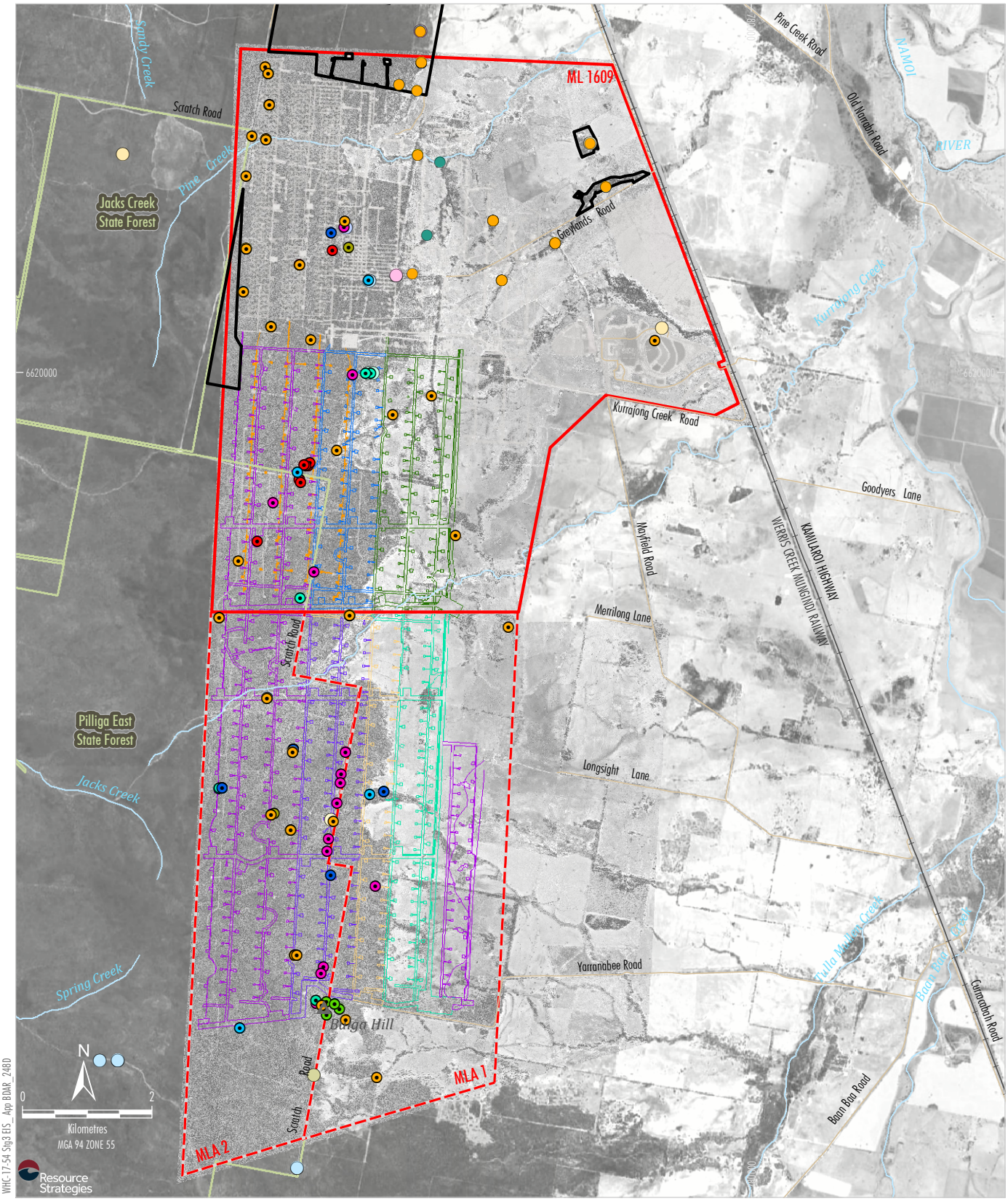
Source:
Survey - Ecotone (2009); ELA (2019b)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); BirdLife Australia (2019); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Threatened Fauna - Birds

Figure 16c



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey	Monitoring	Database	
●			Koala
●		●	Eastern Pygmy Possum
		●	Squirrel Glider
●	●	●	Black-striped Wallaby
●		●	Pilliga Mouse
	●		Eastern False Pipistrelle
●	●	●	Yellow-bellied Sheathtail-bat
●		●	Corben's Long-eared Bat
●			Large Bent-winged Bat
	●		Large-eared Pied Bat
●	●	●	Little Pied Bat
●			Eastern Cave Bat

Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019)

Sources:
Survey - AMBS (2019b); AMBS (2020b); Ecotone (2007); Ecotone (2009); ELA (2016a); ELA (2019b)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Threatened Fauna - Mammals

Figure 17

Threatened species credit species found during ecological monitoring surveys are the Little Eagle (*Hieraaetus morphnoides*), Glossy Black-Cockatoo, and Large Bent-winged Bat (*Miniopterus orianae oceanensis*), (ELA, 2012; 2013a; 2013b; 2015a; 2015b; 2015c; 2015d; 2016a; 2017a and 2018b).

Ecological monitoring surveys have been conducted in the existing offset areas (ELA, 2016c; 2017b and 2018a). The Glossy Black-Cockatoo, Large Bent-winged Bat and Eastern Cave Bat were recorded within the Mine Biodiversity On-site Offset Areas during 2016 and 2017 monitoring (ELA, 2016c; 2017b and 2018a). No rocky outcrops with bat habitat are known to occur around the existing on-site offset areas.

Initial Fauna Surveys for Narrabri Underground Mine Stage 3 Extension

Fauna surveys commenced in 2015 in an area south of ML 1609 for the Project, and preparatory exploration works. Initial fauna surveys in this area were undertaken by ELA (2016b) in June 2015. The surveys involved targeted threatened species searches as well as exploration of potential threatened fauna habitat such as hollow-bearing trees and fallen logs (ELA, 2016b). One threatened species credit species was identified by ELA (2016b), namely the Glossy Black-Cockatoo.

4.2.2 Step 2: Assessment of the Habitat Constraints for Species Credit Species on the Subject Land

Habitat constraints are identified in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) for some fauna species credit species, and the absence of the habitat constraints precludes the species from further assessment (Table 7). Step 2 is not applicable to a species where no habitat constraints are listed for that species in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). Species shaded in Table 7 are species that have been recorded in MLA 1 and/or MLA 2.

The following species in the initial list of species credit species (Table 4) can be excluded from further assessment as species credit species based on the absence of habitat constraints as described in Table 7:

- Square-tailed Kite (*Lophoictinia isura*);
- Black-breasted Buzzard (*Hamirostra melanosternon*);
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*);
- Little Eagle *(Hieraaetus morphnoides)*;
- Swift Parrot (*Lathamus discolor*);
- Superb Parrot (*Polytelis swainsonii*);
- Regent Honeyeater (*Anthochaera phrygia*); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

Despite the BAM (OEH, 2017a) not requiring the above listed species to be targeted during the surveys, AMBS (2020b) (Attachment C) undertook targeted surveys for these species in potential foraging habitat. None of these species were recorded but are retained in Table 3 as ecosystem credit species.

Table 7
Species Credit Species – Habitat Constraints Assessment

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraint (DPIE, 2020d)	Assessment
		BC Act[1]	EPBC Act[2]			
Reptiles						
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species	*Rocky areas, or within 50 m of rocky areas.*	Habitat constraint present.
Birds						
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	*Nest trees.*	Nest trees absent (AMBS, 2020b) (Attachment C). The records of this species on Figure 16 are of birds not associated with nests.
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	*Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts.*	Habitat constraint absent in the Subject land. No evidence of raptor nests used by this species within the Subject land (AMBS, 2020b) (Attachment C).
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	*Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines.*	Habitat constraint absent in the Subject land. No evidence of raptor nests used by this species within the Subject land (AMBS, 2020b) (Attachment C).
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	*Nest trees – live (occasionally dead) large old trees within vegetation.*	Nest trees absent (AMBS, 2020b) (Attachment C). The records of this species on Figure 16 are of birds not associated with nests.
Burhinus grallarius	Bush Stone-curlew	E	-	Species	*Fallen/standing dead timber including logs.*	Habitat constraint present.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/Ecosystem	*Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground.* *Presence of Allocasuarina and casuarina species.*	Habitat constraint present.
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	*Living or dead tree with hollows greater than 10 cm diameter.*	Habitat constraint present.
Lathamus discolor	Swift Parrot	E	CE	Species/Ecosystem	*Breeding habitat in DPIE-mapped important habitat areas.*	DPIE confirmed (email 9 July 2019) that the Subject land is not within a mapped important habitat area for this species.

Table 7 (Continued)
Species Credit Species – Habitat Constraints Assessment

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraint (DPIE, 2020d)	Assessment
		BC Act[1]	EPBC Act[2]			
Polytelis swainsonii	Superb Parrot	V	V	Species/Ecosystem	*Living or dead E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta with hollows greater than 5 cm diameter; greater than 4 m above ground or trees with a DBH of greater than 30cm.*	This species' core breeding area is well-known, and roughly bounded by Cowra and Yass in the east and Grenfell, Cootamundra and Coolac in the west (DPIE, 2020e). The Subject land occurs well outside of the breeding area.
Tyto novaehollandiae	Masked Owl	V	-	Species/Ecosystem	*Living or dead trees with hollows greater than 20 cm diameter.*	Habitat constraint present.
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	*Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.*	Habitat constraint present.
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/Ecosystem	*Breeding habitat in DPIE mapped important habitat areas.*	The Subject land is not within a mapped important habitat area for this species (DPIE, 2020f).
Mammals						
Phascolarctos cinereus	Koala	V	V	Species/Ecosystem	*Areas identified via survey as important habitat ('important' habitat is defined by the density of koalas and quality of habitat determined by on-site survey).*	DPIE confirmed (email 9 July 2019) that the Koala should be considered a species credit species.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species	*Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines.*	Habitat constraint present.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem	*Breeding camps.*	No nearby camps, the nearest known Grey-headed Flying-fox camp is near Tamworth approximately 120 km away (DAWE, 2020e).
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species Ecosystem	*Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding, including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500.*	Habitat constraint present.

Table 7 (Continued)
Species Credit Species – Habitat Constraints Assessment

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraint (DPIE, 2020d)	Assessment
		BC Act[1]	EPBC Act[2]			
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	*Cliffs; within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.*	Habitat constraint present.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Species	*Caves; within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within 2 km of old mines, tunnels, old buildings or sheds.*	Habitat constraint present.

Note: Highlighted species are species recorded in MLA 1 and/or MLA 2.

[1] Conservation status under the BC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered; V = Vulnerable.

[3] Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

4.2.3 Step 3: Identify Candidate Species Credit Species for Further Assessment

After considering the habitat constraints (Step 2), candidate species credit species for further assessment are listed in Table 8 (along with the eight species listed above with habitat constraints – listed in Table 8 with blue text).

4.2.4 Step 4: Determine Presence or Absence of a Candidate Species Credit Species

AMBS (2020a and 2020b) (Attachments B and C) undertook targeted surveys for candidate species credit species (and the species with habitat constraints [Section 4.2.2]) to determine presence or absence of the species. Months in which targeted surveys were conducted are shaded in Table 8. The timing, methods and effort are outlined below and detailed in Attachments B and C.

Threatened Flora

Targeted searches for threatened flora species in Table 8 were undertaken by AMBS (2020a) (Attachment B) in accordance with the BAM (OEH, 2017a) and the *NSW Guide to Surveying Threatened Plants* (OEH, 2016a) in areas of potential habitat. Surveys for threatened flora species were undertaken in June, July, August, October and November 2019 and January 2020 (AMBS, 2020a) (Attachment B).

It is noted that DPIE has released an updated *Surveying Threatened Plants and their Habitats: NSW Survey Guide for the Biodiversity Assessment Method*, dated April 2020. Flora surveys for the Project were completed as of January 2020, in accordance with the *NSW Guide to Surveying Threatened Plants* (OEH, 2016a) and the BAM (OEH, 2017a), which was the current recommended method at the time of the surveys. The *Surveying Threatened Plants and their Habitats: NSW Survey Guide for the Biodiversity Assessment Method*, dated April 2020 is not referenced in the BAM (OEH, 2017a). The differences between the guidelines is not likely to result in any material impact on the survey findings.

Threatened Fauna

AMBS (2020b) (Attachment C) undertook surveys for threatened fauna species involving both direct observation and indirect observation methods. Surveys for fauna species were consistent with the:

- *Threatened Species Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation [DEC], 2004);
- *Survey Guidelines for Australia's Threatened Reptiles* (Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC], 2011b);
- *Survey Guidelines for Australia's Threatened Birds* (Department of Environment, Water, Heritage and the Arts [DEWHA], 2010b);
- *Survey Guidelines for Australia's Threatened Mammals* (DSEWPaC, 2011a);
- *Survey Guidelines for Australia's Threatened Bats* (DEWHA, 2010a); and
- *'Species Credit' Threatened Bats and their Habitats - NSW Survey Guide for the Biodiversity Assessment Method* (OEH, 2018a).

Table 8
Candidate Species Credit Species – Survey Timing

Scientific Name	Common Name	Biodiversity Credit Class[1]	January	February	March	April	May	June	July	August	September	October	November	December
Flora														
Bertya opponens	Coolabah Bertya	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Commersonia procumbens (syn. Androcalva procumbens)	-	Species	Yes	Yes	Yes	Yes	Yes	-	-	Yes	Yes	Yes	Yes	Yes
Cyperus conicus	-	Species	Yes	Yes	Yes	Yes	Yes	-	-	-	-	-	-	-
Dichanthium setosum	Bluegrass	Species	Yes	Yes	Yes	Yes	Yes	-	-	-	-	-	Yes	Yes
Digitaria porrecta	Finger Panic Grass	Species	Yes	Yes	-	-	-	-	-	-	-	-	-	-
Diuris tricolor	Pine Donkey Orchid	Species	-	-	-	-	-	-	-	-	Yes	Yes	-	-
Homoranthus darwinioides	-	Species	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lepidium aschersonii	Spiny Peppercress	Species	Yes	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes
Monotaxis macrophylla	Large-leafed Monotaxis	Species	Yes	Yes	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes
Polygala linariifolia	Native Milkwort	Species	Yes	Yes	-	-	-	-	-	-	-	Yes	Yes	Yes
Pomaderris queenslandica	Scant Pomaderris	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pterostylis cobarensis	Greenhood Orchid	Species	-	-	-	-	-	-	-	-	-	Yes	-	-
Swainsona murrayana	Slender Darling Pea	Species	-	-	-	-	-	-	-	-	Yes	-^	-	-
Swainsona sericea	Silky Swainson-pea	Species	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Tylophora linearis	-	Species	Yes	Yes	Yes	Yes	Yes	-	-	-	-	Yes	Yes	Yes

Table 8 (Continued)
Candidate Species Credit Species – Survey Timing

Scientific Name	Common Name	Biodiversity Credit Class[1]	January	February	March	April	May	June	July	August	September	October	November	December
Zieria ingramii	Keith's Zieria	Species	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes	Yes
Reptiles														
Uvidicolus sphyrurus	Border Thick-tailed Gecko	Species	Yes	Yes	Yes	-	-	-	-	-	-	-	Yes	Yes
Aprasia parapulchella	Pink-tailed Legless Lizard	Species	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Hoplocephalus bitorquatus	Pale-headed Snake	Species	Yes	Yes	Yes	-	-	-	-	-	-	-	Yes	Yes
Birds														
Lophoictinia isura	Square-tailed Kite	Species/Ecosystem	Yes	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes
Hamirostra melanosternon	Black-breasted Buzzard	Species/Ecosystem	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-
Haliaeetus leucogaster	White-bellied Sea-Eagle	Species/Ecosystem	-	-	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Hieraaetus morphnoides	Little Eagle	Species/Ecosystem	-	-	-	-	-	-	-	Yes	Yes	Yes	-	-
Ardeotis australis	Australian Bustard	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Burhinus grallarius	Bush Stone-curlew	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calyptorhynchus lathami	Glossy Black-Cockatoo	Species/Ecosystem	-	-	-	Yes	Yes	Yes	Yes	Yes	-	-	-	-
Lophochroa leadbeateri	Major Mitchell's Cockatoo	Species/Ecosystem	-	-	-	-	-	-	-	-	Yes	Yes	Yes	Yes
Lathamus discolor	Swift Parrot*	Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-
Polytelis swainsonii	Superb Parrot	Species/Ecosystem	-	-	-	-	-	-	-	-	Yes	Yes	Yes	-

Table 8 (Continued)
Candidate Species Credit Species – Survey Timing

Scientific Name	Common Name	Biodiversity Credit Class[1]	January	February	March	April	May	June	July	August	September	October	November	December
Tyto novaehollandiae	Masked Owl	Species/Ecosystem	-	-	-	-	Yes	Yes	Yes	Yes	-	-	-	-
Ninox connivens	Barking Owl	Species/Ecosystem	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Anthochaera phrygia	Regent Honeyeater*	Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-
Mammals														
Phascogale tapoatafa	Brush-tailed Phascogale	Species	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	-	-	Yes
Phascolarctos cinereus	Koala	Species/Ecosystem	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cercartetus nanus	Eastern Pygmy-possum	Species	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes
Petaurus norfolcensis	Squirrel Glider	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aepyprymnus rufescens	Rufous Bettong	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Petrogale penicillata	Brush-tailed Rock-wallaby	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pteropus poliocephalus	Grey-headed Flying-fox	Species/Ecosystem	-	-	-	-	-	-	-	-	-	Yes	Yes	Yes
Miniopterus orianae oceanensis	Large Bent-winged Bat	Species/Ecosystem	Yes	Yes	-	-	-	-	-	-	-	-	-	Yes
Chalinolobus dwyeri	Large-eared Pied Bat	Species	Yes	-	-	-	-	-	-	-	-	-	Yes	Yes
Vespadelus troughtoni	Eastern Cave Bat	Species	Yes	-	-	-	-	-	-	-	-	-	Yes	Yes

Note: Months in which surveys for the species are to be conducted in accordance with the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) are denoted with "Yes". The shaded months are the months in which targeted surveys were undertaken by AMBS (2020a and 2020b) (Attachments B and C) for the relevant species. Candidate species credit species with habitat constraints (and do not require surveys) are shown in blue text.

Note: Blue text – eight species with habitat constraints (Sections 4.2.2 and 4.2.3).

[1] Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

^ This species can also be found in October as described by AMBS (2020a) (Attachments B).

* Not within a mapped important area for this species.

Direct survey methods involved trapping techniques, hair tubes, Anabat and Song Meter surveys, spotlighting, call playbacks, diurnal active searches, Koala Spot Assessment Technique (SAT) (Phillips and Callaghan, 2011) surveys and motion-detecting cameras within and nearby the Development Footprint. Indirect survey techniques involved searches for scats, tracks and signs (e.g. diggings), incidental observations and habitat assessments (AMBS, 2020b) (Attachment C).

4.2.5 Step 5: Determine the Area or Count, and Location of Suitable Habitat for a Species Credit Species

Table 9 provides the results of the targeted surveys by AMBS (2020a and 2020b) (Attachments B and C) for all the species in Table 8. AMBS (2020a and 2020b) (Attachments B and C) recorded seven species requiring species credits for the Project, namely Coolabah Bertya, *Tylophora linearis*, Glossy Black-Cockatoo, Koala, Eastern Pygmy-possum, Large-eared Pied Bat and Eastern Cave Bat. Three additional species requiring species credits for the Project, the Spiny Peppercress, Pale-headed Snake and Squirrel Glider (*Petaurus norfolcensis*), were not recorded by AMBS (2020b) (Attachment C). The Spiny Peppercress has previously been recorded in the Subject land by ELA (2019e), the Pale-headed Snake has previously been recorded in ML 1609 during a separate recent survey by AMBS (reported in Attachment C) and a database record for the Squirrel Glider occurs within the Subject land (Landmark Ecological Services, 2012; DPIE, 2020a). Species recorded in MLA 1 and/or MLA 2 are shaded in Table 9.

Coolabah Bertya, Large-eared Pied Bat and Eastern Cave Bat are candidates for serious and irreversible impacts and are further discussed in Section 8.1.

Habitat (Species Polygons) were created by AMBS (2020a and 2020b) (Attachments B and C) for Coolabah Bertya (a count of individuals), Spiny Peppercress, *Tylophora linearis*, Pale-headed Snake, Glossy Black-Cockatoo, Koala, Eastern Pygmy-possum, Squirrel Glider, Large-eared Pied Bat and Eastern Cave Bat (Figures 18 to 27). The count of individuals for Coolabah Bertya and area of habitat for the other species is provided in Attachment F for each vegetation zone.

The extent of the Species Polygons is justified in AMBS (2020a and 2020b) (Attachments B and C). A description is provided below.

Coolabah Bertya Habitat (Species Polygon)

Predicted habitat in the Subject land according to the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) occurs in PCTs 405, 406, 408, 432. Coolabah Bertya was found to be present in the Subject land in PCTs 404, 405, 406 and 141 (AMBS, 2020a) (Attachment B). The species polygon for Coolabah Bertya on Figure 18 was mapped as a 30 m buffer around the population of individuals.

Table 9
Candidate Species Credit Species – Presence Status

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Biodiversity Risk Weighting (DPIE, 2020d)	Result (AMBS, 2020a and 2020b) (Attachments B and C)
		BC Act[1]	EPBC Act[2]			
Flora						
Bertya opponens	Coolabah Bertya	V	V	Species	2.00	Species was recorded within the Subject land by AMBS and ELA (AMBS, 2020a) (Attachment B) as single plants but more commonly as patches of plants of varying size and age. It was most abundant in the northern part of the Subject land.
Commersonia procumbens (syn. Androcalva procumbens)	-	V	V	Species	2.00	These species were not recorded by AMBS or ELA (AMBS, 2020a) (Attachment B), despite targeted surveys.
Cyperus conicus	-	E	-	Species	2.00	
Dichanthium setosum	Bluegrass	V	V	Species	2.00	
Digitaria porrecta	Finger Panic Grass	E	-	Species	2.00	
Diuris tricolor	Pine Donkey Orchid	V	-	Species	1.50	
Homoranthus darwinioides	-	V	V	Species	2.00	
Lepidium aschersonii	Spiny Peppercress	V	V	Species	2.00	Species was recorded within the Subject land by ELA (AMBS, 2020a) (Attachment B). A total of 32 plants were found in the centre of the Subject land.
Monotaxis macrophylla	Large-leafed Monotaxis	E	-	Species	2.00	These species were not recorded by AMBS or ELA (AMBS, 2020a) (Attachment B), despite targeted surveys.
Polygala linariifolia	Native Milkwort	E	-	Species	2.00	
Pomaderris queenslandica	Scant Pomaderris	E	-	Species	2.00	Species was recorded within the Subject land by ELA (AMBS, 2020a) (Attachment B). Twenty plants were found in the southern part of the Subject land.
Pterostylis cobarensis	Greenhood Orchid	V	-	Species	2.00	These species were not recorded by AMBS or ELA (AMBS, 2020a) (Attachment B), despite targeted surveys.
Swainsona murrayana	Slender Darling Pea	V	V	Species	2.00	
Swainsona sericea	Silky Swainson-pea	V	-	Species	2.00	
Tylophora linearis	-	V	E	Species	2.00	Species was recorded within the Subject land by AMBS and ELA (AMBS, 2020a) (Attachment B). A total of 188 plants were found across the extent of the Subject land.
Zieria ingramii	Keith's Zieria	E	E	Species	2.00	Species was not recorded by AMBS or ELA (AMBS, 2020a) (Attachment B), despite targeted surveys.

Table 9 (Continued)
Candidate Species Credit Species – Presence Status

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Biodiversity Risk Weighting (DPIE, 2020d)	Result (AMBS, 2020a and 2020b) (Attachments B and C)
		BC Act[1]	EPBC Act[2]			
Reptiles						
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V	Species	2.00	These species were not recorded by AMBS (2020b) (Attachment C), despite targeted surveys.
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species	2.00	
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	Species	2.00	A single individual of this species was previously recorded 3.6 km to the north of the Subject land by AMBS in 2019 (2020b) (Attachment C) during spotlighting, on the trunk of a *Eucalyptus* sp.
Birds						
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	1.50	These species were not recorded by AMBS (2020b) (Attachment C), despite targeted surveys.
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	1.50	
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	2.00	
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	1.50	No evidence of raptor nests within the Subject land (AMBS, 2020b) (Attachment C). The records on Figure 16 are of birds not associated with nests.
Ardeotis australis	Australian Bustard	E	-	Species	2.00	These species were not recorded by AMBS (2020b) (Attachment C), despite targeted surveys.
Burhinus grallarius	Bush Stone-curlew	E	-	Species	2.00	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/Ecosystem	2.00	This species was recorded on numerous occasions in the Subject land by AMBS (2020b) (Attachment C). The number of individuals ranged from 1-15 and chewed *Allocasuarina* sp. cones were observed throughout the Subject land.
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	2.00	These species were not recorded by AMBS (2020b) (Attachment C), despite targeted surveys.
Lathamus discolor	Swift Parrot	E	CE	Species/Ecosystem	3.00	
Polytelis swainsonii	Superb Parrot	V	V	Species/Ecosystem	2.00	
Tyto novaehollandiae	Masked Owl	V	-	Species/Ecosystem	2.00	
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	2.00	
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/Ecosystem	3.00	

Table 9 (Continued)
Candidate Species Credit Species – Presence Status

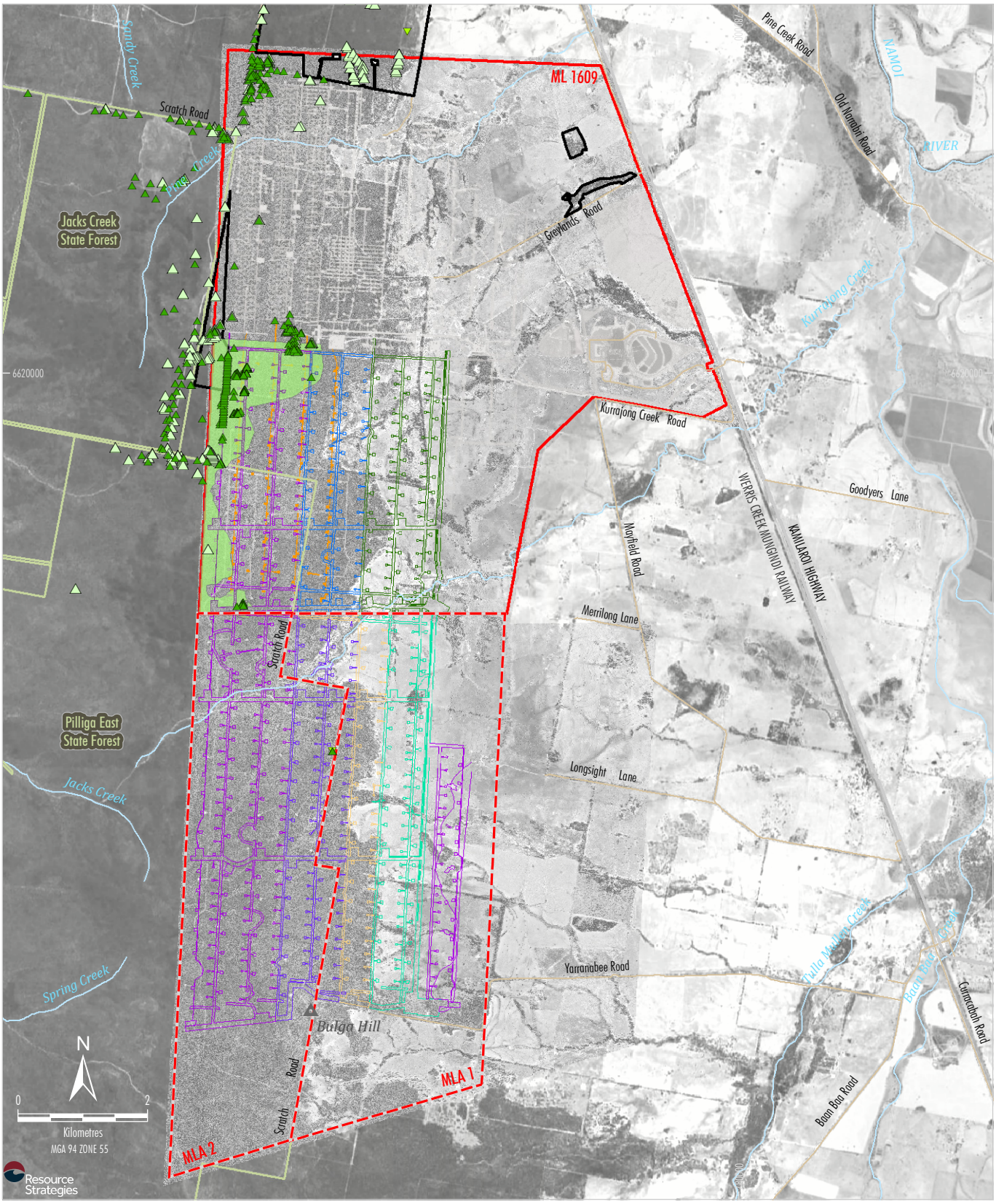
Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Biodiversity Risk Weighting (DPIE, 2020d)	Result (AMBS, 2020a and 2020b) (Attachments B and C)
		BC Act[1]	EPBC Act[2]			
Mammals						
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Species	2.00	This species was not recorded by AMBS (2020b) (Attachment C), despite targeted surveys.
Phascolarctos cinereus	Koala	V	V	Species/Ecosystem	2.00	Evidence of the species (scats) was recorded within the Subject land by AMBS (2020b) (Attachment C).
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species	2.00	This species was recorded by AMBS and ELA within habitat in the vicinity of alluvial drainage lines (AMBS, 2020b) (Attachment C).
Petaurus norfolcensis	Squirrel Glider	V	-	Species	2.00	*BioNet Atlas* (DPIE, 2020a) record of the species within the Subject land.
Aepyprymnus rufescens	Rufous Bettong	V	-	Species	2.00	These species were not recorded by AMBS (2020b) (Attachment C), despite targeted surveys.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species	3.00	
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem	2.00	Species was not recorded by AMBS (2020b) (Attachment C), despite targeted surveys. No nearby camps, the nearest known Grey-headed Flying-fox camp is near Tamworth approximately 120 km away (DAWE, 2020e).
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/Ecosystem	3.00	Species was not recorded by AMBS (2020b) (Attachment C), despite targeted surveys.
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	3.00	The species was recorded in habitat within 100 m of Bulga Hill, and 100 m of an unnamed rocky outcrop, both of which contain rocky areas, caves, overhangs, outcrops and crevices. No breeding individuals were recorded (AMBS, 2020b) (Attachment C).
Vespadelus troughtoni	Eastern Cave Bat	V	-	Species	3.00	The species was recorded in habitat within 100 m of Bulga Hill, which contains rocky areas, caves, overhangs, outcrops and crevices. Juvenile bats of this species were recorded (AMBS, 2020b) (Attachment C).

Note: Highlighted species are species recorded in MLA 1 and/or MLA 2.

1 Conservation status under the BC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered; V = Vulnerable.

3 Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Flora

Survey Monitoring Database

- Coolabah Bertya

Sources:
Survey - AMBS (2019a); AMBS (2020a); ELA (2006); ELA (2016a); ELA (2019a); FloraSearch (2009)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); DPIE (2019)

- Coolabah Bertya Species Polygon

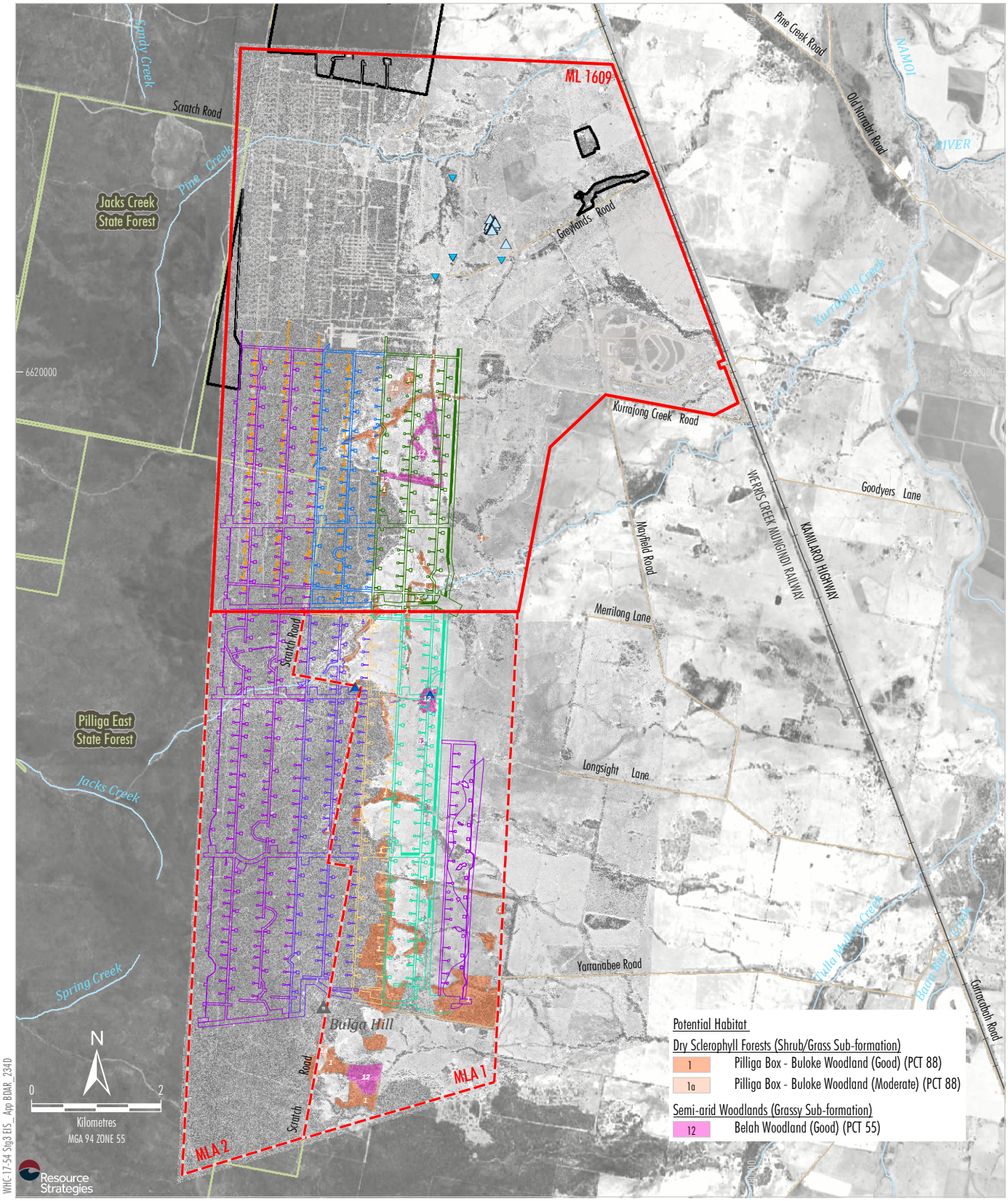
Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Coolabah Bertya Habitat (Species Polygon)

Figure 18



WHC-17-54 Stg3 EIS_App BDAR_234D

LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Flora

Survey Monitoring Database

▲ ▼ △ Spiny Peppercress

Sources:
Survey - AMBS (2019a); ELA (2006); ELA (2016a); ELA (2019a); FloraSearch (2009)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); DPIE (2019)

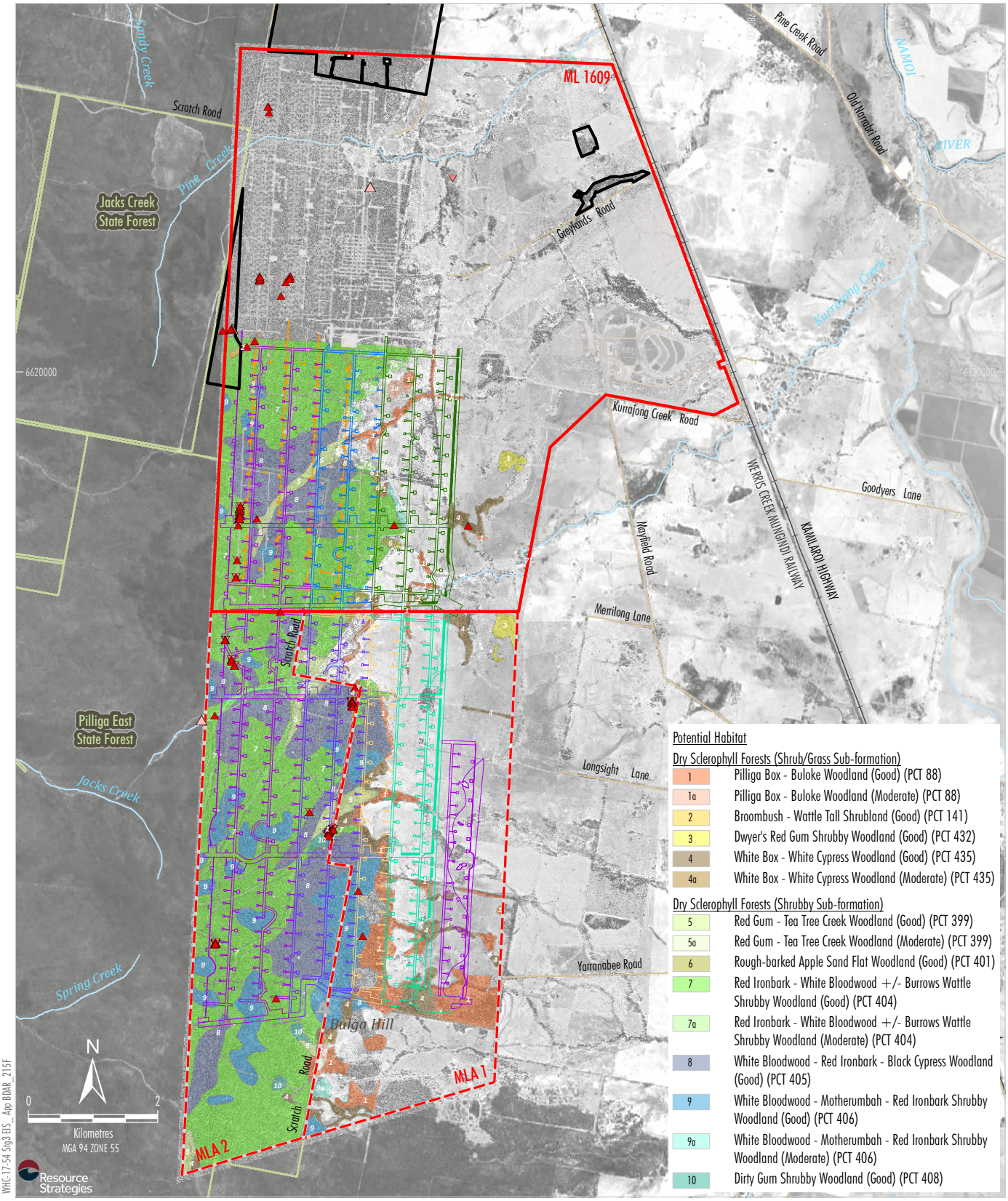
Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Spiny Peppercress Habitat (Species Polygon)

Figure 19



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Flora

Survey Monitoring Database

Tylophora linearis

Sources:
Survey - AMBS (2019a); AMBS (2020a); ELA (2016a); ELA (2019a)
Monitoring - ELA Monitoring Data (2012 to 2018)
Database - ALA (2019); DPIE (2019)

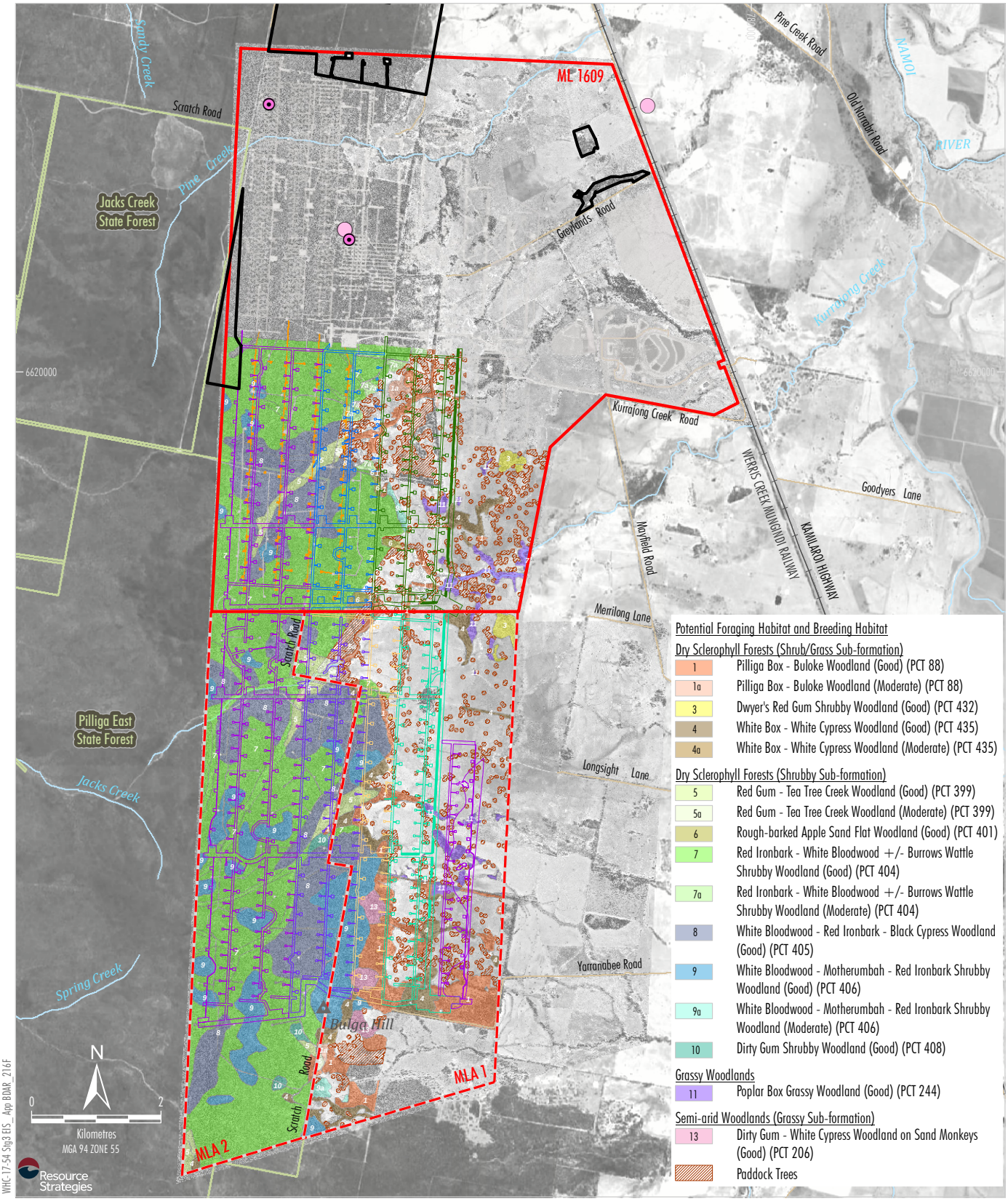
Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019) AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

***Tylophora linearis* Habitat (Species Polygon)**

Figure 20



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

- Pale-headed Snake

Sources:
Survey - AMBS (2019b); Ecotone (2009)
Database - ALA (2019); DPIE (2019)

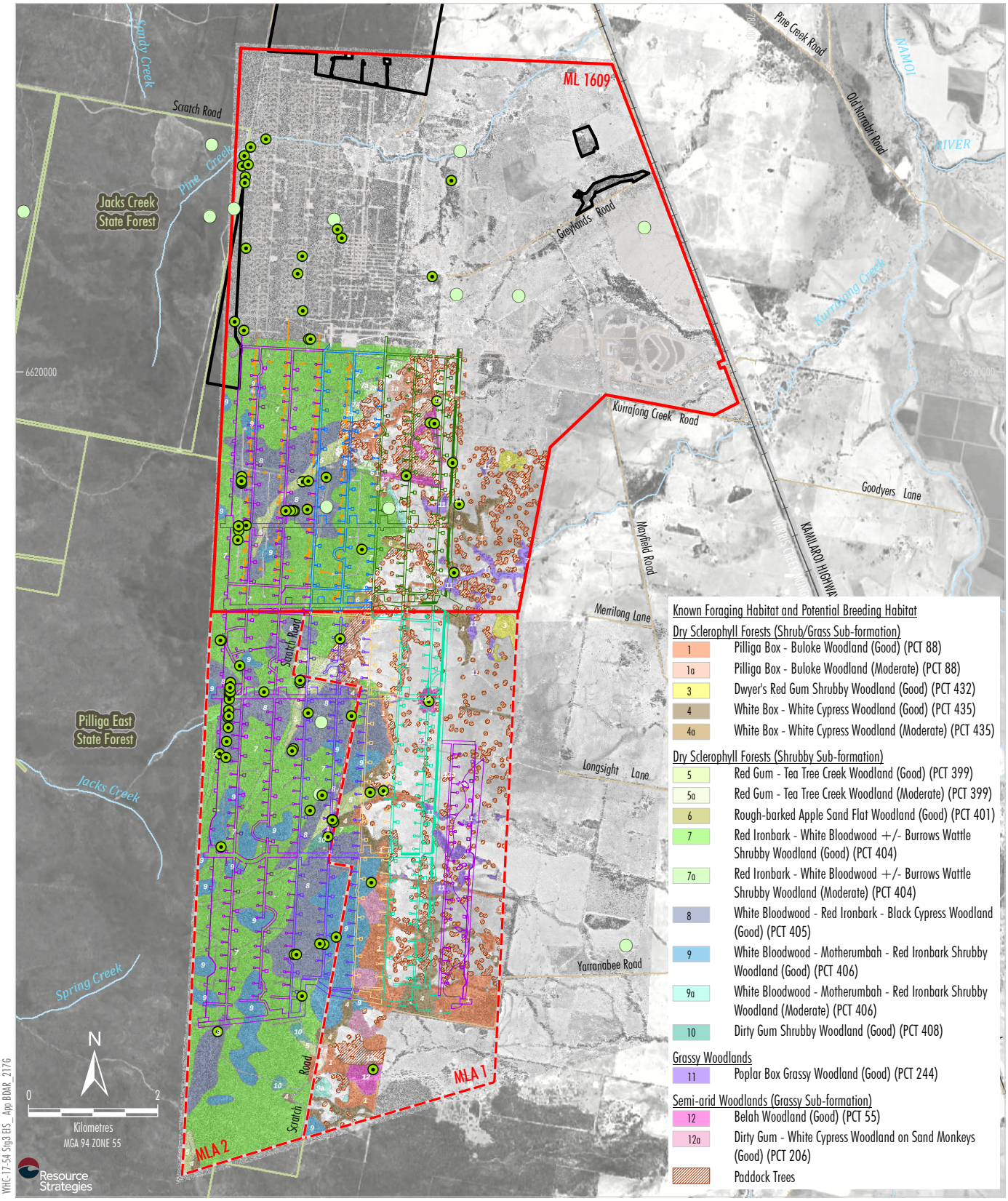
Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Pale-headed Snake Habitat (Species Polygon)

Figure 21



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

- Glossy Black-Cockatoo

Sources:
Survey - AMBS (2019b); AMBS (2020b); Ecotone (2009); ELA (2016a); ELA (2019b)
Database - ALA (2019); BirdLife Australia (2019); DPIE (2019)

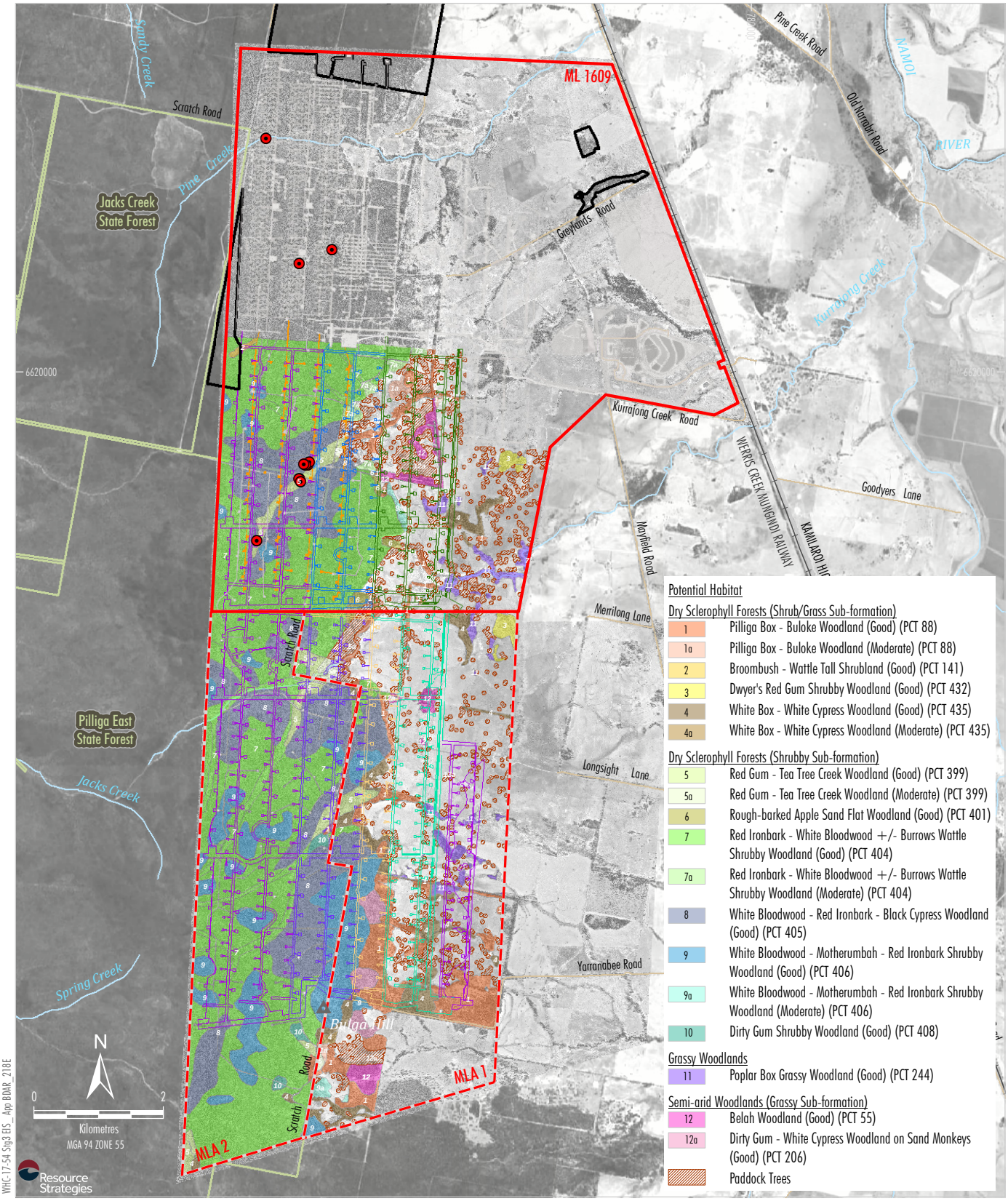
Source: Orthophotos - NCOP (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Glossy Black-Cockatoo Habitat (Species Polygon)

Figure 22



WHC-17-54 Stg3 EIS_App BDAR_218E

LEGEND
- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint
- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna
Survey Monitoring Database
Koala

Sources:
Survey - AMBS (2019b); AMBS (2020b); Ecotone (2009)

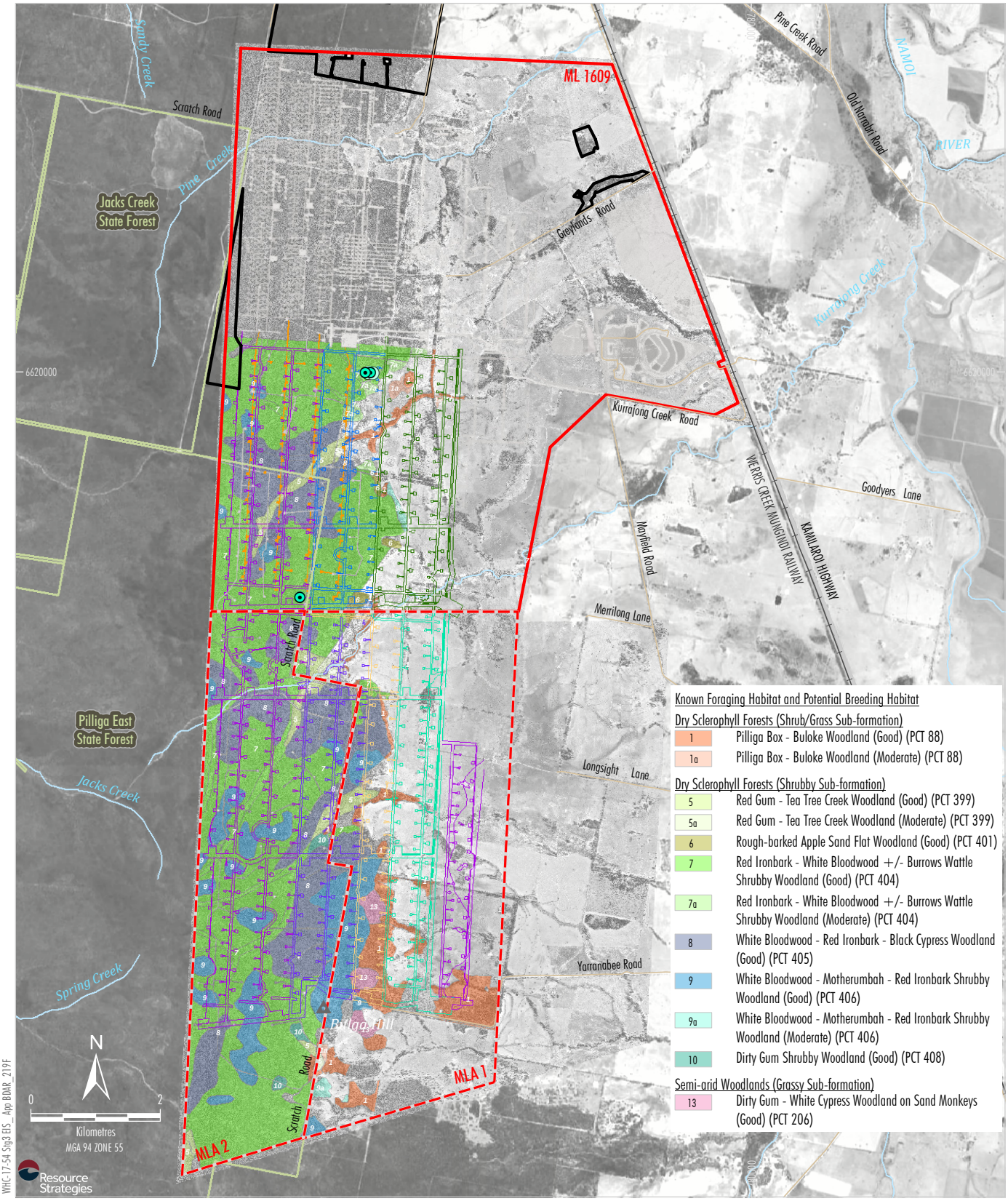
Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Koala Habitat (Species Polygon)

Figure 23



WHC-17-54 Stg3 EIS_App BDAR_219F

LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

Eastern Pygmy-possum

Sources:
Survey - AMBS (2020b); Ecotone (2009)
Database - ALA (2019); DPIE (2019)

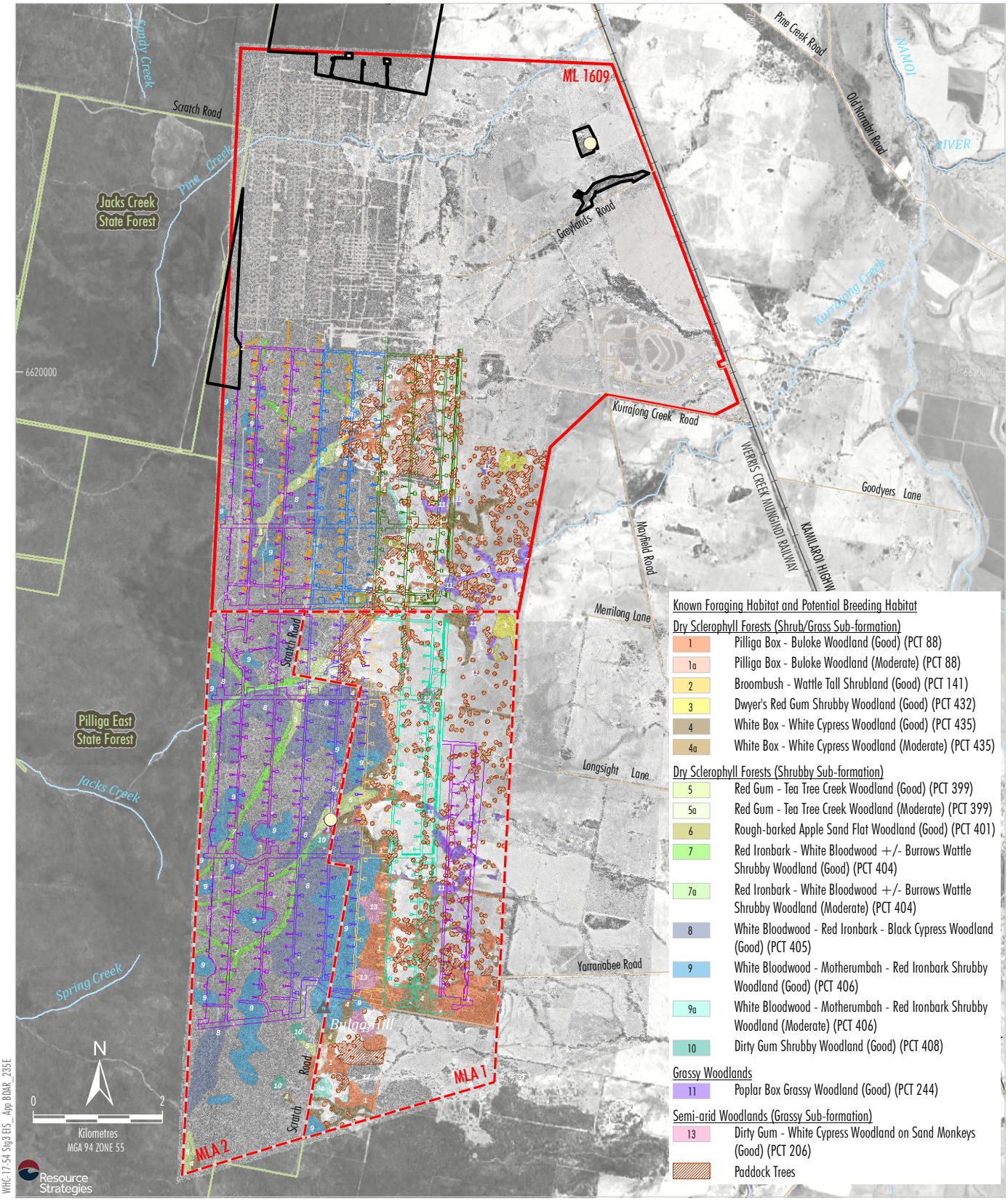
Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Eastern Pygmy-possum Habitat (Species Polygon)

Figure 24



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

- Squirrel Glider

Sources:
Database - ALA (2019); DPIE (2019)

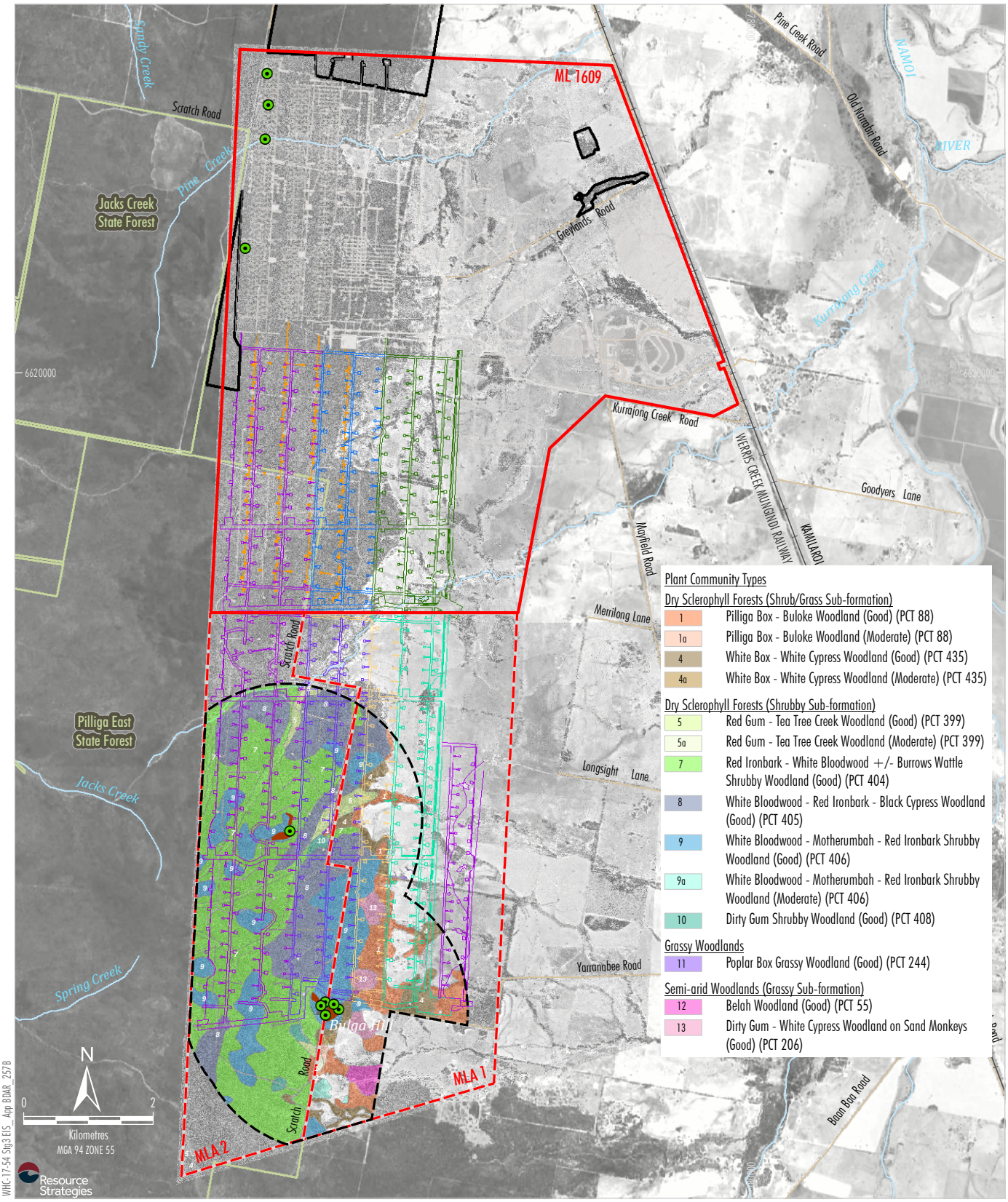
Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Squirrel Glider Habitat (Species Polygon)

Figure 25



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Rocky Outcrops with Bat Habitat

Threatened Fauna

Survey Monitoring Database

- Large-eared Pied Bat

Sources:
Survey - AMBS (2019b); AMBS (2020b)

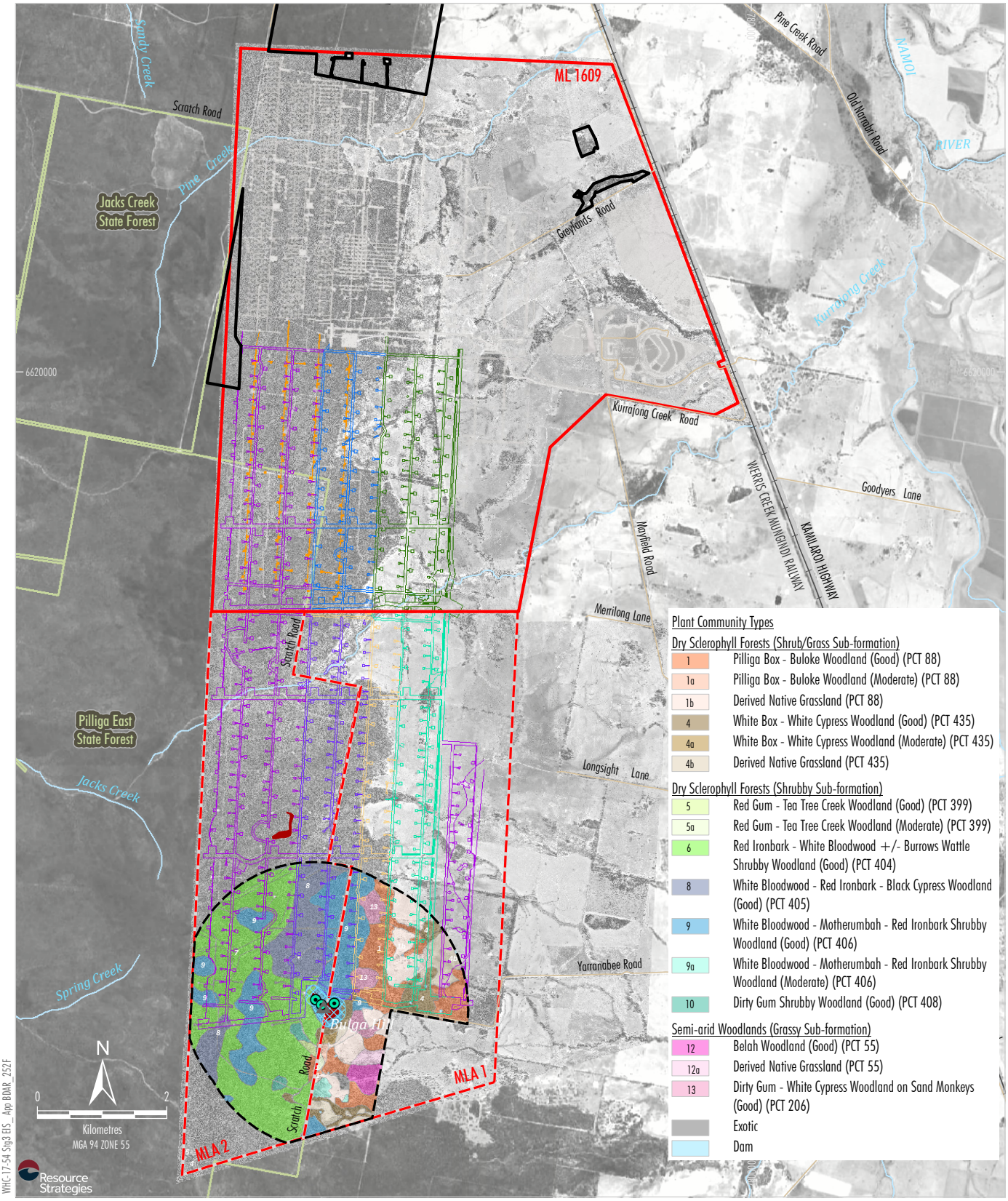
Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Large-eared Pied Bat Habitat (Species Polygon)

Figure 26



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

- Rocky Outcrops with Bat Habitat
- Known Roosting and Breeding Habitat

Threatened Fauna

Survey Monitoring Database

- Eastern Cave Bat

Source:
Survey - AMBS (2020b)

Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Eastern Cave Bat Habitat (Species Polygon)

Figure 27

Spiny Peppercress Habitat (Species Polygon)

Predicted habitat in the Subject land according to the *BioNet Threatened Biodiversity Data Collection* is PCT 55 (DPIE, 2020d). ELA's 2017-2018 surveys recorded 32 individuals of Spiny Peppercress in PCT 55 woodland dominated by *Casuarina cristata* (Belah), and in PCT 88 tall woodland dominated by *Eucalyptus pilligaensis* (Pilliga Box) and *Callitris glaucophylla* (White Cypress Pine). A species polygon for this species has been mapped (Figure 19) across all locations of woodland PCTs 55 and 88 within the proposed indicative surface development footprint (AMBS, 2020a) (Attachment B).

Tylophora linearis Habitat (Species Polygon)

Tylophora linearis was found in multiple locations in the Subject land during AMBS's July, August and October 2019 surveys. A species polygon for this species has been mapped (Figure 20) across all PCTs recognised as habitat in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) for this species (i.e. PCT 88, 141, 399, 401, 404, 405, 406, 408, 432 and 435, excluding derived grasslands) (AMBS, 2020a) (Attachment B).

Pale-headed Snake Habitat (Species Polygon)

Habitat for the Pale-headed Snake has been mapped (Figure 21) as all of the PCTs recognised as habitat in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) for this species (i.e. PCTs 88, 206, 244, 399, 401, 404, 405, 406, 408, 432), as well as PCT 435, which is not listed as associated with the species in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d), but is likely to contain suitable foraging and shelter resources (AMBS, 2020b) (Attachment C).

Glossy Black-Cockatoo Habitat (Species Polygon)

Breeding habitat for the Glossy Black-Cockatoo has been mapped (Figure 22) as all broad habitat types within the Subject land containing suitable large hollow-bearing trees (DPIE, 2020d). As such, PCTs mapped as Glossy Black-Cockatoo habitat include PCTs 55, 88, 206, 244, 399, 401, 404, 405, 406, 408, 432 and 435. PCT 141 did not contain appropriate habitat conditions and has not been mapped as potential breeding habitat (AMBS, 2020b) (Attachment C).

The methodology for defining a species polygon for the Glossy Black-Cockatoo was not defined in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) prior to and during the survey work for this Project and therefore it was taken that species polygon was habitat with suitable hollow bearing trees and frequent sightings (breeding habitat) (AMBS, 2020b) (Attachment C). More recently in mid-2020, after the survey work, the methodology for defining a species polygon for the Glossy Black-Cockatoo has been specified in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) to specifically require the identification of a nest tree (in use by the species) and a circular species polygon with a buffer radius of 200 m to be established around each nest tree. This new method would have the effect of reducing the number of credits required for this Project, but also reducing the number of credits that can be generated for the species at Biodiversity Stewardship Sites.

Given that the methodology for mapping a species credit polygon for the Glossy Black-Cockatoo was revised since the surveys for this Project, it is reasonable for the biodiversity credit requirements for the Glossy Black-Cockatoo to be reduced if NCOPL obtain an Expert Report (in accordance with the BAM [OEH, 2017]) or undertake additional targeted surveys as required by DPIE.

Koala Habitat (Species Polygon)

Known foraging and potential breeding habitat for the Koala within the Subject land occurs throughout all PCTs, including potential Paddock Trees. In the Subject land, the PCTs that have been mapped (Figure 23) as habitat (i.e. contain suitable densities of key feed tree species) include PCTs 55, 88, 141, 206, 244, 399, 401, 406, 408, 432 and 435, and a subset of PCTs 404 and 405 (AMBS, 2020b) (Attachment C).

Eastern Pygmy-possum Habitat (Species Polygon)

Potential habitat for the Eastern Pygmy-possum within the Subject land has been mapped (Figure 24) as PCTs 88, 206, 399, 401, 404, 405, 406 and 408. PCT 244 and PCT 432 are typically associated with the species; however, given the overall degraded state of these PCTs and lack of diverse understory vegetation, they have not been mapped as potential habitat (AMBS, 2020b) (Attachment C).

Squirrel Glider Habitat (Species Polygon)

Within the Subject land, this species is typically associated with all PCTs except PCTs 55, 141, 206 and 244 (DPIE, 2020d). However, PCTs 141, 206 and 244 all presented suitable microhabitat features during field surveys and are, therefore, considered potentially suitable. As such, known foraging and potential breeding habitat for the Squirrel Glider within the Subject land has been mapped (Figure 25) as PCTs 88, 141, 206, 244, 399, 401, 405, 406, 408, 432, 435 and a small subset of PCT 404. Most of PCT 404 was not deemed suitable habitat due to a sparse vegetation structure and unsuitable floristic presence (AMBS, 2020b) (Attachment C).

Large-eared Pied Bat Habitat (Species Polygon)

In accordance with the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitats* (OEH, 2018a), a species polygon is habitat associated with PCTs as per the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (i.e. PCTs 88, 206, 399, 401, 404, 405, 406, 408, 432, 435) within a 2 km radius of Bulga Hill and the unnamed rocky outcrop – two features with bat habitat where this species was recorded (Figure 26). PCTs 55 and 244 have also been included because of their potential to provide habitat and proximity to the cave habitat (AMBS, 2020b) (Attachment C) (Figure 26).

Eastern Cave Bat Habitat (Species Polygon)

In accordance with the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitats* (OEH, 2018a), a species polygon is habitat associated with PCTs as per the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (i.e. PCTs 88, 206, 399, 404, 405, 406, 408, 435) within a 2 km radius of Bulga Hill - a feature with bat habitat where this species was recorded. PCT 55 has also been included because of its proximity to the cave habitat and other areas of suitable habitat (i.e. PCTs associated with the species) (AMBS, 2020b) (Attachment C) (Figure 27).

The habitat disturbance areas are provided in Attachment F.

4.2.6 Step 6: Determine the Habitat Condition within the Habitat (Species Polygon) for Species Assessed by Area

The vegetation integrity score for each vegetation zone associated with the Habitat (Species Polygons) for Spiny Peppercress, *Tylophora linearis*, Pale-headed Snake, Glossy Black-Cockatoo, Koala, Eastern Pygmy-possum, Squirrel Glider, Large-eared Pied Bat and Eastern Cave Bat (Figures 18 to 27) are listed in Attachment D2.

4.3 LOCAL DATA

It was not necessary to use local data to deviate from the DPIE databases (DPIE, 2020b and 2020d).

4.4 EXPERT REPORTS

No expert reports are required because there are no candidate species credits species that were not surveyed for by AMBS (2020a and 2020b) (Attachments B and C) (Table 8). As explained in Section 1.5.1, the flora and fauna survey effort for this Project was substantial, in addition to the previous surveys and monitoring programmes at the operating mine site. Nine flora field surveys were undertaken by AMBS in June 2019, July 2019, August 2019, October 2019 and January 2020, in addition to four prior flora surveys undertaken in September 2017, October 2017, November 2017 and January 2018 by ELA. Seven fauna field surveys were undertaken by AMBS in June, July, August, October and December 2019 and January 2020, in addition to three prior fauna surveys undertaken in August, September, October and November 2017 and February 2018 by ELA.

AMBS (2020a) (Attachments B) explain that below average rainfall and above average temperatures for most of 2017-2020 and the lack of recent fire, may have limited the ability to detect some potentially occurring threatened plants. However, the below average rainfall did not influence the identification and classification of PCTs and associated Threatened Ecological Communities from which the potential occurrences of threatened plants are derived. All threatened flora species previously known to occur at the Narrabri Mine (through years of survey and monitoring) were detected during the survey work by AMBS and ELA.

All of the native vegetation to be cleared would be offset as described in Section 10.

4.5 PRESCRIBED BIODIVERSITY IMPACT ENTITIES

4.5.1 Karst, Caves, Crevices and Cliffs

Rocky outcrops with bat habitat were identified in the Subject land (Figure 8). The Project design was modified in order to avoid Bulga Hill which is now situated outside and to the south of the Development Footprint (Section 5.1).

4.5.2 Rock

Bush rocks provide shelter for lizards and invertebrates. AMBS (2020b) (Attachment C) noted some bush rock areas during the fauna surveys; however, no threatened fauna that use bush rocks were recorded.

4.5.3 Human Made Structures and Non-native Vegetation

There are no human made structures in the Development Footprint that are recognised as habitat for threatened species or areas of non-native vegetation that provide habitat for relevant species credit species.

4.5.4 Hydrological Processes that Sustain and Interact with the Rivers, Streams and Wetlands

The creeks and drainage lines in the Subject land are ephemeral, with flow likely occurring only during heavy rainfall events.

4.6 DEVELOPMENT FOOTPRINT CREDIT REQUIREMENT

The ecosystem and species credit requirements for the Development Footprint (prior to application of the Impact Reduction Area in Section 5.2 and mine site ecological rehabilitation in Section 10.5) are provided in Tables 10 and 11. For the Project ecosystem and species credit requirements after application of the Impact Reduction Area and mine site ecological rehabilitation, refer to Section 10.6.

The credit reports from the BAM Credit Calculator for the Development Footprint Phases 1 to 6 are provided in Attachments G1 to L3.

Table 10
Development Footprint Ecosystem Credit Requirement

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Biodiversity Risk Weighting	Ecosystem Credit Requirement						
				Phase 1 (Attachment G1)	Phase 2 (Attachment H1)	Phase 3 (Attachment I1)	Phase 4 (Attachment J1)	Phase 5 (Attachment K1)	Phase 6 (Attachment L1)	Total
1	Pilliga Box –Buloke Woodland (Good)	88	1.50	149	578	23	191	34	197	**1,172**
1a	Pilliga Box – Buloke Woodland (Moderate)	88	1.50	3	0	0	0	0	0	**3**
1b	Derived Native Grassland	88	1.50	504	175	43	37	53	94	**906**
			Subtotal for PCT 88	**656**	**753**	**66**	**228**	**87**	**291**	**2,081**
2	Broombush – Wattle Tall Shrubland (Good)	141	1.50	0	0	0	0	0	10	**10**
			Subtotal for PCT 141	**0**	**0**	**0**	**0**	**0**	**10**	**10**
4	White Box – White Cypress Woodland (Good)	435	1.75	74	275	0	100	33	46	**528**
4b	Derived Native Grassland	435	1.75	0	0	0	0	0	48	**48**
			Subtotal for PCT 435	**74**	**275**	**0**	**100**	**33**	**94**	**576**
5	Red Gum – Tea Tree Creek Woodland (Good)	399	1.50	0	0	36	30	165	102	**333**
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	1.50	0	0	0	0	13	0	**13**
			Subtotal for PCT 399	**0**	**0**	**36**	**30**	**178**	**102**	**346**
6	Rough-barked Apple Sand Flat Woodland (Good)	401	1.50	20	0	79	8	4	0	**111**
			Subtotal for PCT 401	**20**	**0**	**79**	**8**	**4**	**0**	**111**

Table 10 (Continued)
Development Footprint Ecosystem Credit Requirement

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Biodiversity Risk Weighting	Ecosystem Credit Requirement						
				Phase 1 (Attachment G1)	Phase 2 (Attachment H1)	Phase 3 (Attachment I1)	Phase 4 (Attachment J1)	Phase 5 (Attachment K1)	Phase 6 (Attachment L1)	Total
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	1.50	209	0	874	110	623	3,726	**5,542**
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	1.50	9	0	20	0	0	0	**29**
			Subtotal for PCT 404	**218**	**0**	**894**	**110**	**623**	**3,726**	**5,571**
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	1.50	0	0	211	207	783	1,019	**2,220**
8a	Derived Native Grassland	405	1.50	0	0	9	0	0	0	**9**
			Subtotal for PCT 405	**0**	**0**	**220**	**207**	**783**	**1,019**	**2,229**
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	1.50	0	0	0	295	328	267	**890**
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	1.50	18	0	0	0	0	0	**18**
			Subtotal for PCT 406	**18**	**0**	**0**	**295**	**328**	**267**	**908**
10	Dirty Gum Shrubby Woodland (Good)	408	1.50	0	0	0	0	3	0	**3**
			Subtotal for PCT 408	**0**	**0**	**0**	**0**	**3**	**0**	**3**

Table 10 (Continued)
Development Footprint Ecosystem Credit Requirement

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Biodiversity Risk Weighting	Ecosystem Credit Requirement						
				Phase 1 (Attachment G1)	Phase 2 (Attachment H1)	Phase 3 (Attachment I1)	Phase 4 (Attachment J1)	Phase 5 (Attachment K1)	Phase 6 (Attachment L1)	Total
11	Poplar Box Grassy Woodland (Good)	244	2.00	31 [A]	111 [B]	0	0	0	223 [C]	**365**
11a	Derived Native Grassland	244	2.00	0	0	0	0	0	73	**73**
			Subtotal for PCT 244	**31**	**111**	**0**	**0**	**0**	**296**	**438**
12	Belah Woodland (Good)	55	2.00	92	136	0	11	0	0	**239**
12a	Derived Native Grassland	55	2.00	52	400	0	18	0	130	**600**
			Subtotal for PCT 55	**144**	**536**	**0**	**29**	**0**	**130**	**839**
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	1.75	0	0	0	57	3	0	**60**
			Subtotal for PCT 206	**0**	**0**	**0**	**57**	**3**	**0**	**60**
			Total Woodland	**605**	**1,100**	**1,243**	**1,009**	**1,989**	**5,590**	**11,536**
			Total Derived Native Grassland	**556**	**575**	**52**	**55**	**53**	**345**	**1,636**
			Total Native Vegetation	**1,161**	**1,675**	**1,295**	**1,064**	**2,042**	**5,935**	**13,172**

[A] Includes 24 credits for Poplar Box Woodland EEC.
[B] Includes 34 credits for Poplar Box Woodland EEC.
[C] Includes 86 credits for Poplar Box Woodland EEC.

Table 11
Habitat Disturbance and Species Credit Requirement

Scientific Name	Common Name	Conservation Status		Biodiversity Risk Weighting	Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		Total	
		BC Act[1]	EPBC Act[2]		Total Area (ha)	Credit Requirement (Attachment G1)	Total Area (ha)	Credit Requirement (Attachment H1)	Total Area (ha)	Credit Requirement (Attachment I1)	Total Area (ha)	Credit Requirement (Attachment J1)	Total Area (ha)	Credit Requirement (Attachment K1)	Total Area (ha)	Credit Requirement (Attachment L1)	Total Area (ha)	Total Credit Requirement
Bertya opponens	Coolabah Bertya	V	V	2.00	0	-	0	-	1,297 (individuals)	2,594	0	-	0	-	24,642 (individuals)	49,284	**25,939 (individuals)**	**51,878**
Lepidium aschersonii	Spiny Peppercress	V	V	2.00	9	295	24.8	906	0.8	30	7.3	265	1.3	45	15.6	263	**58.8**	**1,804**
Tylophora linearis	-	V	E	2.00	23.4	628	39.6	1,085	55	1,656	33.6	1,236	82	2,640	210.8	7,146	**444.4**	**14,391**
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	2.00	42.4	864	49.9	1,286	57.8	1,702	36.6	1,327	84.6	2,702	227.7	7,400	**499**	**15,281**
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	2.00	47.5	998	56.4	1,458	57.8	1,702	37.5	1,344	84.6	2,702	230.1	7,415	**513.9**	**15,619**
Phascolarctos cinereus	Koala	V	V	2.00	47.5	998	56.4	1,458	57.8	1,702	37.5	1,344	84.6	2,702	230.7	7,428	**514.5**	**15,632**
Cercartetus nanus	Eastern Pygmy-possum	V	-	2.00	17	468	20.1	751	55	1,656	32.5	1,186	81.1	2,605	207.4	7,061	**413.1**	**13,727**
Petaurus norfolcensis	Squirrel Glider	V	-	2.00	30.9	574	49.9	1,286	18.8	529	32	1,180	63.6	1,959	113.2	2,928	**308.4**	**8,456**
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	3.00	0	-	36.5	1,496	0	-	28.3	1,596	70.7	3,404	109.7	5,441	**245.2**	**11,937**
Vespadelus troughtoni	Eastern Cave Bat	V	-	3.00	0	-	44.2	1,572	0	-	14.9	848	32.8	1,584	59.6	2,560	**151.5**	**6,564**

1 Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). E = Endangered; V = Vulnerable.

5 AVOID AND MINIMISE IMPACTS

This section describes the measures that have been evaluated and adopted by NCOPL to avoid or minimise impacts on biodiversity values (including prescribed impacts). Impacts are avoided when adverse impacts are completely prevented on biodiversity values, or certain areas of biodiversity. Impacts are minimised when impacts on biodiversity values are reduced.

Section 5.1 describes measures to avoid or minimise impacts on biodiversity throughout the Project life. Section 5.2 describes areas of approved surface disturbance that are not included in the Development Footprint (i.e. would not be required for the Project) and would be relinquished following approval of the Project.

This section has been prepared in consideration of the BAM (OEH, 2017a), draft BAM (DPIE, 2019a) and *Biodiversity Assessment Method Operational Manual* (DPIE, 2019b).

5.1 MEASURES TO AVOID AND MINIMISE IMPACTS

Measures to avoid or minimise impacts are discussed below according to the following groupings spanning the life of the mine:

- site selection;
- project design;
- construction and operation; and
- rehabilitation.

Additional measures to mitigate and manage impacts are provided in Section 7.

5.1.1 Site Selection

The Project involves an extension to the existing approved and operating underground mine within ML 1609, into MLA areas 1 and 2. The location of the Project has been selected based upon the presence of a coal seam able to be economically mined (Hoskissons Seam). The new mining areas associated with the Project are largely contiguous with the existing approved and operating underground mine, thereby minimising new disturbance areas that would otherwise be associated with a separate mine.

5.1.2 Project Design

At a broad level, the Project has been designed to avoid or minimise impacts on biodiversity values through:

- the use of underground longwall mining methods, which significantly reduces vegetation and soil disturbance (and impacts on hydrological features) in comparison to open cut mining methods;
- the ability to make minor adjustments to the location of surface infrastructure such as boreholes, service corridors and access tracks to avoid or minimise impacts on biodiversity values;

- the use of the substantial existing infrastructure at the existing approved and operating underground mine (such as the Pit Top Area and the existing ventilation shafts), limiting the requirement to develop new infrastructure (for example, there is approximately 221 ha of existing disturbance at the Pit Top Area for infrastructure such as the box cut, CHPP, coal stockpiles, rail loop and product coal load out infrastructure, site water management infrastructure, administration buildings, service facilities, longwall unit assembly area, access roads, car parking and amenity bunds which would continue to be utilised for the Project); and
- locating multiple surface infrastructure components within the same disturbed area:
  - services corridors would generally include roadways, pipelines, pumps, telecommunication infrastructure, power transmission infrastructure, sediment controls and other ancillary infrastructure; and
  - access tracks would generally include roadways, pipelines, pumps, sediment controls, goaf drainage infrastructure and other ancillary infrastructure.

The proposed surface development area for the Project is smaller than the industry average for similar underground mining operations (Palaris, 2020).

In addition to the above, at a finer scale, surface infrastructure has been designed by NCOPL with the aim of avoiding or minimising impacts on biodiversity values (in addition to heritage values). The initial design (prior to the biodiversity surveys) was based on an assumed amount of surface infrastructure that could be needed to operate the underground mine. Following the initial design, NCOPL reviewed the positioning of surface infrastructure (i.e. developed alternative routes and sites) in consideration of the initial and final assessment of biodiversity values.

Positioning of Surface Infrastructure (Alternative Routes and Sites)

It is not feasible to undertake the Project and completely avoid clearance impacts on woodland and derived native grassland due to the location of the Project and the need for surface infrastructure to support the underground mining operation.

The degree of flexibility available for surface infrastructure components to be positioned to avoid or minimise impacts is in part dependent on the function of the infrastructure. For example, the following infrastructure components are physically constrained by the locations of underground mining components:

- post-drainage corridors have been combined with access tracks and are required to be located above the mined-out longwall blocks (these could generally only move approximately 10 m east/west);
- services corridors allow services to be transported above-ground to service boreholes (these could generally only move approximately 50 m east/west);
- service boreholes are required to be above the underground roadways, which do not subside (these could generally only move approximately 50 m north/south);
- service boreholes (with power reticulation) are also required to be above the underground roadways and, in addition, are required to be located along the services corridors (resulting in limited flexibility);
- ventilation shafts have the same siting requirements as service boreholes (with power reticulation); however, they also need to be located in order to maximise underground ventilation performance (resulting in limited flexibility); and

- exploration bores are used to measure the quality, thickness and location of the coal seam (these could generally only move approximately 50 m north/south).

The routes of light vehicle tracks were generally flexible.

NCOPL reviewed the positioning of infrastructure to avoid or minimise impacts on native vegetation, threatened species habitat and prescribed impacts in consideration of the results of the detailed ecological survey work (AMBS, 2020a and 2020b) (Attachments B and C) (Figure 28), specifically:

- avoiding land clearance impacts on rocky outcrops with bat habitat (including Bulga Hill) reported by AMBS (2020b) (Attachment C) to be used by cave-dwelling bats (potential subsidence impacts are assessed in Section 6.2.1);
- minimising impacts near creeks and drainage features;
- minimising impacts on woodland, which includes habitat for relevant threatened fauna species credit species with a high biodiversity risk rating (sensitivity to loss) (Section 3.3.1) (resulting in approximately 17.6 ha less clearance of woodland compared to the initial design);
- targeting disturbance to cleared land and derived native grasslands (areas of lower vegetation integrity) in preference to woodland; and
- minimising impacts on PCT 55, a PCT that has a percent cleared value in Namoi (DPIE, 2020b) exceeding 70%.

The most direct access route was selected for light vehicle tracks, access tracks and service corridors, except where the components have been moved to accommodate topography, or to avoid or minimise impacts on biodiversity or heritage values.

Service boreholes and exploration boreholes are located to avoid stream channels, except in locations where the service bore and exploration pad is constrained due to the location of the stream channel relative to the underground roadway, above which the service bore is situated. NCOPL considers that it is not feasible to re-align underground roadways to avoid crossing creeks and drainage features because this would result in a less efficient underground mine design.

NCOPL considers that it is not feasible to avoid Poplar Box Woodland EEC (PCT 244), as this woodland is relatively widespread and occurs across the proposed access tracks, post-drainage corridors and service corridors (Figure 12).

Clearance impacts on Belah Woodland (PCT 55) have been minimised by relocating some proposed exploration bores (Figure 5). NCOPL considers that it is not feasible to avoid clearance impacts on Belah Woodland (PCT 55) that occurs across the proposed access tracks and post-drainage corridors and service corridors. In addition, there is not a suitable alternative location for some exploration bores.

NCOPL considers that it is not feasible to avoid Coolabah Bertya as the population extends to the central portion of ML 1609 above the existing approved Stage 2 longwalls (LW 206, 207, 208 and 209).

NCOPL considers that it is not feasible to avoid Spiny Peppercress recorded by ELA (AMBS, 2020a) (Attachment B), as it is located in an area planned for a service borehole with power reticulation. The location of the service borehole with power reticulation is required to be along the service corridor and above the underground roadway, as described above. *Tylophora linearis* is widespread but in low numbers through the woodland and, therefore, it is not feasible to avoid individual records.

A comparison of the initial design and the final design is shown on Figure 28. The final design would result in:

- avoidance of land clearance impacts on rocky outcrops with bat habitat, including Bulga Hill;
- reduced clearance in creeks and drainage features, including Kurrajong Creek;
- approximately 17.6 ha less clearance of woodland;
- approximately 14.4 ha less clearance of derived native grasslands; and
- approximately 1 ha less clearance of Belah Woodland (PCT 55).

Alternative Technologies

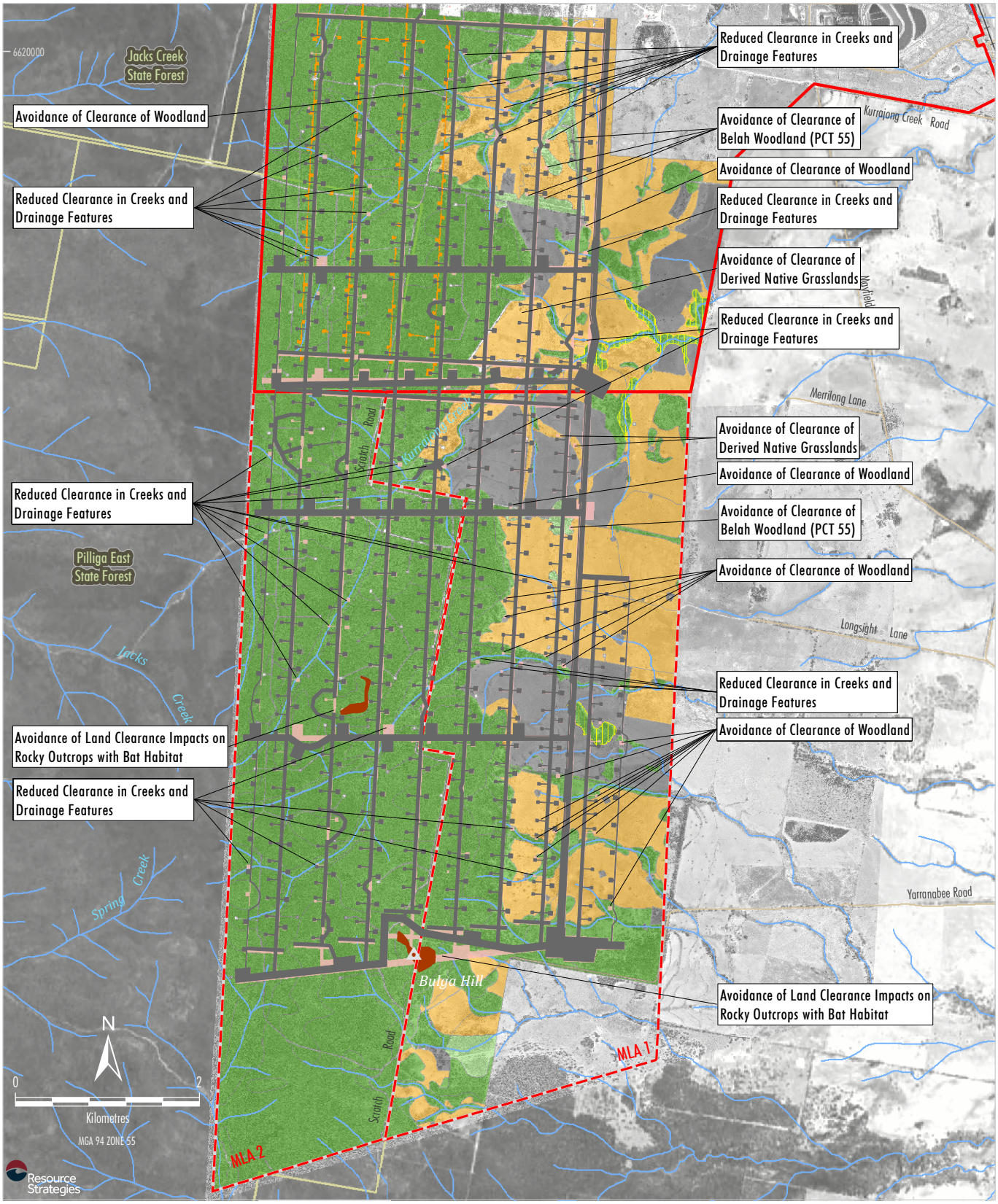
In regard to alternative technologies, Underground In-Seam (UIS) pre-drainage would continue to be undertaken. UIS pre-drainage does not involve surface disturbance (except for infrastructure on the surface to which gas is transferred). Surface to In-Seam (SIS) pre-drainage would also continue to be progressively undertaken where conventional UIS drainage is not feasible (e.g. where gas or water content is too high, or pre-drainage is required prior to establishment of the underground gate roads).

NCOPL expects that ventilation shafts would generally be constructed from the surface down to the underground (i.e. conventional or blind bore drilling methods). The conventional or blind bore method is generally used where ventilation shafts need to be constructed prior to development of the underground workings (e.g. where ventilation is required as soon as development reaches the shaft location).

Alternatively, where practical, ventilation shafts could be constructed from the underground workings to the surface using a pilot hole for guidance (i.e. the “raise bore” method). This method reduces the surface disturbance footprint required during drilling, and can be used where the underground workings have been developed prior to construction of the shaft. Shafts may also be constructed using other methods subject to further detailed mine planning.

Board and pillar mining with secondary extraction is an alternative mining method that could be used for mining coal within the project area. This method is of low productivity, low resource recovery, and high cost compared to longwall extraction. The Board and pillar extraction method also requires good geotechnical conditions which are only present over a small portion of the project area. It is therefore not considered to be a viable mining method for the project.

In addition, longwall top coal caving is a mining technique which allows mining of a greater mining extraction height. This method has previously been considered; however, it was concluded that the additional infrastructure and disturbance associated with longwall top coal caving resulted in conventional longwall mining being preferred.



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Indicative Approved Surface Development (Impact Reduction Area)
- Project Indicative Surface Development Footprint
- Originally Proposed Indicative Surface Development Footprint
- Woodland
- Derived Native Grassland
- Poplar Box Grassy Woodland on Alluvial Plains (PCT 244)
- Belah Woodland (PCT 55)
- Rocky Outcrops with Bat Habitat
- Creeks and Drainage Features
- Cleared Land

Source: Orthophotos - NCOPL (2017); NSW Spatial Services (2019); NCOPL (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Avoidance of Impacts on Biodiversity Values

Figure 28

5.1.3 Construction and Operation

Surface infrastructure would be constructed progressively throughout the mine life. A vegetation clearing protocol would be implemented as outlined in Section 7. During clearing activities, mature trees (such as those with tree hollows) would be retained where it is practicable to do so and would not otherwise increase impacts on biodiversity values (e.g. by diverting infrastructure elsewhere resulting in additional impacts), noting, however, that the Project offset requirement (Sections 8.1 and 8.2) has been calculated assuming complete clearance within the Development Footprint (Figure 6) (i.e. clearance would be permitted within the entire Development Footprint).

To accommodate further detailed mine planning, some flexibility in the Development Footprint is needed over the life of the Project. Any such changes are expected to be minor and, therefore, would not have an increased impact on the biodiversity values identified in the BDAR. Throughout the life of the Project, NCOPL would track actual native vegetation/habitat clearance against the Development Footprint and the allowance included in the calculation of biodiversity credits for each phase. Any proposed native vegetation/habitat clearance outside of the Development Footprint or beyond the allowance for the phase, should it be required, would trigger a review of the proposed activities, the relevant Project approval documentation and the impact on biodiversity values.

To facilitate this review, Vegetation Zones (PCTs in broad condition states) and habitat for species credit species (i.e. those species for which a species polygon is required to be determined by the area of habitat) have been mapped within and surrounding the Development Footprint.

There is a single species credit species recorded, namely Coolabah Bertya, for which the credit requirement is required by the DPIE to be determined by a count of the number of individual plants within the Development Footprint. For this species, the credit requirement was based on a conservative estimate of the density of Coolabah Bertya individuals for each Vegetation Zone (which exceeded the count of the number of individual plants). NCOPL would track the clearance of the number of Coolabah Bertya plants by applying the density to the area of habitat to be cleared.

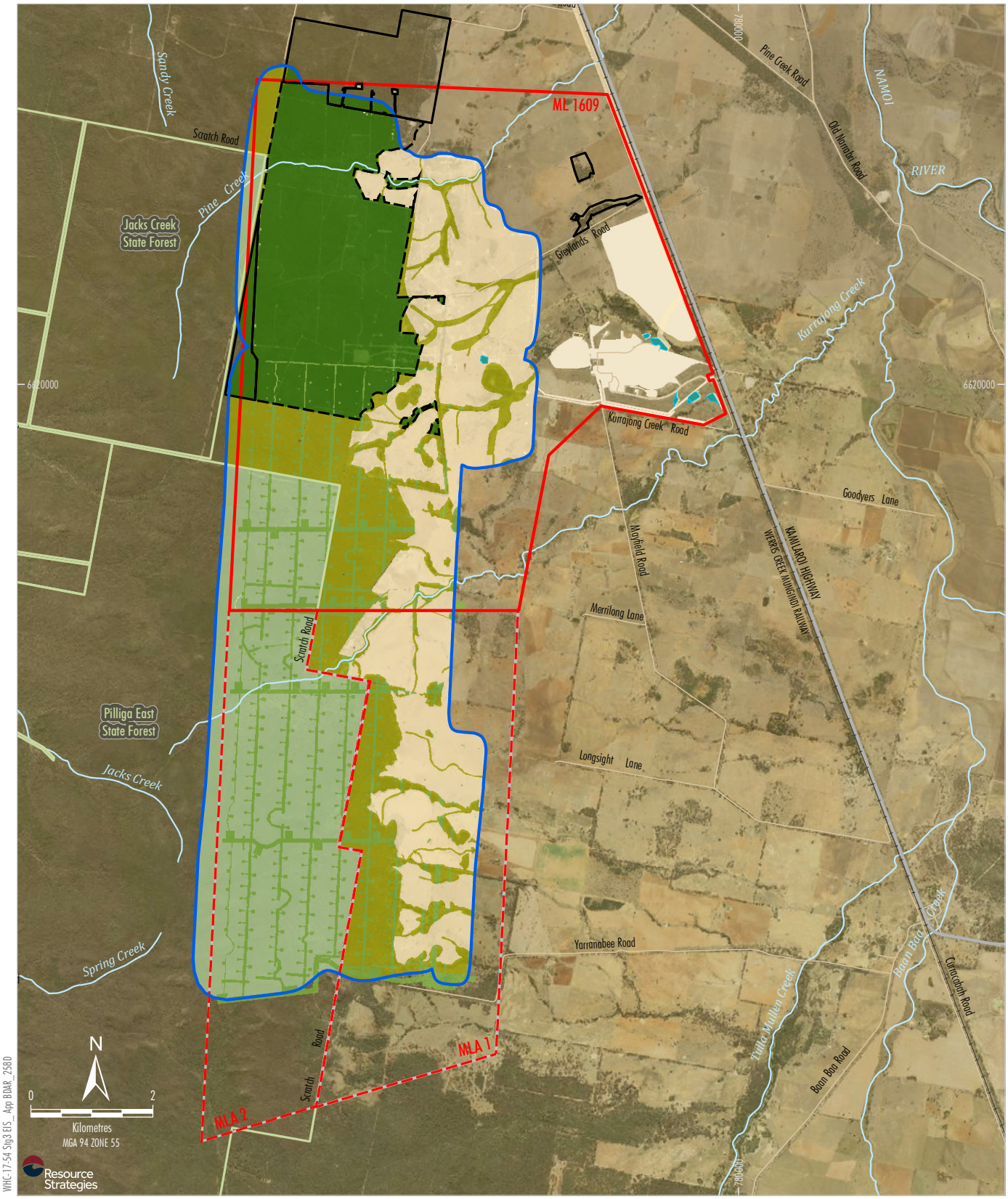
The vegetation clearing protocol (Section 7) includes the following best practice measures to avoid incidental clearance in vegetation to be retained:

- clear delineation of the approved disturbance areas on the ground prior to clearing activities (e.g. flagging tape, painted markers, posts) and restriction of clearing to within these areas;
- signposts to alert personnel not to enter vegetation outside of the disturbance areas; and
- mine staff and contractors would be made aware of clearing limits and restricted access areas.

5.1.4 Rehabilitation

Infrastructure would be removed and surface development areas rehabilitated progressively or at the end of the Project life, unless otherwise agreed with the relevant government agencies and landholders (e.g. services corridors and access roads, sheds, buildings and sediment dams may provide for alternate post-mining uses). Progressive mine rehabilitation has the effect of minimising the duration of the impacts.

The overall rehabilitation goal for the Project mining area is to comprise a combination of native vegetation, agricultural (pasture) and forestry (State Forest) land uses (Figure 29).



LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Remediated Underground Mining Area

Secondary Domains

- Water Management (A)
- Pasture (B)
- Woodland (C)
- State Forest (D)
- Mine Site Ecological Rehabilitation (E)
- Biodiversity Offset (F)

Land Use

- State Forest
- Approved Biodiversity Offset Area
- Future On-site Offset Area (2019)

Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Conceptual Rehabilitation Domains and Proposed Final Land Use Concepts

Figure 29

As described earlier, the use of underground longwall mining methods significantly reduces vegetation and soil disturbance in comparison to open cut mining methods. This also has the effect of increasing the likely success of revegetation of the surface development areas to woodland vegetation types.

During rehabilitation, adverse impacts on surrounding vegetation and habitat can occur if environmental weeds become established or through sedimentation or erosion of cleared areas. To minimise impacts from environmental weeds, NCOPL would continue weed prevention measures, control and monitoring. Operational sediment and erosion control works would be maintained during the establishment of revegetation to minimise impacts from sedimentation or erosion.

5.1.5 Summary

Table 12 provides a summary of the actions NCOPL would implement to avoid and minimise impacts on specific biodiversity values before construction and during operations. A comparison of the initial design and the final design is shown on Figure 28.

5.2 IMPACT REDUCTION AREA

The existing/approved Stage 2 surface infrastructure along LW206 to LW209 (not yet constructed or required for the Project) would be foregone (not cleared) (Figure 7). This area is referred to as the Impact Reduction Area. The BAM Credit Calculator was applied to the Impact Reduction Area as described below so the credits could be deducted from the overall credit requirement.

5.2.1 Plant Community Types

The Impact Reduction Area covers approximately 14.1 ha of native vegetation, comprising 13.9 ha of woodland and 0.2 ha of derived native grassland (Figure 11) (Table 13).

Seven vegetation zones (i.e. areas of native vegetation that are the same PCT and similar broad condition states) are mapped. The main vegetation community in the Impact Reduction Area is Vegetation Community 7 Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good) (PCT 404) (9.5 ha, 67%). The 'Percent Cleared Value' for each PCT is listed in Table 13.

The vegetation integrity (site condition) plots used in the BAM Credit Calculator are shown on Figure 13. The vegetation integrity (site condition) data for the habitat within the Impact Reduction Area is provided in Table 14. The scores generated by the BAM Credit Calculator are also provided in Table 14.

Table 12
Summary of Measures to Avoid and Minimise Impacts on Biodiversity Values

Biodiversity Value	Timing/Action/Outcome
Native vegetation/habitat	▪ Through the design of the Project, NCOPL reviewed the positioning of infrastructure to: - target disturbance to derived native grasslands (areas of lower vegetation integrity) in preference to woodland (e.g. relocation of proposed exploration bores to areas of derived native grassland); and - target disturbance to cleared land without any native vegetation in preference to derived native grasslands (e.g. relocation of proposed exploration bores to derived native grassland). ▪ Clearance impacts on Belah Woodland (PCT 55) have been minimised by relocating some proposed exploration bores. ▪ During operations, a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.
Prescribed Impacts	
The impacts of development on caves, crevices and cliffs habitat of threatened species	▪ NCOPL reduced the length of longwall panels and revised the positioning of surface infrastructure to avoid land clearance impacts on rocky outcrops with bat habitat, including Bulga Hill, reported by AMBS (2020b) (Attachment C) to be used by cave-dwelling bats.
The impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	▪ NCOPL located multiple infrastructure within the same alignment to minimise fragmentation. ▪ NCOPL reviewed the positioning of infrastructure to: - target disturbance to derived native grasslands (areas of lower vegetation integrity) in preference to woodland (e.g. relocation of proposed exploration bores to derived native grassland); and - target disturbance to cleared land without any native vegetation in preference to derived native grasslands (e.g. relocation of proposed exploration bores to cleared land without any native vegetation). ▪ During operations, a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained. ▪ During operations, NCOPL aims to reinstate connectivity through progressive revegetation of temporarily disturbed areas.
The impacts on movement of threatened species that maintains their lifecycle	▪ As above.
The impacts on water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities	▪ Through the design of the Project, NCOPL reviewed the positioning of infrastructure to minimise impacts near creeks and drainage features (e.g. service boreholes and exploration boreholes are located to minimise impacts to stream channels). ▪ During operations, a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.
The impacts of vehicle strike on threatened species of animals or on animals that are part of a threatened ecological community	▪ During operations, a speed limit of 40 km per hour would be applied to roadways required as part of the Project. It is not practical to fence roadways in order to prevent animal entry due to the length and arrangement of the access roads. Further, such fences may instead adversely impact the movement of threatened species.

Table 13
Plant Community Types – Impact Reduction Area

Vegetation Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID and Name		Area (ha)	Percent Cleared in Namoi (DPIE, 2020b)
Dry Sclerophyll Forests Formation (Shrub/grass Sub-formation)					
1b	Derived Native Grassland	88	Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion (DNG)	0.1	38% (+/- 80)
Dry Sclerophyll Forests Formation (Shrubby Sub-formation)					
5	Red Gum – Tea Tree Creek Woodland (Good)	399	Red Gum – Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga to Goonoo sandstone forests, Brigalow Belt South Bioregion (Good)	0.5	10% (+/- 50)
5a	Red Gum – Rough-barked Apple – Tea Tree Creek Woodland (Moderate)	399	Red Gum – Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga to Goonoo sandstone forests, Brigalow Belt South Bioregion (Moderate)	0.1	10% (+/- 50)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests (Good)	9.5	9% (+/- 40)
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests (Moderate)	0.2	9% (+/- 40)
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	White Bloodwood – Red Ironbark – Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions (Good)	3.6	14% (+/- 30)
8a	Derived Native Grassland	405	White Bloodwood – Red Ironbark – Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions (DNG)	0.1	14% (+/- 30)
			Total Area (ha) Woodland	**13.9**	-
			Total Area (ha) Derived Native Grassland	**0.2**	-
			Total Area (ha) Native Vegetation	**14.1**	-

Table 14
Vegetation Integrity Score Detail – Impact Reduction Area

Vegetation Zone	PCT ID and Vegetation Community (AMBS, 2020a) (Attachment B)		PCT – Condition Class	Sensitivity to Gain^	Patch Size	Composition Condition Score*	Structure Condition Score*	Function Condition Score*	Vegetation Integrity Score*
1b	88	Derived Native Grassland	DNG	High	>100	47.9	29.1	3.5	17
5	399	Red Gum – Tea Tree Creek Woodland	Good	High	>100	91	44.7	79.8	68.7
5a	399	Red Gum – Tea Tree Creek Woodland	Mod.	High	>100	79.3	22	33	38.6
7	404	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland	Good	High	>100	65.4	59.6	48.3	57.3
7a	404	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland	Mod.	High	>100	70.4	10.3	48.7	32.8
8	405	White Bloodwood – Red Ironbark – Black Cypress Woodland	Good	High	>100	77.1	27.3	65.6	51.7
8a	405	Derived Native Grassland	DNG	High	>100	64.3	21.4	34.1	36.1

^ The sensitivity class is set for each PCT by DPIE (2020b).

* BAM Credit Calculator.

5.2.2 Ecosystem Species

As described in Section 4.1.1, ecosystem credit species for assessment are identified in the BAM Credit Calculator. A total of 33 ecosystem credit species are listed in Table 15 from the BAM Credit Calculator for the Impact Reduction Area. Species shaded in Table 3 are species with records in MLA 1 and/or MLA 2.

Table 15
Ecosystem Species from the BAM Credit Calculator – Impact Reduction Area

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Sensitivity to Potential Gain
		BC Act[1]	EPBC Act[2]		
Birds					
Lophoictinia isura	Square-tailed Kite	V	-	Species/Ecosystem	Moderate
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/Ecosystem	Moderate
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/Ecosystem	High
Circus assimilis	Spotted Harrier	V	-	Ecosystem	Moderate
Hieraaetus morphnoides	Little Eagle	V	-	Species/Ecosystem	Moderate
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/Ecosystem	High
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	Species/Ecosystem	High (breeding) Moderate (foraging)
Glossopsitta pusilla	Little Lorikeet	V	-	Ecosystem	High
Neophema pulchella	Turquoise Parrot	V	-	Ecosystem	High
Lathamus discolor	Swift Parrot	E	CE	Species/Ecosystem	Moderate

Table 15 (Continued)
Ecosystem Species from the BAM Credit Calculator – Impact Reduction Area

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Sensitivity to Potential Gain
		BC Act[1]	EPBC Act[2]		
Polytelis swainsonii	Superb Parrot	V	V	Species/Ecosystem	High (breeding) Moderate (foraging)
Tyto novaehollandiae	Masked Owl	V	-	Species/Ecosystem	High
Ninox connivens	Barking Owl	V	-	Species/Ecosystem	High
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Ecosystem	High
Chthonicola sagittata	Speckled Warbler	V	-	Ecosystem	High
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Ecosystem	Moderate
Grantiella picta	Painted Honeyeater	V	V	Ecosystem	Moderate
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Ecosystem	Moderate
Petroica boodang	Scarlet Robin	V	-	Ecosystem	Moderate
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Ecosystem	Moderate
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem	Moderate
Pachycephala inornata	Gilbert's Whistler	V	-	Ecosystem	Moderate
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Ecosystem	Moderate
Stagonopleura guttata	Diamond Firetail	V	-	Ecosystem	Moderate
Mammals					
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Ecosystem	High
Phascolarctos cinereus	Koala	V	V	Species/Ecosystem	High
Macropus dorsalis	Black-striped Wallaby	E	-	Ecosystem	High
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem	High
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	High
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/Ecosystem	Very High (breeding) High (foraging)
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Ecosystem	High
Chalinolobus picatus	Little Pied Bat	V	-	Ecosystem	High
Pseudomys pilligaensis	Pilliga Mouse	V	V	Ecosystem	High

Note: Highlighted species are species recorded in MLA 1 and/or MLA 2.

[1] Conservation status under the BC Act (current as at October 2020). E = Endangered; V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; V = Vulnerable.

[3] Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

5.2.3 Species Credit Species

As described in Section 4.2.5, Habitat (Species Polygons) were created by AMBS (2020a and 2020b) (Attachments B and C) for *Tylophora linearis*, Pale-headed Snake, Glossy Black-Cockatoo, Koala, Eastern Pygmy-possum, Squirrel Glider (Figures 20 to 25). Table 16 presents the area of habitat within the Impact Reduction Area and the corresponding credits. The credit report from the BAM Credit Calculator for the Impact Reduction Area is provided in Attachment M.

Table 16
Impact Reduction Credit Summary – Species Credits

Scientific Name	Common Name	Conservation Status		Impact Reduction Area (ha)	Impact Reduction Area Credits (Attachment M)
		BC Act[1]	EPBC Act[2]		
Tylophora linearis	-	V	E	13.9	387
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	13.9	387
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	13.9	387
Phascolarctos cinereus	Koala	V	V	13.9	387
Cercartetus nanus	Eastern Pygmy-possum	V	-	13.9	387
Petaurus norfolcensis	Squirrel Glider	V	-	4.5	121

^ Includes clearance, ponding, ETL management and potential cracking impacts.

[1] Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). E = Endangered; V = Vulnerable.

Coolabah Bertya is conservatively not included in Table 16 as the actual numbers of individuals that would be avoided is not known.

5.2.4 Impact Reduction Credit Summary

The ecosystem and species credit requirements for the Project less those for the Impact Reduction Area (prior to application of the mine site ecological rehabilitation in Section 10.5) are provided in Tables 17 and 18. For the Project ecosystem and species credit requirements after application of the Impact Reduction Area and mine site ecological rehabilitation, refer to Section 10.6. The credit report from the BAM Credit Calculator for the Impact Reduction Area is provided in Attachment M.

Table 17
Impact Reduction Credit Summary – Ecosystem Credits

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Development Footprint		Impact Reduction Area		Remaining Credits to be Offset
			Total Disturbance by the Project (ha)^ (Table 19)	Total Credits (Table 10)	Area (ha) (Table 13)	Credits (Attachment M)	
1	Pilliga Box –Buloke Woodland (Good)	88	51	1,172	0	-	**1,172**
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.2	3	0	-	**3**
1b	Derived Native Grassland	88	73.1	906	0.1	-1	**905**
2	Broombush – Wattle Tall Shrubland (Good)	141	0.6	10	0	-	**10**
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	-	**0**
4	White Box Woodland (Good)	435	28.9	528	0	-	**528**
4a	White Box Woodland (Moderate)	435	0	0	0	-	**0**
4b	Derived Native Grassland	435	23.1	48	0	-	**48**
5	Red Gum – Tea Tree Creek Woodland (Good)	399	12.4	333	0.5	-13	**320**
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0.9	13	0.1	-1	**12**
6	Rough-barked Apple Sand Flat Woodland (Good)	401	4.3	111	0	-	**111**
7	Red Ironbark – White Bloodwood Shrubby Woodland (Good)	404	204.8	5,542	9.5	-204	**5,338**
7a	Red Ironbark – White Bloodwood Shrubby Woodland (Moderate)	404	2	29	0.2	-2	**27**
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	100.4	2,220	3.6	-70	**2,150**
8a	Derived Native Grassland	405	0.7	9	0.1	-1	**8**
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	37.9	890	0	-	**890**
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	18	0	-	**18**
10	Dirty Gum Shrubby Woodland (Good)	408	0.1	3	0	-	**3**
11	Poplar Box Grassy Woodland	244	18.6	365	0	-	**365**
11a	Derived Native Grassland	244	23.9	73	0	-	**73**
12	Belah Woodland	55	7.6	239	0	-	**239**
12a	Derived Native Grassland	55	50.4	600	0	-	**600**
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	2	60	0	-	**60**
		Total	**643.8**	**13,172**	**14.1**	**-292**	**12,880**

^ Includes clearance, ponding, ETL management and potential cracking impacts.

Table 18
Impact Reduction Credit Summary – Species Credits

Scientific Name	Common Name	Conservation Status		Development Footprint		Impact Reduction Area		Remaining Credits to be Offset
		BC Act[1]	EPBC Act[2]	Total Disturbance by the Project (ha)^ (Table 11)	Total Credits (Table 11)	Area (ha)	Credits (Attachment M)	
Bertya opponens	Coolabah Bertya	V	V	25,939 (individuals)	51,878	N/A	-	**51,878**
Lepidium aschersonii	Spiny Peppercress	V	V	58.8	1,804	0	-	**1,804**
Tylophora linearis	-	V	E	444.4	14,391	13.9	-387	**14,004**
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	499	15,281	13.9	-387	**14,894**
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	513.9	15,619	13.9	-387	**15,232**
Phascolarctos cinereus	Koala	V	V	514.5	15,632	13.9	-387	**15,245**
Cercartetus nanus	Eastern Pygmy-possum	V	-	413.1	13,727	13.9	-387	**13,340**
Petaurus norfolcensis	Squirrel Glider	V	-	308.4	8,456	4.5	-121	**8,335**
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	245.2	11,937	0	-	**11,937**
Vespadelus troughtoni	Eastern Cave Bat	V	-	151.5	6,564	0	-	**6,564**

^ Includes clearance, ponding, ETL management and potential cracking impacts.

[1] Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). E = Endangered; V = Vulnerable.

6 EVALUATION OF POTENTIAL IMPACTS

Impacts on vegetation and habitat adjacent to the Development Footprint are assessed below, including those listed in the BAM (OEH, 2017a), draft BAM (DPIE, 2019a) and *Biodiversity Assessment Method Operational Manual* (DPIE, 2019b). Relevant key threatening processes listed under the BC Act and EPBC Act have been assessed.

6.1 DIRECT IMPACTS ON NATIVE VEGETATION AND HABITAT

After applying the measures to avoid and/or minimise impacts on biodiversity values (Section 5), the Project would still have residual direct impacts on native vegetation and habitat as a result of land clearance prior to revegetation. The extent of the Development Footprint is shown on Figure 6.

Clearing of native vegetation is recognised as a key threatening process listed under the BC Act, and *Land clearance* is a related key threatening process listed under the EPBC Act. The sub-sections below evaluate the impact of land clearance on the loss of extant vegetation (Section 6.1.1), loss and fragmentation of fauna habitat resources (Section 6.1.2) and fauna potentially present during clearance activities (Section 6.1.3). Measures to mitigate and manage the impacts are described in the sections below and summarised in Section 7. Biodiversity offsets are described in Section 10.

6.1.1 Clearing of Native Vegetation

The Development Footprint for the Project is 1,731.2 ha in size (985.6 ha from the approved mine and approximately 745.6 ha of additional footprint). The Project would require the progressive clearance of approximately 444.7 ha of woodland and approximately 129.9 ha of derived native grassland over a 23-year period. Land clearance would occur before and during mining of each longwall.

NCOPL anticipates that construction and operational activities associated with the Project would commence as soon as practicable after all necessary consents, approvals and licences for the Project have been obtained. NCOPL has mined Longwalls 101 to 108 at a rate of approximately one longwall block per year.

Mine infrastructure such as gas drainage and mine services would typically be developed ahead of longwall development (i.e. typically approximately one to six months or approximately 500 m ahead of longwall development). This infrastructure would be decommissioned and rehabilitated as required, or where no further beneficial use is identified (i.e. typically commencing within approximately 12 months to 2.5 years after the longwall has passed the location underground). Other infrastructure (e.g. the services corridor that provides access to the southern ventilation shaft [Figure 5]) would be installed towards the start of the Project, and would be required for the life of the mine prior to being decommissioned and rehabilitated.

The native vegetation to be cleared within the Development Footprint is quantified in Table 19 (along with quantified ponding and cracking impacts which are further discussed in Section 6.2.1). Plates 1 to 6 show the PCTs that would be most impacted. PCT 404 would be most impacted (206.2 ha, 36% of total proposed clearance). The majority of vegetation clearance would be required for access tracks.

Table 19
Native Vegetation Clearance within the Phases of the Development Footprint

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Total Development Footprint					Total Area (ha) Mapped on Figure 11 (AMBS, 2020a)	Total Area (ha) Mapped within 100 km (AMBS, 2020a; OEH, 2016b)	Total Area (ha) Mapped in the Namoi Region (OEH, 2016b)	Percent Cleared in Namoi (DPIE, 2020b)
			Clearance Area (ha) (Table 2)	Area of Potential Ponding (ha) (Table 2)	ETL Management Area (ha) (Table 2)	Area of Potential Cracking Impacts on Trees (ha) (Table 2)	Total Disturbance (ha) (Table 2)				
1	Pilliga Box –Buloke Woodland (Good)	88	37	0.6	0	13.4	**51**	284.5	20,640.5	19,591.2	38% (+/- 80)
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0	**0.2**	10.7			38% (+/- 80)
1b	Derived Native Grassland	88	63.9	0	3.4	5.8	**73.1**	468.3			38% (+/- 80)
2	Broombush – Wattle Tall Shrubland (Good)	141	0.6	0	0	0	**0.6**	4.2	12,713.9	12,945.4	11% (+/- 30)
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	**0**	25.8	0*	0*	7% (+/- 60)
4	White Box – White Cypress Woodland (Good)	435	27.9	0.6	0	0.4	**28.9**	151	11,973.5	14,344.8	58% (+/- 50)
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	**0**	3.8			58% (+/- 50)
4b	Derived Native Grassland	435	16.8	0.1	0.9	5.3	**23.1**	203.9			58% (+/- 50)
5	Red Gum – Tea Tree Creek Woodland (Good)	399	11.6	0.8	0	0	**12.4**	100	8,122.2	7,865.2	10% (+/- 50)
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0.9	0	0	0	**0.9**	12.7			10% (+/- 50)
6	Rough-barked Apple Sand Flat Woodland (Good)	401	4.3	0	0	0	**4.3**	16.6	149,399.9	150,791.4	33% (+/- 50)

Table 19 (Continued)
Native Vegetation Clearance within the Phases of the Development Footprint

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Development Footprint					Total Area (ha) Mapped on Figure 11 (AMBS, 2020a)	Total Area (ha) Mapped within 100 km (AMBS, 2020a; OEH, 2016b)	Total Area (ha) Mapped in the Namoi Region (OEH, 2016b)	Percent Cleared in Namoi (DPIE, 2020b)
			Clearance Area (ha) (Table 2)	Area of Potential Ponding (ha) (Table 2)	ETL Management Area (ha) (Table 2)	Area of Potential Cracking Impacts on Trees (ha) (Table 2)	Total Disturbance (ha) (Table 2)				
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	204.2	0.6	0	0	**204.8**	1,714.3	14,065	14,065	9% (+/- 40)
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	2	0	0	0	**2**	21.4			
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	100.4	0	0	0	**100.4**	691.1	149,819.6	149,852.9	14% (+/- 30)
8a	Derived Native Grassland	405	0.7	0	0	0	**0.7**	4.6			
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	37.9	0	0	0	**37.9**	381.1	1,216.3	1,216.3	6% (+/- 50)
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0	**0.9**	15			
10	Dirty Gum Shrubby Woodland (Good)	408	0.1	0	0	0	**0.1**	14.8	2,053.8	2,053.8	14% (+/- 50)
11	Poplar Box Grassy Woodland (Good)	244	7.2[A]	0.4	0	11[B]	**18.6**	79.1	4,308.4	9,976.5	73% (+/- 50)
11a	Derived Native Grassland	244	16.2	0	4.4	3.3	**23.9**	271.7			

Table 19 (Continued)
Native Vegetation Clearance within the Phases of the Development Footprint

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Development Footprint					Total Area (ha) Mapped on Figure 11 (AMBS, 2020a)	Total Area (ha) Mapped within 100 km (AMBS, 2020a; OEH, 2016bb)	Total Area (ha) Mapped in the Namoi Region (OEH, 2016b)	Percent Cleared in Namoi (DPIE, 2020b)
			Clearance Area (ha) (Table 2)	Area of Potential Ponding (ha) (Table 2)	ETL Management Area (ha) (Table 2)	Area of Potential Cracking Impacts on Trees (ha) (Table 2)	Total Disturbance (ha) (Table 2)				
12	Belah Woodland (Good)	55	7.6	0	0	0	**7.6**	60.1	12,494.4	69,668.8	83% (+/- 50)
12a	Derived Native Grassland	55	32.3	0.4	4.2	13.5	**50.4**	266.7			
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	2	0	0	0	**2**	37.1	2,858	3,837.8	50% (+/- 50)
		Total	**574.6**	**3.6**	**12.9**	**52.7**	**643.8**	**4,838.5**	**389,665.5**	**456,209.1**	**-**

[A] Approximately 3.8 ha represents the Poplar Box Woodland EEC.

[B] Approximately 4.1 ha represents the Poplar Box Woodland EEC.

* This PCT has a 'low' classification confidence in the *BioNet Vegetation Classification* (DPIE, 2020b) that needs more data. It is a naturally restricted PCT of which little is thought to have been cleared because it is restricted to poorer soils (DPIE, 2020b). The apparent absence of this PCT in the regional mapping is most likely due to the inaccuracies with the broad-scale regional mapping rather than an actual absence of the PCT (evidenced by the occurrence in the Subject land that is not present in the regional mapping).

Plate 1 – Example of Vegetation Community 1 – Pilliga Box – Buloke Woodland (Good) (PCT 88)

Plate 2 – Example of Vegetation Community 1b – Derived Native Grassland (PCT 88)

Plate 3 – Example of Vegetation Community 7 - Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good) (PCT 404)

Plate 4 – Example of Vegetation Community 8 – White Bloodwood – Red Ironbark – Black Cypress Woodland (Good) (PCT 405)

Plate 5 – Example of Vegetation Community 9 – White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good) (PCT 406)

Plate 6 – Example of Vegetation Community 12a – Derived Native Grassland (PCT 55)

The PCTs that would be subject to clearance are all more widely occurring in the landscape (as surveyed by AMBS, 2020a [Attachment B]) and subregion (as mapped by OEH, 2016b) (Table 19). Table 19 lists the percentage of the PCTs that remain in Namoi IBRA region (DPIE, 2020b). All of the PCTs are over 30% of the estimated pre-European extent except PCT 55 and PCT 244 (Section 3.2). None of the PCTs that would be subject to clearance are listed as threatened under the BC Act; however, a portion of one is listed as threatened under the EPBC Act, namely the Poplar Box Woodland EEC. This TEC is discussed further in Section 9.2.1. It is also noted that many of the PCTs contain threatened flora species (Section 4.2.5).

The 66 kV ETL would be progressively extended as ventilation shafts and the mine is developed (Figure 6). Trees would be removed 30 m either side of the ETL for safety reasons. The maintenance activities along the ETL would conclude once the ETL is no longer operational.

A portion of the total native vegetation to be cleared (239.9 ha, 42%) is located in Pilliga East State Forest (zoned for forestry, recreation and mineral extraction) as discussed in Section 6.6. The remainder of the native vegetation to be cleared (332 ha, 58%) is located on lands designated as RU1 Primary Production zone under the *Narrabri Local Environmental Plan, 2012* (Narrabri LEP).

While the BC Act permits Category 1 land to be developed without surveys and assessment, there has been no attempt at defining Category 1 land, and therefore, it has been excluded from consideration for this Project due to the absence of State-wide Category 1 land mapping yet to be developed by DPIE.

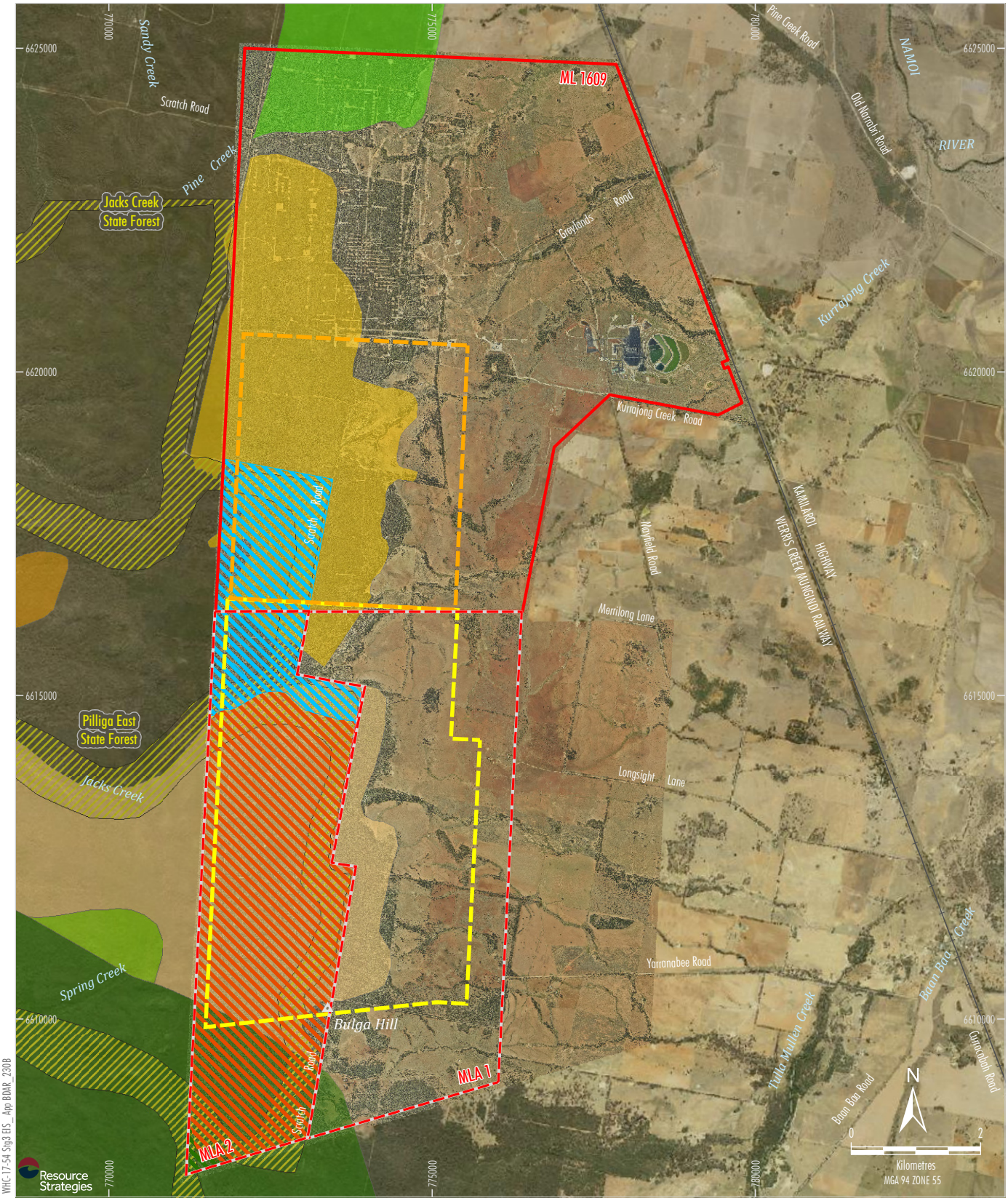
A review of the background information on the management of vegetation in the Subject land showed evidence of logging and bushfires (Figure 30). The general overall condition of the vegetation (floristics, structure, function) is 'good' (AMBS, 2020a) (Attachment B). Attachment D2 presents the vegetation integrity scores (scored out of ten based on survey data) for each PCT.

Measures to Mitigate and Manage the Impact

The following measures would be implemented to mitigate and manage the adverse impacts from land clearance on native vegetation (Section 7):

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*); and
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*).

The Mining Operations Plan (MOP) and Extraction Plan (incorporating the BMP and *Rehabilitation Management Plan* [RMP]) would facilitate the implementation of the management measures.



LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Underground Mine Footprint to be Extended for Project
- Project Underground Mine Footprint

Forestry Logging

- 1978/79 and 1980/81
- 1980/81
- 2000/01

Fire History

- 1951-52 Wildfire
- 1977-78 Wildfire
- 1980-81 Wildfire
- 1982-83 Wildfire
- 1985-86 Wildfire
- 1986-87 Wildfire
- 1991-92 Prescribed Burn

Source: NCOPL (2019); NSW Spatial Services (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Disturbance History

Figure 30

Summary

The native vegetation communities to be cleared are all more widely occurring in the landscape and subregion (Table 19). Vegetation clearance would be undertaken in a controlled manner and it would be possible to compensate for residual impacts by:

- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*); and
- providing appropriate biodiversity offsets that specifically benefit the vegetation communities that would be impacted, particularly conservation significant Poplar Box Woodland EEC (PCT 244) (Section 10.7).

6.1.2 Clearing of Fauna Habitat

The native vegetation communities to be cleared provide habitat resources for fauna species, including 17 threatened fauna species recorded in the Subject land (AMBS, 2020b) (Attachment C). Clearing would result in the *loss of hollow-bearing trees, bushrock removal* and *removal of dead wood and dead trees*, which are key threatening processes listed under the BC Act. These are discussed below.

Hollow-bearing trees are found throughout the woodland but are generally sparse (i.e. thinly dispersed/scattered or uncommon), with their numbers likely to have been reduced due to past logging (Figure 30). In the agricultural areas, paddocks trees are present either as occasional individual trees or in groups.

A range of hollow-nesting birds, bats and arboreal mammals were recorded during the fauna surveys, including cockatoos, parrots, possums and microbats (AMBS, 2020b) (Attachment C). Five threatened fauna species that nest or roost in tree hollows were recorded (not necessarily utilising tree hollows): Glossy Black-Cockatoo, Little Lorikeet (*Glossopsitta pusilla*), Eastern Pygmy-possum, Yellow-bellied Sheath-tailed Bat and Corben's Long-eared Bat (*Nyctophilus corbeni*). It is likely that these species make use of tree hollows in the Development Footprint or surrounds. All of these threatened species, except Eastern Pygmy-possum, are known to nest in disturbed areas (paddock trees and fragmented habitat).

Bush rocks provide shelter for lizards and invertebrates. AMBS (2020b) (Attachment C) noted some bush rock areas during the fauna surveys; however, no threatened fauna that use bush rocks were recorded.

Dead wood and dead trees are present in the Development Footprint and surrounds. Stags (dead trees) can provide habitat for hollow-dwelling fauna (including some threatened birds and bats). Logs on the ground can provide habitat for fauna such as lizards and snakes); however, no threatened fauna that use logs were recorded.

Nectar-producing trees and shrubs occur through-out the native vegetation communities, providing a source of food for fauna (including threatened fauna). Mistletoe (commonly used by honeyeaters) is present, but scarce.

The drainage features in the locality are ephemeral and provide a water source at limited times. NCOPL reviewed the siting of surface infrastructure in consideration of drainage features (creeks). However, it is not possible to avoid crossing drainage features (creeks) with access tracks. Some existing farm dams would be cleared and some areas of ponding would be created and then remediated.

As described in Section 5.1, the mine layout was modified to avoid impacts on Bulga Hill, a rocky outcrop with bat habitat. One other (smaller) rocky outcrop with bat habitat, which is used by the Large-eared Pied Bat (Figure 27), would be subsided by the Project. Mine subsidence impacts (potential cracking) are discussed in Section 6.2.1.

The woodland habitat to be cleared (approximately 444.7 ha) is part of a large continuous expanse of native vegetation including Jacks Creek State Forest (approximately 10,045 ha), Pilliga East State Forest (approximately 131,899 ha) and neighbouring reserves (approximately 192,366 ha total). Clearance of habitat can result in two prescribed impacts listed under the BC Regulation:

- *the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range;* and
- *the impacts of development on movement of threatened species that maintains their lifecycle.*

These impacts are described in Sections 6.3.2 and 6.3.3.

Measures to Mitigate and Manage the Impact

The following measures would be implemented to mitigate and manage the adverse impacts from land clearance on habitat (Section 7):

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- salvage of suitable hollows and logs during vegetation clearance for use in rehabilitation (*Biodiversity Measure 3*); and
- implementation of a nest box programme for the Glossy Black-Cockatoo, Eastern Pygmy-possum, Squirrel Glider and Corben's Long eared Bat outside of the State Forest (*Biodiversity Measure 4*).

Summary

The habitats to be cleared are all more widely occurring in the landscape and subregion. The individual fauna that use or are likely to use the habitats in the Development Footprint are a subset of the more widely occurring species assemblages. Habitat clearance would be undertaken in a controlled manner and it would be possible to compensate for residual impacts by:

- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*); and
- providing appropriate biodiversity offsets that specifically benefits the threatened species that would be impacted (Section 10).

6.1.3 Fauna and Clearance Activities

Fauna present in the areas proposed to be cleared would be at risk of injury or fatality during clearance activities. The risk to fauna would be determined by the method of clearance, type of fauna present, amount of clearance, the presence of surrounding suitable habitat with the ability to accommodate displaced fauna, and the attendance during the clearance by a fauna handler to cater for injured fauna.

Measures to Mitigate and Manage the Impact

The following measures would be implemented to mitigate and manage the adverse impacts from land clearance on fauna individuals (Section 7):

- vegetation clearance protocol, pre-clearance surveys and fauna management (*Biodiversity Measure 1*);
- animal pest control strategies would be implemented as necessary in retained habitat, potentially reducing pressure on displaced native animals (*Biodiversity Measure 11*); and
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*).

Summary

The adverse impacts from land clearance on fauna individuals cannot be avoided but would be mitigated and managed through the vegetation clearance protocol and management of remaining habitat.

6.1.4 Cumulative Impacts

Cumulative impacts are considered to be the total impact on the environment that would result from the incremental impacts of the Project in addition to past, present and reasonably foreseeable planned developments that may interact with Project impacts. Cumulative impacts include both direct and indirect impacts.

Development of the original Narrabri Mine commenced in 2008, and the longwall mining operations associated with Stage 2 commenced in 2012. The current Narrabri Mine approved indicative surface Development Footprint is 750 ha in size and involves the clearance of a total of approximately 210.5 ha of native vegetation[7].

Key proposed or approved projects that may potentially interact with, or have potential cumulative impacts with, the Project include:

- Narrabri Gas Project (approximately 988.8 ha of proposed native vegetation clearance) (ELA, 2016d);
- Narrabri South Solar Farm (indeterminant);
- Silverleaf Solar Farm (approximately 183 ha of proposed native vegetation clearance) (GHD, 2019);
- Inland Rail (Narromine to Narrabri Section) (indeterminant);
- Inland Rail (Narrabri to North Star Section) (approximately 411 ha of proposed native vegetation clearance) (GHD, 2017);
- Queensland Hunter Gas Pipeline (indeterminant) (Hunter Gas Pipeline Pty Ltd, 2008); and

[7] The existing/approved Stage 2 surface infrastructure along LW206 to LW209 (not yet constructed or required for the Project) would be foregone (not cleared). This area covers approximately 14.1 ha of native vegetation is referred to as an Impact Reduction Area (Section 5.2).

- other coal mining operations (e.g. approximately 1,664.8 ha of proposed native vegetation clearance at Maules Creek Coal Mine [Cumberland Ecology, 2011], approximately 1,385 ha of proposed native vegetation clearance at Boggabri Coal Mine [Hansen Bailey, 2010], approximately 397 ha of proposed native vegetation clearance at Tarrawonga Coal Mine [Tarrawonga Coal, 2012] and approximately 2,328 ha [1,786 ha of DNG and 542 ha of woodland] of total proposed native vegetation clearance at the Vickery Extension Project [Resource Strategies, 2018]).

The surface development for the Project would involve progressive clearance (over a 23-year period) of approximately 574.6 ha of native vegetation (Table 19). This is a relatively small area compared to the extensive and continuous native vegetation within Jacks Creek State Forest (approximately 10,045 ha), Pilliga East State Forest (approximately 131,899 ha) and neighbouring reserves (approximately 192,366 ha total).

In addition to potential cumulative adverse impacts, the approved and proposed activities at the Narrabri Mine also have potential cumulative benefits in the form of offset areas. Existing offset areas for the Narrabri Mine include the on-site offset areas (approximately 431 ha) (Figure 7) and the Kenna Property, located 30 km east (approximately 933 ha) (Figure 1). The biodiversity offset strategy for the Project is described in Section 10.

6.2 INDIRECT IMPACTS ON NATIVE VEGETATION AND HABITAT

This section assesses the potential for indirect impacts on vegetation and habitat adjacent to the Development Footprint, during construction and operation. Vegetation adjacent to the Development Footprint is shown on Figure 11. Threatened fauna records adjacent to the Development Footprint are shown on Figures 15 to 17.

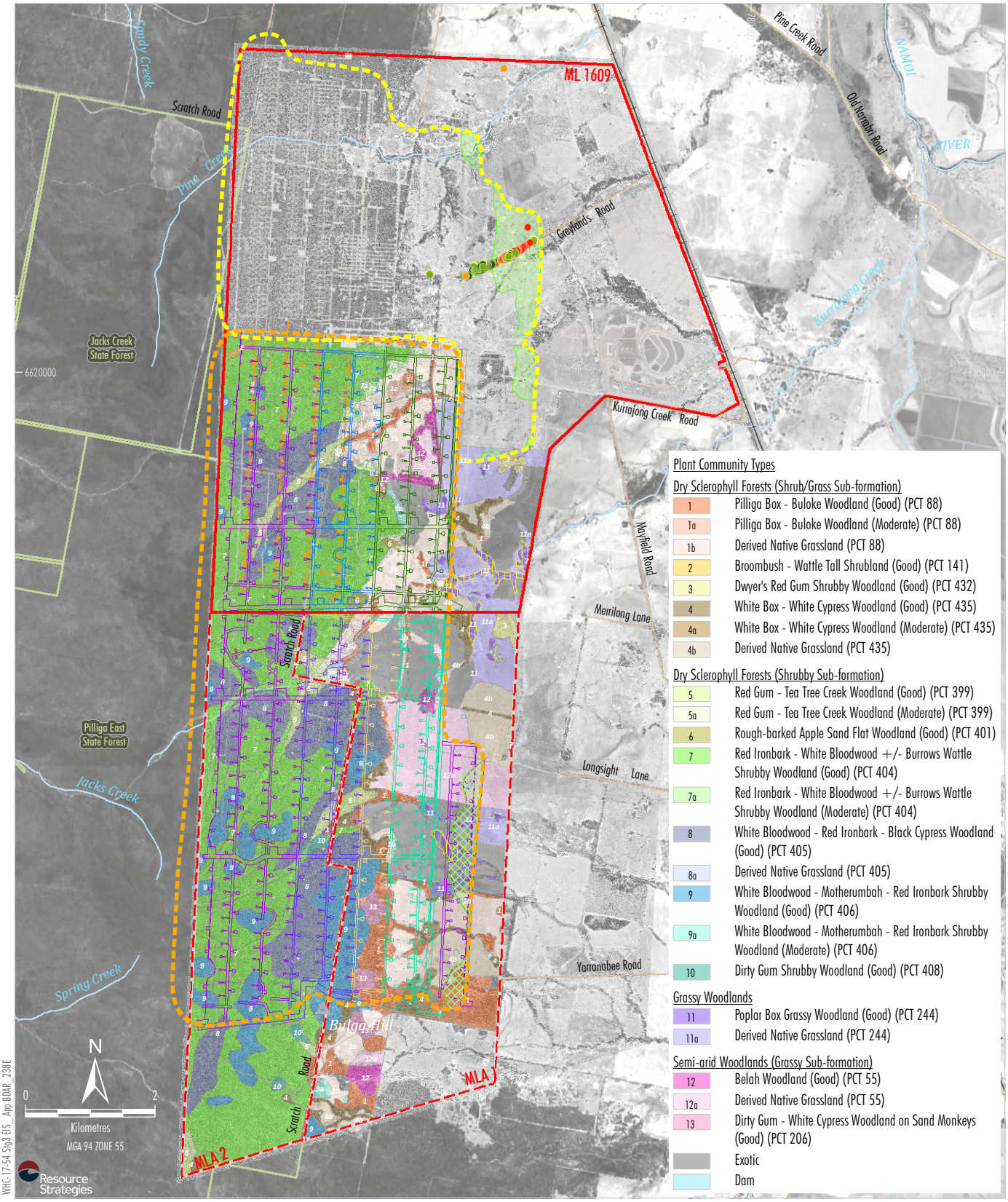
6.2.1 Mine Subsidence

Subsidence is the vertical and horizontal movement of the overburden and land surface as a result of the extraction of underlying coal. These movements are generally referred to as subsidence effects. The type and magnitude of the subsidence effects are dependent on a range of variables (e.g. mine geometry, topography and geology). Subsidence effects which may potentially impact native vegetation and habitat include surface cracking, ponding and root shearing. An assessment of potential subsidence impacts conducted by Ditton Geotechnical Services (2020) and an assessment of the potential subsidence-related impacts on surface water resources was undertaken by WRM (2020). The extent of predicted conventional subsidence relative to native vegetation is shown on Figure 31 and is based on the predicted 20 millimetres (mm) subsidence contour in Ditton Geotechnical Services (2020).

Cracking and Remediation

Ditton Geotechnical Services (2020) expects that typical crack widths in relatively ‘flat’ terrain are estimated to range from 100 mm to 400 mm, up to approximately 390 mm in sand or loam and approximately 780 mm in clay or rock.

The exact location of surface cracking and other potential subsidence impacts is unknown; however, the nature and extent of potential subsidence impacts of the Project can be reasonably estimated and assessed based on experience and monitoring results of the existing mine (Ditton Geotechnical Services, 2020).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

- Stage 2 Extent of Conventional Subsidence (20 mm Subsidence Contour)
- Stage 3 Extent of Conventional Subsidence (20 mm Subsidence Contour)
- Subsidence Area 180 m Cover

Threatened Ecological Communities

- Poplar Box Grassy Woodland on Alluvial Plains

Tree Health Condition

- 1
- 2
- 3
- 4
- 5

Source: Orthophotos - NCOPL (2017)
NCOPL (2019); NSW Spatial Services (2019);
Eco Logical Australia (2014); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Vegetation Mapping - Subsidence Impacts

Figure 31

Minor cracks are not expected to require remediation, as geomorphological processes would result in these cracks filling naturally over time. Remediation of the larger surface cracks would generally be undertaken using conventional earthmoving equipment (such as backhoe or grader), and would involve ground disturbance associated with in-filling of surface cracks by cultivation of the ground surface or in-filling with suitable soil or other material (Ditton Geotechnical Services, 2020).

Prior to any remediation of surface cracks, NCOPL would undertake a review of environmental impacts that may result from the remediation at the specific location and consider whether remediation of surface cracks is environmentally beneficial or if alternative methods of remediating the crack are warranted (e.g. without machinery). The review would consider, among other factors, the known locations of threatened flora species.

Watercourses

Potential impacts on the watercourses overlying Longwalls 203 to 210 were assessed as part of the Surface Water Assessment (WRM, 2020). Potential subsidence impacts on unnamed ephemeral and intermittent watercourses would be monitored and managed through a process of adaptive management. Under this process: (i) regular monitoring would detect if and where the impact occurs, (ii) an assessment would be made to determine the potential consequences of the observed impact, and then (iii) appropriate control works would be put in place.

Potential Ponding

WRM (2020) identified areas of potential ponding resulting from subsidence effects (Figure 6). This area has conservatively been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible). Remediation would generally be undertaken using conventional earthmoving equipment (such as backhoe or grader), and would involve localised regrading or reshaping to limit the potential for water ponding (WRM, 2020).

Potential Cracking Impacts on Vegetation and Fauna

Following completion of mining in LW101 and LW102, it was observed that several large trees, eucalypts in particular, were dead or highly stressed in areas within the LW101 subsidence zone. ELA (2014) investigated the extent and the cause of the impact on the trees and concluded that a number of factors resulted in shearing of tree roots. ELA (2014) reported that it was the combination of dry conditions, the low depth of cover and heavy soil texture that were identified as the contributing factors to the impacts observed at LW101.

Figure 31 presents the tree health condition data gathered by ELA (2014) and the Stage 2 extent of conventional subsidence. The condition score ranges from 1 (normal) to 5 (dead) based on a condition scoring system by Wylie *et al*. (2002). The area with a depth of cover of 180 m and lower was found to approximately correlate to the area of potential cracking impacts on trees noted by ELA (2014).

The depth of cover over LW 203 to 209 is greater than LW 101 and LW 102; however, the depth of cover over the southern end of LW 210 is commensurate with LW102, where some impacts to vegetation were observed (Ditton Geotechnical Services, 2020). Figure 31 shows the subsidence area of 180 m cover above LW 210. Ditton Geotechnical Services (2020) considers that any large trees (eucalypts in particular) in clayey soils above LW 210 would be at risk of root shear leading to tree stress or death, particularly if dry climatic conditions prevail at the time of longwall extraction. For this reason, an offset requirement for the area with a depth of cover of 180 m and lower has been calculated using the BAM Credit Calculator (Table 1) (Figure 6) to account for potential cracking impacts on trees.

Land subsidence is unlikely to materially impact on vegetation or habitat within the predicted subsidence area, as dieback or more than occasional tree fall (outside of potential ponding areas and identified areas of potential cracking impacts [Figure 6]) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

It is conceivable that individual ground animals (e.g. lizards and mice) could fall into subsidence cracks and likely climb out; however, cracks are likely to fill naturally over time (Ditton Geotechnical Services, 2020) and surface cracking would be greater in the eastern portion of the Project area (outside the woodland), where the depth of cover is less (Ditton Geotechnical Services, 2020).

Potential Cracking Impacts on Rocky Outcrops

As described in Section 5.1, the mine layout was modified to avoid clearance and minimise subsidence impacts on Bulga Hill, a rocky outcrop with bat habitat. One other (smaller) rocky outcrop with bat habitat would be subsided by the Project, which is used by the Large-eared Pied Bat (Figure 26). Impacts from subsidence would include cracking (i.e. not complete removal).

Summary

A subsidence monitoring programme and adaptive management approach would be implemented to manage potential subsidence impacts from the Project and would be documented in Extraction Plans. If unpredicted subsidence impacts and/or environmental consequences occur, adaptive management would be undertaken involving the implementation of measures to prevent their re-occurrence. Further information on the Extraction Plan process and adaptive management strategy is provided in Section 7.

6.2.2 Mine Subsidence Erosion and Sedimentation

Ditton Geotechnical Services (2020) considered the potential cracking, erosion and deposition of soils after subsidence. Surface cracks on steep slopes (e.g. rocky outcrops) may allow surface runoff to enter the rock mass. The seepage pathways could result in internal erosion and local instability to develop. Erosion along the creek beds would be expected to develop above chain pillars between the panels and on the side where the gradients increase. Sediment would be expected to accumulate where gradients decrease.

Measures to Mitigate and Manage the Impact

Potential cracking, erosion and deposition of soils would be mitigated by:

- Selected surface slope and rocky outcrops displacement monitoring (combined with general subsidence monitoring).
- In-filling of surface cracking to reduce erosion.
- Areas that are significantly affected by erosion may need to be repaired (e.g. by re-grading, installation of new contour banks and re-vegetation of exposed areas).

The *Narrabri Mine Land Management Plan* (ELA, 2019c) (or its latest approved version) provides a monitoring programme for soil erosion by identifying erosion or sedimentation issues and triggering additional management actions.

6.2.3 Inadvertent Impacts on Adjacent Habitat or Vegetation

Inadvertent impacts on adjacent habitat or vegetation may occur through human error. However, systems would be put in place to manage the potential for this impact to occur.

Measures to Mitigate and Manage the Impact

A vegetation clearance protocol would be adopted (Section 7) to minimise the risk of inadvertent impacts on adjacent habitat or native vegetation in the short-term during construction or operation of the Project, e.g. clearance of vegetation outside of the approved disturbance limit. Native vegetation clearing requires approval from the NCOPL Environmental Officer under the pre-clearance permit arrangements (ELA, 2019b).

6.2.4 Impacts on Adjacent Habitat or Vegetation from a Change in Land Use Pattern (Increased Human Activity)

Although the Project would temporarily increase human activity during construction and revegetation activities, access to ML 1609, MLA 1 and MLA 2 is controlled and generally restricted to authorised personnel. For this reason, no adverse impacts are likely to result on habitat and vegetation adjacent to the Development Footprint due to the increased human activity. Vehicle strike is assessed in Section 6.3.6.

6.2.5 Reduced Viability of Adjacent Habitat Due to Edge Effects

Edge effects can occur from a change in physical and/or biological conditions at edges of habitat. The proposed clearing associated with the Project within woodland would progressively create new edges to the habitat present. These habitat edges (and potential edge effects on the habitat) would exist temporarily during construction and operation until the cleared areas are revegetated. The woodland present generally has an open structure which, compared to a closed forest, is generally less susceptible to edge effects from changes in physical conditions. There are existing tracks within the woodland areas, including within Pilliga East State Forest, with no notable edge effects.

Fragmentation impacts (that can result in edge effects) have been minimised by the proposed continued use of the substantial existing infrastructure at the existing approved and operating underground mine (limiting the requirement to develop new infrastructure) as well as locating multiple surface infrastructure components within the same disturbed area (Section 5.1).

The potential impact of noise, dust or light spill is discussed further below in Sections 6.2.6, 6.2.7 and 6.2.8. The potential impact of weeds is discussed in Section 6.2.9. Fragmentation is discussed in Section 6.3.2.

Measures to Mitigate and Manage the Impact

The main measure to mitigate edge effects is the progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*). Other measures to mitigate and manage noise, dust, light spill and weeds are discussed further below in Sections 6.2.6, 6.2.7, 6.2.8 and 6.2.9.

Summary

Potential impacts on the edge of surrounding woodland is likely to be comparatively minor compared to the main impact of vegetation and habitat loss. As described above, clearing would be progressive followed by rehabilitation meaning that only portions of the development footprint shown in Figure 8 would be cleared at any point in time.

6.2.6 Reduced Viability of Adjacent Habitat Due to Noise

Noise can potentially adversely impact certain fauna species, although studies on the effect of noise on wildlife have shown very variable responses to potential impacts (Francis *et al.,* 2015; Summers *et al.,* 2011; Radle, 2007; Kaseloo, 2005). Some animals habituate to increases in noise levels, particularly when they are repeated at intervals (Donato, 2007; Radle, 2007).

The main noise sources at the Narrabri Mine are located at the existing Pit Top Area (Figure 2). In addition to these sources are other sources include those associated with ventilation and gas drainage infrastructure. These sources are dispersed over the underground mining area and are relocated from time to time.

Some noise would be created by vehicles during construction of site infrastructure, which would be undertaken periodically throughout the mine life. This would largely be undertaken daytime only (except for some drilling for shaft construction, which would be 24 hours a day). During operations, access to these areas would be required for light vehicles for inspections and general maintenance. This would be infrequent and mostly during daytime hours.

The noise impacts from the Project are expected to be similar in nature to the approved Narrabri Mine, that is continuous in nature, with some fluctuations in perceived noise levels due to noise-enhancing meteorological conditions (Wilkinson Murray, 2020). The scale of noise impacts for the Project would be similar to the approved Narrabri Mine.

Measures to Mitigate and Manage the Impact

A noise monitoring and management system would be implemented for the Project to assist to maintain compliance with operational limits (Wilkinson Murray, 2020).

Summary

Noise would exist temporarily during construction and operation. The scale of noise impacts for the Project would be similar to the approved Narrabri Mine and the main noise sources are located at the existing Pit Top Area (Figure 2). Were the additional noise from the Project to impact fauna in woodland habitat (such as Pilliga East State Forest), any impact from noise would likely be localised and minor compared to the main impact of habitat loss. This conclusion is based on the observation of a range of fauna recorded in habitats adjacent to the existing mining operations.

6.2.7 Reduced Viability of Adjacent Habitat Due to Dust

Material dust sources from the Narrabri Mine are limited to the coal stockpiles at the Pit Top Area. The Project would also result in the generation and dispersion of atmospheric dust from Project activities, with the key sources continuing to be located at the Pit Top Area (Jacobs, 2020).

Measures to Mitigate and Manage the Impact

A dust monitoring and management system would be implemented for the Project to maintain compliance with dust limits, including coal stockpile management, dust suppression and progressive mine rehabilitation (Jacobs, 2020).

Summary

The potential dust impacts on flora and/or fauna (e.g. in woodland habitat such as Pilliga East State Forest) associated with the Project are expected to be similar to those experienced at the Narrabri Mine. The potential dust impacts would be minor through the implementation of the dust management system described above.

6.2.8 Reduced Viability of Adjacent Habitat Due to Light Spill

Operations would continue to occur 24 hours per day. Artificial lighting for the Project has the potential to affect the behavioural patterns of some fauna species. For example, some bird and bat species are attracted to insects that swarm around artificial lights.

Lighting is used at the existing Narrabri Mine and would be used for the Project. Night-lighting of the Project surface facilities would be kept to a practicable minimum and would generally be in working areas only (i.e. the existing pit top area, and some working areas of the underground mine area).

6.2.9 Transport of Weeds and Pathogens from the Site to Adjacent Vegetation

Exotic flora can degrade native vegetation communities and *Novel Biota and their Impact on Biodiversity* is a key threatening process under the EPBC Act. State level determined priority weed species are set by the NSW DPI. The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds and high-risk activities. Regionally determined priority weed species are listed in the *North West Regional Strategic Weed Management Plan 2017–2022* (North West Land Services, 2017) along with regional strategic responses.

AMBS (2020a) (Attachment B) identified a total of 97 exotic flora species in the Subject land, including twelve species listed as High Threat Weeds (OEH, 2017a). Some weeds were common (e.g. Saffron Thistle [*Carthamus lanatus*], Prickly Pear [*Opuntia* spp.]) and other uncommon/sporadic (e.g. Coolatai Grass [*Hyparrhenia hirta*]).

Without weed management, there is a potential for existing exotic flora to become more prevalent or for new weeds to be introduced into the woodland habitat. Activities that could spread weeds during construction and operation include soil disturbance, vehicle movements and movement of soil. Disturbed areas (including those undergoing rehabilitation) provide a substrate in which weed species may grow.

No plant or animal pathogens are likely to be relevant to the construction and operation of the Project. Myrtle Rust (*Austropuccinia psidii*) and *Phytophthora cinnamomi* are fungal pathogens listed under the BC Act as key threatening processes. Neither of these fungal pathogens occur as far inland as the Development Footprint (Department of Environment and Climate Change [DECC], 2008b; Department of Primary Industries [DPI], 2015; ALA, 2019).

Measures to Mitigate and Manage the Impact

Qualified and experienced weed management contractors would manage environmental weeds (*Biodiversity Measure 10*) (Section 7).

Summary

There is a low likelihood of weeds spreading as a result of the Project.

6.2.10 Increased Risk of Fauna Starvation, Exposure and Loss of Shade or Shelter

The vegetation clearance protocol would be implemented to mitigate and manage the adverse impacts from land clearance on fauna individuals. Given the progressive nature of the proposed clearance (i.e. the majority of disturbance areas are developed ahead of underground mining and are rehabilitated after the longwall passes the location) and extensive areas of surrounding habitat, there is minimal risk of fauna becoming at risk of starvation and exposure due to loss of shade or shelter.

6.2.11 Loss of Breeding Habitats

Native vegetation in the Development Footprint are likely to be used as breeding habitat for a number of non-threatened bird and bat species, as discussed in Section 6.1.2.

6.2.12 Trampling of Threatened Flora Species

Threatened flora species known to occur adjacent to the Development Footprint (i.e. Coolabah Bertya, Scant Pomaderris and *Tylophora linearis*) are unlikely to be at risk of trampling during construction or operation, as access to ML 1609, MLA 1 and MLA 2 is controlled and generally restricted to authorised personnel.

6.2.13 Inhibition of Nitrogen Fixation and Increased Soil Salinity

The Project would not involve activities that may inhibit nitrogen fixation or increase soil salinity.

6.2.14 Fertiliser Drift

Fertiliser would be used in select areas for revegetation purposes. The Project would not result in fertiliser drift to habitat adjacent to the Development Footprint because it would be directly applied and not via aerial means.

6.2.15 Rubbish Dumping

The Project would not involve rubbish dumping. Material used for the Project would be recycled or disposed of in designated areas.

6.2.16 Wood Collection

The Project would not necessitate the collection of wood from the surrounding native vegetation outside of the Development Footprint.

6.2.17 Bush Rock Removal and Disturbance

AMBS (2020b) (Attachment C) noted some rock areas during the fauna surveys; however, none provide habitat for threatened fauna. The Project would not involve removal of bush rocks from the surrounding native vegetation outside of the Development Footprint.

6.2.18 Increase in Predatory Species Populations

Two predatory pest species were recorded by AMBS (2020b) (Attachment C), namely the Red Fox (*Vulpes vulpes*) and Feral Cat (*Felis catus*). These animals have corresponding key threatening processes under the EPBC Act, namely, *Predation by European Red Fox* and *Predation by Feral Cats.* The Project is unlikely to increase the populations of predatory pest species as no additional habitat would be provided that could harbour additional numbers of these species.

Measures to Mitigate and Manage the Impact

Qualified and experienced animal pest management contractors would manage the animal pest species Red Fox and Feral Cat (*Biodiversity Measure 11*) (Section 7). The management of animal pests would consider the relevant threat abatement plans for Red Fox and Feral Cat (DoE, 2015c; DEWHA, 2008d).

6.2.19 Increase in Pest Animal Populations

AMBS (2020b) (Attachment C) recorded the Common Myna (*Acridotheres tristis*), Common Starling (*Sturnus vulgaris*), Goat (*Capra hircus*), Feral Pig (*Sus scrofa*), Dog (*Canis lupus*), Red Fox (*Vulpes vulpes*), Feral Cat (*Felis catus*), European Brown Hare (*Lepus europaeus*) and European Rabbit (*Oryctolagus cuniculus*) during surveys. The Black Rat (*Rattus rattus*) is also known to occur in the local area (ELA, 2019b).

Some of these animals have corresponding key threatening processes under the EPBC Act as listed in Section 6.2.18, as well as *Competition and Land Degradation by Rabbits*; *Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.*

Measures to Mitigate and Manage the Impact

Qualified and experienced animal pest management contractors would manage and control animal pest species populations of the Feral Pig, European Rabbit, European Brown Hare, Goat, Red Fox and Feral Cat (*Biodiversity Measure 11*) to reduce the likelihood of their numbers increasing due to the Project (Section 7). The management of animal pests would consider the relevant threat abatement plans for Feral Pig, European Rabbit, Goat, Red Fox and Feral Cat (DEWHA, 2008c and d; DotE, 2015c; DEE, 2016 and 2017).

Summary

With the implementation of the animal pest management programme, it is unlikely that animal pest numbers would increase as a result of the Project.

6.2.20 Increased Risk of Fire

The Narrabri Mine is partially mapped as being bushfire prone. No bushfires have occurred at the Narrabri Mine to date. A small bushfire developed approximately 500 m west of the Narrabri Mine in 2017; however, the bushfire did not reach the Narrabri Mine (NCOPL, 2018).

Bushfire prevention and control measures (*Biodiversity Measure 12*) are described in Section 7 from the RMP (ELA, 2019b). The existing Narrabri Mine infrastructure would remain largely unchanged for the Project. Notwithstanding, there would be an increased fire risk associated with the extension of the surface development into MLA 1 and MLA 2. MLA 2 and a portion of MLA 1 are mapped as being bushfire prone (NSW Rural Fire Service, 2015). Therefore, the Project is not likely to materially increase the potential for bushfires to occur, given that existing mitigation and management measures would continue to be implemented for the Project (Section 7).

6.2.21 Disturbance to Specialist Breeding and Foraging Habitat

The BAM (OEH, 2017a) does not define 'specialist breeding and foraging habitat', although it does give the example of 'beach nesting for shorebirds'. No specialist breeding and foraging habitat occurs in the Development Footprint additional to that assessed above in Section 6.1.2.

6.2.22 Groundwater Dependent Vegetation

Introduction

GDEs are defined as *ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services* (Richardson *et al*., 2011a). There are two main types of Groundwater Dependent Vegetation (Doody *et al*., 2019):

- ecosystems that are dependent in whole or in part on water reserves held in the ground; and
- ecosystems that are dependent on the surface expression of groundwater.

Water reserves held in the ground form the saturated part of the aquifer soil matrix that sits below the 'water table' and are differentiated from water bound in the soil matrix in the unsaturated zone above the water table, with exception of perched water (Doody *et al.,* 2019). Water in the soil unsaturated zone typically originates from rainfall or surface runoff, but in the case of a GDE also groundwater (Doody *et al.,* 2019).

Changes to groundwater quality and quantity can have an indirect impact on ecosystems surrounding a development site and particularly ecosystems that are dependent or partially dependent on groundwater.

Consideration of whether aquatic and subterranean GDEs occur and the relevant impacts are aided by the Groundwater Assessment undertaken by Australasian Groundwater and Environmental Consultants (AGE) (2020). The potential for groundwater dependent terrestrial vegetation to occur and the relevant impacts are assessed below in consideration of relevant guidelines including the *Information Guidelines Explanatory Note: Assessing Groundwater-dependent Ecosystems* (Doody *et al.,* 2019).

Existing Groundwater Environment and the Extent of Groundwater Drawdown

The Groundwater Assessment prepared by AGE (2020) has characterised the groundwater environment. Baseline groundwater levels generally range between approximately 50 to 100 metres below ground level (mbgl) along the western boundary of ML 1609 and MLA 2, and between approximately 2 to 10 mbgl along the eastern boundary of ML 1609 and MLA 1 towards the Namoi River. Figure 32a shows the AGE (2020) modelled depth to groundwater.

Groundwater quality is variable, with median EC being 'fresh' (i.e. less than 700 microSiemens per centimetre [µS/cm]) for the Pilliga Sandstone, and 'moderately saline' (i.e. 2,000 to 10,000 µS/cm) for the Garrawilla Volcanics, Purlawaugh Formation and Napperby Formation (AGE, 2020).

Identifying Groundwater Dependent Vegetation

The potential for vegetation communities to use groundwater was investigated by AMBS (2020b) (Attachment B) in consideration of the *Information Guidelines Explanatory Note: Assessing Groundwater-dependent Ecosystems* (Doody *et al.,* 2019) and *Methods for the Identification of High Probability Groundwater Dependent Vegetation Ecosystems* (DPI – Water, 2016).

The *Groundwater Dependent Ecosystems Atlas* (GDE Atlas) (Bureau of Meteorology [BoM], 2020) was initially reviewed (Figure 32b). The GDE Atlas (BoM, 2020) provides a model of potential GDEs across Australia based on a national-scale analysis or regional studies. GDEs derived in the GDE Atlas are mapped according to the following classifications:

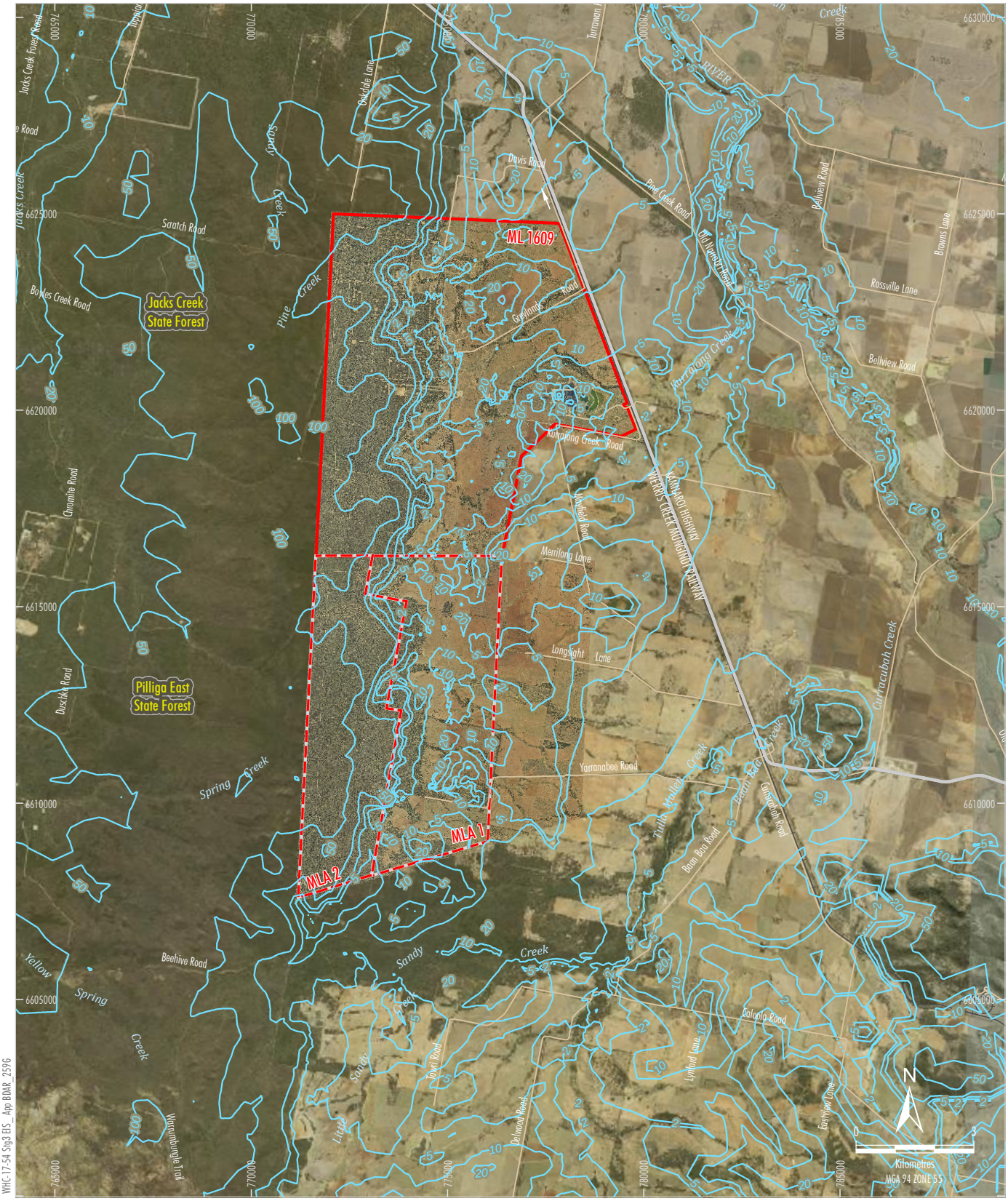
- High potential for groundwater interaction.
- Moderate potential for groundwater interaction.
- Low potential for groundwater interaction.

The final determination of GDE presence is based on an assessment of whether species within each mapped vegetation community are known to be typically groundwater dependent as well as information on the groundwater environment (groundwater depth and quality) provided by AGE (2020) (e.g. depth to groundwater).

Figure 32c shows the PCTs that may access groundwater as identified by AMBS and the depth to groundwater (Figure 32c). AMBS (2020b) (Attachment B) concludes that PCT 55 Belah Woodland (Good), PCT 244 Poplar Box Grassy Woodland (Good)[8] and PCT 399 Red Gum – Tea Tree Creek Woodland are likely to use groundwater due to the depth and quality of groundwater (described above) relative to where these PCTs occur in the landscape. No other terrestrial vegetation (or threatened flora) are considered likely to use groundwater in the MLAs.

To be classed as groundwater dependent vegetation, vegetation does not need to be entirely dependent on groundwater. Facultative GDEs require groundwater in some locations but not in others, particularly where an alternative source of water can be accessed to maintain ecological function (DPI, 2012). Facultative GDEs are Type 3 groundwater dependent ecosystem (ecosystems dependent on the subsurface expression of groundwater) as defined in the *Australian Groundwater-Dependent Ecosystems Toolbox* (Richardson *et al*., 2011).

[8] Part of which is listed as the Poplar Box Woodland EEC.



LEGEND

Mining Lease (ML 1609)

Provisional Mining Lease Application Area

Modelled Depth to Water (mbgl)

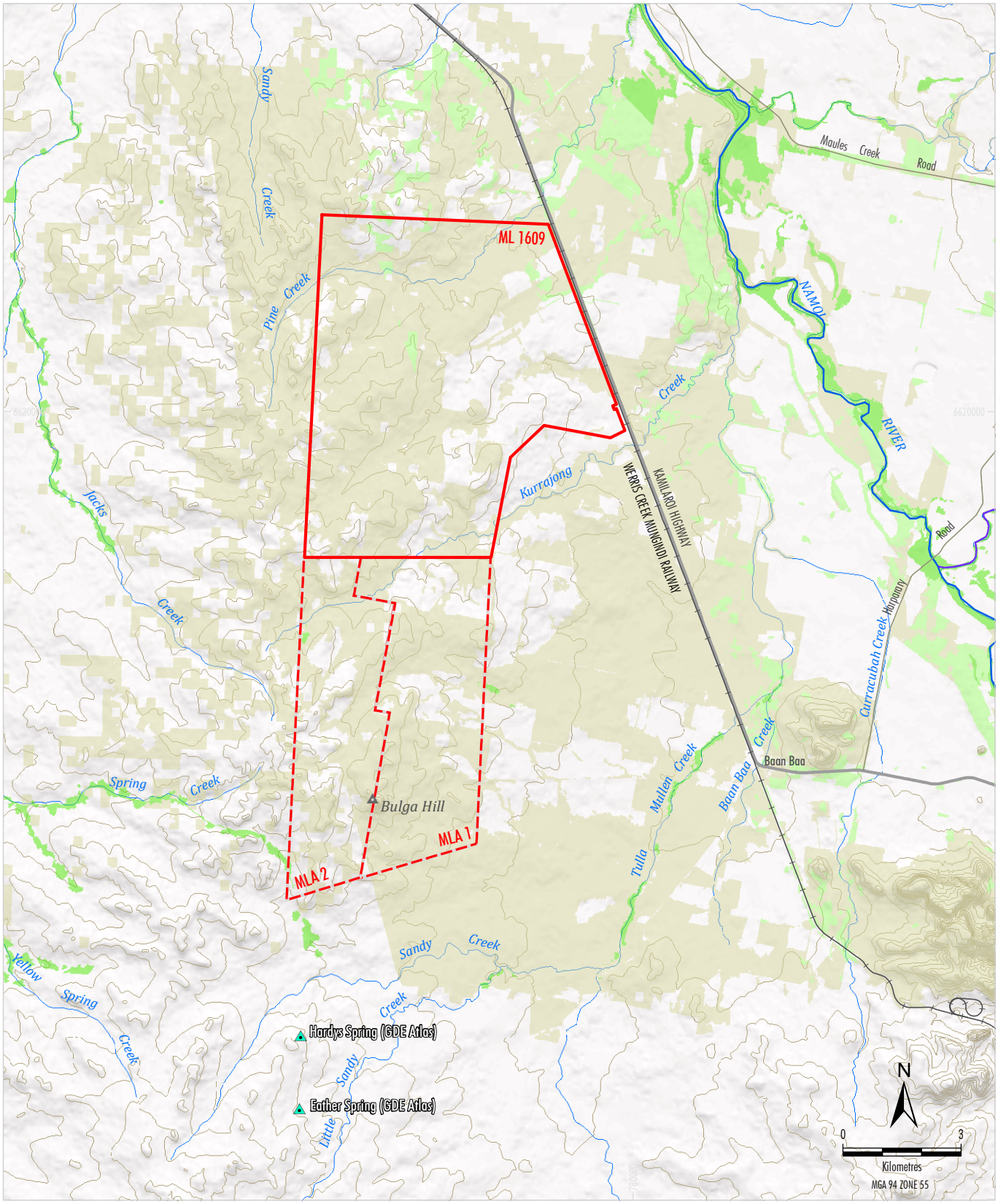
Source: NCOPL (2019); NSW Spatial Services (2019) AGE (2020)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Modelled Depth to Water Table

Figure 32a



WHC-17-54 Stg3 EIS_App BDAR_260B

Source: NCOPL (2019); NSW Spatial Services (2019); BoM (2020)

LEGEND

Mining Lease (ML 1609)

Provisional Mining Lease Application Area

Potential Terrestrial Groundwater Dependent Ecosystems

High potential GDE - from regional studies

Moderate potential GDE - from regional studies

Low potential GDE - from regional studies

Potential Aquatic Groundwater Dependent Ecosystems

Known GDE - from regional studies

High potential GDE - from national assessment

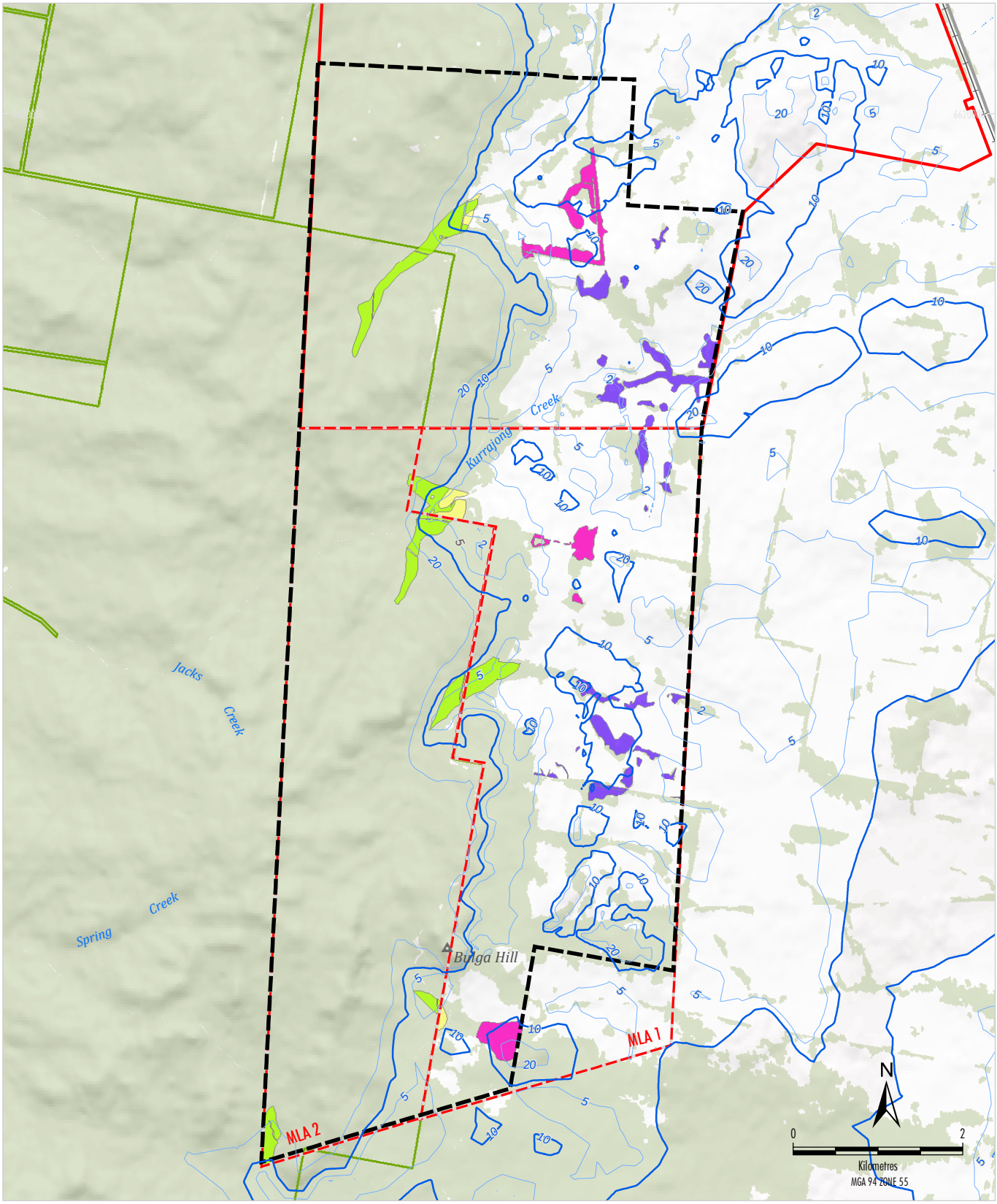
Unclassified potential GDE - from regional studies

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Groundwater Dependent Ecosystems - Altas Mapping

Figure 32b



WHC-17-54 Stg3 EIS_App BDAR_261B

LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Woodland Vegetation
- Modelled Depth to Water (mbgl)
- AMBS (2020) Study Extent

Facultative Groundwater Dependent Vegetation within the AMBS (2020) Study Extent

- Belah Woodland (Good) (PCT 55)
- Poplar Box Grassy Woodland (Good) (PCT 244)
- Red Gum - Tea Tree Creek Woodland (Good) (PCT 399)
- Red Gum - Tea Tree Creek Woodland (Moderate) (PCT 399)

Source: NCOPL (2019); NSW Spatial Services (2019); AGE (2020); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Facultative GDEs Within AMBS Study Extent

Figure 32c

PCT 55 Belah Woodland (Good), PCT 244 Poplar Box Grassy Woodland (Good) and PCT 399 Red Gum – Tea Tree Creek Woodland are likely to be facultative GDEs where the groundwater level is sufficiently high (e.g. where the groundwater is less than 10 mbgl) that the larger Belah trees, Poplar Box trees and Dirty Gum (*Eucalyptus chloroclada*) trees can potentially access the groundwater as part of the plant's water use (Figure 32c). The condition of each of the PCTs is described by AMBS (2020a) (Attachment B).

Based on the groundwater level information from AGE (2020) and vegetation mapping by AMBS (2020a) (Attachment B), PCT 224 in the locality occurs where groundwater is generally 6 mbgl (up to 2 mbgl and down to 10 mbgl), PCT 55 in the locality occurs where groundwater is generally 10 mbgl (up to 5 mbgl and down to 20 mbgl) and PCT 399 in the locality occurs where groundwater is generally 27.5 mbgl (up to 5 mbgl and down to 50 mbgl) (Figure 32c). Some portions of PCT 55 and PCT 399 occur where the groundwater is too deep for the trees to access.

One feature that was identified by AGE (2020) as a spring discharging to the surface is located within MLAs, the Mayfield Spring. AMBS (2020a) (Attachment B) reports that the Mayfield Spring was cleared of most vegetation, unprotected from grazing, highly disturbed and dominated by exotic plant species. AGE (2020) reports negligible Project drawdown impacts at this spring, hence impacts are not considered further.

The presence of GDEs outside the MLAs is discussed below under the heading 'Water Sharing Plans'.

Water Sharing Plans - High Priority GDEs

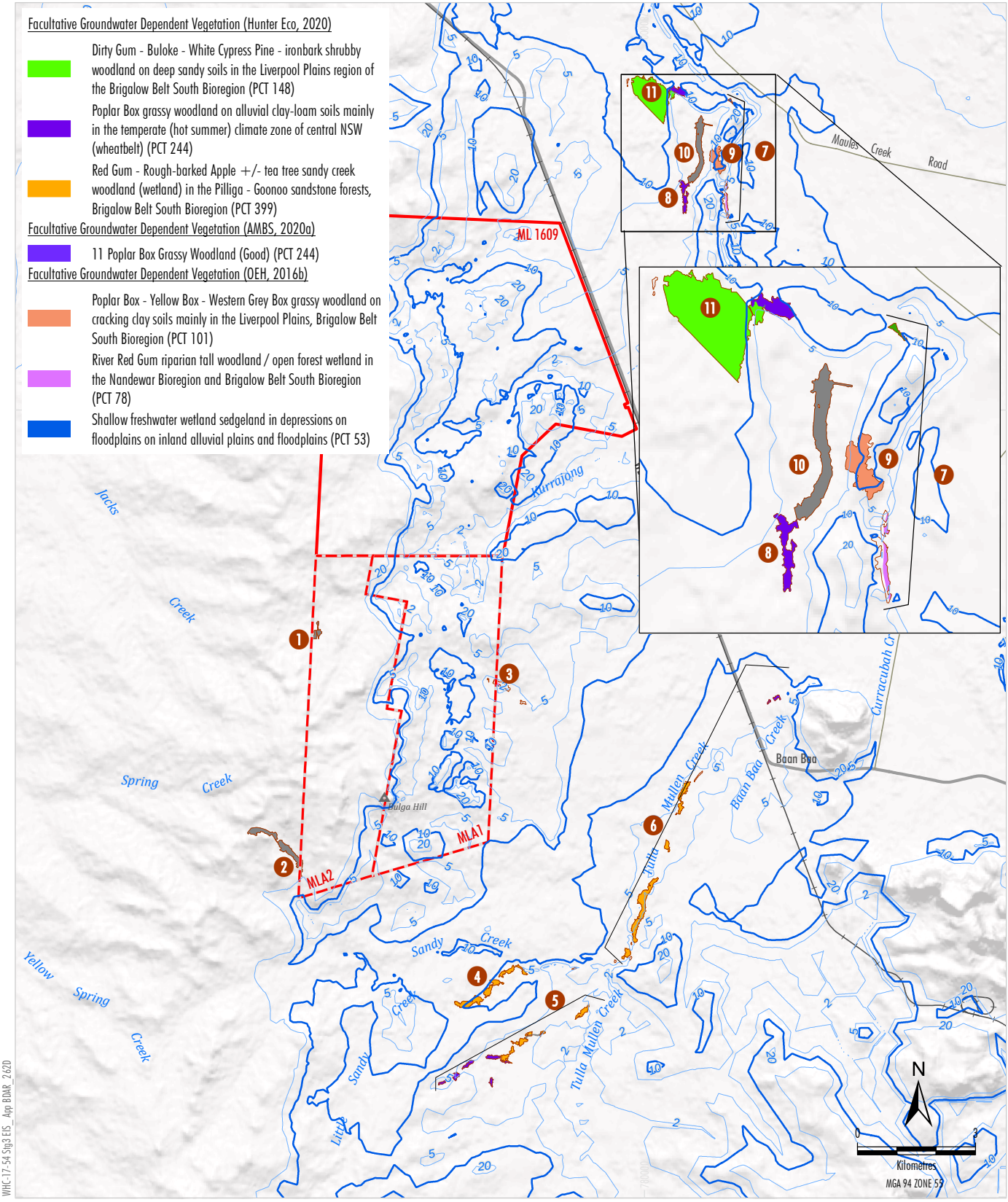
Water Sharing Plans are established under the NSW *Water Management Act 2000* for various rivers and aquifers in NSW. There are three Water Sharing Plans relevant to the Project, namely the Water Sharing Plans for the Namoi Alluvial Groundwater Sources 2020, NSW Great Artesian Basin Groundwater Sources 2020 and NSW Murray Darling Basin Porous Rock Groundwater Sources 2020. These Water Sharing Plans identify a number of high priority GDEs as shown on Figure 32d and discussed below. The mapping on Figure 32d was refined based on groundwater level drawdown predictions by AGE (2020) to identify a number of potential features.

Small Patch of Vegetation in MLA 2 (Feature 1 on Figure 32d)

A small patch of vegetation in MLA 2 is mapped on the GDE Atlas (BoM, 2020) as a 'high potential' GDE. The vegetation in this location was mapped as PCT 404 Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good) by AMBS (2020a) (Attachment B) and considered to have low potential to be associated with subsurface presence of groundwater. The groundwater table is in excess of 20 mbgl along this feature (AGE, 2020) and therefore too deep for terrestrial vegetation to access. Given this, the vegetation along this creek in this locality is not likely to be accessing the groundwater table, and therefore the predicted drawdown on this area (approximately 2 m [AGE, 2020]) would not impact the vegetation.

Vegetation Along an Unnamed 3rd Order Stream in the Southern Portion of MLA 2 (Feature 2 on Figure 32d)

The vegetation along an unnamed 3rd order stream outside the south-west corner of MLA 2 is mapped on the GDE Atlas (BoM, 2020) as a 'high potential' GDE (Figure 32d). Along this feature, the groundwater table is below 20 mbgl and the Project is predicted to drawdown on the area by less than 2 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.



Source: NCOPL (2019); NSW Spatial Services (2019); AGE (2020)

LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Modelled Depth to Water (mbgl)
- High Priority GDE from Water Sharing Plans Where Predicted Maximum Watertable Drawdown Exceeds AIP Criteria
- Terrestrial Vegetation Not Likely to be a GDE
- High Priority GDE Mapping Review Location

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Review of High Priority GDE Mapping in Water Sharing Plans

Figure 32d

Vegetation Along an Unnamed 3rd Order Stream on the Edge of MLA 1 (Feature 3 on Figure 32d)

A small patch of vegetation along an unnamed 3rd order stream on the edge of MLA 1 was mapped as PCT 244 Poplar Box Grassy Woodland (Good) by AMBS (2020a) (Attachment B) and identified as a facultative GDE (Figure 32c). Along this feature, the groundwater table is approximately 6.1 mbgl and the Project is predicted to drawdown on the area by less than 1.4 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Vegetation Along Sandy Creek South of MLA 1 (Feature 4 on Figure 32d)

The riparian vegetation along Sandy Creek south of MLA 1 is mapped on the GDE Atlas (BoM, 2020) as a 'high potential' GDE. The vegetation in this location was mapped as PCT 399 Red Gum – Tea Tree Creek Woodland by Hunter Eco (2020) and is likely to be a facultative GDE given the groundwater is approximately 5 mbgl (AGE, 2020). The Project is predicted to drawdown on the area by approximately 2 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Vegetation Along an Unnamed Tributary of Tulla Mullen Creek South of MLA 1 (Feature 5 on Figure 32d)

The riparian vegetation along an unnamed tributary of Tulla Mullen Creek south of MLA 1 is mapped on the GDE Atlas (BoM, 2020) as a 'high potential' GDE. The vegetation in this location was mapped as PCT 244 Poplar Box Grassy Woodland and PCT 399 Red Gum – Tea Tree Creek Woodland by Hunter Eco (2020), and is likely to be a facultative GDE given the groundwater is approximately 4 mbgl (AGE, 2020). The Project is predicted to drawdown on the area by approximately 2.2 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Vegetation Along Tulla Mullen Creek (Feature 6 on Figure 32d)

The riparian vegetation along Tulla Mullen Creek is mapped on the GDE Atlas (BoM, 2020) as a 'high potential' GDE. This feature was mapped as PCT 399 Red Gum – Tea Tree Creek Woodland along most of the creek and a few small patches of PCT 244 Poplar Box Grassy Woodland at the northern end by Hunter Eco (2020). The vegetation is likely to be a facultative GDE given the groundwater is approximately 5.2 mbgl, and the Project is predicted to drawdown on the area by approximately 1.8 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Vegetation Adjacent to the Namoi River (Feature 7 on Figure 32d)

The riparian vegetation on the Namoi River is mapped as PCTs 53 and 78 (OEH, 2016b) and as a 'high potential' GDE (BoM, 2020). The vegetation in this location is likely to be a facultative GDE given the groundwater is approximately 6.8 mbgl. The Project is predicted to drawdown on the area by approximately 1 m (AGE, 2020). The groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 8.7 m.

Vegetation Along an Unnamed Drainage Line (Feature 8 on Figure 32d)

A small patch of riparian vegetation along an unnamed drainage line is mapped on the GDE Atlas (BoM, 2020) as PCTs 53 and 78 and a 'high potential' GDE. This feature was mapped as PCT 244 Poplar Box Grassy Woodland by Hunter Eco (2020) and the vegetation is likely to be a facultative GDE given the groundwater is approximately 2.5 mbgl (AGE, 2020). The Project is predicted to drawdown on the area by approximately 7.8 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Namoi River Floodplain (Feature 9 on Figure 32d)

A small patch of vegetation in the Namoi River Floodplain is mapped as PCT 101 (OEH, 2016b) and as a 'high potential' GDE (BoM, 2020). The vegetation in this location is likely to be a facultative GDE given the groundwater is approximately 9.5 mbgl, and the Project is predicted to drawdown on the area by approximately 2.3 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Depression (Feature 10 on Figure 32d)

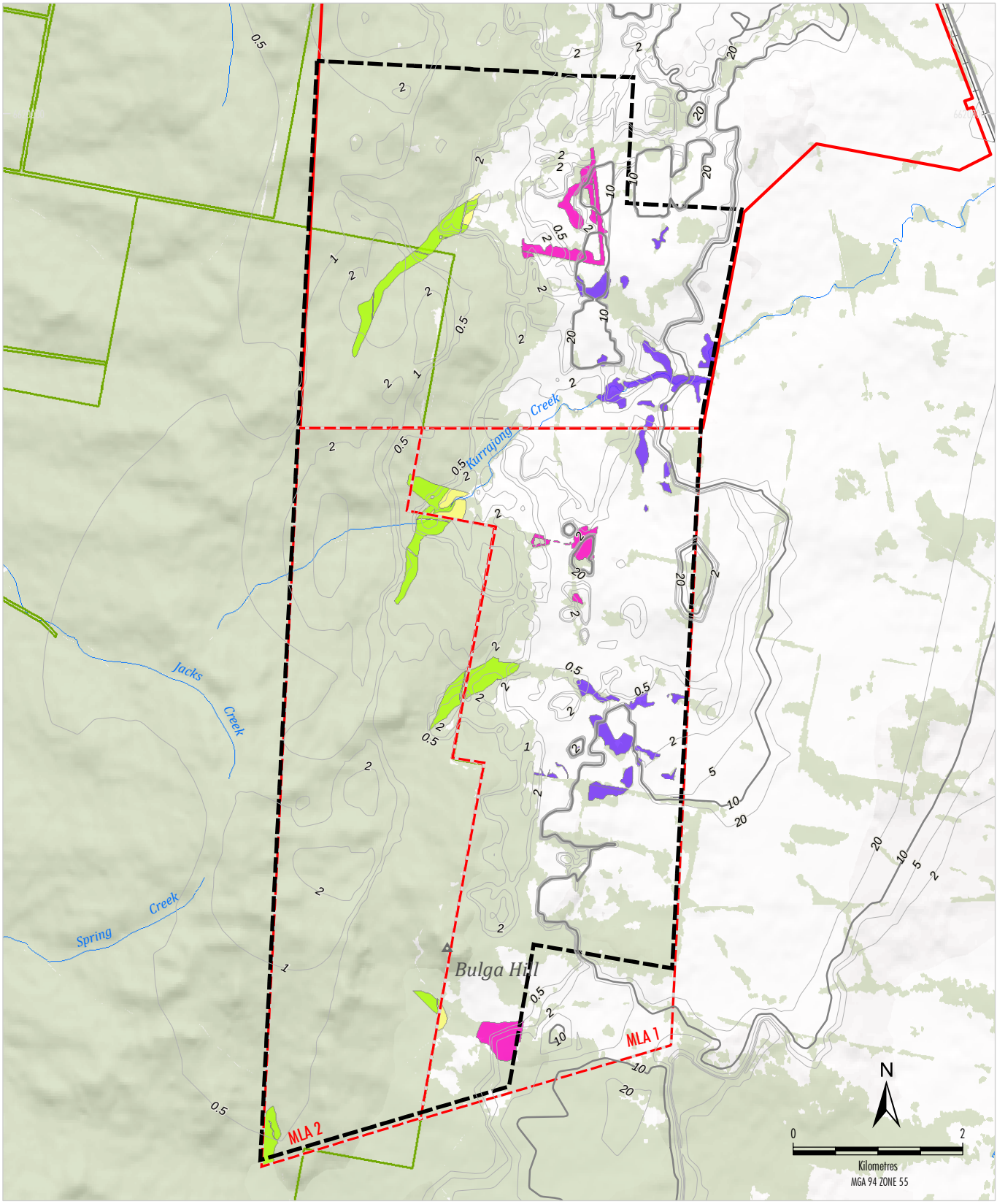
The vegetation in a depression to the west of the Namoi River is mapped on the GDE Atlas (BoM, 2020) as PCTs 53 and as a 'high potential' GDE. The vegetation in this location is not likely to be a GDE (Hunter Eco, 2020). The groundwater is approximately 2.5 mbgl, and the Project is predicted to drawdown on the area by approximately 3.7 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Namoi River Floodplain (Feature 11 on Figure 32d)

The patch of vegetation in the Namoi River Floodplain is mapped on the GDE Atlas (BoM, 2020) as a 'high potential' GDE. This feature was mapped as PCT 148 Dirty Gum – Buloke – White Cypress Pine – Ironbark Shrubby Woodland and PCT 244 Poplar Box Grassy Woodland (Good) by Hunter Eco (2020). The vegetation in this location is likely to be a facultative GDE given the groundwater is approximately 8 mbgl, and the Project is predicted to drawdown on the area by approximately 1 m (AGE, 2020). The natural groundwater fluctuation estimated by AGE (2020) at bores in the locality is approximately 5.1 m.

Potential Impacts

Similar to the approved Narrabri Mine, groundwater table drawdown is expected to occur within ML 1609, MLA 1 and MLA 2 (Figures 32e and 32f), with drawdown reducing gradually to the east of the Project (i.e. within outcropping less permeable units) and more rapidly to the west (i.e. within the more productive Pilliga Sandstone). The Groundwater Assessment prepared by AGE (2020) evaluated the potential impacts of the Project on groundwater resources using a numerical regional groundwater model. Groundwater modelling by AGE (2020) included predictive modelling over the life of the Project as well as modelling to show the recovery of groundwater levels post-mining.



WHC-17-54 Stg3 EIS_App BDAR_263A

LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Woodland Vegetation
- Predicted Groundwater Drawdown Contours (m)
- AMBS (2020) Study Extent

Facultative Groundwater Dependent Vegetation within the AMBS (2020) Study Extent

- Belah Woodland (Good) (PCT 55)
- Poplar Box Grassy Woodland (Good) (PCT 244)
- Red Gum - Tea Tree Creek Woodland (Good) (PCT 399)
- Red Gum - Tea Tree Creek Woodland (Moderate) (PCT 399)

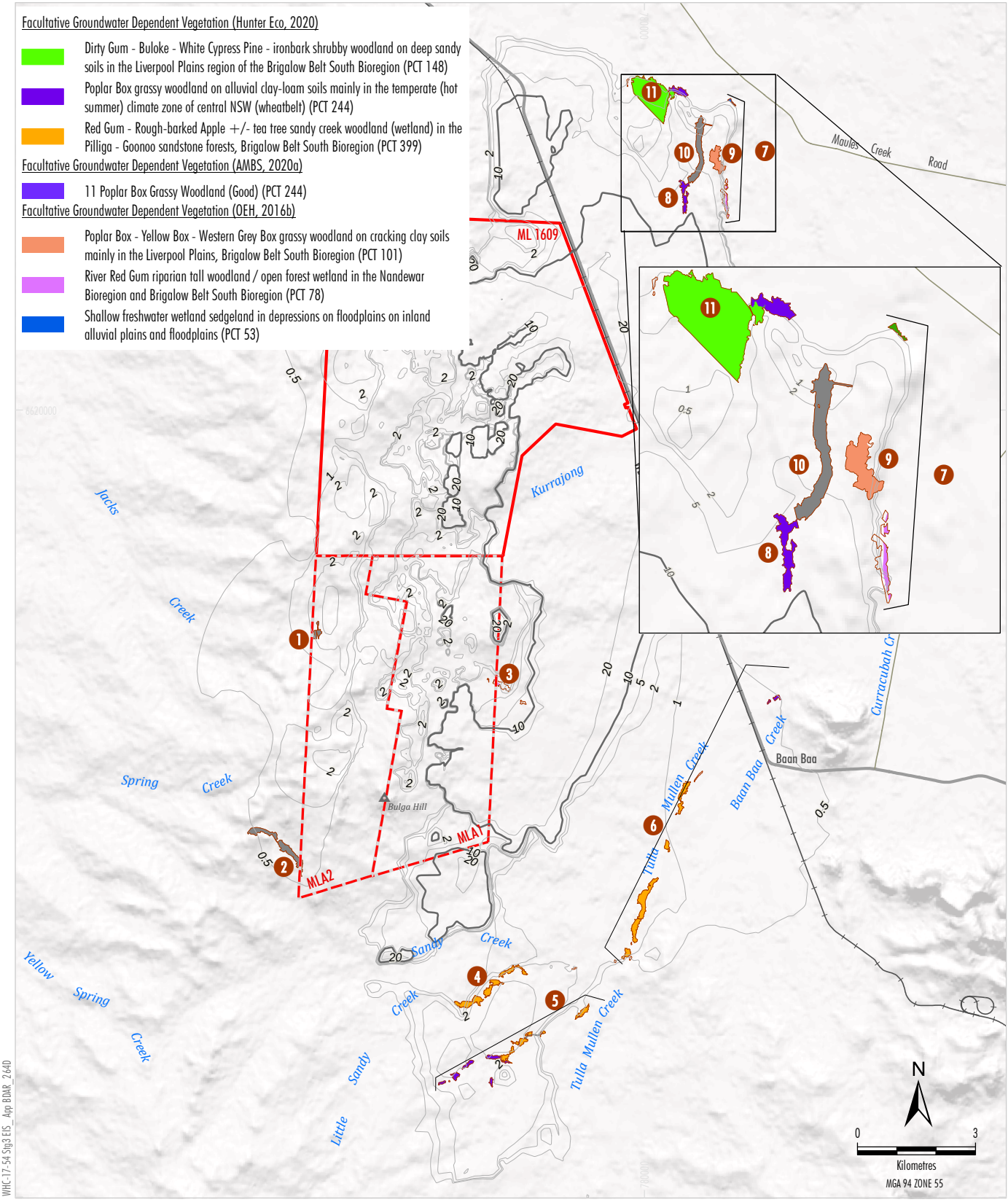
Source: NCOPL (2019); NSW Spatial Services (2019); AGE (2020); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Groundwater Drawdown at Facultative GDEs Mapped by AMBS

Figure 32e



WHC-17-54 Stg3 EIS_App BDAR_264D

LEGEND

- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- High Priority GDE from Water Sharing Plans Where Predicted Maximum Watertable Drawdown Exceeds AIP Criteria
- Terrestrial Vegetation Not Likely to be a GDE
- Predicted Groundwater Drawdown Contours (m)
- High Priority GDE Mapping Review Location

Source: NCOPL (2019); NSW Spatial Services (2019); AGE (2020)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Groundwater Drawdown at High Priority GDE Mapping in Water Sharing Plans

Figure 32f

Figure 32e also shows the predicted groundwater table drawdown greater than 1 m. Figure 32e shows:

- drawdown in the western area of the Project (generally less than 2 m) where the groundwater table is approximately 50 to 100 mbgl;
- maximum drawdown of more than 20 m within (or within approximately 3 km of) the ML 1609 or MLA boundaries; and
- drawdown reduces gradually to the east of the Project (approximately 0-20 m).

Groundwater drawdown is expected to occur gradually during operations, with maximum drawdown predicted to occur post mining, and recharge taking decades (for the Pilliga Sandstone) to centuries (for the less permeable units) (AGE, 2020).

As per the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (DPI, 2012), minor changes to the groundwater regime may not have any adverse impacts on facultative GDEs that use groundwater as required (opportunistically) but these ecosystems can dieback if reduced access to groundwater is prolonged or if the change is too rapid that the trees are not able to adapt.

There is no evidence that any vegetation surrounding the existing Narrabri Mine has experienced any groundwater drawdown related impacts (i.e. dieback) from the existing operations.

Figure 32e shows the extent of predicted maximum drawdown for the Project (including the existing Narrabri Mine) in relation to the facultative GDEs identified by AMBS (2020a) (Attachment B). Figure 32f shows the extent of predicted maximum drawdown for the Project (including the existing Narrabri Mine) in relation to the high priority GDEs identified in the Water Sharing Plans. As described above, all of the features shown on Figure 32f are likely to be facultative GDEs.

The groundwater drawdown is generally low at the facultative GDEs, however there could be drawdown up to 10 m below a small portion of the patches of vegetation, resulting in those larger trees potentially not being able to access groundwater in drought conditions. The maximum drawdown shown on Figure 32e is predicted to occur post-mining over several decades to centuries, with recharge occurring gradually in the long term. The drawdown could result in additional stress to larger trees associated with the facultative GDEs during prolonged drought conditions but is not likely to result in the widespread loss of the larger trees, or prevent the long-term viability of the dependent ecosystem, due to:

- the GDEs being facultative (not obligate) (e.g. some portions of PCT 55 and PCT 399 already occur where the groundwater is too deep for the trees to access);
- the localised areas of material (>1 m) predicted drawdown;
- the availability of other water sources during non-drought conditions; and
- the slow rate of drawdown.

It is also noted that there is drawdown predicted to the east, outside of the Subject land (Figures 32e and f). Although not within the survey extent by AMBS (2020a) (Attachment B), it is considered likely that the above assessment of potential impacts would apply (i.e. any facultative GDEs may experience some material drawdown, resulting in additional stress to larger trees during prolonged drought conditions).

No groundwater quality impacts are anticipated during operation of the mine, since no discharge to groundwater is proposed. Furthermore, since hydraulic gradients would be towards the mine, any contamination or poor-quality groundwater would likely be captured in the mine dewatering system and pumped to surface for treatment (AGE, 2020). Re-injection of brine proposed to occur towards the end of mining operations would have a negligible effect on groundwater quality as hydraulic gradients would remain towards the mine and the brine would be diluted by the lower salinity groundwater from surrounding groundwater units (AGE, 2020).

Monitoring and Mitigation

The Narrabri Mine operates an extensive existing groundwater monitoring network to monitor the response to mining operations in nearby aquifers. Ongoing monitoring of groundwater levels and quality would be used to assess the extent and rate of groundwater impacts (including groundwater table drawdown), and to distinguish natural groundwater level fluctuations (e.g. response to rainfall) from groundwater level impacts due to mining. AGE (2020) has also recommended additional monitoring sites be included in the monitoring network as part of the Project.

The results of the groundwater monitoring programme would be used to progressively refine the numerical model developed for the Groundwater Assessment (AGE, 2020) over the life of the Project. The numerical model would be used as a management tool for the periodic review and validation of predicted groundwater impacts, including groundwater table drawdown.

6.3 PRESCRIBED BIODIVERSITY IMPACTS

The BC Regulation identifies actions that are prescribed as impacts to be assessed under the Biodiversity Offsets Scheme. Prescribed Biodiversity Impacts are as follows:

(a) the impacts of development on the following habitat of threatened species or ecological communities:

(i) karst, caves, crevices, cliffs and other geological features of significance,

(ii) rocks,

(iii) human made structures,

(iv) non-native vegetation,

(b) the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,

(c) the impacts of development on movement of threatened species that maintains their lifecycle,

(d) the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),

(e) the impacts of wind turbine strikes on protected animals,

(f) the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.

These impacts are assessed below in relation to the Project.

6.3.1 Impacts on Habitat Resources Other than Native Vegetation

(a) the impacts of development on the following habitat of threatened species or ecological communities:

(i) karst, caves, crevices, cliffs and other geological features of significance,

The BAM (OEH, 2017a) states the following assessment requirements for habitat of threatened species associated with caves, crevices and cliffs:

The assessment of the impacts of development on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance must:

a) identify the species and ecological communities likely to use the habitat

b) describe, with reference to relevant literature and other reliable published sources of information, the importance within the bioregion of the habitat to these species or ecological communities

c) predict the nature, extent and duration of short and long-term geological impacts

d) predict the nature, extent and duration of short and long-term impacts on environmental processes critical to the formation and persistence of the unique natural features of the area of karst, geological features of significance, and cliff fall

e) predict the consequences of impacts for the persistence of the suite of threatened species and communities likely to use these areas as habitat, with reference to relevant literature and other published sources of information

f) justify the predictions of impacts with appropriate modelling and with reference to relevant literature and guidelines

As described in Section 5.1, the mine layout was modified to avoid clearance and subsidence impacts on Bulga Hill, a rocky outcrop with bat habitat. Two threatened bat species have been recorded at Bulga Hill, namely the Large-eared Pied Bat and Eastern Cave Bat. Impacts on the Large-eared Pied Bat and Eastern Cave Bat are assessed in Sections 8.1.3 and 9.2.11.

One other (smaller) rocky outcrop with bat habitat, which is used by the Large-eared Pied Bat (Figure 26) would be subsided by the Project.

(a) the impacts of development on the following habitat of threatened species or ecological communities:

…

(ii) rocks,

(iii) human made structures,

(iv) non-native vegetation,

There are no rocks, human made structures or non-native vegetation that provide habitat for threatened species that would be adversely impacted by the Project.

6.3.2 Habitat Fragmentation

(b) the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,

The BAM (OEH, 2017a) states the following assessment requirements for habitat connectivity:

> *The assessment of the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range must:*
>
> *a) identify the area/s of connectivity joining different areas of habitat that intersect with the subject land and the areas of habitat that are connected according to Paragraph 4.2.1.3*
>
> *b) identify the species and ecological communities likely to benefit from the connectivity*
>
> *c) describe the nature, extent and duration of short and long-term impacts*
>
> *d) describe, with reference to relevant literature and other reliable published sources of information, the importance of the area of connectivity within the bioregion*
>
> *e) predict the consequences of impacts for the bioregional persistence of the suite of threatened species and communities currently benefitting from the connectivity with reference to relevant literature and other published sources of information and taking into consideration mobility, abundance, range and other relevant life history factors.*

Habitat connectivity areas are shown on Figure 8 and woodland areas within the assessment buffer area are shown on Figure 9. There are no defined woodland corridors on the Subject land; however, all habitats in the Subject land are well-connected with other vegetation areas within the landscape. All threatened species and communities known to occur on the Subject land are likely to benefit from the current level of connectivity.

The Project would impact the current habitat connectivity through the clearance of native vegetation. Light vehicle tracks are approximately 5 m wide, which is an estimate of the road width based on average widths of tracks at the Narrabri Mine. Access tracks and post drainage corridors (with roadways, pipelines, pumps, sediment controls, goaf drainage infrastructure and other ancillary infrastructure) are approximately 33 m wide.

Services corridors (with roadways, pipelines, pumps, telecommunication infrastructure, power transmission infrastructure, sediment controls and other ancillary infrastructure) are approximately 75 m wide (for the main north-south services corridor, and the southernmost east/west services corridor) and 65 m wide (for the rest of the east/west Services Corridors).

Fragmentation impacts have been minimised by the proposed continued use of the substantial existing infrastructure at the existing approved and operating underground mine (limiting the requirement to develop new infrastructure) as well as locating multiple surface infrastructure components within the same disturbed area (Section 5.1).

Clearing would be progressive followed by rehabilitation meaning that only portions of the development footprint shown in Figure 8 would be cleared at any point in time. Rehabilitation would aim to restore the connectivity of woodland vegetation through revegetation of native species in cleared areas (Section 7).

Despite the impact to habitat connectivity, sufficient connectivity would remain around the Development Footprint (Figure 8) such that no habitat for a threatened species are likely to become isolated as a result of the Project. In the medium to long-term, the mine rehabilitation would restore connectivity. Habitat clearance would be offset in accordance with the BAM (OEH, 2017) as described in Section 10.

6.3.3 Fauna Movement

(c) the impacts of development on movement of threatened species that maintains their lifecycle,

The BAM (OEH, 2017a) states:

> *The assessment of the impacts of the development on movement of threatened species that maintains their life cycle must:*
>
> *(a) identify movement patterns key to the life cycle of relevant threatened species that intersect with the subject land*
>
> *(b) describe the nature, extent and duration of short and long-term impacts*
>
> *(c) describe, with reference to relevant literature and other reliable published sources of information, the importance of the movement of the threatened species to their life cycle*
>
> *(d) predict the consequences of the impacts for the bioregional persistence of the threatened species, with reference to relevant literature and other published sources of information.*

Movement patterns key to the life cycle of threatened species could include seasonal movements between foraging and breeding habitats. The Project is not likely to impact a well-defined movement pattern for any particular threatened species.

All threatened species and communities known to occur in the Subject land are likely to benefit from the current level of connectivity. However, despite impact to habitat connectivity, sufficient connectivity would remain surrounding the Development Footprint (Figure 8) (Section 6.3.2) such that no threatened species are likely to become isolated as a result of the Project. All the threatened fauna species recorded on the Subject site are sufficiently mobile to cross the narrow access tracks.

As described above, clearing would be progressive followed by rehabilitation meaning that only portions of the development footprint shown in Figure 8 would be cleared at any point in time. Rehabilitation would aim to restore the connectivity of woodland vegetation through revegetation of native species in cleared areas (Section 7).

6.3.4 Water Quality, Water Bodies and Hydrological Processes that Sustain Threatened Species and Threatened Ecological Communities

(d) the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),

Potential impacts on streams are described in Sections 6.2.1 and 6.4. The Project would not impact water quality, water bodies or hydrological processes that are known to sustain a threatened species or TEC.

6.3.5 Wind Turbines

(e) the impacts of wind turbine strikes on protected animals,

No wind turbines are planned for the Project.

6.3.6 Vehicle Strike

(f) the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.

The BAM (OEH, 2017a) states:

> *The assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC must:*
>
> *(a) identify the range of threatened animal species or animals that are part of a threatened ecological community at risk of vehicle (or other transport mode) strike*
>
> *(b) predict the likelihood of vehicle strike to each relevant species, taking into consideration mobility, abundance, range and other relevant life history factors*
>
> *(c) estimate vehicle strike rates where supporting data or literature is available*
>
> *(d) predict the consequences of the impacts for the local and bioregional persistence of the suite of relevant species, with reference to relevant literature and other published sources of information.*

The site access road would be used for personnel and visitor access and deliveries. Site infrastructure in the mining area would be accessed via a network of unsealed and sealed access tracks and roads, which would be expanded for the Project. Access during construction of site infrastructure, which would be undertaken periodically throughout the mine life, would be required for construction fleet items such as a Bulldozer, Grader, Gravel truck, Water cart and light vehicles. This would largely be undertaken daytime only (except for some drilling for shaft construction, which would be 24 hours a day).

During operations, access to these areas would be required for light vehicles for inspections and general maintenance. This would be infrequent and mostly during daytime hours.

The potential impacts of vehicle strikes have been minimised for the Project through:

- use of the existing site access to the Narrabri Mine from the Kamilaroi Highway;
- construction activities mostly limited to daytime hours;
- access limited to designated roads and tracks; and
- imposing speed limits on internal roads.

During operations, a speed limit of 40 km per hour would be applied to roadways required as part of the Project. It is not practical to fence roadways in order to prevent animal entry due to the length and arrangement of the access roads. Further, such fences may instead adversely impact the movement of threatened species.

Vehicle strike of animals is possible; however, it is not expected to be of a magnitude that would result in the loss of any threatened species from the local area. The consequences of the impacts from vehicle strike are predicted to be negligible as the threatened fauna species are more widespread in adjacent connected habitat.

6.4 IMPACTS ON THREATENED SPECIES AND COMMUNITIES UNDER THE NSW FISHERIES MANAGEMENT ACT 1994

No threatened species listed under the NSW *Fisheries Management Act 1994* (FM Act) potentially occur within creeks (Kurrajong Creek and Pine Creek) or unnamed drainage lines within the Development Footprint.

The Lowland Darling River aquatic endangered ecological community listed under the FM Act includes the Namoi River (Figure 1) and associated tributaries, such as Kurrajong Creek and Pine Creek. Kurrajong Creek and Pine Creek do not provide any sufficient permanent habitat for aquatic biota as flow likely only occurs during heavy rainfall events. The potential for aquatic GDEs to occur was considered by AGE (2020), who concluded that Kurrajong Creek and Pine Creek are not aquatic GDEs.

Kurrajong Creek would be traversed by multiple access tracks and the services corridor associated with the Project within the Development Footprint. There would also be subsidence impacts on watercourses as described in Section 6.2.1. Erosion and sedimentation are discussed in Section 6.2.2.

The following measures would be implemented to mitigate and manage the adverse impacts on the Lowland Darling River aquatic endangered ecological community (Section 7):

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- management of the potential for localised Project-related channel erosion on Kurrajong Creek and other ephemeral creek lines using appropriate sediment and erosion controls (*Biodiversity Measure 6*);
- monitoring programme for creek lines (including Kurrajong Creek) (*Biodiversity Measure 7*); and
- construction of drainage line crossings would be undertaken in accordance with the policy and guideline document of DPI-Fisheries NSW *Why do fish need to cross the road*? (Fairfull and Witheridge, 2003) (*Biodiversity Measure 8*).

Also, as part of the Project, NCOPL would decommission two existing farm dams on Kurrajong Creek prior to longwall mining occurring in those areas. Decommissioning activities would occur generally in accordance with Landcom (2004).

Based on the above, the Project would not adversely impact any threatened species or communities listed under the FM Act. The MOP and Extraction Plan (incorporating the BMP and RMP) would facilitate the implementation of the management measures.

6.5 STATE ENVIRONMENTAL PLANNING POLICY (KOALA HABITAT PROTECTION) 2019

Impacts on the Koala are assessed through the credit calculations (Section 4), and an assessment is provided in Section 9.2.9. This section discusses the *State Environmental Planning Policy (Koala Habitat Protection) 2019* (Koala Habitat Protection SEPP) in consideration of the draft *Koala Habitat Protection Guideline* (DPIE, 2020g).

Application of Koala Habitat Protection SEPP to the Project

The SEARs list *State Environmental Planning Policy 44* (SEPP 44) as an environmental planning instrument that may be relevant to the environmental assessment of the Project. On 1 March 2020, SEPP 44 was repealed and replaced by the Koala Habitat Protection SEPP.

The Project is located within a local government area (Narrabri) to which the Koala Habitat Protection SEPP applies. However, the Koala Habitat Protection SEPP does not apply to land dedicated under the *Forestry Act 2012* as State forest (i.e. the Koala Habitat Protection SEPP does not apply to the portion of the Project [koala habitat] within Pilliga East State Forest) (Figure 23).

With regard to the portion of the Project outside of the Pilliga East State Forest (approximately 282 ha of Koala habitat), Whitehaven has received advice that development controls within the Koala Habitat Protection SEPP do not apply to Part 4 development applications (such as the Project) which are determined by a consent authority other than a local council.

Koala Habitat Values

Core koala habitat is defined in the Koala Habitat Protection SEPP as:

> *an area of land where koalas are present, or*
>
> *(a) an area of land –*
>
> *(i) which has been assessed by a suitably qualified and experienced person in accordance with the* ***Guideline*** [i.e. the *Koala Habitat Protection Guideline* (DPIE, 2020g)] *as being highly suitable koala habitat, and*
>
> *(ii) where koalas have been recorded as being present in the previous 18 years.*

Figure 23 shows the location of Koala habitat and recent Koala records. The Koala habitat identified in the Project area (Figure 23) meets the definition of *core koala habitat* because it is *highly suitable koala habitat* and also contains evidence of Koalas (scats – no individual Koalas were recorded) (AMBS, 2020b) (Attachment C). Koala feed tree species listed in Schedule 2 of Koala Habitat Protection SEPP (for the Northwest Slopes Koala management area) that occur in the Subject land include (AMBS, 2020b) (Attachment C):

- Rough-barked Apple (*Angophora floribunda*);
- White Cypress Pine (*Callitris glaucophylla*);
- Belah (*Casuarina cristata*);
- White Box (*Eucalyptus albens*);
- Dirty Gum (*Eucalyptus chloroclada*);
- Narrow-leaved Ironbark (*Eucalyptus crebra*);
- Dwyer's Red Gum (*Eucalyptus dwyeri*);

- Broad-leaved Red Ironbark (*Eucalyptus fibrosa*);
- Pilliga Box (*Eucalyptus pilligaensis*); and
- Poplar Box (*Eucalyptus populnea*).

Koala Surveys

The flora and fauna survey reports in Attachments A and B provide a description of the general environment and condition. The impacts from the Project are evaluated in Section 6 of this BDAR.

Targeted surveys for the Koala were undertaken by AMBS (2020b) (Attachment C) prior to the release of the draft *Koala Habitat Protection Guideline* (DPIE, 2020g). However, the SAT (Phillips and Callaghan, 2011) was followed along with spotlighting. Koala scats were found using these methods (Figure 23).

Figure 42 shows the location of Koala records in the wider landscape. The western portion of the Subject land consists of woodland vegetation that adjoins an extensive area of native vegetation within Jacks Creek State Forest, Pilliga East State Forest and neighbouring reserves. The Project is located 60 km north-west of Gunnedah (a known central area of the Koala), in between which is highly cleared and fragmented habitat. The landscape surrounding the Project is relatively intact (after Australian Koala Foundation, 2007).

Potential Impacts

Potential direct and indirect impacts on the Koala are assessed in Section 9.2.9. The Project would result in the progressive disturbance of habitat (clearance and subsidence over a 23-year period) and a risk to individual Koalas present in the clearance areas. However, the Project would also result in progressive revegetation of the vegetation cleared and offsets in accordance with the NSW Offset Scheme. Given these factors, the Project is unlikely to lead to a decline in the viability of the local Koala population in the medium to long-term.

Management Measures

A number of measures have been adopted to avoid and minimise clearance as described in Section 5.1. Mitigation measures relevant to this species are outlined in Section 7 and include the following:

- vegetation clearance protocol, including management of Koalas should they be encountered in consideration of the *Code of Practice for Injured, Sick and Orphaned Koalas* prepared by OEH (2018e) (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*) (further discussed in Section 7);
- management of animal pests within ML 1609, MLA 1 and MLA 2 by qualified and experienced animal pest management contractors (*Biodiversity Measure 11*);
- bushfire prevention and control measures (*Biodiversity Measure 12*); and
- vehicle speed limits 40 km per hour (km/hr) (*Biodiversity Measure 14*).

NCOPL would prepare a BMP to document the above measures to reduce impacts on koalas and their habitat.

Offsets

The impacts on the known habitat for the Koala would be offset in accordance with the NSW Biodiversity Offsets Scheme and would result in the retirement of the required number and class of like-for-like biodiversity credits for the Koala (Section 8.3).

6.6 PILLIGA EAST STATE FOREST AND JACKS CREEK STATE FOREST

The Project would involve approximately 239.9 ha of clearing and 1 ha of potential ponding impacts within the Pilliga East State Forest over a 23-year period (which has a total area of approximately 131,899 ha) (Figure 6). The Pilliga East State Forest is a forestry resource managed by the Forestry Corporation of NSW. Forestry, recreation and mineral extraction are permissible land use categories within Pilliga East State Forest (NSW *Brigalow and Nandewar Community Conservation Area Act, 2005*).

Jacks Creek State Forest (an area of approximately 10,045 ha) is located directly west of the Project (Figure 6). The Project would not involve any clearance within the Jacks Creek State Forest.

The likelihood of indirect impacts on the native vegetation and habitat in Pilliga East State Forest and Jacks Creek State Forest from the Project has been considered in Section 6.2. In summary:

- there is a low likelihood of weeds spreading into Pilliga East State Forest and Jacks Creek State Forest as a result of the Project given the weed management and revegetation measures; and
- feral animals would be controlled to reduce the likelihood of their populations increasing in abundance due to the Project.

7 MEASURES TO MITIGATE AND MANAGE IMPACTS

The Project has been designed to avoid and minimise impacts on biodiversity values as described in Section 5.1.

Table 20 provides measures to mitigate and manage impacts from the Project. NCOPL would be responsible for implementing the measures. After the measures to mitigate and manage impacts, there would be a negligible risk to biodiversity with a low consequence in the medium to long term after mining operations. The SEARs require measures consistent with industry best practice and a full range of reasonable and feasible mitigation measures. The EIS provides a number of other measures to mitigate and manage other potential impacts from the Project, such as measures to manage erosion and sediment, dust, noise, lighting and groundwater.

Table 20
Mitigation Measures

Potential Impact	Mitigation Measures	Timing/Frequency	Potential Risk of Failure	Likelihood and Consequence of Residual Impacts
Clearing of Native Vegetation and Habitat	***Biodiversity Measure 1*** - Vegetation Clearance Protocol	Prior to/during native vegetation clearance	Low	Low risk of resident fauna becoming displaced or injured Vegetation clearance is quantified in Table 17
	Biodiversity Measure 2 - Rehabilitation and Revegetation	Over the life of the mine Surface facilities used for the Project would be progressively closed and rehabilitated once mine safety pre-conditioning activity has been undertaken, unless required for future access	Low	None
	Biodiversity Measure 3 - Salvage and Relocation of Habitat Resources	During and following vegetation clearance	Low	None
	Biodiversity Measure 4 - Nest Box Programme	During and following vegetation clearance	Low	Low
	Biodiversity Measure 5 - Site Induction/Access	Over the life of the mine	Low	Low
	Biodiversity Measure 6 - Sediment and Erosion Controls	Over the life of the mine	Low	Low
Potential Impacts to Streams	***Biodiversity Measure 7*** - Creek Line Monitoring Programme	Over the life of the mine	Low	Low
	Biodiversity Measure 8 - Construction of Drainage Line Crossings	Construction	Low	Low
Inadvertent Impacts on Adjacent Habitat or Native Vegetation	***Biodiversity Measure 9*** - Fencing and Managing Poplar Box Woodland EEC	Over the life of the mine	Low	Low

Table 20 (Continued)
Mitigation Measures

Potential Impact	Mitigation Measures	Timing/Frequency	Potential Risk of Failure	Likelihood and Consequence of Residual Impacts
Indirect Impacts on Native Vegetation and Habitat	***Biodiversity Measure 10*** - Weed Management	Over the life of the mine	Moderate	Low
	Biodiversity Measure 11 - Animal Pest Management	Over the life of the mine	Low	Low
	Biodiversity Measure 12 - Bushfire Prevention and Control Measures	Over the life of the mine	Low	Low
	Biodiversity Measure 13 - Remediation of Surface Cracks	Over the life of the mine	Low	Low
	Biodiversity Measure 14 - Vehicle Speed Limits	Over the life of the mine	Low	Low

Biodiversity Measure 1 - Vegetation Clearance Protocol

The main impact of the Project on biodiversity is clearance of vegetation and habitat. The purpose of a Vegetation Clearance Protocol is to minimise the impacts of clearing on vegetation and fauna present during clearing. The Vegetation Clearance Protocol would include, but not be limited to:

- mine staff and contractors involved in vegetation clearance works would be made aware of clearing limits in the relevant Project approval documentation and of restricted access areas;
- micro-siting of access tracks and other disturbance to minimise clearance of trees with hollows and drainage features (creeks);
- the area cleared at any particular time would generally be no greater than that required to accommodate development needs for the following 12 months;
- clearance authorisation process with final signoff for the areas to be cleared by the Environment Superintendent or delegate;
- clear delineation of the areas to be cleared on the ground prior to clearing activities (e.g. paint, flagging tape and posts) and restriction of clearing to within these areas (signposts to alert personnel not to enter vegetation outside of the disturbance areas);
- pre-clearance fauna surveys would be undertaken by a suitably trained and qualified ecologist or wildlife handler to:
  - identify trees with suspected active nests; and
  - identify trees with suspected actively used tree hollows;
- a suitably trained and qualified ecologist or wildlife handler would be present during the clearing of habitat to manage animals that may be encountered during land clearing;
- options to minimise harm to fauna by modifying the clearance method would be evaluated by the suitably trained and qualified ecologist or wildlife handler (e.g. shaking or nudging tree trunks to evacuate mobile fauna, retaining trees with suspected active nests until the nest is disused or lowering trees with suspected tree hollows being used by fauna with the hollow facing upwards to enable fauna to exit);

- in the unlikely event that a Koala is identified in a tree marked to be cleared, the tree would be retained until the Koala moves of its own accord;
- management of the Koala in consideration of the *Code of Practice for Injured, Sick and Orphaned Koalas* management plan prepared by OEH (2018e);
- management of fauna may include relocating the individual to adjacent habitat or treating injuries (the nearest veterinary clinic, wildlife carer and/or appropriately trained ecologist contact information would be on hand in case any fauna are injured);
- the selective collection of seed from felled trees for propagation and use in rehabilitation;
- the retention of ground cover (e.g. logs, fallen branches and leaf litter) within stripped topsoil to improve the viability of the soil when it is used in rehabilitation;
- the management of topsoil (seed bank) for reuse on rehabilitation; and
- salvage of suitable hollows and logs for use in rehabilitation.

Biodiversity Measure 2 - Rehabilitation and Revegetation

Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified). Mine components that would be progressively rehabilitated include goaf gas drainage infrastructure, service boreholes, access tracks and post drainage corridor and pre-conditioning area. Other mine components, such as the vents and services corridors, would typically be decommissioned following mine closure.

The conceptual final landform would include woodland and pasture areas to provide habitat for flora and fauna.

A propagation and translocation trial would be implemented for the Coolabah Bertya. This would involve collection of vegetative material from the local population (either above-ground parts and/or soil seed bank) and use of that material in an attempt to re-establish individual plants in rehabilitation areas.

Biodiversity Measure 3 - Salvage and Relocation of Habitat Resources

Key habitat features would be salvaged during vegetation clearance activities and stockpiled for relocation to rehabilitation areas. When relocated, these features are likely to provide habitat resources for a range of invertebrate and ground-dwelling fauna.

Vegetative material from the local population of Coolabah Bertya (either above-ground parts and/or soil seed bank) may be re-used for the Coolabah Bertya propagation and translocation trial.

Biodiversity Measure 4 - Nest Box Programme

NCOPL undertook the installation of 92 nest boxes within MLA 1 and MLA 2 in February and March 2020. The nest boxes were designed to target threatened species known or with potential to occur in the area, including the Glossy Black-Cockatoo, Little Lorikeet, Eastern Pygmy-possum, Squirrel Glider and microbats (e.g. Corben's Long-eared Bat).

The existing programme would be doubled for the Project with a further 100 salvaged hollows or nest boxes (*Biodiversity Measure 3*) of varying sizes to provide nesting habitat for Glossy Black-Cockatoo, Eastern Pygmy-possum, Squirrel Glider and Corben's Long-eared Bat.

The nest boxes would be installed outside of the State Forest as NSW Forestry do not support the installation of the nest boxes within the State Forest because of issues with attracting pests and bees, and also disrupt forestry activities.

The nest box programme would be documented in a BMP. Once installed, the nest boxes would be monitored by suitably qualified personnel to observe fauna usage. A monitoring report would be prepared annually that includes a summary of previous monitoring reports. The monitoring results would be reported in the Annual Review.

Biodiversity Measure 5 - Site Induction/Access

Access to active operational/construction areas would only be allowed for authorised personnel and machinery thereby minimising impacts associated with human access.

Biodiversity Measure 6 - Sediment and Erosion Controls

The potential for localised Project-related channel erosion on Kurrajong Creek and other ephemeral creek lines has been assessed by WRM (2020) and would be managed using appropriate sediment and erosion controls.

Biodiversity Measure 7 - Creek Line Monitoring Programme

The *Land Management Plan* (ELA, 2019c) (or its latest approved version) provides a monitoring programme for creek lines for the purpose of monitoring changes to creek condition and triggering management actions, if required (e.g. stabilising damaged and eroded banks).

Biodiversity Measure 8 - Construction of Drainage Line Crossings

Construction of drainage line crossings would be undertaken in accordance with the policy and guideline document of DPI-Fisheries NSW *Why do fish need to cross the road*? (Fairfull and Witheridge, 2003) as required by the Fisheries NSW *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI, 2013). The waterways traversed by the Development Footprint are Class 3 (Minimal fish habitat[9]) and Class 4 (Unlikely fish habitat[10]) (Fairfull and Witheridge, 2003). Crossings would involve installation of fords or culverts.

[9] Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway after a rain event.

[10] Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free-standing water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present).

Biodiversity Measure 9 - Fencing and Managing Poplar Box Woodland EEC

The *Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains* (DEE, 2019) recommends the application of 30 m buffers from the Poplar Box Woodland EEC. NCOPL would erect a livestock proof fence around a 30 m buffer from the Poplar Box Woodland EEC within ML 1609, MLA 1 and MLA 2. The areas would be signed 'Environmental Protection Area' or similar. Weed management measures would be undertaken within the fenced area. In this way, the Project is likely to have a positive impact on the Poplar Box Woodland EEC as the occurrences are currently in paddocks used for grazing livestock. The management of the Poplar Box Woodland EEC would be documented in a BMP.

Biodiversity Measure 10 - Weed Management

All plants are regulated under the *Biosecurity Act, 2015* with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant has a duty to prevent, eliminate or minimise the risk, so far as is reasonably practicable.

Qualified and experienced weed management contractors would manage environmental weeds within ML 1609, MLA 1 and MLA 2. Weed management measures would be documented in a BMP and include:

- During introduction to site all vehicles and mechanical equipment that will be working within native vegetation areas will be subject to a clean down to minimise seed transport off-site.
- Identification of weeds requiring control.
- Mechanical removal of identified weeds and/or the application of approved herbicides.
- Follow-up site inspections to determine the effectiveness of the eradication programmes.

Biodiversity Measure 11 - Animal Pest Management

Qualified and experienced animal pest management contractors would manage animal pest species in ML 1609, MLA 1 and MLA 2 to reduce the likelihood of populations increasing due to the Project. Animal pest management measures would be documented in a BMP. The management of animal pests would consider the relevant threat abatement plans for Feral Pig, European Rabbit, Goat, Red Fox and Feral Cat (DEWHA, 2008a and b; DotE, 2015; DEE, 2016 and 2017).

Biodiversity Measure 12 - Bushfire Prevention and Control Measures

The Narrabri Mine maintains a Bushfire Prevention Standard (NCOPL, 2016) and Fire Danger Trigger Action Response Plans (NCOPL, 2019) to provide bushfire prevention and control measures for the Narrabri Mine. These measures include:

- Fixed plant and building required to meet the Building Code of Australia and comply with Australian Standard (AS) 2419.
- Fuel and storage areas located and constructed in accordance with AS 1940-2017, fitted with fire extinguishers and self-bunded.
- The Narrabri Mine is a non-smoking site.
- Clear access is maintained around all mining-related activities.

- Implementation of fire breaks.
- Implementation of appropriate firefighting equipment.

Biodiversity Measure 13 - Remediation of Surface Cracks

Remediation of mine subsidence effects (e.g. surface cracking and minor erosion). A preliminary assessment would be undertaken to minimise impact of remediation actions. Prior to any remediation of surface cracks, NCOPL would undertake a review of environmental impacts that may result from the remediation at the specific location and consider whether remediation of surface cracks is environmentally beneficial or if alternative methods of remediating the crack are warranted (e.g. without machinery). The review would consider, among other factors, avoidance of known locations of threatened flora species.

Biodiversity Measure 14 - Vehicle Speed Limits

During operations, a speed limit of 40 km/hr would be applied to surface roadways required as part of the Project (excluding the Mine Access Road).

Extraction Plan

Prior to causing any subsidence, NCOPL would be required to prepare and submit an Extraction Plan for approval by DPIE. This is an approval required by standard conditions of development consents for underground coal mines in NSW. Extraction Plans are prepared for a series of panels that are a subset of the approved mine layout. There is a process to review the adequacy and effectiveness of an Extraction Plan during the preparation of a new Extraction Plan for subsequent panels.

The Extraction Plans would include performance measures for natural and built features, including watercourses, threatened ecological communities and threatened species. NCOPL would implement an adaptive management approach to ensure the performance measures are achieved for the Project. Adaptive management would involve the monitoring and periodic evaluation of the environmental consequences against the performance measures, and adjustment (if necessary) of the management and control measures to achieve the adopted performance measures.

Extraction Plans prepared for the Project would include:

- a summary of relevant background or baseline data;
- a review of predictions of the potential subsidence effects, subsidence impacts and environmental consequences, incorporating any relevant information obtained since the EIS (such as monitoring results obtained during mining);
- a monitoring programme to provide data to assist with the management of the risks associated with subsidence, validate subsidence predictions and analyse the relationship between subsidence effects and impacts and any ensuing environmental consequences;
- a plan to manage and remediate subsidence impacts and/or environmental consequences (e.g. remediation of observed cracking);
- trigger action response plans to identify risks and outline specific follow-up actions to avoid exceedances of agreed performance measures;

- contingency plans that provide for adaptive management where monitoring indicates that there has been an exceedance of agreed performance measures; and
- reporting and review mechanisms.

Extraction Plans would include the following key component plans:

- Water Management Plan;
- Land Management Plan;
- Biodiversity Management Plan;
- Heritage Management Plan;
- Built Features Management Plan;
- Public Safety Management Plan; and
- Subsidence Monitoring Programme.

Monitoring Programme

A monitoring programme is provided in Table 21.

Table 21
Monitoring Programme

Impact	Mitigation Measure	Monitoring Schedule	Responsibility
Clearing of Native Vegetation and Habitat	***Biodiversity Measure 1*** - Vegetation Clearance Protocol	**Prior to construction:** inspection of delineated areas to be cleared and/or retained **After clearance:** annual review of the vegetation clearance methods and results of implementing the vegetation clearance protocol to identify potential improvements	General Manager and Environmental Coordinator
	Biodiversity Measure 2 - Rehabilitation and Revegetation	**During operations:** annual inspection of vegetation growth	Environmental Coordinator
	Biodiversity Measure 3 - Salvage and Relocation of Habitat Resources	**Prior to and during construction and operations:** visual inspection of potential habitat resources to be salvaged	Environmental Coordinator
	Biodiversity Measure 4 - Nest Box Programme	**During construction and operations:** annual inspection to observe fauna usage for the life of the Project	Environmental Coordinator
	Biodiversity Measure 5 - Site Induction/Access	**During construction and operations:** annual review of the induction process for contractors and site personnel involved in vegetation clearance, implementation of the biodiversity measures and monitoring work to identify improvements	Site Supervisor
	Biodiversity Measure 6 - Sediment and Erosion Controls	**During construction and operations:** visual inspection whilst controls are in place	Environmental Coordinator

Table 21 (Continued)
Monitoring Programme

Impact	Mitigation Measure	Monitoring Schedule	Responsibility
Potential Impacts to Streams	***Biodiversity Measure 7*** - Creek Line Monitoring Programme	**During construction and operations:** annual geomorphic survey of creek stability and condition for up to two years after longwall mining in the vicinity of the creek is complete	Environmental Coordinator
	Biodiversity Measure 8 - Construction of Drainage Line Crossings	**During construction and operations:** visual inspection of drainage line crossings whilst these crossing remain in-place	Site Supervisor
Inadvertent Impacts on Adjacent Habitat or Native Vegetation	***Biodiversity Measure 9*** - Fencing and Managing Poplar Box Woodland EEC	**During operations:** weekly visual inspections of fencing, annual inspection of vegetation growth	Site Supervisor and Environmental Coordinator
Indirect Impacts on Native Vegetation and Habitat	***Biodiversity Measure 10*** – Weed Management	**During construction and operations:** visual inspection of vehicles entering site and quarterly visual inspections to identify high threat weed infestations in disturbance/rehabilitation areas (mapping extent, identifying species, and estimating cover) Reduced inspections to annually for the life of the Project once vegetation has established in rehabilitation areas and risk of weeds has reduced	Environmental Coordinator
	Biodiversity Measure 11 - Animal Pest Management	**During construction and operations:** seasonal and/or life cycle stage inspections to identify what, where, when and how to target appropriate resources to control and minimise animal pest populations (maximum four occasions per year)	Environmental Coordinator
	Biodiversity Measure 12 - Bushfire Prevention and Control Measures	**During construction and operations:** visual inspection to identify all bushfire hazards and monitor fuel loads at six monthly intervals	General Manager
	Biodiversity Measure 13 - Remediation of Surface Cracks	**During operations:** visual inspections of surface cracking weekly and following significant rainfall events	Site Supervisor and Environmental Coordinator
	Biodiversity Measure 14 – Vehicle Speed Limits	**During construction and operations:** monitoring of vehicle speeds on site and annual review of the circumstances leading to fauna vehicle strike	Environmental Coordinator

Performance and Completion Criteria

Performance and completion criteria are provided in Table 22.

Table 22
Performance and Completion Criteria

Mitigation Measure	Performance Criteria	Method	Completion Criteria
Biodiversity Measure 1 - Vegetation Clearance Protocol	Areas to be cleared and/or retained are clearly delineated and mapped No adjacent vegetation outside of delineated areas is cleared The area cleared at any particular time is generally no greater than that required to accommodate development needs for the following 12 months	Clearance authorisation process with final signoff for the areas to be cleared by the General Manager or delegate All staff involved in vegetation clearance works to be made aware of clearing limits Pre-clearance fauna surveys	Ongoing for the life of the Project
Biodiversity Measure 2 - Rehabilitation and Revegetation	Revegetation of cleared areas Propagation and translocation of Coolabah Bertya is attempted	Revegetation using natural regeneration or seed collected from felled trees Propagation and translocation of Coolabah Bertya	Revegetation of cleared areas
Biodiversity Measure 3 - Salvage and Relocation of Habitat Resources	A selection of habitat features is salvaged during vegetation clearance activities and stockpiled for relocation to rehabilitation areas	Key habitat features to be salvaged are identified prior to clearance, salvaged, stockpiled and reused	Ongoing for the life of the Project
Biodiversity Measure 4 - Nest Box Programme	Recorded usage of nest boxes by target fauna species	Installation of salvaged hollows and/or nest boxes	Ongoing for the life of the Project
Biodiversity Measure 5 - Site Induction/Access	Limited occurrences of unauthorised site access	All identified steps to restrict access are followed All staff to be made aware of restricted access areas	Ongoing for the life of the Project
Biodiversity Measure 6 - Sediment and Erosion Controls	No significant erosion that impacts native vegetation	Retain topsoil and install sediment fencing where required Undertake stabilisation works along sections of bank which are damaged or steeply eroded	Ongoing for the life of the Project
Biodiversity Measure 7 - Creek Line Monitoring Programme	Change to overall drainage pattern is not more than predicted Detected alteration in channel dimensions or processes within normal range compared to baseline data	Geomorphic survey and cross-sections of creek lines and targeted pools	Ongoing for the life of the Project
Biodiversity Measure 8 - Construction of Drainage Line Crossings	Drainage line (stream) crossings do not restrict fish passage	Construction of drainage line (stream) crossings in accordance the DPI (2013) *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management* and *Why do Fish Need to Cross the Road?* (Fairfull and Witheridge, 2003)	Ongoing for the life of the Project

Table 22 (Continued)
Performance and Completion Criteria

Mitigation Measure	Performance Criteria	Method	Completion Criteria
Biodiversity Measure 9 - Fencing and Managing Poplar Box Woodland EEC	No occurrences of unauthorised access or livestock within Environmental Protection Areas Also refer to weed management (*Biodiversity Measure 10*)	Erect livestock proof fence around a 30 m buffer from the EEC Also refer to weed management (*Biodiversity Measure 10*)	Ongoing for the life of the Project
Biodiversity Measure 10 - Weed Management	Number of infestations of identified weed species equal to or less than baseline dataset Percent cover for identified weed species equal to or less than baseline dataset Weeds identified during monitoring have been controlled	Survey at existing infestation locations Control of high threat weeds using ecologically appropriate methods for the target weed	Ongoing for the life of the Project
Biodiversity Measure 11 - Animal Pest Management	Animal pest identified during monitoring have been controlled	Use of baiting, trapping, mustering or shooting as appropriate to manage animal pest species	Ongoing for the life of the Project
Biodiversity Measure 12 - Bushfire Prevention and Control Measures	No incidence of unplanned bushfire Any outbreak of fire is contained	Comply with relevant Australian Standards Undertake fuel reduction burns as required Implementation of appropriate firefighting equipment	Ongoing for the life of the Project
Biodiversity Measure 13 - Remediation of Surface Cracks	Surface cracks that are deemed environmentally beneficial to remediate are remediated as soon as practicably possible (and safe to do so)	Prior to any remediation of surface cracks, NCOPL would undertake a review of environmental impacts that may result from the remediation at the specific location and consider if remediation of surface cracks is environmentally beneficial or if alternative methods of remediating the crack are warranted (e.g. without machinery). The review would consider, among other factors, the known locations of threatened flora species.	Ongoing for the life of the Project
Biodiversity Measure 14 - Vehicle Speed Limits	Limited fauna vehicle strikes due to vehicle speed	Enforcement of speed limits.	Ongoing for the life of the Project

8 IMPACT SUMMARY

8.1 SERIOUS AND IRREVERSIBLE IMPACTS

8.1.1 Introduction

Under the BC Act, there is a small list of threatened species and communities that are considered by the NSW Government to be at risk of a serious and irreversible impact. These species/communities are named 'serious and irreversible impact entities' (SAII entities). There are established principles and thresholds for impacts on SAII entities that are considered below, but the onus is on the approval authority to decide if an impact is serious and irreversible.

There are two species recorded on the Subject land that can be 'potential SAII entities' for breeding habitat, namely the Large-eared Pied Bat and Eastern Cave Bat (DPIE, 2020d). There is a third species (Coolabah Bertya) that is being considered for inclusion on the list of 'potential SAII entities' (DPIE, 2020d). These species are discussed below.

Bulga Hill - Large-eared Pied Bat and Eastern Cave Bat

Species credits have been calculated for the Large-eared Pied Bat and Eastern Cave Bat (Section 4.6) as the Project would involve clearance of foraging habitat within 2 km of a Pilliga Sandstone rocky outcrop with bat habitat found to be used by these bats (e.g. Bulga Hill). If the Project were to have impacts on breeding habitat, there would be a requirement for additional assessment of that impact as the species are listed as a 'potential SAII entities' (DPIE, 2020d). Breeding habitat is defined in the *'Species credit' Threatened Bats and their Habitats – NSW Survey Guide for the Biodiversity Assessment Method* (OEH, 2018a) as potential breeding habitat (in this case the relevant PCTs within 100 m of Bulga Hill) with breeding individuals of the target species[11]. It is noted, however, that ecologically speaking, the potential breeding habitat resources are within Bulga Hill not the surrounding PCTs.

AMBS undertook targeted surveys of Bulga Hill and found two juvenile (approximately <6 months old) males of the Eastern Cave Bat and one individual Large-eared Pied Bat that was potentially a juvenile female; however, the age of the individual was not definitive. Although the age of the Large-eared Pied Bat is not conclusive, it is conservatively assumed that relevant PCTs within 100 m of Bulga Hill is 'breeding habitat' for both species of bat.

NCOPL reviewed the extent of the mine plan and reduced the length of the longwalls so there would be no subsidence impacts on Bulga Hill (Ditton Geotechnical Services, 2020). Further, there would be no clearance impacts within 100 m of Bulga Hill.

[11] The *'Species credit' Threatened Bats and their Habitats – NSW Survey Guide for the Biodiversity Assessment Method* (OEH, 2018a) defines breeding bat as a female bat of the target species that is pregnant, carrying pups, lactating and/or juveniles of the target species.

While no subsidence impacts are predicted to occur on Bulga Hill (i.e. on the features used by the bats for breeding), Ditton Geotechnical Services (2020) is predicting some subsidence effects including potential cracking within the vegetation that occurs within the 100 m buffer of Bulga Hill. Land subsidence is unlikely to materially impact on vegetation or habitat within the predicted subsidence area as dieback or more than occasional tree fall (outside of potential ponding areas and identified areas of low depth of cover where potential cracking impacts may affect vegetation) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

Since breeding habitat would not be impacted by the Project, the Project is not likely to contribute significantly to the risk of extinction of the bats.

Coolabah Bertya

Coolabah Bertya is not listed as a 'potential SAII entity'; however, is being considered for inclusion on the list of 'potential SAII entities' (DPIE, 2020d). Species credits have been calculated for Coolabah Bertya (Section 4.6). This species is considered further below as required by the BAM (OEH, 2017a).

SAII Assessment Requirements

For impacts on 'potential SAII entities', the BAM (OEH, 2017a) requires the following information to be provided:

(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

(b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification

(c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

(d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to:

(i) an estimate of the change in habitat available to the local population as a result of the proposed development

(ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and

(iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.

BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development

(e) the likely impact on the ecology of the local population. At a minimum, address the following:

(i) for fauna:

- *breeding*
- *foraging*
- *roosting, and*
- *dispersal or movement pathways*

(ii) for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available:

- *pollination cycle*
- *seedbanks*
- *recruitment, and*
- *interactions with other species (e.g. pollinators, host species, mycorrhizal associations)*

(f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development

(g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range

(h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population

(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion

(j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.

Clause 6.7 of the BC Regulation provides principles for the purposes of determining whether an impact on diversity values is a serious and irreversible impact for the purposes of the Biodiversity Offsets Scheme. It states:

(2) An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

(a) it will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or

(b) it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or

(c) it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or

(d) the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

(3) For the purpose of this clause, a decline *of a species or ecological community is a continuing or projected decline in:*

(a) an index of abundance appropriate to the taxon, or

(b) the geographic distribution and habitat quality of the species or ecological community.

The above are addressed in Sections 8.1.2 to 8.1.4 in consideration of the DPIE (2019c) *Guidance to assist a decision-maker to determine a serious and irreversible impact.*

8.1.2 Coolabah Bertya (*Bertya opponens*)

(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

At a broad level, the Project has been designed to avoid or minimise impacts on biodiversity values through:

- the use of underground longwall mining methods, which significantly reduces vegetation and soil disturbance (and impacts on hydrological features) in comparison to open cut mining methods;
- the use of the substantial existing infrastructure at the existing approved and operating underground mine (such as the Pit Top Area), limiting the requirement to develop new infrastructure; and
- locating multiple surface infrastructure components within the same alignment.

NCOPL considers that it is not feasible to avoid all clearance impacts on Coolabah Bertya as the population extends to the central portion of ML 1609 above the existing approved Stage 2 longwalls (LW 206, 207, 208 and 209) (Figure 18).

(b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification

The Project would result in the direct clearance of approximately 6 ha of known habitat for the Coolabah Bertya, comprising an estimated 25,939 individuals (Figure 18). There is estimated to be in the order of 1.1 million individuals in the Subject land[12]; the size of the population may be much greater as the habitat extends into Jacks Creek State Forest (Figure 35). Jacks Creek State Forest has the largest population in NSW (estimated at >5 million plants) (National Parks and Wildlife Service [NPWS], 2002).

(c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

DPIE has not set any thresholds for impacts on potential SAII entities (DPIE, 2019c).

(d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to:

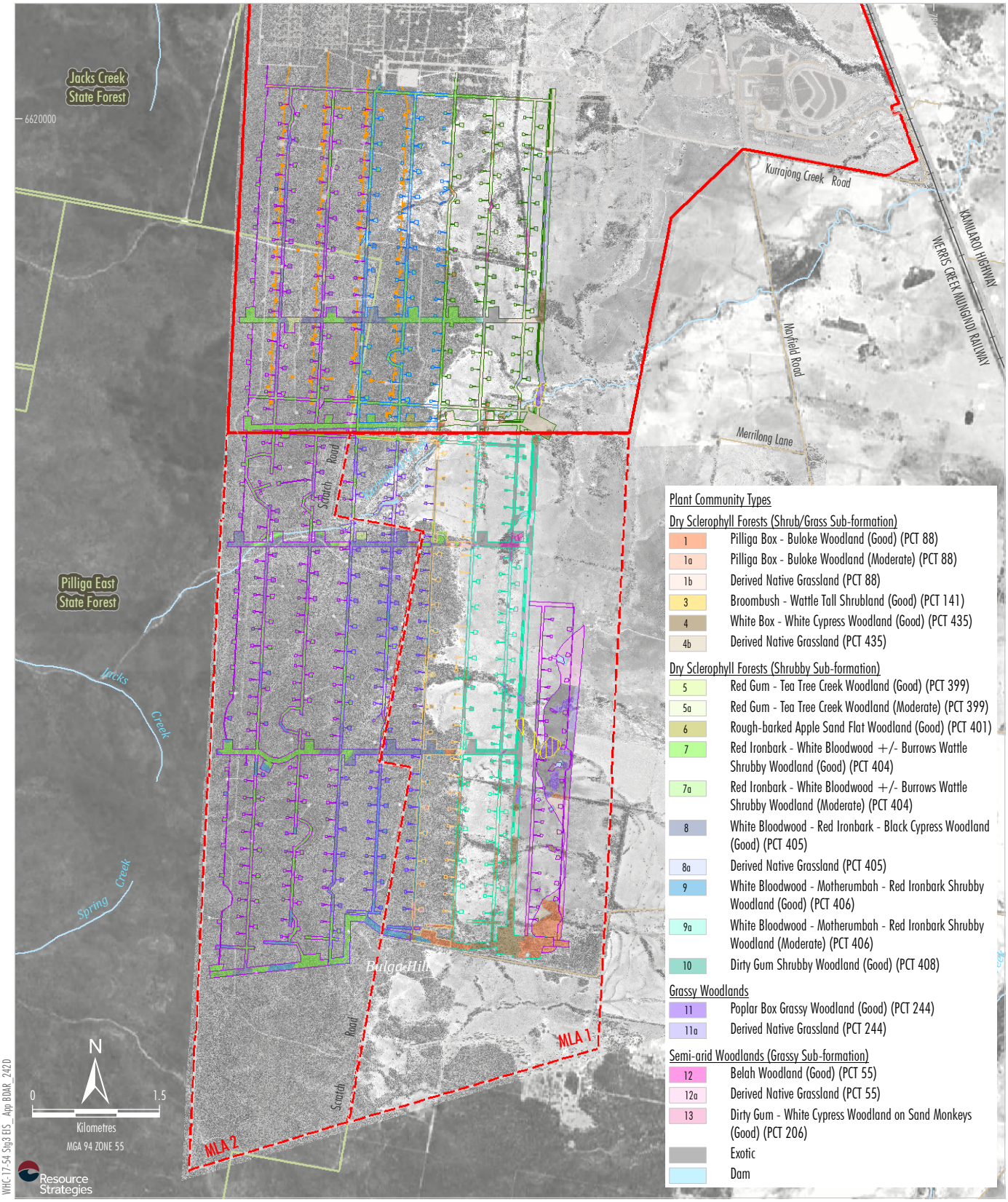
(i) an estimate of the change in habitat available to the local population as a result of the proposed development

(ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and

(iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.

The Project would result in the direct clearance of 6 ha of known habitat (approximately 2.3% of the species' habitat mapped on Figure 18). This is a small subset of the total habitat for Coolabah Bertya mapped on Figure 18 (approximately 261.6 ha) and an even smaller subset of the area covered by the entire population.

[12] Based on a density of approximately 4,330 plants per ha over 261 ha (AMBS, 2020a) (Attachment B).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Ecological Communities

- Poplar Box Grassy Woodland on Alluvial Plains

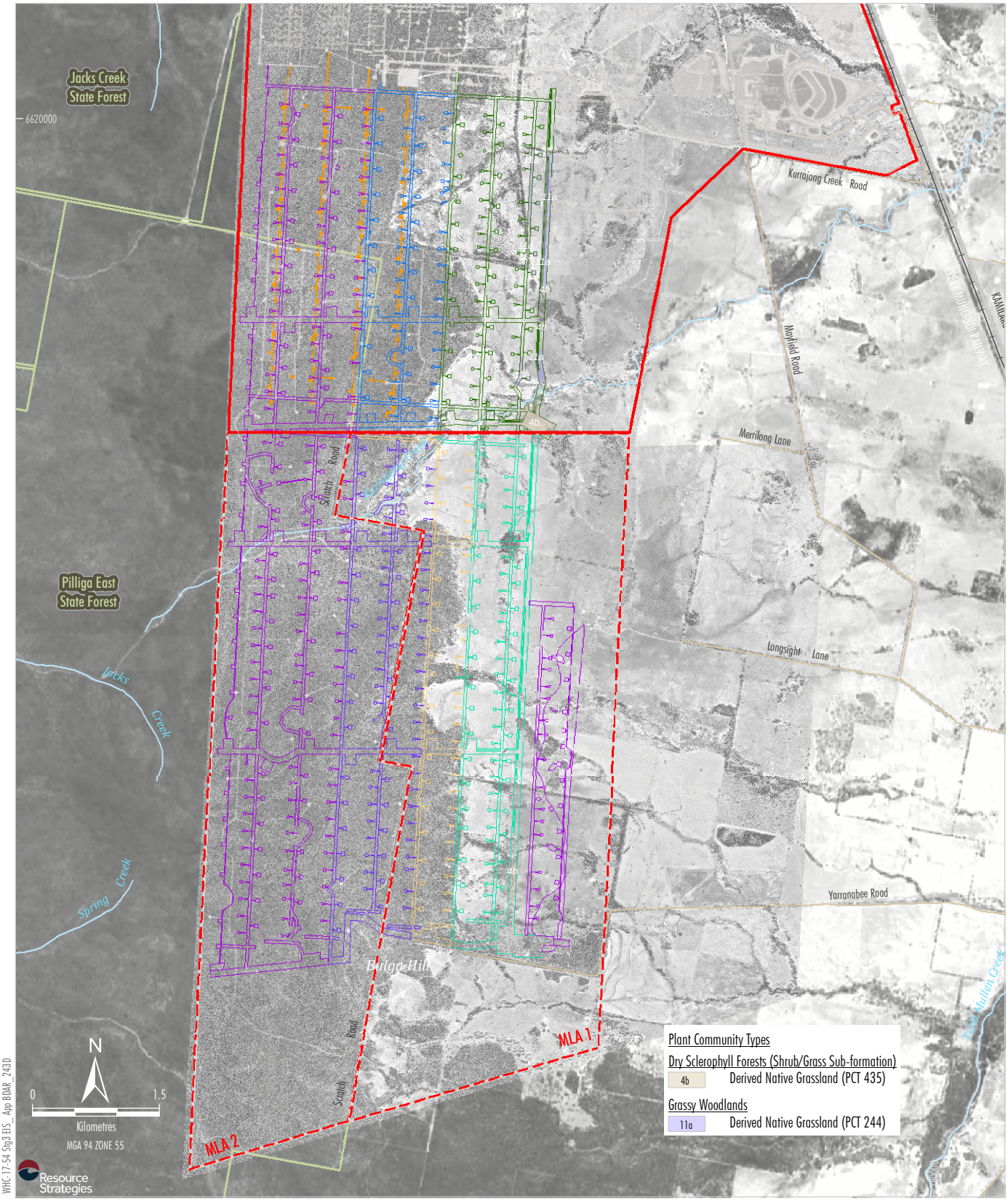
Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Areas Requiring Offset

Figure 33



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

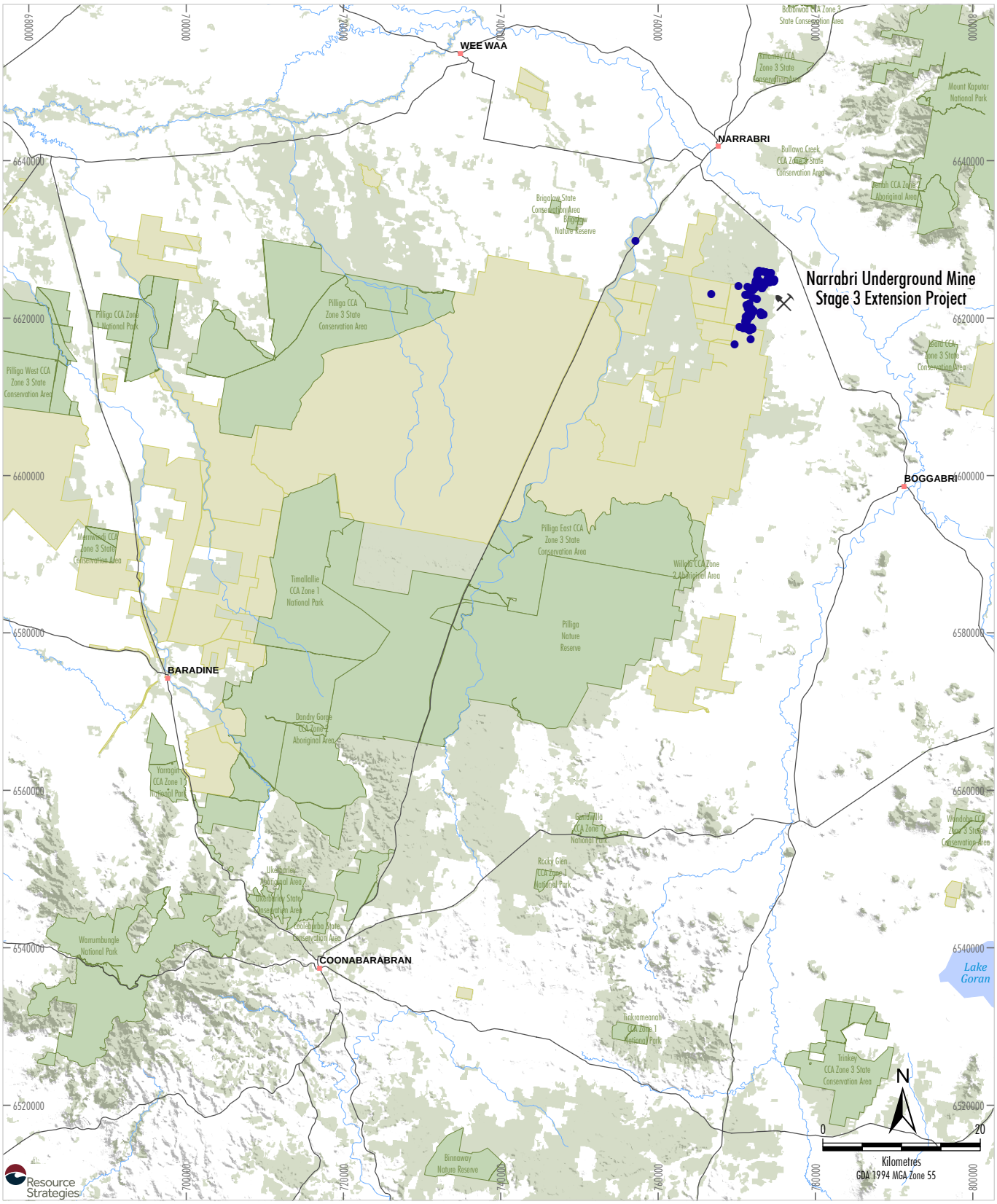
Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Areas Not Requiring Assessment or Offset

Figure 34



LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Coolabah Bertya

Source: Geoscience Australia - Topograhic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Coolabah Bertya Landscape Distribution

Figure 35

As described in Section 7, a propagation and translocation trial would be implemented for the Coolabah Bertya. This would involve collection of vegetative material from the local population (either above-ground parts and/or soil seed bank) and use of that material to re-establish individual plants in rehabilitation areas. However, at this stage, NCOPL are not proposing to obtain credits for Coolabah Bertya as part of the mine site ecological rehabilitation.

Section 9.2.2 further describes the likely impact that the Project would have on the habitat of the local population of Coolabah Bertya.

(e) the likely impact on the ecology of the local population. At a minimum, address the following:

(ii) for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available:

- ***pollination cycle***
- ***seedbanks***
- ***recruitment, and***
- ***interactions with other species (e.g. pollinators, host species, mycorrhizal associations)***

The clearance of 6 ha of known habitat would occur progressively for the mining of LW 206, 207, 208 and 209 and would be followed by progressive revegetation. Austen (1999) notes that populations may need some form of disturbance to stimulate recruitment (e.g. fire or physical disturbance such as that associated with earthworks). Prolific regrowth of plants in the Jacks Creek State Forest population occurred after the adjacent fire-break was graded, suggesting that the species resprouts from the roots following disturbance (NPWS, 2002). This increases the likelihood that Bertya would resprout in areas undergoing revegetation.

(f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development

While there would be some temporary fragmentation of the local population as a result of the Project in the short-term, there would be no isolation of Coolabah Bertya as it would remain present around the Development Footprint and in the neighbouring Jacks Creek State Forest.

(g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range

The local population of Coolabah Bertya forms part of the Jacks Creek State Forest population. Jacks Creek State Forest has the largest population in NSW (estimated at >5 million plants) (NPWS, 2002).

(h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population

The management of weeds, animal pest species and other threats and indirect impacts are described in Section 6.2. Coolabah Bertya is unlikely to be indirectly impacted by the Project.

(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion

Coolabah Bertya is currently known from four scattered sites in NSW: one from private property near Coolabah in western NSW and two to the south of Narrabri on the North West Slopes, including the largest population in Jacks Creek State Forest. The fourth population has not been seen since 1982 and is possibly now extinct (DPIE, 2020e). As described above, the Jacks Creek State Forest has the largest population in NSW (estimated at >5 million plants) (NPWS, 2002).

(j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.

The Subject land is on the boundary of the Pilliga and Liverpool Plains IBRA Subregions of the Brigalow Belt South IBRA Region. As described in Section 7, a propagation and translocation trial would be implemented for the Coolabah Bertya. This would involve collection of vegetative material from the local population (either above-ground parts and/or soil seed bank) and use of that material to re-establish individual plants in rehabilitation areas.

Species credits have been calculated for Coolabah Bertya (Section 4.6) and residual impacts on this species would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

Impact Assessment

Will the Project cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline?

The NSW final determination for Coolabah Bertya (Scientific Committee, 2009), describes that there appears to be no evidence that the total population of Coolabah Bertya is undergoing a continuing decline. The very large population in Jacks creek State Forest is described as thriving (Scientific Committee, 2009).

Will the Project further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size?

The Project would not impact a very small size population of Coolabah Bertya. There is estimated to be in the order of 1.1 million individuals in the Subject land[13] and the size of the population would be much greater as the population extends into Jacks Creek State Forest (Figure 35). Jacks Creek State Forest has the largest population in NSW (estimated at >5 million plants) (NPWS, 2002).

Will the Project impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution?

Coolabah Bertya has a highly restricted geographic distribution in NSW (Scientific Committee, 2009). The residual impacts on this species would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

[13] Based on a density of approximately 4,330 plants per ha over 261 ha (AMBS, 2020a) (Attachment B).

Is the impacted species unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable?

The potential for this species to recover is high if appropriate management strategies are in place. Coolabah Bertya is resilient to disturbance and appears to readily re-establish under favourable management (NPWS, 2002).

8.1.3 Large-eared Pied Bat and Eastern Cave Bat

(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

AMBS undertook targeted surveys of Bulga Hill and found two juvenile (<6 months old) males of the Eastern Cave Bat and one individual Large-eared Pied Bat that was potentially a juvenile female; however, the age of the individual was not definitive. Although the age of the Large-eared Pied Bat is not conclusive, it is conservatively assumed that relevant PCTs within 100 m of Bulga Hill is 'breeding habitat' for both species of bat.

NCOPL reviewed the extent of the mine plan and reduced the length of the longwalls so there would be no subsidence impacts on Bulga Hill (Ditton Geotechnical Services, 2020). Further, there would be no clearance impacts within 100 m of Bulga Hill.

(b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification

Since breeding habitat would not be adversely impacted by the Project, the Project is not likely to impact breeding individuals.

The Eastern Cave Bat has previously been recorded within the Pilliga Nature Reserve and Pilliga East State Forest (Ellis, 2001); however, the population information for the area is unknown.

(c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact

DPIE has not set any thresholds for impacts on potential SAII entities (DPIE, 2019c).

(d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to:

- ***(i) an estimate of the change in habitat available to the local population as a result of the proposed development***
- ***(ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and***
- ***(iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.***

NCOPL reviewed the extent of the mine plan and reduced the length of the longwalls so there would be no subsidence impacts on Bulga Hill (Ditton Geotechnical Services, 2020). Further, there would be no clearance impacts within 100 m of Bulga Hill.

While no subsidence impacts are predicted to occur on Bulga Hill (i.e. on the features used by the bats for breeding), Ditton Geotechnical Services (2020) is predicting some subsidence within the vegetation that occurs within the 100 m buffer of Bulga Hill. Land subsidence is unlikely to materially impact on vegetation or habitat within the predicted subsidence area as dieback or more than occasional tree fall (outside of potential ponding areas and identified areas of potential cracking impacts [Figure 6]) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

(e) the likely impact on the ecology of the local population. At a minimum, address the following:

(i) for fauna:

- ***breeding***
- ***foraging***
- ***roosting, and***
- ***dispersal or movement pathways***

Since breeding habitat would not be adversely impacted by the Project, the Project is not likely to impact breeding individuals. Species credits have been calculated for the Large-eared Pied Bat and Eastern Cave Bat (Section 4.6) as the Project would involve clearance of foraging habitat within 2 km of a Pilliga Sandstone rocky outcrop with bat habitat found to be used by these bats (e.g. Bulga Hill).

(f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development

The local population of the Large-eared Pied Bat and Eastern Cave Bat is not likely to become fragmented or isolated as a result of the Project due to the mobility of the bats.

(g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range

Available roosts are not evenly distributed throughout the range of the Large-eared Pied Bat. In particular, the populations in north-east NSW are likely to be isolated, with little interaction with their nearest populations (Hoye, 2005). It is not likely that the local population of the Large-eared Pied Bat is important to other populations for factors such as breeding, dispersal and genetic viability/diversity, but the level of interaction between adjacent colonies has not been ascertained (DAWE, 2020c).

(h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population

The management of weeds, animal pest species and other threats and indirect impacts are discussed in Section 6.2.

(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion

There is insufficient data to estimate abundance or population trends of the Large-eared Pied Bat. The species appears to exist in a number of small populations throughout its range and colonies seldom contain more than 50 individuals (DAWE, 2020c). Important populations supporting higher numbers of individuals include those present in the sandstone escarpments of the Hunter Valley, Sydney Basin and Southern Tablelands of NSW. Additional smaller populations of importance occur in limestone caves, and caves and mines with rocks of volcanic origin in the western and north-east parts of its range in NSW (Hoye, 2005).

The Eastern Cave Bat has been recorded in populations of about 50 to over 100 individuals (Law *et al.*, 2005) and occasionally in colonies of up to 500 individuals (DPIE, 2020e). Little is known or understood of this species, however, and there is insufficient data to estimate abundance or population trends of the Eastern Cave Bat.

(j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.

The Subject land is on the boundary of the Pilliga and Liverpool Plains IBRA Subregions of the Brigalow Belt South IBRA Region. Mine site ecological rehabilitation would be undertaken to restore foraging habitat for the Large-eared Pied Bat and Eastern Cave Bat. Species credits have been calculated for these bats (Section 4.6) and residual impacts on this species would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

Impact Assessment

Will the Project cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline?

The main known cause of decline of the Large-eared Pied Bat or Eastern Cave Bat is the destruction of, and interference with maternity and other roosts. As the species' known roosting and potential breeding habitat on the Subject land would not be impacted, the Project is unlikely to cause a further decline of the Large-eared Pied Bat or Eastern Cave Bat.

Will the Project further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size?

The Project is unlikely to further reduce the population size of the Large-eared Pied Bat or Eastern Cave Bat.

Will the Project impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution?

The Large-eared Pied Bat and Eastern Cave Bat do not have a limited geographic distribution, though breeding habitat is limited within the distribution.

Is the impacted species unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable?

NCOPL reviewed the extent of the mine plan and reduced the length of the longwalls so there would be no subsidence impacts on Bulga Hill (Ditton Geotechnical Services, 2020). Further, there would be no clearance impacts within 100 m of Bulga Hill.

8.1.4 Conclusion

Based on the information above, the Project is unlikely to contribute significantly to the risk of extinction of the Coolabah Bertya, Large-eared Pied Bat or Eastern Cave Bat.

8.2 IMPACTS ON NATIVE VEGETATION (ECOSYSTEM CREDITS)

Table 23 provides the ecosystem credit requirements after the application of the Impact Reduction Area in Section 5.2 (not including the application of the mine site ecological rehabilitation in Section 10.5). Figure 33 shows areas requiring offset and Figure 34 shows areas not requiring assessment or offset.

8.3 IMPACTS ON THREATENED SPECIES (SPECIES CREDITS)

Table 24 provides the species credit requirements after the application of the Impact Reduction Area in Section 5.2 (not including the application of the mine site ecological rehabilitation in Section 10.5).

Table 23
Project Ecosystem Credit Requirements After Impact Reduction

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Biodiversity Risk Weighting	Ecosystem Credit Requirement										
				Phase 1			Phase 2	Phase 3			Phase 4	Phase 5	Phase 6	Total
				Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 1		Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 3				
1	Pilliga Box – Buloke Woodland (Good)	88	1.50	149	0	149	578	23	0	23	191	34	197	**1,172**
1a	Pilliga Box – Buloke Woodland (Moderate)	88	1.50	3	0	3	0	0	0	0	0	0	0	**3**
1b	Derived Native Grassland	88	1.50	504	-1	503	175	43	0	43	37	53	94	**905**
			Subtotal for PCT 88	**656**	**-1**	**655**	**753**	**66**	**0**	**66**	**228**	**87**	**291**	**2,080**
2	Broombush – Wattle Tall Shrubland (Good)	141	1.50	0	0	0	0	0	0	0	0	0	10	**10**
			Subtotal for PCT 141	**0**	**0**	**0**	0	**0**	**0**	**0**	**0**	**0**	**10**	**10**
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	-	0	0	0	0	0	0	0	0	0	**0**	**0**
			Subtotal for PCT 432	**0**	**0**	**0**	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**
4	White Box – White Cypress Woodland (Good)	435	1.75	74	0	74	275	0	0	0	100	33	46	**528**
4a	White Box – White Cypress Woodland (Moderate)	435	1.75	0	0	0	0	0	0	0	0	0	0	**0**
4b	Derived Native Grassland	435	1.75	0	0	0	0	0	0	0	0	0	48	**48**
			Subtotal for PCT 435	**74**	**0**	**74**	**275**	**0**	**0**	**0**	**100**	**33**	**94**	**576**
5	Red Gum – Tea Tree Creek Woodland (Good)	399	1.50	0	0	0	0	36	-14	22	30	165	102	**319**
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	1.50	0	0	0	0	0	0	0	0	13	0	**13**
			Subtotal for PCT 399	**0**	**0**	**0**	**0**	**36**	**-14**	**22**	**30**	**178**	**102**	**332**

Table 23 (Continued)
Project Ecosystem Credit Requirements After Impact Reduction

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Biodiversity Risk Weighting	Ecosystem Credit Requirement										
				Phase 1			Phase 2	Phase 3			Phase 4	Phase 5	Phase 6	Total
				Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 1		Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 3				
6	Rough-barked Apple Sand Flat Woodland (Good)	401	1.50	20	0	20	0	79	0	79	8	4	0	**111**
			Subtotal for PCT 401	**20**	**0**	**20**	**0**	**79**	**0**	**79**	**8**	**4**	**0**	**111**
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	1.50	209	-178	31	0	874	-26	848	110	623	3,726	**5,338**
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	1.50	9	-2	7	0	20	0	20	0	0	0	**27**
			Subtotal for PCT 404	**218**	**-180**	**38**	**0**	**894**	**-26**	**868**	**110**	**623**	**3,726**	**5,365**
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	1.50	0	0	0	0	211	-70	141	207	783	1,019	**2,150**
8a	Derived Native Grassland	405	1.50	0	0	0	0	9	-1	8	0	0	0	**8**
			Subtotal for PCT 405	**0**	**0**	**0**	**0**	**220**	**-71**	**149**	**207**	**783**	**1,019**	**2,158**
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	1.50	0	0	0	0	0	0	0	295	328	267	**890**
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	1.50	18	0	18	0	0	0	0	0	0	0	**18**
			Subtotal for PCT 406	**18**	**0**	**18**	**0**	**0**	**0**	**0**	**295**	**328**	**267**	**908**

Table 23 (Continued)
Project Ecosystem Credit Requirements After Impact Reduction

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Biodiversity Risk Weighting	Ecosystem Credit Requirement										
				Phase 1			Phase 2	Phase 3			Phase 4	Phase 5	Phase 6	Total
				Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 1		Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 3				
10	Dirty Gum Shrubby Woodland (Good)	408	1.50	0	0	0	0	0	0	0	0	3	0	**3**
			Subtotal for PCT 408	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**3**
11	Poplar Box Grassy Woodland (Good)	244	2.00	31 [A]	0	31 [A]	111 [B]	0	0	0	0	0	223 [C]	**365**
11a	Derived Native Grassland	244	2.00	0	0	0	0	0	0	0	0	0	73	**73**
			Subtotal for PCT 244	**31 [A]**	**0**	**31 [A]**	111 [B]	**0**	**0**	**0**	**0**	**0**	**296 [C]**	**438**
12	Belah Woodland (Good)	55	2.00	92	0	92	136	0	0	0	11	0	0	**239**
12a	Derived Native Grassland	55	2.00	52	0	52	400	0	0	0	18	0	130	**600**
			Subtotal for PCT 55	**144**	**0**	**144**	**536**	**0**	**0**	**0**	**29**	**0**	**130**	**839**
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	1.75	0	0	0	0	0	0	0	57	3	0	**60**
			Subtotal for PCT 206	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**57**	**3**	**0**	**60**
			Total Credits	**1,161**	**-181**	**980**	**1,675**	**1,295**	**-111**	**1,184**	**1,064**	**2,042**	**5,935**	**12,880**

[A] Includes 24 credits for Poplar Box Woodland EEC.

[B] Includes 34 credits for Poplar Box Woodland EEC.

[C] Includes 86 credits for Poplar Box Woodland EEC.

Table 23 (Continued)
Project Ecosystem Credit Requirements After Impact Reduction

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Biodiversity Risk Weighting	Ecosystem Credit Requirement										
				Phase 1			Phase 2	Phase 3			Phase 4	Phase 5	Phase 6	Total
				Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 1		Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Residual Total for Phase 3				
10	Dirty Gum Shrubby Woodland (Good)	408	1.50	0	0	0	0	0	0	0	0	3	0	**3**
			Subtotal for PCT 408	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**3**
11	Poplar Box Grassy Woodland (Good)	244	2.00	31 [A]	0	31 [A]	111 [B]	0	0	0	0	0	223 [C]	**365**
11a	Derived Native Grassland	244	2.00	0	0	0	0	0	0	0	0	0	73	**73**
			Subtotal for PCT 244	**31** [A]	**0**	**31** [A]	111 [B]	**0**	**0**	**0**	**0**	**0**	**296** [C]	**438**
12	Belah Woodland (Good)	55	2.00	92	0	92	136	0	0	0	11	0	0	**239**
12a	Derived Native Grassland	55	2.00	52	0	52	400	0	0	0	18	0	130	**600**
			Subtotal for PCT 55	**144**	**0**	**144**	**536**	**0**	**0**	**0**	**29**	**0**	**130**	**839**
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	1.75	0	0	0	0	0	0	0	57	3	0	**60**
			Subtotal for PCT 206	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**57**	**3**	**0**	**60**
			Total Credits	**1,161**	**-181**	**980**	**1,675**	**1,295**	**-111**	**1,184**	**1,064**	**2,042**	**5,935**	**12,880**

[A] Includes 24 credits for Poplar Box Woodland EEC.

[B] Includes 34 credits for Poplar Box Woodland EEC.

[C] Includes 101 credits for Poplar Box Woodland EEC.

Table 24
Project Species Credit Requirements After Impact Reduction

Scientific Name	Common Name	Conservation Status		Species Credit Requirement								
		BC Act[1]	EPBC Act[2]	Phase 1 Development Footprint (Table 11)	Phase 1 Impact Reduction Area (Table 18)	Residual Total for Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total
Bertya opponens	Coolabah Bertya	V	V	0	0	0	0	2,594	0	0	49,284	**51,878**
Lepidium aschersonii	Spiny Peppercress	V	V	295	0	295	906	30	265	45	263	**1,804**
Tylophora linearis	-	V	E	628	-387	241	1,085	1,656	1,236	2,640	7,146	**14,004**
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	864	-387	477	1,286	1,702	1,327	2,702	7,400	**14,894**
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	998	-387	611	1,458	1,702	1,344	2,702	7,415	**15,232**
Phascolarctos cinereus	Koala	V	V	998	-387	611	1,458	1,702	1,344	2,702	7,428	**15,245**
Cercartetus nanus	Eastern Pygmy-possum	V	-	468	-387	81	751	1,656	1,186	2,605	7,061	**13,340**
Petaurus norfolcensis	Squirrel Glider	V	-	574	-121	453	1,286	529	1,180	1,959	2,928	**8,335**
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	0	0	0	1,496	0	1,596	3,404	5,441	**11,937**
Vespadelus troughtoni	Eastern Cave Bat	V	-	0	0	0	1,572	0	848	1,584	2,560	**6,564**

[1] Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). E = Endangered; V = Vulnerable.

9 COMMONWEALTH ASSESSMENT

This section provides an assessment for EPBC Act listed threatened species and communities. Assessment on water resources is provided in the *Narrabri Underground Mine Stage 3 Extension Project – Groundwater Impact Assessment* (AGE, 2020) and *Narrabri Underground Mine Stage 3 Extension Project – Surface Water Assessment* (WRM, 2020).

9.1 SURVEYS FOR THREATENED SPECIES AND COMMUNITIES LISTED UNDER THE EPBC ACT

Since the Project was referred under the EPBC Act, detailed surveys for EPBC Act listed threatened species and communities have been completed by AMBS (2020a and 2020b) (Attachments B and C) across the Subject land.

9.1.1 Survey Scope, Timing and Methodology

EPBC Act listed threatened species and communities to target during surveys were identified by undertaking database reviews (including DAWE, 2020d) and literature reviews prior to field surveys (AMBS, 2020a and 2020b) (Attachments B and C). Species were evaluated for their known presence or likelihood of occurring within the Subject land based on known habitat preferences. EPBC Act listed threatened species and communities targeted during the surveys are listed in Table 25.

Flora surveys were undertaken between June 2019 and January 2020 (AMBS, 2020a) (Attachment B) and fauna surveys were undertaken between June 2019 and January 2020 (AMBS, 2020b) (Attachment C).

Table 25
EPBC Act Species and Communities Targeted for Survey

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]
		BC Act[1]	EPBC Act[2]	
Flora				
Bertya opponens	Coolabah Bertya	V	V	Species
Commersonia procumbens (syn. Androcalva procumbens)	-	V	V	Species
Dichanthium setosum	Bluegrass	V	V	Species
Homoranthus darwinioides	-	V	V	Species
Lepidium aschersonii	Spiny Peppercress	V	V	Species
Swainsona murrayana	Slender Darling Pea	V	V	Species
Tylophora linearis	-	V	E	Species
Zieria ingramii	Keith's Zieria	E	E	Species
Reptiles				
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V	Species
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species
Birds				
Leipoa ocellata	Malleefowl	E	V	Ecosystem
Hirundapus caudacutus	White-throated Needletail	-	V	Species
Lathamus discolor	Swift Parrot	E	CE	Species*/Ecosystem
Polytelis swainsonii	Superb Parrot	V	V	Species*/Ecosystem

Table 25 (Continued)
EPBC Act Species and Communities Targeted for Survey

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]
		BC Act[1]	EPBC Act[2]	
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species*/Ecosystem
Grantiella picta	Painted Honeyeater	V	V	Ecosystem
Mammals				
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Ecosystem
Phascolarctos cinereus	Koala	V	V	Species/Ecosystem
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species*/Ecosystem
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Ecosystem
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species
Pseudomys pilligaensis	Pilliga Mouse	V	V	Ecosystem
Community				
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		CE	CE	Ecosystem
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia		E	E	Ecosystem
Poplar Box Grassy Woodland on Alluvial plains		-	E	Ecosystem

Note: Highlighted species/community are those recorded in MLA 1 and/or MLA 2.

1 Conservation status under the BC Act (current as at October 2020). CE = Critically Endangered, E = Endangered; V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered, E = Endangered; V = Vulnerable.

3 Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

* Habitat constraint is not present in the Subject land.

Surveys by AMBS (2020a and 2020b) (Attachments B and C) were undertaken in accordance with published Commonwealth guidelines and policy statements and follow guidelines set in the BAM (OEH, 2017a). Further details of the survey scope, timing and methodology are provided in Attachments B and C. Species shaded in Table 25 are species with records in MLA 1 and/or MLA 2.

9.1.2 Occurrence of Threatened Species and Their Habitat

Three threatened flora species listed under the EPBC Act were recorded in the Project area or immediate surrounds, namely, Coolabah Bertya, Spiny Peppercress and *Tylophora linearis* (AMBS, 2020a) (Attachment B) (Table 26). Six threatened fauna species listed under the EPBC Act were recorded during the surveys, namely, the White-throated Needletail, Painted Honeyeater, Koala, Corben's Long-eared Bat, Large-eared Pied Bat and Pilliga Mouse (AMBS, 2020b) (Attachment C) (Table 26).

The Superb Parrot and Regent Honeyeater have not been recorded in the Subject land. The Subject land does not provide breeding habitat for either species, but may provide occasional foraging habitat (AMBS, 2020b) (Attachment C).

It is considered unlikely that the other species listed in Table 25 use the habitat within the Subject land.

Table 26
Threatened Species Listed Under the EPBC Act Recorded During Surveys

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Occurrence	Habitat
		BC Act[1]	EPBC Act[2]			
Flora						
Bertya opponens	Coolabah Bertya	V	V	Species	The species was found as single plants, but more commonly as patches of small to large numbers of plants of varying size and age. It is most abundant in the north-western part of the Subject land where the species occurs across a hillside below a prominent ridge (in PCTs 141, 404, 405 and 406). Approximately 11,126 stems were recorded by AMBS using a combination of direct count and estimation by extrapolation (Keith, 2000) within 2.57 ha of the proposed indicative surface Development Footprint (approximately 4,330 plants per ha) (AMBS, 2020a) (Attachment B).	Predicted habitat in the Subject land according to the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) occurs in PCTs 405, 406, 408, 432. Coolabah Bertya was found to be present in the Subject land in PCTs 404, 405, 406 and 141 (AMBS, 2020a) (Attachment B).
Lepidium aschersonii	Spiny Peppercress	V	V	Species	ELA's 2017-2018 surveys recorded 32 individuals of Spiny Peppercress in PCT 55 woodland dominated by *Casuarina cristata* (Belah), and in PCT 88 tall woodland dominated by *Eucalyptus pilligaensis* (Pilliga Box) and *Callitris glaucophylla* (White Cypress Pine) (AMBS, 2020a) (Attachment B).	A species polygon for this species has been mapped across all locations of woodland PCTs 55 and 88 within the proposed indicative surface development footprint (AMBS, 2020a) (Attachment B).
Tylophora linearis	-	V	E	Species	*Tylophora linearis* was found in multiple locations in the Subject land during AMBS's July, August and October 2019 surveys. A total of 96 stems were recorded in the Subject land in PCTs 141, 399, 404, 406 and 435. ELA surveys in 2017-18 previously recorded 92 individuals of *Tylophora linearis* in what has been mapped by AMBS as PCTs 404 and 435 (AMBS, 2020a) (Attachment B).	A species polygon for this species has been mapped across all PCTs recognised as habitat in the BioNet Threatened Biodiversity Data Collection (DPIE, 2020d) for this species (i.e. PCT 88, 141, 399, 401, 404, 405, 406, 408, 432 and 435, excluding DNGs) (AMBS, 2020a) (Attachment B).

Table 26 (Continued)
Threatened Species Listed Under the EPBC Act Recorded During Surveys

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Occurrence	Habitat
		BC Act[1]	EPBC Act[2]			
Birds						
Hirundapus caudacutus	White-throated Needletail	-	V	Species	Recorded once by ELA during their surveys in the Subject land between 2017-2018. Also recorded by AMBS during summer 2019. Approximately 250 individuals were observed above the south-east corner of Bulga Hill just after dawn, indicating probable roosting nearby (AMBS, 2020b) (Attachment C).	Because the White-throated Needletail is aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps (DAWE, 2020c).
Grantiella picta	Painted Honeyeater	V	V	Ecosystem	Recorded on one occasion incidentally in 2019 by AMBS during flora surveys (AMBS, 2020b) (Attachment C).	Painted Honeyeaters tend to inhabit *Acacia pendula* (Boree/Weeping Myall), *Acacia harpophylla* (Brigalow) and Box-Gum Woodlands and Box-Ironbark Forests. They are a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring mistletoes of the genus *Amyema*. Insects and nectar from mistletoe or eucalypts are occasionally eaten (DPIE, 2020e). Vegetation associations for the species within the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) include all PCTs except Broombush – Wattle Tall Shrubland (PCT 141).
Mammals						
Phascolarctos cinereus	Koala	V	V	Species/Ecosystem	Recorded by AMBS in three general locations in 2019. Scats were found at the base of nine trees within the Shallow, Undefined Drainage Channel broad habitat type (PCTs 399 and 405) (AMBS, 2020b) (Attachment C).	Known foraging and potential breeding habitat for the Koala within the Subject land occurs throughout all PCTs, including potential Paddock Trees. In the Subject land, the PCTs that have been mapped as habitat (i.e. contain suitable densities of key feed tree species) include PCTs 55, 88, 141, 206, 244, 399, 401, 406, 408, 432 and 435, and a subset of PCTs 404 and 405 (AMBS, 2020b) (Attachment C).

Table 26 (Continued)
Threatened Species Listed Under the EPBC Act Recorded During Surveys

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Occurrence	Habitat
		BC Act[1]	EPBC Act[2]			
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Ecosystem	The species has been recorded on several occasions within the Subject land, within PCTs 404, 405 and 408. ELA captured the species in harp traps at seven of their survey sites and also recorded the species opportunistically on one occasion. Recorded by AMBS in 2019 at the unnamed rocky outcrop in harp traps. Adults and juveniles were captured (AMBS, 2020b) (Attachment C).	The Corben's Long-eared Bat inhabits a variety of vegetation types, including mallee, *Allocasuarina luehmannii* (Buloke) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Qld. They roost in tree hollows, crevices, and under loose bark (DPIE, 2020e). Potential habitat for the Corben's Long-eared Bat is likely to occur throughout all woodland and forest habitats within the Subject land (AMBS, 2020b) (Attachment C).
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	Recorded on Anabat detectors by AMBS at Bulga Hill and an unnamed rocky outcrop in December 2019 to January 2020. Four individuals were caught in harp traps at Bulga Hill, and one individual was hand-caught roosting in a small horizontal hole in the rock. One individual was potentially a juvenile (<6 months old) on the basis that it had very small nipples indicating it had not bred in its lifetime, and the wings were relatively unscarred (AMBS, 2020b) (Attachment C).	In accordance with the NSW survey guide for 'Species Credit' Threatened Bats and Their Habitat (OEH, 2018a), a species polygon is habitat associated with PCTs as per the BioNet Threatened Biodiversity Data Collection (DPIE, 2020d) (i.e. PCTs 88, 206, 399, 401, 404, 405, 406, 408, 432, 435) within a 2 km radius of Bulga Hill and the unnamed rocky outcrop. PCTs 55 and 244 have also been included because of their proximity to the cave habitat and other areas of suitable habitat (i.e. PCTs associated with the species) (AMBS, 2020b) (Attachment C).

Table 26 (Continued)
Threatened Species Listed Under the EPBC Act Recorded During Surveys

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Occurrence	Habitat
		BC Act[1]	EPBC Act[2]			
Pseudomys pilligaensis	Pilliga Mouse	V	V	Ecosystem	The species has been recorded on several occasions within the Subject land by ELA at five survey sites in 2017, from Elliot traps and pitfall traps in PCTs 404 and 405 (AMBS, 2020b) (Attachment C).	The Pilliga Mouse occurs only within the Pilliga region of NSW. The species tends to occur in low-nutrient deep sand soils that support Pilliga Scrub, appearing to prefer areas with sparse ground cover. Recent studies have found they occur in greatest abundance in recently burnt moist gullies, in habitat dominated by *Melaleuca uncinata* (Broombush) and areas containing an understorey of *Acacia burrowii* (Burrow's Wattle) with a *Corymbia trachyphloia* (White Bloodwood) overstorey. In one location, habitats were described as containing high plant species richness, moderate to high density of low-level shrub cover; and a moist ground cover of plants, litter and fungi. The gully where the highest rates of capture were encountered had an extensive cover of low grasses and sedges, with little shrub cover and large areas of ash-covered ground. The species is nocturnal and shelters in burrows (DPIE, 2020e). Potential habitat for the Pilliga Mouse in the Subject land includes PCTs 88, 141, 399, 401, 404, 405, 406, 408 and 244, excluding smaller patches in poor condition and with low connectivity that are unlikely to provide habitat for this species (AMBS, 2020b) (Attachment C).

1 Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). E = Endangered; V = Vulnerable.

3 Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

9.1.3 Occurrence of Threatened Ecological Communities

One TEC listed under the EPBC Act (Poplar Box Woodland EEC) was recorded during the surveys (AMBS, 2020a) (Attachment B) (Table 27), which would be subject to clearing as part of the Project. A description of the occurrence of the Poplar Box Woodland EEC is provided below. Further detail is provided in Attachment B (AMBS, 2020a).

The EPBC Act referral described that preliminary surveys by ELA (2016b) mapped the *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* present within the Project area. More detailed surveys were subsequently undertaken by AMBS (2020a) (Attachment B), and it was confirmed that the *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* is not present. Therefore, the Project would not have a significant impact on the *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* and no further assessment is required.

Previous surveys conducted by Ecotone (2009) mapped a woodland comprising Grey Box (*Eucalyptus microcarpa*) as present within ML 1609. Recent surveys have confirmed that the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* is not present in the Project area (AMBS, 2020a) (Attachment B).

9.2 IMPACTS ON THREATENED SPECIES AND COMMUNITIES LISTED UNDER THE EPBC ACT

This section provides a detailed analysis of the nature and extent of the likely direct, indirect and consequential impacts relevant to specific protected matters, including likely short-term and long-term impacts. Potential impacts on the following species and communities are assessed below:

- Poplar Box Woodland EEC;
- Coolabah Bertya;
- Spiny Peppercress;
- *Tylophora linearis*;
- Superb Parrot[14];
- Regent Honeyeater[15];
- Painted Honeyeater;
- Koala (combined populations of Qld, NSW and the ACT);
- Corben's Long eared Bat;
- Large-eared Pied Bat; and
- Pilliga Mouse.

[14] This species was not recorded by AMBS (2020b) (Attachment C), however, the DEE (now DAWE) considered (in the input into the SEARs) that the Project may significantly impact this species.

[15] The Project area is not within an important habitat area for this species (DPIE, 2020f) and this species was not recorded by AMBS (2020b) (Attachment C), however, the DEE (now DAWE) considered (in the input into the SEARs) that the Project may significantly impact this species.

Table 27
Threatened Ecological Communities Listed Under the EBPC Act Recorded During Surveys

Threatened Ecological Community	Conservation Status[1]	Phase 1				Phase 2				Phase 6				Overall Impacts			
		Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Trees (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management Area (ha)	Area of Potential Cracking Impacts on Trees (ha)
Poplar Box Grassy Woodlands on Alluvial Plains	Endangered	2.1	0	0	**2.1**	1	0	0	**1**	0.7	0	4.1	**4.8**	**3.8**	**0**	**0**	**4.1**

[1] Conservation status under the EPBC Act (current as at October 2020).

The assessments are in accordance with relevant Commonwealth guidelines and policy statements (DAWE, 2020b). The impacts of the Project on protected matters are known or predictable. Table 28 summarises the clearance of known and/or potential habitat for the threatened fauna species listed above. There are no other adverse impacts on these species that would occur as a result of the Project.

There would be a cumulative impact on threatened species and communities as a result of the Project (considering impacts from other existing and proposed surrounding developments [Section 6.1.4]), however, the cumulative impact is not likely to result in the loss of any of these species from the landscape.
As described in Table 26, the White-throated Needletail has been recorded in the locality. The White-throated Needletail is a migratory species that is widespread in eastern and south-eastern Australia. In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1,000 m above the ground (Coventry; Tarburton; Watson, as cited in DAWE, 2020c). White-throated Needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats (DAWE, 2020c). This species does not breed in Australia, but instead migrates to the Northern Hemisphere (Higgins, as cited in DAWE, 2020c).

The only known current threat to the White-throated Needletail in Australia is collision with wind turbines and overhead wires (Threatened Species Scientific Committee [TSSC], 2019), though, as this affects only a few individuals, it is not a threat to the species overall (DAWE, 2020c). This is not a relevant threat from the Project. A potential additional threat is insecticide use (TSSC, 2019) (also not relevant to the Project) and a suspected threat may be loss of woodland that results in a reduction in invertebrate prey. The Project is not likely to result in a reduction in the invertebrate prey given that the White-throated Needletail and its prey can move large distances and the Project area adjoins an extensive area of native vegetation within Jacks Creek State Forest, Pilliga East State Forest and neighbouring reserves. This species is not likely to be significantly impacted by the Project and is therefore not discussed further.

9.2.1 Poplar Box Woodland Endangered Ecological Community

Background

Poplar Box Woodland EEC is scattered across a broad distribution across eastern Australia, ranging approximately from central Qld south to the Riverina and NSW Southwestern Slopes Bioregions in NSW (DEE, 2019). Poplar Box Woodland EEC typically occurs on active and relictual depositional plains and flats, and is sometimes found in close proximity to ephemeral watercourses and depressions (DEE, 2019). Poplar Box Woodland EEC is characterised by an overstorey dominated by Poplar Box (*Eucalyptus populnea*), and an understorey dominated by native grasses and perennial forbs. In NSW, PCTs that are associated with the Poplar Box Grassy Woodland include PCTs 56, 87, 101 and 244. However, they must meet condition thresholds outlined in the *Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains* (DEE, 2019) to be determined as the EEC.

Assessment

The Project would result in the direct clearance of approximately 3.8 ha of Poplar Box Woodland EEC comprising various woodland patches (Figure 12; Table 27). The Poplar Box Woodland EEC adjacent to the Development Footprint (Figure 12) is mostly located in an agricultural grazing property and as such is subject to a number of existing recognised threats, namely, clearance and fragmentation, weed invasion, and invasive fauna (DEE, 2019).

Table 28
Threatened Fauna Habitat Clearance Summary

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
		BC Act[1]	EPBC Act[2]		Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Trees (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management Area (ha)	Area of Potential Cracking Impacts on Trees (ha)
Flora																												
Bertya opponens	Coolabah Bertya	V	V	Species	0	0	0	**0**	0	0	**0**	**0**	1,297 (individuals)	0	**1,297 (individuals)**	0	**0**	0	0	**0**	24,642 (individuals)	0	0	**24,642 (individuals)**	**25,939 (individuals)**	**0**	**0**	**0**
Lepidium aschersonii	Spiny Peppercress	V	V	Species	8.8	0.2	0	**9**	24.6	0.2	**0**	**24.8**	0.5	0.3	**0.8**	7.3	**7.3**	1.3	0	**1.3**	2.2	0	13.4	**15.6**	**44.7**	**0.7**	**0**	**13.4**
Tylophora linearis	-	V	E	Species	23.2	0.2	0	**23.4**	39.4	0.2	**0**	**39.6**	54.4	0.6	**55**	33.6	**33.6**	81.4	0.6	**82**	195.9	1.1	13.8	**210.8**	**427.9**	**2.7**	**0**	**13.8**
Birds																												
Polytelis swainsonii	Superb Parrot	V	V	Species/ Ecosystem	83.1	0.2	7.7	**91**	85.1	0.4	**5.2**	**90.7**	9.5	0.6	**10.1**	17.3	**17.3**	14.6	0.5	**15.1**	34.3	1.8	52.7	**88.8**	**243.9**	**3.5**	**12.9**	**52.7**
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/ Ecosystem	29	0.2	0	**29.2**	46.7	0.4	**0**	**47.1**	54.4	0.6	**55**	35.9	**35.9**	81.5	0.6	**82.1**	197.2	1.3	24.8	**223.3**	**444.7**	**3.1**	**0**	**24.8**
Grantiella picta	Painted Honeyeater	V	V	Ecosystem	29	0.2	0	**29.2**	46.7	0.4	**0**	**47.1**	54.4	0.6	**55**	35.9	**35.9**	81.5	0.6	**82.1**	196.6	1.3	24.8	**222.7**	**444.1**	**3.1**	**0**	**24.8**
Mammals																												
Phascolarctos cinereus	Koala	V	V	Species/ Ecosystem	45.8	0.2	1.5	**47.5**	55.6	0.4	**0.4**	**56.4**	57.2	0.6	**57.8**	37.5	**37.5**	84	0.6	**84.6**	199.9	1.3	29.5	**230.7**	**480**	**3.1**	**1.9**	**29.5**
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Ecosystem	29	0.2	0	**29.2**	46.7	0.4	**0**	**47.1**	54.4	0.6	**55**	35.9	**35.9**	81.5	0.6	**82.1**	197.2	1.3	24.8	**223.3**	**444.7**	**3.1**	**0**	**24.8**
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	0	0	0	**0**	36.3	0.2	**0**	**36.5**	0	0	**0**	28.3	**28.3**	70.4	0.3	**70.7**	97.9	0.2	11.6	**109.7**	**232.9**	**0.7**	**0**	**11.6**
Pseudomys pilligaensis	Pilliga Mouse	V	V	Ecosystem	16.8	0.2	0	**17**	22	0.4	**0**	**22.4**	54.4	0.6	**55**	30.6	**30.6**	80.4	0.6	**81**	195.8	0.7	16.8	**213.3**	**400**	**2.5**	**0**	**16.8**

1 Conservation status under the BC Act (current as at October 2020). CE = Critically Endangered, V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered, E = Endangered; V = Vulnerable.

3 Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

The clearance would occur during Phases 1, 2 and 6 (Figure 12; Table 27). As described in Section 5.1, a number of measures have been adopted to avoid and minimise clearance. At a broad level, the Project has been designed to avoid or minimise impacts on biodiversity values through:

- the use of underground longwall mining methods, which significantly reduces vegetation and soil disturbance (and impacts on hydrological features) in comparison to open cut mining methods;
- the use of the substantial existing infrastructure at the existing approved and operating underground mine (such as the Pit Top Area), limiting the requirement to develop new infrastructure; and
- locating multiple surface infrastructure components within the same alignment.

NCOPL considers that it is not feasible to avoid all clearance impacts on Poplar Box Woodland EEC (PCT 244) because this woodland is relatively widespread and occurs across the proposed access tracks, post-drainage corridors and service corridors (Figure 12).

The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life. Mine rehabilitation would include species characteristic of the Poplar Box Woodland EEC and would aim to establish PCTs that would be cleared (Section 7).

Approximately 4.1 ha of Poplar Box Woodland EEC is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 12) (Table 27). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

The Project is unlikely to indirectly impact the Poplar Box Woodland EEC adjacent to the Development Footprint as potential indirect impacts (and edge effects) from environmental weeds, dust, erosion and sediment would be managed (Section 7). Potential indirect impacts from the Project on native vegetation and habitat are described in Section 6.2.

There is approximately 13.2 ha of Poplar Box Woodland EEC within the area subject to subsidence. Land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (outside of potential ponding areas and identified areas of low depth of cover where potential cracking impacts may occur) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

The Poplar Box Woodland has been identified as a facultative GDE and an assessment is provided in Section 6.2.22.

Mitigation measures for the Poplar Box Woodland EEC are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- erecting a livestock-proof fence around a 20 m buffer from the Poplar Box Woodland EEC within ML 1609, MLA 1 and MLA 2 (*Biodiversity Measure 9*);
- management of environmental weeds within ML 1609, MLA 1 and MLA 2 by qualified and experienced weed management contractors (*Biodiversity Measure 10*);

- management of animal pests within ML 1609, MLA 1 and MLA 2 by qualified and experienced animal pest management contractors (*Biodiversity Measure 11*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

In consideration of the *Matters of National Environmental Significance Significant Impact Guidelines 1.1.* (Department of the Environment [DotE], 2013), the Project would reduce the extent of the Poplar Box Woodland EEC (by approximately 3.8 ha) and result in some fragmentation. The Project is unlikely to:

- modify or destroy abiotic factors (such as water, nutrients or soil) necessary for an ecological community's survival;
- cause a substantial change in the species composition in the ecological community;
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community (e.g. assist invasive species to become established or kill or inhibit the growth of species in the ecological community through the use of fertilisers, herbicides or other chemicals or pollutants); or
- interfere with the recovery of the ecological community.

The Project's adverse impacts on the Poplar Box Woodland EEC are not likely to be significant (as defined by DotE, 2013) given the small size of the impact (approximately 7.9 ha) relative to the wider occurrence of the community (which is indicative of the wider occurrence of PCT 244 [Table 19]) and the mitigation measures. The impacts on the Poplar Box Woodland EEC (PCT 244) would be offset in accordance with the NSW Biodiversity Offsets Scheme and would result in the retirement of the required number and class of like-for-like biodiversity credits for the Poplar Box Woodland EEC (Section 10).

9.2.2 Coolabah Bertya

Background

Coolabah Bertya ranges from central Qld south into the North Western Plains of NSW. In Qld it is widely distributed within an area bounded by Emerald in the north and Charleville in the west, with an outlier near Charters Towers (DAWE, 2020c). In NSW, the species has a highly restricted geographic distribution (Scientific Committee, 2009). Its occurrence is scattered over a wide range, however, with an estimated extent of occurrence of approximately 50,000 km^2 in NSW (Copeland, as cited in Scientific Committee, 2009).

Coolabah Bertya is currently known from four scattered sites in NSW: one from private property near Coolabah in western NSW and two to the south of Narrabri on the North West Slopes, including the largest population in Jacks Creek State Forest. The fourth population has not been seen since 1982 and is possibly now extinct (DPIE, 2020e). The total known population of Coolabah Bertya has been estimated to include at least five million individuals (Austen, 1999; NPWS, 2002).

This species occurs in a range of habitats including stony mallee ridges and cypress pine forest on red soils (DPIE, 2020e) recorded as shallow and rocky or much deeper and well-drained (Scientific Committee, as cited in DAWE, 2020c). Associated species at Jacks Creek State Forest include *Eucalyptus chloroclada, Callitris glaucophylla* and *Eucalyptus fibrosa.*

It is thought that the pollen of Coolabah Bertya is probably dispersed by wind, but European honey-bees have been observed visiting the flowers (TSSC, 2016a). Austen (1999) notes that populations may need some form of disturbance to stimulate recruitment (e.g. fire or physical disturbance such as that associated with earthworks). Prolific regrowth of plants in the Jacks Creek State Forest population occurred after the adjacent fire-break was graded, suggesting that the species resprouts from the roots following disturbance (NPWS, 2002). The exact mechanism for seed dispersal is not known but it is thought that the seed is projected a short distance from the parent plant and may be dispersed through water flow (NPWS, 2002).

Most plants of Coolabah Bertya are believed to be killed by fire although wildfires may increase the rate of germination from the seed bank (Scientific Committee, 2009).

Assessment

Detailed surveys undertaken by AMBS (2020a) (Attachment B) subsequent to the EPBC Act referral found a population of Coolabah Bertya in a concentrated location in the north-west of the Project area. The Project would result in the direct clearance of approximately 6 ha of known habitat for the Coolabah Bertya, comprising an estimated 25,939 individuals (Figure 18) (Table 28). There is estimated to be in the order of 1.1 million individuals in the AMBS (2020a) (Attachment B) study area[16] and the size of the population would be much greater as the population extends into Jacks Creek State Forest (Figure 35). Jacks Creek State Forest has the largest population in NSW (estimated at >5 million plants) (NPWS, 2002).

The clearance would occur during Phases 3 and 6 (Figure 18) (Table 28), predominantly for gas drainage facilities, service boreholes and access tracks. The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life.

A propagation and translocation trial would be implemented for the Coolabah Bertya. This would involve collection of vegetative material from the local population (either above ground parts and/or soil seed bank) and use of that material to re-establish individual plants in rehabilitation areas.

No Coolabah Bertya occurs within the areas of potential ponding (WRM, 2020), ETL management area or area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 18). The Project is unlikely to indirectly impact the Coolabah Bertya adjacent to the Development Footprint as potential indirect impacts (and edge effects) from environmental weeds, dust, erosion and sediment would be managed (Section 7). Potential indirect impacts from the Project on native vegetation and habitat are described in Section 6.2.

There is approximately 357 ha of known habitat for the Coolabah Bertya within the area subject to subsidence (Figure 18). Land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (outside of potential ponding areas and identified areas of potential cracking impacts [Figure 6]) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

[16] Based on a density of 4,330 plants per ha over 261 ha (AMBS, 2020a) (Attachment B).

Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*); and
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*).
- vegetative material from the local population of Coolabah Bertya (either above-ground parts and/or soil seed bank) would be re-used for the Coolabah Bertya propagation and translocation trial (*Biodiversity Measures 3 and 4*);
- management of environmental weeds within ML 1609, MLA 1 and MLA 2 by qualified and experienced weed management contractors (*Biodiversity Measure 10*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

Based on the information available in the EPBC Act Referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project is likely to have a significant impact on the Coolabah Bertya. The Project may lead to a long-term decrease in the size of an important population of a species (albeit overall a small decrease relative to loss of approximately 2.3% of the species' habitat mapped on Figure 18). The residual impacts on this species would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10). Impacts on this species have also been assessed in Section 8.1.2.

9.2.3 Spiny Peppercress

Background

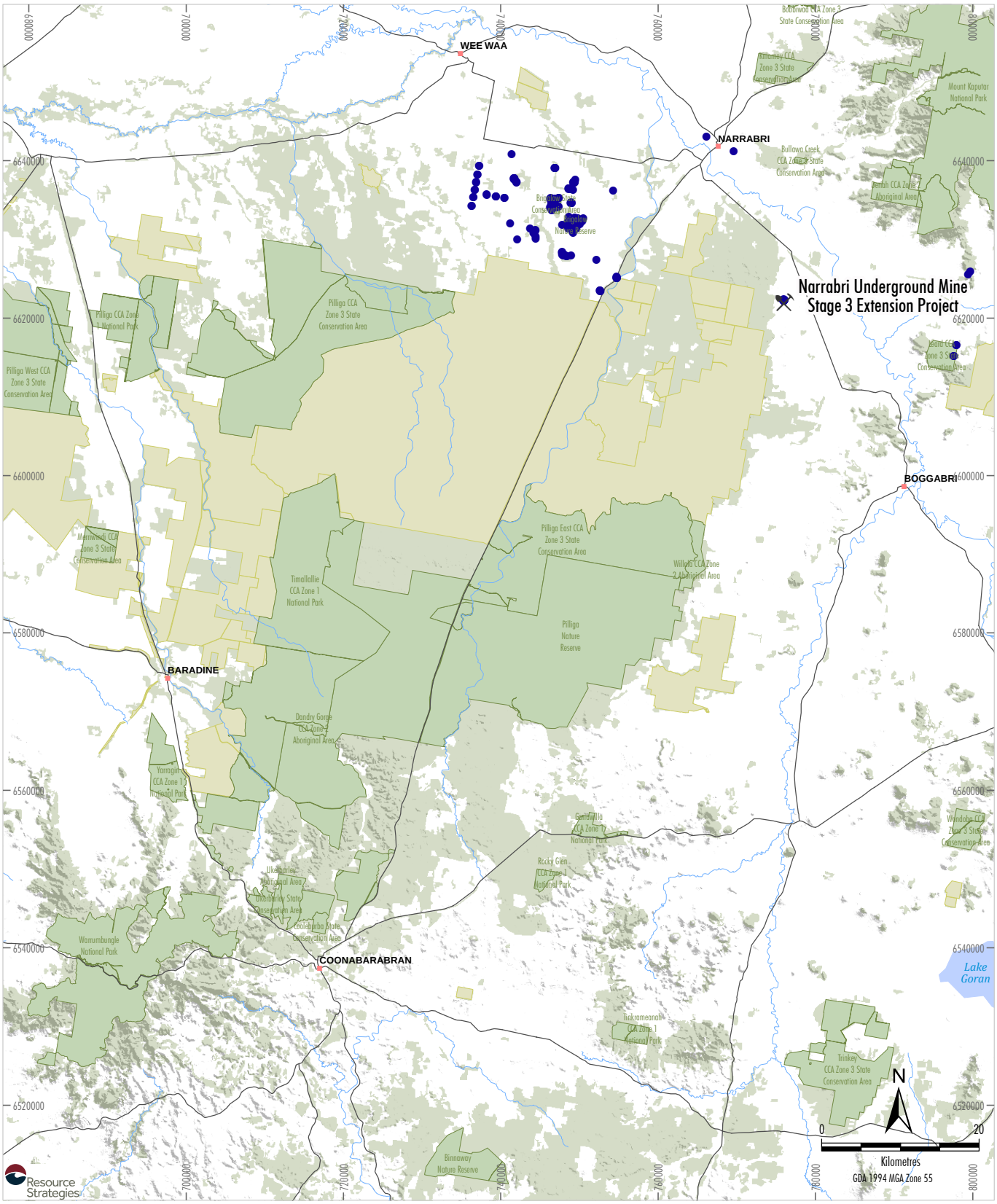
Spiny Peppercress is not widespread, occurring in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south-western plains). Its two main known occurrences are from West Wyalong in the south of NSW and around Narrabri (DPIE, 2020e).

Approximately 50% of the total Spiny Peppercress recorded for Australia occurs in NSW. In the north of the State recent surveys have recorded a number of new sites including Brigalow Nature Reserve, Brigalow State Conservation Area, Leard State Conservation Area and Bobbiwaa State Conservation Area. Recorded population sizes vary from 18 to 5000+ plants (DPIE, 2020e).

One population in Brigalow Park Nature Reserve near Narrabri contains 'many thousands' of individuals (M. White DSE pers. comm. in Carter, 2010) (Figure 36).

Spiny Peppercress is found on ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), Belah (*Casuarina cristata*), Buloke (*Allocasuarina luehmannii*) and Grey Box (*Eucalyptus microcarpa*). In the south it has been recorded growing in Bull Mallee (*Eucalyptus behriana*). Often the understorey is dominated by introduced plants and the species grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense, with sparse grassy understorey and occasional heavy litter (DPIE, 2020e).

Plants in the Narrabri population have been observed producing abundant seed, and as the species is believed to be short-lived and large numbers of plants were present at the site, Spiny Peppercress appears to be successfully reproducing (DPIE, 2020e).



LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Spiny Peppercress

Source: Geoscience Australia - Topograhic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Spiny Peppercress Landscape Distribution

Figure 36

Populations have been known to immediately disappear following inundation by flooding, reappearing several seasons later. An apparent increase in numbers during drought conditions has also been observed. The species is reported to be salt tolerant and also grows well under dry conditions. Plant numbers decrease with increasing overstorey density, and plants were not found where the Brigalow canopy cover exceeded about 60%. Spiny Peppercress is often described as a "weed" where it dominates paddocks (DPIE, 2020e).

Assessment

The Project would result in the direct clearance of approximately 44.7 ha of potential habitat for the Spiny Peppercress, comprising one location of known individuals (Figure 19) (Table 28).

NCOPL considers that it is not feasible to avoid the known individual Spiny Peppercress recorded by ELA (Figure 19) because it is located in an area planned for a service borehole with power reticulation. The location of the service borehole with power reticulation is required to be along the service corridor and above the underground roadway, as described above. The known individual Spiny Peppercress is located in an agricultural grazing property.

The clearance of potential habitat would occur during all phases of the Development Footprint (Figure 19) (Table 28). The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life.

Approximately 0.7 ha of potential habitat for the Spiny Peppercress is within areas of potential ponding (identified by WRM, 2020) (Figure 19) (Table 28). Altered hydrology is a recognised threat to this species (after Carter, 2010) and this area has been assumed as a long-term loss of potential habitat in the offset calculations (assumed irreversible). The Project is unlikely to indirectly impact the Spiny Peppercress (were individuals to occur adjacent to the Development Footprint) as potential indirect impacts (and edge effects) from environmental weeds, dust, erosion and sediment would be managed (Section 7). Potential indirect impacts from the Project on native vegetation and habitat are described in Section 6.2.

Approximately 13.4 ha of potential habitat for the Spiny Peppercress is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 19) (Table 28). The area of potential cracking impacts on trees may not have a material impact on this species (because the species has not been recorded in the area of potential cracking impacts on trees [Figure 19] and may persist even if it were present), however, an offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

There is approximately 232 ha of potential habitat for the Spiny Peppercress within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d). This herb has also been recorded in a number of locations within the ML 1609, to the north of the Project area (Figure 14) showing the species persisting after longwall subsidence has occurred.

There is no approved conservation advice for this species (DAWE, 2020c). Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- management of environmental weeds within ML 1609, MLA 1 and MLA 2 by qualified and experienced weed management contractors (*Biodiversity Measure 10*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

The Project may have a significant impact on this species (in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* [DotE, 2013]) as it would result in the removal of the known individuals inside the MLAs (potentially an important population defined by DotE [2013] noting that the species has also been recorded elsewhere locally [Figure 19]). The residual impacts on this species would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

9.2.4 Tylophora linearis

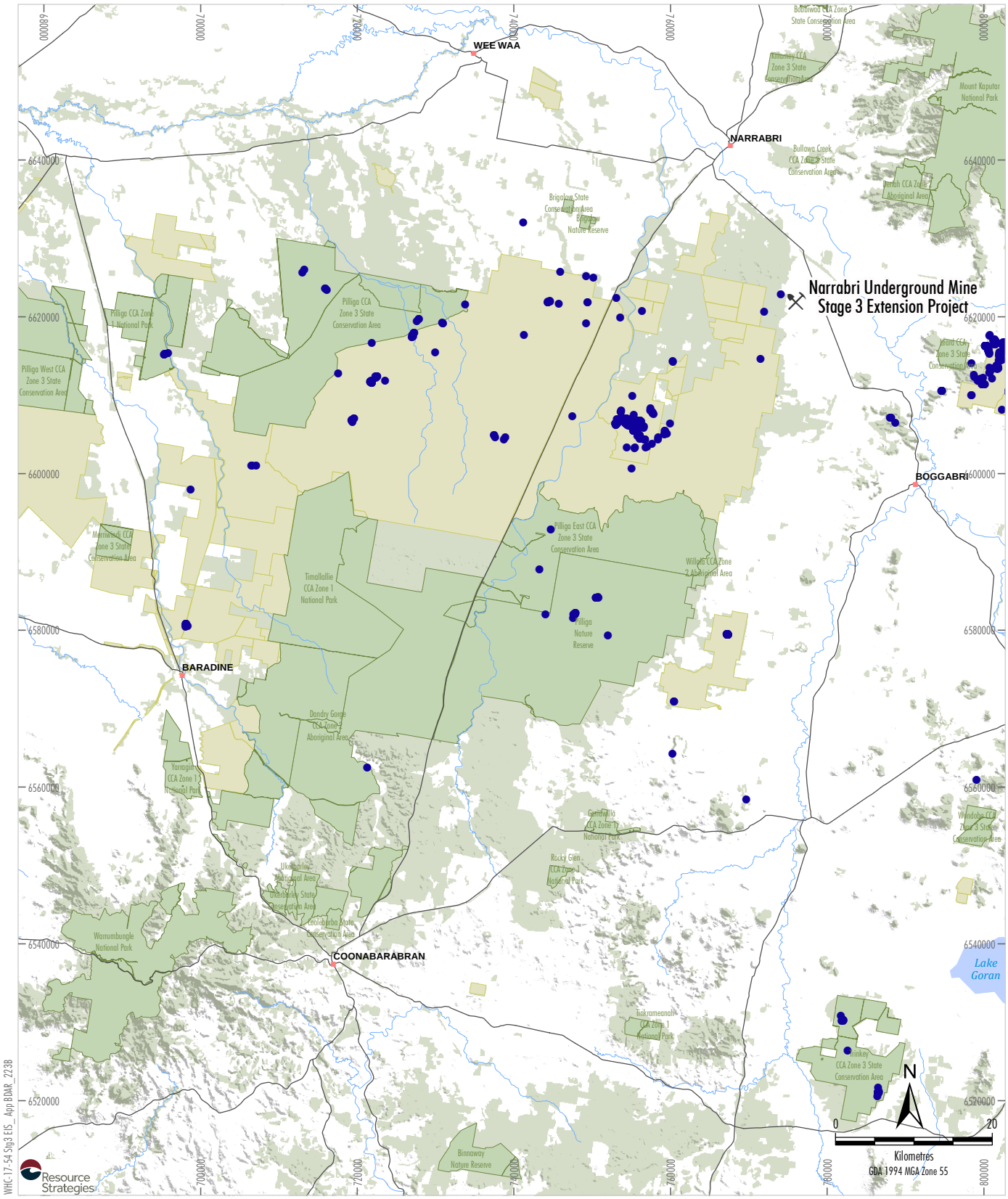
Background

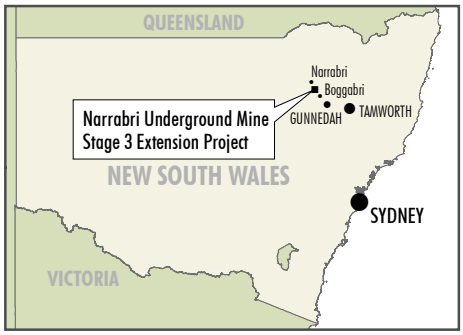
Tylophora linearis occurs from southern Qld into central NSW as far south as Temora. This species has been recorded in numerous NSW Reserves (Nature Reserves, National Parks and Other Conservation Areas), namely Beni State Conservation Area, Boonalla Aboriginal Area, Breelong National Park, Bullala National Park, Coolbaggie Nature Reserve, Goobang National Park, Goonoo National Park, Goonoo State Conservation Area, Leard State Conservation Area, Pilliga National Park, Pilliga State Conservation Area, Pilliga East State Conservation Area, Pilliga Nature Reserve, Trinkey State Conservation Area (DPIE, 2020e). Is has also been recorded in numerous NSW State Forests, namely Baradine, Bibblewindi, Breeza, Cumbil, Daffeys Creek, Doona, Euligal, Kerringle, Leard, Pilliga East, Pilliga West State Forests (DPIE, 2020e) (Figure 37).

Tylophora linearis grows in dense shrublands occasionally overtopped by *Callitris glaucophylla* and various species of *Eucalyptus*. *Melaleuca uncinata* appears to be the most common shrub in the habitat of the *Tylophora linearis* populations around Dubbo. Most populations occur on the western slopes of NSW with some possibly occurring in flatter terrain on the western plains. Altitudes are generally in the range of 300-400 m above sea level. Variation in flowering is uncertain, but suspected to be partly related to rainfall (Scientific Committee, 2008). *Tylophora linearis* apparently has the ability to survive fires as it has been observed resprouting from the lower stems within 12 months of a moderately intense wildfire (Forster *et al*., as cited in Scientific Committee, 2008).

Assessment

The Project would result in the progressive clearance (over a 23-year period) of approximately 427.9 ha of known and potential habitat for the *Tylophora linearis* (Figure 20) (Table 28). *Tylophora linearis* is present in low numbers through the woodland and given the cryptic nature of the species it is not feasible to locate and avoid individual records (noting that this species is an 'area' species for the purpose of the BAM and individual plants are not required to be quantified).





LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- *Tylophora linearis*

Source: Geoscience Australia - Topographic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Tylophora linearis Landscape Distribution

Figure 37

The clearance would occur during all phases of the Development Footprint (Figure 20) (Table 28). The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life.

Approximately 2.7 ha of known and potential habitat for *Tylophora linearis* is within areas of potential ponding (identified by WRM, 2020). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Approximately 13.8 ha of known and potential habitat for *Tylophora linearis* is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 20) (Table 28). The area of potential cracking impacts on trees may not have a material impact on this species (because the species has not been recorded in the location [Figure 20] and may persist in the event of cracking even if it were present), however, an offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

The Project is unlikely to indirectly impact *Tylophora linearis* adjacent to the Development Footprint as potential indirect impacts (and edge effects) from environmental weeds, dust, erosion and sediment would be managed (Section 7). Potential indirect impacts from the Project on native vegetation and habitat are described in Section 6.2.

There is approximately 3,042 ha of known and potential habitat for *Tylophora linearis* within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (in areas of habitat for this species) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- management of environmental weeds within ML 1609, MLA 1 and MLA 2 by qualified and experienced weed management contractors (*Biodiversity Measure 10*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

Based on the information available in the EPBC Act Referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project is likely to have a significant impact on *Tylophora linearis*. The Project is not considered likely to have a significant impact on this species given that this species would persist within the Subject land and is known to occur in a number of locations throughout NSW, including 13 NSW conservation reserves and 11 NSW State Forests (ALA, 2019; DPIE, 2020a). The residual impacts on this species would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

9.2.5 Superb Parrot

Background

The core range of the Superb Parrot is west of the Great Dividing Range in NSW from Canberra, Goulburn and as far west as Nyngan and Swan Hill. In NSW, the species mostly occurs west of the Great Divide, where it mainly inhabits the Riverina, the South-west Slope and Tableland Regions: west to Mathoura, Booroorban, Goolgowi, and east to Canberra, Yass and Cowra. Its range extends north to around Narrabri and Wee Waa in the North-west Plain Region, from a line joining Coonabarabran and Narrabri, and extending at least as far west as Tottenham and Quambone, with occasional records even further west (Baker-Gabb, 2011; TSSC, 2016b; DAWE, 2020c).

There are two main Superb Parrot populations in NSW, although they are likely to be interconnected (OEH, 2018c). On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. Within these breeding areas, Superb Parrots breed in either River Red Gum forests and woodlands or box woodlands. Figure 38 shows the distribution of the Superb Parrot in the landscape surrounding the Subject land.

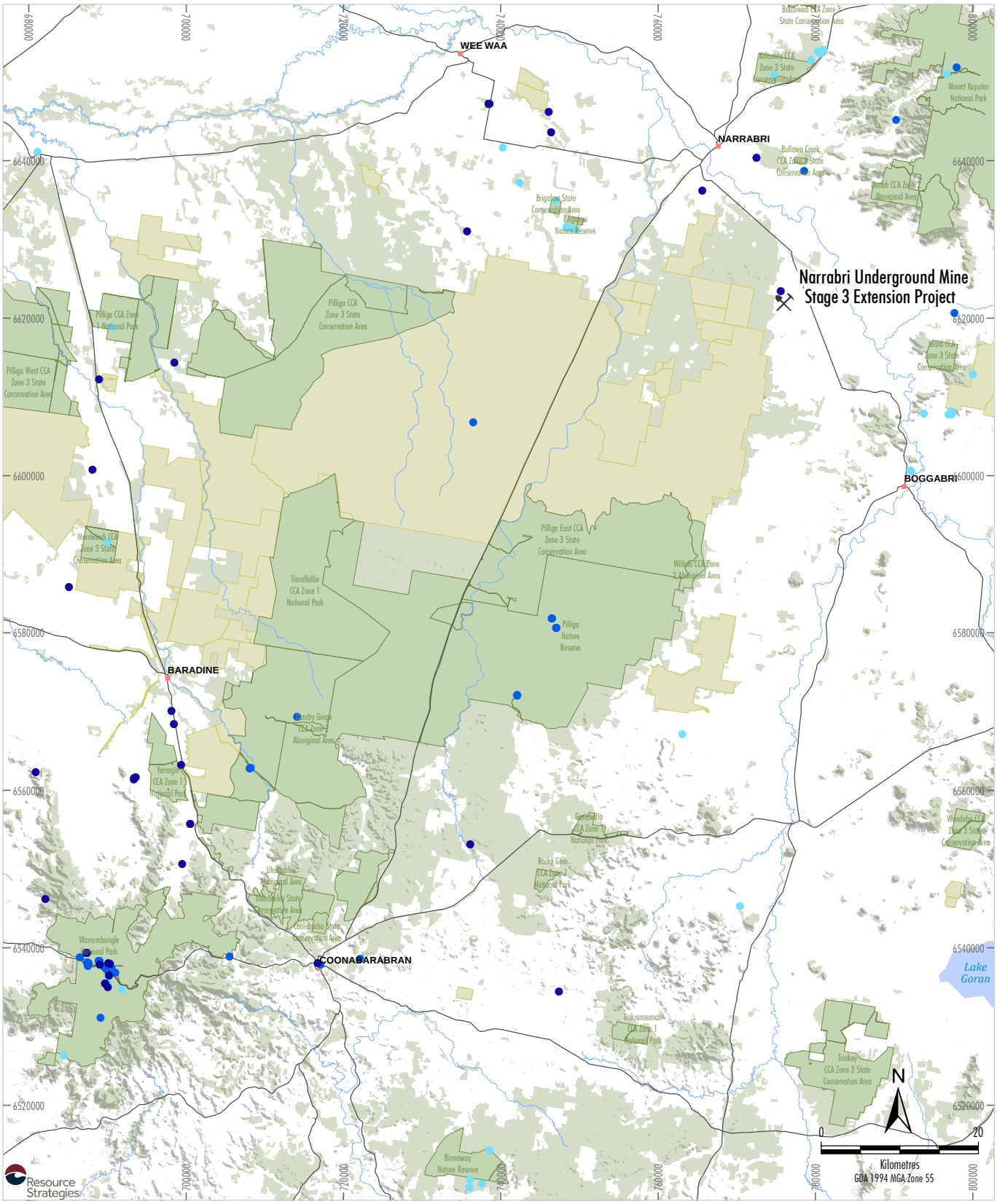
Outside the breeding season, some Superb Parrots forage in scattered Boree woodlands or box-pine woodlands between the Murrumbidgee and Murray Rivers (Webster, as cited in DAWE, 2020c).

The Superb Parrot forages mainly on the ground, often eating the seeds of plants such as the native Ringed Wallaby-grass (*Danthonia caespitosa*), barley-grasses (*Critesion*), as well as cereal crops including wheat, oats, canola (*Brassica napus*) and split grain (Christie; Webster; Webster and Ahern, as cited in DAWE, 2020c). They also eat the seed-pods of many understorey species of wattles such as Gold-dust Wattle (*Acacia acinacea*), Silver Wattle (*A. dealbata*) and Deane's Wattle (*A. deanei*) and cultivated Cootamundra Wattle (*A. baileyana*) (Christie; Webster; Webster, as cited in DAWE, 2020c). When foraging in the forest canopy, Superb Parrots eat the flowers, fruits and lerps of eucalypts and the berries of mistletoe, such as Box Mistletoe (*Amyema miquelii*) and Grey Mistletoe (*A. quandang*) (Webster, as cited in DAWE, 2020c).

The Superb Parrot has been considered nomadic (Sharrock, as cited in DAWE, 2020c), resident (Schrader, as cited in DAWE, 2020c), dispersive (Webster; Webster and Ahern, as cited in DAWE, 2020c), migratory (Schrader, as cited in DAWE, 2020c) or partly migratory (Higgins, as cited in DAWE, 2020c). Most birds undertake regular seasonal movements between breeding and non-breeding areas, although some birds remain in the breeding range throughout the year (Blakers *et al.*; Webster, as cited in DAWE, 2020c). Movements have been attributed to changes in food supply between the breeding and non-breeding seasons. In central NSW, movements are said to occur when eucalypts flower, and when food becomes scarce due to drought and birds seek alternative sources of food (Higgins, as cited in DAWE, 2020c). When making local foraging movements, birds usually move along wooded corridors, seldom crossing extensive open areas (Webster; Webster and Ahern, as cited in DAWE, 2020c).

Assessment

As described above, the Superb Parrot has not been recorded in the Subject land surrounding the Project. The Project would result in the progressive clearance (over a 23-year period) of approximately 243.9 ha of native vegetation that may provide potential foraging habitat that may be occasionally used by the Superb Parrot (Figure 39) (Table 28). No breeding habitat would be cleared as the species does not breed in the locality.



LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Superb Parrot
- Regent Honeyeater
- Painted Honeyeater

Source: Geoscience Australia - Topograhic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Superb Parrot, Regent Honeyeater and Painted Honeyeater Landscape Distribution

Figure 38

As described in Section 5.1, a number of measures have been adopted to avoid and minimise clearance. Impact avoidance measures relevant to the potential habitat for the Superb Parrot are:

- targeting disturbance to cleared land and derived native grasslands (areas of lower vegetation integrity) in preference to woodland; and
- a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.

The clearance would occur during all phases of the Development Footprint (Figure 39) (Table 28). The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life. For this reason, no adverse impacts on the Superb Parrot are likely to occur in the long-term.

Approximately 3.5 ha of potential foraging habitat that may be occasionally used by the Superb Parrot is within areas of potential ponding (identified by WRM, 2020). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Trees that could provide potential foraging habitat that may be occasionally used by the Superb Parrot would be removed either side of the ETL, so the offset calculations have included the loss of trees in approximately 12.9 ha due to this activity (Figure 39) (Table 28). The maintenance activities along the ETL would conclude once the ETL is no longer operational.

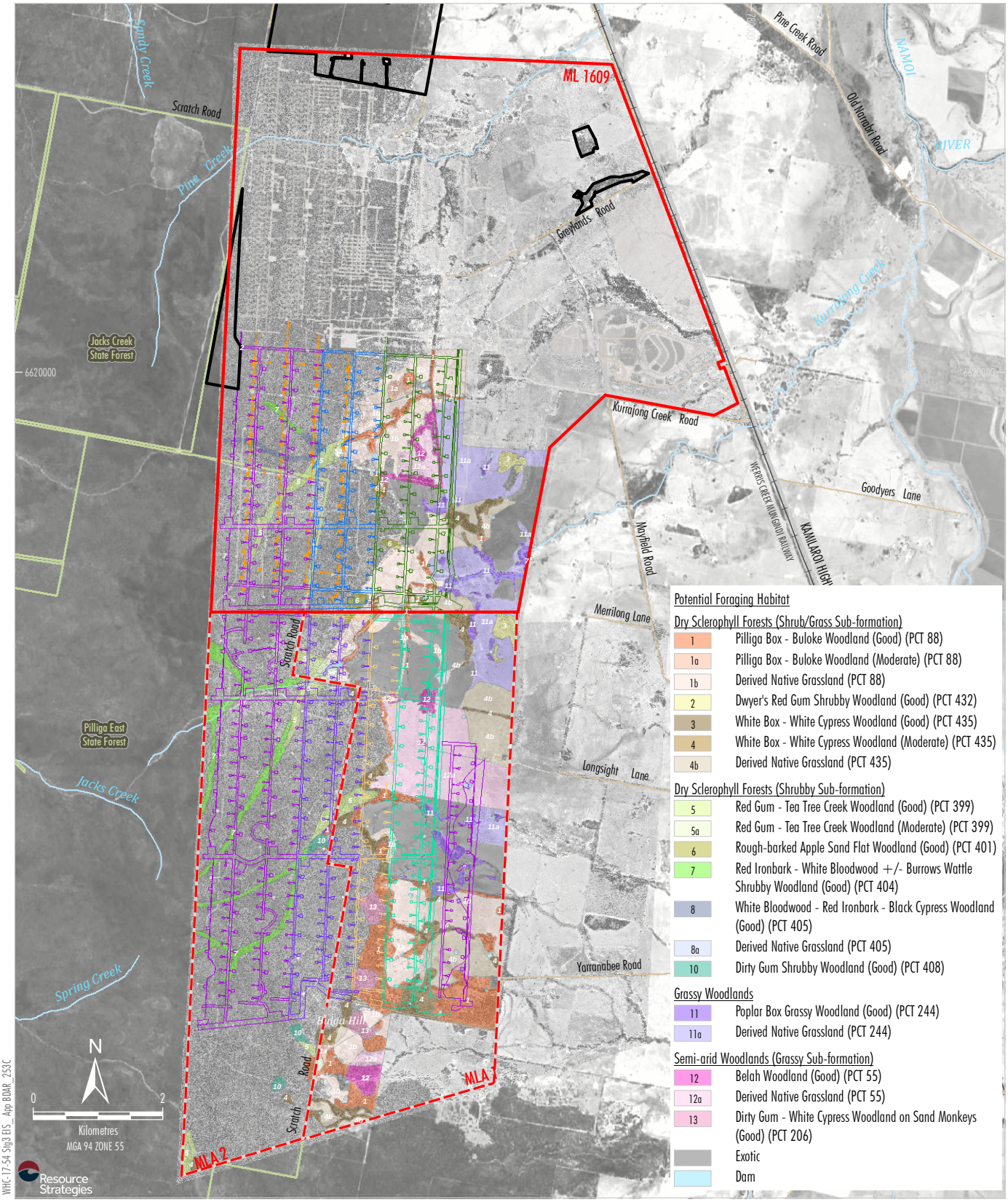
Approximately 52.7 ha of potential foraging habitat that may be occasionally used by the Superb Parrot is located in the area of low depth of cover where potential cracking impacts on trees may occur (Ditton Geotechnical Services, 2020) (Figure 39) (Table 28). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

There is approximately 1,392 ha of potential foraging habitat that may be occasionally used by the Superb Parrot within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (outside of potential ponding areas and identified areas of potential cracking impacts [Figure 6]) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

The loss of potential foraging habitat (prior to rehabilitation) is likely to be of little consequence to the Superb Parrot given that this species has not been recorded in the Subject land (despite targeted surveys), is a vagrant in the locality and the occurrence of similar potential habitat in the surrounding landscape.

As described earlier, based on the information available in the EPBC Act referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project may have a significant impact on the Superb Parrot. However, the species is unlikely to be adversely or significantly impacted given the Superb Parrot has not been recorded in the Development Footprint, and no breeding habitat for this species is present (as it breeds elsewhere in NSW).

This species is classified as an 'Ecosystem Credit Species' in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The ecosystem credit generated by the Project would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Superb Parrot Potential Habitat

Figure 39

9.2.6 Regent Honeyeater

Background

The Regent Honeyeater has a patchy distribution which extends from south-east Qld, through NSW and the Australian Capital Territory, to central Victoria (DAWE, 2020c). Records are widely distributed across its range, but it is only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded (DotE, 2015a). There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region (DPIE, 2020e).

The species range and numbers have contracted greatly since about the 1940s. It previously ranged from near Rockhampton in Qld, to Wilmington in South Australia. It was last recorded in South Australia in 1977 and is now probably extinct in that state. There were reports of 'immense' numbers and 'very large flocks' in the early 20th century, but flocks of more than 30 birds are now uncommon (Higgins *et al*., as cited in DotE, 2015a).

The global extent of occurrence of the Regent Honeyeater was estimated as 300,000 km^2 in 2000, with a high level of confidence, with about 70% of its distribution falling in NSW (Garnett and Crowley, as cited in Scientific Committee, 2010). In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands (DPIE, 2020e). It is estimated that the NSW population of Regent Honeyeaters may now be fewer than 250 mature individuals. Minor and sporadic breeding occurs in other areas such as Warrumbungle National Park, Pilliga forests, Mudgee-Wollar region, and the Hunter and Clarence Valleys (Scientific Committee, 2010). Figure 38 shows the distribution of the Regent Honeyeater in the landscape surrounding the Subject land.

Since 2000, only very small numbers (fewer than 10 birds) of Regent Honeyeaters have been reported for each of the minor Regent Honeyeater sites in NSW, apart from the lower Hunter and Central Coast, where tens of birds are still sometimes reported (Scientific Committee, 2010). Populations of this species at particular locations fluctuate greatly between years and sites, according to seasonal conditions (Garnett and Crowley, as cited in Scientific Committee, 2010).

The Regent Honeyeater inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak (*Casuarina* spp.) where it feeds on needle-leaved mistletoe and sometimes breeds (Franklin *et al.*; Higgins *et al.*; Oliver *et al.*; Webster and Menkhorst, as cited in DotE, 2015a). It sometimes utilises lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought (Menkhorst *et al.*, as cited in DotE, 2015a). It also uses a range of other habitats including remnant patches in farmland and urban areas, roadside reserves and travelling stock routes (Franklin *et al.*; Higgins *et al.*; Oliver and Lollback, as cited in DotE, 2015a).

Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests. In the last ten years Regent Honeyeaters have been recorded in urban areas around Albury where woodland tree species such as Mugga Ironbark and Yellow Box were planted 20 years (DPIE, 2020e).

Principally a canopy bird, the Regent Honeyeater is reliant on select species of eucalypt and mistletoe which provide rich nectar flows (DAWE, 2020c). Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important, for example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events. Flowering of associated species such as Thin-leaved Stringybark *Eucalyptus eugenioides* and other Stringybark species, and Broad-leaved Ironbark *E. fibrosa* can also contribute important nectar flows at times. Nectar and fruit from the mistletoes *Amyema miquelii*, *A. pendula* and *A. cambagei* are also utilised. When nectar is scarce lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings (DPIE, 2020e).

Regent Honeyeater nests are usually placed in the canopy of mature trees with rough bark. A cup-shaped nest is constructed in which two to three eggs are laid. Nests may be near or far from food resources; one nest has been recorded 700 m from a resource tree (Geering and French, as cited in DotE, 2015a).

The Regent Honeyeater's movement through the landscape is governed by the flowering of select eucalypt species. It is nomadic and partly migratory, with some predictable seasonal movements observed (DAWE, 2020c). Colour-banding of the Regent Honeyeater has shown that the species can undertake large-scale nomadic movements in the order of hundreds of kilometres, with some species sighted at known breeding areas dispersing more than 530 km (Geering; Geering, as cited in Scientific Committee, 2010).

Breeding varies between regions, and corresponds with flowering of key eucalypt and mistletoe species. Although breeding may occur at the same site between seasons, some pairs change breeding sites between seasons (DAWE, 2020c). Breeding territories usually consist of the nest-tree and surrounding feeding areas, and may extend 5 m to 40 m or more from the nest-tree. Most pairs nest solitarily, but sometimes nest in loose congregations where distances between nests can range from 40 m to 110 m depending on location and habitat (Higgins *et al.*, as cited in DotE, 2015a).

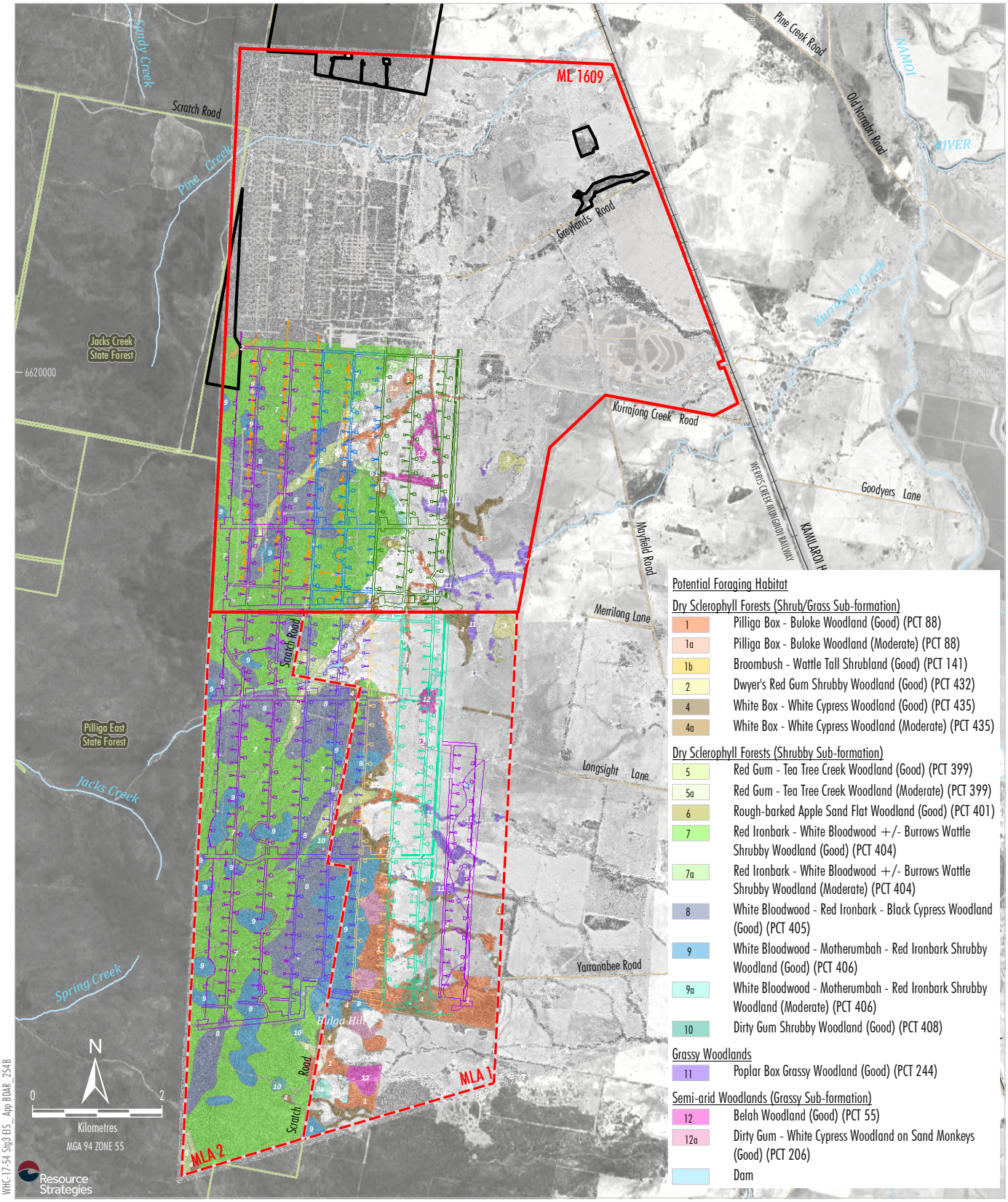
Assessment

As described above, the Regent Honeyeater has not been recorded in the Subject land surrounding the Project. The Project would result in the progressive clearance (over a 23-year period) of approximately 444.7 ha of native vegetation that may provide potential foraging habitat that may be occasionally used by the Regent Honeyeater (Figure 40) (Table 28). No breeding habitat would be cleared as the species does not breed in the locality.

Habitat critical to the survival of the Regent Honeyeater is defined by the *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (DotE, 2016) as:

- *any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map); and*
- *any newly discovered breeding or foraging locations.*

The Pilliga forest is recognised as a subsidiary breeding site for the Regent Honeyeater (DotE, 2016) and, therefore, meets the definition of 'habitat critical to the survival' of the Regent Honeyeater. However, there is no evidence that the species uses the potential habitat in the Project area for either foraging or breeding.



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Regent Honeyeater Potential Habitat

Figure 40

The clearance would occur during all phases of the Development Footprint (Figure 40) (Table 28). The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life. For this reason, no adverse impacts on the Regent Honeyeater are likely to occur in the long-term.

Approximately 3.1 ha of potential foraging habitat that may be occasionally used by the Regent Honeyeater is within areas of potential ponding (identified by WRM, 2020). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Approximately 24.8 ha of potential foraging habitat that may be occasionally used by the Regent Honeyeater is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 40) (Table 28). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

There is approximately 3,156 ha of potential foraging habitat that may be occasionally used by the Regent Honeyeater within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (in areas of habitat for this species) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

The loss of potential foraging habitat (prior to rehabilitation) is likely to be of little consequence to the Regent Honeyeater given that this species has not been recorded in the Subject land (despite targeted surveys), is a vagrant in the locality and the occurrence of similar potential habitat in the surrounding landscape.

Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*); and
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*).

As described earlier, based on the information available in the EPBC Act referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project may have a significant impact on the Regent Honeyeater. However, the Regent Honeyeater is unlikely to be adversely or significantly impacted given that the Regent Honeyeater has not been recorded in the Development Footprint, no breeding habitat for this species is present (as it breeds elsewhere in NSW).

This species is classified as an 'Ecosystem Credit Species' in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The ecosystem credit generated by the Project would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

9.2.7 Painted Honeyeater

Background

The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Qld. During the winter it is more likely to be found in the north of its distribution (DPIE, 2020e).

The greatest concentrations and almost all records of breeding come from south of 26 degrees south, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Qld (Higgins *et al*., as cited in DotE, 2015b). The species often occurs singly or in pairs, and less often in small flocks (DotE, 2015b). Figure 38 shows the distribution of the Painted Honeyeater in the landscape surrounding the Subject land.

The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands that contain a higher number of mature trees, as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips (Garnett *et al*., as cited in DotE, 2015b), although it breeds in quite narrow roadside strips if ample mistletoe fruit is available (BirdLife International, as cited in DotE, 2015b).

The Painted Honeyeater is the most specialised of Australia's honeyeaters. Its diet mainly consists of mistletoe fruits, but also includes nectar (from flowering mistletoe, eucalypts and possibly banksias) and arthropods, especially in the non-breeding season (Garnett *et al*.; Higgins *et al*.; BirdLife International, as cited in DotE, 2015b). Arthropods are an important dietary item provided to nestlings (Barea, as cited in DotE, 2015b) and for adults during the breeding season (Barea and Herrera, as cited in DotE, 2015b).

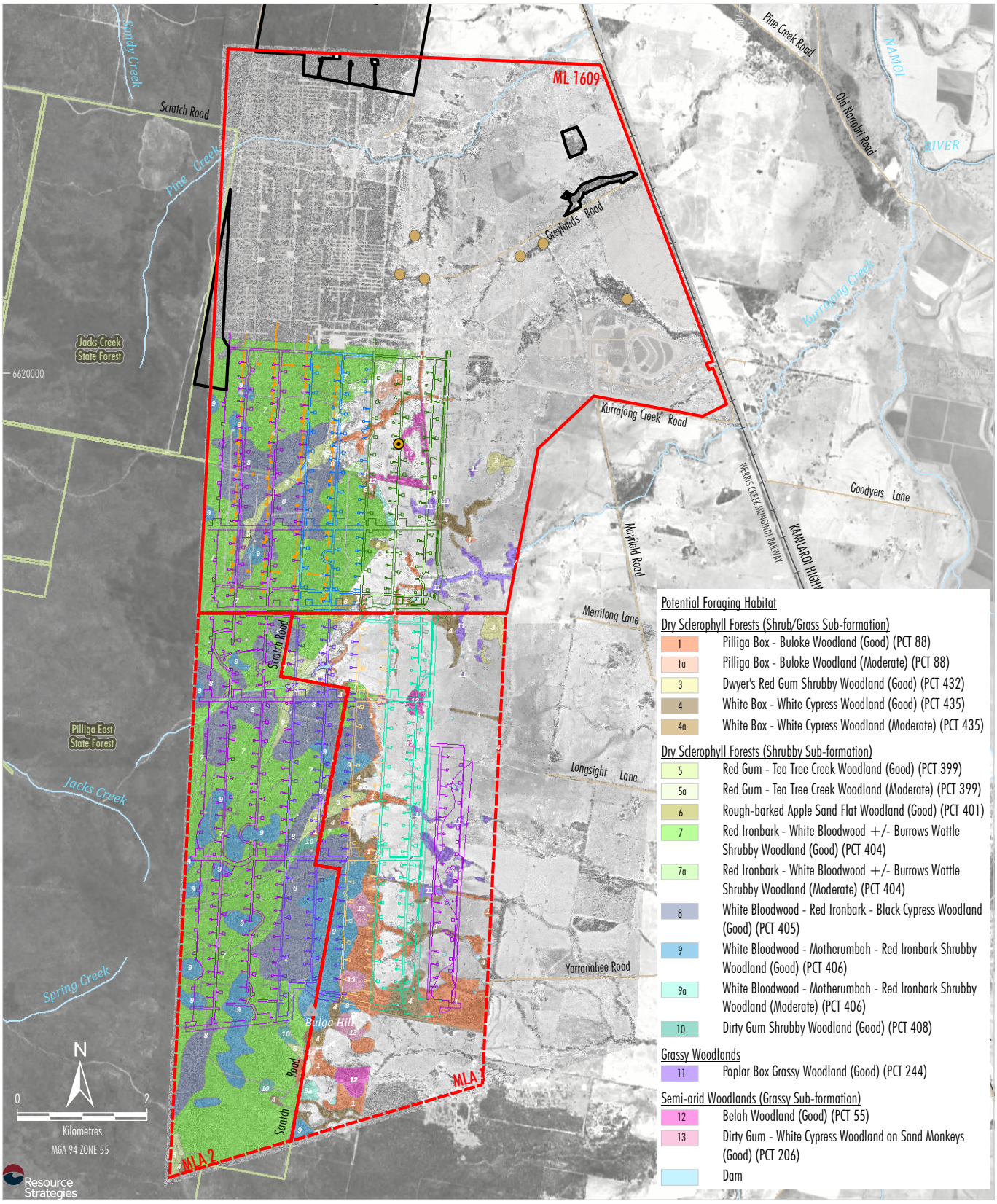
The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with which its breeding season is closely matched (Barea and Watson, as cited in DotE, 2015b). Many birds move after breeding to semi-arid regions such as north-eastern South Australia, central and western Qld, and central Northern Territory. Considering its dispersive habits, the species is considered to have a single population (Garnett *et al*., as cited in DotE, 2015b).

Assessment

The Painted Honeyeater was recorded in the Subject land surrounding the Project. The Project would result in the progressive clearance (over a 23-year period) of approximately 444.1 ha of native vegetation that may provide potential foraging habitat that may be occasionally used by the Painted Honeyeater (Figure 41) (Table 28). No breeding habitat would be cleared as the species does not breed in the locality.

As described in Section 5.1, a number of measures have been adopted to avoid and minimise clearance. Impact avoidance measures relevant to the potential habitat for the Painted Honeyeater are:

- targeting disturbance to cleared land and derived native grasslands (areas of lower vegetation integrity) in preference to woodland; and
- a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.



WHC-17-54 Stg3 EIS_App BDAR_255D

LEGEND
- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint
- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

Painted Honeyeater

Source:
Survey - AMBS (2020b)
Monitoring - ELA Monitoring Data (2012 to 2018)

Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Painted Honeyeater Habitat

Figure 41

The clearance would occur during all phases of the Development Footprint (Figure 41) (Table 28). The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life. For this reason, no adverse impacts on the Painted Honeyeater are likely to occur in the long-term.

Approximately 3.1 ha of potential foraging habitat that may be occasionally used by the Painted Honeyeater is within areas of potential ponding (identified by WRM, 2020). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Approximately 24.8 ha of potential foraging habitat that may be occasionally used by the Painted Honeyeater is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 41) (Table 28). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

There is approximately 3,151 ha of potential foraging habitat that may be occasionally used by the Painted Honeyeater within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (in areas of habitat for this species) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

The loss of potential foraging habitat (prior to rehabilitation) is likely to be of little consequence to the Painted Honeyeater given that this species has not been recorded in the Subject land (despite targeted surveys), is a vagrant in the locality and the occurrence of similar potential habitat in the surrounding landscape.

This species is classified as an 'Ecosystem Credit Species' in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The ecosystem credit generated by the Project would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

9.2.8 Koala (combined populations of Qld, NSW and the ACT)

Background

The Koala has a fragmented distribution throughout eastern Australia from north-east Qld to the Eyre Peninsula in South Australia. In NSW, populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains and southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range (DPIE, 2020e).

The distribution of the Koala and its habitat are influenced by altitude (generally limited to <800 m above sea level), temperature and, at the western and northern ends of the range, leaf moisture (Munks *et al*., as cited in DAWE, 2020c). In the semi-arid regions in the western and northern parts of the species' range, Koala distribution and abundance are strongly influenced by the availability of water in soils from which food trees draw water. Given that average annual rainfall is considerably higher towards the coast, the density of the Koala population is generally greater there than inland (DAWE, 2020c).

In NSW, west of the Great Dividing Range, Koalas occur in the Pilliga East State Forest and in the Gunnedah area with smaller groups elsewhere (DECC, 2008a). In areas of the Pilliga, where Koalas were once abundant in the 1990s, they are now rare or absent and there has been little sign of recovery (Parnaby, 2010 pers. comm.). State-wide surveys of Koala distribution indicate that the number of Koalas in the Gunnedah area is regionally significant (Crowther *et al.*, as cited in DAWE, 2020c) and has expanded against the state trend due to revegetation aimed at addressing soil salinity problems (DAWE, 2020c) (Figure 42), noting that the Gunnedah population is likely to be different to the Pilliga population. It is noted, however, that following the 2019-2020 bushfires in NSW and the general trend of population decline, the current estimated number of koalas in New South Wales is outdated and unreliable (New South Wales Legislative Council, 2020).

Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by *Eucalyptus* species (Martin and Handasyde, as cited in DAWE, 2020c). Koala habitat can be broadly defined as any forest or woodland containing species that are known Koala food trees, or shrubland with emergent food trees. Preferred food and shelter trees are naturally abundant on fertile clay soils (DAWE, 2020c).

The species feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, such as *Corymbia, Angophora, Lophostemon, Leptospermum* and *Melaleuca* (DAWE, 2020c), but in any one area will select preferred browse species (DPIE, 2020e).

The Koala is not territorial and the home ranges of individuals extensively overlap (Ellis *et al.*, as cited in DAWE, 2020c). Individuals tend to use the same set of trees, but generally not at the same time. Home ranges are variable depending on the location, with those in poorer habitats being larger than in higher quality habitats (DAWE, 2020c), ranging from less than 2 ha to several hundred hectares in size (DPIE, 2020e). On average, male Koalas usually have larger home ranges than females (DAWE, 2020c).

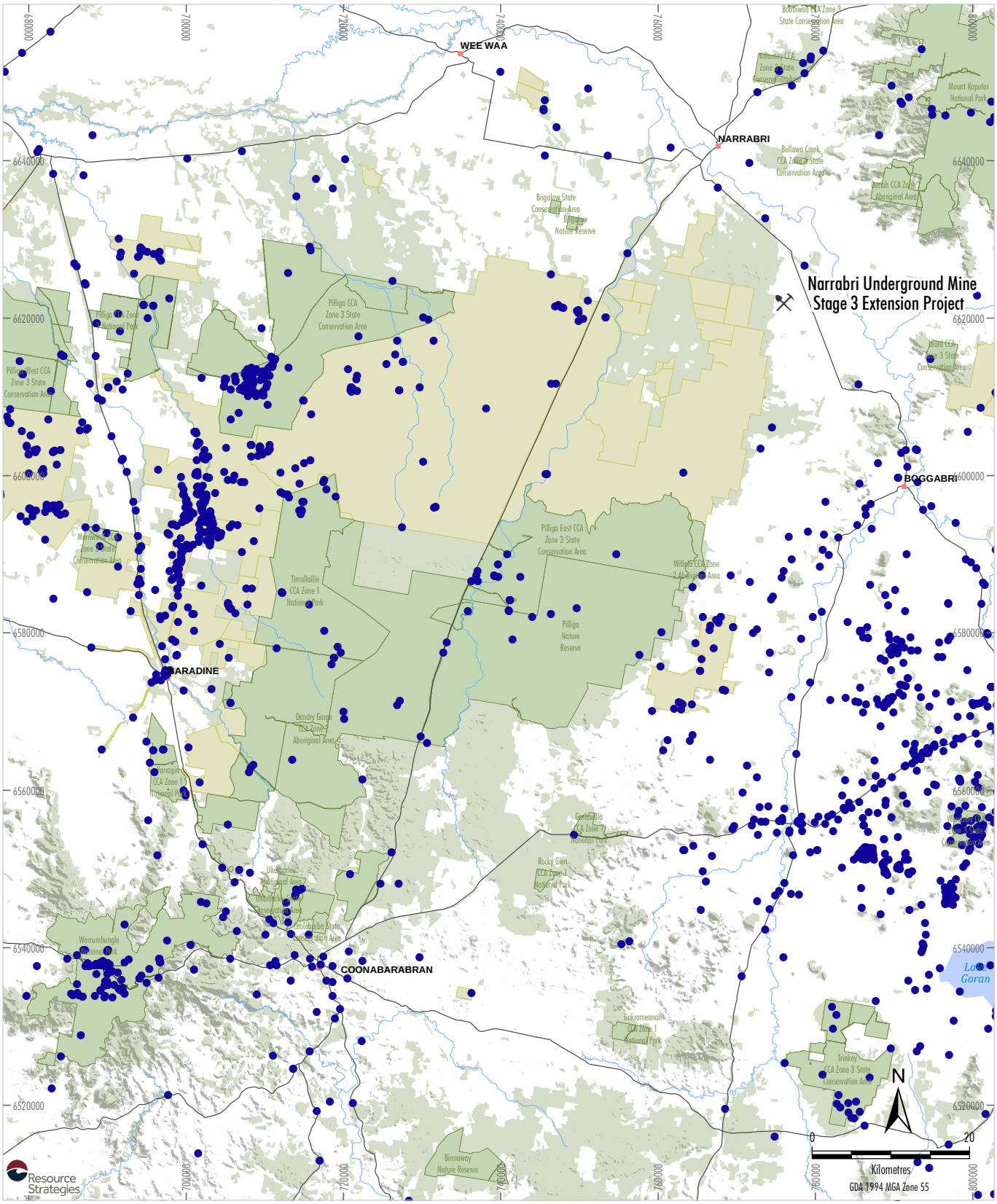
Koalas tend to move little under most conditions, changing trees only a few times each day. There is little evidence for longer movements in most cases (Ellis *et al.*, as cited in DAWE, 2020c), though dispersing individuals, mostly young males, may occasionally cover distances of several kilometres over land with little vegetation (DAWE, 2020c).

Assessment

The Koala has not been recorded in the Subject land surrounding the Project; however, evidence was recorded during surveys (i.e. scats). The Project would result in the progressive clearance of approximately 480 ha of known habitat for the Koala over a 23-year period, likely used for foraging and potentially breeding (Figure 23) (Table 28).

As described in Section 5.1, a number of measures have been adopted to avoid and minimise clearance. Impact avoidance measures relevant to the potential habitat for the Koala are:

- targeting disturbance to cleared land and derived native grasslands (areas of lower vegetation integrity) in preference to woodland; and
- a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.



LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Koala

Source: Geoscience Australia - Topograhic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Koala Landscape Distribution

Figure 42

The clearance would occur during all phases of the Development Footprint (Figure 23) (Table 28). During operations, potential habitat would be fragmented for linear surface infrastructure (e.g. access tracks) and gas drainage bore holes, however after operations, the potential habitat would be re-connected due to rehabilitation/natural regeneration. For this reason, no adverse impacts on the Koala are likely to occur in the long-term.

Approximately 3.1 ha of known habitat for the Koala is within areas of potential ponding (identified by WRM, 2020) (Figure 23) (Table 28). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Trees that could provide known habitat for the Koala would be removed either side of the ETL, so the offset calculations have included the loss of trees in approximately 1.9 ha due to this activity (Figure 23) (Table 28). The maintenance activities along the ETL would conclude once the ETL is no longer operational.

Approximately 29.5 ha of known habitat for the Koala is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 23) (Table 28). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

There is approximately 3,368 ha of known habitat for the Koala within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (in areas of habitat for this species) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- management of animal pests within ML 1609, MLA 1 and MLA 2 by qualified and experienced animal pest management contractors (*Biodiversity Measure 11*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

As described earlier, based on the information available in the EPBC Act referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project is likely to have a significant impact on the Koala. The habitat meets the definition of habitat critical to the survival of the Koala (DotE, 2014).

This species is classified as a 'Species Credit Species' in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The impacts on the known habitat for the Koala would be offset in accordance with the NSW Biodiversity Offsets Scheme and would result in the retirement of the required number and class of like-for-like biodiversity credits for the Koala (Section 8.3).

9.2.9 Corben's Long-eared Bat

Background

The Corben's Long-eared Bat is found in southern Qld, central western NSW, north-western Victoria and eastern South Australia, where it is patchily distributed, with most of its range in the Murray Darling Basin (Duncan *et al.*; Turbill and Ellis, as cited in TSSC, 2015). Most records are from the inland of the Great Dividing Range (Parnaby, as cited in TSSC, 2015). The species is uncommon within this distribution and is rarely recorded, except in some areas including the Nandewar and Brigalow Belt South bioregions in NSW and Qld. The Corben's Long-eared Bat occurs in a number of national parks and nature reserves across its range, including Hattah-Kulkyne and Murray Sunset National Parks in Victoria, Danggali Conservation Park in South Australia and the Goulburn River, Monabalai, Yathong, Budigower, Woggon, Mungo, Cocoparra, Ben Halls Gap, Pilliga, Gooban, Warrumbungle and the Rocks National Parks in NSW (DAWE, 2020c).

Approximately 30% of the total distribution of the species occurs in Qld, although there are records from fewer than 30 localities, mainly from within the Brigalow Belt South bioregion (Reardon, as cited in TSSC, 2015). There are very few records for the species in Victoria, which are from widely scattered locations in the Northern Plains and the Mallee regions (Lumsden; Schulz and Lumsden, as cited in TSSC, 2015). In South Australia the species occurs in the far east of the state, with records north of the Murray River, east of Canegrass Station and south of the Barrier Highway, but the northern range limit is unclear (Duncan *et al.*, as cited in TSSC, 2015). The species occurs primarily within the Riverland Biosphere Reserve, including Danggali Conservation Park and the Birds Australia Gluepot Reserve (DAWE, 2020c).

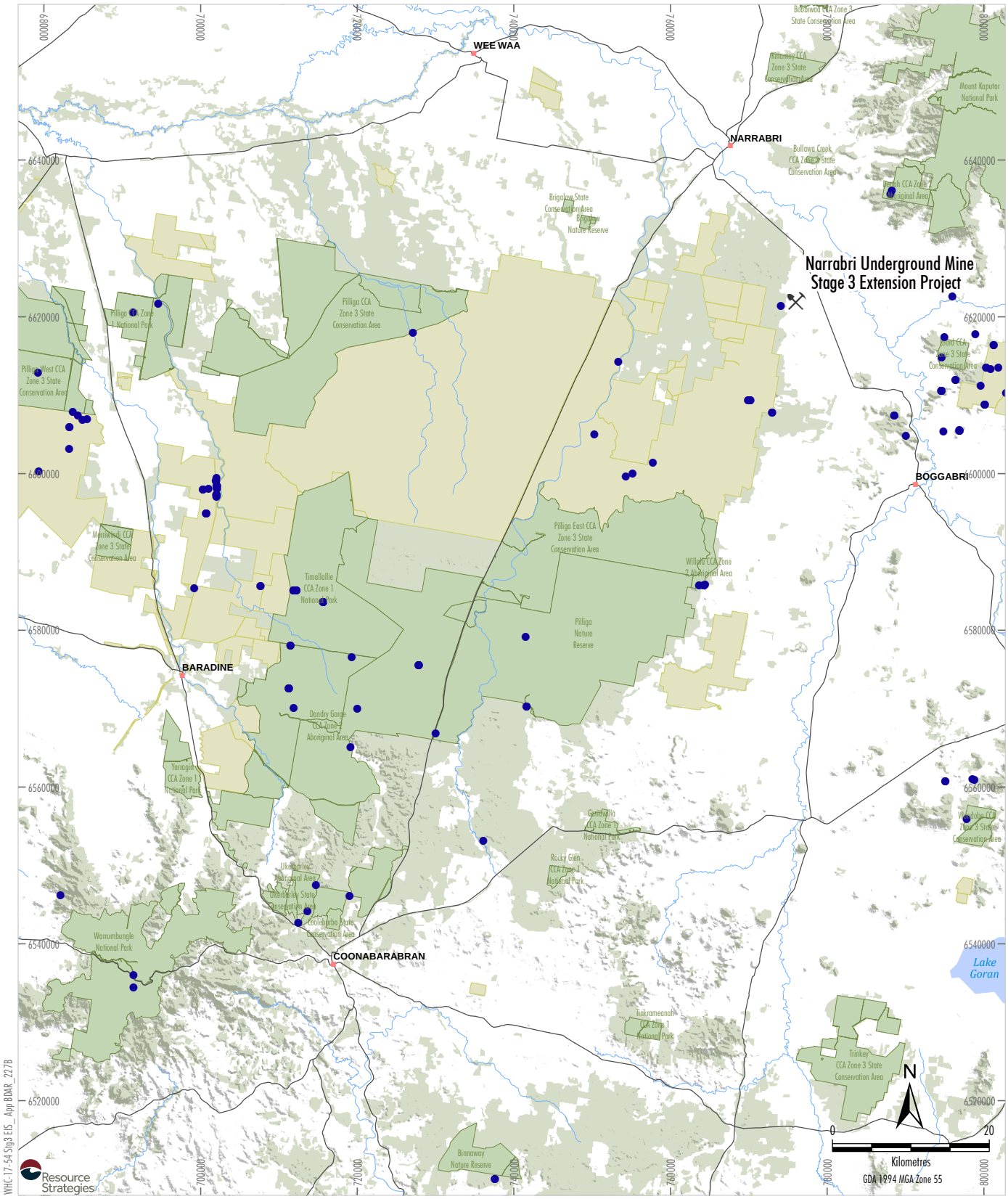
There is little information currently available regarding population numbers and structure for the Corben's Long-eared Bat. Currently all population information is based on trapping results and no detailed demographic studies have been conducted (Schulz and Lumsden, as cited in TSSC, 2015).

The Corben's Long-eared Bat occurs throughout much of inland NSW with at least 50% of the species' known distribution occurring in this state (Parnaby *et al.*, as cited in TSSC, 2015). The Pilliga Scrub region is known to be a distinct stronghold for this species (DPIE, 2020e) (Figure 43).

This species is found in a wide range of inland woodland vegetation types. These include box/ironbark/cypress pine woodlands, Buloke woodlands, Brigalow woodland, Belah woodland, smooth-barked apple woodland, river red gum forest, black box woodland and various types of tree mallee (Duncan *et al.*; Schulz and Lumsden; Woinarski *et al.*, as cited in TSSC, 2015). The Corben's Long-eared Bat has been found to be much more abundant in habitats that have a distinct tree canopy and a dense, cluttered understorey layer (Turbill and Ellis, as cited in TSSC, 2015).

In NSW this species inhabits a variety of vegetation types including mallee, Buloke (*Allocasuarina luehmannii*) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW (DPIE, 2020e).

The Corben's Long-eared Bat roosts in tree hollows, crevices and under loose bark. It is a slow- flying agile bat, utilising the understorey to hunt non-flying prey, especially caterpillars and beetles, and will even hunt on the ground (DPIE, 2020e).



LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Corben's Long-eared Bat

Source: Geoscience Australia - Topograhic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Corben's Long-eared Bat
Landscape Distribution

Figure 43

The Corben's Long-eared Bat is more abundant in extensive stands of vegetation in comparison to smaller woodland patches (Turbill and Ellis, as cited in TSSC, 2015), suggesting its home range is probably large (Lumsden *et al.*, as cited in TSSC, 2015).

Studies have found that the Corben's Long-eared Bat roosts solitarily, mainly in dead trees or dead spouts of live trees. It appears that most roost sites are used just for a single day and large distances are travelled at night, with consecutive roost sites generally within 4 km (Lumsden *et al.*, as cited in TSSC, 2015).

Assessment

Corben's Long-eared Bat was recorded during in the Subject land surrounding the Project. The Project would result in the progressive clearance (over a 23-year period) of approximately 444.7 ha of known habitat for the Corben's Long-eared Bat, likely used for foraging and breeding (Figure 44) (Table 28).

As described in Section 5.1, a number of measures have been adopted to avoid and minimise clearance. Impact avoidance measures relevant to the potential habitat for the Corben's Long-eared Bat are:

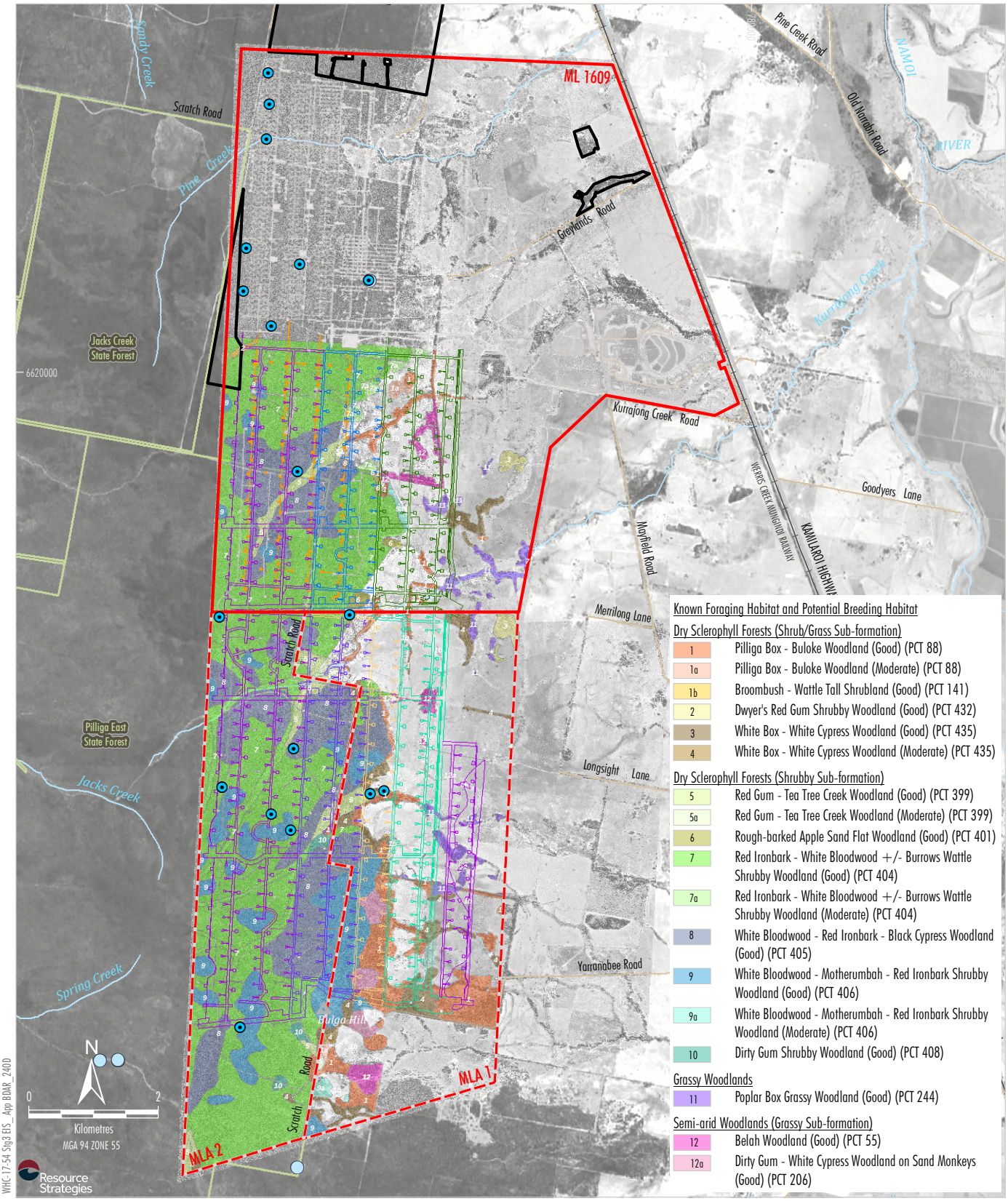
- targeting disturbance to cleared land and derived native grasslands (areas of lower vegetation integrity) in preference to woodland; and
- a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.

The clearance would occur during all phases of the Development Footprint (Figure 44) (Table 28). The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life. For this reason, no adverse impacts on the Corben's Long-eared Bat are likely to occur in the long-term.

Approximately 3.1 ha of known habitat for the Corben's Long-eared Bat is within areas of potential ponding (identified by WRM, 2020) (Figure 44) (Table 28). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Approximately 24.8 ha of known habitat for the Corben's Long-eared Bat is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 44) (Table 28). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

There is approximately 3,156 ha of known habitat for the Corben's Long-eared Bat within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (in areas of habitat for this species) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

Corben's Long-eared Bat

Sources:
Survey - AMBS (2019b); AMBS (2020b); Ecotone (2009); ELA (2019b)
Database - ALA (2019); DPIE (2019)

Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBs (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Corben's Long-eared Bat Habitat

Figure 44

Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- implementation of a nest box programme for the Corben's Long-eared Bat (*Biodiversity Measure 4*);
- management of animal pests within ML 1609, MLA 1 and MLA 2 by qualified and experienced animal pest management contractors (*Biodiversity Measure 11*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

As described earlier, based on the information available in the EPBC Act referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project is likely to have a significant impact on the Corben's Long-eared Bat.

This species is classified as an 'Ecosystem Credit Species' in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The impacts on the native vegetation that provides habitat for the Corben's Long-eared Bat would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

9.2.10 Large-eared Pied Bat

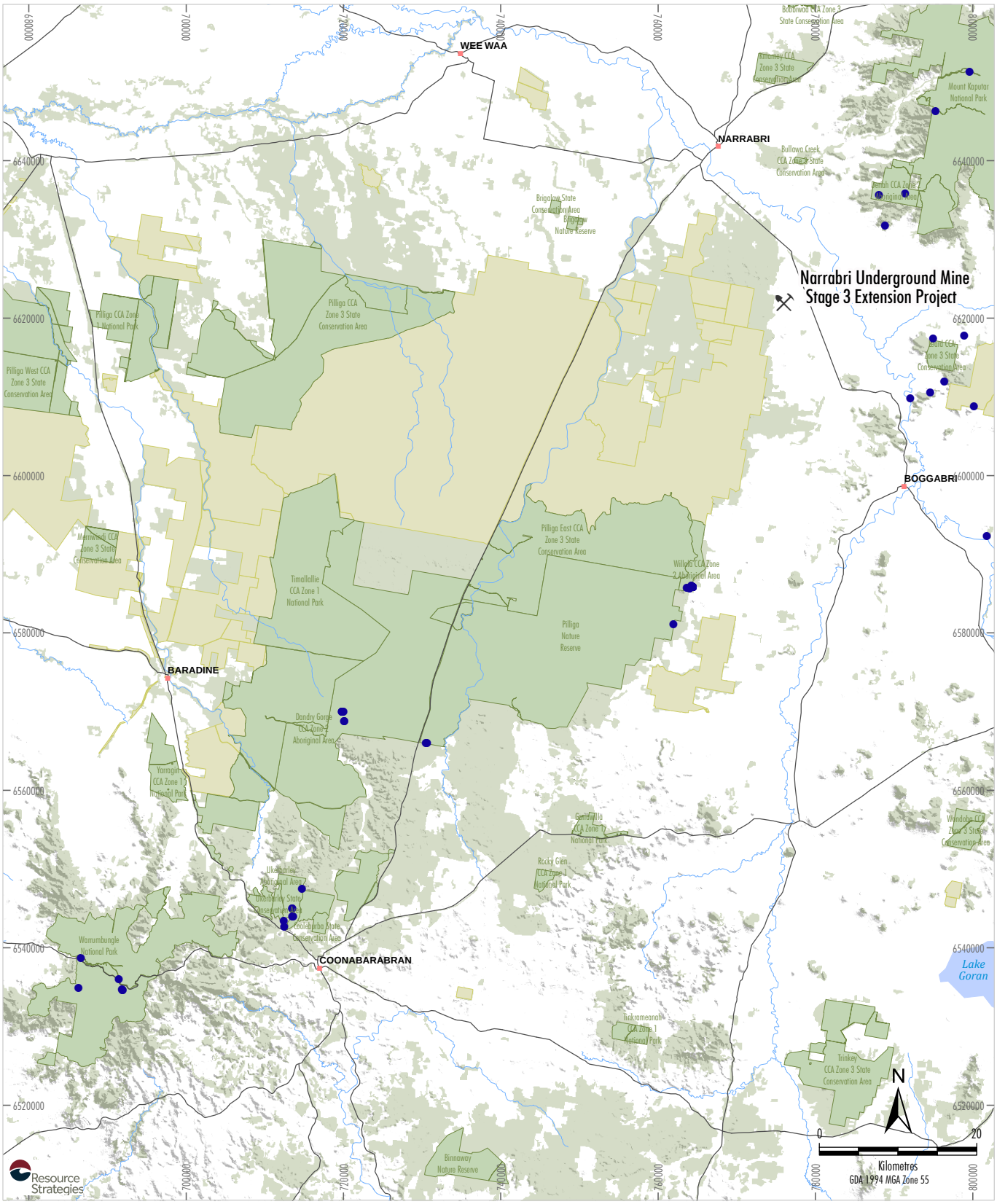
Background

The Large-eared Pied Bat is known from Shoalwater Bay, north of Rockhampton, Qld, south to the vicinity of Ulladulla in NSW. Further records are known in Qld from sandstone escarpments in the Carnarvon and Expedition Ranges and Blackdown Tablelands. It is likely that these areas support a high proportion of the Qld populations of this bat, although estimates of the number of individuals present and their distribution in these areas has not been established. Additional records exist in the Scenic Rim near the NSW/Qld border (Department of Environment and Resource Management [DERM], 2011).

Much of the known distribution of the species is within NSW. Available records suggest that the largest concentrations of populations appear to be in the sandstone escarpments of the Sydney basin and the north-west slopes (Coolah Tops, Mt Kaputar, Warrumbungle National Park and Pilliga Nature Reserve). Although the Large-eared Pied Bat is widely distributed, it is uncommon and patchy within this area (DAWE, 2020c) (Figure 45).

In NSW, four maternity roost sites have been recorded (Hoye, 2005), however, one was permanently flooded in 1976 and one was abandoned in 2009 (TSSC, 2012a). Lactating and pregnant females have been captured adjacent to sandstone escarpments near Ulan, NSW (Fly By Night Bat Surveys, 2004) and adjacent to rhyolite cliffs near Lismore (Parnaby, as cited in DAWE, 2020c). Breeding females have also recently been recorded in sandstone caves near Coonabarabran, NSW (Pennay, as cited in DAWE, 2020c). Almost all species records have been found within several kilometres of rock outcrops or rocky terrain (Hoye, 2005).

In NSW the Large-eared Pied Bat has been recorded from a large range of vegetation types including: dry and wet sclerophyll forest; Cyprus Pine (*Callitris glauca*) dominated forest; tall open eucalypt forest with a rainforest sub-canopy; sub-alpine woodland; and sandstone outcrop country (Duncan *et al.*, as cited in DAWE, 2020c).



LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Large-eared Pied Bat

Source: Geoscience Australia - Topographic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Large-eared Pied Bat
Landscape Distribution

Figure 45

Sandstone cliffs and fertile woodland valley habitat within close proximity of each other is habitat of importance to the Large-eared Pied Bat (DECC, 2007). The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box-gum woodlands or river/rainforest corridors which are used for foraging (TSSC, 2012a). Roosting has been observed in disused mine shafts, caves, overhangs and disused Fairy Martin (*Hirundo ariel*) nests (Hoye and Dwyer; Schulz, as cited in DAWE, 2020c). It also possibly roosts in the hollows of trees (Duncan *et al.*, as cited in DAWE, 2020c).

Roosts are utilised during the day and also at night when not feeding, as well as for the raising of young (Schulz, as cited in DERM, 2011). The structure of primary nursery roosts appears to be very specific, i.e. arch caves with dome roofs (that need to be deep enough to allow juvenile bats to learn to fly safely inside) and with indentations in the roof (presumably to allow the capture of heat). These physical characteristics are not very common in the landscape and are, therefore, a limiting factor (DAWE, 2020c).

The relatively short, broad wings of this bat suggest that it manoeuvres easily and forages below the canopy, particularly for insects at night around roost sites for a distance of up to several kilometres (Hoye, 2005). Modelling based on presence-only data indicates that the Large-eared Pied Bat forages in fertile valleys and plains, as well as areas with moderately tall to taller trees along watercourses. The majority of records are from canopied habitat, suggesting a sensitivity to clearing, although narrow connecting riparian strips in otherwise cleared habitat are sometimes quite heavily used (DECC, 2007).

The Large-eared Pied Bat has been recorded congregating in groups of up to 50 breeding females at maternity roosts (Dwyer, as cited in DAWE, 2020c). Individuals disperse from the maternity roosts around April and these roosts are largely unused until the following September. The distance bats move from the maternity roost to wintering roosts has not been established, but is likely to be less than 100 km (Hoye pers. comm., as cited in DAWE, 2020c). Bats remain loyal to the same cave over many years (DPIE, 2020e).

Assessment

The Large-eared Pied Bat was recorded in the Subject land surrounding the Project. The Project would result in the progressive clearance (over a 23-year period) of approximately 232.9 ha of potential foraging habitat for the Large-eared Pied Bat within 2 km of two rocky outcrops with bat habitat (Figure 26) (Table 28), as well as subsidence of a rocky outcrop with bat habitat.

As described in Section 5.1, a number of measures have been adopted to avoid and minimise clearance. Impact avoidance measures relevant to the habitat for the Large-eared Pied Bat are:

- avoidance of impacts on Bulga Hill;
- targeting disturbance to cleared land and derived native grasslands (areas of lower vegetation integrity) in preference to woodland; and
- a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.

The clearance would occur during Phases 2, 4, 5 and 6 of the Development Footprint (Figure 26) (Table 28). The clearance areas would be progressively rehabilitated and revegetated when the surface facilities are no longer required or at the end of the mine life.

There is approximately 1,659 ha of known habitat for the Large-eared Pied Bat within the area subject to subsidence. One rocky outcrop with bat habitat would be subsided by the Project, which is used by the Large-eared Pied Bat (Figure 26). Impacts from subsidence would include cracking (i.e. not complete removal). No known breeding habitat (maternity sites) have been recorded at this rocky outcrop, despite targeted surveys by AMBS (2020b) (Attachment C).

Approximately 0.7 ha of known habitat for the Large-eared Pied Bat is within areas of potential ponding (identified by WRM, 2020) (Figure 26) (Table 28). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Approximately 11.6 ha of known habitat for the Large-eared Pied Bat is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 26) (Table 28). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential foraging habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (in areas of habitat for this species) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- management of animal pests within ML 1609, MLA 1 and MLA 2 by qualified and experienced animal pest management contractors (*Biodiversity Measure 11*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

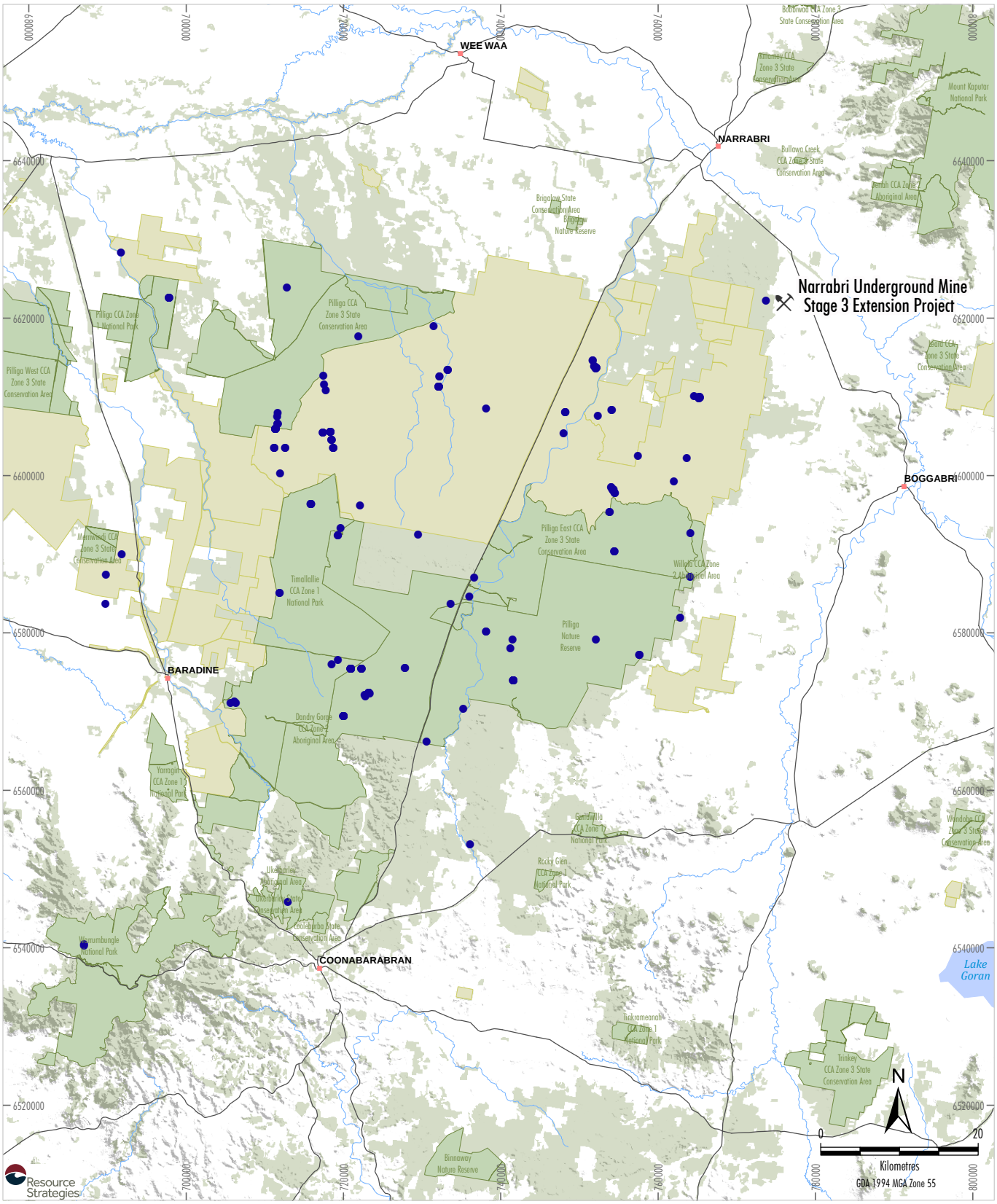
As described earlier, based on the information available in the EPBC Act referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project may have a significant impact on the Large-eared Pied Bat.

This species is classified as a 'Species Credit Species' in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The impacts on the known habitat for the Large-eared Pied Bat would be offset in accordance with the NSW Biodiversity Offsets Scheme and would result in the retirement of the required number and class of like-for-like biodiversity credits for the Large-eared Pied Bat (Section 8.3).

9.2.11 Pilliga Mouse

Background

The Pilliga Mouse is known only from the type locality in Pilliga, NSW, and three other nearby sites all in the immediate surrounding area (Fox and Briscoe, as cited in DAWE, 2020c). This includes the Pilliga Nature Reserve and the adjacent Pilliga East State Forest (Lee, as cited in DAWE, 2020c) (Figure 46). This area is known as the Pilliga Scrub (Tokushima *et al.*, as cited in DAWE, 2020c). A Pilliga Mouse was reportedly trapped in the Warrumbungles after a major wildfire in January 2013, suggesting a sparse local population may have previously existed that could now respond to early stages of post-fire succession (DPIE, 2020e).



LEGEND

- NSW Protected Area (NP&W Act)
- State Forest (Forestry Act)
- Major Roads
- Pilliga Mouse

Source: Geoscience Australia - Topograhic Data (2011); DPIE (2019)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Pilliga Mouse
Landscape Distribution

Figure 46

The species is sparsely distributed within its restricted range, although population fluctuations have been recorded. The population size of the Pilliga Mouse is hard to estimate and demographics are irruptive (DAWE, 2020c), and intensive trapping over many years has produced very few individuals (Strahan, as cited in DEWHA, 2008a). Paull and Milledge (as cited in DAWE, 2020c) mapped potential suitable habitat of the species and, based on density calculations, estimate a population of 50,000-100,000 during irruptive periods (i.e. La Niña events).

Within the Pilliga region the Pilliga Mouse is largely restricted to low-nutrient deep sand soils which are recognised as supporting a distinctive vegetation type referred to as the Pilliga Scrub (DPIE, 2020e). Individuals have been captured in different vegetation within the Pilliga Scrub (Fox and Briscoe, as cited in DAWE, 2020c). These included mixed *Eucalyptus, Acacia* and *Callitris* open forest. The Pilliga Mouse is found in greatest abundance in recently burnt moist gullies, areas dominated by Broombush (*Melaleuca uncinata*) and areas containing an understorey of *Acacia burrowii* with a Bloodwood (*Corymbia trachyphloia*) overstorey. Consistent features of the latter two habitats were: a relatively high plant species richness; a moderate to high low-shrub cover; site moisture retention; and groundcover of plants, litter and fungi. Areas with high rates of capture have extensive low grasses and sedges, with little shrub cover and large areas of ash-covered ground (Fox and Briscoe; Tokushima *et al.*, as cited in DAWE, 2020c; DPIE, 2020e).

One survey observed an irruptive population in post-fire habitat during a high rainfall period (Tokushima *et al.*, as cited in DAWE, 2020c). It is unknown which of these factors is more important for the Pilliga Mouse: rainfall, and associated food availability, is known to lead to population increases in arid and semi-arid rodents; similarly, other rodent species have shown higher population densities in areas of regenerating vegetation (Tokushima *et al.*, as cited in DAWE, 2020c). A study reported sparse populations following wet years in an area unburnt for 14-30 years (Fox and Briscoe, as cited in DAWE, 2020c).

The Pilliga Mouse is terrestrial and lives in burrows (Strahan, as cited in DAWE, 2020c). Breeding habitat for the species has been recorded as Broombush scrub, *Corymbia/Acacia* woodlands and Red Gum (*Eucalyptus chloroclada*) / Rough-barked Apple (*Angophora floribunda*) / *Corymbia* heathy woodlands. In some instances, Broad-leaved Ironbark (*Eucalyptus fibrosa*), Dwyer's Red Gum (*Eucalyptus dwyeri*) and Scribbly Gum (*Eucalyptus rossii*) dominate overstorey, and *Calytrix tetragona* dominates the understorey of breeding habitat (Paull and Milledge, as cited in DAWE, 2020c). Broombush used over wintering and breeding sites tend to consist of young (1.5-3-year regrowth) or mature (>25 years old) trees (Paull; Paull and Milledge, as cited in DAWE, 2020c).

Topography of sites where this species is found include rolling landscapes with low relief on sandy soil and sandstone ridges (Lee; Tokushima *et al.*, as cited in DAWE, 2020c). This species occurs in an area of low-nutrient deep sands with mean annual rainfall of approximately 750 mm (Tokushima *et al.*, as cited in DAWE, 2020c).

Seed is the main food of the Pilliga Mouse (95% of its diet in spring and summer and 62% in winter). Leaf matter makes up the remainder of the diet (Jefferys and Fox, as cited in DAWE, 2020c).

The Pilliga Mouse is nocturnal and seeks refuge in burrows (DPIE, 2020e). Tokushima and Jarman (as cited in DAWE, 2020c) measured average movement distances of 40 m for recaptured individuals, with a total home area ranging from 0-181 m. However, larger movement patterns cannot be disregarded.

During non-peak population periods distribution is patchy and during peak periods distribution is ubiquitous (Tokushima *et al.*, as cited in DAWE, 2020c). No low-density non-peak refugia have been identified.

Assessment

The Pilliga Mouse was recorded in the Subject land surrounding the Project. The Project would result in the progressive clearance (over a 23-year period) of approximately 400 ha of known habitat for the Pilliga Mouse, likely used for foraging and breeding (Figure 47) (Table 28).

As described in Section 5.1, a number of measures have been adopted to avoid and minimise clearance. Impact avoidance measures relevant to the potential habitat for the Pilliga Mouse are:

- targeting disturbance to cleared land and derived native grasslands (areas of lower vegetation integrity) in preference to woodland; and
- a vegetation clearance protocol would be implemented during construction and operation, including delineating areas to be cleared and/or retained.

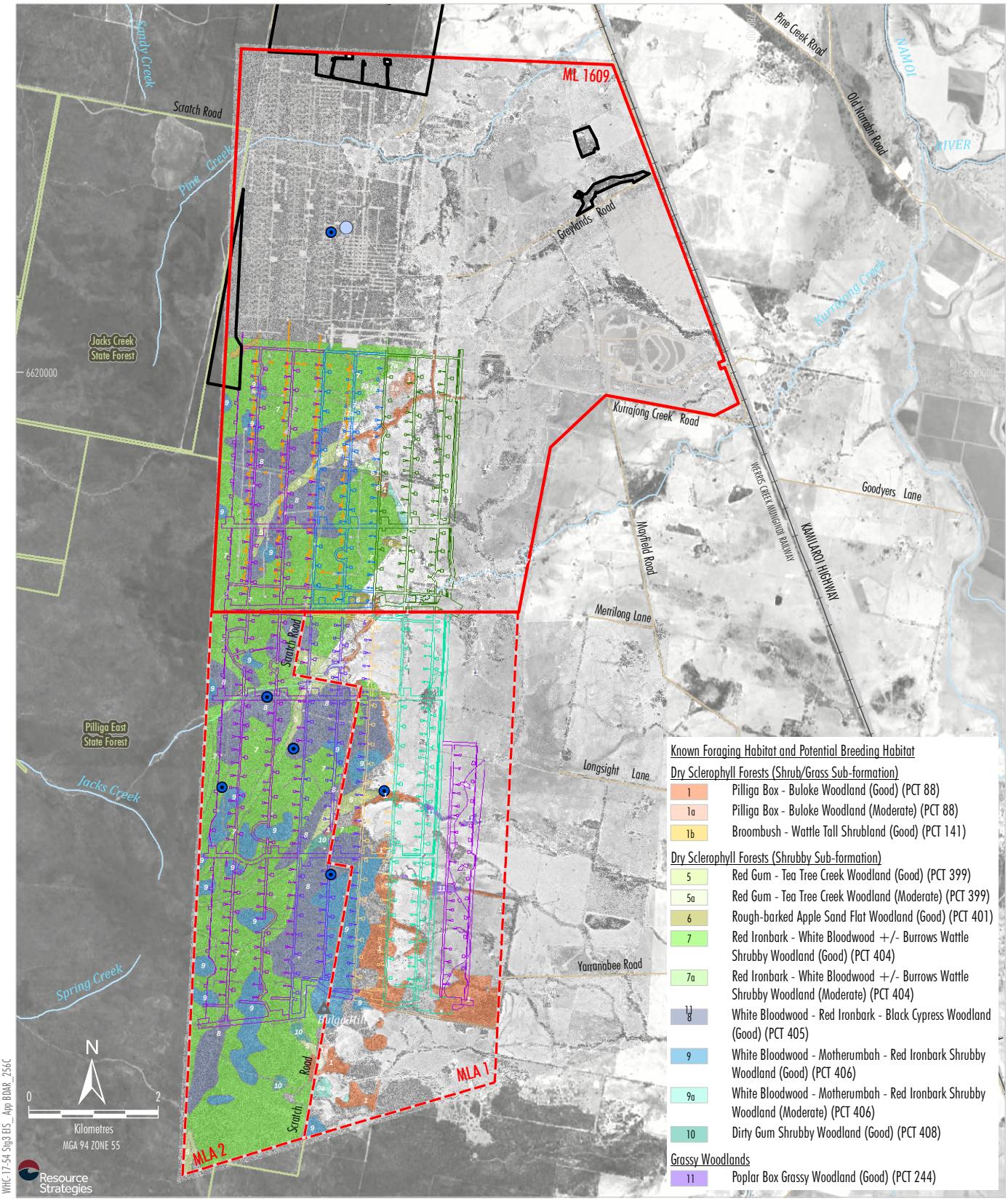
The clearance would occur during all phases of the Development Footprint (Figure 47) (Table 28). During operations, potential habitat would be fragmented for linear surface infrastructure (e.g. access tracks) and gas drainage bore holes; however, after operations, the potential habitat would be re-connected due to rehabilitation/natural regeneration. For this reason, no adverse impacts on the Pilliga Mouse are likely to occur in the long-term.

Approximately 2.5 ha of known habitat for the Pilliga Mouse is within areas of potential ponding (identified by WRM, 2020) (Figure 47) (Table 28). This area has been assumed as a long-term loss of potential habitat in the calculation of the offset requirement using the BAM Credit Calculator (assumed irreversible).

Approximately 16.8 ha of known habitat for the Pilliga Mouse is located in the area of potential cracking impacts on trees (Ditton Geotechnical Services, 2020) (Figure 47) (Table 28). An offset requirement for this potential impact has been calculated using the BAM Credit Calculator.

There is approximately 2,982 ha of known habitat for the Pilliga Mouse within the area subject to subsidence. Outside of the areas of potential ponding and potential cracking impacts on trees, land subsidence is unlikely to materially impact the potential habitat for this species within the predicted subsidence area as dieback or more than occasional tree fall (in areas of habitat for this species) is unlikely based on experience and monitoring results at the existing mine (ELA, 2014; ELA, 2019d).

It is conceivable that an individual Pilliga Mouse could fall into subsidence cracks (and be able to climb out), however, cracks would be temporary, are likely to fill naturally over time (Ditton Geotechnical Services, 2020) and surface cracking would be greater in the eastern portion of the Project area (outside the Pilliga East State Forest), where the depth of cover is less (Ditton Geotechnical Services, 2020).



LEGEND

- State Forest
- Mining Lease (ML 1609)
- Provisional Mining Lease Application Area
- Existing/Approved Indicative Surface Development Footprint
- Narrabri Mine Existing Offset Area
- Indicative Approved Surface Development (Impact Reduction Area)

Development Footprint

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6

Threatened Fauna

Survey Monitoring Database

- Pilliga Mouse

Sources:
Survey - Ecotone (2009); ELA (2019b)
Database - ALA (2019); DPIE (2019)

Source: Orthophotos - NCOPL (2017); NCOPL (2019); NSW Spatial Services (2019); AMBS (2020a)

WHITEHAVEN COAL

NARRABRI STAGE 3 PROJECT

Pilliga Mouse Habitat

Figure 47

Mitigation measures relevant to this species are outlined in Section 9.3 and include the following:

- vegetation clearance protocol, including delineating areas to be cleared and/or retained (*Biodiversity Measure 1*);
- progressive revegetation of disturbed areas (mine rehabilitation) with species characteristic of the surrounding vegetation (*Biodiversity Measure 2*);
- management of animal pests within ML 1609, MLA 1 and MLA 2 by qualified and experienced animal pest management contractors (*Biodiversity Measure 11*); and
- bushfire prevention and control measures (*Biodiversity Measure 12*).

As described earlier, based on the information available in the EPBC Act referral, DEE (now DAWE) considered (in the input into the SEARs) that the Project is likely to have a significant impact on the Pilliga Mouse.

This species is classified as an 'Ecosystem Credit Species' in the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d). The impacts on the native vegetation that provides habitat for the Pilliga Mouse would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

9.2.12 Summary

The Project would adversely impact Poplar Box Woodland EEC, Coolabah Bertya, *Tylophora linearis*, Spiny Peppercress, Koala, Corben's Long-eared Bat, Pilliga Mouse and Large-eared Pied Bat. The impacts would be offset in accordance with the NSW Biodiversity Offsets Scheme (Section 10).

9.3 IMPACT AVOIDANCE AND MITIGATION MEASURES FOR MATTERS OF NATIONAL SIGNIFICANCE

As described in Sections 5.1 and 7, where possible the Project has been located and designed to avoid and minimise impacts on biodiversity values, including native vegetation and potentially occurring threatened species.

Table 29 provides information on proposed avoidance and mitigation measures to manage relevant impacts of the Project for the following species that DEE (now DAWE) considered (in the input into the SEARs) that the Project is likely to significantly impact:

- Coolabah Bertya;
- *Tylophora linearis*;
- Koala;
- Corben's Long-eared Bat; and
- Pilliga Mouse.

Table 29 also includes the Poplar Box Woodland EEC (recorded since the EPBC Act referral), Spiny Peppercress (due to impacts on the population) and Large-eared Pied Bat (recorded since the EPBC Act referral).

Included in Table 29 is a description and assessment of the expected or predicted effectiveness of the mitigation measures, and any statutory policy basis for the mitigation measures (e.g. conservation advice or recovery plan for the species or community, relevant threat abatement plans).

Proposed management plans are described in Section 7.

Section 10.7 describes the Offset Strategy for the Project in accordance with the NSW Biodiversity Offsets Scheme.

Table 29
Impact Mitigation Measures Relevant to Threatened Species and Communities Listed Under the EPBC Act

Matter	Impact	Mitigation Measure (Section 7)	Techniques (Section 7)	Impact Mitigation Measures/Effectiveness	Basis for the Mitigation Measures
Poplar Box Woodland EEC	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage to adjoining areas during vegetation clearance activities or other works.	Effective if clearly delineated.	DEE (2019a)
	Loss of Community	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	
	Indirect Impacts on Native Vegetation and Habitat	Weed Management (*Biodiversity Measure 10*)	During introduction to site all vehicles and mechanical equipment that will be working within native vegetation areas will be subject to a clean down to minimise seed transport off-site.	Effective when done in a controlled manner.	
			Identification of weeds requiring control.		
			Mechanical removal of identified weeds and/or the application of approved herbicides.		
			Follow-up site inspections to determine the effectiveness of the eradication programmes.		
		Animal Pest Management (*Biodiversity Measure 11*)	Manage animal pest species to reduce the likelihood of them increasing in abundance.	Effective when applied.	
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		
Coolabah Bertya	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage during vegetation clearance activities or other works.	Effective if clearly delineated.	TSSC (2016), DEWHA (2008c)
	Loss of Individuals	Salvage and Relocation of Habitat Resources (*Biodiversity Measure 3*)	Identification of vegetative material (e.g. above-ground parts and/or soil seed bank) that would be beneficial for growth and habitat enhancement.	Propagation and translocation trial.	
	Loss of Habitat	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	

Table 29 (Continued)
Impact Mitigation Measures Relevant to Threatened Species and Communities Listed Under the EPBC Act

Matter	Impact	Mitigation Measure (Section 7)	Techniques (Section 7)	Impact Mitigation Measures/Effectiveness	Basis for the Mitigation Measures
	Indirect Impacts on Native Vegetation and Habitat	Weed Management (*Biodiversity Measure 10*)	During introduction to site all vehicles and mechanical equipment that will be working within native vegetation areas will be subject to a clean down to minimise seed transport off-site.	Effective when applied.	
			Identification of weeds requiring control.		
			Mechanical removal of identified weeds and/or the application of approved herbicides.		
			Follow-up site inspections to determine the effectiveness of the eradication programmes.		
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		
Spiny Peppercress	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage during vegetation clearance activities or other works.	Effective if clearly delineated.	Carter (2010), DEE (2016) and (2017)
	Loss of Habitat	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	
	Indirect Impacts on Native Vegetation and Habitat	Weed Management (*Biodiversity Measure 10*)	During introduction to site all vehicles and mechanical equipment that will be working within native vegetation areas will be subject to a clean down to minimise seed transport off-site.	Effective when applied.	
			Identification of weeds requiring control.		
			Mechanical removal of identified weeds and/or the application of approved herbicides.		
			Follow-up site inspections to determine the effectiveness of the eradication programmes.		
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		

Table 29 (Continued)
Impact Mitigation Measures Relevant to Threatened Species and Communities Listed Under the EPBC Act

Matter	Impact	Mitigation Measure (Section 7)	Techniques (Section 7)	Impact Mitigation Measures/Effectiveness	Basis for the Mitigation Measures
Tylophora linearis	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage during vegetation clearance activities or other works.	Effective if clearly delineated.	DEWHA (2008b)
	Loss of Habitat	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	
	Indirect Impacts on Native Vegetation and Habitat	Weed Management (*Biodiversity Measure 10*)	During introduction to site all vehicles and mechanical equipment that will be working within native vegetation areas will be subject to a clean down to minimise seed transport off-site.	Effective when applied.	
			Identification of weeds requiring control.		
			Mechanical removal of identified weeds and/or the application of approved herbicides.		
			Follow-up site inspections to determine the effectiveness of the eradication programmes.		
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		
Koala	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage during vegetation clearance activities or other works.	Effective if clearly delineated.	DSEWPaC (2012), DotE (2014) and TSSC (2012b)
	Loss of Habitat	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	
	Indirect Impacts on Native Vegetation and Habitat	Animal Pest Management (*Biodiversity Measure 11*)	Manage animal pest species to reduce the likelihood of them increasing in abundance.	Effective when applied.	
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		

Table 29 (Continued)
Impact Mitigation Measures Relevant to Threatened Species and Communities Listed Under the EPBC Act

Matter	Impact	Mitigation Measure (Section 7)	Techniques (Section 7)	Impact Mitigation Measures/Effectiveness	Basis for the Mitigation Measures
Corben's Long-eared Bat	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage during vegetation clearance activities or other works.	Effective if clearly delineated.	TSSC (2015)
	Loss of Habitat	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	
	Indirect Impacts on Native Vegetation and Habitat	Animal Pest Management (*Biodiversity Measure 11*)	Manage animal pest species to reduce the likelihood of them increasing in abundance.	Effective when applied.	
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		
Large-eared Pied Bat	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage during vegetation clearance activities or other works.	Effective if clearly delineated.	DERM (2011) and TSSC (2012a)
	Loss of Habitat	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	
	Indirect Impacts on Native Vegetation and Habitat	Animal Pest Management (*Biodiversity Measure 11*)	Manage animal pest species to reduce the likelihood of them increasing in abundance.	Effective when applied.	
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		

Table 29 (Continued)
Impact Mitigation Measures Relevant to Threatened Species and Communities Listed Under the EPBC Act

Matter	Impact	Mitigation Measure (Section 7)	Techniques (Section 7)	Impact Mitigation Measures/Effectiveness	Basis for the Mitigation Measures
Pilliga Mouse	Clearance Impacts on Native Vegetation and Habitat	Vegetation Clearance Protocol (*Biodiversity Measure 1*)	Areas to be cleared are delineated to prevent accidental damage during vegetation clearance activities or other works.	Effective if clearly delineated.	DEWHA (2008a), TSSC (2012c), DEWHA, (2008d) and DotE (2015c)
	Loss of Habitat	Rehabilitation and Revegetation (*Biodiversity Measure 2*)	Surface disturbance areas associated with the Development Footprint would be rehabilitated and revegetated (when the surface facilities are no longer required or at the end of the mine life where no further ongoing beneficial use is identified).	Effective when applied.	
	Subsidence Impacts on Native Vegetation and Habitat	Remediation of Surface Cracks (*Biodiversity Measure 13*)	Remediation of mine subsidence effects (e.g. surface cracking and minor erosion). Preliminary assessment to minimise impact of remediation actions.	Effective when done in a controlled manner.	
	Indirect Impacts on Native Vegetation and Habitat	Animal Pest Management (*Biodiversity Measure 11*)	Manage animal pest species to reduce the likelihood of them increasing in abundance.	Effective when applied.	
		Bushfire Prevention and Control Measures (*Biodiversity Measure 12*)	According to the Bushfire Prevention and Control Measures.		

10 BIODIVERSITY OFFSET STRATEGY

Existing offset areas for the Narrabri Mine include the on-site offset areas (Figure 29), future on-site offset area (Figure 29) and the Kenna Property, located 30 km east (Figure 1). The offset areas have been subject to management since 2014. Management activities undertaken in the offset areas include, weed control via spraying, feral animal management via baiting and trapping, and firebreak maintenance.

This Biodiversity Offset Strategy outlines how NCOPL would offset the impacts of the Project on biodiversity in accordance with the NSW Biodiversity Offsets Scheme established under the BC Act and associated regulations. The BC Regulation states a BDAR must include:

> *(a) the number and classes of biodiversity credits required to be retired in accordance with the like-for-like requirements of the offset rules, and*
>
> *(b) the number and classes of biodiversity credits that could be retired in accordance with the variation rules (in any case in which the proponent of the development proposes to use the variation rules), and*
>
> *(c) details of any proposal to fund a biodiversity conservation action in accordance with the offset rules, and*
>
> *(d) details of any ecological rehabilitation of a site impacted by mining under a mining lease that is proposed as a measure to offset or compensate for those impacts, and*
>
> *…*

These aspects are discussed below.

10.1 OFFSET REQUIREMENTS

The NSW Biodiversity Offsets Scheme requires the biodiversity credits calculated for the biodiversity impacts to be retired via the offset rules. Tables 10 and 11 provide the ecosystem and species credit requirements for the Development Footprint (prior to application of the Impact Reduction Area in Section 5.2 and mine site ecological rehabilitation in Section 10.5). Tables 23 and 24 provide the ecosystem and species credit requirements after the application of the Impact Reduction Area in Section 5.2 (not including the application of the mine site ecological rehabilitation in Section 10.5).

10.2 OFFSET RULES

The offset rules established under the BC Regulation govern the types of biodiversity offsets that can be used to meet an offset requirement under the NSW Biodiversity Offsets Scheme. In summary, impacts can be offset by one or a combination of the following options:

- the retirement of the required number and class of like-for-like biodiversity credits (Section 10.3);
- the retirement of the required biodiversity credits in accordance with the variation rules (Section 10.4);
- undertaking mine site ecological rehabilitation of the impacted site (Section 10.5);
- the funding of a biodiversity conservation action in accordance with the *Ancillary Rules: Biodiversity Conservation Actions* (OEH, 2017b) (Section 10.6.2); or
- the payment of an amount into the Biodiversity Conservation Fund determined in accordance with the BAM Credit Calculator (Section 10.6.3).

These options are discussed below in relation to the Project.

10.3 LIKE-FOR-LIKE BIODIVERSITY CREDITS

Biodiversity credits are generated from Biodiversity Stewardship Sites established via a Biodiversity Stewardship Agreement under the BC Act. Like-for-like biodiversity credits are defined under the BC Regulation as:

…

(2) In the case of impacts on threatened ecological communities, like-for-like biodiversity credits represent—

(a) the same threatened ecological community located in—

(i) the same or an adjoining Interim Biogeographic Regionalisation of Australia subregion as the impacted site, or

(ii) any such subregion that is within 100 kilometres of the outer edge of the impacted site, and

(b) if the threatened ecological community contains hollow bearing trees—vegetation that contains hollow bearing trees.

(3) In the case of impacts on the habitat of threatened species that are ecosystem credit species or other native vegetation (other than impacts on threatened ecological communities), like-for-like biodiversity credits represent:

(a) the same class of native vegetation located in:

(i) the same or an adjoining Interim Biogeographic Regionalisation of Australia subregion as the impacted site, or

(ii) any such subregion that is within 100 kilometres of the outer edge of the impacted site, and

(b) the same or a higher offset trading group, and

(c) if the impacted habitat contains hollow bearing trees—vegetation that contains hollow bearing trees.

(4) In the case of impacts on threatened species that are species credit species, like-for-like biodiversity credits represent the same threatened species.

A class of credits is defined in the BAM (OEH, 2017a) as:

A class of credits is formed where the biodiversity credit shares the same attributes. For ecosystem credits, the attributes are as follows:

(a) name of the PCT impacted by development, clearing or conferral of biodiversity certification

(b) name of any CEEC or EEC or vulnerable ecological community (VEC) associated with the PCT identified in (a)

(c) name of the offset trading group for the PCT or TEC as identified in Table 5

(d) vegetation class of the PCT identified in (a)

(e) vegetation formation of the PCT identified in (a)

(f) presence or absence of hollow bearing trees

(g) IBRA subregion in which the development, clearing or biodiversity certification occurs.

…

For species credits, name of the threatened species being impacted at the development site, clearing site or land to be certified is the only attribute that needs to be shared in order to be in the same class of credits.

Trading groups for ecosystem credits are defined in the BAM (OEH, 2017a) as:

Very high threat status

Tier 1: Name of the critically endangered ecological community

Tier 2: PCTs in the same vegetation class with a percent cleared value ≥90% (being the name of the vegetation class – percent cleared value ≥90%)

High threat status

Tier 3: Name of the endangered ecological community

Tier 4: PCTs in the same vegetation class with a percent cleared value ≥70% and <90% (being the name of the vegetation class – percent cleared value ≥70% and <90%)

Moderate threat status

Tier 5: Name of the vulnerable ecological community

Tier 6: PCTs in the same vegetation class with a percent cleared value ≥50% and <70% (being the name of the vegetation class – percent cleared value ≥50% and <70%)

Low threat status

Tier 7: PCTs in the same vegetation class with a percent cleared value <50% (being the name of the vegetation class – percent cleared value <50%)

The reports detailing the like-for-like credit requirements from the BAM Credit Calculator are provided in Attachments G2 (Phase 1), H2 (Phase 2), I2 (Phase 3), J2 (Phase 4), K2 (Phase 5) and L2 (Phase 6).

The credits required for threatened species and communities listed under the EPBC Act are required to be like-for-like credits. The number and class of like-for-like biodiversity credits for threatened species and communities listed under the EPBC Act are listed in Section 10.7.

10.4 VARIATION RULES

In some circumstances, like-for-like biodiversity credits are not able to be retired. The BC Regulation establishes the following variation rules:

(a) The proponent who is to retire the biodiversity credits has taken reasonable steps to obtain the requisite like-for-like biodiversity credits and requests the variation of the ordinary offset rules.

…

(c) In the case of impacts on threatened species that are species credit species—the biodiversity credits to be retired need not represent the same threatened species, so long as:

(i) if the impacted species is a plant—they represent a plant, and

(ii) if the impacted species is an animal—they represent an animal, and

(iii) they represent a species that has the same or a higher category of listing under Part 4 of the Act as a threatened species, and

(iv) they represent a location that is in:

(A) the same or an adjoining Interim Biogeographic Regionalisation of Australia subregion as the impacted site, or

(B) any such subregion that is within 100 kilometres of the outer edge of the impacted site.

(2) The variation rules do not apply in relation to impacts on threatened species or ecological communities that are excluded by the Environment Agency Head.

The reports detailing the variation credit requirements from the BAM Credit Calculator are provided in Attachments G3 (Phase 1), H3 (Phase 2), I3 (Phase 3), J3 (Phase 4), K3 (Phase 5) and L3 (Phase 6).

The *Ancillary Rules: Reasonable Steps to Seek Like-For-Like Biodiversity Credits* (OEH, 2017d) details the minimum requirements to demonstrate reasonable steps to obtain like-for-like credits before the variation rules can be applied.

The *Ancillary Rules: Impacts on Threatened Species and Ecological Communities Excluded from Application of Variation Rules* (OEH, 2017c) do not apply to the biodiversity credits required for the Project as no credits are required for impacts on critically endangered entities.

The variation rules would not be applied to credits required for threatened species and communities listed under the EPBC Act.

10.5 MINE SITE ECOLOGICAL REHABILITATION

Under the NSW Biodiversity Offsets Scheme, State Significant Development mining projects can use mine site ecological rehabilitation to meet an offset requirement in accordance with the offset rules. Mine site ecological rehabilitation goes beyond standard rehabilitation required by the *Mining Act 1992*. The potential ecological benefit of mine site ecological rehabilitation is that it aims to re-create a functioning native ecosystem (habitat) at the site of disturbance. This can have a greater benefit to local flora and fauna than standard mine rehabilitation that is not targeted towards re-creating habitats.

Importantly, the mine site ecological rehabilitation only contributes a portion of the overall offset (land-based offset areas would also be required and in a greater quantity than the area to be cleared). Mine site ecological rehabilitation generates fewer credits than a land-based offset area. If the mine site ecological rehabilitation is not achieved, the credit requirement must instead be met by another offset option.

At the time of preparing this BDAR, the *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset* was not yet published and so the DPIE provided NCOPL with a final draft for publishing review (DPIE, 2019d) for the basis of this section of the BDAR. This section describes how mine site ecological rehabilitation (based on the draft guidance material) could be used to satisfy a portion of the offset requirement.

Figure 29 presents the conceptual final rehabilitation domains for the Project, including the indicative Mine Site Ecological Rehabilitation Area. The overall rehabilitation goal for the Project mining area is to reinstate the cover and connectivity of native woodland and re-establish agricultural land to a comparable land capability to that of the pre-disturbance environment. The *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset* final draft for publishing review (DPIE, 2019d) do not preclude the implementation of mine site ecological rehabilitation within a State Forest, such as Pilliga East State Forest.

The indicative Mine Site Ecological Rehabilitation Area is a subset of the overall mine rehabilitation, for the purpose of generating biodiversity credits. A detailed description of the rehabilitation and mine closure is provided in Attachment 5 of the EIS.

10.5.1 Target Plant Community Types and Species Habitat

Recognisable and self-sustaining PCTs are required to be created as part of mine site ecological rehabilitation. The mine site ecological rehabilitation would aim to re-create like-for-like PCTs in similar locations to those cleared for the Project. An indication of where each PCT is proposed to be rehabilitated is provided by Figure 11 which shows the location of the PCTs prior to clearance, and Figure 29 which provides the location of the Mine Site Ecological Rehabilitation Area.

The PCTs targeted by the mine site ecological rehabilitation, and the area (size) of land that would be rehabilitated, are listed in Table 30. A description of each of the PCTs listed in Table 30 is provided in AMBS (2020a) (Attachment B).

A total of 434.5 ha of mine site ecological rehabilitation would be undertaken to contribute towards credits. Note, however, that the areas presented in Table 30 are conservatively less than the area of each PCT to be cleared to account some minor variation in the extent of each PCT at ecological ecotones. This is due to the primary method of revegetation being through natural regenerate of the vegetation (through seed bank in the topsoil or seed from surrounding vegetation). This would require management of the soil stockpiles relevant to each PCT so as not to re-create a mix of species between PCTs.

Further to the above, not all PCTs to be cleared are proposed to be revegetated to gain credits. Two PCTs not included in Table 30 (i.e. PCTs 141 and 408) are represented in only a relatively small area of the development footprint (approximately 0.6 ha and 0.1 ha).

The *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset* final draft for publishing review (DPIE, 2019d) state that it is expected that rehabilitation objectives can generally be achieved within 20 years of commencement of an area of mine site ecological rehabilitation.

Table 30
Mine Site Ecological Rehabilitation Plant Community Type Targets

PCT	Phase 1 Area (ha)	Phase 2 Area (ha)	Phase 3 Area (ha)	Phase 4 Area (ha)	Phase 5 Area (ha)	Phase 6 Area (ha)	Total Area (ha)
55	3	4	0	0	0	0	**7**
88	5.5	20	0	6.5	1	2	**35**
206	0	0	0	1.5	0	0	**1.5**
244	2.5	3	0	0	0	1	**6.5**
399	0	0	1	1	6	4	**12**
401	0.5	0	2.5	0	0	0	**3**
404	11	0	39.5	4.5	23	127	**205**
405	0	0	10	7.5	35	47	**99.5**
406	0.5	0	0	9.5	14	14	**38**
435	4	19	0	3	1	0.5	**27.5**
Total Area (ha)	**27**	**46**	**53**	**33.5**	**80**	**195.5**	**435**

It is reasonable to revegetate to the PCTs in Table 30 as all of the PCTs are present in the surrounding habitat. As described earlier, the use of underground longwall mining methods significantly reduces vegetation and soil disturbance in comparison to open cut mining methods. This also has the effect of increasing the likely success of revegetation of the surface development areas to woodland vegetation types. As mentioned above, the primary method of revegetation being through natural regenerate of the vegetation (through seed bank in the topsoil or seed from surrounding vegetation). Plate 7 shows areas undergoing rehabilitation at the existing Narrabri Mine.

Plate 7 Examples of a Bore Pad Undergoing Natural Regeneration at the Existing Narrabri Mine

The Project would result in the direct clearance of approximately 3.8 ha of Poplar Box Woodland EEC (PCT 244) comprising various woodland patches. The clearance of the Poplar Box Woodland EEC would not be offset using mine site ecological rehabilitation.

The mine site ecological rehabilitation would benefit many local occurring threatened species; however, habitat for only the following species is proposed to be created for the purpose of obtaining biodiversity credits:

- Koala foraging habitat (435 ha);
- Eastern Pygmy-possum foraging habitat (394 ha);
- Squirrel Glider foraging habitat (428 ha);
- Large-eared Pied Bat foraging habitat (345.5 ha); and
- Eastern Cave Bat foraging habitat (324 ha).

It is reasonable to create foraging habitat for these species as all of these species are already known to use the surrounding habitat. Potential and/or known breeding/shelter habitat for these species exists in the surrounds.

As described in Section 7, a propagation and translocation trial would be implemented for the Coolabah Bertya. At this stage, until there is evidence that this species can be propagated, NCOPL are not proposing to obtain credits for Coolabah Bertya as part of the mine site ecological rehabilitation.

10.5.2 Rehabilitation Objectives, Criteria and Performance Indicators

Table 31 outlines the rehabilitation objectives, proposed completion criteria and performance indicators that apply to each PCT in accordance with the *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset* final draft for publishing review (DPIE, 2019d).

Table 32 outlines the rehabilitation objectives, proposed completion criteria and performance indicators for the target threatened species and their habitat at the proposed mine site ecological rehabilitation in accordance with the *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset* final draft for publishing review (DPIE, 2019d).

10.5.3 Mine Site Ecological Rehabilitation Credit Calculation

The *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset* final draft for publishing review (DPIE, 2019d) describes how credits can be generated from commitments to undertake mine site ecological rehabilitation and those credits can be deducted from the credits required for the Project. This section describes the credit calculation. The mine site ecological rehabilitation approach was discussed with the BCD and DPIE in June and July 2020.

Future Vegetation Integrity

The starting vegetation integrity score in the BAM Credit Calculator is set at zero in accordance with the *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset* final draft for publishing review (DPIE, 2019d).

Table 31
Ecological Rehabilitation Objectives, Completion Criteria and Performance Indicators for Ecosystem Credits

Ecological Rehabilitation Objective	Completion Criteria	Performance Indicators
Objective 1: *The* ***vegetation composition*** *of the rehabilitation is recognisable as a plant community type contained within the BioNet Vegetation Classification.*	*Native plant species are characteristic of the target plant community type(s).*	*All native vascular plant species are recorded to species level from fixed 0.04 ha monitoring plots.*
Objective 2: *The* ***vegetation structure*** *of the rehabilitation is recognisable as, or is trending towards, a plant community type contained within the BioNet Vegetation Classification.*	*Cover, abundance and height range of native plant growth forms are characteristic of, or trending toward, the target plant community type(s).*	*The cover, abundance and height range of all native vascular plant species are recorded from fixed 0.04 ha monitoring plots.*
Objective 3: *Levels of* ***ecosystem function*** *have been established that demonstrate the rehabilitation is self-sustainable.*	*Growth medium is suitable for target plant community type establishment, and indicators of nutrient cycling are suitable for sustaining the target plant community type.*	*Routine agricultural soil test.* *Litter biomass (dry weight) and evidence of decomposition is recorded from five 1x1m quadrats along a 50 m fixed monitoring transect.*
	Plant recruitment is suitable for sustaining the target plant community type.	*All growth forms are monitored for establishment of second-generation juveniles/immatures and survival to adulthood, at fixed monitoring plots or transects.*
	Plant competition is suitable for sustaining the target plant community type.	*The total cover of exotic plant species is recorded at fixed 0.04 ha monitoring plots. And the cover and abundance of each high threat, noxious, invasive, or weed of national significance is separately recorded.*
	Fauna food and shelter is characteristic of the target plant community type(s).	*Invertebrates: Evidence of habitat resources (any additional evidence of litter invertebrate presence).* *Vertebrates: Evidence of habitat resources (any additional evidence of litter vertebrate presence).*

Table 32
Ecological Rehabilitation Objectives, Completion Criteria and Performance Indicators for Species Credits

Ecological Rehabilitation Objective	Completion Criteria	Performance Indicators
Objective 4: Achieve the restoration target value used to calculate the credit value for the area of **habitat suitability** for the target fauna species.	Achievement of the restoration target value specific for the area of habitat suitability used to calculate the credit value of rehabilitation for the target fauna species.	***Koala foraging habitat (435 ha)*** Mature flowering trees that provide potential foraging habitat for the Koala (consistent with published literature and baseline data [Attachment C]) are recorded within the relevant area of mine site ecological rehabilitation.
		Eastern Pygmy-possum foraging habitat (394 ha) Mature flowering trees that provide potential foraging habitat for the Eastern Pygmy Possum (consistent with published literature and baseline data [Attachment C]) are recorded within the relevant area of mine site ecological rehabilitation.
		Squirrel Glider foraging habitat (428 ha) Mature flowering trees that provide potential foraging habitat for the Squirrel Glider (consistent with published literature and baseline data [Attachment C]) are recorded within the relevant area of mine site ecological rehabilitation.
		Large-eared Pied Bat foraging habitat (345.5 ha) Mature flowering trees that provide potential foraging habitat for the Large-eared Pied Bat (consistent with published literature and baseline data [Attachment C]) are recorded within the relevant area of mine site ecological rehabilitation.
		Eastern Cave Bat foraging habitat (324 ha) Mature flowering trees that provide potential foraging habitat for the Eastern Cave Bat (consistent with published literature and baseline data [AMBS, 2020b] [Attachment C]) are recorded within the relevant area of mine site ecological rehabilitation.
Objective 5: Threatened fauna species for which species credits have been calculated are **present** on the rehabilitation site and form part of a **self-sustaining population**.	Threatened fauna for which species credits have been calculated are present on the rehabilitation site. The individuals present on-site form part of a self-sustaining population. Habitat suitable for the threatened fauna species for which species credits have been generated has been established on site.	Species specific habitat is created and adequacy is verified by suitably qualified ecologist. The rehabilitation site is either large enough to support a self-sustaining population of the threatened fauna species or is connected to other native vegetation through which the species moves and this combined area is large enough to support a self-sustaining population. Monitoring use of habitat by the target species. Undertaking a threatened species survey in accordance with the BAM or obtaining an expert report in accordance with the BAM.

The background information (DPIE, 2019d) incentivises mining proponents to commit to a high standard of mine site ecological rehabilitation. With this in mind, the future value of vegetation integrity attributes (20-year time span) has been estimated based on the published benchmarks and an average value for each attribute across the data collected from the site for each PCT (Table 33). The published benchmark was used for an attribute where the site date exceeded 100% of the published benchmark. The percentage of the published benchmarks is provided in brackets in Table 33. Tree regeneration would be present.

The future vegetation integrity scores calculated in the BAM Credit Calculator are provided in Table 34.

Table 33
Mine Site Ecological Rehabilitation Future Value of Vegetation Integrity Attributes

PCT	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Litter Cover	Length Fallen Logs	Tree Regeneration
55	1 (33%)	7 (78%)	5 (71%)	7 (78%)	0	2 (100%)	21 (100%)	3 (17%)	12 (39%)	2 (33%)	0	0	35 (100%)	28 (100%)	1
88	4 (80%)	8 (100%)	7 (88%)	8 (100%)	1 (100%)	2 (100%)	32 (68%)	20 (100%)	9 (31%)	3 (60%)	0	0	60 (100%)	45 (87%)	1
206	5 (100%)	5 (100%)	6 (75%)	7 (70%)	1 (100%)	3 (100%)	35 (63%)	0	14 (23%)	0	0	0	40 (80%)	28 (74%)	1
244	3 (75%)	3 (50%)	8 (100%)	8 (80%)	1 (100%)	1 (50%)	22 (67%)	8 (100%)	13 (30%)	3 (50%)	0	0	46 (77%)	41 (91%)	1
399	3 (60%)	10 (91%)	8 (100%)	8 (100%)	0	1 (50%)	19 (32%)	29 (97%)	10 (45%)	5 (100%)	0	0	59 (89%)	58 (98%)	1
401	4 (80%)	6 (55%)	8 (100%)	7 (88%)	1 (100%)	2 (100%)	31 (53%)	0	11 (50%)	1 (20%)	0	0	66 (100%)	37 (63%)	1
404	3 (60%)	6 (55%)	6 (75%)	4 (50%)	0	0	28 (47%)	24 (80%)	6 (27%)	5 (100%)	0	0	66 (100%)	49 (83%)	1
405	4 (80%)	10 (91%)	5 (63%)	7 (88%)	0	0	25 (42%)	13 (43%)	6 (27%)	5 (100%)	0	0	66 (100%)	47 (80%)	1
406	4 (80%)	6 (55%)	4 (50%)	6 (75%)	0	0	31 (53%)	14 (47%)	7 (32%)	3 (60%)	0	0	66 (100%)	53 (100%)	1
435	2 (40%)	3 (38%)	8 (89%)	11 (100%)	1 (100%)	2 (67%)	28 (47%)	7 (33%)	18 (58%)	1 (14%)	1 (100%)	0	50 (100%)	35 (66%)	1

Table 34
Mine Site Ecological Rehabilitation Vegetation Integrity Score Detail

Vegetation Zone	PCT ID and Vegetation Community (AMBS, 2020a) (Attachment B)		Composition Condition Score	Structure Condition Score	Function Condition Score	Vegetation Integrity Score
12	55	Belah Woodland	11.8	7.7	8.7	9.3
1	88	Pilliga Box – Buloke Woodland	20.2	10	7.5	11.5
13	206	Dirty Gum – White Cypress Woodland on Sand Monkeys	16.4	3.7	5	6.7
11	244	Poplar Box Grassy Woodland	14.1	6.5	6.2	8.3
5	399	Red Gum – Tea tree Creek Woodland	17.8	8.2	7.8	10.4
6	401	Rough-barked Apple Sand Flat Woodland	15	3.7	5.7	6.8
7	404	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland	6.8	7.1	7.2	7
8	405	White Bloodwood – Red Ironbark – Black Cypress Woodland	13.7	3.8	6.9	7.1
9	406	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland	7.8	4.5	7.8	6.5
4	435	White Box – White Cypress Woodland	13.5	4.1	5.9	6.9

The future vegetation integrity scores in Table 34 represent the change (increase) in vegetation integrity. Without mine site ecological rehabilitation, the vegetation integrity score would be zero.

10.5.4 Management Plan

The MOP or equivalent required under the NSW *Mining Act, 1992* would identify the mine site ecological rehabilitation details. The MOP would be prepared in accordance with the relevant NSW Government rehabilitation and mine closure guidelines.

10.5.5 Management Actions

A detailed description of the rehabilitation and mine closure is provided in Attachment 5 of the EIS.

Natural revegetation within woodland secondary domain areas would be allowed to occur; however, if this is not successful within three months during peak growing periods (i.e. spring and summer) and six months during slower growing periods (i.e. autumn and winter or drought periods), the sites would be seeded using species occurring in the adjacent remnant vegetation. The seed mix would be specific to the PCT being targeted in the rehabilitation location. The species selected would aim to establish vegetation that reflects the composition and structure of vegetation communities present in the area.

10.5.6 Ecosystem Credits from Mine Site Ecological Rehabilitation

Table 35 presents the ecosystem credits calculated for the mine site ecological rehabilitation. A total of 816 ecosystem credits were generated, which equates to approximately 6% of the total ecosystem credit requirement (i.e. 12,880) (Table 23).

Table 35
Ecosystem Credits from Mine Site Ecological Rehabilitation

PCT	Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		Total	
	Area (ha)	Credits (Attachment N)	Area (ha)	Credits (Attachment O)	Area (ha)	Credits (Attachment P)	Area (ha)	Credits (Attachment Q)	Area (ha)	Credits (Attachment R)	Area (ha)	Credits (Attachment S)	Area (ha)	Credits
55	3	7	4	9	0	-	0	-	0	-	0	-	**7**	**16**
88	5.5	16	20	57	0	-	6.5	19	1	3	2	6	**35**	**101**
206	0	-	0	-	0	-	1.5	3	0	-	0	-	**1.5**	**3**
244	2.5	5	3	6	0	-	0	-	0	-	1	2	**6.5**	**13**
399	0	-	0	-	1	3	1	3	6	16	4	10	**12**	**32**
401	0.5	1	0	-	2.5	4	0	-	0	-	0	-	**3**	**5**
404	11	19	0	-	39.5	69	4.5	8	23	40	127	223	**205**	**359**
405	0	-	0	-	10	18	7.5	13	35	62	47	84	**99.5**	**177**
406	0.5	1	0	-	0	-	9.5	15	14	23	14	23	**38**	**62**
435	4	7	19	33	0	-	3	5	1	2	0.5	1	**27.5**	**48**
Total	**27**	**56**	**46**	**105**	**53**	**94**	**33.5**	**66**	**80**	**146**	**195.5**	**349**	**435**	**816**

The credit reports from the BAM Credit Calculator for the mine site ecological rehabilitation Phases 1 to 6 are provided in Attachments N to S.

10.5.7 Species Credits from Mine Site Ecological Rehabilitation

Table 36 presents the species credits calculated for the mine site ecological rehabilitation. Between 599 and 816 species credits were generated for each species, which equates to between approximately 5 and 9% of the total species credit requirement for these species (Table 24). The credit reports from the BAM Credit Calculator for the mine site ecological rehabilitation Phases 1 to 6 are provided in Attachments N to S.

Table 36
Species Credits from Mine Site Ecological Rehabilitation

Scientific Name	Common Name	Conservation Status		Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		Total	
		BC Act[1]	EPBC Act[2]	Area (ha)	Credits (Attachment N)	Area (ha)	Credits (Attachment O)	Area (ha)	Credits (Attachment P)	Area (ha)	Credits (Attachment Q)	Area (ha)	Credits (Attachment R)	Area (ha)	Credits (Attachment S)	Area (ha)	Credits
Phascolarctos cinereus	Koala	V	V	27	56	46	105	53	94	33.5	66	80	146	195.5	349	**435**	**816**
Cercartetus nanus	Eastern Pygmy-possum	V	-	17.5	37	20	57	53	94	30.5	61	79	144	194	346	**394**	**739**
Petaurus norfolcensis	Squirrel Glider	V	-	24	49	42	96	53	94	33.5	66	80	146	195.5	349	**428**	**800**
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	0	-	42	96	0	-	29	58	80	146	194.5	347	**345.5**	**647**
Vespadelus troughtoni	Eastern Cave Bat	V	-	0	-	39	90	0	-	20.5	42	74	130	190.5	337	**324**	**599**

[1] Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). V = Vulnerable.

10.5.8 Conclusion

The use of mine site ecological rehabilitation to satisfy approximately 6% of the ecosystem credit requirement and between approximately 5 and 9% of the species credit requirement for the target species is reasonable given:

- re-establishing local habitat is more beneficial to the local fauna (than establishing an offset in a more distant location);
- if mine site ecological rehabilitation is not undertaken (e.g. deemed not a viable option or unsuccessful) then NCOPL would need to retire the credits via other means (e.g. additional land-based offset areas or contribution towards the Biodiversity Conservation Fund) in accordance with the offset rules; and
- a security bond for the commitment would be provided under the *Mining Act, 1992*.

The Mine Site Ecological Rehabilitation areas would be rehabilitated consistent with the rehabilitation strategy for the Woodland secondary domain if the rehabilitation objectives, performance indicators and completion criteria for the Mine Site Ecological Rehabilitation areas are not able to be satisfied.

10.6 OTHER OFFSET OPTIONS

Tables 10 and 11 provide the ecosystem and species credit requirements for the Development Footprint (prior to application of the Impact Reduction Area in Section 5.2 and mine site ecological rehabilitation in Section 10.5).

Tables 23 and 24 provide the ecosystem and species credit requirements after the application of the Impact Reduction Area in Section 5.2 (not including the application of the mine site ecological rehabilitation in Section 10.5).

Tables 37 and 38 provide the Project offset requirement (i.e. remaining ecosystem and species credit requirements after application of the Impact Reduction Area in Section 5.2 and mine site ecological rehabilitation in Section 10.5).

10.6.1 Biodiversity Stewardship Site Investigation

NCOPL may choose to establish a Biodiversity Stewardship Site on land owned by Whitehaven. A Biodiversity Stewardship Site Management Plan, including management actions to improve biodiversity values, is required for all Biodiversity Stewardship Sites.

Potential Resource Sterilisation

The SEARs for the EIS requested a summary of any potential resource sterilisation in relation to biodiversity offset areas. The Biodiversity Stewardship Site would be established in accordance with the BC Act requirements in relation to potential resource sterilisation.

Table 37
Offset Requirement - Residual Ecosystem Credits

Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1					Phase 2			Phase 3				Phase 4			Phase 5			Phase 6			Total
		Biodiversity Risk Weighting	Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Mine Site Ecological Rehabilitation (Table 35)	Residual Total for Phase 1	Development Footprint (Table 10)	Mine Site Ecological Rehabilitation (Table 35)	Residual Total for Phase 2	Development Footprint (Table 10)	Impact Reduction Area (Table 17)	Mine Site Ecological Rehabilitation (Table 35)	Residual Total for Phase 3	Development Footprint (Table 10)	Mine Site Ecological Rehabilitation (Table 35)	Residual Total for Phase 4	Development Footprint (Table 10)	Mine Site Ecological Rehabilitation (Table 35)	Residual Total for Phase 5	Development Footprint (Table 10)	Mine Site Ecological Rehabilitation (Table 35)	Residual Total for Phase 6	
Pilliga Box –Buloke Woodland	88	1.50	656	-1	-16	**639**	753	-57	**696**	66	0	0	**66**	228	-19	**209**	87	-3	**84**	291	-6	**285**	**2,080**
Broombush – Wattle Tall Shrubland	141	1.50	0	0	0	**0**	0	0	**0**	0	0	0	**0**	0	0	**0**	0	0	**0**	10	0	**10**	**10**
White Box – White Cypress Woodland	435	1.75	74	0	-7	**67**	275	-33	**242**	0	0	0	**0**	100	-5	**95**	33	-2	**31**	94	-1	**93**	**576**
Red Gum – Tea Tree Creek Woodland	399	1.50	0	0	0	**0**	0	0	**0**	36	-14	-3	**19**	30	-3	**27**	178	-16	**162**	102	-10	**92**	**332**
Rough-barked Apple Sand Flat Woodland	401	1.50	20	0	-1	**19**	0	0	**0**	79	0	-4	**75**	8	0	**8**	4	0	**4**	0	0	**0**	**111**
Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland	404	1.50	218	-180	-19	**19**	0	0	**0**	894	-26	-69	**799**	110	-8	**102**	623	-40	**583**	3,726	-223	**3,503**	**5,365**
White Bloodwood – Red Ironbark – Black Cypress Woodland	405	1.50	0	0	0	**0**	0	0	**0**	220	-71	-18	**131**	207	-13	**194**	783	-62	**721**	1,019	-84	**935**	**2,158**
White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland	406	1.50	18	0	-1	**17**	0	0	**0**	0	0	0	**0**	295	-15	**280**	328	-23	**305**	267	-23	**244**	**908**
Dirty Gum Shrubby Woodland	408	1.50	0	0	0	**0**	0	0	**0**	0	0	0	**0**	0	0	**0**	3	0	**3**	0	0	**0**	**3**
Poplar Box Grassy Woodland	244	2.00	31[A]	0	-5	**26**[A]	111[B]	-6	**105**	0	0	0	**0**	0	0	**0**	0	0	**0**	296[C]	-2	**294**	**438**[C]
Belah Woodland	55	2.00	144	0	-7	**137**	536	-9	**527**	0	0	0	**0**	29	0	**29**	0	0	**0**	130	0	**130**	**839**
Dirty Gum – White Cypress Woodland on Sand Monkeys	206	1.75	0	0	0	**0**	0	0	**0**	0	0	0	**0**	57	-3	**54**	3	0	**3**	0	0	**0**	**60**
		Total	**1,161**	**-181**	**-56**	**924**	**1,675**	**-105**	**1,570**	**1,295**	**-111**	**-94**	**1,090**	**1,064**	**-66**	**998**	**2,042**	**-146**	**1,896**	**5,935**	**-349**	**5,586**	**12,880**

[A] Includes 24 credits for Poplar Box Woodland EEC.
[B] Includes 34 credits for Poplar Box Woodland EEC.
[C] Includes 86 credits for Poplar Box Woodland EEC.

Table 38
Offset Requirement - Residual Species Credits

Scientific Name	Common Name	Conservation Status		Phase 1				Phase 2			Phase 3			Phase 4			Phase 5			Phase 6			Total
		BC Act[1]	EPBC Act[2]	Development Footprint (Table 11)	Impact Reduction Area (Table 18)	Mine Site Ecological Rehabilitation (Table 36)	Residual Total for Phase 1	Development Footprint (Table 11)	Mine Site Ecological Rehabilitation (Table 36)	Residual Total for Phase 2	Development Footprint (Table 11)	Mine Site Ecological Rehabilitation (Table 36)	Residual Total for Phase 3	Development Footprint (Table 11)	Mine Site Ecological Rehabilitation (Table 36)	Residual Total for Phase 4	Development Footprint (Table 11)	Mine Site Ecological Rehabilitation (Table 36)	Residual Total for Phase 5	Development Footprint (Table 11)	Mine Site Ecological Rehabilitation (Table 36)	Residual Total for Phase 6	
Bertya opponens	Coolabah Bertya	V	V	0	0	0	**0**	0	0	**0**	2,594	0	**2,594**	0	0	**0**	0	0	**0**	49,284	0	**49,284**	**51,878**
Lepidium aschersonii	Spiny Peppercress	V	V	295	0	0	**295**	906	0	**906**	30	0	**30**	265	0	**265**	45	0	**45**	263	0	**263**	**1,804**
Tylophora linearis	-	V	E	628	-387	0	**241**	1,085	0	**1,085**	1,656	0	**1,656**	1,236	0	**1,236**	2,640	0	**2,640**	7,146	0	**7,146**	**14,004**
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	864	-387	0	**477**	1,286	0	**1,286**	1,702	0	**1,702**	1,327	0	**1,327**	2,702	0	**2,702**	7,400	0	**7,400**	**14,894**
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	998	-387	0	**611**	1,458	0	**1,458**	1,702	0	**1,702**	1,344	0	**1,344**	2,702	0	**2,702**	7,415	0	**7,415**	**15,232**
Phascolarctos cinereus	Koala	V	V	998	-387	-56	**555**	1,458	-105	**1,353**	1,702	-94	**1,608**	1,344	-66	**1,278**	2,702	-146	**2,556**	7,428	-349	**7,079**	**14,429**
Cercartetus nanus	Eastern Pygmy-possum	V	-	468	-387	-37	**44**	751	-57	**694**	1,656	-94	**1,562**	1,186	-61	**1,125**	2,605	-144	**2,461**	7,061	-346	**6,715**	**12,601**
Petaurus norfolcensis	Squirrel Glider	V	-	574	-121	-49	**404**	1,286	-96	**1,190**	529	-94	**435**	1,180	-66	**1,114**	1,959	-146	**1,813**	2,928	-349	**2,579**	**7,535**
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	0	0	0	**0**	1,496	-96	**1,400**	0	0	**0**	1,596	-58	**1,538**	3,404	-146	**3,258**	5,441	-347	**5,094**	**11,290**
Vespadelus troughtoni	Eastern Cave Bat	V	-	0	0	0	**0**	1,572	-90	**1,482**	0	0	**0**	848	-42	**806**	1,584	-130	**1,454**	2,560	-337	**2,223**	**5,965**

[1] Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2020). E = Endangered; V = Vulnerable.

10.6.2 Funding of a Biodiversity Conservation Action

The *Ancillary Rules: Biodiversity Conservation Actions* (OEH, 2017b) set out the actions that can be funded as biodiversity conservation action. None of the actions listed in the *Ancillary Rules: Biodiversity Conservation Actions* (OEH, 2017b) apply to the biodiversity credits required for the Project.

10.6.3 Payments to the NSW Biodiversity Conservation Fund

NCOPL could choose to make a payment to the NSW Biodiversity Conservation Fund, administered by the NSW Biodiversity Conservation Trust (BCT), instead of retiring credits for a portion or all of the biodiversity credit requirement. The total cost of the payment would be determined at the time of applying to the BCT to make a payment into the NSW Biodiversity Conservation Fund.

10.6.4 Timing

Credits would be retired (or payments made) for each Biodiversity Development Footprint stage according to the timing that would be specified in the NSW Development Consent and Commonwealth approval, to the satisfaction of the DPIE and/or the Commonwealth Minister.

10.7 COMMONWEALTH OFFSET

The Action is to be assessed by accredited assessment under the EP&A Act. Accordingly, this document provides an assessment of those components of the Project that comprise the Action on the relevant threatened species and communities listed under the EPBC Act. On 24 March 2020, the Australian Government entered into a new bilateral assessment agreement with New South Wales - Amending Agreement No. 1, endorsing the NSW Biodiversity Offsets Scheme, which includes the BAM, the offset rules, the BC Regulation, and payments to the BCT.

All native vegetation to be cleared is required to be offset under the BC Act. A summary of the specific number and class of like-for-like biodiversity credits for threatened species and communities listed under the EPBC Act are listed in Table 39. Table 39 includes the following species that DEE (now DAWE) considered (in the input into the SEARs) that the Project is likely to significantly impact:

- Coolabah Bertya;
- *Tylophora linearis*;
- Koala;
- Corben's Long-eared Bat; and
- Pilliga Mouse.

Table 39 also includes the Spiny Peppercress (due to impacts on the population) and Large-eared Pied Bat (recorded since the EPBC Act referral). Table 39 provides the credit requirements after the application of the Impact Reduction Area in Section 5.2 (not including the application of the mine site ecological rehabilitation in Section 10.5).

Table 39
Credit Requirement for Threatened Species and Communities Listed Under the EPBC Act

Scientific Name	Common Name	Conservation Status		Total Disturbance by the Project (ha)	Credit Requirement						
		BC Act[1]	EPBC Act[2]		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Total
Poplar Box Grassy Woodland on Alluvial Plains (PCT 244)		-	E	7.9	24*	34*	0	0	0	86*	**144***
Bertya opponens	Coolabah Bertya	V	V	25,939 (individuals)	0	0	2,594	0	0	49,284	**51,878**
Lepidium aschersonii	Spiny Peppercress	V	V	58.8	295	906	30	265	45	263	**1,804**
Tylophora linearis	-	V	E	444.4	241	1,085	1,656	1,236	2,640	7,146	**14,004**
Grantiella picta	Painted Honeyeater	V	V	472	Ecosystem credits[3]						
Phascolarctos cinereus	Koala	V	V	514.5	611	1,458	1,702	1,344	2,702	7,428	**15,245**
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	472.6	Ecosystem credits[4]						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	245.3	0	1,496	0	1,596	3,404	5,441	**11,937**
Pseudomys pilligaensis	Pilliga Mouse	V	V	419.3	Ecosystem credits[5]						

1 Conservation status under the BC Act (current as at October 2020). V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). E = Endangered; V = Vulnerable.

3 Ecosystem credits calculated for PCTs associated with potential habitat for this species, namely the woodland forms of PCT 88, 435, 399, 401, 404, 405, 406, 408, 244, 55 and 206 (Table 37).

4 Ecosystem credits calculated for PCTs associated with potential habitat for this species, namely the woodland forms of PCT 88, 141, 435, 399, 401, 404, 405, 406, 408, 244, 55 and 206 (Table 37).

5 Ecosystem credits calculated for PCTs associated with potential habitat for this species, namely the woodland forms of PCT 88, 141, 399, 401, 404, 405, 406, 408 and 244 (Table 37).

* A portion of the ecosystem credits calculated for PCT 244 (Table 37).

The conservation benefit associated for EPBC Act listed threatened species and communities with the proposed offset strategy is that larger areas of habitat (compared to that which would be cleared) would be conserved and enhanced under the NSW Biodiversity Offsets Scheme in perpetuity.

11 CONCLUSION

The BAM establishes the circumstances where offsetting the impacts of development will result in no net loss of biodiversity. This BDAR has followed the BAM and determined the biodiversity credit requirements of the Project. NCOPL is committed to satisfying the biodiversity credit requirements using offset mechanisms allowed by the NSW Biodiversity Offsets Scheme (i.e. retirement of biodiversity credits, mine site ecological rehabilitation and/or contribution to the Biodiversity Conservation Fund).

12 REFERENCES

AMBS Ecology and Heritage (2020a) *Narrabri Underground Mine Stage 3 Extension Project – Flora Survey Report.* Prepared for Narrabri Coal Operations Pty Ltd.

AMBS Ecology and Heritage (2020b) *Narrabri Underground Mine Stage 3 Extension Project – Fauna Survey Report.* Prepared for Narrabri Coal Operations Pty Ltd.

Atlas of Living Australia (2019) *Atlas of Living Australia Website.* Database search within the following area: *-30.542399 149.829821, -30.543878 149.888873, -30.543878 149.888873, -30.622793 149.892306.* Website Accessed: November 2019.

Austen, J. A. (1999) 'The management of *Bertya opponens* – a vulnerable shrub: A precursor to the Draft Recovery Plan for the vulnerable shrub *Bertya opponens*.' Unpublished B. Nat. Res thesis available from the University of England, Armidale.

Australian Koala Foundation (2007) *Planning Guidelines for Koala Conservation and Recovery: A guide to best planning practice*.

Australasian Groundwater and Environmental Consultants (2020) *Narrabri Underground Mine Stage 3 Extension Project – Groundwater Impact Assessment.* Prepared for Narrabri Coal Operations Pty Ltd.

Baker-Gabb, D. (2011). *National Recovery Plan for the Superb Parrot Polytelis swainsonii*. Department of Sustainability and Environment, Melbourne. In effect under the EPBC Act from 21-Apr-2011.

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

Barea, L. P. (2012) Habitat influences on nest-site selection by the Painted Honeyeater (*Grantiella picta*): do food resources matter? *Emu*, 112:39-45.

Barrett, G. W., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003) *The New Atlas of Australian Birds.* Prepared for the Royal Australasian Ornithologists Union of Melbourne.

Bell, D., Hunter, J. T., & Montgomery, L. (2012) Ephemeral wetlands of the Pilliga Outwash, northwest NSW. *Cunninghamia*.

BirdLife Australia (2019) *BirdLife Australia Website*. Database search within the following area: *-30.542399 149.829821, -30.543878 149.888873, -30.543878 149.888873, -30.622793 149.892306.*
Website Accessed: November 2019.

Bowen, M. and Goldingay, R. (2000) Distribution and status of the Eastern Pygmy Possum (Cercartetus nanus) in New South Wales. *Aust Mammal.* In press.

Bravery, J. A. (1971) Sight record of Uniform Swiftlet at Atherton, Qld. *Emu,* 71:182.

Bureau of Meteorology (2020) *Groundwater Dependent Ecosystems Atlas*.
Website: http://www.bom.gov.au/water/groundwater/gde/.
Website Accessed: May 2020.

Carter, O. (2010) *National Recovery Plan for the Spiny Peppercress Lepidium aschersonii*. Department of Sustainability and Environment, Melbourne. In effect under the EPBC Act from 13-Aug-2010.

Cenwest (2009) *Narrabri Mine EPBC Referral – Fauna Survey and Assessment*. Prepared for Whitehaven Coal Limited.

Chan, K. (2001) Partial migration in Australian landbirds: a review. *Emu,* 101:281-292.

Chantler, P. (1999) Apodidae (swifts) species accounts. In: del Hoyo, J., Elliott, A. and Sargatal, J., eds. *Handbook of the Birds of the World. Barn-owls to Hummingbirds,* 5:419-457.

Coventry, P. (1989) Comments on airborne sightings of White-throated Needletails *Hirundapus caudacutus*. *Australian Bird Watcher*, 13:36-37.

Cramp, S. (1985) *Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palearctic. Volume 4.* Oxford: Oxford University Press.

Cumberland Ecology (2011) *Maules Creek Coal Project Ecological Assessment.* Prepared for Hansen Bailey.

Department of Agriculture, Water and the Environment (2020a) *Directory of Important Wetlands of Australia.* Website: http://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands.
Website Accessed: April 2020.

Department of Agriculture, Water and the Environment (2020b) *New South Wales Bilateral Agreement Information*. Website: https://www.environment.gov.au/protection/environment-assessments/bilateral-agreements/nsw. Website Accessed: April 2020.

Department of Agriculture, Water and the Environment (2020c) *Species Profile and Threats Database.*
Website: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.
Website Accessed: April 2020.

Department of Agriculture, Water and the Environment (2020d) *EPBC Act Protected Matters Search Tool.* Database search within the following area: -30.5424 149.82982, -30.54388 149.88887, -30.62279 149.89231, -30.61836 149.82639, -30.5424 149.82982. Website Accessed: May 2020.

Department of Agriculture, Water and the Environment (2020e) *National Flying-fox monitoring viewer*.
Website: http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf.
Website Accessed: May 2020.

Department of Environment and Climate Change (2007) *Terrestrial Vertebrate Fauna of the Greater Southern Sydney Region: Volume 2 Species of Conservation Concern and Priority Pest Species.* A joint project between the Sydney Catchment Authority and the Department of Environment and Climate Change Parks and Wildlife Division.

Department of Environment and Climate Change (2008a) *Recovery plan for the koala (Phascolarctos cinereus).* Prepared by the New South Wales Department of Environment and Climate Change, November 2008.

Department of Environment and Climate Change (2008b) *Statement of Intent – 1: Infection of native plants by Phytophthora cinnamomi*. Prepared by New South Wales Department of Environment and Climate Change, April, 2008.

Department of Environment and Conservation (2004) *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)* Prepared by New South Wales Department of Environment and Conservation, November 2004.

Department of Environment and Resource Management (2011) *National recovery plan for the large-eared pied bat Chalinolobus dwyeri*. Prepared for the Department of Sustainability, Environment, Water, Population and Communities, 2011.

Department of Planning, Industry and Environment (2019a) *Biodiversity Assessment Method: Draft for Exhibition – 2019.* Prepared by the New South Wales Department of Planning, Industry and Environment, September 2019.

Department of Planning, Industry and Environment (2019b) *Biodiversity Assessment Method Operational Manual.* Prepared by the New South Wales Department of Planning, Industry and Environment, September 2019.

Department of Planning, Industry and Environment (2019c) *Guidance to assist a decision-maker to determine a serious and irreversible impact*. Prepared by the New South Wales Department of Planning, Industry and Environment, September 2019.

Department of Planning, Industry and Environment (2019d) *Ancillary Rules for use of Mine Site Ecological Rehabilitation as an Offset.* Final Draft for Publishing Review.

Department of Planning, Industry and Environment (2020a) *BioNet Atlas.* Database search within the following area: *-30.5992 149.775, -30.5992 149.9683, -30.4325 149.9683, -30.4325 149.775*.
Website Accessed: April 2020.

Department of Planning, Industry and Environment (2020b) *BioNet Vegetation Classification*.
Website: http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?ReturnUrl=%2fNSWVCA20PR ap%2fdefault.aspx.
Website Accessed: April 2020.

Department of Planning, Industry and Environment (2020c) *NSW Wetlands.*
Website: https://data.nsw.gov.au/data/ dataset/nsw-wetlands047c7.
Website Accessed: April 2020.

Department of Planning, Industry and Environment (2020d) *BioNet Threatened Biodiversity Data Collection*.
Website: http://www.environment.nsw.gov.au/AtlasApp/UI_Modules/TSM_/Default.aspx.
Website Accessed: April 2020.

Department of Planning, Industry and Environment (2020e) *Threatened Species Profile Database*.
Website: https://www.environment.nsw.gov.au/threatenedspeciesapp/.
Website Accessed: April 2020.

Department of Planning, Industry and Environment (2020f) *Biodiversity Offsets and Agreement Management System (BOAMS).*
Website: https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/biodiversity-offsets-and-agreement-management-system.
Website Accessed May 2020.

Department of Planning, Industry and Environment (2020g) *Koala Habitat Protection Guideline: Implementing State Environmental Planning Policy (Koala Habitat Protection) 2019.* Published by the New South Wales Department of Planning, Industry and Environment, March 2020.

Department of Primary Industries (2012) *Risk Assessment Guidelines for Groundwater Dependent Ecosystems: Volume 1 – The conceptual framework.* Prepared by the New South Wales Department of Primary Industries, Office of Water.

Department of Primary Industries (2013) *Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management*. Published by the New South Wales Department of Primary Industries, Department of Trade and Investment, Regional Infrastructure and Services.

Department of Primary Industries (2015) *Myrtle Rust in Australia*. Prepared by New South Wales Department of Primary Industries, July 2015.

Department of Primary Industries – Water (2016) *Methods for the identification of high probability groundwater dependent vegetation ecosystems.* Published by the Department of Primary Industries, a Division of New South Wales Department of Industry, Skills and Regional Development, September 2016.

Department of Primary Industries – Water (2020)
Website: https:// www.dpi.nsw.gov.au/about-us/publications/pdi/2018/water.
Website Accessed: April 2020.

Department of Sustainability, Environment, Water, Population and Communities (2011a) *Survey Guidelines for Australia's Threatened Mammals – Guidelines for Detecting Mammals listed as Threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia, 2011.

Department of Sustainability, Environment, Water, Population and Communities (2011b) *Survey Guidelines for Australia's Threatened Reptiles – Guidelines for Detecting Reptiles listed as Threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia, 2011.

Department of Sustainability, Environment, Water, Population and Communities (2012) *Approved Conservation Advice for Phascolarctos cinereus (combined populations in Queensland, New South Wales and the Australian Capital Territory).* Department of Sustainability, Environment, Water, Population and Communities, Canberra. In effect under the EPBC Act from 02-May-2012.

Department of the Environment (2013) *Matters of National Environmental Significance Significant Impact Guidelines 1.1.* Commonwealth of Australia, 2013.

Department of the Environment (2014) *EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory).* Commonwealth of Australia, 2014.

Department of the Environment (2015a) *Conservation Advice Anthochaera phrygia regent honeyeater.* Department of the Environment, Canberra. In effect under the EPBC Act from 08-Jul-2015.

Department of the Environment (2015b) *Conservation Advice Grantiella picta painted honeyeater.* Department of the Environment, Canberra. In effect under the EPBC Act from 08-Jul-2015.

Department of the Environment (2015c) *Threat abatement plan for predation by feral cats*. Commonwealth of Australia, Canberra. In effect under the EPBC Act from 23-Jul-2015.

Department of the Environment (2016) *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia).* Commonwealth of Australia, Canberra. In effect under the EPBC Act from 04-May-2016.

Department of the Environment and Energy (2016) *Threat abatement plan for competition and land degradation by rabbits*. Commonwealth of Australia, Canberra, January 2016.

Department of the Environment and Energy (2017) *Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (Sus scrofa)*. Commonwealth of Australia, Canberra, March 2017.

Department of the Environment and Energy (2018) *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Regions) - States and Territories.*
Website: http://www.environment. gov.au/land/nrs/science /ibra/australias-bioregions-maps.
Website Accessed: April 2020.

Department of the Environment and Energy (2019) *Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains.* Department of the Environment and Energy, Canberra. In effect under the EPBC Act from 04-Jul-2019.

Department of the Environment, Water, Heritage and the Arts (2008a) *Approved Conservation Advice for Pseudomys pilligaensis (Pilliga Mouse).* Department of the Environment, Water, Heritage and the Arts, Canberra. In effect under the EPBC Act from 26-Mar-2008.

Department of the Environment, Water, Heritage and the Arts (2008b) *Approved Conservation Advice for Tylophora linearis.* Department of the Environment, Water, Heritage and the Arts, Canberra. In effect under the EPBC Act from 01-Oct-2008.

Department of the Environment, Water, Heritage and the Arts (2008c) *Threat abatement plan for competition and land degradation by unmanaged goats*. Commonwealth of Australia, Canberra, 2008.

Department of the Environment, Water, Heritage and the Arts (2008d) *Threat abatement plan for predation by the European red fox*. Commonwealth of Australia, Canberra. In effect under the EPBC Act from 01-Oct-2008.

Department of the Environment, Water, Heritage and the Arts (2010a) *Survey Guidelines for Australia's Threatened Bats – Guidelines for Detecting Bats listed as Threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia, 2010.

Department of the Environment, Water, Heritage and the Arts (2010b) *Survey Guidelines for Australia's Threatened Birds – Guidelines for Detecting Birds listed as Threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia, 2010.

Dingle, H. (2004) The Australo-Papuan bird migration system: another consequence of Wallace's Line. *Emu*, 104:95-108.

Ditton Geotechnical Services (2020) *Mine Subsidence Assessment for the Narrabri Underground Mine Stage 3 Extension Project.* Prepared for Narrabri Coal Operations Pty Ltd.

Donato, D. B., Nichols, O., Possingham, H., Moore, M., Ricci, P. F., & Noller, B. N. (2007) A critical review of the effects of gold cyanide-bearing tailings solutions on wildlife. *Environment International*, 33(7):974-984.

Doody, T. M., Hancock, P. J. and Pritchard, J. L. (2019) *Information Guidelines Explanatory Note: Assessing groundwater-dependent ecosystems*. Report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment and Energy, Commonwealth of Australia 2019.

Draffan, R. D. W., Garnett, S. T. and Malone, G. J. (1983) Birds of the Torres Strait: an annotated list and biogeographic analysis. *Emu*, 83:207-234.

Eco Logical Australia (2012) *Narrabri Mine LW 101 – 103: Biodiversity Management – Baseline Monitoring.* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2013a) *Narrabri Mine LW 101 – 103: Biodiversity Management – 2012 Monitoring Report*. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2013b) *Narrabri Mine LW 101 – 103: Biodiversity Management – 2013 Monitoring Report.* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2014) *Narrabri Mine Tree Health Assessment (LW101-103).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015a) *Narrabri Mine LW 101 – 105: Biodiversity Management – 2014 Monitoring Report (Volume 1).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015b) *Narrabri Mine LW 101 – 105: Biodiversity Management – 2014 Monitoring Report (Volume 2).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015c) *Narrabri Mine LW 101 – LW106: Biodiversity Management – 2015 Monitoring Report (Volume 1).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015d) *Narrabri Mine LW 101 – W106: Biodiversity Management – 2015 Monitoring Report (Volume 2).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016a) *Narrabri Mine LW101-LW106: Biodiversity – 2016 Monitoring Report*. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016b) *Narrabri South Exploration Program - Flora and Fauna Impact Assessment.* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016c) *Narrabri Mine Biodiversity Offsets – Spring 2016 Monitoring Report (Volume 2 – Appendices)* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016d) *Narrabri Gas Project – Ecological Impact Assessment*. Prepared for Santos New South Wales (Eastern) Pty Ltd.

Eco Logical Australia (2017a) *Narrabri Mine LW101-LW106: Biodiversity – 2016 Monitoring Report (Volume 2 – Appendices).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2017b) *Narrabri Mine Biodiversity Offset – Spring 2016 Monitoring Report (Volume 1)* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2018a) *Narrabri Mine On-site Biodiversity Offset Area – Monitoring 2017.* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2018b) *Narrabri Mine LW101-LW106 Biodiversity – 2017 Monitoring Report.* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2018c) *Narrabri Mine LW101-LW106 Biodiversity – 2018 Monitoring Report.* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2018d) *LW107 to LW110 Annual Monitoring Report 2018.* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2019a) *Narrabri Mine Biodiversity Management Plan (LW107 to LW110).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2019b) *Narrabri Mine Rehabilitation Management Plan (LW101 to LW110).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2019c) *Narrabri Mine Land Management Plan (LW107 to LW110).* Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2019d) *Fauna Surveys South of the Narrabri Underground Mine.* Prepared for Whitehaven Coal Limited.

Eco Logical Australia (2019e) *Flora Surveys South of the Narrabri Underground Mine.* Prepared for Whitehaven Coal Limited.

Eco Logical Australia (2020) *LW101-LW106 Biodiversity – 2019 Monitoring Report Narrabri Mine Annual Monitoring.* Prepared for Narrabri Coal Operations Pty Ltd.

Ecotone Ecological Consultants (2007) *Narrabri Coal Project Ecological Assessment.* Prepared for Whitehaven Coal Limited.

Ecotone Ecological Consultants (2009) *Narrabri Mine Stage 2 Longwall Project. Flora and Fauna Impact Assessment.* Prepared for Whitehaven Coal Limited.

Ellis, M. V. (2001) *Extension to the known range of the Eastern Cave Bat Vespadelus troughtoni (Kitchener, Jones and Caputi 1987) into the Brigalow Belt South Bioregion in New South Wales.* The Australasian Bat Society Newsletter, Number 16, March 2001. Prepared for the New South Wales National Parks and Wildlife Service.

Emison, W. B., Beardsell, F. I., Norman, F. I., Loyn, R. H. and Bennett, S. C. (1987) *Atlas of Victorian Birds.* Melbourne: Department of Conservation (Forest & Lands) & Royal Australian Ornithological Union.

Fairfull, S. and Witheridge, G. (2003) *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings.* NSW Fisheries, Cronulla.

FloraSearch (2009) *Narrabri Mine EPBC Referral – Supplementary Flora Survey and Assessment.* Prepared for Whitehaven Coal Limited.

Fly By Night Bat Surveys Pty Ltd (2004) *Monitoring of the Bat Fauna of Ulan Underground Coal Mine Lease and Rehabilitation Areas of Ulan Open Cut Coal Mine during 2004.* Prepared for Mount King Ecological Surveys, December 2004.

Forster, P. I., Binns, D. and Robertson, G. R. (2004) Rediscovery of *Tylophora linearis* P. I. Forst. (Apocynaceae: Asclepiadoideae) from New South Wales, with revision of its conservation status to vulnerable. *Austrobaileya*, 6(4): 941-947.

Francis, M. J., Spooner, P. G., & Matthews, A. (2015) The influence of urban encroachment on squirrel gliders (Petaurus norfolcensis): effects of road density, light and noise pollution. *Wildlife Research*, 42(4):324-333.

GHD (2017) *Inland Rail Programme Narrabri to North Star Project Environmental Impact Statement.* Prepared for the Australian Government.

GHD (2019) *Narrabri 120 MW Solar Farm Environmental Impact Statement.* Prepared for Silverleaf Solar Farm Pty Ltd.

Hansen Bailey (2010) *Continuation of Boggabri Coal Mine Environmental Assessment.* Prepared for Boggabri Coal Pty Limited.

Hoye, G. A. (2005) *Recovery plan for the large-eared pied bat Chalinolobus dwyeri*. Prepared by Fly By Night Bat Surveys Pty Ltd for the Queensland Parks and Wildlife Service, Brisbane.

Hunter Gas Pipeline Pty Ltd (2008) *Queensland Hunter Gas Pipeline Environmental Assessment.* Prepared for the Australian Government.

Jacobs Group Australia (2020) *Narrabri Underground Mine Stage 3 Extension Project Air Quality and Greenhouse Gas Assessment.* Prepared for Narrabri Coal Operations Pty Ltd.

Kaseloo, P.A. (2005) *Synthesis of Noise Effects on Wildlife Populations.* Department of Biology, Virginia State University.

Keith, D. (2004) *Ocean Shores to Desert Dunes: the native vegetation of New South Wales and the ACT*. Prepared for the New South Wales National Parks and Wildlife Service, Sydney.

Keith, D. A. (2000) Sampling designs, field techniques and analytical methods for systematic plant population surveys. *Ecological Management and Restoration*, 1:125-139.

Landcom (2004) *Managing Urban Stormwater, Soils and Construction.*

Landmark Ecological Services (2012) *The Ecological Values of the Pilliga East Forest and the Threats Posed by Coal Seam Gas Mining 2011-2012.* A report prepared for the Northern Inland Council for the Environment and the Coonabarabran and Upper Castlereagh Catchment and Landcare Group.

Law, B., Chidel, M. and Mong, A. (2005) Life under a sandstone overhang: the ecology of the eastern cave bat *Vespadelus troughtoni* in northern New South Wales. *Australian Mammalogy*, 27:137-145.

Learmonth, N. F. (1951) More observations on swifts. *Emu*, 51:151-152.

McDonald, N. H. E. (1938) Notes on swifts. *Emu*, 38:339.

Mitchell, P. (2002) *NSW Landscapes Mapping: Background and Methodology*. Prepared for the New South Wales National Parks and Wildlife Service.

Narrabri Coal Operations Pty Ltd (2016) *Bushfire Prevention Standard.* Prepared for Whitehaven Coal Limited.

Narrabri Coal Operations Pty Ltd (2018) *Narrabri Mine 2017 Annual Review*. Prepared for Whitehaven Coal Limited.

Narrabri Coal Operations Pty Ltd (2019) *Bushfire Prevention Trigger Action Response Plan*. Prepared for Whitehaven Coal Limited.

National Parks and Wildlife Service (2002) *Bertya sp. Cobar-Coolabah (Cunningham & Milthorpe s.n., 2/8/73) Recovery Plan.* Prepared by the New South Wales National Parks and Wildlife Service, July 2002.

New South Wales Rural Fire Service (2015) *Guide for Bush Fire Prone Land Mapping Version 5b.* Published by the State of New South Wales through the New South Wales Rural Fire Service, November 2015.

New South Wales Legislative Council (2020) *Koala Populations and Habitat in New South Wales / Portfolio Committee No. 7 – Planning and Environment [Sydney, N.S.W.]: The Committee, 2020. [xviii, 291 pages; 30 cm. (Report no. 3 / Portfolio Committee No. 7 – Planning and Environment).*

North West Land Services (2017) *North West Regional Strategic Weed Management Plan 2017-2022.* Prepared for the New South Wales Local Land Services, June 2017.

Office of Environment and Heritage (2016a) *NSW Guide to Surveying Threatened Plants*. Prepared by the New South Wales Office of Environment and Heritage, February 2016.

Office of Environment and Heritage (2016b) *State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0. VIS_ID 4467.*
Website: https://www.environment.nsw.gov.au/vegetation/ state-vegetation-type-map.htm.
Website Accessed: April 2020.

Office of Environment and Heritage (2017a) *Biodiversity Assessment Method*. Prepared by the New South Wales Office of Environment and Heritage, August 2017.

Office of Environment and Heritage (2017b) *Ancillary Rules: Biodiversity Conservation Actions*. Prepared by the New South Wales Office of Environment and Heritage, August 2017.

Office of Environment and Heritage (2017c) *Ancillary Rules: Impacts on Threatened Species and Ecological Communities Excluded from Application of Variation Rules*. Prepared by the New South Wales Office of Environment and Heritage, August 2017.

Office of Environment and Heritage (2017d) *Ancillary Rules: Reasonable Steps to Seek Like-For-Like Biodiversity Credits*. Prepared by the New South Wales Office of Environment and Heritage, August 2017.

Office of Environment and Heritage (2018a) *'Species credit' Threatened Bats and their Habitats – NSW Survey Guide for the Biodiversity Assessment Method*. Prepared by the New South Wales Office of Environment and Heritage, September 2018.

Office of Environment and Heritage (2018b) *Saving our species: Glossy black-cockatoo, Calyptorhynchus lathami*. Prepared by the New South Wales Office of Environment and Heritage, August 2018.

Office of Environment and Heritage (2018c) *Saving our species: Superb parrot, Polytelis swainsonii*. Prepared by the New South Wales Office of Environment and Heritage, August 2018.

Office of Environment and Heritage (2018d) *Saving our Species Database*. New South Wales Department of Planning, Industry and Environment.
Website: https://www.environment.nsw.gov.au/savingourspecies app/default.aspx.

Office of Environment and Heritage (2018e) *Code of Practice for Injured, Sick and Orphaned Koalas*. Management plan prepared by the New South Wales Office of Environment and Heritage, 2018.

Palaris (2020) *Narrabri South – Surface Disturbance Review*.

Phillips, S. and Callaghan, J. (2011) The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus. *Australian Zoologist, 35*(3): 774-780.

Radle, A.L. (2007) *The Effect of Noise on Wildlife: A Literature Review*. College of Education, University of Oregon, Eugene, Oregon.

Resource Strategies (2018) *Vickery Extension Project - Biodiversity Assessment Report and Biodiversity Offset Strategy*. Prepared for Whitehaven Coal Limited.

Richardson, S., Irvine, E., Froend, R., Boon, P., Barber, S. and Bonneville, B. (2011) *Australian groundwater-dependent ecosystems toolbox part 1: assessment framework.* Waterlines report, National Water Commission, Canberra.

Scientific Committee (2008) *Tylophora linearis – vulnerable species listing.* NSW Scientific Committee – final determination.
Website: https://www.environment.nsw.gov.au/Topics/Animals-and-plants/Threatened-species/NSW-Threatened-Species-Scientific-Committee/Determinations/Final-determinations/2008-2010/Tylophora-linearis-vulnerable-species-listing.
Website Accessed: May 2020.

Scientific Committee (2009) *Bertya opponens – vulnerable species listing.* NSW Scientific Committee – final determination.
Website: https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2008-2010/bertya-opponens-vulnerable-species-listing.
Website Accessed: May 2020.

Scientific Committee (2010) *Regent honeyeater (Anthochaera phrygia) – critically endangered species listing.* NSW Scientific Committee – final determination.
Website: https://www.environment.nsw.gov.au/Topics/ Animals-and-plants/Threatened-species/NSW-Threatened-Species-Scientific-Committee/Determinations /Final-determinations/2008-2010/Regent-Honeyeater-Anthochaera-phrygia-critically-endangered-species-listing.
Website Accessed: May 2020.

Summers, P. D., Cunnington, G. M., & Fahrig, L. (2011) Are the negative effects of roads on breeding birds caused by traffic noise? *Journal of Applied Ecology*, 48(6):1527-1534.

Tarburton, M. K. (1993) Radiotracking a White-throated Needletail to roost. *Emu*, 93:121-124.

Tarrawonga Coal Pty Ltd (2012) *Tarrawonga Coal Project Environmental Assessment.*

Templeton, M. T. (1991) Birds of scientific area S.A.16, Marbletop, Nanango, Queensland. *Sunbird*, 21:19-25.

Threatened Species Scientific Committee (2012a) *Commonwealth Listing Advice on Chalinolobus dwyeri (Large-eared Pied Bat).* Prepared for the Department of Sustainability, Environment, Water, Population and Communities, Canberra. In effect under the EPBC Act from 29-Jun-2012.

Threatened Species Scientific Committee (2012b) *Listing advice for Phascolarctos cinereus (Koala).* In effect under the EPBC Act from 02-May-2012.

Threatened Species Scientific Committee (2012c) *Commonwealth Listing Advice on Pseudomys pilligaensis (Pilliga Mouse).* Department of Sustainability, Environment, Water, Population and Communities, Canberra. In effect under the EPBC Act from 29-Jun-2012.

Threatened Species Scientific Committee (2015) *Conservation Advice Nyctophilus corbeni south-eastern long-eared bat.* Department of the Environment, Canberra. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2016a) *Conservation Advice – Bertya opponens*. Department of the Environment, Commonwealth of Australia, November 2016. In effect under the EPBC Act from 16-Dec-2016.

Threatened Species Scientific Committee (2016b) *Conservation advice Polytelis swainsonii superb parrot*. Department of the Environment, Canberra. In effect under the EPBC Act from 02-May-2016.

Threatened Species Scientific Committee (2019) *Conservation Advice Hirundapus caudacutus White-throated Needletail*. Department of the Environment and Energy, Canberra. In effect under the EPBC Act from 04-Jul-2019.

Warham, J. (1962) Bird islands within the Barrier Reef and Torres Strait. *Emu*, 62:99-111.

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

WRM Water & Environment (2020) *Narrabri Underground Mine Stage 3 Extension Project – Surface Water Assessment.* Prepared for Narrabri Coal Operations Pty Ltd.

Wylie, F.R., Johnston, P.J.M. and Eisemann, R.L. (1992) *A Survey of Native Tree Dieback in Queensland*. Forest Research Institute Research Paper No. 16. DPI, Brisbane.

ATTACHMENT A

PEER REVIEW LETTER

Whitehaven Coal Limited
10 Kurrajong Creek Rd
BAAN BAA NSW 2390

Attention: Mark Vile

10 October 2020

Dear Mark

NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT
BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT PEER REVIEW

Whitehaven Coal has asked me to review the Biodiversity Development Assessment Report (BDAR) and associated Biodiversity Offset Strategy developed for the Narrabri Underground Mine Stage 3 Extension Project (the Project) by Resource Strategies Pty Ltd.

I hold Biodiversity Assessment Method (BAM) assessor accreditation (BAAS 17004) as provided for under the NSW *Biodiversity Conservation Act 2016* (BC Act). A bi-lateral agreement means that a BAM can also include assessment of impacts on matters of national significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In reviewing the BDAR, I aimed to ensure that it met the BAM and EPBC Act guidelines for assessing the residual impact of the Project on threatened biodiversity. As well as assessing that it accurately reflected the findings of the baseline flora and fauna reports, and provided a feasible and realistic biodiversity offset strategy.

My review comments/corrections have been incorporated to my satisfaction and I consider that the BDAR comprehensively addresses the requirements of the BAM and EPBC Act guidelines.

I have no conflicts of interest in conducting this review.

Yours Sincerely,
HUNTER ECO

Colin Driscoll

Dr Colin Driscoll
Environmental Biologist

HUNTER ECO · ABN 25 112 984 240
PO Box 1047, Toronto, NSW 2283 **Phone/Fax** +61 2 4959 8016 **Mobile** 0438 773 029 **Email** cd_enviro@bigpond.com

Contact Details

PO Box 1047
Toronto NSW 2283

Mobile 0438 773029
Email cd_enviro@bigpond.com

Qualifications

BSc (Lond)
PhD (Newcastle) "*The ecology of reproduction and propagation in a rare plant,* Tetratheca juncea."

Plant Sciences Group
School of Environmental and Life Sciences
University of Newcastle Australia

Employment History

Mar 2007 – current	Independent environmental consultant trading as HUNTER ECO.
Jan 2001 – Mar 2007:	Senior Environmental Biologist with EcoBiological.
1983 – 2000	Part-time environmental consultant.
1977 – 1983	Environmental assessments for the Electricity Commission of NSW through TUNRA along with work towards MSc (Newcastle).
1976 – 1977	Commenced working towards MSc (Biology, Newcastle) Topic: The reproductive biology and ecology of the Sugar Glider (*Petaurus breviceps*).
1967 – 1975	Researcher and Deputy Director Australasian Food Research Laboratories (a division of Sanitarium).

Professional Associations

Australian Network for Plant Conservation
Ecological Society of Australia

Licenses

NPWS Scientific Licence SL101245 valid to October 2020
NSW Biobanking Assessor 0011
NSW BAM Assessor Accreditation BAAS17004 valid to 13/09/2021

Affiliation

The University of Queensland
School of Agriculture and Food Sciences
Adjunct Senior Fellow

ECOLOGY & BIOLOGY

Primary areas of expertise are in the fields of botany and vegetation ecology although I did start my career as a fauna person so have a good knowledge of birds and mammals and a fair knowledge of amphibians and reptiles. Current and past projects and research involve the following:

- Vegetation community classification and mapping
- Threatened flora species monitoring
- Translocation of threatened plant species
- Population density assessment of rare plants
- Rare plant breeding systems
- Pollinator-plant interactions
- Rare plant habitat suitability modelling
- Groundwater Dependent Ecosystems
- Distribution and function of biological soil crusts across Australia's north

TARGETED THREATENED PLANT POPULATION COUNTS

Targeted population counts have been conducted for the following threatened species:

- *Acacia bynoeana*
- *Angophora inopina*
- *Cymbidium canaliculatum*
- *Diuris tricolor*
- *Grevillea parviflora* subsp. *parviflora*
- *Hibbertia procumbens*
- *Melaleuca biconvexa*
- *Ozothamnus tesselatus*
- *Pomaderris queenslandica*
- *Rutidosis heterogama*
- *Senecio spathulata*
- *Tetratheca juncea*
- *Tylophora linearis*

GIS & DATA ANALYSIS

In association with the ecological consultancy and research work, a comprehensive range of skills has been acquired in spatial data management, analysis and presentation using various Geographical Information Systems (GIS), along with other analytical tools. Main programs used are Manifold System GIS, Surfer, SAGA GIS, QGIS, Global Mapper, Primer 7+PERMANOVA, Minitab 19 and several vector and raster handling programs. Capabilities include:

- Georeferencing of aerial images
- Development of digital terrain models
- Visual fields analysis
- Hydrology
- Topography
- Landform analysis
- Lidar data manipulation
- Spatial data management and analysis
- Presentation maps
- Similarity analysis
- Statistical analysis

LEGISLATION

Familiar with the relevant requirements of the following:

Commonwealth
Environment Protection & Biodiversity Conservation Act 1999
Environment Protection and Biodiversity Conservation Regulations 2000
JAMBA, CAMBA & RoKAMBA migratory bird agreements

NSW
Environmental Planning and Assessment Act 1979
Environmental Planning and Assessment Amendment (Biodiversity Conservation) Regulation 2017
National Parks and Wildlife Act 1974
Biodiversity Conservation Act 2016
Biodiversity Conservation Regulation 2017
Biodiversity Assessment Method Order 2017
Water Management Act 2000
Relevant State Environment Planning Policies.
Local Government requirements.

Projects

The following describe the range of work conducted:

- Review of Environmental Factors
- Preparation of Biodiversity Development Assessment Reports and Biodiversity Stewardship Assessment Reports
- Ecological constraints assessment
- Threatened species assessment
- Groundwater Dependent Ecosystems assessment
- Preparation of ecological management and monitoring plans
- Implementation of ecological management and monitoring plans
- Targeted threatened plant surveys, population counts and density assessments
- Threatened plant habitat suitability modelling
- Translocation of threatened plants
- Approved by NSW Department of Planning as an independent specialist auditor of mining ecological management and monitoring programmes

Clients include:

- Extractive industries such as mining and quarrying
- Resource exploration companies
- Local, State (NSW) and Commonwealth Government

Major clients:

- BHP (Mount Arthur and Caroona)
- The Bloomfield Group
- Centennial Coal (Awaba, Cooranbong, Myuna, Mandalong, Newstan)
- Cockatoo Coal (Bylong Valley exploration)
- Peabody Energy (Wilpinjong and Wambo)
- MACH Energy (Mt Pleasant)
- Malabar Coal (Maxwell)
- Whitehaven Coal (Maules Creek, Narrabri, Tarrawonga and Vickery)
- Yancoal (Abel, Donaldson and Tasman)
- Glencore (Mangoola)
- Newcrest Mining
- CleanTEQ
- Newcastle Coal Infrastructure Group
- Lake Macquarie City Council
- NSW Department of Industry Planning and the Environment

Independent Biodiversity Auditor

Biodiversity component within: Independent Environmental Audit – NCIG Export Coal Loader Kooragang Island January 2014 & January 2015 Report prepared by: Trevor Brown & Associates Applied Environmental Management Consultants 3 Forwood Crescent Bundanoon NSW 2578

Peer Reviews

Peer review of annual monitoring reports; Biodiversity Management Plans; Biodiversity Assessment Reports and Biodiversity Offset Strategies; Biodiversity Development Assessment Rorts and Biodiversity Stewardship Site Assessment Reports.

NSW Land & Environment Court (expert witness)

DCR Property Consultants -v- Great Lakes Council Land & Environment Court Proceedings No. 10263 of 2003. Premises: Lot 474, DP95462, Parish of Carrington.

ProTen Karuah Limited ats The Karuah Action Group. Land and Environment Court Proceedings No 10653 of 2004.

Geographic Area

The majority of my work is in Central and Eastern New South Wales with research projects also conducted across Queensland and into the Northern Territory.

Academic

The University of Newcastle, Australia, honours students

A. T. Blundell (2003) *The Powerful Owl* (Ninox strenua) *in Disturbed Environments.*

D. Landenberger (2003) *Defining the Niche of* Tetratheca juncea.

A. Jones (2011) *Conservation genetics and its application to the threatened native shrub* Tetratheca juncea.

The University of Queensland, Gatton, research

Team member (2019 -) *Boosting natural regeneration of nitrogen in grazing lands.*

Reports

Driscoll, C. (2006) Acacia bynoeana: *a review of species information*. Unpublished Report prepared for the Department of Environment and Conservation, Newcastle. EcoBiological. June 2006.

Driscoll, C. (2009) *A review of the ecology and biology of* Tetratheca juncea *Sm. (Elaeocarpaceae*). Prepared for Lake Macquarie City Council. November 2009.

Driscoll C. (2013) *The ecology of* Grevillea Parviflora subsp. parviflora, *a review*. Report prepared for Lake Macquarie City Council March 2013.

Driscoll, C. & Bell, S.A.J. (2008) *The Experimental Translocation of* Tetratheca juncea *Sm. (Elaeocarpaceae) at Gwandalan, Wyong Shire*. Report to Crighton Properties Pty Ltd, Wyong Shire Council, NSW Department of Environment & Climate Change. December 2008.

Peer-reviewed

Bell, S.A.J. & Driscoll, C. (2005) New records for the endangered *Hibbertia procumbens* from the Central Coast of NSW. *Australasian Plant Conservation* 13(4): 24-25.

Bell, S.A.J. & Driscoll, C. (2006) Vegetation of the Tomago and Anna Bay Sandbeds, Port Stephens, New South Wales: Management of Ground Water Dependent Ecosystems. Part 1 – Vegetation Classification. Unpublished Report to Hunter Water. Eastcoast Flora Survey. August 2006.

Bell, S.A.J. & Driscoll, C. (2007) Vegetation of the Cessnock-Kurri Region, Cessnock LGA, New South Wales: Survey, Classification & Mapping. Unpublished Report to Department of Environment & Climate Change. Eastcoast Flora Survey. November 2007.

Bell, S.A.J. & Driscoll, C. (2014) *Acacia pendula* (Weeping Myall) in the Hunter Valley of New South Wales: early explorers' journals, database records and habitat assessments raise doubts over naturally occurring populations. *Cunninghamia* 14: (2014) 179–200

Bell, S.A.J. & Driscoll, C. (2016) Hunter Valley Weeping Myall Woodland – is it really definable and defendable with and without Weeping Myall (*Acacia pendula*)? Cunninghamia 16: 15-30.

Bell, S.A.J. & Driscoll, C. (2017) *Acacia wollarensis* (Fabaceae, Mimosoideae sect. Botrycephalae), a distinctive new species endemic to the Hunter Valley of New South Wales, Australia. Telopea 20:125-136.

Bell, S.A.J. and Driscoll, C. (2020) Data-informed Sampling and Mapping: an approach to ensure plot-based classifications locate, classify and map rare and restricted vegetation types. *Australian Journal of Botany*, in press.

Bell, S., Branwhite, B., & Driscoll, C. (2005) *Thelymitra adorata* Jeanes ms (Orchidaceae): population size and habitat of a highly restricted orchid from the Central Coast of New South Wales. *The Orchadian* 15 (1): 6-10.

Driscoll, C. & Bell, S.A.J. (2006) Vegetation of the Tomago and Anna Bay Sandbeds, Port Stephens, New South Wales: Management of Ground Water Dependent Ecosystems. Part 2 – Groundwater Dependency. Unpublished Report to Hunter Water. Eastcoast Flora Survey. August 2006.

Bell, S., Peake, T., and Driscoll, C. (2007) Dealing with taxonomic uncertainty in Weeping Myall *Acacia pendula* from the Hunter catchment, New South Wales. *Australasian Plant Conservation* 16(1) 14 – 15.

Driscoll, C. (2003) The Pollination Ecology of *Tetratheca juncea* (Tremandraceae): finding the pollinators. *Cunninghamia* 8(1):133-140.

Williams, W.J., Budel, B., & Driscoll, C. (2008) *Biogeography and Biodiversity of Biological Soil Crusts across Queensland*. Australian Rangeland Society. 15th Biennial Conference, Charter's Towers. September 2008.

Williams, W.J., Driscoll, C., Williams, S. & Ezzy, L. (2014) *Ecosystem engineers of the micro-savannah. A study of biological soil and rock crusts with a special focus on cyanobacteria from Pungalina-Seven Emu Nature Reserve, Northern Territory*. Report prepared for Australian Wildlife Conservancy.

Williams, W., Chilton, A., Schneemilch, M., Williams, S., Neilan, B. and Driscoll, C. (2019) Microbial biobanking – cyanobacteria-rich top soil facilitates mine rehabilitation. *Biogeosciences*, 16, 2189–2204.

ATTACHMENT B

NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT – FLORA SURVEY REPORT

Narrabri Underground Mine Stage 3 Extension Project – Flora Survey

Prepared by AMBS Ecology & Heritage
for Narrabri Coal Operations Pty Ltd

Final Report

July 2020

AMBS Reference: 18599

Document Information

Citation:	AMBS Ecology & Heritage 2020. *Narrabri Underground Mine Stage 3 Extension Project – Flora Survey*. Consultancy report to Narrabri Coal Operations Pty Ltd.
AMBS Ref:	18599
Versions:	Version 1: Draft Report issued 8 November 2019 Version 2: Draft Report issued 19 December 2019 Version 3: Draft Report issued 28 February 2020 Version 4: Draft Report issued 3 April 2020 Version 5: Final Report issued 27 May 2020 Version 6: Revised Final Report issued 17 June 2020 Version 7: Revised Final Report issued 21 July 2020
Authors:	Ruby Stephens, Michael Somerville, Belinda Pellow
Recipient:	Narrabri Coal Operations Pty Ltd
Approved by:	Belinda Pellow, Mark Semeniuk

Executive Summary

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by Narrabri Coal Operations Pty Ltd to undertake flora surveys for the Narrabri Underground Mine Stage 3 Extension Project.

The scope of this study involves the survey and documentation of native vegetation communities, threatened flora and habitat within a study area in accordance with the Biodiversity Assessment Method 2017. The study area spans the southern portion of the Mining Lease 1609, and mining lease application areas 1 and 2. The western portion of the study area is within native forest and woodland, while the eastern portion consists of semi-cleared agricultural land.

Nine field surveys were undertaken by AMBS in June 2019, July 2019, August 2019, October 2019 and January 2020, in addition to four prior surveys undertaken in September 2017, October 2017, November 2017 and January 2018 by Eco Logical Australia. The primary tasks included verifying and mapping plant community types (PCTs), identifying vegetation condition, collecting vegetation integrity data and completing targeted threatened plant surveys in suitable habitat and during the required survey season.

A total of 472 plant species in 72 families were recorded during surveys to determine the PCTs in the study area. Of these, 375 were native plant species.

This study has confirmed 13 PCTs within the study area:

- PCT 55 *Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions* (60.1 hectares [ha] in good condition and 266.7 ha *Derived Native Grassland* [DNG]);
- PCT 88 *Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion* (284.5 ha in good condition, 10.7 ha in moderate condition and 468.3 ha DNG);
- PCT 141 *Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion* (4.2 ha in good condition);
- PCT 206 *Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion* (37.1 ha in good condition);
- PCT 244 *Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)* (79.1 ha in good condition and 271.7 ha DNG);
- PCT 399 *Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion* (100.0 ha in good condition and 12.7 ha in moderate condition);
- PCT 401 *Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region* (16.6 ha in good condition);
- PCT 404 *Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests* (1,714.3 ha in good condition and 21.4 ha in moderate condition);
- PCT 405 *White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions* (691.1 ha in good condition and 4.6 ha DNG);
- PCT 406 *White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests* (381.1 ha in good condition and 15.0 ha in moderate condition);
- PCT 408 *Dirty Gum (Baradine Gum) – Black Cypress Pine – White Bloodwood shrubby woodland of the Pilliga forests and surrounding region* (14.8 ha in good condition);

- PCT 432 *Dwyer's Red Gum - Dirty (Baradine) Gum - Cypress Pine shrubby woodland of the Narrabri region of the Brigalow Belt South Bioregion* (25.8 ha in good condition); and
- PCT 435 *White Box – White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion* (151.0 ha in good condition, 3.8 ha in moderate condition and 203.9 ha DNG).

One Threatened Ecological Community was identified in the study area, namely the *Poplar Box Grassy Woodland on Alluvial Plains* listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Approximately 43.1 ha of *Poplar Box Grassy Woodland* occurs in the study area.

The following four threatened plant species were recorded in the study area, all of which are threatened under the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and/or EPBC Act:

- *Bertya opponens* (BC Act - Vulnerable, EPBC Act - Vulnerable);
- *Lepidium aschersonii* (BC Act – Vulnerable, EPBC Act - Vulnerable);
- *Pomaderris queenslandica* (BC Act – Endangered, EPBC Act – Not listed); and
- *Tylophora linearis* (BC Act - Vulnerable, EPBC Act - Endangered).

Species polygons were prepared for *Bertya opponens*, *Lepidium aschersonii* and *Tylophora linearis*. Direct impacts to *Pomaderris queenslandica* are likely to be avoided and a species polygon was not prepared.

Below average rainfall and above average temperatures for most of 2017-2020 and the lack of recent fire, may have limited the ability to detect some potentially occurring threatened plants. However, the below average rainfall did not influence the identification and classification of PCTs and associated Threatened Ecological Communities from which the potential occurrence of threatened plants are derived. All threatened flora species previously known to occur at the Narrabri Mine (through years of survey and monitoring) were detected during the survey work.

Contents

Executive Summary ..... **III**

1 Introduction **1**
1.1 Background 1
1.2 Scope and Objectives 1
1.3 Location of the Study Area 2
1.4 Bioregion and Landscape 2
1.5 Climate 4
1.6 Topography and Drainage 5
1.7 Geology and Soils 5
1.8 Land Use and Disturbance 6
1.9 Fire History 6

2 Methods **8**
2.1 Desktop Review 8
2.2 Field Surveys 8
2.2.1 Weather Conditions 9
2.2.2 Plant Community Type Identification 11
2.2.3 Vegetation Integrity (Site Condition) 12
2.2.4 Threatened Plants 5
2.2.5 Threatened Plant Habitat Assessment and Species Polygons 6
2.3 Threatened Ecological Communities 9
2.4 Groundwater Dependent Ecosystems 9

3 Results **10**
3.1 Plant Community Types 10
3.1.1 Plant Community Descriptions 12
3.2 Threatened Ecological Communities 34
3.3 Groundwater Dependent Vegetation 37
3.4 Threatened Plants Recorded 40
3.4.1 Bertya opponens (BC Act – Vulnerable, EPBC Act - Vulnerable) 40
3.4.2 Lepidium aschersonii (BC Act – Vulnerable, EPBC Act - Vulnerable) 44
3.4.3 Pomaderris queenslandica (BC Act – Endangered, EPBC Act - Not listed) 46
3.4.4 Tylophora linearis (BC Act – Vulnerable, EPBC Act - Endangered) 48
3.5 Other Threatened Plants 50
3.5.1 Commersonia procumbens 50
3.5.2 Cyperus conicus 50
3.5.3 Dichanthium setosum 50
3.5.4 Digitaria porrecta 51
3.5.5 Diuris tricolor 51
3.5.6 Homoranthus darwinioides 52
3.5.7 Monotaxis macrophylla 52
3.5.8 Polygala linariifolia 52
3.5.9 Pterostylis cobarensis 53
3.5.10 Swainsona murrayana 53
3.5.11 Swainsona sericea 54
3.5.12 Zieria ingramii 54
3.6 Exotic Species and High Threat Weeds 55

4 Conclusion **56**

Bibliography **58**

Appendix A: Flora Species List **61**

Appendix B: Output of Floristic Analysis **74**

Appendix C: Vegetation Integrity Plot Data **81**

Appendix D: Threatened Plant Records **89**

Tables

Table 2.1 Survey timing and personnel....8
Table 2.2 Experience and qualifications of survey personnel....9
Table 2.3 Weather conditions during the survey periods....10
Table 2.4 Plant Community Types, associated condition states and the number of vegetation integrity plots surveyed....2
Table 2.5 Predicted threatened plants for the study area and their survey requirements (OEH 2016, DPIE 2020e)....6
Table 3.1 Confirmed PCTs, condition states and their extent in the study area....10
Table 3.2 Threatened ecological community equivalence....36
Table 3.3 GDEs in the GDE Atlas (BoM 2020) as they relate to PCTs in the study area....37
Table 3.4 Threatened species recorded in the study area....40
Table 3.5 High Threat Weeds Recorded....55

Figures

Figure 1.1 Location Map....3
Figure 1.2 Annual average rainfall recorded at Narrabri West Post Office, 1961 – 2017 and Narrabri Airport AWS for 2018-2019 showing the variation relative to the long-term average of 658.5 mm (Source: BoM 2019)....4
Figure 1.3 Known disturbance history of the study area (Source: Forestry Corporation of NSW, NPWS 2019, NCOPL 2018)....7
Figure 2.1 Location of vegetation integrity plots/full floristic plots in the study area....4
Figure 2.2 Threatened plant survey effort....8
Figure 3.1 Plant community types mapped in the study area....11
Figure 3.2 Threatened ecological communities in the study area....35
Figure 3.3 *Bertya opponens* records, species polygon and potential habitat....43
Figure 3.4 *Lepidium aschersonii* records and species polygon habitat in the study area....45
Figure 3.5 *Pomaderris queenslandica* records and potential habitat in the study area....47
Figure 3.6 *Tylophora linearis* records and species habitat habitat in the study area....49

Plates

Plate 3.1 Example of PCT 55 woodland in good condition....13
Plate 3.2 Example of PCT 55 *Derived Native Grassland*....14
Plate 3.3 Example of PCT 88 woodland in good condition....15
Plate 3.4 Example of PCT 88 woodland in moderate condition....15
Plate 3.5 Example of PCT 88 *Derived Native Grassland*....16
Plate 3.6 Example of PCT 141 shrubland in good condition....17
Plate 3.7 Example of PCT 206 woodland in good condition....18
Plate 3.8 Example of PCT 244 woodland in good condition....20
Plate 3.9 Example of PCT 244 *Derived Native Grassland*....20
Plate 3.10 Example of PCT 399 woodland in good condition....21
Plate 3.11 Example of PCT 399 woodland in moderate condition....22
Plate 3.12 Example of PCT 401 woodland in good condition....23
Plate 3.13 Example of PCT 404 woodland in good condition....24
Plate 3.14 Example of PCT 404 woodland in moderate condition....25
Plate 3.15 Example of PCT 405 woodland in good condition....26
Plate 3.16 Example of PCT 405 woodland in moderate condition....26
Plate 3.17 Example of PCT 406 woodland in good condition....28
Plate 3.18 Example of PCT 406 woodland in moderate condition....29
Plate 3.19 Example of PCT 408 woodland in good condition....30
Plate 3.20 Example of PCT 432 woodland in good condition....31
Plate 3.21 Example of PCT 435 woodland in good condition....32
Plate 3.22 Example of PCT 435 woodland in moderate condition....33
Plate 3.23 Example of PCT 435 *Derived Native Grassland*....33

1 Introduction

1.1 Background

The Narrabri Mine is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah within the Narrabri Shire Council Local Government Area of New South Wales (NSW) (Figure 1.1). The Narrabri Mine is operated by Narrabri Coal Operations Pty Limited (NCOPL).

NCOPL is seeking a new State significant development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (NSW) for the Narrabri Underground Mine Stage 3 Extension Project (the Project). This Flora Survey Report forms part of the Environmental Impact Statement (EIS), which has been prepared to accompany the development application for the Project.

The Project involves an extension to the south of the approved underground mining area to gain access to additional coal reserves within mining lease application (MLA) areas 1 and 2, an extension of the mine life to 2044, and development of supporting surface infrastructure. ROM coal production would occur at a rate of up to 11 million tonnes per annum, consistent with the currently approved limit.

A detailed description of the Project is provided in Section 2 in the Main Report of the EIS. The proposed indicative surface development footprint is shown on Figure 1.1.

1.2 Scope and Objectives

The scope of work for this study involves the survey and documentation of native vegetation communities, threatened ecological communities (TECs), and threatened plants and habitat within the study area. The objectives of the study include the following:

- description of plant community types (PCTs) within the study area, including:
  - species relied upon for identification of vegetation type and relative abundance;
  - justification of evidence used to identify a PCT; and
  - mapping of the extent of vegetation communities within the study area, including cleared areas;
- identification and mapping of TECs according to the relevant State and Commonwealth listings under the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act);
- vegetation integrity (VI) assessment, including:
  - mapping vegetation condition;
  - collection of data from plot locations relative to PCTs; and
  - provision of field data sheets and tabulated spatial data, consistent with the Biodiversity Assessment Method (BAM) (Office of Environment and Heritage [OEH] 2017);
- survey for predicted threatened plants listed under the BC Act and EPBC Act in the study area, including:
  - compiling a list of candidate species to survey;
  - assessment of habitat based on vegetation communities verified in the study area and relevant databases/literature;
  - targeted survey based on accepted methodology and documenting the effort, timing and weather conditions;
  - collection of quantitative data for species found, by either count or area as required for each species; and
    - description and mapping of predicted threatened plant habitats.

1.3 Location of the Study Area

The study area is shown on Figure 1.1. It occupies an area of approximately 5,426 hectares (ha) and spans the southern part of the Mining Lease (ML) 1609 and MLA areas 1 and 2.

1.4 Bioregion and Landscape

The study area lies within the NSW botanical division of the North Western Plains, within the Brigalow Belt South (BBS) Interim Biogeographic Regionalisation for Australia (IBRA) bioregion, and the Pilliga and Liverpool Plains IBRA subregions (Thackway & Cresswell 1995, Department of the Environment and Energy [DEE] 2020). The native vegetation of the region generally consists of the Pilliga Outwash Dry Sclerophyll Forests and Western Slopes Dry Sclerophyll Forests vegetation classes of Keith (2006).

The eastern portion of the study area is within the Liverpool Plains subregion and the western portion is located within the Pilliga subregion. This adjoins the Pilliga Outwash subregion to the west. Land to the east consists of flats mostly cleared for agriculture, while to the west an extensive area of native vegetation occurs within the Pilliga East State Forest and adjoining reserves.

The elevation across the study area ranges from approximately 280 metres (m) above sea level (ASL) in the flatter plains to the east to almost 400 m ASL on the rock ridges to the west.

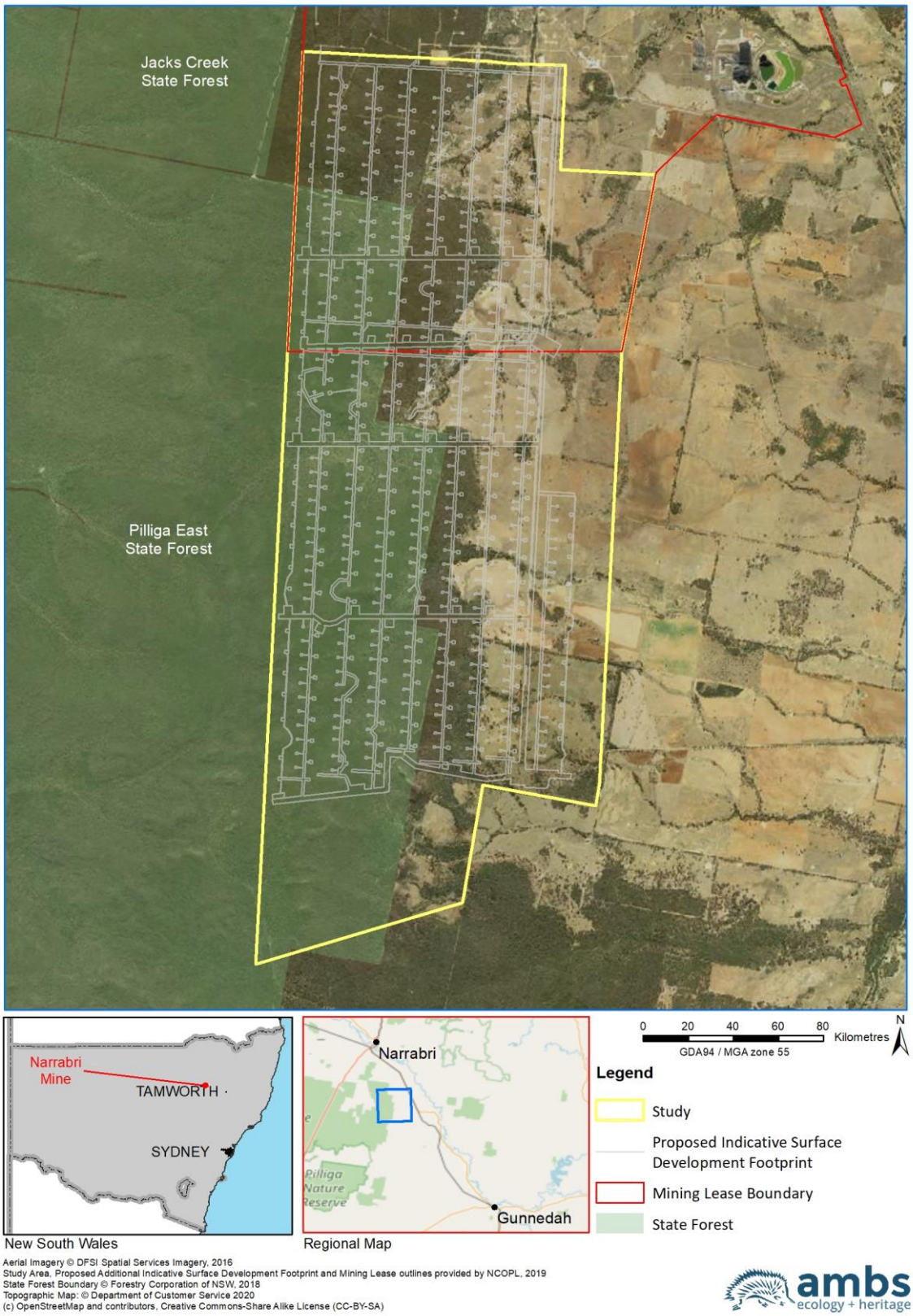


Figure 1.1 Location Map

1.5 Climate

Weather records were obtained from the nearby Commonwealth Bureau of Meteorology (BoM) weather stations at Narrabri West Post Office (Station ID 053030) and Narrabri Airport Automatic Weather Station (AWS) (Station ID 054038), both located approximately 25 km north of the study area. Data displayed in Figure 1.2 below is taken from the Narrabri West Post Office, except for 2018-2019 where data was incomplete and data from the Narrabri Airport AWS was used.

The locality receives an average of about 658.5 millimetres (mm) of rainfall per annum, based on the long-term average between 1891 and 2017 (BoM 2019). Higher rainfall tends to occur in spring and summer with lower rainfall in autumn and winter.

Rainfall varies widely from year to year, as shown in Figure 1.2, with a lowest recorded total annual rainfall of 206.2 mm (in 2019) and a highest of 1,012.1 mm (in 1969). The seven years from 2013 to 2019 had below average annual rainfall, and 2019 recorded the lowest annual rainfall since 1961.

Average monthly temperatures range between a minimum of 3.7 degrees Celsius (°C) and a maximum of 33.8°C. The warmest month is usually January (mean monthly maximum 33.8°C, mean minimum 19.3°C) and the coolest is July (mean maximum 18.0 °C, mean minimum 3.7 °C) (Narrabri West Post Office 1962-2002 data, BoM 2019).

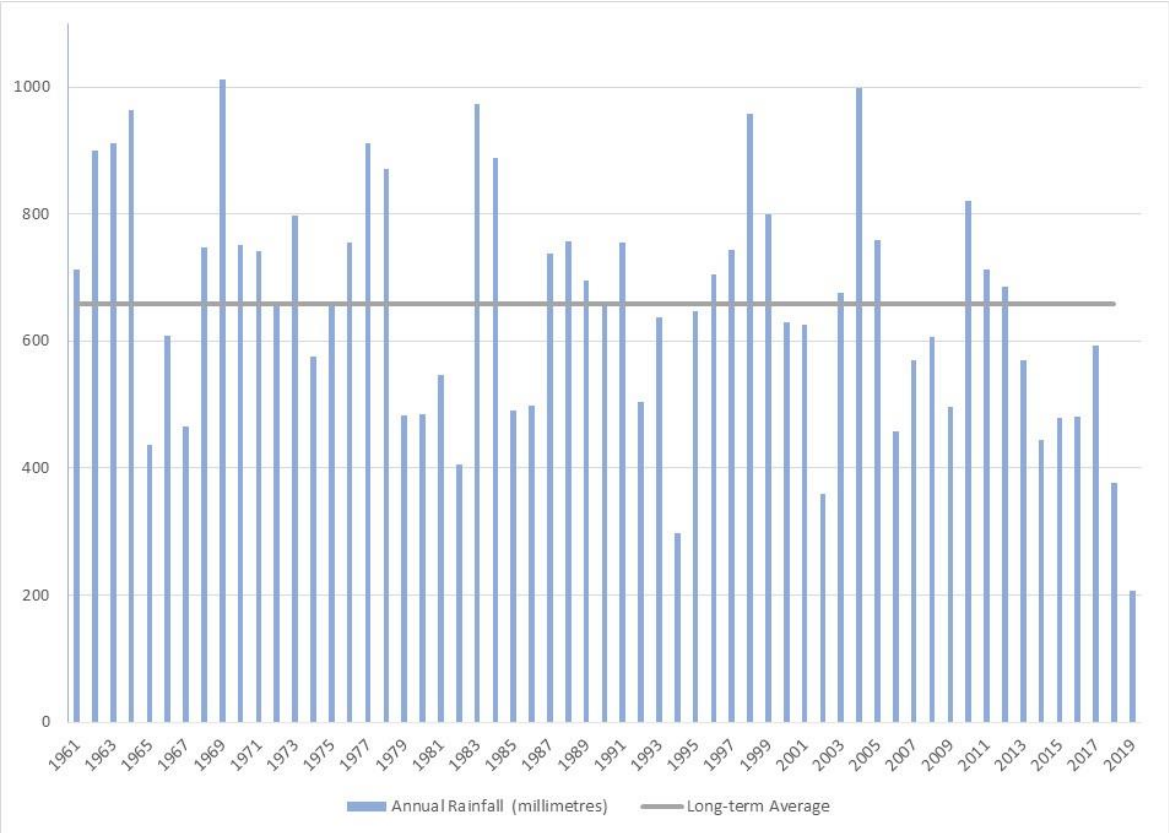


Figure 1.2 Annual average rainfall recorded at Narrabri West Post Office, 1961 – 2017 and Narrabri Airport AWS for 2018-2019 showing the variation relative to the long-term average of 658.5 mm (Source: BoM 2019)

1.6 Topography and Drainage

Natural drainage in the study area consists of several first-, second- and third-order ephemeral drainage lines, flowing generally to the east. During the majority of survey work, drainage lines in the study area were dry. The major drainage line within the study area is Kurrajong Creek, which drains from the higher sandstone areas in the west, into the Namoi River. The drainage lines are distinguished by slight depressions or a minor creek channel, and by a variation in vegetation structure. For example, vegetation near drainage lines was often characterised by low, shrubby *Melaleuca* and *Leptospermum* thickets.

1.7 Geology and Soils

The Pilliga subregion consists of the Pilliga sandstones, limited shales, and localised basalt caps and plugs (e.g. the Warrumbungles). Soils are derived from these geologies, with soils in the eastern portion of the study area composed of more loam and clay, as opposed to the sandier soils in the western portion (DPIE 2020g).

The study area is within the Mitchell Landscapes of the Bugaldie and Cubbo Uplands. In general terms, the Bugaldie Uplands consist of (Mitchell 2002):

> *Stepped stony ridges on Jurassic quartz sandstone with some conglomerate, shale and occasional interbedded basaltic volcanic rocks. General elevation 350 to 490m local relief 50 to 150m, extensive joint controlled stream network. Abundant outcrop on ridge tops with thin discontinuous soils with stony, sandy profiles and low nutrients. Down slope texture-contrast soils are more common typically with harsh clay subsoils and deep uniform or gradational yellow-brown sands on the valley floors. Patches of green mallee (Eucalyptus viridis) and white mallee (Eucalyptus dumosa), clumps of curracabah (Acacia concurrens) and motherumbah (Acacia cheelii) amongst ironbark (Eucalyptus sideroxylon) and black cypress pine (Callitris endlicheri) with shrubby understorey including rusty spider flower (Grevillea floribunda), mint bush (Prostanthera sp.), nodding blue lily (Stypandra glauca) and rock fern (Cheilanthes sieberi) on ridges and stony slopes. Narrow-leaved ironbark (Eucalyptus crebra), red stringybark (Eucalyptus macrorhyncha), black cypress pine (Callitris endlicheri), brown (white) bloodwood (Corymbia trachyphloia) and rough-barked apple (Angophora floribunda) on the sandy flats. White box (Eucalyptus albens) and Port Jackson fig (Ficus rubiginosa) occur on the volcanics.*

Whilst the Cubbo Uplands consist of:

> *Pilliga horizontal Jurassic quartz sandstones, limited shales, Tertiary basalt caps and plugs plus the sediments derived from these rocks. Stepped sandstone ridges with low cliff faces and high proportion of rock outcrop. Long gentle outwash slopes intersected by sandy streambeds and prior stream channels. A few patches of heavy clay. General elevation 400 to 550m, local relief 50m. On sandstone, the ridge tops have thin discontinuous soils with stony, sandy profiles and low nutrients. Down slope texture-contrast soils are more common typically with harsh clay subsoils and in the valley floors sediments tend to be sorted into deep sands with yellow earthy profiles, harsh grey clays, or more texture-contrast soils with a greater concentration of soluble salts. The sandstone outcrop areas support various forests and woodlands including; blue-leaved ironbark (Eucalyptus fibrosa ssp. nubila), scribbly gum (Eucalyptus rossii), black cypress pine (Callitris endlicheri), whitewood (Atalaya hemiglauca), and rough-barked apple (Angophora floribunda). Stony hills in the north of the region carry mallee patches with; silver-leaved ironbark (Eucalyptus melanophloia), spotted gum (Corymbia maculata), and smooth-barked apple (Angophora costata). Gentler sandstone slopes over most of the region carry; narrow-leaved ironbark (Eucalyptus crebra), white cypress pine (Callitris glaucophylla), red stringybark (Eucalyptus macrorhyncha), patches of green mallee (Eucalyptus viridis) and*

broombush heath (Melaleuca uncinata). In western and northern sections on texture-contrast or more uniform harsh clay soils forests of Pilliga box (Eucalyptus pilligaensis), grey box (Eucalyptus microcarpa), bimble box (Eucalyptus populnea), and fuzzy box (Eucalyptus conica) are found with stands of bull oak (Allocasuarina luehmannii), rosewood (Alectryon oleifolium), whitewood (Atalaya hemiglauca), wilga (Geijera parviflora), belah (Casuarina cristata), yarran (Acacia homalophylla), and budda (Eremophila mitchellii).

1.8 Land Use and Disturbance

The western portion of the study area is within native forest and woodland, while the eastern portion consists of semi-cleared agricultural land. Vegetation condition in the eastern portion is variable, in some locations small patches of remnant trees occur while in others the land has been completely cleared. A large expanse of native vegetation also occurs in land to the west of the study area within the Pilliga reserves and some private land.

Disturbance in the past within the study area is likely to have consisted mainly of logging for timber (probably targeting *Eucalyptus crebra* [Narrow-leaved Ironbark], *Eucalyptus fibrosa* [Red Ironbark], *Callitris endlicheri* [Black Cypress Pine] and *Callitris glaucophylla* [White Cypress Pine]). Data provided by the Forestry Corporation of NSW indicates harvesting events in State Forest compartments subject to Exploration Licence 6243 took place in 1978/79, 1980/81 and 2000/01 (Figure 1.3). Due to the low-nutrient (sandstone-derived) soils and the predominantly shrubby vegetation with minimal grass cover, there has probably been low use of the western portion of the study area for livestock. In general, there are very few to no weeds.

1.9 Fire History

The Pilliga landscape is subject to occasional, large and intense wildfires. Fire history is likely to have influenced the current patterns of vegetation in parts of the study area, including understorey composition. The even-aged stands of Acacia (e.g. *Acacia burrowii* [Burrow's Wattle]) are an indication of past fire which, in shrubby dry sclerophyll forests, can result in the mass germination of seeds present in the soil seedbank. Other evidence of past fires included charring on the trunks of large trees and old epicormic regrowth in the canopy (with old dead branches), indicating that at least some areas had been burnt in the past by intense wildfire. The vegetation structure (tall, even-aged shrub thickets) in some areas are an indication that the last fire was some decades ago.

Based on the available fire history (National Parks and Wildlife Service [NPWS] 2019), the northern part of the study area was burnt by a wildfire in 1985-86; the central and southern parts of the study area were burnt by a wildfire in 1982-83 and a prescribed burn in 1991-92 (Figure 1.3). In summary, the northernmost section of the study area (north of Pine Creek) has apparently not been burnt for 33 years or more, and much of the remainder of the study area has not burnt for at least 27 years.

An area of approximately 57 ha within the Jacks Creek State Forest, located a few kilometres to the north of the study area boundary was burnt by an unplanned fire in February 2017. This fire did not spread onto the study area (ML 1609 land) (NCOPL 2018).

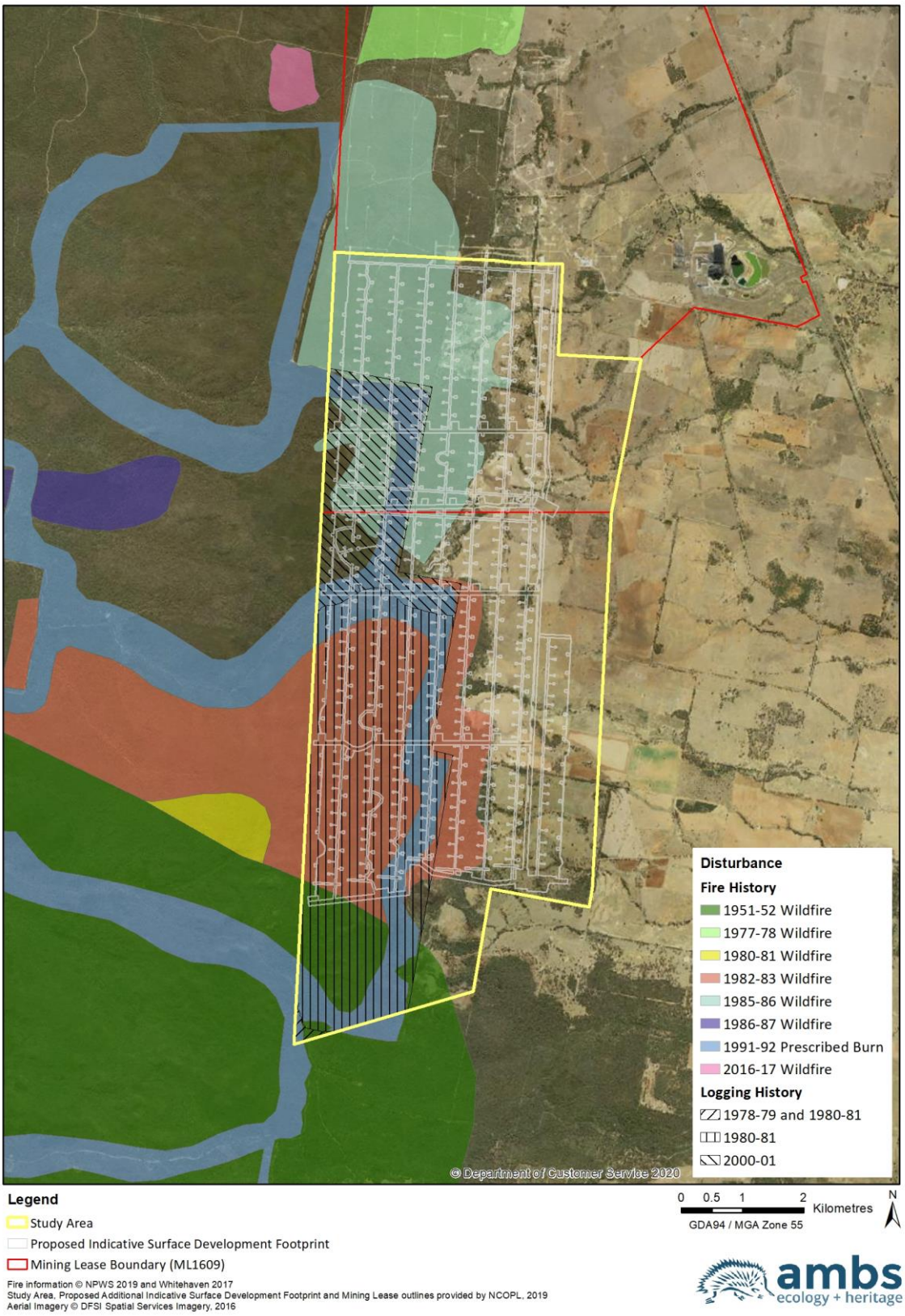


Figure 1.3 Known disturbance history of the study area (Source: Forestry Corporation of NSW, NPWS 2019, NCOPL 2018)

2 Methods

2.1 Desktop Review

A desktop study of ecological information and local reports was conducted prior to undertaking field surveys. This included review of:

- previous vegetation mapping (Ecotone 2009);
- Border Rivers Gwydir/Namoi Region 2.0 VIS 4467 vegetation map (Department of Planning, Industry and Environment [DPIE] 2020d);
- previous flora and fauna reports for the existing Narrabri Mine and Narrabri Mine Biodiversity Offsets areas (Eco Logical Australia [ELA] 2012a, ELA 2013a, ELA 2013b, ELA 2015a, ELA 2015b, ELA 2015c, ELA 2016a, ELA 2016b, ELA 2016c, ELA 2016d, ELA 2018a, ELA 2018b, AMBS 2019);
- previous report for a portion of the study area by ELA (ELA 2019);
- previous records of threatened species available on the *BioNet Atlas* (DPIE 2020a) and from the *Atlas of Living Australia* (ALA) (ALA 2019); and
- species profiles for predicted threatened species and TECs available on the *EPBC Act Protected Matters Search Tool* and *Threatened Biodiversity Data Collection* (DEE 2019, DPIE 2020a and 2020e).

2.2 Field Surveys

Flora surveys were undertaken during 2017 and 2018 by ELA and, subsequently, by AMBS in 2019 and 2020. The field surveys primarily included verifying and mapping PCTs, identifying vegetation condition, collecting vegetation integrity (BAM) data and completing targeted threatened species surveys in suitable habitat and during the required survey season, in accordance with the BAM (OEH 2017). A summary of the field survey months, tasks and personnel are provided in Table 2.1. Personnel experience and qualifications are given below and in Table 2.2.

Field surveys undertaken by AMBS were supervised by Michael Somerville. Michael is a botanist with over 14 years' professional experience and specialist technical knowledge in the field. Michael is an accredited BAM assessor.

Table 2.1 Survey timing and personnel

Survey dates	Tasks	Personnel
26-29 September 2017	PCT Mapping, Vegetation integrity plots, Threatened plant surveys	Nicole McVicar, Justin Russel (ELA)
16-24 October 2017	PCT Mapping, Vegetation integrity plots, Threatened plant surveys	Gordon Patrick, Nicole McVicar, Justin Russel, Ronald Hill (ELA)
20-23 November 2017	PCT Mapping, Vegetation integrity plots, Threatened plant surveys	Nicole McVicar, Ronald Hill (ELA)
22-24 January 2018	PCT Mapping, Vegetation integrity plots, Threatened plant surveys	Martin Sullivan, David Allworth, Tom Kelly, Mick Lawrie (ELA)
17-21 June 2019	Scoping	Michael Somerville (AMBS)
1-5, 16-20 July 2019	PCT Mapping, Vegetation integrity plots	Michael Somerville, Ruby Stephens, Tom O'Sullivan (AMBS)
5-9 August 2019	PCT Mapping, Vegetation integrity plots	Michael Somerville, Diane Callaghan (AMBS)
1-8, 15-22 October 2019, 28 Oct – 2 Nov 2019	Threatened plant surveys	Michael Somerville, Ruby Stephens, Diane Callaghan, Tom O'Sullivan, Kate Hammill, James Schlunke, Daniel Clarke, Charlotte Mills, Pandora Holliday, Alicia Cooper, Neil Ross (AMBS)

Survey dates	Tasks	Personnel
7-12, 19-22 January 2020	Threatened plant surveys, Vegetation integrity plots	Michael Somerville, Tom O'Sullivan, James Schlunke, Charlotte Mills, Alicia Cooper, Neil Ross (AMBS)

Table 2.2 Experience and qualifications of survey personnel

Name	Company	Qualifications	Experience
Martin Sullivan	ELA	Bachelor of Science Accredited BAM Assessor	15 years' experience
Nicole McVicar	ELA	Bachelor of Environmental Science Accredited BAM Assessor	12 years' experience
David Allworth	ELA	Bachelor of Natural Resources	14 years' experience
Gordon Patrick	ELA	Bachelor of Environmental Science Accredited BAM Assessor	18 years' experience
Justin Russel	ELA	Bachelor of Horticultural Science	14 years' experience
Tom Kelly	ELA	Bachelor of Science	3 years' experience
Mick Lawrie	ELA	Bachelor of Environmental Science and Management Master of Environment	4 years' experience
Ronald Hill	ELA	Bachelor of Environmental Science	2 years' experience
Michael Somerville	AMBS	Bachelor of Science Graduate Diploma in Natural Resource Management Accredited BAM Assessor	14 years' experience
Ruby Stephens	AMBS	Bachelor of Science (Honours) Certificate III Conservation and Land Management	6 years' experience
Diane Callaghan	AMBS	Bachelor of Science Master of Science (Plant Biology)	9 years' experience
James Schlunke	AMBS	Bachelor of Science (Honours) PhD Accredited BAM Assessor	10 years' experience
Charlotte Mills	AMBS	Bachelor of Environmental Science PhD (submitted 2019)	7 years' experience
Daniel Clarke	AMBS	Bachelor of Science (Honours) Certificate IV General Horticulture	14 years' experience
Tom O'Sullivan	AMBS	Master of Environmental Studies	24 years' experience
Kate Hammill	AMBS	Bachelor of Science (Honours) PhD Accredited BAM Assessor	16 years' experience
Pandora Holliday	AMBS	Bachelor of Science (Honours)	7 years' experience
Alicia Cooper	AMBS	Bachelor of Science (in progress 2019) Certificate III Conservation and Land Management	6 years' experience
Neil Ross	AMBS	Bachelor of Science (Honours)	4 years' experience

2.2.1 Weather Conditions

Weather conditions during the survey period as recorded at the Narrabri Mine AWS ('M4') are displayed in Table 2.3. Below average rainfall and above average temperatures for most of 2017-2020 and the lack of recent fire, may have limited the ability to detect some potentially occurring threatened plants, including *Cyperus conicus*, *Diuris tricolor* (Pine Donkey Orchid), *Monotaxis macrophylla* (Large-leafed Monotaxis), *Polygala linariifolia* (Native Milkwort), *Pterostylis cobarensis* (Cobar Rustyhood), *Swainsona murrayana* (Slender Darling Pea) and *Tylophora linearis*. However, the below average rainfall did not influence the identification and classification of PCTs and associated Threatened Ecological Communities.

Table 2.3 Weather conditions during the survey periods

Survey	Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
ELA PCT Mapping, Vegetation integrity plots, Threatened plant surveys	26/09/2017	11.1	28.5	0
	27/09/2017	14.5	33.2	0
	28/09/2017	15.6	28.8	0.4
	29/09/2017	10.6	26.9	0.2
ELA PCT Mapping, Vegetation integrity plots, Threatened plant surveys	16/10/2017	13.7	27.5	0
	17/10/2017	14.9	29	0
	18/10/2017	14.2	31.2	0
	19/10/2017	13.4	30.2	0
	20/10/2017	15.4	23.6	4.2
	21/10/2017	12.7	22.7	13
	22/10/2017	9.9	26.2	0
	23/10/2017	9.6	25.7	0
	24/10/2017	11.1	28.1	0
ELA PCT Mapping, Vegetation integrity plots, Threatened plant surveys	20/11/2017	14.3	28.2	0
	21/11/2017	14.2	27.8	1.8
	22/11/2017	13.3	29.8	0
	23/11/2017	14.3	29	0
ELA PCT Mapping, Vegetation integrity plots, Threatened plant surveys	20/01/2018	20.8	40.6	0
	21/01/2018	20.1	39.4	0
	22/01/2018	23.8	40	0
	23/01/2018	26.1	38.9	0
	24/01/2018	26	39.6	0
AMBS Scoping	17/06/2019	3.4	16.7	0
	18/06/2019	5.9	18.1	0
	19/06/2019	1.6	16.1	0
	20/06/2019	0.8	16.6	0
	21/06/2019	-2.1	13.2	0
AMBS PCT Mapping, Vegetation Integrity Plots	1/07/2019	4.6	21.9	0
	2/07/2019	5	20	0
	3/07/2019	5	21.9	0
	4/07/2019	7.9	20.9	0
	5/07/2019	7.2	21.7	0
AMBS PCT Mapping, Vegetation Integrity Plots	16/07/2019	0.1	17.1	0
	17/07/2019	1.6	17	0
	18/07/2019	3	16.8	0
	19/07/2019	-0.6	15.9	0
	20/07/2019	2.8	20.3	0
AMBS PCT Mapping, Vegetation Integrity Plots	5/08/2019	2.7	21.8	0
	6/08/2019	1.5	21.9	0
	7/08/2019	3.2	21.5	0
	8/08/2019	7.7	22.9	0
	9/08/2019	5.4	18.1	0
AMBS Threatened plant surveys	1/10/2019	12.6	26.9	0
	2/10/2019	9.4	27.3	0
	3/10/2019	10.1	29.1	0
	4/10/2019	11	32.4	0
	5/10/2019	13.4	29.6	0
	6/10/2019	15.6	35	0
	7/10/2019	22.7	38.1	0
	8/10/2019	13.1	27.9	0
AMBS Threatened plant surveys	15/10/2019	17	33.3	0
	16/10/2019	14.9	35.8	0.4
	17/10/2019	14.3	31.7	0
	18/10/2019	9.6	27.6	0
	19/10/2019	6.7	29.3	0
	20/10/2019	11.7	24.8	0
	21/10/2019	12.8	27.4	0
	22/10/2019	14.4	29.6	0

Survey	Date	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall (mm)
AMBS Threatened plant surveys	28/10/2019	12.3	29.9	0
	29/10/2019	15.4	30.2	0
	30/10/2019	18.4	26.3	0
	31/10/2019	17.4	30.9	0
	1/11/2019	16.3	31.5	0
	2/11/2019	20.3	31.5	0
AMBS Threatened plant surveys	7/01/2020	23.1	37.3	0
	8/01/2020	23.9	39.4	0
	9/01/2020	25.2	41.8	2.8
	10/01/2020	22.7	39.8	0
	11/01/2020	23.3	36.1	0
	12/01/2020	19	34.2	0
AMBS Threatened plant surveys	19/01/2020	19.1	32.6	0
	20/01/2020	21.7	38.2	0
	21/01/2020	16.6	34.8	0
	22/01/2020	17.5	39.6	0

2.2.2 Plant Community Type Identification

The distribution of PCTs in the study area was identified and mapped in accordance with *BioNet Vegetation Classification* (DPIE 2020c) and the BAM (OEH 2017). The existing information on native vegetation in the study area and surrounding locality was reviewed (Section 2.1) and the survey was designed to sample the entire study area and the expected environmental variation. The following information sources and approaches were used to prepare the PCT map:

- current aerial imagery of the study area was used to interpret variations in vegetation;
- existing mapping (DPIE 2020d) for the Brigalow Belt South, Nandewar and Western New England Tablelands Bioregions was used to identify candidate PCTs and assisted in understanding the vegetation patterns in the study area and in the wider landscape;
- descriptions of candidate PCTs in the *BioNet Vegetation Classification* (DPIE 2020c) and Benson *et al.* (2010), including species composition, structure and associated landforms, were reviewed in relation to the field observations; and
- previous PCT mapping for a portion of the study area by ELA (ELA 2019).

A total of 169 full floristic plots (ELA and AMBS) were surveyed for the purpose of developing a PCT map and assessing site condition (Figure 2.1). The data collected from these plots were quantitively analysed along with 161 pre-existing data from plots within a 10 km radius of the study area held in the *BioNet Systematic Flora Survey* (DPIE 2020b). PCTs in the study area were assigned using the output from the analyses (dendrogram showing clustered relationships between groups of plots) with a best-fit approach applied to the output groups, using a comparison of the PCT descriptions published in the *BioNet Vegetation Classification* (DPIE 2020c). The dendrogram from the cluster analysis and a table showing interpretation of the resulting groups are included in Appendix B.

Data from plots in derived native grassland (DNG) and other modified landscapes were included in the analysis; however, due to the low level of floristic data within them these were mostly assigned individually to a PCT based on landscape position, soils, paddock trees and surrounding vegetation. Floristic and structural data from 456 strategically located rapid data point plots were used to finalise PCT boundaries in the study area.

Plant species identifications were checked against descriptions and distribution information provided by PlantNet (2020). Some plant identifications were unable to be confirmed due to insufficient material, primarily the results of below-average rainfall. These plants were still able to be assigned to a growth form group and status (native or exotic) and have been included in the collated data for the purposes of the BAM (OEH 2017).

2.2.3 Vegetation Integrity (Site Condition)

Vegetation integrity was determined using floristic and structural data from 159 plots. The location and number of plots were determined using PCTs and the minimum requirements of the BAM (OEH 2017) for the allocation of vegetation integrity plots. Vegetation condition, in combination with PCTs, was used to delineate vegetation zones (Table 2.4) and finalise the number of vegetation integrity plots required. Three categories of condition were used: 'Good' for relatively intact areas; 'Moderate' for areas with a substantially modified canopy; and 'Derived Native Grassland' for previously cleared areas of native grassland. The location of vegetation integrity plots is shown in Figure 2.1 and the data is presented in Appendix C.

The vegetation integrity plots were randomly located by walking a random distance into the designated vegetation zone. Each vegetation integrity plot consisted of a 20 m x 20 m floristic plot nested at one end of a 20 m x 50 m plot. The following data were collected in the 20 m x 20 m plot as per the BAM (OEH 2017):

- identification of all flora species, stratum in which each species occurs and growth form;
- an estimate of the percent (%) foliage cover across the plot of each species rooted in or overhanging the plot;
- a record of the abundance of each species where the cover score was less than or equal to 5% (numbers above 20 are estimates only); and
- a record of whether each species is native, exotic or a high threat exotic (OEH, 2017).

The following data were collected in the 20 m x 50 m plot:

- a record of the number of large trees, tree stem size class, tree regeneration and length of fallen logs; and
- a record of the presence of trees in the 20 m x 50 m plot having diameter at breast height (1.4 m) <5 centimetres (cm), 5–10 cm, 10–20 cm, 20-30 cm, 30–50 cm, 50–80 cm, and 80+ cm.

Table 2.4 Plant Community Types, associated condition states and the number of vegetation integrity plots surveyed

PCT ID	PCT Name	AMBS Name (Figure 2.1)	Condition State	Area (ha)	VI plots required (OEH 2017)	VI plots surveyed	Survey Plot #
55	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	Belah Woodland	Good	60.1	5	5	N3BP0059a, N3BP0076, ELA0084, ELA0002, ELA0053
			DNG	266.7	7	7	N3BP0078, ELA0085, ELA0086, ELA0087, ELA0103, ELA0104, ELA0054
88	Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion	Pilliga Box –Buloke Woodland	Good	284.5	7	11	N3BP2004, N3BP2006, N3BP0058a, ELA0093, ELA0110, ELA0058, ELA0060, ELA0065, ELA0071, ELA0027, ELA0043
			Moderate	10.7	3	3	N3BP0067a, N3BP0068a, N3BP0083
			DNG	468.3	7	13	N3BP0056a, N3BP0069a, ELA0081, ELA0082, ELA0083, ELA0107, ELA0108, ELA0109, ELA0111, ELA0039, ELA0040, ELA0041, ELA0042
141	Broombush – wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	Broombush – Wattle Tall Shrubland	Good	4.2	2	2	N3BP0072, N3BP0073
206	Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Dirty Gum - White Cypress Woodland on Sand Monkeys	Good	37.1	4	4	N3BP0000a, N3BP0055a, N3BP0060a, N3BP0061a
244	Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)	Poplar Box Grassy Woodland	Good	79.1	5	8	N3BP2002, N3BP2003, N3BP0088, ELA0113, ELA0046, ELA0045, ELA0059, ELA0061
			DNG	271.7	7	12	N3BP0007, N3BP2000, N3BP2001, N3BP0051a, ELA0077, ELA0078, ELA0079, ELA0080, ELA0100, ELA0112, ELA0005, ELA0062
399	Red gum – Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga to Goonoo sandstone forests, Brigalow Belt South Bioregion	Red Gum –Tea Tree Creek Woodland	Good	100.0	6	10	N3BP0050a, N3BP0090, ELA0089, ELA0090, ELA0020, ELA0022, ELA0024, ELA0067, ELA0029, ELA0031
			Moderate	12.7	3	3	N3BP0091, ELA0106, ELA0038
401	Rough-barked Apple – Blakely's Red Gum – Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Rough-barked Apple Sand Flat Woodland	Good	16.6	3	3	N3BP0084, ELA0094, ELA0037

PCT ID	PCT Name	AMBS Name (Figure 2.1)	Condition State	Area (ha)	VI plots required (OEH 2017)	VI plots surveyed	Survey Plot #
404	Red Ironbark – White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Red Ironbark - White Bloodwood +/- Burrows Wattle Shrubby Woodland	Good	1,714.3	8	26	N3BP0009a, N3BP0063a, N3BP0064a, ELA0095, ELA0096, ELA0097, ELA0001, ELA0006, ELA0008, ELA0010, ELA0011, ELA0012, ELA0014, ELA0016, ELA0017, ELA0048, ELA0021, ELA0068, ELA0070, ELA0073, ELA0076, ELA0028, ELA0033, ELA0034, ELA0035, ELA0036
			Moderate	21.4	4	5	N3BP0066a, N3BP0070a, N3BP0071, N3BP0074, N3BP0075
405	White Bloodwood – Red Ironbark – Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	White Bloodwood – Red Ironbark – Black Cypress Woodland	Good	691.1	7	9	N3BP0003a, ELA0007, ELA0019, ELA0023, ELA0025, ELA0055, ELA0063, ELA0075, ELA0032
			DNG	4.6	2	2	N3BP0065a, N3BP0092
406	White Bloodwood – Motherumbah – Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland	Good	381.1	7	9	N3BP0054a, ELA0091, ELA0092, ELA0013, ELA0015, ELA0018, ELA0056, ELA0074, ELA0009
			Moderate	15.0	3	3	N3BP0077, N3BP0079, N3BP0080
408	Dirty Gum (Baradine Gum) – Black Cypress Pine – White Bloodwood shrubby woodland of the Pilliga forests and surrounding region	Dirty Gum - Black Cypress Pine - White Bloodwood Shrubby Woodland	Good	14.8	3	4	N3BP0085, N3BP0089, ELA0064, ELA0072
432	Dwyer's Red Gum – Dirty (Baradine) Gum – cypress pine shrubby woodland of the Narrabri region of the Brigalow Belt South Bioregion	Dwyer's Red Gum Shrubby Woodland	Good	25.8	4	6	N3BP0012a, N3BP0086, ELA0003, ELA0044, ELA0047, ELA0049
435	White Box – White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	White Box - White Cypress Woodland	Good	151.0	6	12	N3BP0009, N3BP0053a, ELA0098, ELA0099, ELA0004, ELA0051, ELA0052, ELA0057, ELA0026, ELA0066, ELA0069, ELA0030
			Moderate	3.8	2	2	N3BP0081, N3BP0082
			DNG	203.9	6	10	N3BP0008, N3BP2005, N3BP0057a, N3BP0062a, N3BP0087, ELA0088, ELA0101, ELA0102, ELA0105, ELA0050

Note: Each condition state in a PCT represents a vegetation zone

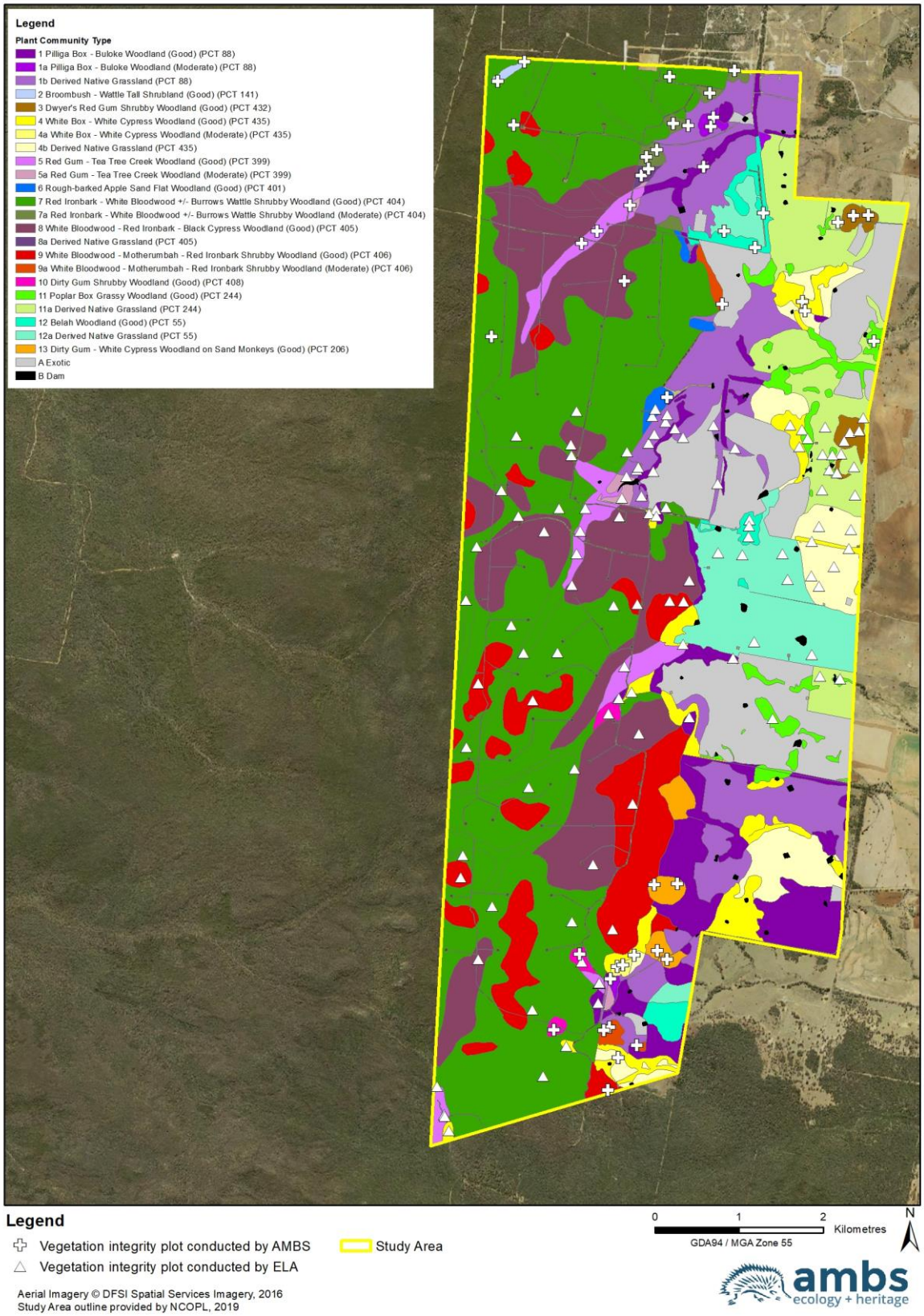


Figure 2.1 Location of vegetation integrity plots/full floristic plots in the study area

2.2.4 Threatened Plants

Targeted surveys for threatened plants were undertaken by ELA in portions of the study area in September, October and November 2017 and January 2018. Surveys involved fixed 100 m transects in predetermined stratification units, which were supplemented with vegetation integrity plot surveys (in accordance with Table 5.2 of the *Threatened Species Survey and Assessment: Guidelines for Developments and Activities (Working Draft)* [Department of Environment and Conservation 2004]). Survey locations were collocated with vegetation integrity plots. Surveys also included opportunistic searches while walking or driving between sites and targeted searches at survey plots. Where only small, isolated populations were identified, the full extent of the population was mapped, and a count was made. A voucher of *Lepidium aschersonii* (Spiny Peppercress) was lodged with the National Herbarium of NSW.

A list of threatened plant species required to be surveyed was identified from the *Threatened Biodiversity Data Collection* (DPIE 2020e). The list was adjusted once PCTs were confirmed and the associated threatened plants could be determined. The growth form, habitat type and survey requirement were then reviewed for each species to plan the appropriate field survey parameters. Targeted threatened plant searches were completed across the study area in selected habitat types. Targeted surveys for threatened plants were undertaken by AMBS in accordance with the BAM (OEH 2017) and *NSW Guide to Surveying Threatened Plants* (OEH 2016)[*] in July, August, October and November 2019 and in January 2020. The survey effort for threatened plants is shown in Figure 2.2. Parallel transects were used in locations identified as potential habitat, within areas of Project proposed indicative surface development footprint. Suitable distances between transects were determined based on the growth form of the target species. Multiple species were searched for simultaneously that occurred in similar habitat and were of the same life form/habit and had the same optimal survey time. A list of threatened plants targeted by the surveys is given in Table 2.5. Opportunistic observations of target threatened plants were made during vegetation integrity plot surveys and random meanders when traversing the study area to access integrity plot locations.

Specimens of threatened plants recorded were collected under licence and examined for identification. For each threatened plant species found, the following was recorded:

- extent of the occurrence within the proposed indicative surface development footprint;
- population count or population estimate within the proposed indicative surface development footprint; and
- the vegetation type, microhabitat and condition of the habitat in which it was found.

During the surveys the population count or population estimate was recorded in the following way. The size of small localised populations was determined by directly counting all stems. If numbers of plants were likely to exceed 100 stems an estimate of the population size was made by extrapolation from a sample of plant density using the area of occupancy methods described by Keith (2000). Surveyors counted the number of stems in randomly placed 5 m x 5 m quadrats which provided an estimate of the density of stems, which was multiplied by the area of occupancy to give a population count estimate. Area of occupancy was determined by recording the outer boundaries of the population within the proposed indicative surface development footprint area with a GPS and then delineating an area based on the location of these points. This method was used in particular for the species *Bertya opponens* (Coolabah Bertya) which occurred in high numbers in the study area.

[*] AMBS notes that a new survey method has been introduced specifically for areas over 50 ha in size in a revised version of the NSW threatened plant survey guidelines (DPIE May 2020). Threatened plant surveys undertaken as part of this assessment followed the previous BAM approved guidelines (OEH 2016) where survey effort was at least as comprehensive as the new method now recommended for areas over 50 ha.

2.2.5 Threatened Plant Habitat Assessment and Species Polygons

The BAM (2017) defines a 'species polygon' as an area of land that contains habitat or is occupied by a threatened species. The BAM (OEH 2017) also defines 'habitat' as an area or areas occupied, or periodically or occasionally occupied, by a species or ecological community, including any biotic or abiotic component.

Threatened plant survey data ('count' and 'area' information) was used to prepare species polygons for the purpose of quantifying and mapping the species extent (i.e. where the species was present), as well as the potential habitat (i.e. areas that contain similar habitat where the species could be, but was not observed on this occasion to be present). Potential habitat included PCTs in which the species was recorded in the study area, as well as predicted PCTs as per the *Threatened Biodiversity Data Collection* (DPIE 2020e).

The following information provided by DPIE was also considered when preparing species polygons:

For species assessed by area of suitable habitat, the species polygon must be mapped around the extent of suitable habitat for the species on the subject land (BAM Paragraph 6.4.1.33). The method and information used to define the area of suitable habitat must be documented in the BAR (e.g. Threatened Biodiversity Data Collection, scientific literature, current or past site surveys, survey of reference populations).

For species where the unit of measure is area of habitat, the threatened plant surveyor must consider information on the following when defining the species polygon:

- *the land-use history and disturbance on the subject land, including fire history*
- *recent rainfall history, and how it compares to long-term averages*
- *previous surveys for the species at or near the subject land*
- *reference populations in the local area*
- *life history characteristics of the species, and*
- *habitat constraints, growth form, any other relevant ecological information (e.g. hydrology, aspect, soil type, underlying lithology, fire ecology and vegetation community).*

Table 2.5 Predicted threatened plants for the study area and their survey requirements (OEH 2016, DPIE 2020e)

Scientific Name	Common Name	Associated PCTs in the BBS-Pilliga and BBS-Liverpool Plains subregions (DPIE 2020e)	Recommended transect width (OEH 2016)	Quantification (DPIE 2020e)	Survey months as defined by the *Threatened Biodiversity Data Collection* (DPIE 2020e)	Dates surveyed (AMBS)
Bertya opponens	Coolabah Bertya	405, 406, 408, 432	20 m	Count	All year	1-8, 15-22 October 2019, 28 Oct – 2 November 2019
Commersonia procumbens	-	88, 141, 399, 401, 404, 405, 406, 408, 432, 435	15 m	Area	From August through to May	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Cyperus conicus	-	55, 88, 206	10 m	Area	From January through to May	7-12, 19-21 January 2020
Dichanthium setosum	Bluegrass	55, 432, 435	10 m	Area	From November through to May	7-12, 19-21 Jan 2020
Digitaria porrecta	Finger Panic Grass	55, 244	10 m	Area	January and February	7-12, 19-21 Jan 2020
Diuris tricolor	Pine Donkey Orchid	88, 206, 399, 401, 404, 405	10 m	Area	September and October	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019

Scientific Name	Common Name	Associated PCTs in the BBS-Pilliga and BBS-Liverpool Plains subregions (DPIE 2020e)	Recommended transect width (OEH 2016)	Quantification (DPIE 2020e)	Survey months as defined by the *Threatened Biodiversity Data Collection* (DPIE 2020e)	Dates surveyed (AMBS)
Homoranthus darwinioides	-	141	15 m	Area	From March through to December	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Lepidium aschersonii	Spiny Peppercress	55	10 m	Area	From November through to April	7-12, 19-21 Jan 2020
Monotaxis macrophylla	Large-leafed Monotaxis	399, 401, 404, 405, 406, 408, 432, 435	10 m	Area	From August through to February	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Polygala linariifolia	Native Milkwort	88, 399, 401, 405, 406, 408, 432, 435	10 m	Area	From October through to February	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Pomaderris queenslandica	Scant Pomaderris	399, 401, 404, 405, 406, 408, 432, 435	20 m	Area	All year	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Pterostylis cobarensis	Cobar Rustyhood	88, 141, 244, 401, 404, 405, 406, 408	10 m	Area	October	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Swainsona murrayana	Slender Darling Pea	55, 244	10 m	Area	September*	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019*
Swainsona sericea	Silky Swainson-pea	244, 399, 401, 405	10 m	Area	From September through to November	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Tylophora linearis	-	88, 141, 399, 401, 404, 405, 406, 408, 432, 435	10 m	Area	From October through to May	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019
Zieria ingramii	Keith's Zieria	399	15 m	Area	From September through to February	1-8, 15-22 Oct 2019, 28 Oct – 2 Nov 2019

* According to the Approved Conservation Advice for *Swainsona murrayana* (DEWHA 2008), this species flowers from spring to early summer and responds to cool season rains. Given the known flowering time and the lack of early cool season rainfall, it was considered suitable to survey for this species in October rather than September.

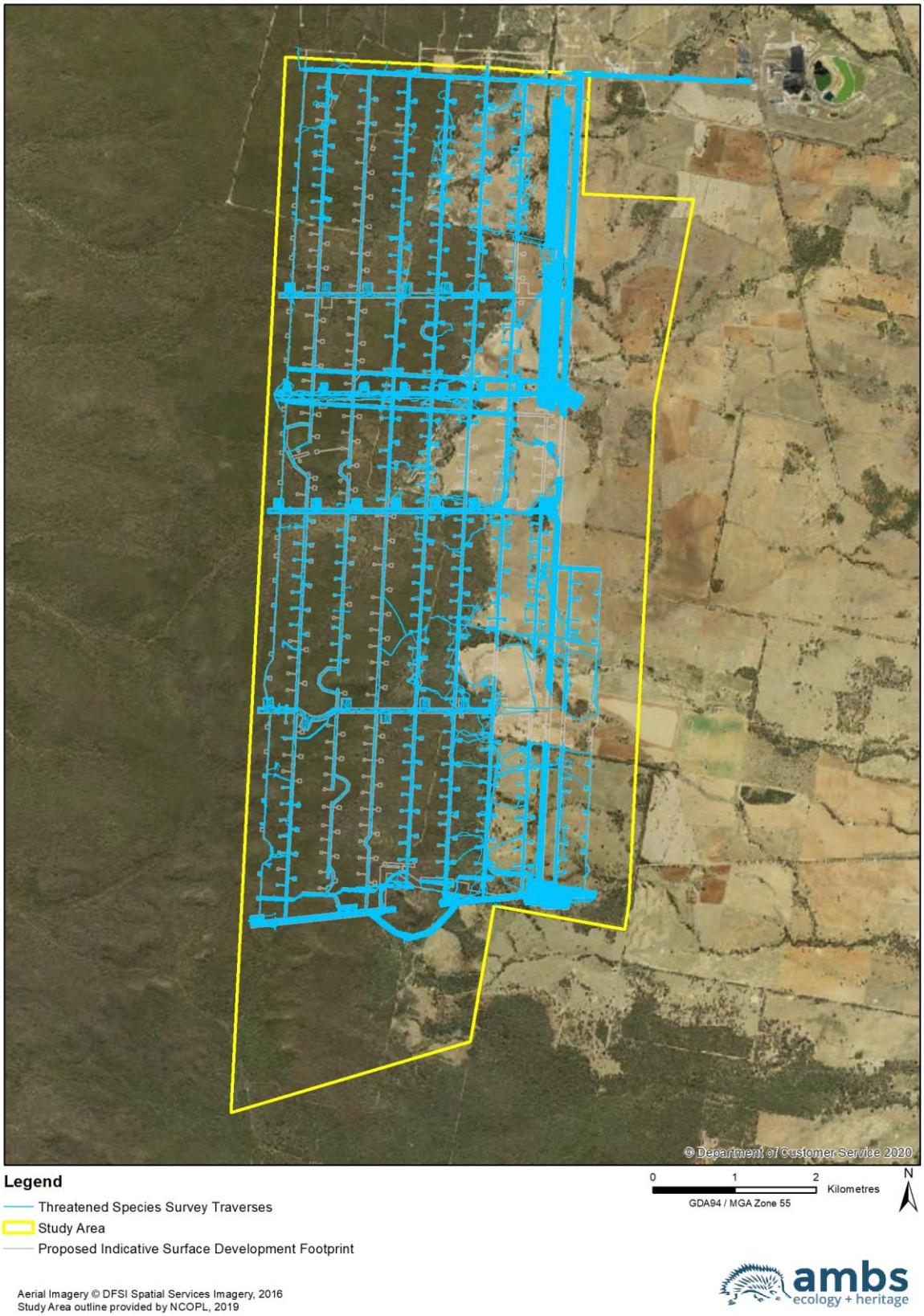


Figure 2.2 Threatened plant survey effort

2.3 Threatened Ecological Communities

Determination of PCTs that conform to TECs was based on criteria outlined in relevant EPBC Act listing advice and BC Act final determinations. Information from desktop assessment and field surveys, including soils, topography, patch size (ha), characteristic species, degree of past disturbance, indications of past canopy using isolated canopy trees, and dead identifiable canopy trees or regenerating canopy species, were used to assess the criteria and assign TEC status. In areas identified as a DNG form of a TEC, proximity to structurally intact stands of the relevant TEC was also considered.

2.4 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) are defined as *ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services* (Richardson *et al.* 2011a).

The potential for vegetation communities in the study area to use groundwater was investigated in consideration of the *Information Guidelines Explanatory Note: Assessing Groundwater-dependent Ecosystems* (Doody *et al.* 2019) and *Methods for the Identification of High Probability Groundwater Dependent Vegetation Ecosystems* (Department of Primary Industries - Water 2016).

The *Groundwater Dependent Ecosystems Atlas* (GDE Atlas) (BOM 2020) was consulted. The GDE Atlas (BOM 2020) provides a model of potential GDE across Australia based on a national-scale analysis and, where available, regional studies. It allocates a potential to be GDE in a scale of Low to High. A PCT's potential to be a GDE can be Low (has a low potential for groundwater interaction), Medium (has a moderate potential for groundwater interaction) or High (has a high potential for groundwater interaction depending on modelling of location characteristics (Doody et al. 2017).

The final determination of GDE presence in the study area is based on an assessment of whether species within each mapped vegetation community have the potential to utilise groundwater on a permanent (obligatory) or intermittent (facultative) basis as well as information on the groundwater environment provided by Australasian Groundwater and Environmental Consultants (AGE) (2020).

3 Results

3.1 Plant Community Types

A total of 472 plant species in 72 families were recorded during surveys to determine the PCTs in the study area (Appendix A). Of these, 375 were native plant species.

Thirteen PCTs were identified in the study area (Table 3.1). The extent of PCTs mapped in the study area is shown in Figure 2.1. A description of the PCTs in the study area is provided in Section 3.1.1 below.

Table 3.1 Confirmed PCTs, condition states and their extent in the study area

AMBS Name (Figure 2.1)	PCT ID	PCT Name	Broad Condition State (ha)		
			Good	Moderate	DNG
Belah Woodland	55	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	60.1		266.7
Pilliga Box – Buloke Woodland	88	Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	284.5	10.7	468.3
Broombush – Wattle Tall Shrubland	141	Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	4.2		
Dirty Gum - White Cypress Woodland on Sand Monkeys	206	Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	37.1		
Poplar Box Grassy Woodland	244*	Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)	79.1		271.7
Red Gum –Tea Tree Creek Woodland	399	Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	100.0	12.7	
Rough-barked Apple Sand Flat Woodland	401	Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	16.6		
Red Ironbark - White Bloodwood +/- Burrows Wattle Shrubby Woodland	404	Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	1,714.3	21.4	
White Bloodwood – Red Ironbark – Black Cypress Woodland	405	White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	691.1		4.6
White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland	406	White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	381.1	15.0	
Dirty Gum Shrubby Woodland	408	Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland of the Pilliga forests and surrounding region	14.8		
Dwyer's Red Gum Shrubby Woodland	432	Dwyer's Red Gum - Dirty (Baradine) Gum - cypress pine shrubby woodland of the Narrabri region of the Brigalow Belt South Bioregion	25.8		
White Box - White Cypress Woodland	435	White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	151.0	3.8	203.9
		TOTAL	**4,838.5**		
		Cleared Land (Exotic/Dam)	**526.9**		

* Some parts of this PCT are equivalent to the TEC Poplar Box Grassy Woodland on Alluvial Plains Endangered Ecological Community (EPBC Act). Patches that meet the TEC criteria, discussed below in Section 3.2, are considered equivalent to the TEC.

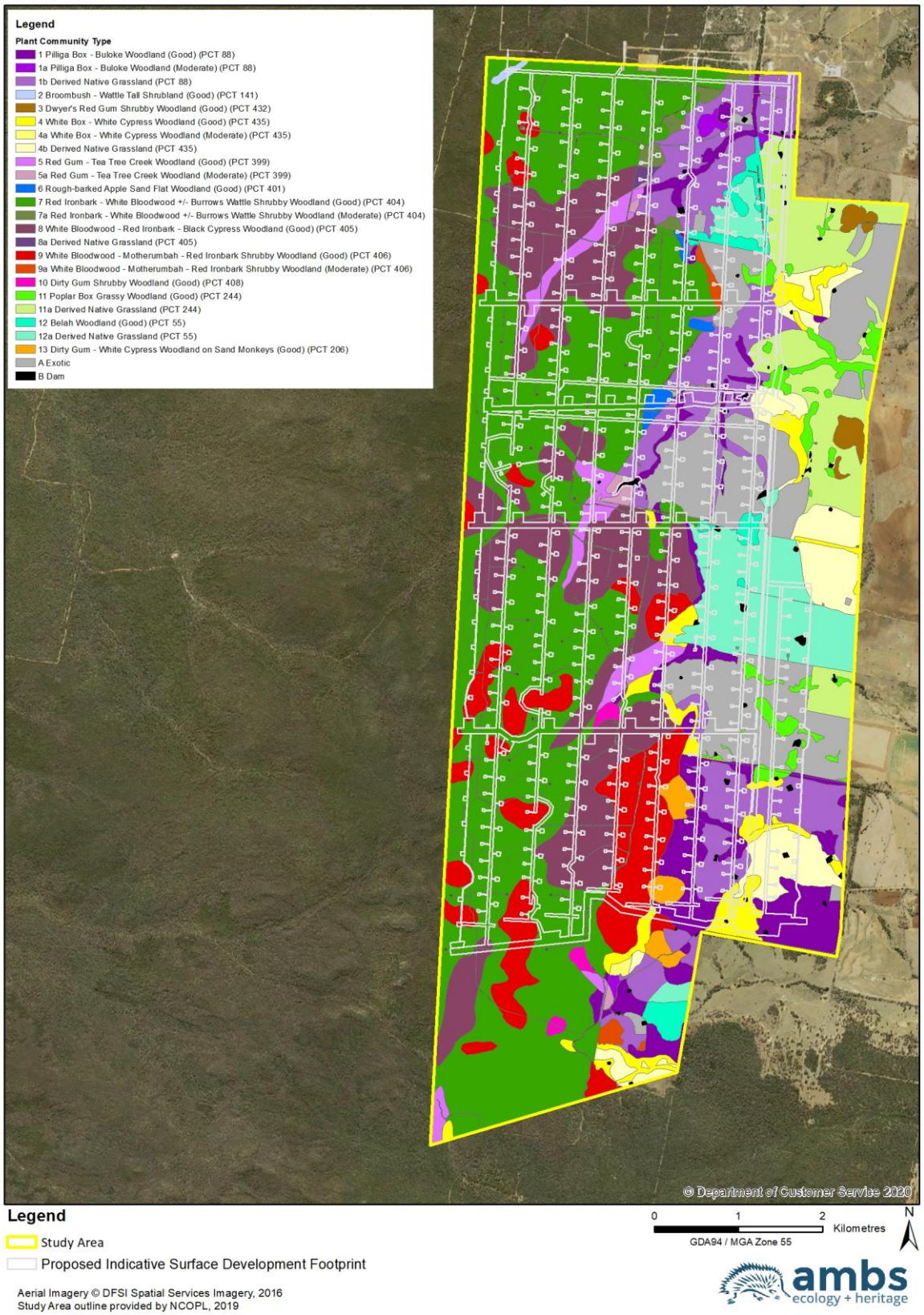


Figure 3.1 Plant community types mapped in the study area

3.1.1 Plant Community Descriptions

Belah Woodland (PCT 55)

Vegetation class: North-west Floodplain Woodlands

PCT name: *Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions*

Condition states:

Vegetation Zone 12 Belah Woodland (Good)
Vegetation Zone 12a Derived Native Grassland

Belah Woodland (PCT 55) is dominated by *Casuarina cristata* (Belah), often as a monodominant. A range of tall shrubs is often present, including *Geijera parviflora* (Wilga), *Alectryon oleifolius* (Western Rosewood), *Eremophila mitchellii* (Budda), *Apophyllum anomalum* (Warrior Bush) and *Capparis mitchellii* (Wild Orange). The mid-storey is typically open and may include shrubs such as *Myoporum montanum* (Western Boobialla), *Rhagodia spinescens* (Spiny Rhagodia), and *Maireana enchylaenoides*. The ground layer is also often sparse and typically includes low chenopod shrubs such as *Sclerolaena birchii* (Galvanised Burr) and *Sclerolaena muricata* (Black Rolypoly), grasses such as *Austrostipa verticillata* (Slender Bamboo Grass) and *Enteropogon acicularis* (Curly Windmill Grass), and various forbs including *Brunoniella australis* (Blue Trumpet) and *Sida corrugata* (Corrugated Sida).

Within the study area, *Belah Woodland* (PCT 55) occurs as both a woodland (Plate 3.1) and as *Derived Native Grassland* (Plate 3.2). In the latter case, scattered trees are occasionally present, larger shrubs are usually very sparse and the ground layer is typically of higher cover, with the dominant species typically the grass and chenopod shrub species that occur in the intact community. This vegetation community occurs on alluvial grey or brown clay soils on floodplains and alluvial soils, often along ephemeral watercourses.

Plate 3.1 Example of PCT 55 woodland in good condition

Plate 3.2 Example of PCT 55 *Derived Native Grassland*

PCT 88 Pilliga Box - Buloke Woodland

Vegetation class: Pilliga Outwash Dry Sclerophyll Forests

PCT name: *Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion*

Condition states:

Vegetation Zone 1 Pilliga Box – Buloke Woodland (Good)
Vegetation Zone 1a Pilliga Box – Buloke Woodland (Moderate)
Vegetation Zone 1b Derived Native Grassland

PCT 88 is a tall woodland to open forest, dominated by *Eucalyptus pilligaensis* (Pilliga Box), often in association with *Callitris glaucophylla* (White Cypress Pine) and *Allocasuarina luehmannii* (Buloke). The mid-storey is variable and can be sparse or in some cases shrubbier. Common shrub species include *Geijera parviflora* (Wilga), *Acacia deanei* (Dean's Wattle) and *Acacia ixiophylla* (Sticky-leaved Wattle). The vine *Parsonsia eucalyptophylla* (Gargaloo) is also often present. The ground layer is sparse and often includes the chenopod shrubs *Enchylaena tomentosa* (Ruby Saltbush) and *Einadia nutans* (Climbing Saltbush), as well as a range of grasses including *Aristida ramosa* (Purple Wiregrass) and *Austrostipa scabra* (Speargrass). Other species commonly found in the ground layer include *Cheilanthes sieberi* (Poison Rock Fern), *Sida corrugata* (Corrugated Sida) and *Cyperus gracilis* (Slender Flat Sedge).

Within the study area, PCT 88 occurs as an intact woodland (Plate 3.3), as a modified woodland dominated by colonising species such as *Callitris glaucophylla* (White Cypress Pine), *Allocasuarina luehmannii* (Buloke) and *Acacia deanei* (Dean's Wattle) (Plate 3.4), and as a DNG (Plate 3.5). As a DNG, this vegetation community is often dominated by *Aristida ramosa* (Purple Wiregrass). This

vegetation community occurs on clay loams and sandy clay loams on low rises and plains. Where this vegetation community occurs on sandier soils, the mid-storey is typically shrubbier.

Plate 3.3 Example of PCT 88 woodland in good condition

Plate 3.4 Example of PCT 88 woodland in moderate condition

Plate 3.5 Example of PCT 88 *Derived Native Grassland*

PCT 141 Broombush - Wattle Tall Shrubland

Vegetation class: Pilliga Outwash Dry Sclerophyll Forests

PCT name: *Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion*

Condition state:

Vegetation Zone 2 Broombush - Wattle Tall Shrubland (Good)

PCT 141 is a tall shrubland to closed shrubland, often strongly dominated by *Melaleuca uncinata* (Broombush), sometimes in association with *Acacia burrowii* (Burrow's Wattle). *Eucalyptus fibrosa* (Red Ironbark) or *Corymbia trachyphloia* (Brown Bloodwood) may be present as sparse, emergent trees. A range of smaller shrubs is typically present, including *Calytrix tetragona* (Fringe Myrtle), *Philotheca ciliata*, *Melichrus urceolatus* (Urn Heath), *Homoranthus flavescens* and *Prostanthera ringens* (Gaping Mint-bush). The ground layer is typically sparse and commonly includes Weeping Grass (*Microlaena stipoides*), *Aristida ramosa* (Purple Wire Grass), *Cheilanthes sieberi* (Poison Rock Fern), *Goodenia rotundifolia* and *Dianella revoluta* (Blue Flax-lily).

Within the study area, this vegetation community only occurs as an intact shrubland (Plate 3.6), never as a derived community. PCT 141 typically occurs on loamy sand over sandy clay derived from sandstone on plains or low rises.

Plate 3.6 Example of PCT 141 shrubland in good condition

PCT 206 Dirty Gum - White Cypress Woodland on Sand Monkeys

Vegetation class: North-west Alluvial Sand Woodlands

PCT name: *Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion*

Condition state:

Vegetation Zone 13 Dirty Gum - White Cypress Woodland on Sand Monkeys (Good)

PCT 206 is a tall woodland dominated by *Eucalyptus chloroclada* (Dirty Gum), often in association with *Callitris glaucophylla* (White Cypress Pine) and *Alphitonia excelsa* (Red Ash). The shrub layer is typically sparse and often includes *Notelaea microcarpa* (Native Olive), *Geijera parviflora* (Wilga), *Alstonia constricta* (Quinine Bush), and the vine *Parsonsia eucalyptophylla* (Gargaloo). The ground layer is usually grassy with common grass species including *Aristida ramosa* (Purple Wire Grass) and *Microlaena stipoides* (Weeping Grass). Other common ground layer species include *Cheilanthes sieberi* (Poison Rock Fern), *Einadia nutans* (Climbing Saltbush), *Dichondra sp.* (Kidney Weed) and *Solanum parvifolium*.

Within the study area, this vegetation community only occurs as an intact woodland (Plate 3.7), not as a derived community. PCT 206 occurs on sand and sandy loams of Quaternary alluviums derived from the nearby sandstone hills, often on meander plain landforms.

Plate 3.7 Example of PCT 206 woodland in good condition

PCT 244 Poplar Box Grassy Woodland

Vegetation class: Floodplain Transition Woodlands

PCT name: *Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)*

Condition states:

Vegetation Zone 11 Poplar Box Grassy Woodland (Good)
Vegetation Zone 11a Derived Native Grassland

PCT 244 is a woodland or open woodland dominated by *Eucalyptus populnea* (Poplar Box), often in association with *Callitris glaucophylla* (White Cypress Pine) or *Casuarina cristata* (Belah). Shrubs are typically sparse and may include a range of tall shrubs or small trees, including *Geijera parviflora* (Wilga), *Eremophila mitchellii* (Budda) and *Alectryon oleifolius* (Western Rosewood). Common low shrubs include *Maireana microphylla* (Small-leaf Bluebush), *Sclerolaena birchii* (Galvanised Burr) and *Rhagodia spinescens* (Spiny Saltbush). The ground layer is usually dominated by grasses, with common species including *Enteropogon acicularis* (Curly Windmill Grass), *Austrostipa scabra* (Spear Grass) and *Bothriochloa decipiens* (Redleg Grass). A range of forbs may also be present in the ground layer, including *Sida corrugata* (Corrugated Sida), *Wahlenbergia communis* (Tufted Bluebell) and *Glycine tabacina*.

Within the study area, this vegetation community occurs mainly as *Derived Native Grassland* (Plate 3.9), with small patches of intact woodland (Plate 3.8). The derived grassland areas are dominated by grass and forb species that occur in the intact woodland, with scattered mature trees and patches of regrowth of associated tree and shrub species. In some cases, patches with intact canopy may be considerably modified and dominated by associated tree species such as *Casuarina cristata* (Belah). PCT 244 occurs on clay-loam soils on alluvial flats, often adjacent to drainage lines.

The occurrence of this community in the study area best fits the PCT 244 as the PCT 244 description does not include any eucalypt species other than *E. populnea* (only *Casuarina cristata* [Belah] and *Callitris glaucophylla* [White Cypress Pine] as associated species). Other PCTs with Poplar Box in the wider region, e.g. PCT 101, include a variety of eucalypt species *Eucalyptus melliodora, E. microcarpa, E. melanophloia, E. pilligaensis, Callitris glaucophylla* and *Casuarina cristata* and/or more shrub species.

Plate 3.8 Example of PCT 244 woodland in good condition

Plate 3.9 Example of PCT 244 *Derived Native Grassland*

PCT 399 Red Gum - Tea Tree Creek Woodland

Vegetation class: Western Slopes Dry Sclerophyll Forests

PCT name: *Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion*

Condition states:

Vegetation Zone 5 Red Gum – Tea Tree Creek Woodland (Good)
Vegetation Zone 5a Red Gum – Tea Tree Creek Woodland (Moderate)

PCT 399 is a tall riparian woodland dominated by *Eucalyptus chloroclada* (Dirty Gum), often in association with *Callitris glaucophylla* (White Cypress Pine) and *Angophora floribunda* (Rough-barked Apple). *Casuarina cristata* (Belah) and *Allocasuarina luehmannii* (Buloke) may also be present in some areas. The shrub layer is often dense and may be strongly dominated by *Leptospermum polygalifolium* (Tantoon), sometimes in association with *Melaleuca diosmatifolia* (Rosy Honey-myrtle). A diverse range of other shrubs may also be present, including *Calytrix tetragona* (Common Fringe Myrtle), *Persoonia sericea*, *Brachyloma daphnoides* (Daphne Heath) and *Acacia ixiophylla* (Sticky-leaved Wattle). The ground layer is typically patchy, with areas of bare sand and patches of sedges, grasses and forbs. Common ground species include *Microlaena stipoides* (Weeping Grass), *Gahnia aspera* (Rough Saw-sedge), *Lomandra leucocephala* (Woolly Mat-rush), *Cymbopogon refractus* (Barbed Wire Grass), *Laxmannia gracilis* (Slender Wire Lily) and *Glycine clandestina*.

Within the study area, this vegetation community occurs mainly as an intact woodland (Plate 3.10), with some small patches of modified woodland with a disturbed canopy (Plate 3.11). PCT 399 occurs on sandy creeklines and grades into PCT 401 on adjacent sand flats.

Plate 3.10 Example of PCT 399 woodland in good condition

Plate 3.11 Example of PCT 399 woodland in moderate condition

PCT 401 Rough-barked Apple Sand Flat woodland

Vegetation class: Western Slopes Dry Sclerophyll Forests

PCT name: *Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region*

Condition state:

Vegetation Zone 6 Rough-barked Apple Sand Flat Woodland (Good)

PCT 401 is a woodland or tall open forest dominated by *Eucalyptus chloroclada* (Dirty Gum), often in association with *Angophora floribunda* (Rough-barked Apple) and *Callitris endlicheri* (Black Cypress Pine) or *Callitris glaucophylla* (White Cypress Pine). *Brachychiton populneus* (Kurrajong) is also often present. Shrubs are typically very sparse and may include *Melichrus urceolatus* (Urn Heath), *Homoranthus flavescens*, *Brachyloma daphnoides* (Daphne Heath) and *Cassinia sifton* (Sifton Bush). The ground layer is sparse to dense and often dominated by *Lomandra leucocephala* (Woolly Mat-rush)*, Lomandra filiformis* (Wattle Mat-rush) and *Lomandra longifolia* (Spiny-headed Mat-rush). Other common ground species include *Microlaena stipoides* (Weeping Grass), *Cymbopogon refractus* (Barbed Wire Grass), *Ajuga australis* (Austral Bugle) and *Chrysocephalum apiculatum* (Common Everlasting Daisy).

Within the study area, this vegetation community occurs as an intact woodland (Plate 3.12). PCT 401 occurs on sandy loams derived from sandstone on valley flats, often adjacent to sandy drainage lines, where it may grade into PCT 399.

Plate 3.12 Example of PCT 401 woodland in good condition

PCT 404 Red Ironbark - White Bloodwood +/- Burrows Wattle Shrubby Woodland

Vegetation class: Western Slopes Dry Sclerophyll Forests

PCT name: *Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests*

Condition states:

Vegetation Zone 7 Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)

Vegetation Zone 7a Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)

PCT 404 is a mid-high to tall, shrubby woodland with a canopy dominated by *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia trachyphloia* (White Bloodwood). The canopy may also include *Eucalyptus dwyeri* (Dwyer's Red Gum), *Callitris glaucophylla* (White Cypress Pine) or *Callitris endlicheri* (Black Cypress Pine). A small tree layer dominated by *Acacia burrowii* (Burrow's Wattle) and *Allocasuarina diminuta* is often present. In some areas, *Acacia burrowii* (Burrow's Wattle) may come to dominate in response to fire.

The shrub layer may be dense and contains a diverse range of species, including *Philotheca ciliata*, *Phebalium squamulosum* (Scaly Phebalium), *Calytrix tetragona* (Common Fringe Myrtle) and *Harmogia densifolia*. The vulnerable shrub *Bertya opponens* (Coolabah Bertya) may be dominant in some areas. A sparse low shrub layer is often present and includes *Homoranthus flavescens and Melichrus urceolatus* (Urn Heath). The ground layer is typically sparse but may be dense in patches and is typically dominated by grasses such as *Thyridolepis mitchelliana* (Mulga Mitchell Grass), *Aristida ramosa* (Purple Wiregrass) and *Cleistochloa rigida*, and sedges such as *Schoenus kennyi*

and *Gahnia aspera* (Rough Saw-sedge). Forb species commonly present include *Gonocarpus elatus, Goodenia rotundifolia, Pomax umbellata, Actinotus gibbonsii, Tricoryne elatior* (Yellow Autumn-lily) and *Chrysocephalum apiculatum* (Common Everlasting Daisy).

Within the study area this vegetation community occurs both as an intact woodland (Plate 3.13) and as a modified woodland with disturbed canopy and often dense regrowth of *Acacia burrowii* or *Callitris glaucophylla* (Plate 3.14). PCT 404 occurs on sandy loam soils derived from sandstone and grades into PCT 406 on rocky rises.

Plate 3.13 Example of PCT 404 woodland in good condition

Plate 3.14 Example of PCT 404 woodland in moderate condition

PCT 405 White Bloodwood - Red Ironbark - Black Cypress Woodland

Vegetation class: Western Slopes Dry Sclerophyll Forests

PCT name: *White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions*

Condition states:

Vegetation Zone 8 White Bloodwood - Red Ironbark – Black Cypress Woodland (Good)
Vegetation Zone 8a White Bloodwood - Red Ironbark – Black Cypress Woodland (Moderate)

PCT 405 is a tall woodland dominated by *Eucalyptus fibrosa* (Red Ironbark), *Corymbia trachyphloia* (White Bloodwood) and *Callitris endlicheri* (Black Cypress Pine). Other tree species, including *Eucalyptus chloroclada* (Dirty Gum) and *Eucalyptus crebra* (Narrow-leaved Ironbark) may also be present. In some cases, the canopy is dominated by dense stands of *Callitris endlicheri*.

The shrub layer is variable and often dense with a high diversity of species. Common shrub species include *Calytrix tetragona* (Common Fringe Myrtle), *Acacia deanei* (Dean's Wattle), *Melichrus urceolatus* (Urn Heath) and *Harmogia densifolia*. The ground layer is typically sparse and dominated by a range of grasses, including *Aristida ramosa* (Purple Wire Grass), *Cymbopogon refractus* (Barbed Wire Grass) and *Austrostipa scabra* (Spear Grass), and sedges such as *Schoenus ericetorum*. A range of forbs, including *Solenogyne bellioides*, *Chrysocephalum apiculatum* (Common Everlasting Daisy) and *Goodenia rotundifolia* are typically present.

Within the study area this vegetation community occurs as both an intact woodland (Plate 3.15) and as a modified woodland dominated by Callitris and often with a dense shrub layer (Plate 3.16).

PCT 405 occurs on sandy loam soils derived from sandstone on hillslopes and low hills and often grades into PCT 404.

Plate 3.15 Example of PCT 405 woodland in good condition

Plate 3.16 Example of PCT 405 woodland in moderate condition

PCT 406 White Bloodwood - Motherumbah - Red Ironbark Shrubby Woodland

Vegetation class: Western Slopes Dry Sclerophyll Forests

PCT name: *White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests*

Condition states:

Vegetation Zone 9 White Bloodwood - Motherumbah - Red Ironbark Shrubby Woodland (Good)

Vegetation Zone 9a White Bloodwood - Motherumbah - Red Ironbark Shrubby Woodland (Moderate)

PCT 406 is a mid-high to tall, shrubby woodland with a canopy dominated by *Eucalyptus fibrosa* (Red Ironbark), often in association with *Corymbia trachyphloia* (White Bloodwood). This vegetation community is characterised by a small tree layer dominated by *Acacia cheelii* (Motherumbah). *Eucalyptus dwyeri* (Dwyer's Red Gum) and *Alphitonia excelsa* (Red Ash) may also be present.

The shrub layer is typically dense and dominated by a diverse range of tall shrubs, including *Philotheca difformis* (Small-leaf Wax-flower), *Philotheca salsolifolia, Philotheca ciliata*, *Phebalium squamulosum* (Scaly Phebalium) and *Calytrix tetragona* (Common Fringe Myrtle). The vulnerable shrub *Bertya opponens* (Coolabah Bertya) may be dominant in some areas. A sparse low shrub layer is often present and includes *Homoranthus flavescens and Melichrus urceolatus* (Ruby Urn Heath). The ground layer is variable and may be sparse or dense in places. Common grass species include *Cleistochloa rigida, Thyridolepis mitchelliana* (Mulga Mitchell Grass) and *Aristida ramosa* (Purple Wiregrass). The sedges *Lepidosperma laterale* and *Schoenus kennyi* are often present. The ground layer may also include a range of forb species such as *Goodenia rotundifolia*, *Stypandra glauca* (Nodding Blue Lily) and *Chloanthes parviflora.*

Within the study area, this vegetation community occurs both as an intact woodland (Plate 3.17) and as a modified woodland with disturbed canopy and often dense regrowth of Motherumbah Wattle (Plate 3.18). This vegetation community occurs on rocky sandstone rises and grades into PCT 404 on the surrounding flats and lower slopes.

Plate 3.17 Example of PCT 406 woodland in good condition

Plate 3.18 Example of PCT 406 woodland in moderate condition

PCT 408 Dirty Gum Shrubby Woodland
Vegetation class: Western Slopes Dry Sclerophyll Forests

PCT name: *Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland of the Pilliga forests and surrounding region*

Condition states:
Vegetation Zone 10 Dirty Gum Shrubby Woodland (Good)

PCT 408 is a woodland or open forest dominated by *Eucalyptus chloroclada* (Dirty Gum), *Corymbia trachyphloia* (White Bloodwood) and *Callitris endlicheri* (Black Cypress Pine) or *Callitris glaucophylla* (White Cypress Pine). The shrub layer is variable and may be sparse or denser in places. Common shrub species include *Brachyloma daphnoides* (Daphne Heath), *Calytrix tetragona* (Common Fringe Myrtle), Sword Wattle (*Acacia gladiiformis*), *Persoonia sericea* and *Boronia glabra*. The ground layer is usually sparse and includes a range of grass and graminoid species and forbs. Common ground species include *Aristida vagans* (Threeawn Speargrass), *Gahnia aspera* (Rough Saw-Sedge), *Microlaena stipoides* (Weeping Grass), *Cheilanthes sieberi* (Poison Rock Fern) and *Gonocarpus elatus*.

Within the study area, this vegetation community only occurs as an intact woodland (Plate 3.19). PCT 408 occurs on loam and sandy loam soils on hillslopes.

Plate 3.19 Example of PCT 408 woodland in good condition

PCT 432 Dwyer's Red Gum Shrubby Woodland

Vegetation class: North-west Slopes Dry Sclerophyll Woodlands

PCT name: *Dwyer's Red Gum - Dirty (Baradine) Gum - Cypress Pine shrubby woodland of the Narrabri region of the Brigalow Belt South Bioregion*

Condition states:

Vegetation Zone 3 Dwyer's Red Gum Shrubby Woodland (Good)

PCT 432 is a low to mid-high woodland dominated by *Eucalyptus dwyeri* (Dwyer's Red Gum) and *Callitris glaucophylla* (White Cypress Pine). Although not recorded within vegetation integrity plots, *Eucalyptus chloroclada* (Dirty [Baradine] Gum) was recorded at rapid point locations within patches of this PCT. The small trees *Alphitonia excelsa* (Red Ash) and *Acacia cheelii* (Motherumbah) are often present. The shrub layer is sparse and includes *Melichrus urceolatus* (Peach Urn Heath), *Geijera parviflora* (Wilga), *Solanum ferocissimum* and *Solanum parvifolium*. The vines *Parsonsia eucalyptophylla* (Gargaloo) and *Clematis microphylla* (Small-leaved Clematis) are often present. The ground cover is sparse and includes the grasses *Aristida caput-medusae* (Many-headed Wiregrass) and *Thyridolepis mitchelliana* (Mulga Mitchell Grass) and forbs such as *Crassula sieberiana* (Australian Stonecrop) and *Brunoniella australis* (Blue Trumpet).

Within the study area, this vegetation community occurs as an intact woodland (Plate 3.20); however, the canopy may be modified in some places and dominated by dense stands of *Callitris glaucophylla*. PCT 432 occurs on brown sandy loams derived from sandstone on rocky hills.

Plate 3.20 Example of PCT 432 woodland in good condition

PCT 435 White Box - White Cypress Woodland

Vegetation class: North-west Slopes Dry Sclerophyll Woodlands

PCT name: *White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion*

Condition states:

Vegetation Zone 4 White Box – White Cypress Woodland (Good)
Vegetation Zone 4a White Box – White Cypress Woodland (Moderate)
Vegetation Zone 4b Derived Native Grassland

PCT 435 is a tall woodland dominated by *Eucalyptus albens* (White Box) often in association with *Callitris glaucophylla* (White Cypress Pine). *Brachychiton populneus* (Kurrajong) is also often present in the canopy. The shrub layer is typically sparse and may include a range of species such as *Geijera parviflora* (Wilga), *Acacia implexa* (Hickory Wattle), *Dodonaea viscosa* (Sticky Hop Bush) and *Teucrium betchei*. The ground layer is typically dominated by grasses, including *Aristida personata* (Purple Wire-Grass), *Cymbopogon refractus* (Barbed-wire Grass), *Rytidosperma racemosum* (Wallaby Grass) and *Austrostipa verticillata* (Slender Bamboo Grass) and *Austrostipa scabra* (Spear Grass). Common forb species include *Calotis lappulacea* (Yellow Burr-Daisy), *Einadia nutans* (Climbing Saltbush), *Wahlenbergia communis* (Tufted Bluebells), *Dianella longifolia* (Blue Flax-Lily), *Daucus glochidiatus* (Native Carrot), *Oxytes brachypoda* (Large Tick-trefoil) and *Desmodium varians* (Slender Tick-foil).

Within the study area, this vegetation community occurs as an intact woodland (Plate 3.21) as well as in a disturbed state with regenerating canopy (Plate 3.22) and *Derived Native Grassland* (Plate

3.23). In some modified patches, the canopy is regenerating and dominated by colonising species such as *Callitris glaucophylla* and *Acacia deanei* (Deane's Wattle). PCT 435 occurs on clay loam soils on lower slopes and gullies.

Plate 3.21 Example of PCT 435 woodland in good condition

Plate 3.22 Example of PCT 435 woodland in moderate condition

Plate 3.23 Example of PCT 435 *Derived Native Grassland*

3.2 Threatened Ecological Communities

One TEC was identified in the Study Area, namely the *Poplar Box Grassy Woodland on Alluvial Plains* listed as Endangered under the EPBC Act (not listed under the BC Act).

Poplar Box Grassy Woodland on Alluvial Plains

Within the study area, individual patches over 5 ha mapped as PCT 244 with a sufficiently intact canopy were considered to be equivalent to the EPBC Act listed TEC *Poplar Box Grassy Woodland on Alluvial Plains*. Table 3.2 provides an assessment of all PCT 244 patches against the criteria used to determine the equivalence as per the Threatened Species Scientific Committee (2019). Figure 3.2 below shows the location of patches of the TEC *Poplar Box Grassy Woodland on Alluvial Plains* in the study area. A total area of 43.1 ha of this TEC occurs in the study area.

Derived grassland areas of this PCT did not sufficiently meet all criteria within the TEC listing advice.

Inland Grey Box Woodland

Within the study area no patches were considered to be equivalent to the BC Act listed TEC *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* (NSW Threatened Species Scientific Committee 2007) or the EPBC Act listed TEC *Grey Box (Euclayptus macrocarpa) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia* (Threatened Species Scientific Committee 2010). In most cases patches were dominated by the similar species *Eucalyptus pilligaensis* and fell within the definition of PCT 88. Some scattered individuals of *Eucalyptus microcarpa* (Inland Grey Box) were observed, but no patches that fit the definition of the TEC. Patches dominated by *Eucalyptus microcarpa* (Inland Grey Box) were recorded outside of the study area on heavier soils closer to the Namoi River floodplain. It is considered that within the study area the influence of the sandier soils has favoured the dominance of *Eucalyptus pilligaensis* (Pilliga Box) over *Eucalyptus microcarpa* (Inland Grey Box).

White Box Woodland

One of the PCTs mapped at the site, PCT 435, is considered to be partially equivalent to the EPBC Act and BC Act listed TEC *White Box Yellow Box Blakely's Red Gum Woodland*. Areas of PCT 435 within the study area tend to occur on rocky slopes, have a relatively high cover of shrubs (>30%) and often dominance of *Callitris glaucophylla,* as well as a low cover of tussock grasses, and so are not considered to occur as a grassy woodland. For this reason, these patches were not considered to be equivalent to the listed TEC under the BC Act or EPBC Act. The following section from the Commonwealth Listing Advice for the TEC (Threatened Species Scientific Committee 2006) was used to make this determination:

"Shrub cover in this ecological community is naturally patchy, and shrubs may be dominant only over a very localised area. Shrub cover should therefore be assessed over the entire remnant, not just in a localised area. A remnant with a significant ground layer of tussock grasses, and where the distribution of shrubs is scattered or patchy, is part of the ecological community. In shrubby woodlands, the dominance of native tussock grasses in the ground layer of vegetation is lost. Therefore, a remnant with a continuous shrub layer, in which the shrub cover is greater than 30%, is considered to be a shrubby woodland and so is not part of the listed ecological community."

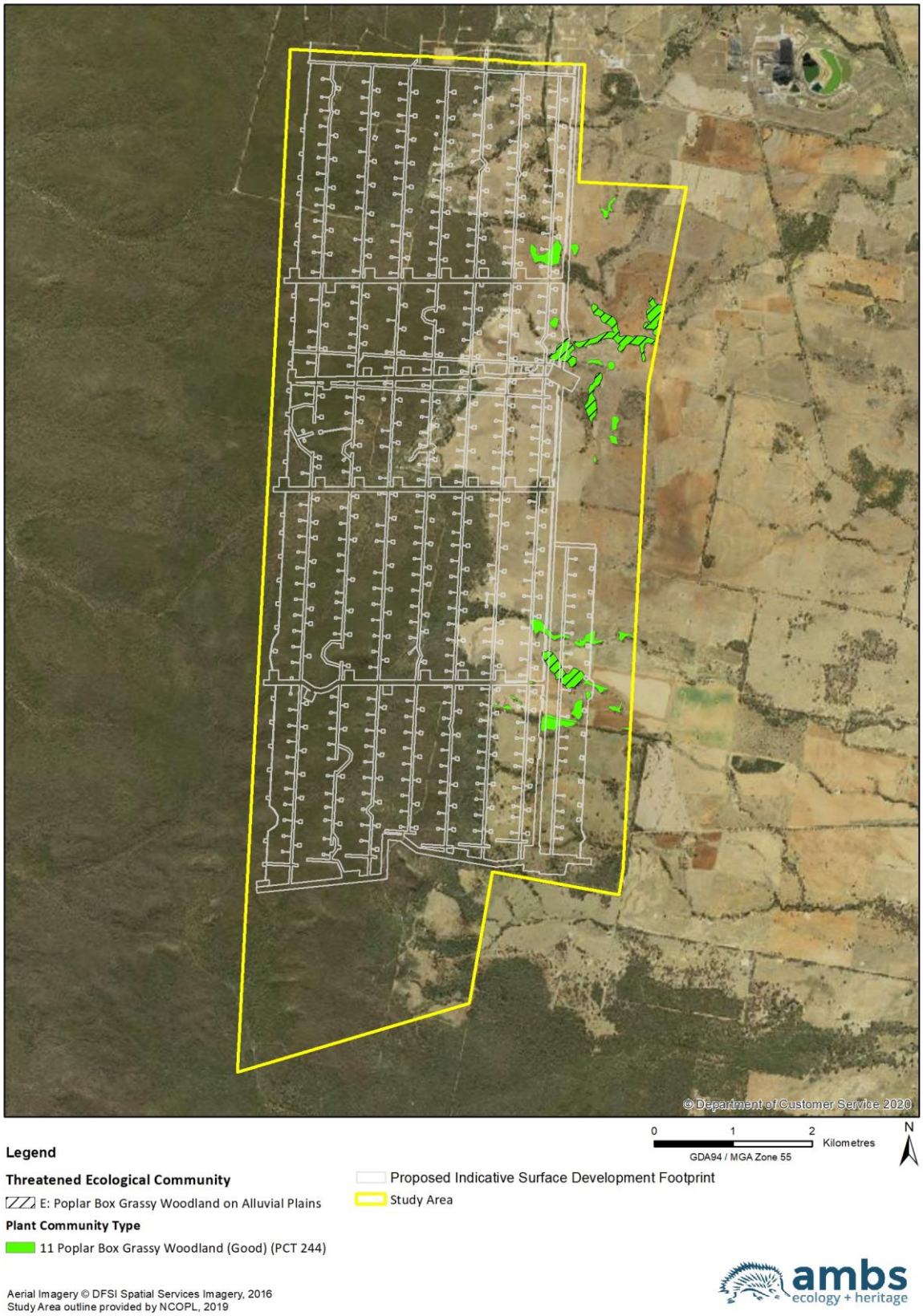


Figure 3.2 Threatened ecological communities in the study area

Table 3.2 Threatened ecological community equivalence

Poplar Box Grassy Woodland on Alluvial Plains Criteria (Threatened Species Scientific Committee, 2019)	PCT 244 (Good Condition) Patches Recognised as Poplar Box Grassy Woodland on Alluvial Plains	PCT 244 (Good Condition) Patches Not Recognised as Poplar Box Grassy Woodland on Alluvial Plains	PCT 244 (DNG)
Occurs in the Brigalow Belt North, Brigalow Belt South, Southeast Queensland, Cobar Peneplains, Darling Riverine Plains, NSW South Western Slopes, Riverina and Murray Darling Depression IBRA bioregions.	Yes. Occurs in the Brigalow Belt South bioregion.	Yes. Occurs in the Brigalow Belt South bioregion.	Yes. Occurs in the Brigalow Belt South bioregion.
Associated with ancient and recent depositional alluvial plains with clay, clay-loam, loam and sandy loam, typically duplex soils or sodosols. This includes areas that may not be part of currently defined floodplains.	Yes. Occurs on alluvial clay and clay-loam soils.	Yes. Occurs on alluvial clay and clay-loam soils.	Yes. Occurs on alluvial clay and clay-loam soils.
A grassy woodland to grassy open woodland with a tree crown cover of 10% or more at patch scale.	Yes. All patches included have tree crown cover > 10%.	Yes. All patches included have tree crown cover >10%.	No.
Canopy tree species are capable of reaching 10 m or more in height.	Yes.	Yes.	No.
Eucalyptus populnea (Poplar Box) must be present in the canopy and is the dominant tree species.	Yes. *Eucalyptus populnea* is a dominant species in all patches included.	Yes. *Eucalyptus populnea* is a dominant species in all patches included.	No.
Mid layer (1-10 m) crown cover of shrubs to small trees is low, about 30% or less.	Yes. Mid-layer cover <30% in all patches included.	Yes. Mid-layer cover <30% in all patches included.	Yes. Mid layer cover < 30% in all patches included.
A ground layer (< 1 m) mostly dominated across a patch by native grasses, other herbs and occasionally chenopods (during extended dry periods), ranging from sparse to thick (in response to canopy development, soil moisture, disturbance and/or management history).	Yes. Ground layer fits these criteria in all patches included.	Yes. Ground layer fits these criteria in all patches included.	Ground layer fits these criteria in all patches included.
A list of diagnostic native plant species and some of the key native fauna that make up the ecological community is given at Appendix A; although particular species may be abundant or rare, or not necessarily present, at every location.	Yes. The species recorded in all included patches fit with the diagnostic species expected.	Yes. The species recorded in all included patches fit with the diagnostic species expected.	Yes. The species recorded in all included patches fit with the diagnostic species expected.
Condition Thresholds.	Yes. Given the condition of the patches mapped, only patches >5 ha were equated to the TEC as per the condition thresholds.	No. Patches did not fit condition thresholds as they were less than 5 ha in area.	N/A as other criteria not met.
Conclusion	**Poplar Box Grassy Woodland on Alluvial Plains EEC**	**Not EEC**	**Not EEC**

3.3 Groundwater Dependent Vegetation

PCTs mapped in the study area were assessed for their potential to be GDEs using the method described in Section 2.4.

Three isolated occurrences in the study area of 'high potential' GDEs in the GDE Atlas (BoM 2020) were sampled and mapped by AMBS as:

- Poplar Box Grassy Woodland (Good) (PCT 244), which is a PCT that occurs on clay-loam soils on alluvial flats.
- Red Gum - Tea Tree Creek Woodland (Good) (PCT 399), which is a PCT that occurs along ephemeral drainage lines.
- Red Ironbark - White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good) (PCT 404), which is a widespread PCT with a low potential to be associated with subsurface presence of groundwater.

From a review of the GDE Atlas (BoM 2020), the occurences of these PCTS in the wider region are recognised as, low potential GDE (PCT 404), a low to medium potential GDE (PCT 244) and a high potential GDE (PCT 399) (Table 3.3). AMBS have made an assessment of GDE potential based on knowledge of the subject PCT, as well as the depth to groundwater provided by AGE (2020) in locations within the study area where these PCTs occurs. It is considered that PCT 404 and PCT 399 have a low potential for groundwater interaction in the study area. PCT 244 is further discussed below.

Two other PCTs mapped in the study area by AMBS are identified elsewhere in the region as having a greater than low potential to be GDEs in some locations according to the GDE Atlas (BoM 2020), namely PCTs 55 and 206 (Table 3.3). It is considered that PCT 206 has a low potential for groundwater interaction in the study area. PCT 55 is further discussed below.

The remaining three PCTs mapped in the study area by AMBS (PCT 88, 141, 401) are recognised as low potential GDEs in the GDE Atlas (BoM 2020) (Table 3.3). It is considered that these three PCTs have a low potential for groundwater interaction in the study area.

Table 3.3 GDEs in the GDE Atlas (BoM 2020) as they relate to PCTs in the study area

PCT mapped in study area (AMBS)	Potential to be a GDE as shown in GDE Atlas within the Regional Mapping of the PCT (BoM 2020)	Potential of mapped PCT to be a facultative GDE in the study area as determined by AMBS
PCTs associated with areas in the GDE Atlas mapped 'high potential' GDEs in the study area		
PCT 244 Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)	Low-med potential GDE#	High
PCT 399 Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	High potential GDE - from regional studies	High
PCT 404 Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Low potential GDE - from regional studies	Low
PCTs associated with the GDE Atlas mapped 'moderate to high potential' GDEs elsewhere in the region		
PCT 55 Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	Low-high potential GDE#	High
PCT 206 Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Low-med potential GDE#	Low

PCT mapped in study area (AMBS)	Potential to be a GDE as shown in GDE Atlas within the Regional Mapping of the PCT (BoM 2020)	Potential of mapped PCT to be a facultative GDE in the study area as determined by AMBS
PCTs associated with the GDE Atlas mapped 'low potential' GDEs		
PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Low potential GDE - from regional studies	Low
PCT 141 Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	Low potential GDE - from regional studies	Low
PCT 401 Rough-barked Apple – Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Low potential GDE - from regional studies	Low

Note: *Nearby = the PCT was not in the study area in the GDE Atlas (BoM 2020), but was within 5 km and occured in similar topography
Information obtained from other locations in the region where these PCTs occur

As listed in Table 3.3, three PCT's are considered to have high potential to be facultative users of groundwater (PCT 55 and PCT244):

- PCT 55 Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions which is an alluvial floodplain PCT and as such is likely to be an facultative user of groundwater. The depth to groundwater in locations where this PCT occurs is 2-10 m (AGE 2020).
- Red Gum - Tea Tree Creek Woodland (Good) (PCT 399), is a PCT that occurs along ephemeral drainage lines. The depth to groundwater in locations where this PCT occurs is 2-50 m (AGE 2020). This PCT is likely to be a facultative user of groundwater, particularly in locations with a lower depth to groundwater.
- Poplar Box Grassy Woodland (Good) (PCT 244), which is a PCT that occurs on clay-loam soils on alluvial flats, and as such is likely to be a facultative user of groundwater. The depth to groundwater in locations where this PCT occurs is 2-10 m (AGE 2020).

One feature that was identified by AGE (2020) as a spring discharging to the surface is located in the study area, the Mayfield Spring. The Mayfield Spring was cleared of most vegetation, unprotected from grazing, highly disturbed and dominated by exotic plant species (Plate 3.24). While prior to land clearing and agricultural disturbance the spring may have supported GDEs, it no longer supports a native vegetation community. The Mayfield Spring is not mapped as a GDE in the GDE Atlas (BoM 2020).

Plate 3.24 Mayfield Spring

3.4 Threatened Plants Recorded

The *BioNet Atlas* search within 10 km of the study area identified records of four threatened plant species: *Bertya opponens*, *Tylophora linearis, Lepidium aschersonii* and *Pomaderris queenslandica* (DPIE 2020a). Of these, *Bertya opponens* has been previously recorded in the study area. An *Atlas of Living Australia* (2019) search found previous records of *Bertya opponens* in the study area, and *Bertya opponens*, *Commersonia procumbens*, *Lepidium aschersonii*, *Polygala linariifolia*, *Pomaderris queenslandica* and *Tylophora linearis* records within 10 km of the study area.

Surveys by ELA and AMBS recorded the following four threatened plant species in the study area:

- *Bertya opponens* (BC Act - Vulnerable, EPBC Act - Vulnerable);
- *Lepidium aschersonii* (BC Act – Vulnerable, EPBC Act - Vulnerable);
- *Pomaderris queenslandica* (BC Act – Endangered, EPBC Act – Not listed); and
- *Tylophora linearis* (BC Act - Vulnerable, EPBC Act - Endangered).

Locations and the habitat of threatened plants recorded are shown on Figures 3.3-3.6. For three threatened plants species that were recorded within the proposed indicative surface development footprint, a summary of information for each species is shown in Table 3.3, including the number of individuals, the PCT in which they were recorded, and the area (ha) of the species polygon. *Pomaderris queenslandica* (Scant Pomaderris) was recorded outside the proposed indicative surface development footprint, and is discussed in Section 3.4.3.

Table 3.4 Threatened species recorded in the study area

Species	Common Name	Number recorded	AMBS Survey Method	Recorded PCTs	Predicted PCTs	Total Potential Habitat (Ha)	Total Species Polygon (Ha)
Bertya opponens	Coolabah Bertya	11,126 (AMBS) 1 (ELA)	Estimation by extrapolation (Keith 2000) and direct count	141, 404, 405, 406	405, 406, 408, 432	2,846.7	261.6
Lepidium aschersonii	Spiny Peppercress	32 (ELA)	-	55, 88	55	1,090.2	355.3
Tylophora linearis	Tylophora linearis	96 (AMBS) 92 (ELA)	Direct count	141, 399, 404, 406, 435	88, 141, 399, 401, 404, 405, 406, 408, 432, 435	3,447.1	3,447.1

3.4.1 Bertya opponens (BC Act – Vulnerable, EPBC Act - Vulnerable)

Bertya opponens is a medium to tall shrub with oppositely-arranged leaves that are distinctively tomentose hairy (Plate 3.25). The species flowers during July and August but can be identified year-round on the basis of leaf morphology. Across NSW the species is known from only a few scattered sites near Coolabah, Cobar and south of Narrabri. The largest population in NSW is in Jacks Creek State Forest, to the north-west of the study area. The habitat for the species is noted as being stony mallee ridges, cypress pine forest, gum and ironbark forests on red and brown soils with *Eucalyptus chloroclada*, *Callitris glaucophylla* and *Eucalyptus fibrosa* communities (DPIE 2020f).

Plate 3.25 *Bertya opponens* in the study area

Predicted habitat in the study area according to the *Threatened Biodiversity Data Collection* (DPIE 2020e) occurs in PCTs 405, 406, 408, 432. The current surveys found the species to be present in the study area in *Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland* (PCT 404) (Plate 3.13), *White Bloodwood - Red Ironbark – Black Cypress Woodland* (PCT 405), *White Bloodwood - Motherumbah - Red Ironbark Shrubby Woodland* (PCT 406) and *Broombush - Wattle Tall Shrubland* (PCT 141).

Plate 3.26 An example of *Bertya opponens* in PCT 404 habitat in the study area

The species was found as single plants, but more commonly as patches of small to large numbers of plants of varying size and age. It is most abundant in the north-western part of the study area where the species occurs across a hillside below a prominent ridge.

Specimens were collected in various locations and identification of the species was on the basis of both leaf morphology and fruit.

The locations of *Bertya opponens* records and the estimated extent of the population is shown in Figure 3.3 below. A species polygon has been prepared based on the known records of *Bertya opponens* in the study area in combination with the associated solodised solonetz soils, with a 30 m buffer around an outlying record in the south-east of the study area (Figure 3.3). Potential habitat, namely the PCTs in which *Bertya opponens* was recorded, is also shown on Figure 3.3 below. Approximately 11,126 stems were recorded by AMBS using a combination of direct count and estimation by extrapolation (Keith 2000) within 2.57 ha of the proposed indicative surface development footprint (approximately 4,330 plants per ha). The tabulated data for the records is provided in Appendix D.

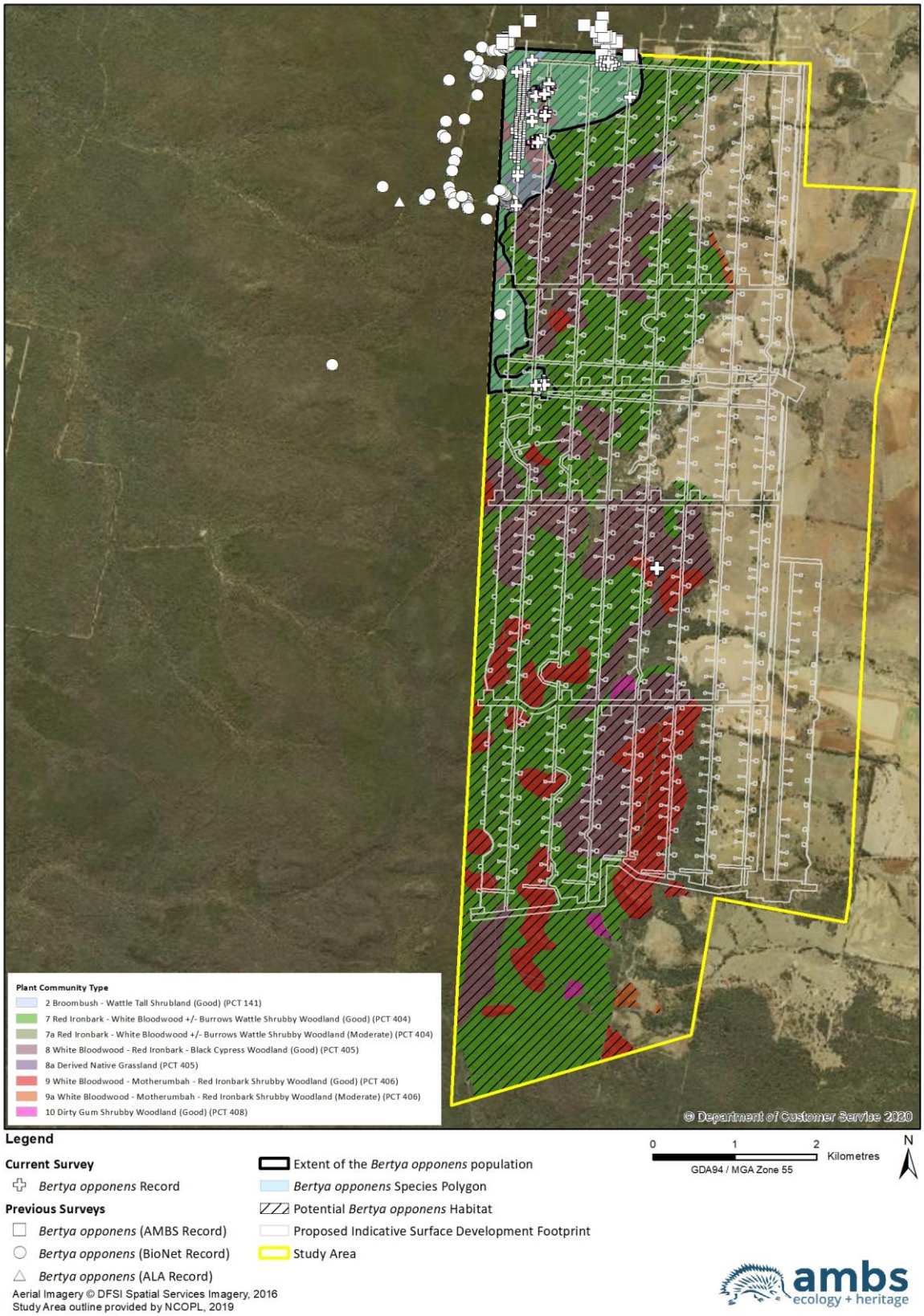


Figure 3.3 *Bertya opponens* records, species polygon and potential habitat

3.4.2 Lepidium aschersonii (BC Act – Vulnerable, EPBC Act - Vulnerable)

Lepidium aschersonii is an erect perennial herb which can be distinguished from other Lepidium species by the presence of spines on the smaller branches. In NSW, *Lepidium aschersonii* occurs in the marginal central-western slopes and north-western plains, and potentially also in the south-western plains. Habitat for the species is described as vegetation on clay soils dominated by *Acacia harpophylla* (Brigalow), *Casuarina cristata* (Belah), *Allocasuarina luehmannii* (Buloke) and *Eucalyptus microcarpa* (Grey Box). It grows in the ground layer often among exotic plants (DPIE 2020f).

Predicted habitat in the study area according to the *Threatened Biodiversity Data Collection* includes PCT 55 (DPIE 2020e). ELA's 2017-2018 surveys recorded 32 individuals of *Lepidium aschersonii* in PCT 55 woodland dominated by *Casuarina cristata* (Belah), and in PCT 88 tall woodland dominated by *Eucalyptus pilligaensis* (Pilliga Box) and *Callitris glaucophylla* (White Cypress Pine) (ELA 2019).

A species polygon for this species has been mapped across all locations of woodland PCTs 55 and 88 within the proposed indicative surface development footprint (Figure 3.4). It was considered appropriate to include all locations of woodland PCT 55 and 88 within the species polygon given their similar condition state and the low detectability of this species in dry conditions. Areas of derived native grassland have been mapped as potential habitat but were excluded from the species polygon as it was considered unlikely that the species would persist in this condition state.

On the basis of the above, a species polygon for *Lepidium aschersonii* has been mapped that occupies approximately 355.3 ha in the study area. The tabulated data for the records is provided in Appendix D.

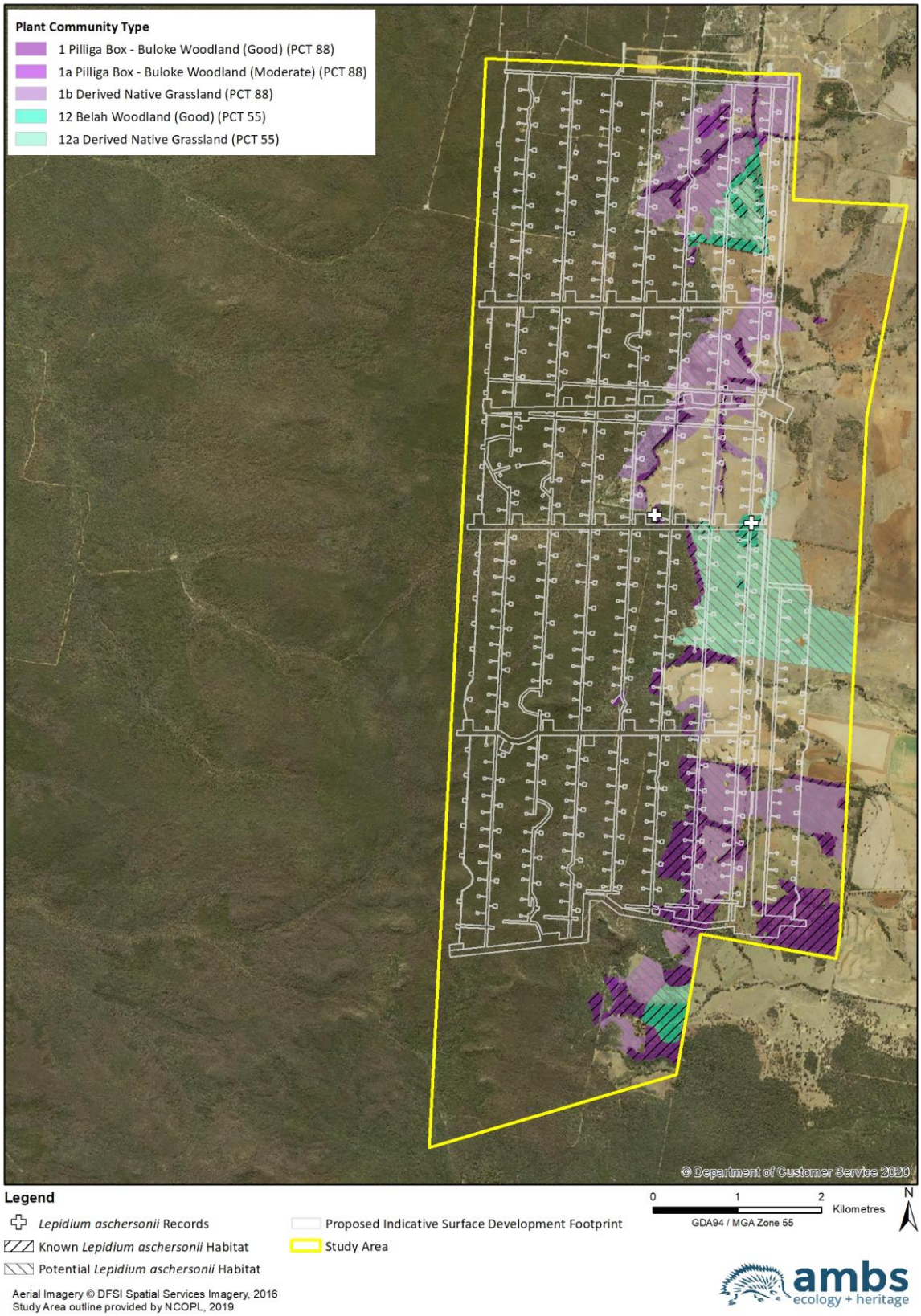


Figure 3.4 *Lepidium aschersonii* records and species polygon habitat in the study area

3.4.3 Pomaderris queenslandica (BC Act – Endangered, EPBC Act - Not listed)

Pomaderris queenslandica is a shrub growing to 2-3 m tall with whitish stellate-tomentose hairs on stems and the underside of leaves. It is a rare species that is widely scattered but not common in north-east NSW including the north coast, New England Tablelands and North West Slopes, also extending into Queensland. It usually occurs in moist eucalypt forest or sheltered woodlands with a shrubby understorey, including along creeks (DPIE 2020f).

Predicted habitat in the study area according to the *Threatened Biodiversity Data Collection* includes PCTs 399, 401, 404, 405, 406, 408, 432 and 435 (DPIE 2020e). However, the most likely habitat for the species is forests along the drainage lines, with previous nearby records occurring within PCTs 88, 399, 404, 405 and 435 with intact canopies. The species was searched for throughout the proposed indicative surface development footprint, and was not found.

ELA's 2017-2018 surveys recorded 20 individuals of *Pomaderris queenslandica* in PCT 435 woodland dominated by *Eucalyptus albens* (White Box), and occasional *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus fibrosa* (Red Ironbark) (ELA 2019).

No species polygon was produced for *Pomaderris queenslandica,* as the species was not detected within the proposed indicative surface development footprint during the threatened species surveys. Based on the proposed indicative surface development footprint, known records of the species within the study area will not be directly impacted, as they occur approximately 1 km south of the closest extent of the Footprint (Figure 3.5). Given that it is a long-lived and easily detectable species, it was considered unlikely to occur in the footprint based on extensive surveys.

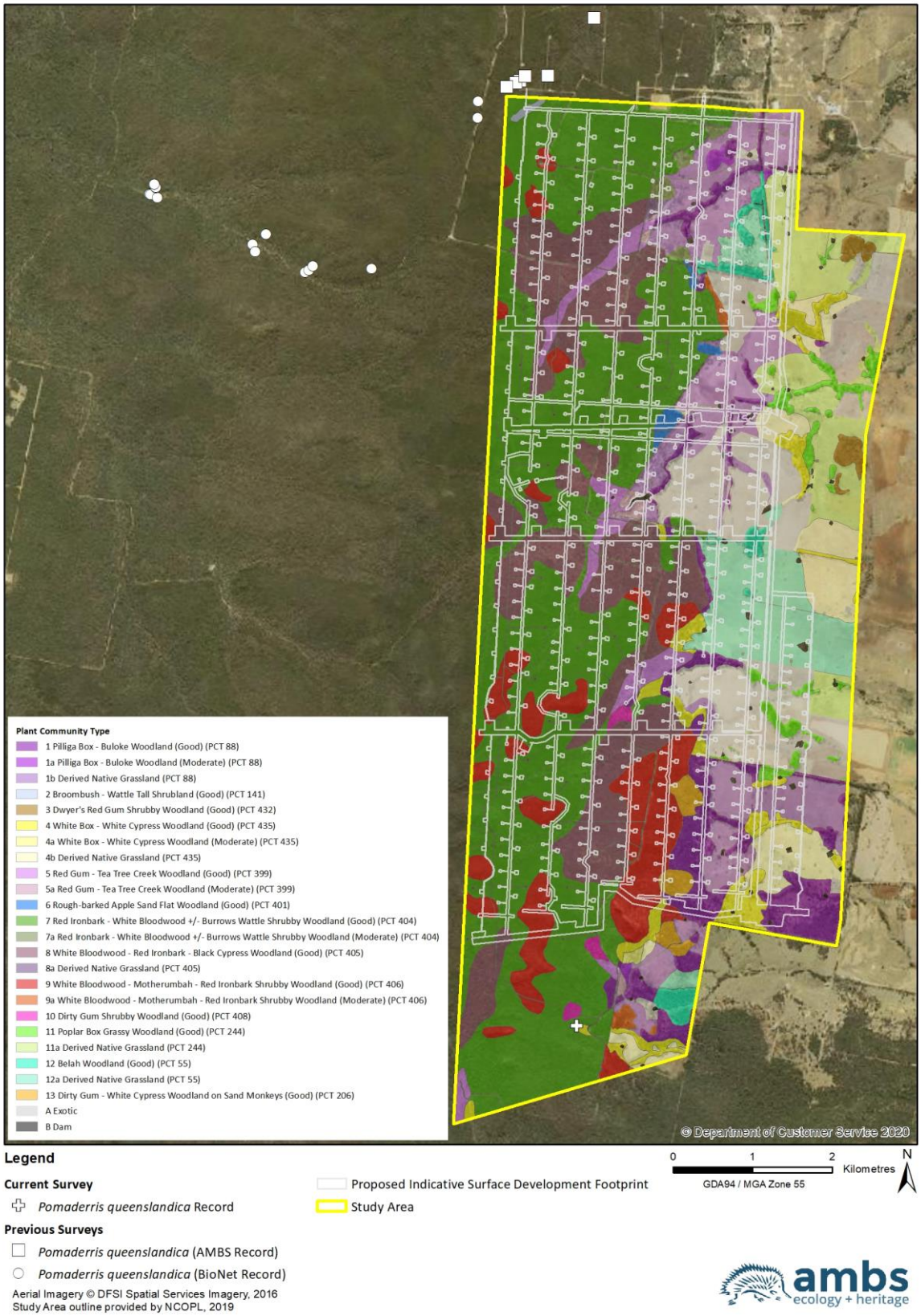


Figure 3.5 *Pomaderris queenslandica* records and potential habitat in the study area

3.4.4 Tylophora linearis (BC Act – Vulnerable, EPBC Act - Endangered)

Tylophora linearis is a slender almost hairless twiner, often associated with ironbark woodlands (Plate 3.27). The species can be distinguished in the field from other twiners by a combination of leaf morphology, growth form and the presence of clear sap. In NSW, the majority of records are from the central-west region of NSW. In this location the species grows in dry scrub and open forest, on usually low-altitude sedimentary flats with *Eucalyptus fibrosa*, *Eucalyptus sideroxylon, Eucalyptus albens*, *Callitris endlicheri*, *Callitris glaucophylla* and *Allocasuarina luehmannii* (DPIE 2020f).

Plate 3.27 *Tylophora linearis* in the study area

Predicted habitat in the study area according to the *Threatened Biodiversity Data Collection* includes PCTs 88, 141, 399, 401, 404, 405, 406, 408, 432 and 435 (DPIE 2020e). Suitable timing for survey includes all months except June through September (DPIE 2020e), although records of the species were made within this period during field surveys.

Tylophora linearis was found in multiple locations in the study area during AMBS's July, August and October 2019 surveys. A total of 96 stems were recorded in the study area in PCTs 141, 399, 404, 406 and 435. ELA surveys in 2017-18 previously recorded 92 individuals of *Tylophora linearis* in what has been mapped by AMBS as PCTs 404 and 435 (ELA 2019).

The locations of the *Tylophora linearis* records in the study area are shown in Figure 3.6 below.

A species polygon for this species has been mapped across PCTs 88, 141, 399, 401, 404, 405, 406, 408, 432 and 435, excluding DNGs. The species polygon includes PCTs where the species was recorded during the surveys and PCTs where the species has high potential to occur (DPIE 2020e). Approximately 3,447.1 ha of *Tylophora linearis* habitat occur in the Study Area. The tabulated data for the records is provided in Appendix D.

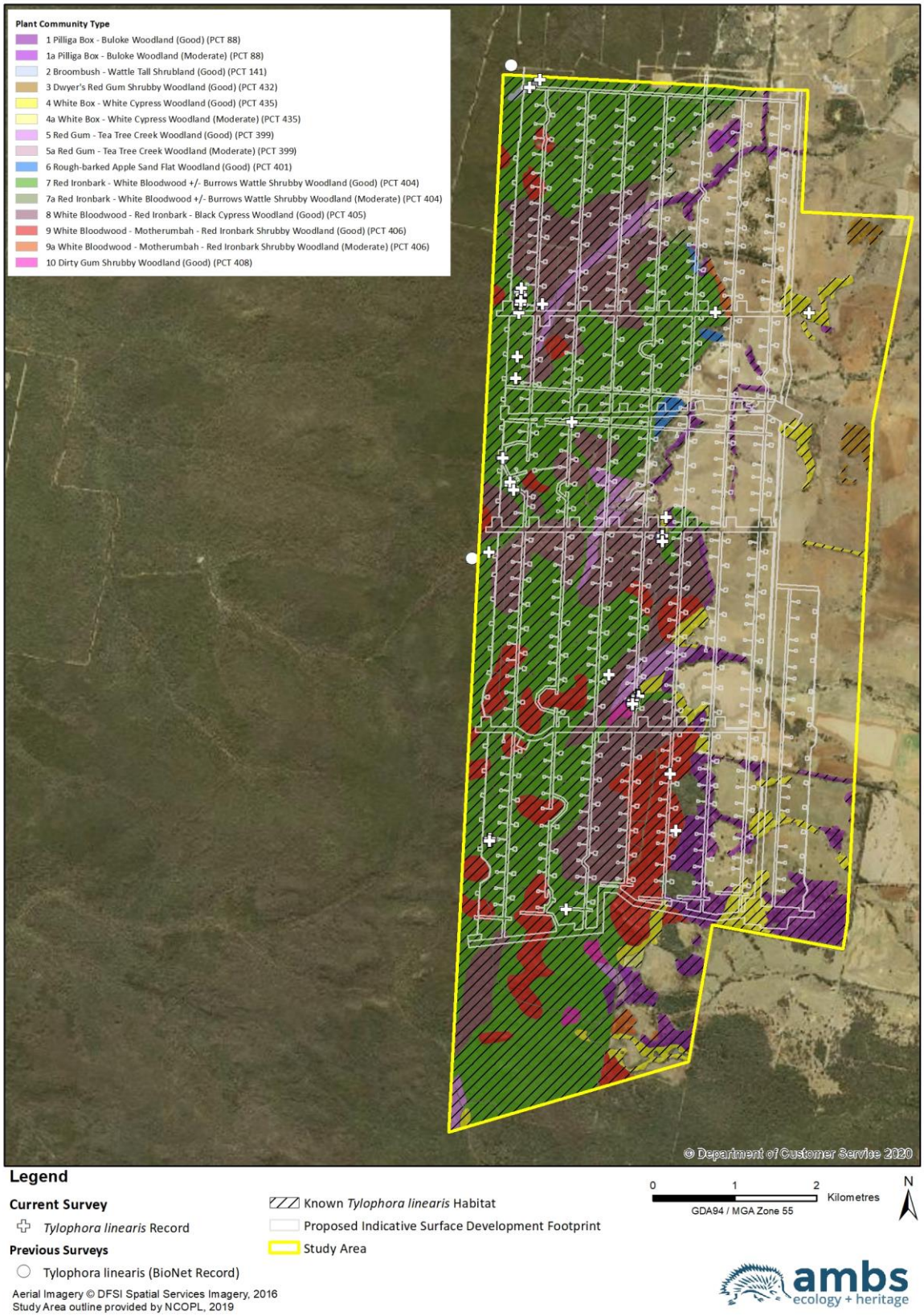


Figure 3.6 *Tylophora linearis* records and species habitat habitat in the study area

3.5 Other Threatened Plants

Other threatened plants associated with PCTs in the study area, but not detected during the surveys are discussed below. Each species profile includes a discussion of the known distribution, potential habitat, PCT associations, ecology, and the proximity of known records to the study area.

3.5.1 Commersonia procumbens

Commersonia procumbens (syn. *Androcalva procumbens*) (BC Act – Vulnerable, EPBC Act - Vulnerable) is a prostrate shrub with trailing stems and stellate-hairy leaves. In NSW, the species is found occasionally in the Dubbo-Mendooran-Gilgandra region, the Nymagee area and the Pilliga. The species has been found in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with *Calytrix tetragona*, and in recently burnt Ironbark and *Callitris* (DPIE 2020f).

Commersonia procumbens has previously been recorded 2.5 km south-west of the study area in the Pilliga East State Forest, with several more records approximately 20 km south-west of the study area in the Pilliga East State Conservation Area and north-east of the study area in Mount Kaputar National Park (ALA 2019, DPIE 2020a). Potential habitat in the study area is reported to be PCTs 88, 141, 399, 401, 404, 405, 406, 408, 432 and 435 (DPIE 2020e). Suitable timing for survey includes all months except June and July (DPIE 2020e). All threatened flora survey months during this study were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e).

Fire or physical disturbance to the soil within the last 1 to 2 seasons is required for above-ground identification of *Commersonia procumbens*, with the species then reverting to underground thickened rootstock (DPIE 2020f). There has been no fire in the study area for 27-33 years (Section 1.9), although there has been physical disturbance for clearing of tracks and exploration bore pads.

The survey for this species included searches along some of the tracks and exploration bore pads in the study area. *Commersonia procumbens* has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.2 Cyperus conicus

Cyperus conicus (BC Act – Endangered, EPBC Act – not listed) is a tufted, greyish perennial sedge with a short, thick underground stem and 3-5mm-wide rough leaves. In NSW the species occurs rarely in the Pilliga area, in *Callitris* forest on sandy soil with other *Cyperus* species including *Cyperus gracilis*, *Cyperus squarrosus* and *Cyperus fulvus* (DPIE 2020f).

Cyperus conicus has previously been recorded 30 km north of the study area in Killarney State Conservation Area and 40 km west of the study area in the Pilliga State Conservation Area (DPIE 2020a). Potential habitat in the study area is reported to be PCTs 55, 88 and 206 (DPIE 2020e). Suitable timing for survey is from January to May (DPIE 2020e). January 2018 and January 2020 surveys within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e).

Cyperus conicus has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.3 Dichanthium setosum

Dichanthium setosum (BC Act – Vulnerable, EPBC Act – Vulnerable) is an upright, perennial tussock grass less than 1 m tall, with mostly hairless leaves and bearded nodes. The flowers are densely

hairy and grow in pairs along a stalk, with a sessile full flower and a male flower on a short stalk (PlantNet 2020, DPIE 2020f). In NSW, the species occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes. It is associated with heavy basaltic black soils and red-brown loams in grassy woodlands or cleared or disturbed grassy areas (DPIE 2020f).

Dichanthium setosum has previously been recorded 18 km east of the study area on an offset property south of the Leard State Conservation Area and approximately 20 km north-northwest of the study area in the Narrabri area (DPIE 2020a). Potential habitat in the study area is reported to be PCTs 55, 432 and 435 (DPIE 2020e). *Dichanthium setosum* can only be positively identified from flowers that appear in summer, with predicted suitable survey months from November to May (DPIE 2020e). January 2018 and January 2020 surveys were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e).

Dichanthium setosum has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.4 Digitaria porrecta

Digitaria porrecta (BC Act – Endangered, EPBC Act – not listed) is a loosely tufted, hairy perennial grass growing to 60 cm tall. In NSW the species is found on the North West Slopes and Plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran. It occurs in native grasslands, woodlands or grassy open forest on richer soils, often under *Eucalyptus albens* or *Acacia pendula* (DPIE 2020f).

Digitaria porrecta has previously been recorded in a travelling stock reserve under *Eucalyptus populnea* approximately 13 km east of the study area, and also approximately 32 km north-northwest of the study area on private property (DPIE 2020a). Potential habitat in the study area is in PCTs 55 and 244 (DPIE 2020e). *Digitaria porrecta* can only be positively identified from flowers that appear in summer, with suitable survey months of January and February (DPIE 2020e). January 2018 and January 2020 surveys were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e).

Digitaria porrecta has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.5 Diuris tricolor

Diuris tricolor (BC Act – Vulnerable, EPBC Act – not listed) is a terrestrial orchid with 1-3 linear leaves to 30 cm long and 2-6 yellow to orange flowers speckled with red to purple and white markings. The species is deciduous, persisting as below-ground tubers when not in flower. In NSW the species occurs sporadically across the western slopes, in open grassy habitat often with *Callitris* spp. (DPIE 2020f).

Diuris tricolor has previously been recorded approximately 13 km west of the study area in Bibblewindi State Forest (ELA 2012b, DPIE 2020a). Potential habitat in the study area is PCTs 88, 206, 399, 401, 404 and 405 (DPIE 2020e). The species can be observed within suitable habitat in September or October, with observation likelihood enhanced by sufficient rainfall in preceding winter months (DPIE 2020e). September-October 2017 and October 2019 surveys were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e) for the species. Below-average rainfall for most of the 2017-2020 survey period may have affected the resprouting of *Diuris tricolor*.

Diuris tricolor has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.6 Homoranthus darwinioides

Homoranthus darwinioides (BC Act – Vulnerable, EPBC Act – Vulnerable) is a slender hairless shrub up to 1.5 m high, with linear cylindrical leaves and characteristic drooping paired flower heads. The species is rare in the central tablelands and western slopes of NSW, occurring from Putty to the Dubbo area. Habitat is typically woodland with a shrubby understorey on deep sandy soils (DPIE 2020f, PlantNet 2020).

Homoranthus darwinioides has not previously been recorded in the Narrabri LGA, and the nearest record for the species is approximately 165 km south-west of the study area in Goonoo State Conservation Area (DPIE 2020e). Potential habitat in the study area is restricted to PCT 141 (DPIE 2020e). Suitable timing for survey is from March to December (DPIE 2020e). September 2017, October 2017, November 2017 and October 2019 surveys were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e).

Homoranthus darwinioides has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.7 Monotaxis macrophylla

Monotaxis macrophylla (BC Act – Endangered, EPBC Act – not listed) is an erect, hairless herb to c. 25 cm tall with oblong leaves up to 50 mm long and 15 mm wide, and flowers in yellow clusters. In NSW several highly disjunct populations have been recorded, from Woodenbong near the Queensland border in the north to Bemboka near the Victorian border in the south. A wide variety of habitats have been recorded including coastal heath, arid shrubland, forests and montane heath (DPIE 2020f, PlantNet 2020).

Monotaxis macrophylla has been recorded approximately 15 km south-southwest of the study area just east of Pilliga East State Conservation Area (DPIE 2020a). Potential habitat in the study area is reported to be PCTs 399, 401, 404, 405, 406, 408, 432, 435 (DPIE 2020e). Suitable months for survey are from August to February (DPIE 2020e). September 2017, October 2017, November 2017, January 2018, October 2019 and January 2020 threatened flora surveys were within the recommended months identified in the Threatened Biodiversity Data Collection (DPIE 2020e).

Monotaxis macrophylla is a fire-ephemeral species that germinates after fire from soil-stored seed, flowers within a few months, and then dies off and persists only as seed in the soil (DPIE 2020e). In the absence of recent fire, the species is difficult to detect. Based on the available fire history information the study area has not burnt for at least 27 years (NPWS 2019). A nearby area in Jacks Creek State Forest that was burnt in February 2017 was briefly searched for the species during an August 2018 survey for an adjacent study area. No sign of the species was found in that area.

Monotaxis macrophylla has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.8 Polygala linariifolia

Polygala linariifolia (BC Act – Endangered, EPBC Act – not listed) is an annual or perennial herb to 20 cm tall with a woody tap root and purplish-blue or yellow pea flowers. It is mainly found in north-eastern NSW with one isolated population in far north-western NSW. Habitat includes dry eucalypt forests and woodlands with a sparse understorey on sandy soils (DPIE 2020f, PlantNet 2020).

Polygala linariifolia has previously been recorded 8.7 km west-southwest of the study area in Pilliga East State Forest, 38 km south of the study area in Kerringle State Forest, and 31 km north of the

study area near Killarney State Conservation Area (SCA) (ALA 2019, DPIE 2020a). ELA have recorded *Polygala linariifolia* in a range of habitat types in the Pilliga area, observing a high number of plants following rainfall and population declines in the absence of rainfall (ELA 2016e, ELA 2012b). Potential habitat in the study area is reported to be PCTs 88, 399, 401, 405, 406, 408, 432 and 435 (DPIE 2020e). Suitable survey months are from October to February (DPIE 2020e). October and November 2017, January 2018, October 2019 and January 2020 threatened flora surveys were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e). Below average rainfall for most of the 2017-2020 survey period may have affected the possibility of detecting *Polygala linariifolia*. Recent surveys in the Pilliga area observed significant declines in populations over autumn and winter, apparently the result of *Polygala linariifolia* increasing with the previous summer's high rainfall then declining under below-average conditions (DPIE 2020f).

Polygala linariifolia has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.9 Pterostylis cobarensis

Pterostylis cobarensis (BC Act – Vulnerable, EPBC Act – not listed) is a terrestrial greenhood orchid with 7-11 narrow-elliptic rosette leaves at the base and 3-8 flowers on a scape to 40 cm high. The species is deciduous, persisting as below-ground tubers between flowering and fruiting. In NSW the species occurs from Mutawintji National Park in the west to the Pilliga East State Forest in the east. Habitats include eucalypt woodlands, open mallee or Callitris shrublands on low stony ridges and slopes in skeletal sandy-loam soils (DPIE 2020f, PlantNet 2020).

This species was de-listed under the EPBC Act in 2013 based on available information on the species' population size and geographic distribution, including no evidence of decline (Threatened Species Scientific Committee 2013). It is currently listed as vulnerable in NSW.

The nearest records of *Pterostylis cobarensis* are located approximately 12 km west of the study area, within Bibblewindi State Forest (ELA 2012b, ELA 2016e, DPIE 2020a). ELA (2012b) recorded the species in a broad range of vegetation types in the Pilliga area, but most often associated with a dense mid-storey of *Allocasuarina luehmannii* or *Callitris glaucophylla*. Potential habitat in the study area is reported to be PCTs 88, 141, 244, 401, 404, 405, 406 and 408 (DPIE 2020e). *Pterostylis cobarensis* is reported as flowering between September and November following significant autumn and winter rainfall (DPIE 2020f). Suitable survey months according to the *Threatened Biodiversity Data Collection* are restricted to October (DPIE 2020e). October 2017 and October 2019 surveys were at a suitable time for detecting the species, as per DPIE (2020e). Below-average rainfall for most of the 2017-2020 survey period may have affected the resprouting of *Pterostylis cobarensis*; however, other ground orchids were recorded (including two *Pterostylis* spp.), suggesting that the surveys could have detected *Pterostylis cobarensis* if it were present.

Pterostylis cobarensis has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.10 Swainsona murrayana

Swainsona murrayana (BC Act – Vulnerable, EPBC Act – Vulnerable) is a sparsely downy perennial forb to 25 cm tall with pink or purple pea flowers spirally twisted at the base of the calyx. The species is found throughout inland NSW, from the Hay plain and Broken Hill in the south-west up to Moree and Weilmoringle in the north. It occurs on heavy clay soils often with *Maireana* species and can tolerate some disturbance (DPIE 2020f, PlantNet 2020, DEWHA 2008).

Swainsona murrayana has previously been recorded approximately 20 km north-northwest of the study area, though this vouchered record is from 1886 with location described as "Narrabri" so its coordinates may be inaccurate (DPIE 2020a). The next nearest record is approximately 42 km south-west of the study area in the Pilliga Nature Reserve (DPIE 2020a).

Potential habitat in the study area is reported to be PCTs 55 and 244 (DPIE 2020e). Suitable survey months according to the *Threatened Biodiversity Data Collection* are restricted to September (DPIE 2020e), though the species is noted to flower from spring to early summer after good cool-season rains (DPIE 2020f). September 2017 surveys were at a suitable time for detecting this species, and October 2019 surveys were considered equally suitable to the recommended September season. Given the lack of cool-season rain prior to surveys and that the flowering period for this species is from spring to early summer (DPIE 2020f), October 2019 was considered to be suitable for surveys under these circumstances. Below average rainfall for most of the 2017-2020 survey period may have affected the resprouting of *Swainsona murrayana*; however, a different species of Swainsona, with similar habit and habitat, was recorded (namely *Swainsona greyana*) suggesting that the surveys could have detected *Swainsona murrayana* if it were present.

Swainsona murrayana has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.5.11 Swainsona sericea

Swainsona sericea (BC Act – Vulnerable, EPBC Act – not listed) is a densely hairy prostrate or low-growing perennial plant to 10 cm tall, with purple pea flowers held on an erect stem. In NSW the species has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. Its habitat includes grasslands and box gum woodland, sometimes with *Callitris* spp. (DPIE 2020f, PlantNet 2020).

Swainsona sericea has previously been recorded 87 km south-east of the study area in a travelling stock route near Coonabarabran (DPIE 2020a). Potential habitat in the study area is reported to be PCTs 244, 399, 401 and 405 (DPIE 2020e). Suitable survey months are September to November (DPIE 2020e). September 2017, October 2017, November 2017 and October 2019 threatened flora surveys were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e). Below-average rainfall for most of the 2017-2020 survey period may have affected the resprouting of *Swainsona sericea*; however, a different species of *Swainsona* was recorded (namely *Swainsona greyana*), suggesting that the surveys could have detected *Swainsona sericea* if it were present.

Swainsona sericea has not been recorded in the study area during the past or present surveys in the study area or at the Narrabri Mine.

3.5.12 Zieria ingramii

Zieria ingramii (BC Act – Endangered, EPBC Act – Endangered) is a slender shrub to 0.6 m high, with ridged branches and oil-dotted leaves with three narrow leaflets 9-19 mm long (PlantNet 2020). The species is known mainly from Goonoo SCA, about 40 km north-east of Dubbo, with one record in Kings Plains National Park 34 km north-east of Inverell (DPIE 2020a). The species' habitat is *Eucalypt-Callitris* woodland or open forest on light sandy soils with a shrubby to heathy understorey (DPIE 2020f).

Zieria ingramii has previously been recorded 150 km south-west of the study area near Goonoo SCA (DPIE 2020a). Potential habitat in the study area is PCT 399 (DPIE 2020e). Suitable survey months are from September to February (DPIE 2020e). All threatened flora survey months during

this study were within the recommended months identified in the *Threatened Biodiversity Data Collection* (DPIE 2020e).

Zieria ingramii has not been recorded during past or present surveys in the study area or at the Narrabri Mine.

3.6 Exotic Species and High Threat Weeds

The flora surveys identified a total of 97 exotic species, including twelve species listed by the BAM as High Threat Weeds (OEH 2017). Table 3.4 lists the High Threat Weeds recorded in the study area.

Table 3.5 High Threat Weeds Recorded

Family	Scientific Name	Common Name	Abundance
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper	Recorded at a single location in low abundance, within Bloodwood-Ironbark forest, in the southern part of the study area.
Asteraceae	*Carthamus lanatus*	Saffron Thistle	Common and sometimes highly abundant in derived native grassland areas.
Cactaceae	*Opuntia aurantiaca*	Tiger Pear	Uncommon and low abundance in disturbed woodland areas.
Cactaceae	*Opuntia stricta*	Common Prickly Pear, Smooth Pest Pear	Common but generally low abundance in more open woodland areas throughout the study area.
Cactaceae	*Opuntia* spp.	A Prickly Pear	An unidentified *Opuntia* species was recorded in 17 plots across the south of the study area.
Cactaceae	*Opuntia tomentosa*	Velvet Tree Pear	Common but low abundance in disturbed woodland areas in the southern part of the study area.
Crassulaceae	*Bryophyllum delagoense*	Mother of millions	Common but sporadic in more disturbed woodland areas across the study area. Can be locally abundant.
Poaceae	*Eragrostis curvula*	African Lovegrass	Sporadic but sometimes locally abundant, mainly in derived native grassland areas.
Poaceae	*Hyparrhenia hirta*	Coolatai Grass	Sporadic but sometimes locally abundant, mainly in derived native grassland areas.
Poaceae	*Paspalum dilatatum*	Paspalum	Sporadic but sometimes locally abundant, mainly in derived native grassland areas.
Solanaceae	*Lycium ferocissimum*	African Boxthorn	Common but sporadic in more disturbed woodland areas across the study area. Can be locally abundant.
Solanaceae	*Solanum elaeagnifolium*	Silver-leaved Nightshade	Common but low abundance, mainly in derived native grassland areas.

4 Conclusion

Nine field surveys were undertaken by AMBS in June 2019, July 2019, August 2019, October 2019 and January 2020, in addition to four others undertaken in September 2017, October 2017, November 2017 and January 2018 by ELA. A total of 97 exotic species were identified, including twelve species listed by the BAM as High Threat Weeds (OEH 2017).

A total of 472 plant species in 72 families were recorded during surveys to determine the PCTs in the study area (Appendix A). Of these, 375 were native plant species.

This study has confirmed thirteen PCTs within the study area:

- PCT 55 *Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions* (60.1 ha Good + 266.7 ha DNG);
- PCT 88 *Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion* (284.5 ha Good + 10.7 ha Moderate + 468.3 ha DNG);
- PCT 141 *Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion* (4.2 ha Good);
- PCT 206 *Dirty Gum – White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion* (37.1 ha Good);
- PCT 244 *Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt)* (79.1 ha Good + 271.7 ha DNG);
- PCT 399 *Red Gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion* (100.0 ha Good + 12.7 ha Moderate);
- PCT 401 *Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region* (16.6 ha Good);
- PCT 404 *Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests* (1,714.3 ha Good + 21.4 ha Moderate);
- PCT 405 *White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions* (691.1 ha Good + 4.6 ha DNG);
- PCT 406 *White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests* (381.1 ha Good + 15.0 ha Moderate);
- PCT 408 *Dirty Gum (Baradine Gum) – Black Cypress Pine – White Bloodwood shrubby woodland of the Pilliga forests and surrounding region* (14.8 ha Good);
- PCT 432 *Dwyer's Red Gum - Dirty (Baradine) Gum - cypress pine shrubby woodland of the Narrabri region of the Brigalow Belt South Bioregion* (25.8 ha Good); and
- PCT 435 *White Box – White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion* (151.0 ha Good + 3.8 ha Moderate + 203.9 ha DNG).

One Threatened Ecological Community was identified in the study area, namely the *Poplar Box Grassy Woodland on Alluvial Plains* listed as Endangered under the EPBC Act. Approximately 43.1 ha of *Poplar Box Grassy Woodland* occurs in the study area.

The following four threatened plant species were recorded in the study area, all of which are threatened under the BC Act and/or EPBC Act:

- *Bertya opponens* (BC Act - Vulnerable, EPBC Act - Vulnerable);
- *Lepidium aschersonii* (BC Act – Vulnerable, EPBC Act - Vulnerable);
- *Pomaderris queenslandica* (BC Act – Endangered, EPBC Act – Not listed); and
- *Tylophora linearis* (BC Act - Vulnerable, EPBC Act - Endangered).

Below average rainfall and above average temperatures for most of 2017-2020 and the lack of recent fire, may have limited the ability to detect some potentially occurring threatened plants, including *Cyperus conicus*, *Diuris tricolor* (Pine Donkey Orchid), *Monotaxis macrophylla* (Large-leafed Monotaxis), *Polygala linariifolia* (Native Milkwort), *Pterostylis cobarensis* (Cobar Rustyhood), *Swainsona murrayana* (Slender Darling Pea), *Swainsona sericea* (Silky Swainson Pea) and *Tylophora linearis*. However, the below average rainfall did not influence the identification and classification of PCTs and associated Threatened Ecological Communities from which the potential occurrence of threatened plants are derived. All threatened flora species previously known to occur at the Narrabri Mine (through years of survey and monitoring) were detected during the survey work.

Bibliography

AMBS Ecology and Heritage (2019). Narrabri Underground Mine Longwalls 110 and 111 – Baseline Flora Survey. Prepared for Narrabri Coal Operations Pty Ltd.

Atlas of Living Australia (2019). Atlas of Living Australia Website. Database search within the following area: -30.1152 149.4038, -30.9903 149.4038, -30.9903 150.1206, -30.1152 150.1206, -30.1152 149.4038. [Accessed November 2019].

Australasian Groundwater and Environmental Consultants (2020). Narrabri Underground Mine Stage 3 Extension Project – Groundwater Impact Assessment.

Benson, J. S., Richards, P. G., Waller, S. and Allen, C. B. (2010). New South Wales Vegetation Classification and Assessment: Part 3 Plant communities of the NSW Brigalow Belt South, Nandewar and west New England Bioregions and update of NSW Western Plains and South-western Slope plant communities, Version 3 of the NSWVCA database. Cunninghamia 11: 457 – 479.

Bureau of Meteorology (2019). Commonwealth of Australia 2019, Bureau of Meteorology [Accessed December 2019].

Bureau of Meteorology (2020). Groundwater Dependent Ecosystems Atlas. Commonwealth of Australia 2019, Bureau of Meteorology. http://www.bom.gov.au/water/groundwater/gde/ [Accessed February 2020].

Department of Environment and Conservation (2004). Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft). New South Wales Department of Environment and Conservation, Hurstville, New South Wales.

Department of Planning, Industry and Environment (2020a). BioNet Atlas. New South Wales Department of Planning, Industry and Environment Website: http://www.bionet.nsw.gov.au/. Database search within the following area: -30.11 149.40, -30.11 150.12, -30.99 149.40, -30.99 150.12. [Accessed March 2019 – February 2020].

Department of Planning, Industry and Environment (2020b) BioNet Systematic Flora Survey. New South Wales Department of Planning, Industry and Environment Website https://www.environment.nsw.gov.au/research/VISplot.htm. [Accessed December 2019 – February 2020].

Department of Planning, Industry and Environment (2020c) BioNet Vegetation Classification. New South Wales Department of Planning, Industry and Environment Website: https://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx. [Accessed March 2019 – February 2020].

Department of Planning, Industry and Environment (2020d). Border Rivers Gwydir/Namoi Region 2.0 VIS 4467 vegetation map. New South Wales Department of Planning, Industry and Environment.

Department of Planning, Industry and Environment (2020e). Threatened Biodiversity Data Collection. New South Wales Department of Planning, Industry and Environment Website: http://www.bionet.nsw.gov.au/. [Accessed March 2019 – February 2020].

Department of Planning, Industry and Environment (2020f). Threatened Species Profile Database. New South Wales Department of Planning, Industry and Environment Website: https://www.environment.nsw.gov.au/threatenedspeciesapp/. [Accessed March 2019 – February 2020].

Department of Planning, Industry and Environment (2020g) Brigalow Belt South – subregions, Website: https://www.environment.nsw.gov.au/bioregions/BrigalowBeltSouth-Subregions.htm [Accessed January 2020].

Department of Primary Industries - Water (2016). Methods for the identification of high probability groundwater dependent vegetation ecosystems. Published by the Department of Primary Industries, a Division of New South Wales Department of Industry, Skills and Regional Development.

Department of the Environment and Energy (2019). EPBC Act Protected Matters Report. Department of the Environment and Energy Database search within the following area: -30.5424 149.82982, -30.54388 149.88887, -30.62279 149.89231, -30.61836 149.82639, -30.5424 149.82982. [Accessed November 2019].

Department of the Environment and Energy (2020). Interim Biogeographic Regionalisation for Australia (IBRA), Version 7. Department of the Environment and Energy.

Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for *Swainsona murrayana* (Slender Darling-pea). Canberra: Department of the Environment, Water, Heritage and the Arts.

Doody TM, Barron OV, Dowlsey K, Emelyanova I, Fawcett J, Overton IC, Pritchard JL, van Dijk AIJM and Warren G 2017. Continental mapping of groundwater-dependent ecosystems: A methodological framework to integrate diverse data and expert opinion. Journal of Hydrology: Regional Studies, 10: 61–81

Doody T.M., Hancock P.J. and Pritchard J.L. (2019). Information Guidelines Explanatory Note: Assessing groundwater-dependent ecosystems. Report prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment and Energy, Commonwealth of Australia 2019.

Eco Logical Australia (2012a). Narrabri Mine LW 101 – 103: Biodiversity Management – Baseline Monitoring. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2012b). North-east Pilliga Forest - targeted threatened flora survey. Prepared by Eco Logical Australia for Santos Limited.

Eco Logical Australia (2013a). Narrabri Mine LW101-103: Biodiversity Management – 2012 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2013b). Narrabri Mine LW101-103: Biodiversity Management – 2013 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015a). Narrabri Mine LW101-105: Biodiversity Management – 2014 Monitoring Report (Volume 1). Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015b). Narrabri Mine LW101-105: Biodiversity Management – 2014 Monitoring Report (Volume 2). Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015c). Narrabri Mine LW101-LW106: Biodiversity Management – 2015 Monitoring Report (Volume 1). Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016a). Narrabri Mine Biodiversity Offsets - 2016 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd. Volume 1.

Eco Logical Australia (2016b). Narrabri Mine Biodiversity Offsets – 2016 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd. Volume 2.

Eco Logical Australia (2016c). Narrabri Mine LW101-LW106: Biodiversity – 2016 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd. Volume 1.

Eco Logical Australia (2016d). Narrabri Mine LW101-105: Biodiversity Management – 2016 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd. Volume 2.

Eco Logical Australia (2016e). Narrabri Gas Project: Ecological Impact Assessment. Prepared by Eco Logical Australia for Santos NSW (Eastern) Pty Ltd, November 2016.

Eco Logical Australia (2018a). Narrabri Mine On-site Biodiversity Offset Area – 2017 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2018b). Narrabri Mine LW101-LW106 Biodiversity – 2017 Monitoring Report. Prepared by Eco Logical Australia for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2019). Flora Surveys South of the Narrabri Underground Mine. Prepared by Eco Logical Australia for Whitehaven Coal Ltd.

Ecotone (2009). Narrabri Coal Mine Stage 2 Longwall Project. Flora and Fauna Impact Assessment. Prepared by Ecotone Ecological Consultants for Narrabri Coal Operations Pty Ltd.

Forestry Corporation of New South Wales (2019). Forestry Corporation of New South Wales Data provided to NCOPL.

Keith, D. (2006). Ocean Shores to Desert Dunes: the native vegetation of New South Wales and the ACT, New South Wales National Parks and Wildlife Service, Sydney.

Keith, D. A. (2000). Sampling designs, field techniques and analytical methods for systematic plant population surveys. Ecological Management and Restoration 1, 125-139.

Mitchell, P. (2002). Descriptions for NSW (Mitchell) Landscapes. New South Wales Department of Environment and Climate Change.

Narrabri Coal Operations Pty Limited (2018). Narrabri Mine 2017 Annual Review.

National Parks and Wildlife Service (2019). NPWS Fire History – Wildfires and Prescribed Burns Dataset. Published by the Department of Planning, Industry and Environment [Accessed November 2019].

NSW Threatened Species Scientific Committee (2007). Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions - endangered ecological community listing. NSW Department of Planning, Industry and Environment, Sydney

Office of Environment and Heritage (2016). NSW Guide to Surveying Threatened Plants. New South Wales Office of Environment and Heritage, Sydney, Australia.

Office of Environment and Heritage (2017). Biodiversity Assessment Method. New South Wales Office of Environment and Heritage, Sydney, Australia.

PlantNet (2020). The New South Wales Plant Information Network System. Royal Botanic Gardens and Domain Trust, Sydney. Website: http://plantnet.rbgsyd.nsw.gov.au [Accessed August 2019- February 2020].

Richardson, S., Irvine, E., Froend, R., Boon, P., Barber, S. and Bonneville, B. (2011). Australian Groundwater-Dependent Ecosystem Toolbox Part 1: Assessment Framework, Waterlines Report, National Water Commission, Canberra.

Thackway, R. and Cresswell, I. D. (1995). An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program, Version 4.0. Australian Nature Conservation Agency, Canberra.

Threatened Species Scientific Committee (2006). Commonwealth Listing and Conservation Advice on White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands. Prepared for the Minister for the Environment and Heritage.

Threatened Species Scientific Committee (2010). Commonwealth Listing Advice on Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia. Department of the Environment, Canberra.

Threatened Species Scientific Committee (2013). Commonwealth Listing Advice on Pterostylis cobarensis (Cobar Greenhood Orchid). Canberra: Department of the Environment.

Threatened Species Scientific Committee (2019). Conservation Advice (including listing advice) for the Poplar Box Grassy Woodland on Alluvial Plains. Prepared for the Department of Environment and Energy.

Appendix A: Flora Species List

Family	Scientific Name	Common Name	Exotic	Status*
Acanthaceae	*Brunoniella australis*	Blue Trumpet	N	
Acanthaceae	*Rostellularia adscendens*	Pink Tongues	N	
Amaranthaceae	*Alternanthera angustifolia*		N	
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	N	
Amaranthaceae	*Alternanthera nana*	Hairy Joyweed	N	
Amaranthaceae	*Alternanthera sp. A*		N	
Amaranthaceae	*Gomphrena celosioides*	Gomphrena Weed	Y	
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily	N	
Anthericaceae	*Thysanotus tuberosus*	Common Fringe-lily	N	
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily	N	
Apiaceae	*Actinotus gibbonsii*		N	
Apiaceae	*Actinotus helianthi*	Flannel Flower	N	
Apiaceae	*Daucus glochidiatus*	Native Carrot	N	
Apiaceae	*Platysace ericoides*		N	
Apocynaceae	*Alstonia constricta*	Quinine Bush	N	
Apocynaceae	*Marsdenia viridiflora* subsp. *viridiflora*	Native Pear	N	
Apocynaceae	*Parsonsia eucalyptophylla*	Gargaloo	N	
Apocynaceae	*Rhyncharrhena linearis*	Purple Pentatrope	N	
Apocynaceae	*Tylophora linearis*		N	BC Act: V EPBC Act: E
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper	Y	HTW
Asphodelaceae	*Bulbine spp.*		N	
Asteraceae	*Ambrosia psilostachya*	Perennial Ragweed	Y	
Asteraceae	*Arctotheca calendula*	Capeweed	Y	
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy	N	
Asteraceae	*Brachyscome nodosa*		N	
Asteraceae	*Brachyscome spp.*		N	
Asteraceae	*Calotis cuneata*	Mountain Burr-Daisy	N	
Asteraceae	*Calotis cuneifolia*	Purple Burr-Daisy	N	
Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy	N	
Asteraceae	*Calotis spp.*	A Burr-daisy	N	
Asteraceae	*Carthamus lanatus*	Saffron Thistle	Y	HTW
Asteraceae	*Cassinia arcuata*		N	
Asteraceae	*Cassinia laevis*	Cough Bush	N	
Asteraceae	*Cassinia quinquefaria*		N	
Asteraceae	*Centaurea melitensis*	Maltese Cockspur	Y	
Asteraceae	*Centaurea solstitialis*	St Barnabys Thistle	Y	
Asteraceae	*Centaurea spp.*	Thistle	Y	
Asteraceae	*Chondrilla juncea*	Skeleton Weed	Y	
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	N	
Asteraceae	*Chrysocephalum semipapposum*	Clustered Everlasting	N	
Asteraceae	*Chrysocephalum spp.*		N	

Family	Scientific Name	Common Name	Exotic	Status*
Asteraceae	*Cirsium vulgare*	Spear Thistle	Y	
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	Y	
Asteraceae	*Conyza spp.*	A Fleabane	Y	
Asteraceae	*Coronidium oxylepis* subsp. *lanatum*		N	
Asteraceae	*Cotula australis*	Common Cotula	N	
Asteraceae	*Craspedia spp.*	Billy Buttons	N	
Asteraceae	*Cymbonotus lawsonianus*	Bear's Ear	N	
Asteraceae	*Euchiton sphaericus*	Star Cudweed	N	
Asteraceae	*Euchiton* spp.	A Cudweed	N	
Asteraceae	*Facelis* spp.		Y	
Asteraceae	*Gamochaeta antillarum*		Y	
Asteraceae	*Glossocardia bidens*	Cobbler's Tack	N	
Asteraceae	*Gnaphalium* spp.	A Cudweed	N	
Asteraceae	*Gnephosis tenuissima*		N	
Asteraceae	*Hypochaeris glabra*	Smooth Catsear	Y	
Asteraceae	*Hypochaeris radicata*	Catsear	Y	
Asteraceae	*Hypochaeris spp.*	A Catsear	Y	
Asteraceae	*Isoetopsis graminifolia*	Grass Cushion	N	
Asteraceae	*Lactuca saligna*	Willow-leaved Lettuce	Y	
Asteraceae	*Lactuca serriola*	Prickly Lettuce	Y	
Asteraceae	*Leontodon rhagadioloides*	Cretan Weed	Y	
Asteraceae	*Olearia decurrens*	Clammy Daisy-bush	N	
Asteraceae	*Olearia elliptica*	Sticky Daisy-bush	N	
Asteraceae	*Pseudognaphalium luteoalbum*	Jersey Cudweed	N	
Asteraceae	*Schkuhria pinnata*	Dwarf Marigold	Y	
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed	N	
Asteraceae	*Senecio spp.*	Groundsel, Fireweed	N	
Asteraceae	*Silybum marianum*	Variegated Thistle	Y	
Asteraceae	*Silybum spp.*		Y	
Asteraceae	*Solenogyne bellioides*	Solenogyne	N	
Asteraceae	*Soliva sessilis*	Bindyi	Y	
Asteraceae	*Soliva spp.*		Y	
Asteraceae	*Soliva stolonifera*	Jo-jo	Y	
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	Y	
Asteraceae	*Taraxacum officinale*	Dandelion	Y	
Asteraceae	*Triptilodiscus pygmaeus*	Common Sunray	N	
Asteraceae	*Vittadinia cuneata*	A Fuzzweed	N	
Asteraceae	*Vittadinia cuneata* var. *cuneata*	A Fuzzweed	N	
Asteraceae	*Vittadinia cuneata* var. *hirsuta*		N	
Asteraceae	*Vittadinia dissecta*		N	
Asteraceae	*Vittadinia muelleri*	A Fuzzweed	N	
Asteraceae	*Vittadinia pterochaeta*	Rough Fuzzweed	N	
Asteraceae	*Vittadinia spp.*	Fuzzweed	N	
Asteraceae	*Vittadinia sulcata*		N	

Family	Scientific Name	Common Name	Exotic	Status*
Asteraceae	*Xerochrysum bracteatum*	Golden Everlasting	N	
Asteraceae	*Xerochrysum viscosum*	Sticky Everlasting	N	
Boraginaceae	*Echium plantagineum*	Patterson's Curse	Y	
Boraginaceae	*Echium vulgare*	Viper's Bugloss	Y	
Brassicaceae	*Lepidium africanum*	Common Peppercress	Y	
Brassicaceae	*Lepidium aschersonii*	Spiny Peppercress	N	BC Act: V EPBC Act: V
Brassicaceae	*Lepidium bonariense*	Argentine Peppercress	Y	
Brassicaceae	*Lepidium spp.*	A Peppercress	Y	
Brassicaceae	*Rapistrum rugosum*	Turnip Weed	Y	
Brassicaceae	*Sisymbrium irio*	London Rocket	Y	
Brassicaceae	*Sisymbrium spp.*		Y	
Cactaceae	*Cereus uruguayanus*	Apple Cactus	Y	
Cactaceae	*Opuntia aurantiaca*	Tiger Pear	Y	HTW
Cactaceae	*Opuntia spp.*		Y	HTW
Cactaceae	*Opuntia stricta*	Common Prickly Pear	Y	HTW
Cactaceae	*Opuntia tomentosa*	Velvet Tree Pear	Y	HTW
Campanulaceae	*Lobelia spp.*		N	
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell	N	
Campanulaceae	*Wahlenbergia gracilenta*	Annual Bluebell	N	
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	N	
Campanulaceae	*Wahlenbergia spp.*	Bluebell	N	
Campanulaceae	*Wahlenbergia stricta* subsp. *alterna*		N	
Capparaceae	*Apophyllum anomalum*	Warrior Bush	N	
Capparaceae	*Capparis lasiantha*	Nepine	N	
Capparaceae	*Capparis mitchellii*	Native Orange	N	
Caryophyllaceae	*Gypsophila tubulosa*	Annual Chalkwort	N	
Caryophyllaceae	*Petrorhagia dubia*		Y	
Caryophyllaceae	*Petrorhagia nanteuilii*	Proliferous Pink	Y	
Caryophyllaceae	*Polycarpaea corymbosa* var. *minor*		N	
Caryophyllaceae	*Polycarpon tetraphyllum*	Four-leaved Allseed	Y	
Caryophyllaceae	*Spergula spp.*		Y	
Caryophyllaceae	*Stellaria media*	Common Chickweed	Y	
Casuarinaceae	*Allocasuarina diminuta*		N	
Casuarinaceae	*Allocasuarina gymnanthera*		N	
Casuarinaceae	*Allocasuarina luehmannii*	Bulloak	N	
Casuarinaceae	*Casuarina cristata*	Belah	N	
Celastraceae	*Maytenus cunninghamii*		N	
Chenopodiaceae	*Chenopodiaceae indeterminate*	Salt-bushes	Y	
Chenopodiaceae	*Chenopodium spp.*	Goosefoot, Crumbweed	Y	
Chenopodiaceae	*Dysphania pumilio*	Small Crumbweed	N	
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	N	
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	N	
Chenopodiaceae	*Einadia nutans* subsp. *linifolia*	Climbing Saltbush	N	
Chenopodiaceae	*Einadia nutans* subsp. *nutans*	Climbing Saltbush	N	

Family	Scientific Name	Common Name	Exotic	Status*
Chenopodiaceae	*Einadia polygonoides*	Knotweed Goosefoot	N	
Chenopodiaceae	*Einadia trigonos*	Fishweed	N	
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush	N	
Chenopodiaceae	*Maireana enchylaenoides*	Wingless Fissure-weed	N	
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush	N	
Chenopodiaceae	*Maireana spp.*	Cotton Bush, Bluebush, Fissure-weed	N	
Chenopodiaceae	*Rhagodia spinescens*	Thorny Saltbush	N	
Chenopodiaceae	*Salsola australis*		N	
Chenopodiaceae	*Salsola kali var. kali*	Buckbush	N	
Chenopodiaceae	*Sclerolaena articulata*		N	
Chenopodiaceae	*Sclerolaena birchii*	Galvinized Burr	N	
Chenopodiaceae	*Sclerolaena muricata*	Black Rolypoly	N	
Chenopodiaceae	*Sclerolaena muricata* var. *muricata*	Black Rolypoly	N	
Chenopodiaceae	*Sclerolaena spp.*	Copperburr, Poverty-bush	N	
Clusiaceae	*Hypericum gramineum*	Small St John's Wort	N	
Convolvulaceae	*Convolvulus angustissimus*		N	
Convolvulaceae	*Convolvulus angustissimus* subsp. *fililobus*		N	
Convolvulaceae	*Convolvulus erubescens*	Pink Bindweed	N	
Convolvulaceae	*Convolvulus graminetinus*		N	
Convolvulaceae	*Convolvulus spp.*	A Bindweed	N	
Convolvulaceae	*Dichondra repens*	Kidney Weed	N	
Convolvulaceae	*Dichondra sp. A*	Kidney Weed	N	
Convolvulaceae	*Evolvulus alsinoides*	Bindweed	N	
Convolvulaceae	*Evolvulus alsinoides var. decumbens*		N	
Crassulaceae	*Bryophyllum delagoense*	Mother of millions	Y	HTW
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop	N	
Crassulaceae	*Crassula sieberiana subsp. tetramera*		N	
Cupressaceae	*Callitris endlicheri*	Black Cypress Pine	N	
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine	N	
Cyperaceae	*Carex inversa*	Knob Sedge	N	
Cyperaceae	*Cyperus fulvus*	Sticky Sedge	N	
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	N	
Cyperaceae	*Cyperus spp.*		N	
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	N	
Cyperaceae	*Fimbristylis spp.*		N	
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge	N	
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	N	
Cyperaceae	*Schoenus ericetorum*		N	
Cyperaceae	*Schoenus kennyi*	A Bog Rush	N	
Dilleniaceae	*Hibbertia circumdans*		N	
Dilleniaceae	*Hibbertia obtusifolia*	Hoary Guinea Flower	N	
Dilleniaceae	*Hibbertia riparia*		N	
Dilleniaceae	*Hibbertia vestita*		N	

Family	Scientific Name	Common Name	Exotic	Status*
Droseraceae	*Drosera peltata*	A Sundew	N	
Droseraceae	*Drosera spp.*		N	
Ericaceae	*Brachyloma daphnoides*	Daphne Heath	N	
Ericaceae	*Leucopogon muticus*	Blunt Beard-heath	N	
Ericaceae	*Leucopogon spp.*	A Beard-heath	N	
Ericaceae	*Lissanthe strigosa subsp. subulata*	Peach Heath	N	
Ericaceae	*Melichrus erubescens*	Ruby Urn Heath	N	
Ericaceae	*Melichrus spp.*		N	
Ericaceae	*Melichrus urceolatus*	Urn Heath	N	
Ericaceae	*Styphelia triflora*	Pink Five-Corners	N	
Euphorbiaceae	*Bertya oblonga*		N	
Euphorbiaceae	*Bertya oleifolia*		N	
Euphorbiaceae	*Bertya opponens*	Coolabah Bertya	N	BC Act: V EPBC Act: V
Euphorbiaceae	*Bertya spp.*		N	
Euphorbiaceae	*Beyeria viscosa*	Sticky Wallaby Bush	N	
Euphorbiaceae	*Euphorbia drummondii*	Caustic Weed	N	
Euphorbiaceae	*Ricinocarpos bowmanii*		N	
Fabaceae (Caesalpinioideae)	*Senna artemisioides subsp. zygophylla*		N	
Fabaceae (Caesalpinioideae)	*Senna pendula var. glabrata*		Y	
Fabaceae (Faboideae)	*Aotus mollis*		N	
Fabaceae (Faboideae)	*Bossiaea rhombifolia subsp. concolor*		N	
Fabaceae (Faboideae)	*Chorizema parviflorum*	Eastern Flame Pea	N	
Fabaceae (Faboideae)	*Daviesia acicularis*		N	
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	N	
Fabaceae (Faboideae)	*Oxytes brachypoda*	Large Tick-trefoil	N	
Fabaceae (Faboideae)	*Pullenia gunnii*	Slender Tick-trefoil	N	
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	N	
Fabaceae (Faboideae)	*Dillwynia phylicoides*	Parrot-pea	N	
Fabaceae (Faboideae)	*Dillwynia sericea*	Egg and Bacon Peas, Parrot Peas	N	
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine	N	
Fabaceae (Faboideae)	*Glycine spp.*		N	
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine	N	
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	N	
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo	N	
Fabaceae (Faboideae)	*Medicago minima*	Woolly Burr Medic	Y	
Fabaceae (Faboideae)	*Medicago polymorpha*	Burr Medic	Y	

Family	Scientific Name	Common Name	Exotic	Status*
Fabaceae (Faboideae)	*Medicago spp.*	A Medic	Y	
Fabaceae (Faboideae)	*Medicago truncatula*	Barrel Medic	Y	
Fabaceae (Faboideae)	*Swainsona greyana*	Darling Pea	N	
Fabaceae (Faboideae)	*Swainsona spp.*		N	
Fabaceae (Faboideae)	*Trifolium arvense*	Haresfoot Clover	Y	
Fabaceae (Faboideae)	*Trifolium glomeratum*	Clustered Clover	Y	
Fabaceae (Faboideae)	*Trifolium spp.*	A Clover	Y	
Fabaceae (Faboideae)	*Trifolium subterraneum*	Subterranean Clover	Y	
Fabaceae (Mimosoideae)	*Acacia blakei*		N	
Fabaceae (Mimosoideae)	*Acacia burrowii*	Burrow's Wattle	N	
Fabaceae (Mimosoideae)	*Acacia caroleae*		N	
Fabaceae (Mimosoideae)	*Acacia cheelii*	Motherumbah	N	
Fabaceae (Mimosoideae)	*Acacia deanei*	Green Wattle	N	
Fabaceae (Mimosoideae)	*Acacia deanei subsp. deanei*	Deane's Wattle	N	
Fabaceae (Mimosoideae)	*Acacia deanei subsp. paucijuga*	Green Wattle	N	
Fabaceae (Mimosoideae)	*Acacia decora*	Western Silver Wattle	N	
Fabaceae (Mimosoideae)	*Acacia doratoxylon*	Currawang	N	
Fabaceae (Mimosoideae)	*Acacia flexifolia*	Bent-leaved Wattle	N	
Fabaceae (Mimosoideae)	*Acacia gladiiformis*	Sword Wattle	N	
Fabaceae (Mimosoideae)	*Acacia havilandiorum*	Haviland's Wattle	N	
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle	N	
Fabaceae (Mimosoideae)	*Acacia ixiophylla*		N	
Fabaceae (Mimosoideae)	*Acacia ixodes*	Motherumbung	N	
Fabaceae (Mimosoideae)	*Acacia penninervis*	Mountain Hickory	N	
Fabaceae (Mimosoideae)	*Acacia salicina*	Cooba	N	
Fabaceae (Mimosoideae)	*Acacia spp.*	Wattle	N	
Gentianaceae	*Centaurium tenuiflorum*	Branched Centaury, Slender Centaury	Y	
Geraniaceae	*Erodium cicutarium*	Common Crowfoot	Y	
Geraniaceae	*Erodium spp.*	Crowfoot	Y	
Geraniaceae	*Geranium solanderi var. solanderi*		N	
Geraniaceae	*Geranium spp.*		N	
Goodeniaceae	*Dampiera lanceolata var. lanceolata*		N	

Family	Scientific Name	Common Name	Exotic	Status*
Goodeniaceae	*Goodenia cycloptera*	Cut-leaf Goodenia	N	
Goodeniaceae	*Goodenia fascicularis*	Mallee Goodenia	N	
Goodeniaceae	*Goodenia glabra*	Smooth Goodenia	N	
Goodeniaceae	*Goodenia hederacea subsp. hederacea*		N	
Goodeniaceae	*Goodenia rotundifolia*		N	
Goodeniaceae	*Goodenia spp.*		N	
Haloragaceae	*Gonocarpus elatus*	A Raspwort	N	
Haloragaceae	*Haloragis aspera*	Rough Raspwort	N	
Haloragaceae	*Haloragis heterophylla*	Variable Raspwort	N	
Juncaceae	*Juncus aridicola*	Tussock Rush	N	
Juncaceae	*Juncus bufonius*	Toad Rush	Y	
Juncaceae	*Juncus dolichanthus*		N	
Juncaceae	*Juncus spp.*	A Rush	N	
Juncaceae	*Juncus subsecundus*	Finger Rush	N	
Juncaceae	*Juncus usitatus*		N	
Juncaceae	*Juncus vaginatus*		N	
Lamiaceae	*Ajuga australis*	Austral Bugle	N	
Lamiaceae	*Chloanthes parviflora*		N	
Lamiaceae	*Marrubium vulgare*	White Horehound	Y	
Lamiaceae	*Mentha satureioides*	Native Pennyroyal	N	
Lamiaceae	*Teucrium betchei*		N	
Lamiaceae	*Prostanthera granitica*		N	
Lamiaceae	*Prostanthera ringens*	Gaping Mint-bush	N	
Lamiaceae	*Salvia verbenaca*	Vervain	Y	
Lamiaceae	*Teucrium junceum*		N	
Lamiaceae	*Westringia eremicola*	Slender Westringia	N	
Lauraceae	*Cassytha pubescens*	Downy Dodder-laurel	N	
Linaceae	*Linum marginale*	Native Flax	N	
Lomandraceae	*Lomandra confertifolia subsp. pallida*	Matrush	N	
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	N	
Lomandraceae	*Lomandra filiformis subsp. coriacea*	Wattle Matt-rush	N	
Lomandraceae	*Lomandra filiformis subsp. filiformis*		N	
Lomandraceae	*Lomandra leucocephala subsp. leucocephala*	Woolly Mat-rush	N	
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	N	
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush	N	
Lomandraceae	*Lomandra spp.*	Mat-rush	N	
Loranthaceae	*Amyema gaudichaudii*		N	
Loranthaceae	*Amyema linophyllum*		N	
Loranthaceae	*Amyema pendula*		N	
Loranthaceae	*Muellerina eucalyptoides*		N	
Loranthaceae	*Muellerina spp.*		N	
Malvaceae	*Abutilon fraseri*	Dwarf Lantern-flower	N	

Family	Scientific Name	Common Name	Exotic	Status*
Malvaceae	*Abutilon oxycarpum*	Straggly Lantern-bush	N	
Malvaceae	*Abutilon spp.*	Lantern-bush	N	
Malvaceae	*Brachychiton populneus*	Kurrajong	N	
Malvaceae	*Brachychiton populneus subsp. trilobus*		N	
Malvaceae	*Hibiscus sturtii*	Hill Hibiscus	N	
Malvaceae	*Keraudrenia corollata var. corollata*		N	
Malvaceae	*Malva parviflora*	Small-flowered Mallow	Y	
Malvaceae	*Malva spp.*	Mallow	Y	
Malvaceae	*Malvastrum americanum*	Spiked Malvastrum	Y	
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	Y	
Malvaceae	*Sida corrugata*	Corrugated Sida	N	
Malvaceae	*Sida cunninghamii*	Ridge Sida	N	
Malvaceae	*Sida spinosa*		Y	
Malvaceae	*Sida spp.*		N	
Malvaceae	*Sida trichopoda*	High Sida	N	
Myoporaceae	*Eremophila debilis*	Amulla	N	
Myoporaceae	*Eremophila mitchellii*	Budda	N	
Myoporaceae	*Myoporum montanum*	Western Boobialla	N	
Myoporaceae	*Myoporum spp.*	Boobialla	N	
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	N	
Myrtaceae	*Calytrix tetragona*	Common Fringe-myrtle	N	
Myrtaceae	*Corymbia trachyphloia*	White Bloodwood	N	
Myrtaceae	*Eucalyptus albens*	White Box	N	
Myrtaceae	*Eucalyptus chloroclada*	Dirty Gum	N	
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	N	
Myrtaceae	*Eucalyptus dwyeri*	Dwyer's Red Gum	N	
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	N	
Myrtaceae	*Eucalyptus pilligaensis*	Narrow-leaved Grey Box	N	
Myrtaceae	*Eucalyptus populnea subsp. bimbil*	Bimble Box	N	
Myrtaceae	*Harmogia densifolia*		N	
Myrtaceae	*Homoranthus flavescens*		N	
Myrtaceae	*Leptospermum parvifolium*		N	
Myrtaceae	*Leptospermum polygalifolium*	Tantoon	N	
Myrtaceae	*Leptospermum polygalifolium subsp. transmontanum*		N	
Myrtaceae	*Melaleuca diosmatifolia*	Pink Honeymyrtle	N	
Myrtaceae	*Melaleuca erubescens*	Pink Honeymyrtle	N	
Myrtaceae	*Melaleuca uncinata*	Broombush	N	
Myrtaceae	*Micromyrtus sessilis*		N	
Nyctaginaceae	*Boerhavia coccinea*	Tarvine	N	
Nyctaginaceae	*Boerhavia dominii*	Tarvine	N	
Oleaceae	*Jasminum lineare*	Desert Jasmine	N	
Oleaceae	*Notelaea longifolia*	Large Mock-olive	N	
Oleaceae	*Notelaea microcarpa*	Native Olive	N	

Family	Scientific Name	Common Name	Exotic	Status*
Oleaceae	*Notelaea microcarpa var. microcarpa*		N	
Oleaceae	*Notelaea spp.*		N	
Onagraceae	*Oenothera stricta*		Y	
Orchidaceae	*Caladenia fuscata*	Dusky Fingers	N	
Orchidaceae	*Cyanicula caerulea*	Blue Caladenia	N	
Orchidaceae	*Cymbidium canaliculatum*	Tiger Orchid	N	
Orchidaceae	*Pterostylis mutica*	Midget Greenhood	N	
Orchidaceae	*Pterostylis praetermissa*		N	
Orchidaceae	*Pterostylis spp.*	Greenhood	N	
Oxalidaceae	*Oxalis chnoodes*		N	
Oxalidaceae	*Oxalis exilis*		N	
Oxalidaceae	*Oxalis perennans*		N	
Oxalidaceae	*Oxalis spp.*		N	
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	N	
Phormiaceae	*Dianella longifolia*	Blueberry Lily	N	
Phormiaceae	*Dianella revoluta*	Blueberry Lily	N	
Phormiaceae	*Dianella revoluta var. revoluta*	A Blue Flax Lily	N	
Phormiaceae	*Stypandra glauca*	Nodding Blue Lily	N	
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	N	
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge	N	
Phyllanthaceae	*Phyllanthus occidentalis*		N	
Phyllanthaceae	*Phyllanthus virgatus*	Wiry Spurge	N	
Phyllanthaceae	*Poranthera microphylla*	Small Poranthera	N	
Pittosporaceae	*Pittosporum angustifolium*	Butterbush	N	
Plantaginaceae	*Plantago coronopus*	Buck's-horn Plantain	Y	
Plantaginaceae	*Plantago debilis*	Shade Plantain	N	
Plantaginaceae	*Plantago turrifera*	Small Sago-weed	N	
Plantaginaceae	*Plantago varia*		N	
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell	N	
Plantaginaceae	*Veronica spp.*		Y	
Poaceae	*Aristida caput-medusae*	Many-headed Wiregrass	N	
Poaceae	*Aristida jerichoensis*	Jericho Wiregrass	N	
Poaceae	*Aristida leichhardtiana*		N	
Poaceae	*Aristida leptopoda*	White Speargrass	N	
Poaceae	*Aristida personata*		N	
Poaceae	*Aristida psammophila*		N	
Poaceae	*Aristida ramosa*	Purple Wiregrass	N	
Poaceae	*Aristida spp.*	A Wiregrass	N	
Poaceae	*Aristida vagans*	Threeawn Speargrass	N	
Poaceae	*Arundinella nepalensis*	Reedgrass	N	
Poaceae	*Austrostipa aristiglumis*	Plains Grass	N	
Poaceae	*Austrostipa bigeniculata*	Yanganbil	N	
Poaceae	*Austrostipa nitida*		N	
Poaceae	*Austrostipa scabra*	Speargrass	N	

Family	Scientific Name	Common Name	Exotic	Status*
Poaceae	*Austrostipa scabra subsp. falcata*	Rough Speargrass	N	
Poaceae	*Austrostipa scabra subsp. scabra*	Rough Speargrass	N	
Poaceae	*Austrostipa setacea*	Corkscrew Grass	N	
Poaceae	*Austrostipa spp.*	A Speargrass	N	
Poaceae	*Austrostipa verticillata*	Slender Bamboo Grass	N	
Poaceae	*Avena fatua*	Wild Oats	Y	
Poaceae	*Avena ludoviciana*	Ludo Wild Oats	Y	
Poaceae	*Bothriochloa decipiens var. decipiens*	Pitted Bluegrass	N	
Poaceae	*Bothriochloa macra*	Red Grass	N	
Poaceae	*Bothriochloa spp.*	Redgrass, Bluegrass	N	
Poaceae	*Bromus catharticus*	Prairie Grass	Y	
Poaceae	*Bromus spp.*	A Brome	N	
Poaceae	*Cenchrus spp.*		Y	
Poaceae	*Chloris divaricata var. divaricata*	Slender Chloris	N	
Poaceae	*Chloris spp.*		N	
Poaceae	*Chloris truncata*	Windmill Grass	N	
Poaceae	*Chloris ventricosa*	Tall Chloris	N	
Poaceae	*Cleistochloa rigida*		N	
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	N	
Poaceae	*Cynodon dactylon*	Common Couch	N	
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass	N	
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	N	
Poaceae	*Dichelachne sieberiana*		N	
Poaceae	*Digitaria breviglumis*		N	
Poaceae	*Digitaria brownii*	Cotton Panic Grass	N	
Poaceae	*Digitaria diffusa*	Open Summer-grass	N	
Poaceae	*Digitaria divaricatissima*	Umbrella Grass	N	
Poaceae	*Digitaria spp.*	A Finger Grass	N	
Poaceae	*Eleusine tristachya*	Goose Grass	Y	
Poaceae	*Anthosachne scabra*	Wheatgrass, Common Wheatgrass	N	
Poaceae	*Enneapogon gracilis*	Slender Nineawn	N	
Poaceae	*Enneapogon nigricans*	Niggerheads	N	
Poaceae	*Enteropogon acicularis*	Curly Windmill Grass	N	
Poaceae	*Entolasia stricta*	Wiry Panic	N	
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	N	
Poaceae	*Eragrostis cilianensis*	Stinkgrass	Y	
Poaceae	*Eragrostis curvula*	African Lovegrass	Y	HTW
Poaceae	*Eragrostis elongata*	Clustered Lovegrass	N	
Poaceae	*Eragrostis lacunaria*	Purple Lovegrass	N	
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	N	
Poaceae	*Eragrostis megalosperma*		N	
Poaceae	*Eragrostis spp.*	A Lovegrass	N	
Poaceae	*Eragrostis trachycarpa*	A Lovegrass	N	
Poaceae	*Eragrostis trichophora*		Y	

Family	Scientific Name	Common Name	Exotic	Status*
Poaceae	*Eriochloa crebra*	Cup Grass, Tall Cupgrass	N	
Poaceae	*Eriochloa procera*	Spring Grass	N	
Poaceae	*Eriochloa pseudoacrotricha*	Early Spring Grass	N	
Poaceae	*Eriochloa spp.*	A Cupgrass	N	
Poaceae	*Hordeum vulgare*	Barley	Y	
Poaceae	*Hyparrhenia hirta*	Coolatai Grass	Y	HTW
Poaceae	*Lolium perenne*	Perennial Ryegrass	Y	
Poaceae	*Lolium spp.*	A Ryegrass	Y	
Poaceae	*Microlaena stipoides var. stipoides*	Weeping Grass	N	
Poaceae	*Panicum buncei*	Native Panic	N	
Poaceae	*Panicum effusum*	Hairy Panic	N	
Poaceae	*Panicum simile*	Two-colour Panic	N	
Poaceae	*Panicum spp.*	Panicum	N	
Poaceae	*Panicum subxerophilum*	Gilgai Grass	N	
Poaceae	*Paspalidium caespitosum*	Brigalow Grass	N	
Poaceae	*Paspalidium constrictum*	Knottybutt Grass	N	
Poaceae	*Paspalidium distans*		N	
Poaceae	*Paspalidium gracile*	Slender Panic	N	
Poaceae	*Paspalidium spp.*		N	
Poaceae	*Paspalum dilatatum*	Paspalum	Y	HTW
Poaceae	*Poa annua*	Winter Grass	Y	
Poaceae	*Rytidosperma erianthum*	Wallaby Grass	N	
Poaceae	*Rytidosperma fulvum*	Wallaby Grass	N	
Poaceae	*Rytidosperma longifolium*	Long-leaved Wallaby Grass	N	
Poaceae	*Rytidosperma monticola*	Mountain Wallaby Grass	N	
Poaceae	*Rytidosperma racemosum*	Wallaby Grass	N	
Poaceae	*Rytidosperma setaceum*	Small-flowered Wallaby-grass	N	
Poaceae	*Rytidosperma spp.*		N	
Poaceae	*Setaria spp.*		N	
Poaceae	*Sporobolus africanus*	Parramatta Grass	Y	
Poaceae	*Sporobolus caroli*	Fairy Grass	N	
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	N	
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass	N	
Poaceae	*Themeda avenacea*	Native Oatgrass	N	
Poaceae	*Themeda triandra*		N	
Poaceae	*Thyridolepis mitchelliana*	Mulga Mitchell Grass	N	
Poaceae	*Tragus australianus*	Small Burrgrass	N	
Poaceae	*Triodia mitchellii*	Spinifex	N	
Poaceae	*Triodia scariosa*	Porcupine Grass	N	
Poaceae	*Urochloa panicoides*	Urochloa Grass	Y	
Poaceae	*Urochloa spp.*		N	
Poaceae	*Vulpia bromoides*	Squirrel Tail Fescue	Y	
Poaceae	*Vulpia spp.*	Rat's-tail Fescue	Y	
Poaceae	*Walwhalleya proluta*		N	

Family	Scientific Name	Common Name	Exotic	Status*
Polygonaceae	*Rumex brownii*	Swamp Dock	N	
Portulacaceae	*Calandrinia eremaea*	Small Purslane	N	
Portulacaceae	*Calandrinia spp.*	A Purslane	N	
Portulacaceae	*Portulaca oleracea*	Pigweed	N	
Portulacaceae	*Portulaca pilosa*	Akulikuli, Djanggara	Y	
Portulacaceae	*Portulaca spp.*		N	
Primulaceae	*Anagallis arvensis*	Scarlet Pimpernel	Y	
Proteaceae	*Grevillea floribunda subsp. floribunda*	Seven Dwarfs Grevillea	N	
Proteaceae	*Persoonia sericea*		N	
Proteaceae	*Persoonia spp.*		N	
Pteridaceae	*Cheilanthes distans*	Bristly Cloak Fern	N	
Pteridaceae	*Cheilanthes sieberi subsp. sieberi*	Rock Fern	N	
Ranunculaceae	*Clematis microphylla*	Small-leaved Clematis	N	
Rhamnaceae	*Alphitonia excelsa*	Red Ash	N	
Rhamnaceae	*Cryptandra amara*	Bitter Cryptandra	N	
Rhamnaceae	*Cryptandra amara var. amara*		N	
Rhamnaceae	*Cryptandra spp.*		N	
Rhamnaceae	*Pomaderris queenslandica*	Scant Pomaderris	N	BC Act: E
Rhamnaceae	*Ventilago viminalis*	Supple Jack	N	
Rosaceae	*Acaena echinata*	Sheep's Burr	N	
Rubiaceae	*Asperula conferta*	Common Woodruff	N	
Rubiaceae	*Asperula cunninghamii*	Twining Woodruff	N	
Rubiaceae	*Asperula spp.*	Woodruff	N	
Rubiaceae	*Galium gaudichaudii*	Rough Bedstraw	N	
Rubiaceae	*Opercularia aspera*	Coarse Stinkweed	N	
Rubiaceae	*Opercularia diphylla*	Stinkweed	N	
Rubiaceae	*Opercularia hispida*	Hairy Stinkweed	N	
Rubiaceae	*Opercularia spp.*		N	
Rubiaceae	*Pomax umbellata*	Pomax	N	
Rubiaceae	*Psydrax odorata*	Shiny-leaved Canthium	N	
Rubiaceae	*Psydrax oleifolia*		N	
Rutaceae	*Boronia glabra*	Sandstone Boronia	N	
Rutaceae	*Boronia occidentalis*		N	
Rutaceae	*Geijera parviflora*	Wilga	N	
Rutaceae	*Phebalium squamulosum*	Scaly Phebalium	N	
Rutaceae	*Phebalium squamulosum subsp. gracile*		N	
Rutaceae	*Philotheca ciliata*		N	
Rutaceae	*Philotheca difformis*		N	
Rutaceae	*Philotheca ericifolia*		N	
Rutaceae	*Philotheca salsolifolia*		N	
Rutaceae	*Philotheca spp.*		N	
Santalaceae	*Exocarpos aphyllus*	Leafless Ballart	N	
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart	N	
Santalaceae	*Santalum lanceolatum*	Northern Sandalwood	N	

Family	Scientific Name	Common Name	Exotic	Status*
Sapindaceae	*Alectryon oleifolius*	Western Rosewood	N	
Sapindaceae	*Atalaya hemiglauca*	Whitewood	N	
Sapindaceae	*Dodonaea boroniifolia*	Fern-leaf Hop-bush	N	
Sapindaceae	*Dodonaea falcata*		N	
Sapindaceae	*Dodonaea viscosa*	Sticky Hop-bush	N	
Sapindaceae	*Dodonaea viscosa subsp. angustifolia*		N	
Sapindaceae	*Dodonaea viscosa subsp. spatulata*	Broad-leaf Hopbush	N	
Scrophulariaceae	*Scrophulariaceae indeterminate*	Toadflaxes and mulleins	Y	
Solanaceae	*Lycium ferocissimum*	African Boxthorn	Y	HTW
Solanaceae	*Solanum amblymerum*		N	
Solanaceae	*Solanum brownii*	Violet Nightshade	N	
Solanaceae	*Solanum elaeagnifolium*	Silver-leaved Nightshade	Y	HTW
Solanaceae	*Solanum esuriale*	Quena	N	
Solanaceae	*Solanum ferocissimum*	Spiny Potato-bush	N	
Solanaceae	*Solanum jucundum*		N	
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	Y	
Solanaceae	*Solanum papaverifolium*		N	
Solanaceae	*Solanum parvifolium*	Nightshade	N	
Solanaceae	*Solanum spp.*		N	
Stackhousiaceae	*Stackhousia monogyna*	Creamy Candles	N	
Stackhousiaceae	*Stackhousia muricata*	Stackhousia	N	
Stackhousiaceae	*Stackhousia spp.*		N	
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia	N	
Stylidiaceae	*Stylidium eglandulosum*	Woolly-stemmed Triggerplant	N	
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower	N	
Thymelaeaceae	*Pimelea linifolia subsp. collina*		N	
Thymelaeaceae	*Pimelea neo-anglica*	Poison Pimelea	N	
Xanthorrhoeaceae	*Xanthorrhoea acaulis*		N	
Xanthorrhoeaceae	*Xanthorrhoea spp.*		N	
Zamiaceae	*Macrozamia glaucophylla*		N	
Zamiaceae	*Macrozamia heteromera*		N	
Zamiaceae	*Macrozamia spp.*		N	
Zygophyllaceae	*Tribulus terrestris*	Cat-head	Y	
Zygophyllaceae	*Zygophyllum apiculatum*	Common Twinleaf	N	

* Status under the BC Act and/or EPBC Act (current as at February 2020). E = Endangered; V = Vulnerable; HTW = High Threat Weed.

Appendix B: Output of Floristic Analysis

Interpretation of cluster analyses groups

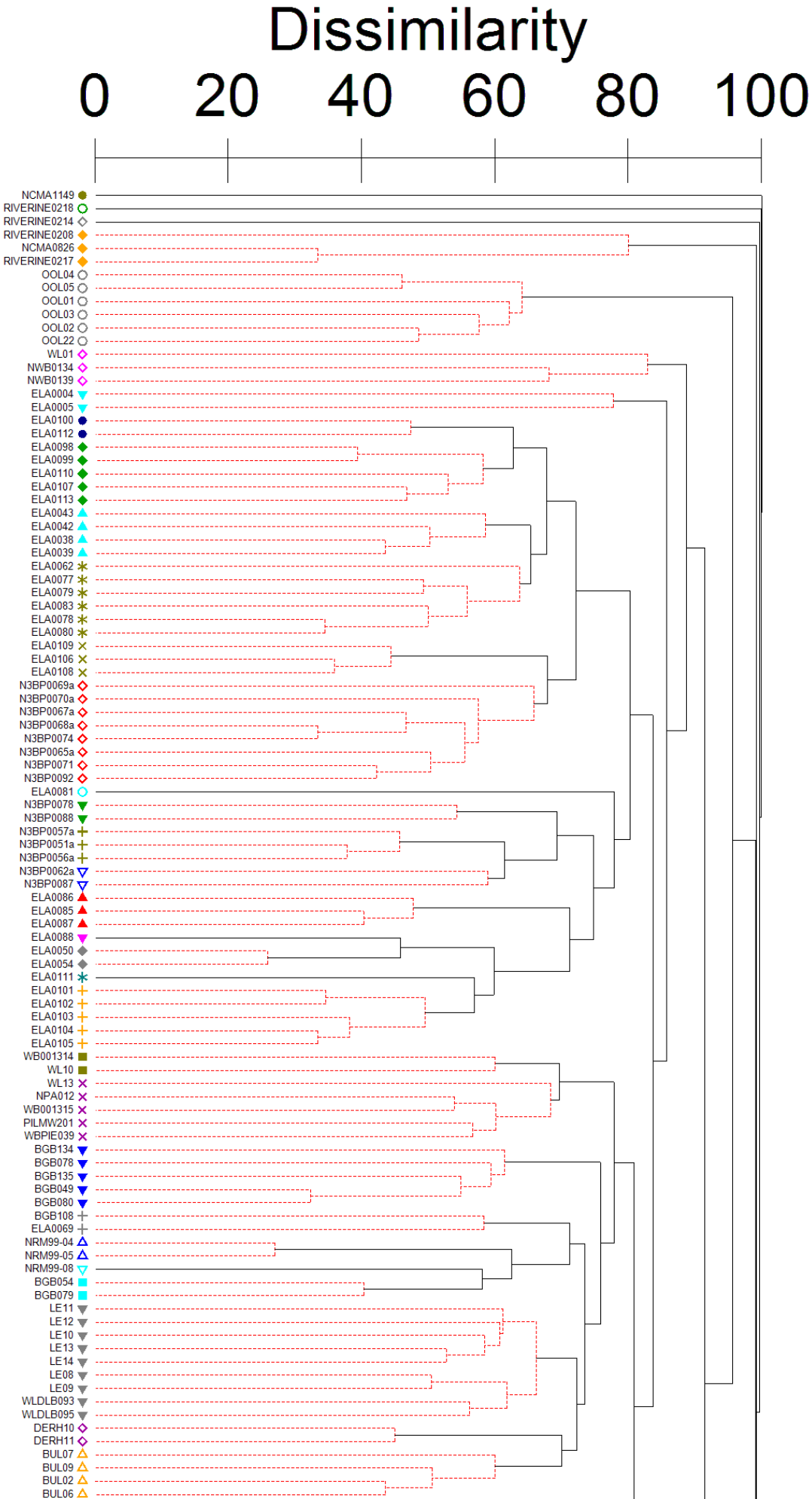
Group	Dominant Species	Group Description	PCT	Notes
+ z	*Eucalyptus albens, Beyeria viscosa, Geijera parviflora, Notelaea microcarpa*	White box shrubby woodland	435	
▽ aw	*Callitris glaucophylla, Eucalyptus chloroclada, Acacia cheelii, Corymbia trachyphloia*	White bloodwood/ Motherumbah/ White cypress/ Dirty gum woodland	406	Reassign ELA0003 to 432 based on ground truthing of polygon
○ bg	*Eucalyptus fibrosa, Callitris glaucophylla, Corymbia trachyphloia, Acacia cheelii*	Red ironbark/White bloodwood/ Motherumbah	406	Reassign ELA0001 to 404 based on dominance of *Acacia burrowii* and ground truthing of polygon
▲ at	*Casuarina cristata, Capparis mitchellii, Geijera parviflora, Maireana microphylla, Austrostipa verticillata*	Belah woodland	55	Reassign N3BP0077 to 406/MOD and ELA0082 to 88/DNG
▼ g		Mixed group		Mixed group of DNG and disturbed sites grouped based on common ground species; assigned based on ground truthing of polygons, landscape position and soils
■ bt	*Acacia burrowii, Eucalyptus fibrosa, Corymbia trachyphloia, Eucalyptus dwyeri, Philotheca ciliata, Phebalium squamulosum*	Red ironbark/White bloodwood/ Burrow's wattle forest	404	Reassign ELA0015 to 406 based on landscape position and ground truthing
◆ ck	*Eucalyptus fibrosa, Corymbia trachyphloia, Allocasuarina diminuta, Triodia mitchellii*	Red ironbark/ White bloodwood forest	405	Reassign ELA0010 to 404 based on ground truthing of polygon
● ca	*Leptospermum polygalifolium, Eucalyptus chloroclada, Eucalyptus fibrosa, Callitris glaucophylla*	Mixed group	404/399	Mix of 399 plots and 404 plots that occur further up same drainage lines, grouped based on dominance of *Leptospermum polygalifolium* in understorey, all in drainage lines. Separated based on canopy dominance of ironbark vs red gum/ rough-barked apple
+ bu	*Eucalyptus fibrosa, Acacia cheelii, Corymbia trachyphloia*	Red ironbark/White bloodwood/ Motherumbah forest	406	Reassign ELA0014 and ELA0017 based on landscape position, ground truthing
× bx		Single plot group	405	
* ao	*Eucalyptus albens, Callitris glaucophylla, Eucalyptus pilligaensis*	Mixed group	435/88	Split based on dominance of *Eucalyptus albens* vs *Eucalyptus pilligaensis*
△ by	*Callitris glaucophylla, Eucalyptus albens, Eucalyptus pilligaensis, Austrostipa scabra*	White box woodland & Pilliga box woodland		Mixed group based on dominance of *Callitris glaucophylla*; assigned to 435 & 88 based on canopy dominance

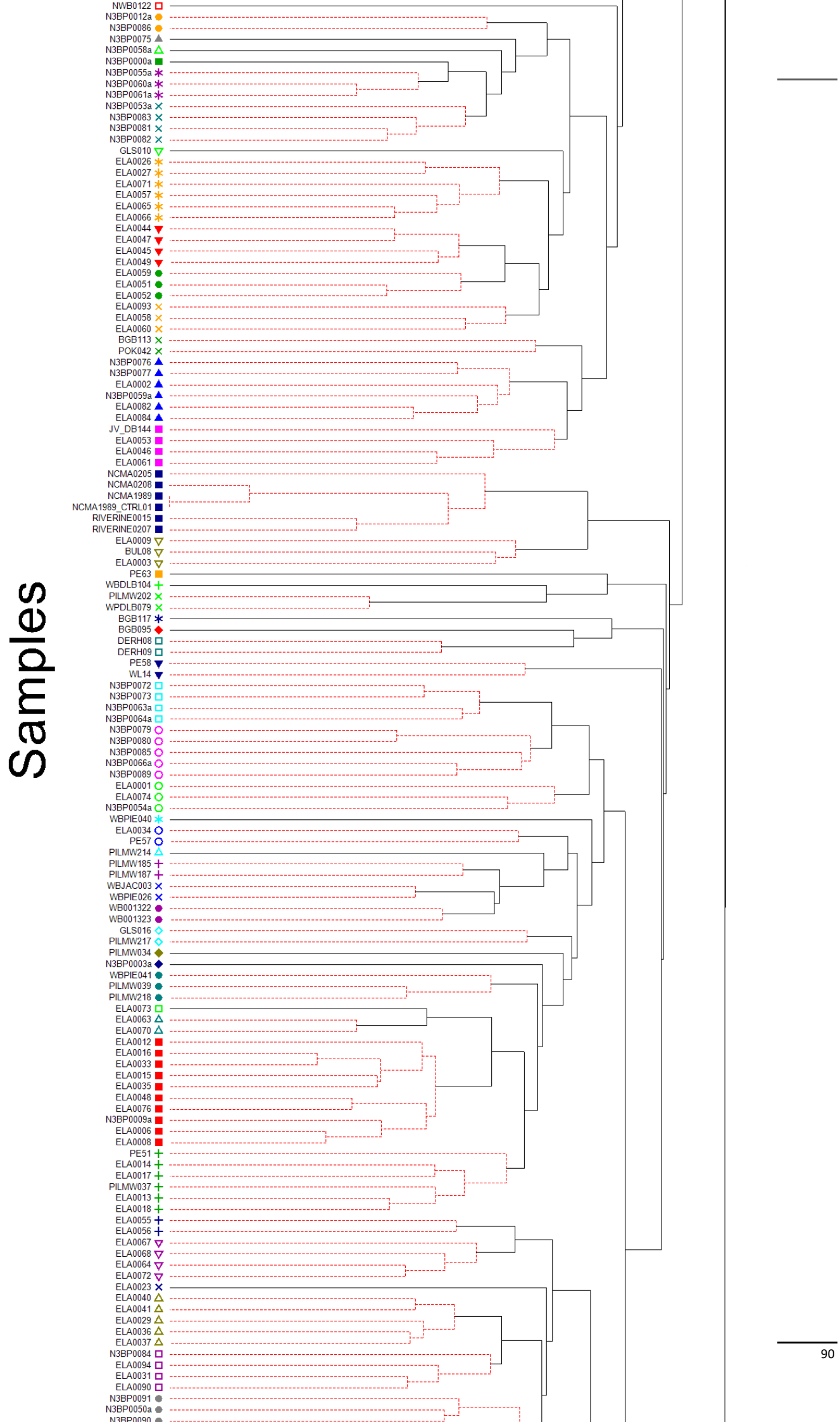
Group	Dominant Species	Group Description	PCT	Notes
ce	*Eucalyptus crebra, Allocasuarina luehmannii, Callitris endlicheri, Callitris glaucophylla, Eucalyptus albens, Eucalyptus fibrosa*	White box shrubby woodland	435	One plot in study area, ecotonal between ironbark forest and white box woodland; best fit for polygon is 435
bz	*Angophora floribunda, Callitris glaucophylla, Eucalyptus chloroclada, Leptospermum polygalifolium*	Rough-barked apple/ Red gum/ White cypress woodland	399/401	Split based on landscape position and presence of *Leptospermum polygalifolium*
cu	*Eucalyptus fibrosa, Eucalyptus crebra, Corymbia trachyphloia, Callitris endlicheri*	Red ironbark/ White bloodwood/ Black cypress forest	405	
bi	*Eucalyptus fibrosa, Acacia burrowii, Exocarpos cupressiformis, Dianella revoluta, Aristida jerichoensis*	Red ironbark forest/ Burrow's wattle forest	404	
j	*Callitris glaucophylla, Acacia deanei, Aristida ramosa, Austrostipa scabra, Cymbopogon refractus*	mixed group	88	Mixed group of DNG and MOD plots, mostly 88. ELA0038 reassigned to 399/MOD based on ground truthing of polygon
ap	*Eucalyptus dwyeri, Callitris glaucophylla, Brachychiton populneus, Notelaea microcarpa*	Dwyer's red gum/ White cypress woodland	432	ELA0045 reassigned to 244 based on dominant species and ground truthing of polygon
au	*Eucalyptus populnea, Casuarina cristata, Geijera parviflora*	Poplar box grassy woodland	244	ELA0053 reassigned to 55 based on presence/absence of *Eucalyptus populnea* and ground truthing of polygon
t	*Austrostipa scabra, Chloris truncata, Sclerolaena birchii*	DNG plots		2 DNG plots assigned based on ground truthing and soils
aq	*Eucalyptus albens, Geijera parviflora, Notelaea microcarpa*	White box shrubby woodland	435	1 x 244 plot, reassigned based on canopy dominants
bv	*Eucalyptus chloroclada, Eucalyptus fibrosa, Corymbia trachyphloia, Notelaea microcarpa, Alphitonia excelsa*	Red ironbark/ White bloodwood forest	405/406	Plots assigned to 405 and 406 based on presence/absence of *Acacia cheelii* and occurrence on rocky rises
ar	*Eucalyptus pilligaensis, Callitris glaucophylla, Geijera parviflora, Notelaea microcarpa*	Pilliga box woodland	88	
k	*Aristida ramosa, Austrostipa scabra, Bothriochloa decipiens, Callitris glaucophylla*	DNG derived from Poplar box woodland	244	One 88/DNG plot assigned based on ground truthing
bs	*Acacia burrowii, Eucalyptus fibrosa, Corymbia trachyphloia*	Red ironbark/ White bloodwood/ Burrow's wattle forest	404	ELA0063 assigned to 405 based on ground truthing of polygon
bw	*Eucalyptus fibrosa, Corymbia trachyphloia, Eucalyptus chloroclada*		408	399 plot reassigned based on *Angophora floribunda* w *Eucalyptus chloroclada*, 404 plot split
br		Single plot group	404	

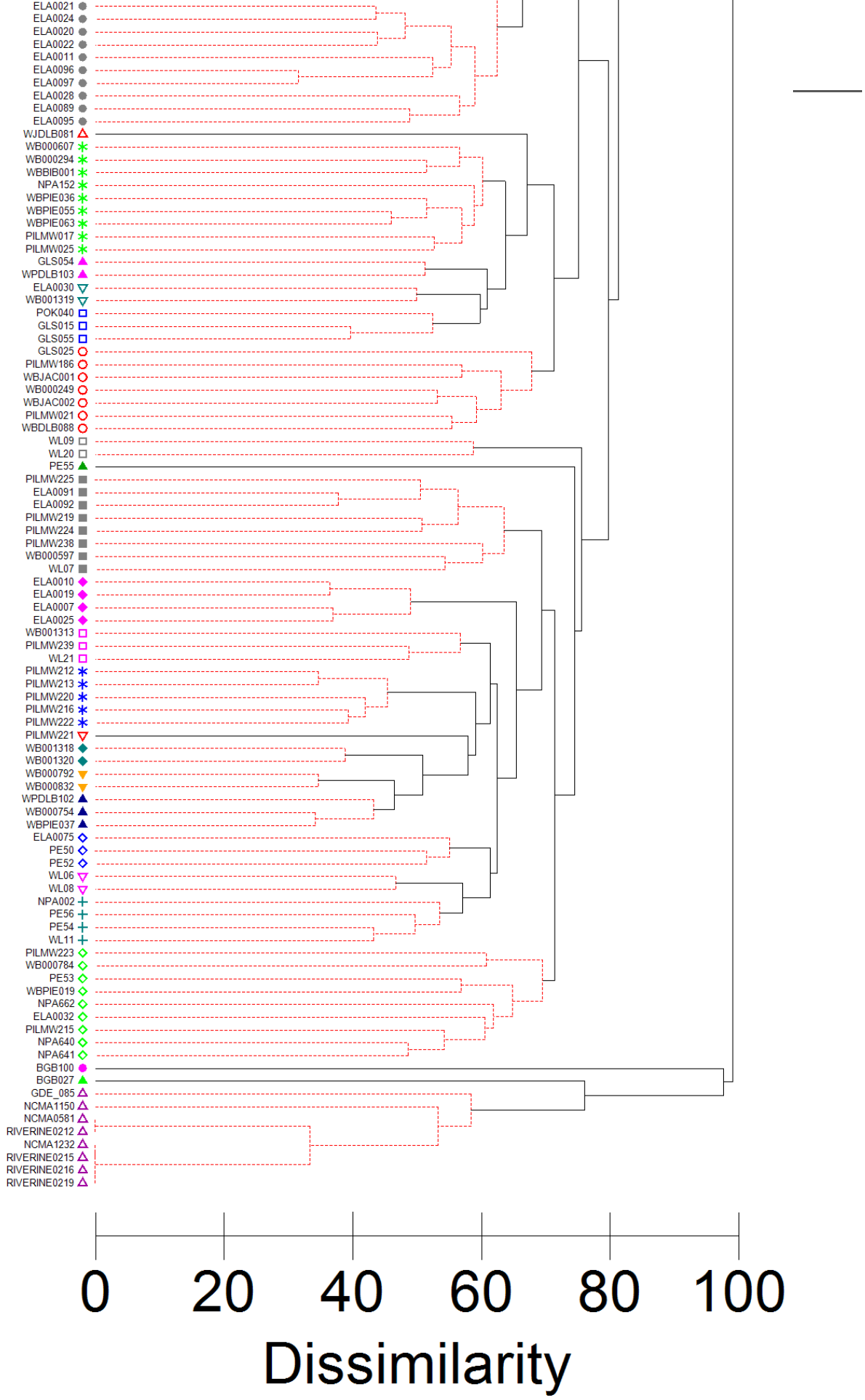
Group	Dominant Species	Group Description	PCT	Notes
◇ cr	*Eucalyptus fibrosa, Corymbia trachyphloia, Callitris endlicheri*	Red ironbark/ White bloodwood/ Black cypress	405	
○ n		Single plot group	88	
▲ r	*Austrostipa scabra, Enteropogon acicularis, Elymus scaber, Enchylaena tomentosa, Bothriochloa decipiens, Maireana microphylla*	DNG derived from Pilliga box woodland	55/DNG	
▼ s		Single plot group	435	
■ cj	*Eucalyptus fibrosa, Corymbia trachyphloia, Acacia cheelii*	Red ironbark/ White bloodwood/ Motherumbah forest	406	
◆ i	*Callitris glaucophylla, Aristida ramosa, Aristida caput-medusae, Cheilanthes sieberi, Cymbopogon refractus*	Mixed group of disturbed grassy woodland sites		Plots assigned to 435, 88 and 244 based on canopy dominance and ground truthing of polygon
● h	*Aristida ramosa, Bothriochloa macra, Elymus scaber*	DNG derived from Poplar box woodland	244/DNG	
+ v	*Austrostipa scabra, Chloris truncata, Maireana microphylla*	DNG plots, mostly white box derived	435/DNG	Two plots assigned to 88/DNG based on ground truthing of polygons
× l	*Aristida ramosa, Cymbopogon refractus, Chrysocephalum apiculatum, Acacia deanei*	DNG derived from Pilliga box woodland	88/DNG	One plot reassigned to 399/MOD based on ground truthing of polygon
✳ u		Single plot group	88/DNG	
■ ak		Single plot group	206	
◆ bp		Single plot group	405	
● ah	*Callitris glaucophylla, Eucalyptus dwyeri, Alphitonia excelsa*	Dwyer's red gum/ White cypress woodland	432	
+ p	*Aristida ramosa, Austrostipa scabra, Chloris truncata*	DNG plots		Assigned to PCT based on ground truthing, landscape position and soils
× am	*Callitris glaucophylla, Brachychiton populneus, Geijera parviflora, Austrostipa scabra*	Modified/ disturbed White box woodland	435	Assigned to PCT based on ground truthing, landscape position and soils
✳ al	*Callitris glaucophylla, Eucalyptus chloroclada, Geijera parviflora, Notelaea microcarpa, Alphitonia excelsa*	Dirty gum/ White cypress woodland	206	
△ aj		Single plot group	88	
▽ q	*Maireana microphylla, Aristida ramosa, Austrostipa scabra, Cheilanthes sieberi*	DNG derived from White box woodland	435	

Group	Dominant Species	Group Description	PCT	Notes
□ be	*Acacia burrowii, Eucalyptus fibrosa, Melaleuca uncinata*	Red ironbark/ White bloodwood forest & Broombush shrubland	404/141	Both 404 and 141 plots grouped based on common tree species, 141 plots split out based on dominance of *Melaleuca uncinata* and shrubland structure, tree species only present as emergents
◇ m	*Callitris glaucophylla, Acacia deanei, Acacia ixiophylla, Calytrix tetragona, Aristida ramosa, Cheilanthes sieberi*	Mixed group		MOD and DNG plots derived from various types, dominated by colonising species, Acacia and Callitris and grasses. Assigned to type based on ground truthing and landscape position
○ bf	*Eucalyptus fibrosa, Callitris glaucophylla, Corymbia trachyphloia, Eucalyptus chloroclada, Acacia cheelii, Acacia burrowii*	Red ironbark/ White bloodwood/ White cypress +- Burrows wattle forest		Various ironbark/bloodwood types, assigned to 406 based on presence of A. cheelii and rocky rises, 408 based on co-dominance of *Eucalyptus chloroclada* and 404 based on codominance of *Acacia burrowii*
▲ ai		Single plot group	404/MOD	
▼ o	*Casuarina cristata, Aristida ramosa, Enteropogon acicularis, Austrostipa scabra*	Mixed group		244/GOOD plot and 55/DNG plot grouped on *Callitris cristata* and common ground species, assigned based on ground truthing of polygons

Dendrogram


Dissimilarity
0
20
40
60
80
100
NCMA1149
RIVERINE0218
RIVERINE0214
RIVERINE0208
NCMA0826
RIVERINE0217
OOL04
OOL05
OOL01
OOL03
OOL02
OOL22
WL01
NWB0134
NWB0139
ELA0004
ELA0005
ELA0100
ELA0112
ELA0098
ELA0099
ELA0110
ELA0107
ELA0113
ELA0043
ELA0042
ELA0038
ELA0039
ELA0062
ELA0077
ELA0079
ELA0083
ELA0078
ELA0080
ELA0109
ELA0106
ELA0108
N3BP0069a
N3BP0070a
N3BP0067a
N3BP0068a
N3BP0074
N3BP0065a
N3BP0071
N3BP0092
ELA0081
N3BP0078
N3BP0088
N3BP0057a
N3BP0051a
N3BP0056a
N3BP0062a
N3BP0087
ELA0086
ELA0085
ELA0087
ELA0088
ELA0050
ELA0054
ELA0111
ELA0101
ELA0102
ELA0103
ELA0104
ELA0105
WB001314
WL10
WL13
NPA012
WB001315
PILMW201
WBPIE039
BGB134
BGB078
BGB135
BGB049
BGB080
BGB108
ELA0069
NRM99-04
NRM99-05
NRM99-08
BGB054
BGB079
LE11
LE12
LE10
LE13
LE14
LE08
LE09
WLDLB093
WLDLB095
DERH10
DERH11
BUL07
BUL09
BUL02
BUL06


Samples
NWB0122
N3BP0012a
N3BP0086
N3BP0075
N3BP0058a
N3BP0000a
N3BP0055a
N3BP0060a
N3BP0061a
N3BP0053a
N3BP0083
N3BP0081
N3BP0082
GLS010
ELA0026
ELA0027
ELA0071
ELA0057
ELA0065
ELA0066
ELA0044
ELA0047
ELA0045
ELA0049
ELA0059
ELA0051
ELA0052
ELA0093
ELA0058
ELA0060
BGB113
POK042
N3BP0076
N3BP0077
ELA0002
N3BP0059a
ELA0082
ELA0084
JV_DB144
ELA0053
ELA0046
ELA0061
NCMA0205
NCMA0208
NCMA1989
NCMA1989_CTRL01
RIVERINE0015
RIVERINE0207
ELA0009
BUL08
ELA0003
PE63
WBDLB104
PILMW202
WPDLB079
BGB117
BGB095
DERH08
DERH09
PE58
WL14
N3BP0072
N3BP0073
N3BP0063a
N3BP0064a
N3BP0079
N3BP0080
N3BP0085
N3BP0066a
N3BP0089
ELA0001
ELA0074
N3BP0054a
WBPIE040
ELA0034
PE57
PILMW214
PILMW185
PILMW187
WBJAC003
WBPIE026
WB001322
WB001323
GLS016
PILMW217
PILMW034
N3BP0003a
WBPIE041
PILMW039
PILMW218
ELA0073
ELA0063
ELA0070
ELA0012
ELA0016
ELA0033
ELA0015
ELA0035
ELA0048
ELA0076
N3BP0009a
ELA0006
ELA0008
PE51
ELA0014
ELA0017
PILMW037
ELA0013
ELA0018
ELA0055
ELA0056
ELA0067
ELA0068
ELA0064
ELA0072
ELA0023
ELA0040
ELA0041
ELA0029
ELA0036
ELA0037
N3BP0084
ELA0094
ELA0031
ELA0090
N3BP0091
N3BP0050a
N3BP0090
90


ELA0021
ELA0024
ELA0020
ELA0022
ELA0011
ELA0096
ELA0097
ELA0028
ELA0089
ELA0095
WJDLB081
WB000607
WB000294
WBBIB001
NPA152
WBPIE036
WBPIE055
WBPIE063
PILMW017
PILMW025
GLS054
WPDLB103
ELA0030
WB001319
POK040
GLS015
GLS055
GLS025
PILMW186
WBJAC001
WB000249
WBJAC002
PILMW021
WBDLB088
WL09
WL20
PE55
PILMW225
ELA0091
ELA0092
PILMW219
PILMW224
PILMW238
WB000597
WL07
ELA0010
ELA0019
ELA0007
ELA0025
WB001313
PILMW239
WL21
PILMW212
PILMW213
PILMW220
PILMW216
PILMW222
PILMW221
WB001318
WB001320
WB000792
WB000832
WPDLB102
WB000754
WBPIE037
ELA0075
PE50
PE52
WL06
WL08
NPA002
PE56
PE54
WL11
PILMW223
WB000784
PE53
WBPIE019
NPA662
ELA0032
PILMW215
NPA640
NPA641
BGB100
BGB027
GDE_085
NCMA1150
NCMA0581
RIVERINE0212
NCMA1232
RIVERINE0215
RIVERINE0216
RIVERINE0219
0
20
40
60
80
100
Dissimilarity

Appendix C: Vegetation Integrity Plot Data

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
ELA	ELA0001	404	Good	55	774002	6615189	270	4	2	11	9	1	4	50	0	3	1	0	0	1	0	92	44	1	0	1	1	1	0		1
ELA	ELA0002	55	Good	55	774983	6614969	350	2	5	3	11	0	8	25	1	12	2	0	1	0	0	76.8	130	0	0	1	1	1	0		2
ELA	ELA0003	432	Good	55	776183	6616085	20	4	2	5	5	1	0	15	0	10	1	0	0	0	0	47.6	180	1	1	1	1	1	0		0
ELA	ELA0004	435	Good	55	775612	6616115	140	1	0	7	12	1	4	3	0	1	1	0	0	0	1	73	15	1	1	1	1	0	0		1
ELA	ELA0005	244	DNG	55	775891	6616145	350	1	0	8	5	1	2	2	0	68	1	1	0	0	0	71.2	0	0	0	0	0	0	0		3
ELA	ELA0006	404	Good	55	772935	6616334	250	4	4	6	3	0	0	28	22	1	7	0	0	0	1	57.8	67	1	1	1	1	0	0		0
ELA	ELA0007	405	Good	55	772553	6614905	95	4	14	4	8	0	2	8	26	4	1	0	0	7	3	60	8	1	1	1	1	1	0		0
ELA	ELA0008	404	Good	55	772222	6616039	20	2	2	1	3	0	1	30	35	0	10	0	0	0	0	80	60	1	1	1	1	0	0		0
ELA	ELA0009	406	Good	55	774043	6614080	215	7	6	8	8	1	3	17	7	7	3	0	0	0	2	86.6	173	1	0	1	1	1	0		0
ELA	ELA0010	404	Good	55	772043	6615391	140	2	19	9	7	1	0	21	17	4	4	0	0	2	3	78	41	1	1	1	1	1	1		0
ELA	ELA0011	404	Good	55	771623	6614087	260	2	11	7	5	1	1	21	15	3	5	1	0	3	4	18.4	58	1	1	1	1	1	1		0
ELA	ELA0012	404	Good	55	772158	6613789	110	4	9	4	6	0	0	20	16	21	3	0	0	1	7	58.4	63	1	1	1	1	1	1		0
ELA	ELA0013	406	Good	55	771767	6613101	290	3	8	3	4	0	0	22	12	15	1	0	0	0	3	78.8	30	1	1	1	1	1	0		0
ELA	ELA0014	404	Good	55	771626	6612343	207	4	6	10	6	1	1	27	2	9	3	1	0	0	4	48	119	1	1	1	1	1	0		0
ELA	ELA0015	406	Good	55	771559	6610795	260	3	3	1	3	0	0	34	4	2	1	0	0	0	0	73	55	1	1	1	0	1	0		0
ELA	ELA0016	404	Good	55	771582	6611059	235	4	2	2	3	0	0	34	6	15	16	0	0	0	1	59	0	1	1	1	1	1	0		0
ELA	ELA0017	404	Good	55	772307	6613460	30	4	14	10	4	1	0	17	15	3	4	0	0	3	2	65	122	1	1	1	1	1	1		0
ELA	ELA0018	406	Good	55	772418	6612898	265	4	5	6	4	1	1	27	7	11	1	1	0	0	4	72.6	41	1	1	1	1	1	0		0
ELA	ELA0019	405	Good	55	772882	6614270	335	3	11	8	8	1	0	8	16	4	2	0	0	0	1	43	71	1	1	1	1	1	0		0

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
ELA	ELA0020	399	Good	55	772939	6614638	165	3	13	6	4	1	0	16	27	3	3	0	0	1	2	35	58	1	1	1	1	0	1		0
ELA	ELA0021	404	Good	55	772730	6615176	150	4	12	16	8	1	1	12	32	11	2	0	0	1	3	64	70	0	1	1	1	1	1		0
ELA	ELA0022	399	Good	55	772977	6614907	40	4	12	16	8	1	1	12	32	11	2	0	0	0	4	56	134	1	0	1	1	1	0		0
ELA	ELA0023	405	Good	55	773446	6615084	0	5	10	7	15	1	2	29	3	2	2	0	0	0	0	61	94	1	1	1	1	1	0		1
ELA	ELA0024	399	Good	55	773038	6615182	180	3	8	12	14	1	1	11	12	15	4	0	0	0	4	51	45	1	1	1	1	1	0		0
ELA	ELA0025	405	Good	55	772871	6615936	270	3	10	2	5	0	0	8	13	16	2	0	0	1	3	26	9	1	1	1	1	0	1		0
ELA	ELA0026	435	Good	55	773798	6615115	110	3	7	15	16	1	4	12	14	2	2	0	0	1	4	86	62	1	1	1	1	1	1		1
ELA	ELA0027	88	Good	55	773883	6615087	8	5	5	15	14	2	3	14	12	7	2	1	1	2	3	96.6	70	1	1	1	1	1	1		1
ELA	ELA0028	404	Good	55	771282	6608311	130	5	14	12	5	0	0	14	15	3	1	0	0	2	6	96.6	45	1	1	1	1	1	1		0
ELA	ELA0029	399	Good	55	771373	6607954	40	3	8	12	15	1	6	22	7	4	3	0	1	0	2	95.6	62	1	1	1	1	1	0		0
ELA	ELA0030	435	Good	55	771419	6607786	103	7	10	13	15	2	3	19	4	4	3	1	0	2	3	97.4	88	1	1	1	1	1	1		1
ELA	ELA0031	399	Good	55	773206	6609538	224	5	13	11	12	1	1	22	5	6	4	0	1	2	4	93	40	1	1	1	1	1	1		0
ELA	ELA0032	405	Good	55	771770	6609819	28	4	10	7	4	0	1	22	2	2	2	0	1	0	4	97.2	35	1	1	1	1	1	0		0
ELA	ELA0033	404	Good	55	771933	6610453	40	4	5	6	4	0	0	34	21	4	11	0	0	0	1	81	23	1	1	1	1	1	0		0
ELA	ELA0034	404	Good	55	772909	6612082	163	3	6	14	4	1	0	12	8	3	5	0	0	2	2	92	40	1	1	1	1	1	1		0
ELA	ELA0035	404	Good	55	772368	6611864	284	4	3	1	3	1	1	36	5	0	2	0	0	0	1	82	61	1	1	1	1	1	0		0
ELA	ELA0036	404	Good	55	773534	6615851	230	4	8	16	24	1	4	20	2	5	5	0	1	0	3	90.4	33	1	1	1	1	1	0		1
ELA	ELA0037	401	Good	55	773869	6616361	335	4	9	11	8	1	3	32	2	2	1	0	0	2	1	90	40	1	1	1	1	1	1		1
ELA	ELA0038	399	Moderate	55	773529	6615555	50	1	3	14	14	1	2	0	3	40	2	1	1	0	0	98	19	1	1	1	0	0	0		1
ELA	ELA0039	88	DNG	55	773671	6615668	215	2	3	15	18	1	1	0	1	53	3	0	0	0	0	73	29	1	1	0	0	0	0		2
ELA	ELA0040	88	DNG	55	773858	6616060	54	2	5	11	10	1	3	43	2	2	2	1	0	0	0	72	8	1	1	1	1	1	0		1
ELA	ELA0041	88	DNG	55	774012	6616291	0	3	5	14	14	1	4	21	1	7	2	0	1	0	1	94	35	1	1	1	1	1	0		0

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
ELA	ELA0042	88	DNG	55	774200	6616020	50	0	1	9	9	1	0	0	1	43	2	1	0	0	0	80.4	1	0	0	0	0	0	0		3
ELA	ELA0043	88	Good	55	774102	6616125	37	4	4	14	17	1	1	16	1	12	2	0	0	0	0	89.6	72	1	1	1	1	1	0		1
ELA	ELA0044	432	Good	55	776294	6616101	215	6	7	7	13	1	2	56	30	20	3	2	1	2	1	70	29.5	1	1	1	1	1	1		1
ELA	ELA0045	244	Good	55	775683	6616013	311	3	5	12	12	0	0	32	2	20	2	0	0	1	1	63	14	1	1	1	1	1	1		1
ELA	ELA0046	244	Good	55	776118	6615979	334	4	3	7	15	1	1	42	1	44	5	1	0	0	0	81.2	56	1	1	1	1	1	0		0
ELA	ELA0047	404	Good	55	772709	6613469	333	4	4	2	4	0	0	42	56	0	35	0	0	0	0	92	52	1	1	1	0	0	0		0
ELA	ELA0048	244	Good	55	775939	6615636	155	6	3	7	4	1	1	43	3	9	1	0	0	0	2	92.2	21	1	1	1	1	1	0		2
ELA	ELA0049	432	Good	55	776029	6615602	225	7	4	7	13	1	2	39	12	32	3	0	0	1	2	65.6	13	1	1	1	1	1	1		2
ELA	ELA0050	435	DNG	55	775728	6614378	205	0	3	4	9	0	1	0	5	14	4	0	0	0	0	47.6	0	0	0	0	0	0	0		1
ELA	ELA0051	435	Good	55	775730	6614787	270	3	5	7	11	0	2	37	11	34	2	0	0	3	6	91.8	60	1	1	1	1	1	1		2
ELA	ELA0052	435	Good	55	776171	6614700	90	2	5	5	14	1	1	32	9	42	2	1	0	2	6	80	43	0	1	1	1	1	1		2
ELA	ELA0053	55	Good	55	774981	6614844	40	2	5	7	10	0	2	30	2	31	6	0	0	1	0	88.8	10	0	1	1	1	1	0		2
ELA	ELA0054	55	DNG	55	774616	6614655	110	0	2	3	6	0	1	0	2	12	2	0	0	0	0	95.2	0	0	0	0	0	0	0		4
ELA	ELA0055	405	Good	55	774275	6614320	250	9	7	7	10	1	3	66	23	19	4	1	0	0	12	93.6	57	1	1	1	1	1	0		0
ELA	ELA0056	406	Good	55	774207	6614072	135	7	10	4	13	1	2	50	26	22	20	1	0	1	1	93.4	87	1	1	1	1	1	1		0
ELA	ELA0057	435	Good	55	774203	6613563	180	7	3	9	9	2	1	60	14	33	1	5	0	0	5	77	29	1	1	1	1	1	0		1
ELA	ELA0058	88	Good	55	774795	6613397	265	4	4	4	11	1	2	52	14	14	7	3	0	1	1	93	20	1	1	1	1	0	1		1
ELA	ELA0059	244	Good	55	775267	6612686	120	4	7	10	9	1	4	33	50	15	2	1	1	0	4	82.2	67	1	1	1	1	1	0		1
ELA	ELA0060	88	Good	55	774276	6612695	155	7	9	4	9	2	1	48	17	16	8	2	2	0	6	95.4	83	1	1	1	1	1	0		1
ELA	ELA0061	244	Good	55	776068	6613152	95	3	2	13	10	0	1	46	2	26	10	0	0	1	0	75	66	1	1	1	1	1	1		1
ELA	ELA0062	244	DNG	55	775826	6613184	100	1	2	7	7	1	2	1	1	52	2	2	0	0	0	76.2	0	1	0	0	0	0	0		1
ELA	ELA0063	405	Good	55	773678	6612499	340	4	3	5	5	0	0	25	3	1	53	0	0	0	1	98	118	1	1	1	1	1	0		0

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
ELA	ELA0064	408	Good	55	773317	6612741	130	3	13	5	10	1	4	25	51	16	2	0	2	0	3	88.6	32	1	1	1	1	1	0		0
ELA	ELA0065	88	Good	55	773436	6612919	345	3	13	5	10	1	4	25	51	16	2	0	2	0	9	95.4	35	1	1	1	1	1	0		0
ELA	ELA0066	435	Good	55	773593	6612994	20	1	5	10	10	1	1	35	24	11	3	2	0	1	9	96.2	113	1	1	1	1	1	1		0
ELA	ELA0067	399	Good	55	773507	6613299	265	3	10	6	15	1	3	35	35	32	21	1	1	0	0	88.6	44	1	1	1	1	1	0		0
ELA	ELA0068	404	Good	55	772539	6608436	250	3	4	6	9	1	2	45	4	9	5	1	0	0	3	91.8	34	1	1	1	1	1	0		0
ELA	ELA0069	435	Good	55	772813	6608787	90	3	7	6	4	1	1	40	39	4	1	1	0	0	4	98.6	88	1	1	1	1	1	0		0
ELA	ELA0070	404	Good	55	772408	6609220	30	4	6	3	4	0	0	37	6	2	24	0	0	0	1	98.2	70	1	1	1	1	1	0		0
ELA	ELA0071	88	Good	55	773192	6609301	10	4	9	8	11	2	1	64	15	13	4	3	0	3	6	91.8	65	1	1	1	1	1	1		1
ELA	ELA0072	408	Good	55	772995	6609793	65	5	10	6	7	1	2	44	27	12	5	0	0	1	0	99.2	60	1	1	1	1	1	1		0
ELA	ELA0073	404	Good	55	772881	6610267	180	4	6	2	7	1	0	42	8	1	40	0	0	0	0	98.8	66	1	1	1	1	1	0		0
ELA	ELA0074	406	Good	55	773365	6610179	105	6	2	6	8	1	1	38	3	3	1	0	0	0	0	44	133	0	1	1	1	0	0		1
ELA	ELA0075	405	Good	55	773134	6610948	85	4	18	2	6	0	0	34	26	5	16	0	0	0	5	96.2	30	1	1	1	1	1	0		0
ELA	ELA0076	404	Good	55	773374	6614020	190	3	3	4	3	1	0	46	55	1	8	0	0	0	2	94.6	41	1	1	1	1	0	0		0
ELA	ELA0077	244	DNG	55	776345	6616255	90	1	3	12	8	1	1	0	1	46	1	0	0	0	0	24	0	1	0	0	0	0	0		1
ELA	ELA0078	244	DNG	55	776235	6615672	270	1	3	7	5	1	1	0	0	25	1	0	0	0	0	36	0	1	0	0	0	0	0		1
ELA	ELA0079	244	DNG	55	776082	6615825	90	1	1	5	7	1	1	1	0	60	1	0	0	0	0	32.2	0	1	0	0	0	0	0		1
ELA	ELA0080	244	DNG	55	776248	6615340	90	1	2	9	4	0	1	0	1	66	0	0	0	0	0	5.2	0	1	0	0	0	0	0		1
ELA	ELA0081	88	DNG	55	774563	6616161	160	0	2	8	5	0	2	0	0	61	1	0	0	0	0	66	0	1	0	0	0	0	0		1
ELA	ELA0082	88	DNG	55	774611	6615472	0	1	10	11	4	0	4	5	3	36	0	0	1	0	0	53	4	0	0	1	0	1	0		2
ELA	ELA0083	88	DNG	55	773709	6615324	270	2	1	11	2	1	1	1	0	74	0	1	0	0	0	44	0	1	0	0	0	0	0		1
ELA	ELA0084	55	Good	55	774988	6615047	0	1	10	9	6	0	2	15	1	16	1	0	0	0	0	74	122	0	0	1	1	1	0		1
ELA	ELA0085	55	DNG	55	774905	6614626	90	1	5	10	10	0	1	0	6	37	1	0	0	0	0	33	0	1	0	0	0	0	0		1

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
ELA	ELA0086	55	DNG	55	775045	6613593	90	0	6	11	10	1	3	0	2	53	1	0	0	0	0	31	0	0	0	0	0	0	0		1
ELA	ELA0087	55	DNG	55	775729	6613440	0	0	5	7	10	1	2	0	1	48	3	1	0	0	0	38	0	0	0	0	0	0	0		1
ELA	ELA0088	435	DNG	55	775818	6614256	0	0	3	6	6	0	1	0	1	66	1	0	0	0	0	59	0	0	0	0	0	0	0		1
ELA	ELA0089	399	Good	55	771366	6607975	340	4	11	14	6	1	3	25	33	22	1	0	0	3	3	72	45	1	1	1	1	1	1		0
ELA	ELA0090	399	Good	55	773202	6609532	270	4	9	9	6	1	1	35	2	22	1	0	1	1	8	76	33	1	1	1	1	1	1		0
ELA	ELA0091	406	Good	55	773602	6611668	340	3	11	4	6	0	0	43	23	1	2	0	0	0	0	85	7	0	1	1	1	0	0		0
ELA	ELA0092	406	Good	55	773657	6614043	270	3	7	5	4	0	0	19	36	1	1	0	0	0	1	91	39	1	1	1	1	0	0		0
ELA	ELA0093	88	Good	55	773880	6615170	340	4	5	9	6	0	2	19	3	17	1	0	0	0	2	67	16	1	1	1	1	1	0		0
ELA	ELA0094	401	Good	55	773837	6616272	0	5	4	11	5	1	1	32	0	7	1	0	0	0	0	84	29	1	1	1	1	1	0		0
ELA	ELA0095	404	Good	55	772872	6615811	330	3	14	10	5	1	0	27	33	21	1	0	0	0	1	81	7	1	1	1	1	1	0		0
ELA	ELA0096	404	Good	55	772248	6615088	260	1	9	10	4	1	1	30	41	8	1	0	0	1	3	84	29	1	1	1	1	1	1		0
ELA	ELA0097	404	Good	55	771749	6614728	230	2	7	18	3	1	1	20	56	27	1	0	0	0	0	77	29	1	1	1	1	1	0		0
ELA	ELA0098	435	Good	55	775475	6616168	60	1	3	13	10	1	2	15	1	15	1	1	0	0	0	54	8	1	1	1	1	1	0		1
ELA	ELA0099	435	Good	55	775583	6615913	70	1	1	11	9	1	1	30	0	15	1	0	0	0	0	74	14	1	1	1	1	0	0		2
ELA	ELA0100	244	DNG	55	775854	6615402	350	0	2	15	4	0	1	0	0	35	1	0	0	0	0	23	0	0	0	0	0	0	0		1
ELA	ELA0101	435	DNG	55	776195	6614930	370	0	2	10	4	0	1	0	3	16	0	0	0	0	0	49	0	0	0	0	0	0	0		2
ELA	ELA0102	435	DNG	55	775815	6614965	315	0	2	5	5	0	1	0	0	30	1	0	0	0	0	51	0	0	0	0	0	0	0		2
ELA	ELA0103	55	DNG	55	775446	6614337	90	0	3	10	5	0	1	0	1	36	1	0	0	0	0	57	0	0	0	0	0	0	0		2
ELA	ELA0104	55	DNG	55	775385	6614644	40	0	5	10	6	0	1	0	1	8	1	0	0	0	0	19	0	0	0	0	0	0	0		0
ELA	ELA0105	435	DNG	55	775992	6614488	290	0	5	8	3	0	1	0	1	13	0	0	0	0	0	47	0	0	0	0	0	0	0		1
ELA	ELA0106	399	Moderate	55	773475	6615303	30	2	2	3	2	1	0	7	2	7	4	0	0	0	0	7.8	3	1	1	1	1	0	0		0
ELA	ELA0107	88	DNG	55	773650	6615636	200	2	2	10	3	1	1	0	0	13	1	0	0	0	0	51	5	1	1	1	1	0	0		2

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
ELA	ELA0108	88	DNG	55	773790	6615956	20	3	2	9	4	0	0	6	1	16	7	0	0	0	0	22.6	0	1	1	1	0	0	0		1
ELA	ELA0109	88	DNG	55	773991	6616208	20	0	3	9	3	0	1	0	1	1	5	0	0	0	0	24	0	1	1	1	1	0	0		0
ELA	ELA0110	88	Good	55	773845	6615622	30	6	3	19	6	1	1	27	1	5	1	0	0	0	0	45.6	55	1	1	1	1	1	0		0
ELA	ELA0111	88	DNG	56	774820	6615894	100	0	2	17	4	1	2	0	0	27	1	0	0	0	0	63	0	0	0	0	0	0	0		1
ELA	ELA0112	244	DNG	55	775857	6615823	90	1	2	7	2	0	1	0	0	32	0	0	0	0	0	71	0	1	0	0	0	0	0		2
ELA	ELA0113	244	Good	55	775976	6615814	345	4	5	11	4	1	1	20	16	31	0	0	0	0	0	70	0	1	1	1	1	1	0		2
AMBS	N3BP0000a	206	Good	55	773860	6610704	213	4	7	7	6	1	4	35.7	1.3	12.6	0.6	0.1	0.4	3	4	39.8	42	1	1	1	1	1	1	0	0
AMBS	N3BP0003a	405	Good	55	773507	6617874	341	4	11	6	5	1	0	29	5.5	2.4	0.6	0.1	0	0	3	82	9	1	1	1	1	1	0	0	0
AMBS	N3BP0009a	404	Good	55	771929	6617214	140	4	4	1	3	1	1	43	49.1	0.1	0.3	0.1	0.1	0	0	64	13	1	1	1	1	0	0	0	0
AMBS	N3BP0012a	432	Good	55	776224	6618653	2	2	4	6	9	1	2	12.1	0.4	11.4	0.9	0.1	0.2	0	0	28.8	38	1	1	1	1	1	0	0	0.1
AMBS	N3BP0050a	399	Good	55	772997	6618321	186	2	10	8	8	1	2	15.5	43.4	3.6	5.7	0.1	0.2	0	5	54	20	1	1	1	1	1	0	0	0
AMBS	N3BP0051a	244	DNG	55	776045	6618574	204	2	0	9	10	1	1	0.2	0	9.2	1.1	0.1	0.1	0	0	11	0	1	1	0	0	0	0	0	1.1
AMBS	N3BP0053a	435	Good	55	775618	6617628	217	4	3	7	14	0	4	45.3	0.4	0.8	1.4	0	0.4	2	0	67	8	1	1	1	1	1	1	0	0.1
AMBS	N3BP0054a	406	Good	55	773309	6608262	273	7	5	9	7	1	1	37.2	1.5	15.8	1.1	0.1	0.1	1	3	65	43	1	1	1	1	1	1	0	0
AMBS	N3BP0055a	206	Good	55	773899	6609920	306	6	5	6	7	1	6	36.6	5.4	18	1.2	0.1	0.5	0	7	58	41	1	1	1	1	1	0	0	0
AMBS	N3BP0056a	88	DNG	55	773653	6608795	336	2	8	9	15	1	2	0.2	1.4	24.8	1.7	0.1	0.2	0	0	9	13	1	0	0	0	0	0	0	0.3
AMBS	N3BP0057a	435	DNG	55	773434	6608647	75	0	3	12	15	0	1	0	0.4	24.3	1.4	0	0.1	0	0	5.2	0	0	0	0	0	0	0	0	2
AMBS	N3BP0058a	88	Good	55	774447	6619231	238	5	9	12	8	1	3	45.3	10.9	7.1	1.1	0.1	0.3	3	2	77	29	1	1	1	1	1	1	0	0.2
AMBS	N3BP0059a	55	Good	55	775156	6618683	0	2	8	4	3	0	3	15.2	9.6	0.4	0.4	0	0.3	16	1	56	102	0	1	1	1	1		0	0.3
AMBS	N3BP0060a	206	Good	55	774133	6610714	175	6	5	6	9	1	3	36.2	0.6	16.4	1	0.1	0.3	1	7	41	14	1	1	1	1	1	0	0	0.2
AMBS	N3BP0061a	206	Good	55	774014	6609814	125	7	4	10	9	1	3	45.9	0.6	1.6	0.9	0.2	0.3	4	5	48	31	1	1	1	1	1	1	0	0
AMBS	N3BP0062a	435	DNG	55	773623	6609864	138	0	2	8	8	1	0	0	1.2	2.7	0.9	0.1	0	0	0	2.2	0	0	0	0	0	0	0	0	2

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
AMBS	N3BP0063a	404	Good	55	774043	6620306	88	3	3	4	9	1	0	11	0.4	12.3	0.9	0.2	0	0	0	34	13	1	1	1	0	1	0	0	0
AMBS	N3BP0064a	404	Good	55	772191	6619726	242	5	10	5	3	1	1	40.1	26.2	0.7	0.3	0.1	0.1	0	3	65	27	1	1	1	1	1	0	0	0
AMBS	N3BP0065a	405	DNG	55	773707	6619127	40	3	6	4	4	1	0	7.1	21.4	4.2	0.4	0.1	0	0	0	14	3	1	1	0	1	1	0	0	0
AMBS	N3BP0066a	404	Moderate	55	773771	6619348	327	6	4	12	5	1	2	17.4	0.9	7.1	1.4	0.1	0.2	0	0	34	26	1	1	1	1	1	0	0	0
AMBS	N3BP0067a	88	Moderate	55	774560	6619822	258	1	1	5	7	1	0	45	2	0.7	0.7	1	0	0	0	17.4	7	1	1	1	1	0	0	0	0
AMBS	N3BP0068a	88	Moderate	55	774532	6619711	242	1	2	3	3	1	0	55	0.6	0.7	0.3	0.2	0	1	0	27.8	6	1	1	1	0	0	1	0	0.1
AMBS	N3BP0069a	88	DNG	55	774266	6619723	140	0	0	5	10	1	0	0	0	47.6	1	0.1	0	0	0	18.6	0	0	0	0	0	0	0	0	0
AMBS	N3BP0070a	404	Moderate	55	773890	6619435	250	3	2	5	6	1	1	12.1	2.1	3.4	0.6	0.1	0.1	0	0	54	15	1	1	1	1	1	0	0	0
AMBS	N3BP0071	404	Moderate	55	774089	6619745	241	1	4	8	10	1	0	5	2.6	22.2	2.2	0.3	0	0	0	12.4	0	1	1	0	1	0	0	0	0
AMBS	N3BP0072	141	Good	55	772321	6620480	212	1	6	4	7	1	2	2	76.5	0.4	0.7	0.1	0.2	0	0	84.6	5	1	1	1	1	1	0	0	0
AMBS	N3BP0073	141	Good	55	772003	6620250	348	2	8	3	7	1	0	15	45.7	1.6	0.7	0.5	0	0	0	64	38	1	1	1	1	1	0	0	0
AMBS	N3BP0074	404	Moderate	55	774812	6620377	263	2	0	5	2	1	0	35	0	5.6	0.2	0.1	0	0	0	26	0	1	1	1	0	0	0	0	0.1
AMBS	N3BP0075	404	Moderate	55	774521	6620107	238	4	3	3	10	1	0	15.3	5.3	14	1	0.1	0	1	2	42.4	12	1	1	1	1	1	1	0	0
AMBS	N3BP0076	55	Good	55	775061	6618272	261	1	7	3	7	0	3	35	1.6	2.4	0.7	0	0.3	10	2	66.6	109	1	1	1	1	1	1	1	0.1
AMBS	N3BP0077	406	Moderate	55	774669	6617602	338	4	5	3	7	1	1	0.5	31.4	2.7	0.7	0.1	0.1	1	1	39	41	1	1	1	1	1	1	0	0.3
AMBS	N3BP0078	55	DNG	55	774690	6618471	337	2	5	8	9	0	2	2.1	0.5	27.2	0.9	0	0.2	2	0	18	0	1	0	0	0	1	0	0	0.4
AMBS	N3BP0079	406	Moderate	55	773327	6609008	24	2	4	8	3	1	1	25	0.5	3.6	0.4	0.1	0.1	0	0	78.6	22	1	1	1	1	0	0	0	0
AMBS	N3BP0080	406	Moderate	55	773260	6608974	84	4	5	9	4	1	2	32.6	6.3	1.5	0.4	0.1	0.2	0	0	93.6	6	1	1	1	1	0	0	0	0
AMBS	N3BP0081	435	Moderate	55	773418	6609729	84	3	5	15	10	1	2	40.1	2.5	1.8	1	0.1	0.2	1	0	85	42	1	1	1	1	1	1	0	0.6
AMBS	N3BP0082	435	Moderate	55	773487	6609751	104	4	3	8	13	1	1	30.6	0.3	3.1	1.4	0.1	0.1	1	1	59	17	1	1	1	1	1	1	0	0.1
AMBS	N3BP0083	88	Moderate	55	773340	6609586	74	3	2	11	10	1	3	30.1	0.2	8.4	1	0.1	0.3	0	0	36.6	11	1	1	1	1	1	0	0	0.1
AMBS	N3BP0084	401	Good	55	774015	6616495	232	4	6	9	10	1	3	30.5	0.8	26.8	1	0.1	0.3	0	4	79	44	1	1	1	1	0	0	0	0

Surveyor	New Plot No.	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Regeneration	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Stem >80 cm	High Threat Exotic
AMBS	N3BP0085	408	Good	55	772668	6608979	139	4	7	8	8	1	0	32	2.5	1.9	0.9	0.1	0	0	8	40	32	1	1	1	1	1	0	0	0
AMBS	N3BP0086	432	Good	55	776404	6618659	94	5	8	5	9	1	4	18	2.2	7.7	0.9	0.1	0.6	0	6	61	135	1	1	1	1	1	0	0	0.1
AMBS	N3BP0087	435	DNG	55	775652	6617522	288	0	2	8	11	1	1	0	7	1.9	1.1	0.1	0.1	0	0	13	0	0	0	0	0	0	0	0	0.5
AMBS	N3BP0088	244	Good	55	776471	6617161	31	3	4	6	8	0	1	25.4	0.5	14.1	0.8	0	0.1	2	3	89.6	54	1	1	1	1	1	1	0	0.2
AMBS	N3BP0089	408	Good	55	772976	6609879	292	5	12	8	4	1	2	22.1	37.1	3.7	0.4	0.2	0.2	1	3	79	43	1	1	1	1	1	1	0	0
AMBS	N3BP0090	399	Good	55	773182	6618469	24	3	12	7	4	0	2	25.3	27.2	1.1	0.4	0	0.2	1	7	75	47	1	1	1	1	1	1	0	0
AMBS	N3BP0091	399	Moderate	55	773575	6618772	91	3	8	4	5	1	2	7.1	15.8	6.6	0.5	0.5	0.2	0	0	19	0	1	1	1	1	1	0	0	0
AMBS	N3BP0092	405	DNG	55	773793	6619210	335	1	5	4	13	1	1	5	2.3	16.3	1.7	0.1	0.1	0	0	44.4	0	1	1	1	0	0	0	0	0
AMBS	N3BP2000	244	DNG	55	775439	6619314	164	2	3	8	11	1	3	0.2	0.5	2.7	1.1	0.1	0.3	0	0	0.3	0.0	1	0	0	0	0	0	0	0.2
AMBS	N3BP2001	244	DNG	55	775377	6618262	348	0	4	5	7	0	1	0.0	0.4	0.5	0.7	0.0	0.1	0	0	0.0	0.0	0	0	0	0	0	0	0	0.0
AMBS	N3BP2002	244	GOOD	55	775163	6617940	155	2	3	5	5	1	1	0.3	0.3	0.5	0.5	0.1	0.1	0	0	2.8	30.0	1	0	1	0	0	0	0	0.0
AMBS	N3BP2003	244	GOOD	55	775298	6616698	326	3	3	8	9	2	1	11.0	0.3	12.6	0.9	0.2	0.1	1	0	26.0	2.0	0	1	1	1	1	1	0	0.0
AMBS	N3BP2004	88	GOOD	55	775266	6610173	175	6	15	6	7	1	1	20.6	16.9	3.4	0.7	0.1	0.1	2	2	44.0	49.0	1	1	1	0	1	1	0	0.2
AMBS	N3BP2005	435	DNG	55	775199	6610904	161	0	1	1	1	0	1	0.0	0.1	0.1	0.1	0.0	0.1	0	0	0.3	0.0	0	0	0	0	1	0	0	0.0
AMBS	N3BP2006	88	GOOD	55	774300	6610361	178	2	6	3	5	1	4	20.1	20.5	0.3	0.5	0.1	0.4	0	0	52.0	30.5	1	1	1	1	1	0	0	0.1
AMBS	N3BP2007	244	DNG	55	775330	6617075	165	1	3	9	11	1	1	0.1	0.3	2.8	1.2	0.1	0.1	0	0	6.0	0.0	1	0	0	0	0	0	0	0.0
AMBS	N3BP2008	435	DNG	55	775295	6616420	125	0	3	10	9	1	1	0.0	0.5	2.6	1.0	0.2	0.1	0	0	1.2	0.0	0	0	0	0	0	0	0	0.0
AMBS	N3BP2009	435	GOOD	55	774874	6610272	154	3	2	13	12	2	2	3.3	1.1	8.6	1.5	0.6	0.2	1	0	27.0	7.0	1	0	0	0	0	1	0	0.0

Appendix D: Threatened Plant Records

Surveyor	Scientific Name	Date	Zone	Easting	Northing	PCT (AMBS 2019)	Number of Individuals
ELA	*Tylophora linearis*	18/06/2015	55	771858	6615856	404	1
ELA	*Tylophora linearis*	18/06/2015	55	771855	6615858	404	1
ELA	*Tylophora linearis*	18/06/2015	55	771955	6615524	404	1
ELA	*Tylophora linearis*	18/06/2015	55	772005	6615457	404	1
ELA	*Tylophora linearis*	18/06/2015	55	771871	6615853	404	1
ELA	*Tylophora linearis*	18/06/2015	55	771955	6615556	404	1
ELA	*Tylophora linearis*	18/06/2015	55	771958	6615552	404	1
ELA	*Tylophora linearis*	18/06/2015	55	772002	6615460	404	1
ELA	*Tylophora linearis*	20/06/2015	55	773166	6613194	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771717	6611165	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771702	6611160	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771702	6611155	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771700	6611178	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771706	6611172	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771708	6611176	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771714	6611168	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771721	6611166	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771713	6611173	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771710	6611172	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771710	6611174	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771714	6611189	404	1
ELA	*Tylophora linearis*	23/06/2015	55	771707	6611164	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773820	6614916	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773822	6614919	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773816	6614912	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773813	6614909	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773818	6614902	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773816	6614899	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773813	6614889	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773488	6612918	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773489	6612915	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773487	6612913	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773479	6612905	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773456	6612877	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773451	6612864	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773451	6612861	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773447	6612862	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773450	6612859	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773450	6612856	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612846	404	1

Surveyor	Scientific Name	Date	Zone	Easting	Northing	PCT (AMBS 2019)	Number of Individuals
ELA	*Tylophora linearis*	24/06/2015	55	773452	6612843	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773460	6612835	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773829	6614917	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773823	6614906	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773828	6614907	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773825	6614901	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773823	6614901	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773817	6614837	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773820	6614832	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773826	6614829	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773825	6614828	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773488	6612913	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773494	6612916	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773525	6612932	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773526	6612932	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773524	6612937	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773518	6612942	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773526	6612943	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773528	6612938	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773532	6612935	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773474	6612886	435	1
ELA	*Tylophora linearis*	24/06/2015	55	773469	6612886	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773464	6612887	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773464	6612893	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612877	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773461	6612870	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773460	6612874	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773454	6612834	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773455	6612823	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773451	6612863	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773464	6612891	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773464	6612891	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773464	6612891	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773464	6612891	0	1
ELA	*Tylophora linearis*	24/06/2015	55	773463	6612874	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773463	6612874	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773463	6612874	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773463	6612874	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773463	6612874	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773455	6612847	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773455	6612847	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773455	6612847	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773455	6612847	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773455	6612847	404	1

Surveyor	Scientific Name	Date	Zone	Easting	Northing	PCT (AMBS 2019)	Number of Individuals
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612838	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612838	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612838	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612838	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612838	404	1
ELA	*Tylophora linearis*	24/06/2015	55	773458	6612838	404	1
ELA	*Bertya opponens*	24/06/2015	55	773718	6614172	0	1
ELA	*Tylophora linearis*	27/09/2017	55	773868	6615126	88	1
ELA	*Lepidium aschersonii*	27/09/2017	55	773874	6615122	88	30
ELA	*Lepidium aschersonii*	27/09/2017	55	775028	6615022	55	2
ELA	*Pomaderris queenslandica*	23/10/2017	55	772756	6608834	435	20
ELA	*Tylophora linearis*	24/01/2018	55	771700	6614694	404	1
AMBS	*Bertya opponens*	4/10/2019	55	772195	6620392	141	1
AMBS	*Tylophora linearis*	4/10/2019	55	772198	6620389	141	8
AMBS	*Bertya opponens*	4/10/2019	55	773197	6620335	404	4410
AMBS	*Bertya opponens*	4/10/2019	55	773090	6620372	404	
AMBS	*Bertya opponens*	4/10/2019	55	773202	6620346	404	
AMBS	*Bertya opponens*	4/10/2019	55	773040	6620371	404	
AMBS	*Bertya opponens*	4/10/2019	55	773040	6620338	404	
AMBS	*Bertya opponens*	4/10/2019	55	773081	6620335	404	
AMBS	*Bertya opponens*	4/10/2019	55	773122	6620333	404	
AMBS	*Bertya opponens*	4/10/2019	55	773171	6620369	404	
AMBS	*Bertya opponens*	4/10/2019	55	773167	6620329	404	
AMBS	*Bertya opponens*	4/10/2019	55	773130	6620369	404	
AMBS	*Bertya opponens*	5/10/2019	55	772336	6616463	404	1820
AMBS	*Bertya opponens*	5/10/2019	55	772332	6616465	404	
AMBS	*Bertya opponens*	5/10/2019	55	772340	6616468	404	
AMBS	*Bertya opponens*	5/10/2019	55	772348	6616431	404	
AMBS	*Bertya opponens*	5/10/2019	55	772342	6616442	404	
AMBS	*Bertya opponens*	5/10/2019	55	772337	6616434	404	
AMBS	*Bertya opponens*	5/10/2019	55	772333	6616425	404	
AMBS	*Bertya opponens*	5/10/2019	55	772336	6616419	404	
AMBS	*Bertya opponens*	5/10/2019	55	772347	6616417	404	
AMBS	*Bertya opponens*	5/10/2019	55	772312	6616419	404	
AMBS	*Bertya opponens*	5/10/2019	55	772344	6616420	404	
AMBS	*Bertya opponens*	6/10/2019	55	772242	6616409	404	1
AMBS	*Tylophora linearis*	18/10/2019	55	772647	6610322	404	3
AMBS	*Bertya opponens*	20/10/2019	55	772103	6620299	141/404	3647
AMBS	*Bertya opponens*	20/10/2019	55	771984	6619212	404	
AMBS	*Bertya opponens*	20/10/2019	55	771985	6619249	404	
AMBS	*Bertya opponens*	20/10/2019	55	772026	6619210	404	
AMBS	*Bertya opponens*	20/10/2019	55	772029	6619247	404	
AMBS	*Bertya opponens*	20/10/2019	55	772031	6619273	404	
AMBS	*Bertya opponens*	20/10/2019	55	772033	6619296	404	

Surveyor	Scientific Name	Date	Zone	Easting	Northing	PCT (AMBS 2019)	Number of Individuals
AMBS	*Bertya opponens*	20/10/2019	55	772034	6619320	404	
AMBS	*Bertya opponens*	20/10/2019	55	772036	6619347	404	
AMBS	*Bertya opponens*	20/10/2019	55	772037	6619373	404	
AMBS	*Bertya opponens*	20/10/2019	55	772038	6619400	404	
AMBS	*Bertya opponens*	20/10/2019	55	772040	6619424	404	
AMBS	*Bertya opponens*	20/10/2019	55	772041	6619452	404	
AMBS	*Bertya opponens*	20/10/2019	55	772042	6619476	404	
AMBS	*Bertya opponens*	20/10/2019	55	772043	6619505	404	
AMBS	*Bertya opponens*	20/10/2019	55	772001	6619513	404	
AMBS	*Bertya opponens*	20/10/2019	55	772002	6619548	404	
AMBS	*Bertya opponens*	20/10/2019	55	772044	6619545	404	
AMBS	*Bertya opponens*	20/10/2019	55	772047	6619573	404	
AMBS	*Bertya opponens*	20/10/2019	55	772048	6619599	404	
AMBS	*Bertya opponens*	20/10/2019	55	772050	6619624	404	
AMBS	*Bertya opponens*	20/10/2019	55	772052	6619652	404	
AMBS	*Bertya opponens*	20/10/2019	55	772053	6619680	404	
AMBS	*Bertya opponens*	20/10/2019	55	772054	6619705	404	
AMBS	*Bertya opponens*	20/10/2019	55	772055	6619730	404	
AMBS	*Bertya opponens*	20/10/2019	55	772076	6619730	404	
AMBS	*Bertya opponens*	20/10/2019	55	772077	6619754	404	
AMBS	*Bertya opponens*	20/10/2019	55	772078	6619777	404	
AMBS	*Bertya opponens*	20/10/2019	55	772080	6619801	404	
AMBS	*Bertya opponens*	20/10/2019	55	772081	6619825	404	
AMBS	*Bertya opponens*	20/10/2019	55	772082	6619850	404	
AMBS	*Bertya opponens*	20/10/2019	55	772084	6619873	404	
AMBS	*Bertya opponens*	20/10/2019	55	772085	6619896	404	
AMBS	*Bertya opponens*	20/10/2019	55	772086	6619918	404	
AMBS	*Bertya opponens*	20/10/2019	55	772087	6619941	404	
AMBS	*Bertya opponens*	20/10/2019	55	772088	6619964	404	
AMBS	*Bertya opponens*	20/10/2019	55	772090	6619987	404	
AMBS	*Bertya opponens*	20/10/2019	55	772091	6620008	404	
AMBS	*Bertya opponens*	20/10/2019	55	772091	6620033	404	
AMBS	*Bertya opponens*	20/10/2019	55	772093	6620058	404	
AMBS	*Bertya opponens*	20/10/2019	55	772095	6620083	404	
AMBS	*Bertya opponens*	20/10/2019	55	772095	6620107	404	
AMBS	*Bertya opponens*	20/10/2019	55	772096	6620133	404	
AMBS	*Bertya opponens*	20/10/2019	55	772099	6620159	404	
AMBS	*Bertya opponens*	20/10/2019	55	772100	6620185	404	
AMBS	*Bertya opponens*	20/10/2019	55	772100	6620210	404	
AMBS	*Bertya opponens*	20/10/2019	55	772102	6620232	404	
AMBS	*Bertya opponens*	20/10/2019	55	772104	6620257	404	
AMBS	*Bertya opponens*	20/10/2019	55	772104	6620280	404	
AMBS	*Bertya opponens*	20/10/2019	55	772024	6619023	404	137
AMBS	*Bertya opponens*	20/10/2019	55	772016	6618973	404	

Surveyor	Scientific Name	Date	Zone	Easting	Northing	PCT (AMBS 2019)	Number of Individuals
AMBS	*Bertya opponens*	20/10/2019	55	771999	6618607	405	464
AMBS	*Bertya opponens*	20/10/2019	55	772424	6620069	404	504
AMBS	*Bertya opponens*	20/10/2019	55	772392	6620103	404	
AMBS	*Bertya opponens*	20/10/2019	55	772391	6620097	404	
AMBS	*Bertya opponens*	20/10/2019	55	772393	6620089	404	
AMBS	*Bertya opponens*	20/10/2019	55	772397	6620082	404	
AMBS	*Bertya opponens*	20/10/2019	55	772402	6620079	404	
AMBS	*Bertya opponens*	20/10/2019	55	772407	6620081	404	
AMBS	*Bertya opponens*	20/10/2019	55	772403	6620088	404	
AMBS	*Bertya opponens*	20/10/2019	55	772403	6620092	404	
AMBS	*Bertya opponens*	20/10/2019	55	772404	6620097	404	
AMBS	*Bertya opponens*	20/10/2019	55	772407	6620103	404	
AMBS	*Bertya opponens*	20/10/2019	55	772401	6620106	404	
AMBS	*Bertya opponens*	20/10/2019	55	772394	6620106	404	
AMBS	*Bertya opponens*	20/10/2019	55	772393	6620104	404	
AMBS	*Bertya opponens*	20/10/2019	55	772390	6620078	404	
AMBS	*Bertya opponens*	20/10/2019	55	772401	6620106	404	
AMBS	*Bertya opponens*	20/10/2019	55	772391	6620002	404	15
AMBS	*Bertya opponens*	20/10/2019	55	772389	6619995	404	
AMBS	*Bertya opponens*	20/10/2019	55	772392	6619998	404	
AMBS	*Bertya opponens*	20/10/2019	55	772397	6620001	404	
AMBS	*Bertya opponens*	20/10/2019	55	772391	6620002	404	
AMBS	*Bertya opponens*	20/10/2019	55	772393	6619999	404	
AMBS	*Bertya opponens*	20/10/2019	55	772365	6619731	406	35
AMBS	*Bertya opponens*	20/10/2019	55	772367	6619748	406	
AMBS	*Bertya opponens*	20/10/2019	55	772367	6619745	406	
AMBS	*Bertya opponens*	20/10/2019	55	772364	6619742	406	
AMBS	*Bertya opponens*	20/10/2019	55	772357	6619745	406	
AMBS	*Bertya opponens*	20/10/2019	55	772355	6619744	406	
AMBS	*Bertya opponens*	20/10/2019	55	772357	6619751	406	
AMBS	*Bertya opponens*	20/10/2019	55	772359	6619755	406	
AMBS	*Bertya opponens*	20/10/2019	55	772366	6619756	406	
AMBS	*Bertya opponens*	20/10/2019	55	772369	6619746	406	
AMBS	*Bertya opponens*	20/10/2019	55	772367	6619748	406	
AMBS	*Bertya opponens*	20/10/2019	55	772363	6619719	406	35
AMBS	*Bertya opponens*	20/10/2019	55	772357	6619716	406	
AMBS	*Bertya opponens*	20/10/2019	55	772359	6619713	406	
AMBS	*Bertya opponens*	20/10/2019	55	772360	6619709	406	
AMBS	*Bertya opponens*	20/10/2019	55	772356	6619707	406	
AMBS	*Bertya opponens*	20/10/2019	55	772352	6619711	406	
AMBS	*Bertya opponens*	20/10/2019	55	772352	6619717	406	
AMBS	*Bertya opponens*	20/10/2019	55	772354	6619717	406	
AMBS	*Bertya opponens*	20/10/2019	55	772353	6619714	406	
AMBS	*Tylophora linearis*	20/10/2019	55	774471	6617635	404	15

Surveyor	Scientific Name	Date	Zone	Easting	Northing	PCT (AMBS 2019)	Number of Individuals
AMBS	*Bertya opponens*	20/10/2019	55	772218	6619373	404	
AMBS	*Bertya opponens*	20/10/2019	55	772207	6619375	404	
AMBS	*Bertya opponens*	20/10/2019	55	772193	6619374	404	
AMBS	*Bertya opponens*	20/10/2019	55	772194	6619380	404	
AMBS	*Bertya opponens*	20/10/2019	55	772198	6619385	404	
AMBS	*Bertya opponens*	20/10/2019	55	772204	6619389	404	
AMBS	*Bertya opponens*	20/10/2019	55	772208	6619389	404	
AMBS	*Bertya opponens*	20/10/2019	55	772238	6619404	404	26
AMBS	*Bertya opponens*	20/10/2019	55	772245	6619407	404	
AMBS	*Bertya opponens*	20/10/2019	55	772252	6619405	404	
AMBS	*Bertya opponens*	20/10/2019	55	772256	6619395	404	
AMBS	*Bertya opponens*	20/10/2019	55	772259	6619383	404	
AMBS	*Bertya opponens*	20/10/2019	55	772292	6619393	404	
AMBS	*Bertya opponens*	20/10/2019	55	772303	6619415	404	
AMBS	*Bertya opponens*	20/10/2019	55	772262	6619382	404	
AMBS	*Bertya opponens*	20/10/2019	55	772331	6619980	404	
AMBS	*Bertya opponens*	20/10/2019	55	772312	6619987	404	
AMBS	*Bertya opponens*	20/10/2019	55	772318	6619971	404	
AMBS	*Bertya opponens*	20/10/2019	55	772327	6619965	404	
AMBS	*Bertya opponens*	20/10/2019	55	772337	6619960	404	
AMBS	*Bertya opponens*	20/10/2019	55	772343	6619965	404	
AMBS	*Bertya opponens*	20/10/2019	55	772348	6619972	404	
AMBS	*Bertya opponens*	20/10/2019	55	772257	6619992	404	
AMBS	*Bertya opponens*	20/10/2019	55	772255	6620008	404	
AMBS	*Bertya opponens*	20/10/2019	55	772249	6620013	404	31
AMBS	*Bertya opponens*	20/10/2019	55	772242	6620009	404	
AMBS	*Bertya opponens*	20/10/2019	55	772235	6620006	404	
AMBS	*Bertya opponens*	20/10/2019	55	772230	6620002	404	
AMBS	*Bertya opponens*	20/10/2019	55	772220	6619996	404	
AMBS	*Bertya opponens*	20/10/2019	55	772213	6619988	404	
AMBS	*Bertya opponens*	20/10/2019	55	772208	6619977	404	
AMBS	*Bertya opponens*	20/10/2019	55	772223	6619959	404	
AMBS	*Bertya opponens*	20/10/2019	55	772241	6619953	404	
AMBS	*Bertya opponens*	20/10/2019	55	772347	6619977	404	
AMBS	*Tylophora linearis*	21/10/2019	55	773988	6611289	406	7
AMBS	*Tylophora linearis*	21/10/2019	55	773917	6611984	406	1
AMBS	*Tylophora linearis*	15/10/2019	55	772714	6616291	404	1
AMBS	*Tylophora linearis*	3/07/2019	55	775618	6617628	435	50
AMBS	*Tylophora linearis*	6/08/2019	55	772321	6620480	141	10
AMBS	*Tylophora linearis*	17/07/2019	55	772353	6617733	399	1
AMBS	*Bertya opponens*	19/07/2019	55	772191	6619725	404	1
AMBS	*Bertya opponens*	6/08/2019	55	772003	6620249	141	1
AMBS	*Bertya opponens*	18/07/2019	55	772195	6619642	404	1
AMBS	*Bertya opponens*	7/10/2019	55	773395	6619942	404	1

ATTACHMENT C

NARRABRI UNDERGROUND MINE STAGE 3 EXTENSION PROJECT – FAUNA SURVEY REPORT

Narrabri Underground Mine Stage 3 Extension Project – Fauna Survey

Prepared by AMBS Ecology & Heritage
for Narrabri Coal Operations Pty Ltd

Final Report

July 2020

AMBS Reference: 18598

Document Information

Citation:	AMBS Ecology & Heritage (2020). *Narrabri Underground Mine Stage 3 Extension Project – Fauna Survey*. Consultancy report to Narrabri Coal Operations Pty Ltd.
AMBS Ref:	18598
Versions:	Version 1: Draft Report issued 14 November 2019 Version 2: Draft Report issued 20 December 2019 Version 3: Draft Report issued 20 February 2020 Version 4: Draft Report issued 2 March 2020 Version 5: Draft Report issued 3 April 2020 Version 6: Final Report issued 27 May 2020 Version 7: Revised Final Report issued 21 July 2020
Recipient:	Mark Vile, Narrabri Coal Operations Pty Ltd
Authors:	Chris Jackson, Mark Semeniuk, Ulrike Kloecker
Approved by:	Mark Semeniuk

Executive Summary

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by Narrabri Coal Operations Pty Ltd to undertake fauna surveys for the Narrabri Underground Mine Stage 3 Extension Project (the Project).

The scope of this study involved the survey and documentation of threatened fauna and habitat within a study area in accordance with the *Biodiversity Assessment Method* (BAM) as required under the *Biodiversity Conservation Act 2016* (New South Wales) (BC Act). The study area spans the southern portion of Mining Lease 1609, and Mining Lease Application areas 1 and 2. The western portion of the study area is within native forest and woodland, while the eastern portion consists of semi-cleared agricultural land.

Numerous fauna surveys have been undertaken within the study area between October 2017 and January 2020 by Eco Logical Australia and AMBS. The field surveys included completing targeted searches for "species credit" species in accordance with the BAM during the required survey season, as well as targeted surveys for select species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act).

This study has identified eleven broad habitat types based to some extent on thirteen plant community types (PCTs) recorded in the study area:

- Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath (PCT 405);
- Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath (PCT 404);
- Box Woodland (PCTs 88, 244, 435);
- Belah Woodland (PCT 55);
- Shallow, Undefined Drainage Channels (PCT 141, PCT 399, parts of PCTs 404 and 405);
- Red Gum Woodland (Rocky) (PCT 432);
- Red Gum Woodland (Sandy) (PCTs 206, 401, 408);
- Rocky Outcrops and Hills with Open Woodland and Dense Shrubland (PCT 406);
- Derived Native Grassland (PCTs 55, 88, 244, 405, 435);
- Dams; and
- Exotic Grassland.

Two hundred and eight fauna species were recorded during this study. Nineteen of the fauna species recorded during this study are listed as threatened on the schedules of the BC Act, and six are listed as threatened on the schedules of the EPBC Act:

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) (BC Act – Vulnerable);
- Little Lorikeet (*Glossopsitta pusilla*) (BC Act – Vulnerable);
- White-throated Needletail (*Hirundapus caudacutus*) (EPBC Act – Vulnerable);
- Speckled Warbler (*Chthonicola sagittata*) (BC Act – Vulnerable);
- Painted Honeyeater (*Grantiella picta*) (BC Act – Vulnerable, EPBC Act – Vulnerable);
- Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*) (BC Act – Vulnerable);
- Scarlet Robin (*Petroica boodang*) (BC Act – Vulnerable);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) (BC Act – Vulnerable);
- Varied Sittella (*Daphoenositta chrysoptera*) (BC Act – Vulnerable);
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) (BC Act – Vulnerable);
- Diamond Firetail (*Stagonopleura guttata*) (BC Act – Vulnerable);
- Koala (*Phascolarctos cinereus*) (BC Act – Vulnerable, EPBC Act – Vulnerable);

- Eastern Pygmy-possum (*Cercartetus nanus*) (BC Act – Vulnerable);
- Black-striped Wallaby (*Macropus dorsalis*) (BC Act – Endangered);
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) (BC Act – Vulnerable);
- Corben's Long-eared Bat (*Nyctophilus corbeni*) (BC Act – Vulnerable, EPBC Act – Vulnerable);
- Large-eared Pied Bat (*Chalinolobus dwyeri*) (BC Act – Vulnerable, EPBC Act – Vulnerable);
- Little Pied Bat (*Chalinolobus picatus*) (BC Act – Vulnerable);
- Eastern Cave Bat (*Vespadelus troughtoni*) (BC Act – Vulnerable); and
- Pilliga Mouse (*Pseudomys pilligaensis*) (BC Act – Vulnerable, EPBC Act – Vulnerable).

Five of the recorded threatened species are classified as species credit species, namely the Glossy Black-Cockatoo, Koala, Eastern Pygmy-possum, Large-eared Pied Bat and the Eastern Cave Bat. A further two species credit species are considered to potentially be present in the study area, namely the Pale-headed Snake (*Hoplocephalus bitorquatus*) (previously recorded at the Narrabri Mine) and the Squirrel Glider (*Petaurus norfolcensis*) (previously recorded in the study area by a different surveyor).

The Glossy Black-Cockatoo is classified as a dual Species/Ecosystem credit species, with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits. All of the broad fauna habitat types in the study area represent potential foraging and breeding habitat for the Glossy Black-Cockatoo due to the occurrence of *Allocasuarina* sp. and suitable hollow-bearing trees.

The Koala is classified as a dual Species/Ecosystem credit species, with important habitat assessed for species credits. Important habitat mapping for Koalas has not been finalised by the Department of Planning, Industry and Environment. In the meantime, Koalas are treated as a full species credit species, rather than a dual Species/Ecosystem credit species, and assessed via targeted survey. Potential habitat for the Koala included vegetation communities with recognised Koala feed tree species, which occurred primarily in drainage lines and alluvial floodplains. Other areas of potential habitat were included on the basis of the trees identified on Schedule 2 of the *State Environmental Planning Policy (Koala Habitat Protection) 2019*.

The Squirrel Glider potential habitat occurs mainly along drainage lines and alluvial floodplains, with the addition of the Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath broad habitat type.

The majority of the broad habitat types found in the study area represent suitable habitat for the Eastern Pygmy-possum, with the exception of some of the open woodland habitat types that are degraded and lack a thick mid-storey shrub layer. All of the broad fauna habitat types in the study area represent potential habitat for the Pale-headed Snake.

Potential breeding habitat for the Large-eared Pied Bat species occurs at Bulga Hill, while foraging habitat occurs in most broad habitat types within a 2-kilometre (km) radius of Bulga Hill and an unnamed rocky outcrop with bat habitat. Breeding habitat for the Eastern Cave Bat occurs at Bulga Hill, and foraging habitat occurs within a 2 km radius.

The Department of the Environment and Energy (now Department of Agriculture, Water and the Environment) issued the Secretary's Environmental Assessment Requirements (SEARs) for the Project. Under the SEARs, it was required that the suitability of habitats in the study area for six threatened fauna species listed under the EPBC Act be assessed. These six species were:

- Superb Parrot (*Polytelis swainsonii*);

- Regent Honeyeater (*Anthochaera phrygia*);
- Koala;
- Corben's Long-eared Bat;
- Large-eared Pied Bat; and
- Pilliga Mouse.

Habitat for species recorded in the study area (i.e. the Koala, Corben's Long-eared Bat, Large-eared Pied Bat and Pilliga Mouse) has been mapped. Potential foraging habitat for the remaining two species (Superb Parrot and Regent Honeyeater) has also been mapped. Given the presence of survey records for the Painted Honeyeater, foraging habitat for the species has also been mapped in the study area.

Contents

Executive Summary ..... **III**

1 Introduction **1**

1.1 Background 1
1.2 Scope and Objectives 1
1.3 Location of the Study Area 1
1.4 Bioregion and Landscape 3
1.5 Climate 3
1.6 Topography and Drainage 5
1.7 Land Use and Disturbance 5
1.8 Fire History 6
1.9 Plant Community Types and Vegetation Zones 6

2 Methods **8**

2.1 Nomenclature 8
2.2 Desktop Review 8
2.3 Field Surveys 12
2.4 Survey Guidelines and Effort 23
2.5 Weather Conditions 32

3 Results **34**

3.1 Broad Fauna Habitat Types and Condition 34
3.2 Native and Introduced Fauna Species 49
3.3 Threatened Fauna Species Recorded 49
3.4 Summary of Fauna Species Credit Species 53
3.5 Summary of EPBC Act Species 71
3.6 SEPP (Koala Habitat Protection) 2019 78

4 Summary and Conclusion **80**

Bibliography **82**

Appendix A: Fauna survey locations **85**

Appendix B: Fauna species list **90**

Tables

Table 2.1 Threatened fauna known or predicted to occur in the locality 9
Table 2.2 Survey dates and tasks 12
Table 2.3 Experience of survey team personnel 13
Table 2.4 Summary of survey guidelines for threatened species potentially found in the study area 24
Table 2.5 Threatened fauna known or predicted to occur in the locality and associated with PCTs in the study area.....30
Table 2.6 Weather conditions during the survey periods.....32
Table 3.1 Broad habitat types 34
Table 3.2 Threatened fauna recorded in the study area 50
Table 3.3 Species credit species associated with PCTs in the study area 55

Figures

Figure 1.1 Location map.....2
Figure 1.2 Annual average rainfall recorded at Narrabri West Post Office (1961-2017) and Narrabri Airport AWS (2018-2019), showing the variation relative to the long-term average of 658.5 mm (Source: BoM 2020).....5
Figure 1.3 Known disturbance history of the study area (Source: Forestry Corporation of NSW, NPWS 2019, NCOPL 2018).....7
Figure 2.1 Location of diurnal bird, reptile, Koala SAT and winter bird surveys.....14
Figure 2.2 Location of fauna trapping sites and cameras 15
Figure 2.3 Location of call playback, spotlighting and microbat surveys.....16
Figure 3.1 Broad fauna habitat types in the study area.....35
Figure 3.2 Location of threatened fauna 52
Figure 3.3 Pale-headed Snake Species Polygon 58
Figure 3.4 Glossy Black-Cockatoo Species Polygon.....61
Figure 3.5 Eastern Pygmy-possum Species Polygon 62
Figure 3.6 Koala Species Polygon 64
Figure 3.7 Squirrel Glider Species Polygon 66
Figure 3.8 Large-eared Pied Bat Species Polygon 68
Figure 3.9 Eastern Cave Bat Species Polygon.....70
Figure 3.10 Superb Parrot Potential Foraging Habitat.....72
Figure 3.11 Regent Honeyeater Potential Foraging Habitat 74
Figure 3.12 Painted Honeyeater Potential Habitat.....76
Figure 3.13 Pilliga Mouse Potential Habitat.....77
Figure 3.14 Corben's Long-eared Bat Potential Habitat 79

Plates

Plate 3.1: Cave with mouth width greater than 4 m and depth greater than 8 m. 40
Plate 3.2: Cave located on the top tier of Bulga Hill. Cave entrance less than 4 m but with a depth greater than 8 m. A secondary chamber of unknown depth can be observed above the main entrance. 41
Plate 3.3: Eastern Cave Bat in a small hole on the top tier of Bulga Hill.....41
Plate 3.4: Unnamed rocky outcrop relief with low complexity and lacking large caves.....42
Plate 3.5: Small cave on the unnamed rocky outcrop with a depth of approximately 4 metres and with crevicing. 43
Plate 3.6: Broad habitat type – Shallow, Undefined Drainage Channel mapped as PCT 404.....45
Plate 3.7: Broad habitat type – Red Ironbark/White Bloodwood Open Woodland with Dense Shrubland and Thick Heath mapped as PCT 404.....46

1 Introduction

1.1 Background

The Narrabri Mine is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah within the Narrabri Shire Council Local Government Area (LGA) of New South Wales (NSW) (Figure 1). The Narrabri Mine is operated by Narrabri Coal Operations Pty Limited (NCOPL).

NCOPL is seeking a new State significant development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (NSW) for the Narrabri Underground Mine Stage 3 Extension Project (the Project). This Fauna Survey Report provides supporting information to the Biodiversity Development Assessment Report (BDAR) that has been prepared to accompany the development application for the Project.

The Project involves an extension to the south of the approved underground mining area to gain access to additional coal reserves within mining lease application (MLA) areas 1 and 2, an extension of the mine life to 2044 and development of supporting surface infrastructure. Run-of-mine coal production would occur at a rate of up to 11 million tonnes per annum, consistent with the currently approved limit.

1.2 Scope and Objectives

The scope of work for this proposal involves collecting data on the terrestrial vertebrate fauna and fauna habitat within the study areas and providing a report containing the results.

The proposed scope of work includes the following tasks:

- threatened fauna species surveys according to Sections 6.4 and 6.5 of the *Biodiversity Assessment Method* (BAM) (Office of Environment and Heritage [OEH] 2017);
- targeted surveys of all potentially occurring threatened fauna and migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act);
- documenting the presence of all native and introduced fauna species;
- description of fauna habitat features for threatened species that could potentially occur in the study area;
- mapping polygons showing suitable habitat for threatened fauna classified as species credit species or those potentially occurring threatened fauna listed under the EPBC Act; and
- preparation of a survey report documenting the survey methods and findings.

1.3 Location of the Study Area

The study area is shown on Figure 1.1. It occupies an area of approximately 5,426 hectares (ha) and spans the southern part of the Mining Lease (ML) 1609 and MLA areas 1 and 2.

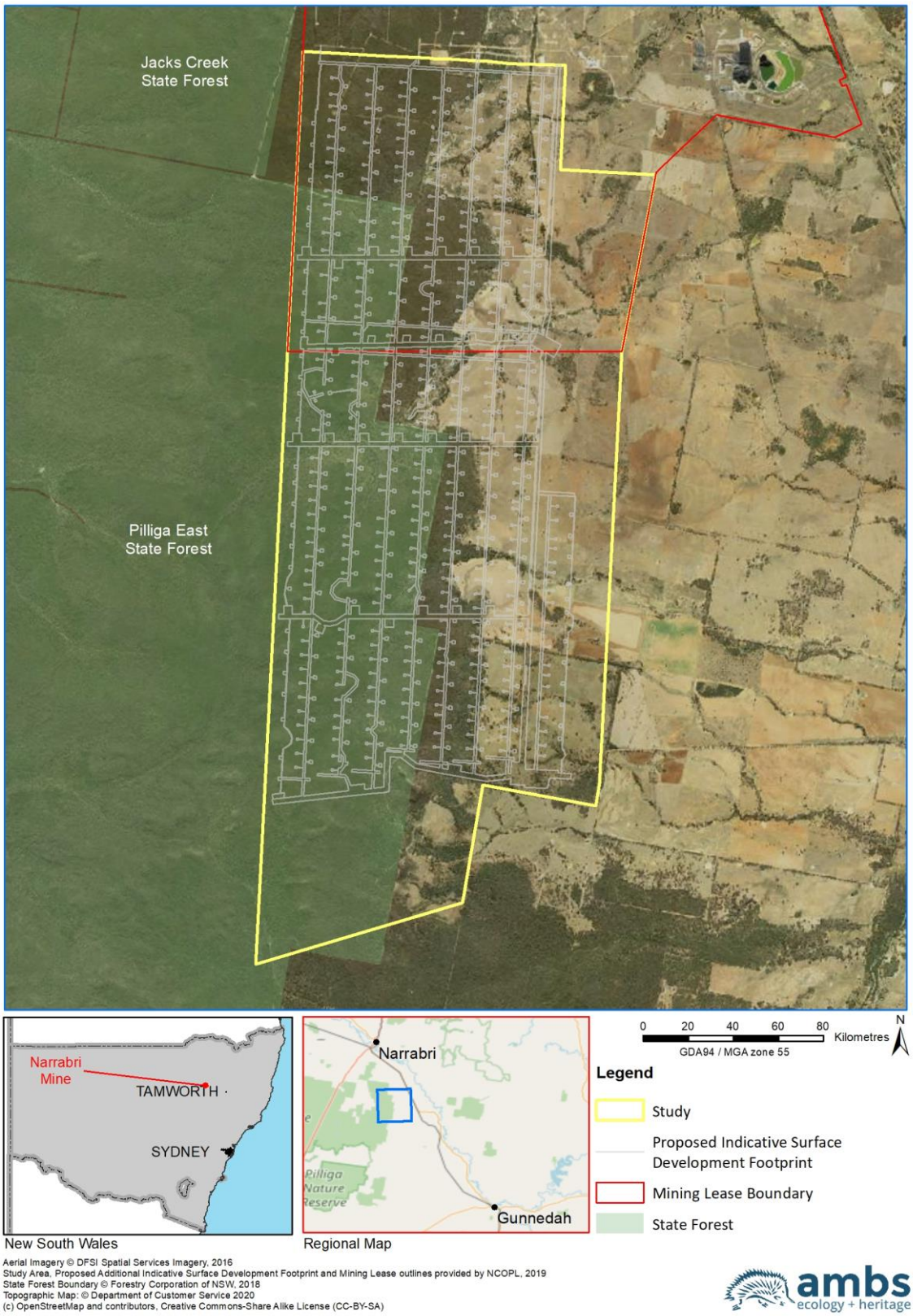


Figure 1.1 Location map

1.4 Bioregion and Landscape

The study area lies within the NSW botanical division of the North Western Plains, within the Brigalow Belt South Interim Biogeographic Regionalisation for Australia (IBRA) bioregion, and the Pilliga and Liverpool Plains subregions (Thackway & Cresswell 1995, Department of the Environment and Energy [DEE] 2019b). The native vegetation of the region generally consists of the Pilliga Outwash Dry Sclerophyll Forests and Western Slopes Dry Sclerophyll Forests vegetation classes of Keith (2006).

The eastern portion of the study area is within the Liverpool Plains IBRA subregion and the western portion is located within the Pilliga IBRA subregion. This adjoins the Pilliga Outwash subregion to the west. Land to the east consists of flats mostly cleared for agriculture, while to the west an extensive area of native vegetation occurs within the Pilliga East State Forest and adjoining reserves.

The elevation across the study area ranges from approximately 280 metres (m) above sea level (ASL) in the flatter plains to the east to almost 400 m ASL on the rock ridges to the west.

1.5 Climate

Weather records were obtained from the nearby Commonwealth Bureau of Meteorology (BoM) weather stations at Narrabri West Post Office (Station ID 053030) and Narrabri Airport Automatic Weather Station (AWS) (Station ID 054038), both located approximately 25 km north of the study area. Data displayed in Figure 1.2 below is taken from the Narrabri West Post Office, except for 2018 - 2019 where data was incomplete and data from the Narrabri Airport AWS was used.

The locality receives an average of about 685.5 millimetres (mm) of rainfall per annum, based on the long-term average between 1891 and 2017 (BoM 2020). Higher rainfall tends to occur in spring and summer, with lower rainfall in autumn and winter.

Rainfall varies widely from year to year, as shown in

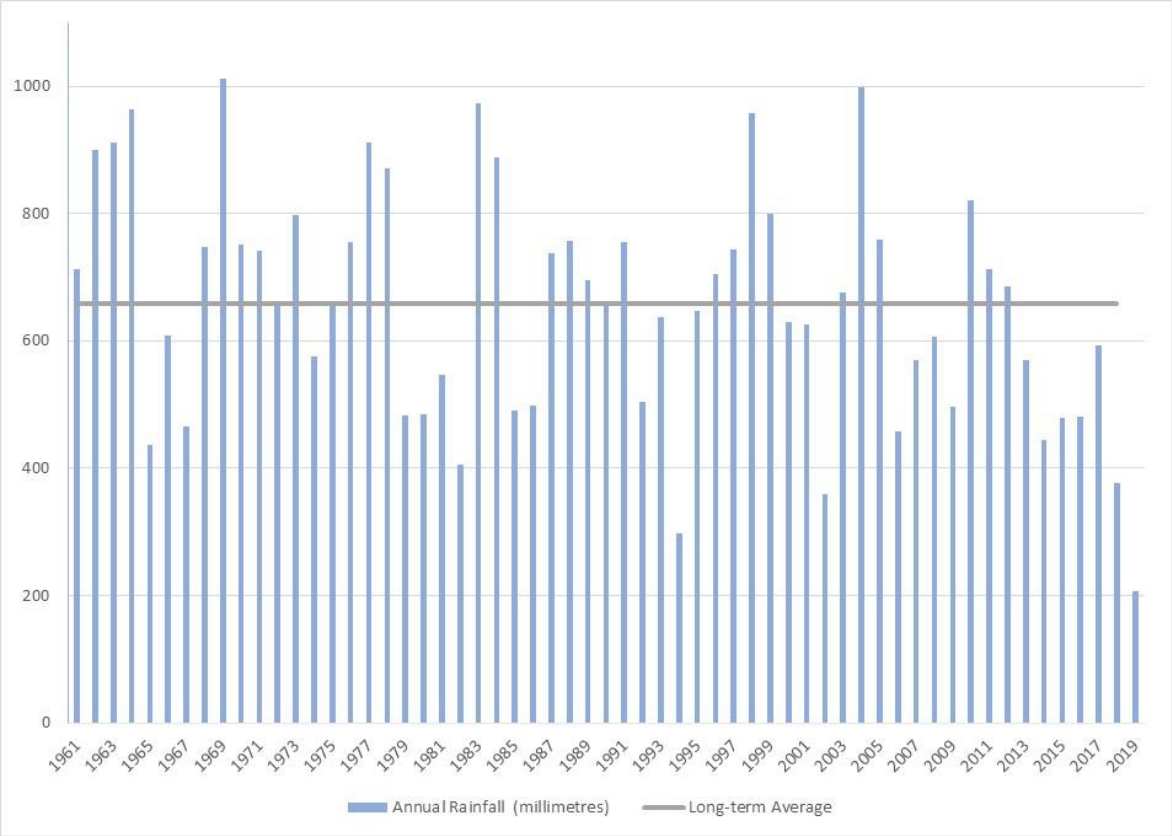


Figure 1.2 (complete data from 1961 to 2018), with a lowest recorded total annual rainfall of 206.2 mm (in 2019) and a highest of 1,012.1 mm (in 1969). The seven years from 2013-2019 had below average annual rainfall.

Average monthly temperatures range between a minimum of 3.7 degrees Celsius (°C) and a maximum of 33.8°C. The warmest month is usually January (mean monthly maximum 33.8°C, mean minimum 19.3°C) and the coolest is July (mean maximum 18.0°C, mean minimum 3.7°C) (Narrabri West Post Office 1962-2002, BoM 2020).

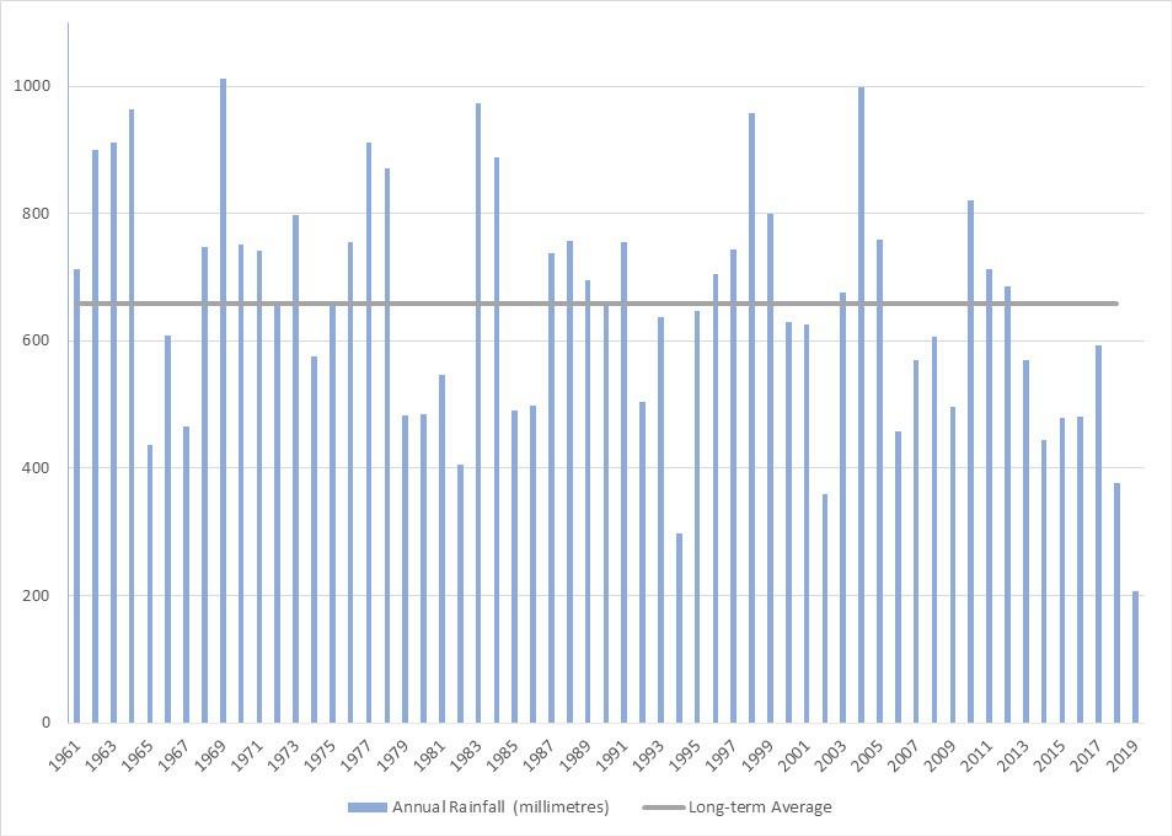


Figure 1.2 Annual average rainfall recorded at Narrabri West Post Office (1961-2017) and Narrabri Airport AWS (2018-2019), showing the variation relative to the long-term average of 658.5 mm (Source: BoM 2020)

1.6 Topography and Drainage

Natural drainage in the study area consists of several first, second and third order ephemeral drainage lines, flowing generally to the east. During the majority of survey work, drainage lines in the study area were dry; however, small pools were observed in one ephemeral stream following rainfall in 2017. Flow likely occurs only during heavy rainfall events. The drainage lines are distinguished by slight depressions or a minor creek channel, and by a variation in vegetation structure. For example, habitats near drainage lines generally contained taller forests and, in some cases, a different vegetation type with a shrub-grass understorey, as opposed to shrubby.

1.7 Land Use and Disturbance

The western portion of the study area is within native forest and woodland, while the eastern portion consists of semi-cleared agricultural land. Vegetation condition in the eastern portion is variable; in some locations small patches of remnant trees occur while in others the land has been completely cleared. A large expanse of native vegetation also occurs in land to the west of the study area within the Pilliga reserves and some private land.

Disturbance in the past within the study area is likely to have consisted mainly of logging for timber (probably targeting *Eucalyptus crebra* [Narrow-leaved Ironbark], *Eucalyptus fibrosa* [Red Ironbark], *Callitris endlicheri* [Black Cypress Pine] and *Callitris glaucophylla* [White Cypress Pine]). Data provided by the Forestry Corporation of NSW indicates harvesting events in State Forest compartments subject to Exploration Licence 6243 took place in 1978-79, 1980-81 and 2000-01 (Figure 1.3).

Due to the low-nutrient (sandstone-derived) soils and the predominantly shrubby vegetation with minimal grass cover, there has probably been minimal use of the western portion of the study area for livestock. In general, there are very few to no weeds.

1.8 Fire History

The Pilliga landscape is occasionally subject to large, intense wildfires. Fire history is likely to have influenced the current patterns of vegetation in parts of the study area, including understorey composition. The even-aged stands of Acacia (e.g. *Acacia burrowii* [Burrow's Wattle]) are an indication of past fires which, in shrubby dry sclerophyll forests, can result in the mass germination of seeds present in the soil seedbank. Other evidence of past fires included charring on the trunks of large trees and old epicormic regrowth in the canopy (with old dead branches), indicating that at least some areas had been burnt in the past by intense wildfire. The vegetation structure (tall, even-aged shrub thickets) in some areas are an indication that the last fire was some decades ago.

Based on the available fire history (National Parks and Wildlife Service [NPWS] 2019), the northern part of the study area was burnt by a wildfire in 1985-86, and the central and southern parts of the study area were burnt by a wildfire in 1982-83 and a prescribed burn in 1991-92 (Figure 1.3). In summary, the northernmost section of the study area (north of Pine Creek) has apparently not been burnt for 33 years or more, and much of the remainder of the study area has not burnt for at least 27 years.

An area of approximately 57 ha within the Jacks Creek State Forest, located a few kilometres to the north of the study area boundary was burnt by an unplanned fire in February 2017. This fire did not spread onto the study area (ML 1609 land) (NCOPL 2018).

1.9 Plant Community Types and Vegetation Zones

Flora surveys undertaken by AMBS (2020) within the study area identified thirteen plant community types (PCTs) and associated vegetation zones:

- *Pilliga Box – Buloke Woodland* (Good, Moderate, *Derived Native Grassland* [DNG]) (PCT 88);
- *Broombush – Wattle Tall Shrubland* (Good) (PCT 141);
- *Dwyer's Red Gum Shrubby Woodland* (Good) (PCT 432);
- *White Box – White Cypress Woodland* (Good, Moderate, DNG) (PCT 435);
- *Red Gum – Tea Tree Creek Woodland* (Good, Moderate) (PCT 399);
- *Rough-barked Apple Sand Flat Woodland* (Good) (PCT 401);
- *Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland* (Good, Moderate) (PCT 404);
- *White Bloodwood – Red Ironbark – Black Cypress Woodland* (Good, DNG) (PCT 405);
- *White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland* (Good, Moderate) (PCT 406);
- *Dirty Gum Shrubby Woodland* (Good) (PCT 408);
- *Poplar Box Grassy Woodland* (Good, DNG) (PCT 244);
- *Belah Woodland* (Good, DNG) (PCT 55); and
- *Dirty Gum – White Cypress Woodland on Sand Monkeys* (Good) (PCT 206).

The PCTs and vegetation zones were used to inform the stratification of the study area and the areas of habitat that required targeted fauna surveys.

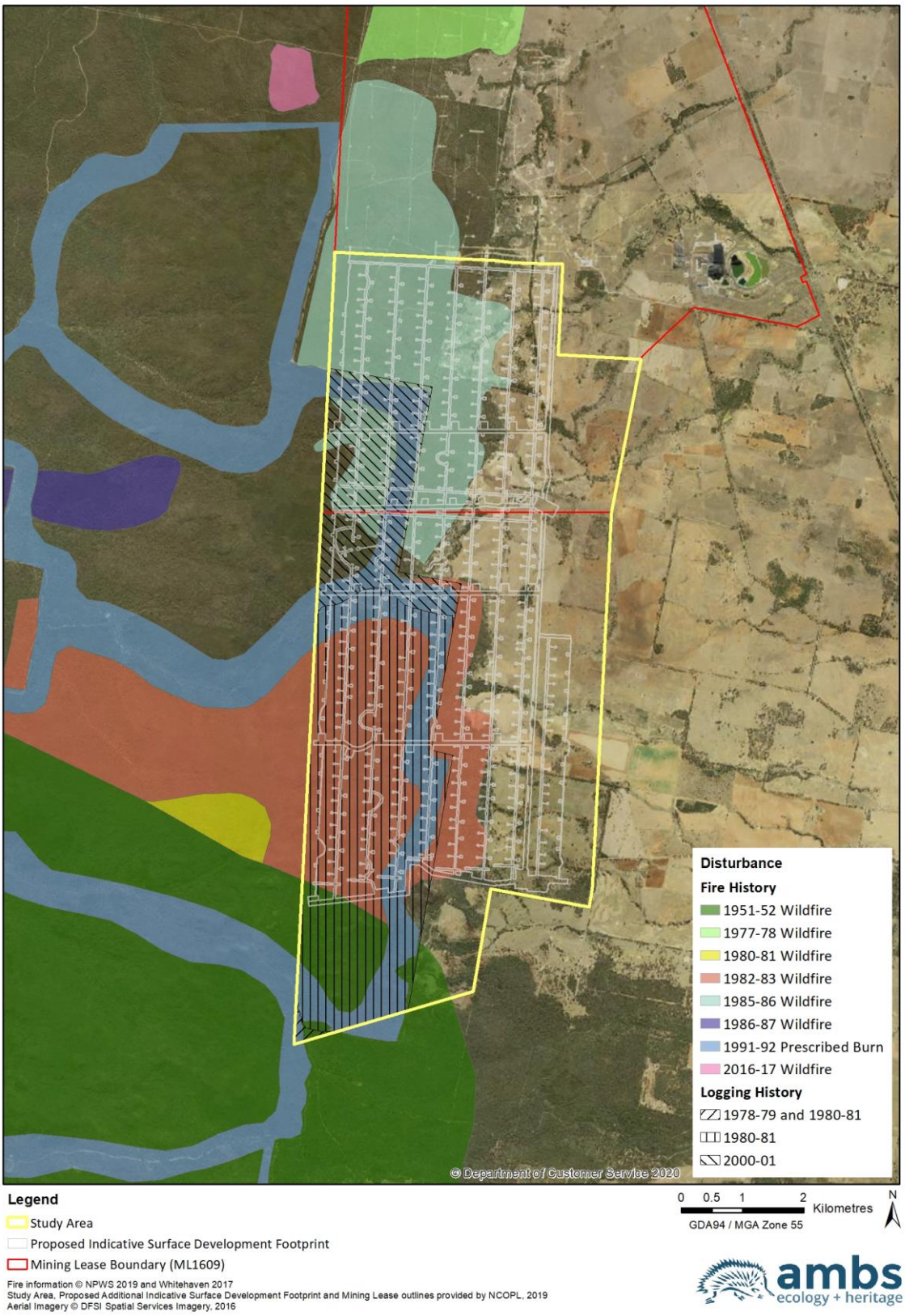


Figure 1.3 Known disturbance history of the study area (Source: Forestry Corporation of NSW, NPWS 2019, NCOPL 2018)

2 Methods

2.1 Nomenclature

The nomenclature of all threatened species follows that used on the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and EPBC Act threatened species lists. For non-threatened species the following applies:

- frog species nomenclature follows *Reptiles and Amphibians of Australia* (Cogger 2014);
- reptile species nomenclature follows *A Complete Guide to Reptiles of Australia* (Wilson & Swan 2017);
- mammal species nomenclature follows *Field Companion to the Mammals of Australia* (Van Dyck *et al.* 2013), with the exception of the free-tail bat genus *Mormopterus*, which follows Reardon *et al.* (2014); and
- bird species nomenclature follows the *BirdLife Australia Working List v2.1* (BirdLife Australia 2019a).

2.2 Desktop Review

A desktop study of ecological information and local reports was conducted prior to undertaking field surveys. This included review of:

- previous vegetation mapping (Ecotone 2009);
- Border Rivers Gwydir/Namoi Region 2.0 VIS 4467 vegetation map (Department of Planning, Industry and Environment [DPIE] 2019b);
- previous fauna surveys, including:
    - Ecological Monitoring Surveys (Eco Logical Australia [ELA] 2012-2018);
    - fauna surveys for the *Narrabri Coal Project Ecological Assessment* (Ecotone 2007);
    - fauna surveys for the *Narrabri Coal Underground Stage 2 Longwall Project* (Ecotone 2009); and
    - baseline fauna survey of *Narrabri Underground Mine Longwalls 110 and 111* (AMBS 2019);
- DPIE *BioNet Atlas* records (DPIE 2019a);
- BirdLife Australia (2019b) records;
- *EPBC Act Protected Matters Search Tool* (DEE 2019a); and
- previous records and species profiles for predicted threatened species and threatened ecological communities (TECs) available in the *Threatened Biodiversity Data Collection* (DPIE 2020a) and *Threatened Species Profile Database* (DPIE 2020b) were also reviewed with respect to known and predicted habitat types.

Utilising information from the desktop review, threatened fauna known from the locality are summarised in Table 2.1.

Table 2.1 Threatened fauna known or predicted to occur in the locality

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	*BioNet Atlas* Records (10 km) (DPIE 2019a)	Narrabri Mine Survey Records (Ecotone 2007, Ecotone 2009, AMBS 2019)	*EPBC Act Protected Matters Search* (DEE 2019a)	BirdLife Australia (2019b) Records	Associated with PCTs in the study area (DPIE 2020a)
		BC Act[1]	EPBC Act[2]						
REPTILES									
Border Thick-tailed Gecko	*Uvidicolus sphyrurus*	V	V	Species	-	-	-	-	Yes
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	Species	✓	✓	-	-	Yes
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	-	-	-	-	Yes
BIRDS									
Spotted Harrier	*Circus assimilis*	V	-	Ecosystem	-	-	-	✓	Yes
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	Species/Ecosystem	✓	-	-	✓	Yes
Black-breasted Buzzard	*Hamirostra melanosternon*	V	-	Species/Ecosystem	✓	-	-	-	Yes
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/Ecosystem	✓	-	-	✓	Yes
Square-tailed Kite	*Lophoictinia isura*	V	-	Species/Ecosystem	✓	✓	-	-	Yes
White-throated Needletail	*Hirundapus caudacutus*	-	V	-	✓	✓	✓	-	No
Bush Stone-curlew	*Burhinus grallarius*	E	-	Species	-	-	-	-	Yes
Australian Painted Snipe	*Rostratula australis*	E	E	Ecosystem	✓	-	✓	-	No
Curlew Sandpiper	*Calidris ferruginea*	E	CE	Species/Ecosystem	-	-	✓	-	No
Grey Falcon	*Falco hypoleucos*	E	-	Ecosystem	-	-		-	Yes
Black Falcon	*Falco subniger*	V	-	Ecosystem	✓	-		✓	No
Malleefowl	*Leipoa ocellata*	E	V	Ecosystem	-	-	✓	-	Yes
Australian Bustard	*Ardeotis australis*	E	-	Species	-	-	-	-	Yes
Speckled Warbler	*Chthonicola sagittata*	V	-	Ecosystem	✓	✓	-	-	Yes
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Ecosystem	✓	✓	-	-	Yes
Brown Treecreeper	*Climacteris picumnus victoriae*	V	-	Ecosystem	✓	-	-	-	Yes
Diamond Firetail	*Stagonopleura guttata*	V	-	Ecosystem	✓	✓	-	-	Yes
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species/Ecosystem	-	-	✓	-	Yes
Pied Honeyeater	*Certhionyx variegatus*	V	-	Ecosystem	-	-	-	✓	Yes
White-fronted Chat	*Epthianura albifrons*	V	-	Ecosystem	✓	-	-	-	No

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	*BioNet Atlas* Records (10 km) (DPIE 2019a)	Narrabri Mine Survey Records (Ecotone 2007, Ecotone 2009, AMBS 2019)	*EPBC Act Protected Matters Search* (DEE 2019a)	BirdLife Australia (2019b) Records	Associated with PCTs in the study area (DPIE 2020a)
		BC Act[1]	EPBC Act[2]						
Painted Honeyeater	*Grantiella picta*	V	V	Ecosystem	-	-	✓	-	Yes
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-	Ecosystem	-	-	-	-	Yes
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Ecosystem	✓	✓	-	-	Yes
Gilbert's Whistler	*Pachycephala inornata*	V	-	Ecosystem	-	-	-	-	Yes
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-	Ecosystem	✓	-	-	-	Yes
Scarlet Robin	*Petroica boodang*	V	-	Ecosystem	-	-	-	-	Yes
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	Ecosystem	✓	✓	-	✓	Yes
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	Species/Ecosystem	✓	✓	-	✓	Yes
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	V	-	Species/Ecosystem	-	-	-	-	Yes
Little Lorikeet	*Glossopsitta pusilla*	V	-	Ecosystem	✓	✓	-	-	Yes
Swift Parrot	*Lathamus discolor*	E	CE	Species/Ecosystem	-	-	-	-	Yes
Turquoise Parrot	*Neophema pulchella*	V	-	Ecosystem	✓	✓	-	✓	Yes
Superb Parrot	*Polytelis swainsonii*	V	V	Species/Ecosystem	✓	✓	✓	-	Yes
Barking Owl	*Ninox connivens*	V	-	Species/Ecosystem	✓	-	-	-	Yes
Masked Owl	*Tyto novaehollandiae*	V	-	Species/Ecosystem	✓	-	-	-	Yes
MAMMALS									
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Ecosystem	✓	✓	-	-	Yes
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Species/Ecosystem	-	-	-	-	Yes
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Species/Ecosystem	-	-	✓	-	Yes
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Species	-	✓	✓	-	Yes
Little Pied Bat	*Chalinolobus picatus*	V	-	Ecosystem	✓	✓	-	-	Yes
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	Ecosystem	✓	✓	✓	-	Yes
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	-	-	-	-	Yes
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	Ecosystem	-	-	✓	-	Yes
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	Species	-	-	-	-	Yes
Stripe-faced Dunnart	*Sminthopsis macroura*	V	-	Ecosystem	-	-		-	Yes

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	*BioNet Atlas* Records (10 km) (DPIE 2019a)	Narrabri Mine Survey Records (Ecotone 2007, Ecotone 2009, AMBS 2019)	*EPBC Act Protected Matters Search* (DEE 2019a)	BirdLife Australia (2019b) Records	Associated with PCTs in the study area (DPIE 2020a)
		BC Act[1]	EPBC Act[2]						
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	Species	✓	✓	-	-	Yes
Black-striped Wallaby	*Macropus dorsalis*	E	-	Ecosystem	✓	✓	-	-	Yes
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	Species	-	-	-	-	Yes
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species	✓	-	-	-	Yes
Koala	*Phascolarctos cinereus*	V	V	Species/Ecosystem	✓	✓	✓	-	Yes
Rufous Bettong	*Aepyprymnus rufescens*	V	-	Species	-	-	-	-	Yes
Pilliga Mouse	*Pseudomys pilligaensis*	V	V	Ecosystem	✓	✓	✓	-	Yes

Note:

[1] Conservation status under the BC Act (current as at April 2020). CE = Critically Endangered, E = Endangered, V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at April 2020). CE = Critically Endangered, E= Endangered, V = Vulnerable.

[3] Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE 2020a) (current as at April 2020).

2.3 Field Surveys

2.3.1 Overview

Numerous targeted fauna surveys have been undertaken between October 2017 and January 2020 within the study area (Table 2.2). Fauna surveys were undertaken during 2017 and 2018 by ELA and subsequently by AMBS in 2019 and 2020. Survey timing and duration was designed to incorporate recommended targeted survey guidelines for threatened fauna species that could potentially occur in the study area. This report includes the methods and results from both studies where relevant, for the purposes of informing the BAM assessment and BDAR.

Table 2.2 Survey dates and tasks

Date	Surveyors	Season	Task
August-September 2017	ELA	Winter-Spring	Long-term Infrared (IR) camera deployment, winter bird surveys.
9 October – 23 November 2017	ELA	Spring	Elliott traps, pitfall traps, funnel traps, cage traps, arboreal hair tubes, harp traps, Song Meters, bird/reptile searches, remote cameras, spotlighting and call playback.
19-20 February 2018	ELA	Summer	Song Meters.
17-21 June 2019	AMBS	Winter	Scoping, bird surveys.
30 July – 1 August 2019	AMBS	Winter	Camera deployment, bird surveys.
8-12 July, 29 July – 3 August, 5-10, 12-16 and 19-22 August 2019	AMBS	Winter	Nocturnal call playback.
1-10 October 2019	AMBS	Spring	Pitfall trap installation, bird/reptile surveys, camera collection & deployment.
21-26 October 2019	AMBS	Spring	Elliott traps, pitfall traps, funnel traps, bird/reptile surveys, camera collection.
9-14 December 2019	AMBS	Summer	Elliott traps, pitfall traps, funnel traps, bird/reptile surveys, harp trapping, Anabats, spotlighting.
28-30 January 2020	AMBS	Summer	Harp trapping, Anabats.

Fauna surveys and related tasks were undertaken by personnel listed in Table 2.3. Please note: information from Table 2.3 regarding ELA personnel was retrieved from ELA (2019). All surveys were designed to ensure individuals with comparatively less experience (e.g. two years) were teamed with survey team leaders.

The survey effort applied throughout the study area was determined by stratifying the study area into broad habitat types. Twelve broad habitat types were identified, based to some extent on the PCTs recorded within the study area by AMBS (2020). A sampling intensity was determined in accordance with relevant fauna survey guidelines, in particular, the *Threatened Species Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation [DEC] 2004) and the *'Species Credit' Threatened Bats and Their Habitats* survey guide (OEH 2018a). Given the large size of the study area, in accordance with the threatened fauna survey guideline (DEC 2004) a stratification of 200 ha was applied. A summary of the broad habitat types and the areas (ha) for each are displayed in Section 3.1. The survey methods undertaken are described below. Survey locations are shown in Figures 2.1, 2.2 and 2.3. Site coordinates are documented in Appendix A.

Table 2.3 Experience of survey team personnel

Name	Company	Qualifications	Experience	Task
Alex Pursche	ELA	Bachelor of Science (Hons) PhD Accredited BAM assessor	9 years	Fauna surveys, planning and reporting
Alicia Scanlon	ELA	Bachelor of Science	10 years	Fauna surveys
Peter Hancock	ELA	Bachelor of Natural Resources PhD	20 years	Fauna surveys
Peter Knock	ELA (Fauna Sonics)	Bachelor of Applied Science Associated Diploma of Environmental Control	20 years	Fauna surveys and analysis of microbat Song Meter data from 2017 and 2018
David Coombs	ELA	Bachelor of Applied Science	17 years	Fauna surveys
Tom Schmidt	ELA	Bachelor of Environmental Science and Management	7 years	Fauna surveys
Mike Lawrie	ELA	Bachelor of Environmental Science and Management Master of Environment (Specialisation in Environmental Science)	4 years	Fauna surveys
Justin Russell	ELA	Graduate Diploma in Environmental Management Bachelor of Horticultural Science Graduate Diploma in Horticulture	14 years	Fauna surveys
Jeni Morris	ELA	Bachelor of Science	2 years	Fauna surveys
Tim Henderson	ELA	Bachelor of Zoology Bachelor of Science	2 years	Fauna surveys
Cassandra Holt	ELA	Bachelor of Environmental Science	2 years	Fauna surveys
Michael Gregor	ELA	Bachelor of Science	2 years	Fauna surveys
Mark Semeniuk	AMBS	Bachelor of Science Master of Applied Science (Wildlife Health and Population Management) Accredited BAM assessor	14 years	Survey planning and reporting
Glenn Muir	AMBS	Bachelor of Science Accredited BAM assessor	25 years	Survey planning and reporting
Chris Jackson	AMBS	Bachelor of Science Master of Applied Science	14 years	Fauna surveys, remote camera footage processing and reporting
David James	AMBS	Bachelor of Science	34 years	Fauna surveys
Henry Cook	AMBS	Bachelor of Science Master of Applied Science	14 years	Fauna surveys
Brendan Schembri	AMBS	Bachelor of Environmental Science (in progress)	10 years	Fauna surveys
Narawan Williams	AMBS	Certificate II in Conservation and Land Management	23 years	Fauna surveys and identification of Anabat sequence files from 2019 and 2020
Frank Makin	AMBS	Bachelor of Environmental Science	4 years	Fauna surveys
Alice Si	AMBS	Bachelor of Science (Hons)	3 years	Fauna surveys and remote camera footage processing
Ulrike Kloecker	AMBS	Diploma in Biology (equivalent honours) PhD	17 years	Remote camera footage processing and mapping

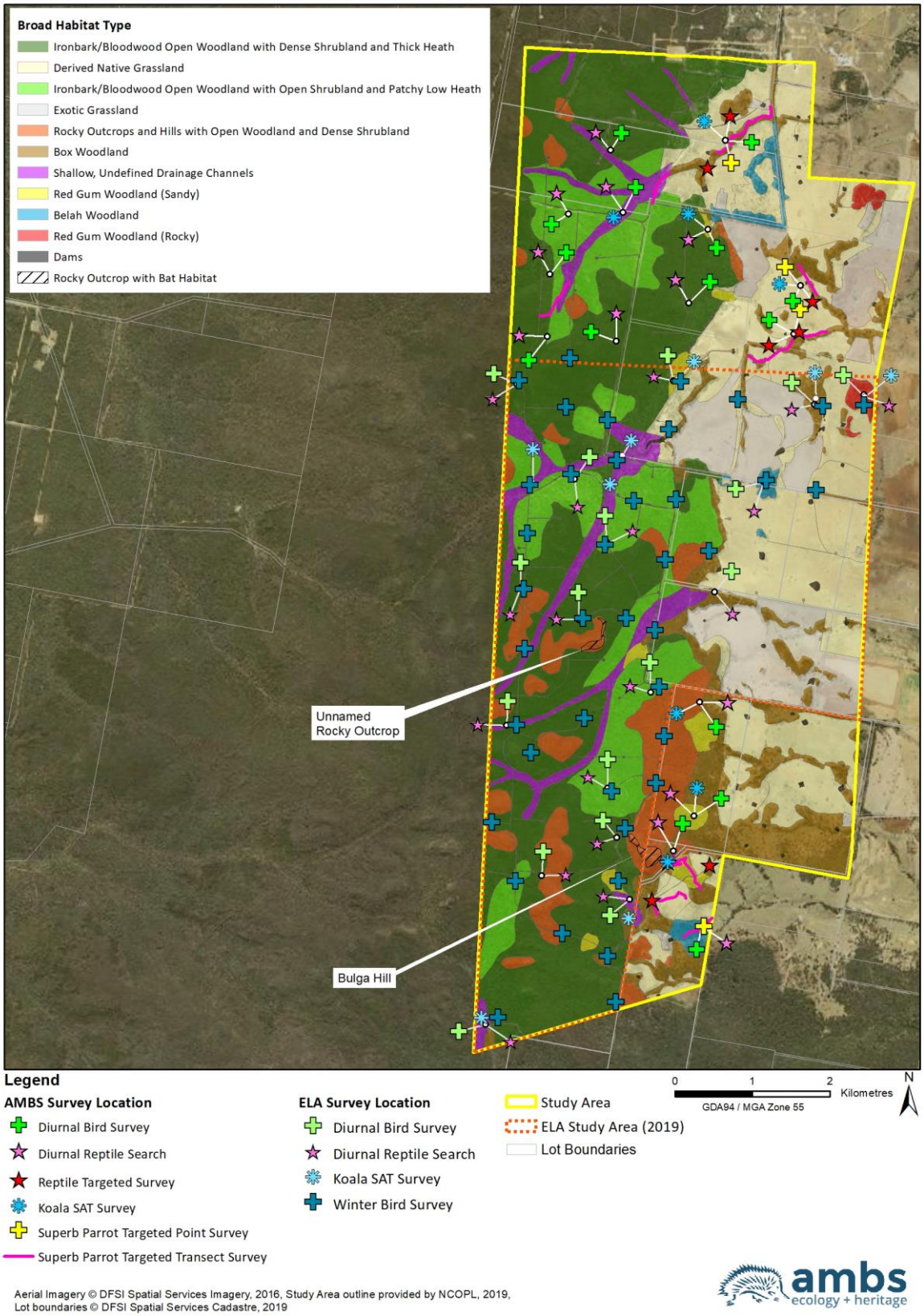


Figure 2.1 Location of diurnal bird, reptile, Koala SAT and winter bird surveys

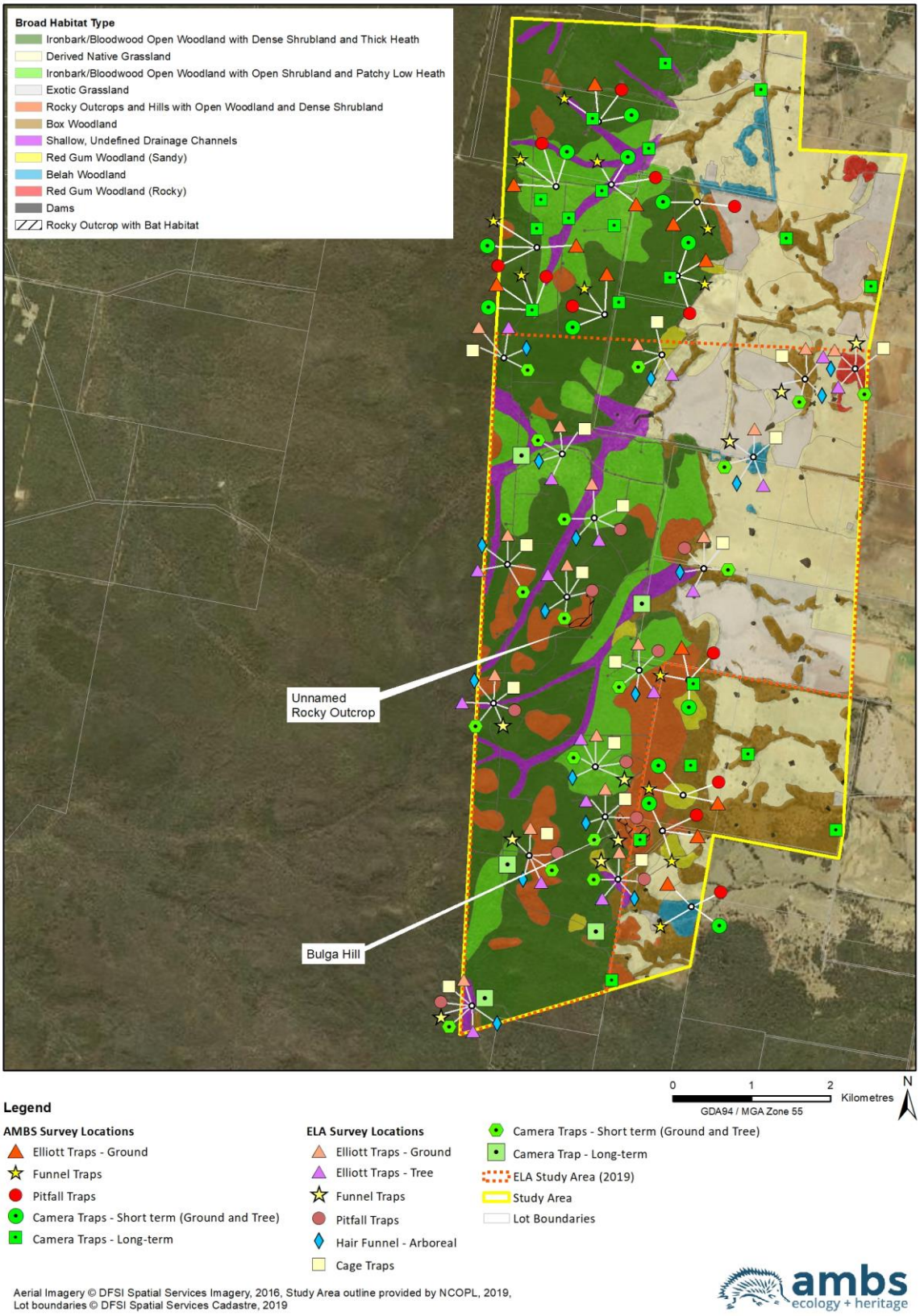


Figure 2.2 Location of fauna trapping sites and cameras

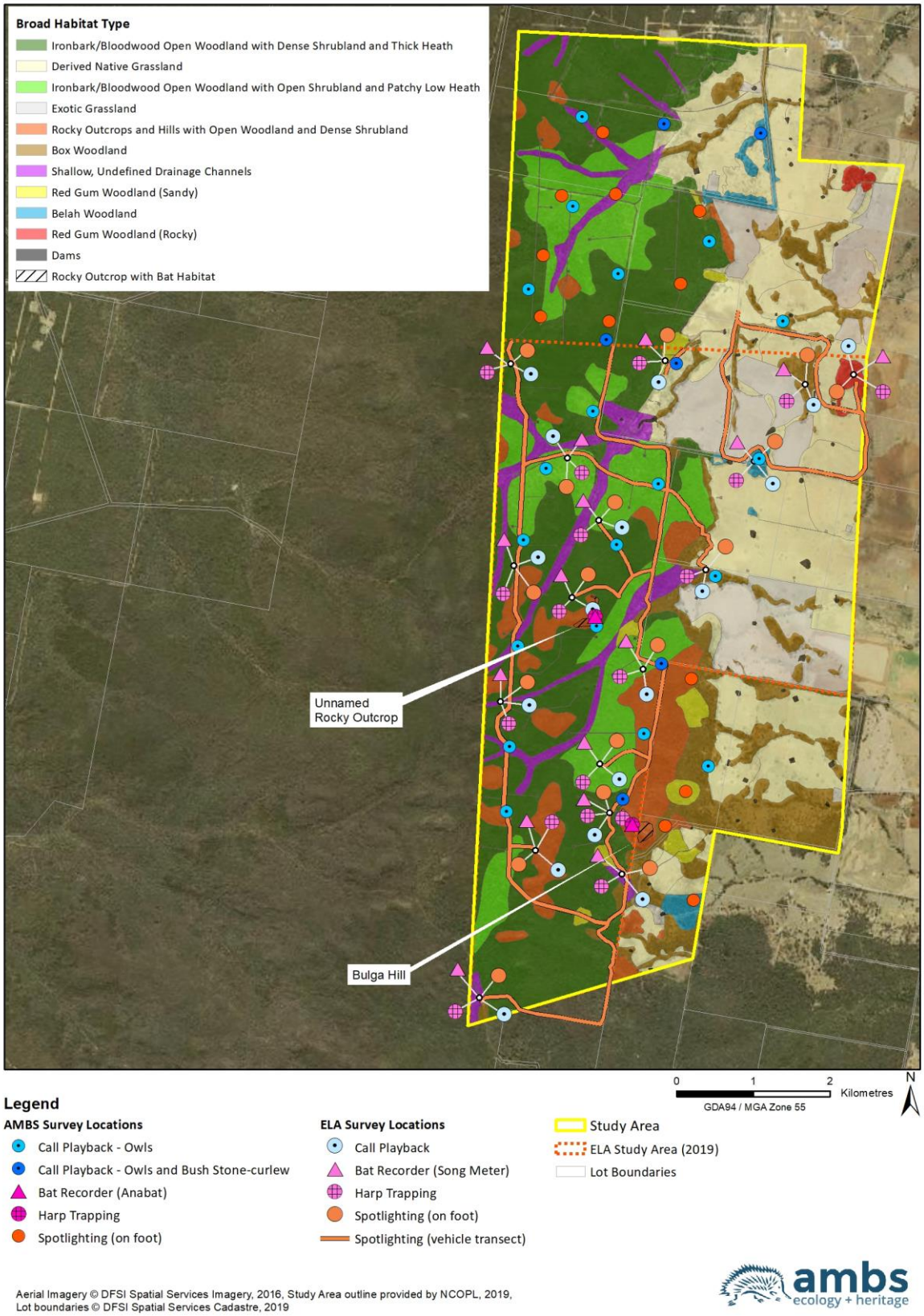


Figure 2.3 Location of call playback, spotlighting and microbat surveys

2.3.2 Reptile Surveys

Diurnal reptile surveys were undertaken at 23 sites in October-November 2017 (ELA 2019) and at 12 sites in October and December 2019 by AMBS (Figure 2.1). At each of 35 locations, 30 person-minutes of active searches were undertaken over two separate days (60 person-minutes at each site), totalling approximately 35 person-hours.

Additional surveys at eight sites by AMBS during October 2019 specifically targeted areas with surface rock and fallen timber (Figure 2.1). Survey techniques included lifting rocks, loose timber, tin and other debris, and sifting through litter and loose soil with a three-toothed rake (DEC 2004, Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC] 2011a). All reptiles detected were recorded.

2.3.3 Bird Surveys

Diurnal bird surveys were undertaken twice on separate mornings at each of 17 sites for a duration of 30 minutes with two observers, during October-November 2017 by ELA (2019) (Figure 2.1). All bird species heard or observed were recorded as present, with threatened species quantified where possible (ELA 2019).

Targeted Superb Parrot (*Polytelis swainsonii*) surveys were completed in October 2019 by AMBS (Figure 2.1). The surveys focused on taller forests that support trees with hollows that appeared to have entrances over 5 centimetres (cm) wide. Over 12 hours of targeted surveys were undertaken over the course of four days, consistent with national survey guidelines (Department of Environment, Water, Heritage and the Arts [DEWHA] 2010).

Standard 20-minute, 2-ha diurnal bird surveys were undertaken at 12 locations in October and December 2019 by AMBS (Figure 2.1). Surveys were undertaken within three hours of dawn, with all species heard or observed recorded. The surveys targeted all bird species, including a variety of threatened woodland species. Each site was surveyed twice.

Winter Bird Surveys targeting the Swift Parrot (*Lathamus discolor*) were undertaken in August 2017 by ELA (2019) (Figure 2.1). Surveys were conducted twice at each of 40 sites, once in the morning (between 06:30 and 10:30) and once in the afternoon (between 14:30 and 17:30). Each survey involved a 30-minute census targeting flowering trees and flocks of other blossom feeders. All bird species heard or observed were recorded, including any opportunistic observations of threatened fauna (ELA 2019).

2.3.4 Pitfall Traps

Pitfall trapping was undertaken at ten fauna sites in October-November 2017 (ELA 2019), and 12 fauna sites in October and December 2019 by AMBS (total 22 sites) (Figure 2.2).

In October 2017, six pitfall traps were deployed along a 30 m fence for three nights (i.e. 18 trap-nights total per site) (ELA 2019).

In October and December 2019, six pitfall traps deployed for four nights by AMBS (i.e. 24 pitfall trap-nights total per site) (Figure 2.2). Traps were checked each morning within three hours of dawn. Each pit was a 20-litre bucket spaced approximately 5 m apart along a 30 m or 40 m drift fence. A small sheet of styrofoam was provided within each bucket to provide cover for any trapped animals and to act as a float in the event of heavy rainfall.

2.3.5 Funnel Traps

Funnel trapping was undertaken at the nine fauna sites in October-November 2017 (ELA 2019), and twelve fauna sites in October and December 2019 by AMBS (total 21 sites) (Figure 2.2). In October 2017, two funnel traps were deployed along a 30 m fence for three nights (i.e. six trap-nights total per site) (ELA 2019).

In October and December 2019, four funnel traps were deployed for four nights by AMBS (i.e. 16 funnel trap-nights total per site). Funnel traps were placed in pairs approximately 5 m from each end of the pitfall trap drift fence. Traps were checked each morning within three hours of dawn.

2.3.6 Elliott Traps

Elliott trapping was undertaken at 17 fauna sites in October-November 2017 (ELA 2019), and 12 fauna sites in October and December 2019 by AMBS (Figure 2.2). At each site, 25 Elliott A Traps (on ground) were deployed for four nights (i.e. 100 Elliott trap-nights total per site). Traps were checked each morning within three hours of dawn. Each trap contained cotton wool and universal bait (peanut butter, rolled oats and honey), although trapping undertaken in 2017 also included sesame oil and sultanas within the bait mixture. Each trap was placed in a plastic bag and spacing between traps was 10 m.

In addition, ELA (2019) deployed six arboreal Elliott B traps for four nights (24 trap-nights) at 17 sites in October-November 2017, targeting Squirrel Gliders (*Petaurus norfolcensis*).

2.3.7 Cage Traps

Cage trapping was undertaken at 17 fauna sites in October-November 2017 by ELA (2019) (Figure 2.2). Two meat-baited wire-cage traps were deployed at each site for four nights (eight trap-nights each, 136 trap-nights in total), targeting the Spotted-tailed Quoll (*Dasyurus maculatus*) (ELA 2019).

2.3.8 Hair Tubes

Hair tube surveys were undertaken at 17 fauna sites in October-November 2017 by ELA (2019) (Figure 2.2). Three arboreal hair funnel traps were deployed for four nights (i.e. 12 trap-nights per site), focusing on Squirrel Gliders and Eastern Pygmy-possums (*Cercartetus nanus*) (ELA 2019).

2.3.9 Camera Traps

Motion-Detecting Cameras were deployed within the study area during four survey periods, in August-September 2017 and October-November 2017 by ELA (2019), and July-August 2019 and October-December 2019 by AMBS (Figure 2.2).

ELA (2019) deployed five unbaited motion-sensitive infrared cameras for 25 days from 21 August 2017, along high-activity fauna trails and watering points to target terrestrial mammals present within the study area.

During October-November 2017, one terrestrial and one arboreal baited camera trap was deployed for four nights at each of 17 fauna sites by ELA (2019). The bait included a mixture of peanut butter, oats, honey, sesame oil and sultanas.

During August 2019, 20 cameras were deployed by AMBS within habitats that were potentially suitable for the Spotted-tailed Quoll. The cameras focused on a bait chamber containing sardines that was placed approximately 2-3 m from the camera. Cameras were programmed to record three images each time they were triggered. The cameras were deployed a minimum of three weeks (DSEWPaC 2011b).

During early October 2019, two cameras were deployed at ten sites by AMBS. At each site, one camera was placed on the ground, and one attached to a bracket about 3 m high in a tree. Both cameras were baited with universal bait. In both instances, the bait was positioned approximately 1-3 m from the camera. Cameras were programmed to record three images each time they were triggered. All cameras were deployed for a minimum of 14 nights. At the end of October 2019, two cameras were also deployed at two sites using the same method as described above (i.e. one terrestrial camera, one arboreal camera), and were collected during December 2019.

All species detected by the cameras were catalogued and included in the overall study species list (Appendix B).

2.3.10 Harp Traps

Two harp traps were installed in flyways at 19 sites (including two sites at Bulga Hill) in October and November 2017 (ELA 2019) (Figure 2.3). Each trap was set for three nights (six trap-nights) and checked twice daily (once in the morning within two hours of dawn, and again at dusk).

In addition, harp trapping was undertaken in the vicinity of two sites with potential roosting caves in December 2019 and January 2020 by AMBS; Bulga Hill and an unnamed rocky outcrop (Figure 2.3).

In December 2019, four harp traps were deployed for four survey nights (16 harp trap-nights per site) at each site. The location of each harp trap was changed each morning after the bats had been collected.

In January 2020, two harp traps were deployed for two nights at the unnamed rocky outcrop. The location of each harp trap was changed on the first morning after the bats had been collected. Five traps were placed for two nights at Bulga Hill and an additional two traps were placed for one night. The location of two harp traps was changed on the first morning after the bats had been collected.

All captured bats were placed in a calico bag and stored in a cool dark place until nightfall, when they were released.

2.3.11 Anabats and Song Meters

Two Song Meter SM2+ detectors were deployed at 16 sites in October-November 2017 and February 2018 for two nights each by ELA (2019) (Figure 2.3).

Anabat Express bat call detectors were deployed by AMBS in the vicinity of two locations with potential roosting caves in December 2019 and January 2020.

In December 2019 at each location, four detectors were deployed and left in-situ for four nights (16 Anabat-nights per site). All units were set to the automatic “night only” recording mode. An additional eleven units were deployed near potential cave entrances at Bulga Hill (i.e. seven detectors for three nights, four detectors for one night). Anabat sequence files were analysed to species level where possible.

In January 2020, two detectors were placed at the unnamed rocky outcrop and left in-situ for two nights (four Anabat-nights). At Bulga Hill, five detectors were deployed and left in-situ for two nights (ten Anabat-nights).

2.3.12 Spotlighting

Spotlight surveys were undertaken at 17 fauna sites in October-November 2017 by ELA (2019) (Figure 2.3). At each site in 2017, a 60 person-minute spotlight survey was undertaken following each call playback session. Spotlighting from a vehicle was also undertaken during October-November 2017. The vehicle was driven in first gear (5-10 km/hr) with the passenger using a hand-held spotlight while in transit between survey sites (ELA 2019).

During December 2019, spotlight surveys were undertaken at 12 locations by AMBS. Each site was surveyed twice on separate evenings for 60 person-minutes. Using head-torches, two people meandered through potential habitat, searching for eye-shine while listening for potential vocalisations. All species detected during each spotlighting survey were noted.

2.3.13 Call Playback

Call playback surveys were undertaken at 42 sites within the study area during October-November 2017 by ELA (2019), and in July-August 2019 by AMBS (Figure 2.3).

During October-November 2017, call playback was undertaken at 17 sites targeting the Squirrel Glider, Bush Stone-curlew (*Burhinus grallarius*), Barking Owl (*Ninox connivens*) and Masked Owl (*Tyto novaehollandiae*) by ELA (2019). For ten of these sites, four repetitions were undertaken for each species. At seven sites, two repetitions were undertaken for each species.

During July-August 2019, call playback was undertaken at 25 sites by AMBS targeting the Barking Owl and Masked Owl, while five sites also targeted the Bush Stone-curlew. For some AMBS sites that were located close to a previous site surveyed by ELA (2019), the number of repetitions between a nearby pair were combined because they were considered functionally to be the same site. This allowed AMBS to build on survey effort previously undertaken by ELA (2019), to achieve the required number of repetitions for each of the target species. Overall survey effort for each species when AMBS survey effort is combined with ELA (2019) is:

- Barking Owl: five nights at 25 sites (AMBS and ELA);
- Masked Owl: eight nights at 19 sites, seven nights at two sites, six nights at four sites (AMBS);
- Bush Stone-curlew: five nights at six sites (AMBS), four nights at ten sites (ELA), two nights at seven sites (ELA); and
- Squirrel Glider: four nights at ten sites (ELA), two nights at seven sites (ELA).

In accordance with relevant guidelines (DEC 2004), sites targeting the forest owls were separated by approximately 800-1,000 m, while sites which targeted the Bush Stone-curlew were separated by at least 2 km. Consequently, call playback sites were not necessarily in the same locations as the standard targeted survey sites. At each site, each call playback session commenced with a 10-15-minute listening period, followed by 10 minutes spotlighting, then call broadcast of the first target species. In 2017 (ELA 2019), the call broadcast for each species was five minutes followed by a five-minute listening period. At the conclusion of all species broadcasts and listening periods, a 30-minute spotlight search was undertaken.

In 2019, the duration of each species call broadcast and listening period by AMBS was 15 minutes. The Bush Stone-curlew sequence consisted of a 30-second call broadcast and 4.5 minutes of listening, with the sequence repeated three times. The Barking Owl and Masked Owl sequence consisted of a five-minute call broadcast and a 10-minute listening period. Following the final 10-minute listening period, 10 minutes of spotlighting was undertaken to detect species that may have moved into the area without vocalising.

2.3.14 Koala SAT Surveys

The Spot Assessment Technique (SAT) (Phillips & Callaghan 2011) was used to assess the potential occurrence of Koalas (*Phascolarctos cinereus*) within the study area. SAT surveys were undertaken at 14 survey sites which contained potential feed trees (Figure 2.1). For each SAT survey a centre tree was selected and its co-ordinates were recorded. The closest 30 feed trees or shelter trees were then surveyed for signs of Koalas. At each tree, the ground surface within a 100-cm radius of the trunk was checked for Koala faecal pellets, initially by a cursory inspection without disturbing the ground surface, followed by raking the leaf litter for a more thorough inspection. Each tree was also inspected for potential Koala scratches on the trunk and lower limbs.

2.3.15 Incidental Observations

Searches for scats, tracks and signs (e.g. diggings, sap feeding marks, chewed *Allocasuarina* cones, large stick nests) were undertaken concurrently with all other survey techniques. In particular, records were made of species that are not detected frequently with other survey techniques, for example Emu (*Dromaius novaehollandiae*) scats.

2.3.16 Habitat Assessment

Habitat assessments were undertaken at each standard fauna survey site in October-November 2017 and December 2019. Data was collected on:

- vegetation structure and age;
- site condition;
- dominant flora species;
- presence of livestock;
- evidence of feral animals;
- hollow-bearing trees and decorticating bark;
- nectar or fruit resources;
- bush rock;
- rocky outcrops;
- caves;
- logs, fallen timber and leaf litter;
- ephemeral and permanent waterbodies;
- evidence of disturbance (e.g. grazing, fire, tracks, logged stumps, erosion);
- important feed trees and shrubs (e.g. primary feed trees for Koala, *Allocasuarina* sp. *and Acacia* sp.);
- abundance of ground or arboreal termite mounds; and
- mistletoe.

At Bulga Hill and an unnamed rocky outcrop, additional characterisation of rocky outcrops and caves were undertaken to gain a better understanding of the potential presence of roosting habitat for microbat species.

In December 2019, the perimeter of Bulga Hill and the unnamed rocky outcrop were walked by pairs of ecologists and potential overhangs and caves were identified. Each cave or overhang was given a preliminary inspection to determine its potential suitability for roosting bats. The GPS location of caves with potential to support roosting bats was recorded. If possible, photographs were taken and an Anabat detector was deployed at the mouth entrance.

Data from the Anabat detectors was collated prior to the January 2020 survey. Anabat detectors that recorded either threatened bat species or bat species with highly specific cave roosting requirements (i.e. Eastern Horseshoe Bat [*Rhinolophus megaphyllus*]) were identified. Their corresponding caves were investigated in greater depth during the January 2020 trip. Where safe to do so, an ecologist investigated easily accessed parts of the caves or overhang roofs, looking for signs of bat presence, including bat scats. Crevices and rock hollows were also investigated. Visible cave depth was estimated.

2.3.17 Species Polygons

Species polygons were prepared for a number of threatened fauna species within the study area. This included mapping of habitat for "Species Credit" or dual-credit "Species/Ecosystem" species.

The BAM (2017) defines a "species polygon" as an area of land that contains habitat or is occupied by a threatened species. The BAM (2017) also defines "habitat" as an area or areas occupied, or periodically or occasionally occupied, by a species or ecological community, including any biotic or abiotic component.

A variety of information was considered to prepare species polygons for the purpose of quantifying and mapping the species extent (i.e. where the species was present), as well as the potential habitat (i.e. areas that contain similar habitat where the species could be, but was not observed on this occasion to be present).

When mapping species polygons for each threatened species, consideration was given to:

- requirements in the BAM (OEH 2017) and the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitat* (OEH 2018a);
- all current and previous records of the species within the Stage 3 study area and adjoining habitat;
- the PCTs mapped within the Stage 3 study area (AMBS, 2020);
- PCT associations and habitat constraints for each threatened species, as identified in the *Threatened Biodiversity Data Collection* (DPIE 2020a);
- habitat data collected by AMBS within the study area;
- satellite imagery, contour and drainage lines; and
- relevant scientific literature.

Consideration was also given to if the *Threatened Biodiversity Data Collection* (DPIE 2020a) identified that the subject fauna species is known to use Paddock Trees. For the purpose of mapping species polygons, identification of Paddock Trees was undertaken by analysing aerial imagery of the study area, and applying a 30m buffer to all trees that were considered to have potential to be Paddock Trees.

2.3.18 SEPP (Koala Habitat Protection) 2019

An assessment of potential Koala habitat under State Environmental Planning Policy (Koala Habitat Protection) 2019 (SEPP 2019) was undertaken. In accordance with SEPP 2019, information was utilised from a variety of sources including:

- the Koala Development Application Map;
- the Site Investigation Area for Koala Plans of Management Map;
- tree species listed under Schedule 2 of SEPP 2019; and
- relevant scientific literature regarding the Koala.

Relevant information outlined above was considered in conjunction with the results of the Stage 3 flora surveys, including the PCTs mapped within the study area, PCT associations, and the location and abundance of key Koala tree species.

2.4 Survey Guidelines and Effort

A reconciliation of survey effort against relevant guidelines is provided in Table 2.4, pertaining to the threatened species that were (prior to the survey) conservatively considered to have potential to occur in the study area.

Table 2.4 Summary of survey guidelines for threatened species potentially found in the study area

Species	Method	Suggested Effort	Method Source	Relevant Survey Period (DPIE 2020a)	Applied Effort	Suggested Effort Met
Pink-tailed Legless Lizard	Reptile Surveys	Active search of potential habitats performed for 30 person-minutes at each site on two separate days. Target areas with surface rock and fallen timber.	DEC (2004) DSEWPaC (2011a)	Spring	30 person-minutes repeated twice at 23 locations in spring 2017 (ELA 2019) and twelve sites in spring/summer 2019 (AMBS). 7.9 person-hours in October 2019 at eight locations targeting areas with surface rock and fallen timber.	Yes (Exceeded)
Australian Bustard, Square-tailed Kite, Black-breasted Buzzard, White-bellied Sea-Eagle, Bush Stone-curlew, Glossy Black-Cockatoo, Major Mitchell's Cockatoo, Superb Parrot, Masked Owl, Barking Owl,	Diurnal Bird Surveys: area search	20 or 30-minute standard search within three hours of dawn. All birds observed or heard recorded.	DEC (2004)	All year	30-minute, 2-ha diurnal bird surveys repeated twice at 17 sites in spring 2017 (ELA 2019). 20-minute, 2-ha diurnal bird surveys repeated twice at 12 sites in spring and summer 2019 (AMBS) (58 surveys totalling 19.3 hours). 40 hours bird survey over eight days in August 2017 (ELA 2019). 20.8 hours bird survey over five days in October 2019.	Yes
Swift Parrot, Regent Honeyeater in particular (as well as most birds mentioned above)	Diurnal Bird Surveys: targeting flowering eucalypts	20 hours over eight days targeting heavily-flowering eucalypts or large flocks of blossom feeders.	DEWHA (2010)	Autumn and winter	30-minute survey targeting flowering trees and flocks of blossom feeders, undertaken twice at each of 40 sites in winter 2017 (ELA 2019). Total 40 hours survey.	Yes
Superb Parrot (as well as most birds mentioned above)	Area search	12 hours over four days in suitable habitat.	DEWHA (2010)	September to November	20.9 hours over four days in potential breeding habitat within study area during spring 2019 (AMBS).	Yes (Exceeded)
Eastern Pygmy-possum, Pilliga Mouse	Pitfall traps	24 trap-nights per stratification.	DEC (2004)	Spring and summer	Six pitfall traps for three nights at ten sites by ELA (2019) in spring 2017 (180 trap-nights). Six pitfall traps for four nights at 12 sites by AMBS in spring and summer 2019 (288 trap-nights). Total effort - 468 pitfall trap-nights.	Yes

Species	Method	Suggested Effort	Method Source	Relevant Survey Period (DPIE 2020a)	Applied Effort	Suggested Effort Met
Pink-tailed Legless Lizard, Pale-headed Snake, Border Thick-tailed Gecko	Funnel traps	-	DSEWPaC (2011a)	Spring and summer	Two traps for three nights at nine sites by ELA (2019) in spring 2017 (54 trap-nights). Four traps for four nights at 12 sites by AMBS in spring and summer 2019 (192 trap-nights). Total effort - 246 funnel trap nights.	-
Eastern Pygmy-possum, Pilliga Mouse, Brush-tailed Phascogale	Elliott traps	100 trap-nights per stratification.	DEC (2004)	Spring and summer	25 Elliot traps deployed for four nights at eight sites by ELA (2019) and 12 sites by AMBS (2,000 trap-nights).	Yes
Spotted-tailed Quoll	Cage traps	24 trap-nights per stratification.	DEC (2004)	-	Two cage traps deployed for four nights at 17 sites by ELA (2019) (136 trap-nights).	Yes (in combination with hair tubes and camera traps)
Spotted-tailed Quoll, Brush-tailed Phascogale, Eastern Pygmy-possum, Squirrel Glider	Hair tubes	Ten large and ten small in pairs for at least four nights.	DEC (2004)	-	Three hair tubes deployed for four nights at 17 sites by ELA (2019) (204 trap-nights).	Yes (in combination with Elliott traps, pitfall traps, cage traps and camera traps)

Species	Method	Suggested Effort	Method Source	Relevant Survey Period (DPIE 2020a)	Applied Effort	Suggested Effort Met
Spotted-tailed Quoll, Koala, Brush-tailed Phascogale, Eastern Pygmy-possum, Rufous Bettong, Brush-tailed Rock-wallaby	Camera traps (ground)	Remote cameras deployed for a minimum of 14 nights. Remote cameras deployed for three weeks, baited with sardines (for Spotted-tailed Quoll).	DEC (2004) DSEWPaC (2011b)	All year	Five unbaited cameras deployed for 25 days in August-September by ELA (2019) (125 camera trap-nights). 17 terrestrial cameras deployed for four nights in October-November 2017 by ELA (2019), baited with universal bait (68 camera trap-nights). 20 cameras deployed for a minimum of 21 nights in July and August 2019 by AMBS, baited with sardines (minimum of 420 camera trap-nights). 12 terrestrial cameras deployed for a minimum of 14 nights in October and December 2019 by AMBS, baited with universal bait (168 camera trap-nights). Total effort - 1,045 camera trap-nights.	Yes (Exceeded)
Brush-tailed Phascogale, Eastern Pygmy-possum, Squirrel Glider	Camera traps (arboreal)	Remote cameras deployed for a minimum of 14 nights.	DEC (2004) DSEWPaC (2011b)	All year	17 arboreal cameras deployed for four nights in October-November 2017 by ELA (2019), baited with universal bait (68 camera trap-nights). 12 arboreal cameras deployed for a minimum of 14 nights in October and December 2019 by AMBS, baited with universal bait (168 camera trap-nights).	Yes

Species	Method	Suggested Effort	Method Source	Relevant Survey Period (DPIE 2020a)	Applied Effort	Suggested Effort Met
Large Bentwing-bat, Large-eared Pied Bat, Eastern Cave Bat	Harp trapping	Two harp traps for two nights. 16 traps over four nights, traps moved each morning.	DEC (2004) OEH (2018a)	Spring and summer	Two harp traps for three nights at 19 sites by ELA (2019), during October-November 2017 (114 harp trap-nights). Four harp traps deployed for four nights at each of two rocky hills/outcrops bearing caves by AMBS, during December 2019 (32 harp trap-nights). Two harp traps deployed for two nights at the unnamed rocky outcrop in January 2020. Five harp traps deployed for two nights at Bulga Hill in January 2020, and an additional two harp traps deployed for one night at Bulga Hill.	Yes (Exceeded)
Large Bentwing-bat, Large-eared Pied Bat, Eastern Cave Bat	Anabats and Song Meters	Two detectors for two nights. Four detectors for four nights.	DEC (2004) OEH (2018a)	Spring and summer	Two Song Meters for two nights at 16 sites by ELA (2019), during October-November 2017 (64 Song Meter nights). Four Anabats deployed for four nights at each of two rocky outcrops/hills bearing caves by AMBS, during December 2019. Seven detectors deployed for three nights at potential cave mouth openings, and four detectors deployed for one night at potential cave mouth openings at Bulga Hill in December 2019. Two detectors for two nights at the unnamed rocky outcrop, and five detectors for two nights at Bulga Hill in January 2020 (55 Anabat-nights).	Yes (Exceeded)
Pale-headed Snake, Border Thick-tailed Gecko, Masked Owl, Barking Owl, Spotted-tailed Quoll, Koala, Brush-tailed Phascogale, Eastern Pygmy-possum, Squirrel Glider, Rufous Bettong, Brush-tailed Rock-wallaby, Grey-headed Flying-fox,	Spotlighting	One hour on two separate nights.	DEC (2004)	All year	Spotlighting for 60 person-minutes on foot at 17 sites by ELA (2019) in October-November 2017, following each call playback session. Spotlighting from a vehicle during October-November 2017 (ELA 2019). Spotlighting at 12 sites by AMBS in December 2019, totalling 24 person-hours.	Yes

Species	Method	Suggested Effort	Method Source	Relevant Survey Period (DPIE 2020a)	Applied Effort	Suggested Effort Met
Masked Owl, Barking Owl, Squirrel Glider, Bush Stone-curlew	Call playback	Five or eight nights with sites between 800 – 1000 m apart for forest owls and 2 km apart for Bush-stone curlew. Two sites per stratification unit, each site surveyed twice on separate nights for Squirrel Glider.	DEC (2004)	May to August	Five nights for Barking Owl at 25 sites (ELA 2019 and AMBS).** Five nights for Bush Stone-curlew at six sites (AMBS), four nights at ten sites (ELA), two nights at seven sites (ELA).** Eight nights for Masked Owl at 19 sites (AMBS), seven nights at two sites (AMBS), six nights at four sites (AMBS).* Four nights for Squirrel Glider at ten sites (ELA), two nights at seven sites (ELA).**	Yes
Koala	SAT survey	Searches for scats and signs at 30 trees, starting with centre feed tree.	Phillips & Callaghan (2011)	All year	Eight SAT surveys by ELA (2019) in October-November 2017. Six SAT surveys by AMBS in October and December 2019.	Yes

Note:
* ELA Masked Owl survey effort not included as it was completed outside of the current recommended survey window.
** Five sites assessed by ELA during the 2017 surveys were outside of the current development footprint.

The following species, listed as migratory under the EPBC Act, were also surveyed for using the techniques outlined in Table 2.4: Cattle Egret (*Bubulcus ibis*), Great Egret (*Ardea alba*), Painted Snipe (*Rostratula australis*), Latham's Snipe (*Gallinago hardwickii*), Common Sandpiper (*Actitis hypoleucos*), Pectoral Sandpiper (*Calidris melanotos*), Sharp-tailed Sandpiper (*Calidris acuminata*), Curlew Sandpiper (*Calidris ferruginea*), White-throated Needletail (*Hirundapus caudacutus*), Fork-tailed Swift (*Apus pacificus*), Rainbow Bee-eater (*Merops ornatus*), Satin Flycatcher (*Myiagra cyanoleuca*) and Yellow Wagtail (*Motacilla flava*).

A list of threatened fauna species required to be surveyed in accordance with the BAM (OEH 2017), was identified from the *Threatened Biodiversity Data Collection* (DPIE 2020a) based on the revised PCT map provided by AMBS (2020). The refined list of species included "Species Credit" species or dual-credit "Species/Ecosystem" species that were predicted to occur in the PCTs within the study area, in the Pilliga and/or Liverpool Plains IBRA subregions (Table 2.5). Also included were select threatened fauna listed under the EPBC Act that are known or predicted to occur from the *EPBC Act Protected Matters Search Tool* that required additional survey effort (DEE 2019a) (Table 2.5).

Table 2.5 Threatened fauna known or predicted to occur in the locality and associated with PCTs in the study area

Common Name	Scientific Name	PCTs	Biodiversity Credit Class[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Technique
Border Thick-tailed Gecko	*Uvidicolus sphyrurus*	88, 399, 401, 404, 405, 406, 408, 432, 435	Species	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	SL, PT
Pale-headed Snake	*Hoplocephalus bitorquatus*	88, 206, 244, 399, 401, 404, 405, 406, 408, 432	Species	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	SL
Pink-tailed Legless Lizard	*Aprasia parapulchella*	399, 401, 404, 405, 406, 408, 432	Species	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	RS, FT, PT
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	55, 88, 141, 206, 244, 399, 401, 404, 405, 408, 435	Species/Ecosystem	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	DB
Black-breasted Buzzard	*Hamirostra melanosternon*	55, 88, 206	Species/Ecosystem	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	DB
Little Eagle	*Hieraaetus morphnoides*	55, 88, 141, 206, 244, 399, 401, 404, 405, 406, 408, 432, 435	Species/Ecosystem	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	DB
Square-tailed Kite	*Lophoictinia isura*	55, 88, 206, 244, 399, 401, 404, 405, 406, 408, 432, 435	Species/Ecosystem	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	DB
Bush Stone-curlew	*Burhinus grallarius*	88, 244, 399, 401, 405	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CP
Malleefowl	*Leipoa ocellata*	141	EPBC Act/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, CA
Australian Bustard	*Ardeotis australis*	55, 206, 244	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	DB
Painted Honeyeater	*Grantiella picta*	55, 88, 206, 244, 399, 401, 404, 405, 406, 408, 432, 435	EPBC Act/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	55, 88, 141, 206, 244, 399, 401, 404, 405, 406, 408, 432, 435	Species/Ecosystem	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	DB
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	55, 88, 206, 244, 401, 404, 405, 406, 432	Species/Ecosystem	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	DB
Swift Parrot	*Lathamus discolor*	88, 399, 401, 404, 405, 406, 408, 432, 435	EPBC Act/Species/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB
Superb Parrot	*Polytelis swainsonii*	55, 88, 206, 244, 399, 401, 432	EPBC Act/Species/Ecosystem	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	DB
Barking Owl	*Ninox connivens*	55, 88, 206, 244, 399, 401, 404, 405, 406, 408, 432, 435	Species/Ecosystem	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CP, SL
Masked Owl	*Tyto novaehollandiae*	55, 88, 206, 244, 399, 401, 404, 405, 406, 408, 432, 435	Species/Ecosystem	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	CP, SL

Common Name	Scientific Name	PCTs	Biodiversity Credit Class[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Technique
Large Bentwing-bat	*Miniopterus orianae oceanensis*	55, 88, 244, 399, 401, 404, 405, 406, 408, 432, 435	Species/Ecosystem	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	HTr, AN
Grey-headed Flying-fox	*Pteropus poliocephalus*	55, 244, 399, 401, 404, 405, 406, 408, 432, 435	Species/Ecosystem	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	SL, OPP
Large-eared Pied Bat	*Chalinolobus dwyeri*	88, 206, 399, 401, 404, 405, 406, 408, 432, 435	EPBC Act/Species	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes	HTr
Corben's Long-eared Bat	*Nyctophilus corbeni*	55, 88, 244, 399, 401, 404, 405, 406, 408, 432, 435	EPBC Act/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	HTr
Eastern Cave Bat	*Vespadelus troughtoni*	88, 206, 399, 401, 404, 405, 406, 408, 432, 435	Species	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes	HTr
Spotted-tailed Quoll	*Dasyurus maculatus*	399, 401, 404, 405, 406, 408, 432, 435	EPBC Act/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	CA, CT, HTu
Brush-tailed Phascogale	*Phascogale tapoatafa*	399, 401, 404, 405, 406, 408, 432	Species	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	CA
Eastern Pygmy-possum	*Cercartetus nanus*	88, 244, 399, 401, 404, 405, 406, 408, 432	Species	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	ET, PT, SL, CA, HTu
Brush-tailed Rock-wallaby	*Petrogale penicillata*	88, 244, 405, 406, 435	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CA
Squirrel Glider	*Petaurus norfolcensis*	88, 399, 401, 404, 405, 406, 408, 432, 435	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	SL, CA, ET, HTu, CP
Koala	*Phascolarctos cinereus*	55, 88, 141, 206, 244, 399, 401, 404, 405, 406, 408, 432, 435	EPBC Act/Species/Ecosystem	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	SAT, SL, CP
Rufous Bettong	*Aepyprymnus rufescens*	399, 401, 404, 405, 406, 408, 432	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CA
Pilliga Mouse	*Pseudomys pilligaensis*	88, 141, 244, 399, 401, 404, 405, 406, 408, 432	EPBC Act/Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	ET, PT

Note:

[1] Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE 2020a) (current as at April 2020).

Highlighted months are months surveyed by AMBS. Recommended survey months for the Brush-tailed Phascogale were changed in the *Threatened Biodiversity Data Collection* (DPIE 2020a) after Project commission (i.e. previous data recommended the species could be surveyed all year). However, the species is capable of being detected throughout the year, and considerable camera trapping and hair tube survey effort was undertaken in the study area. Recent advice from DPIE for this species outlined that "*the Liverpool plains subregion is a predicted occurrence and it is exceptionally unlikely the species would be found there based on lack of historical records*" and that "*the inclusion of the Liverpool plains subregion for the predicted occurrence of the Brush-tailed Phascogale is under review*".

RS = reptile search, SL = spotlight, CP = call playback, DB = diurnal bird survey, HTr = harp trap, AN = Anabat, CA = remote camera, ET = Elliott trap, PT = pitfall trap, FT = funnel trap, SAT = Koala SAT search, HTu = hair tube, CT = cage trap, OPP = opportunistic searches/observation while undertaking other survey techniques.

2.5 Weather Conditions

Weather conditions during the survey period as recorded at Narrabri Mine AWS are displayed in Table 2.6. Little rainfall was observed in the study area during the surveys, contributing to very dry survey conditions.

Table 2.6 Weather conditions during the survey periods

Date	Temp °C (min)	Temp °C (max)	Rainfall (mm)	Date	Temp °C (min)	Temp °C (max)	Rainfall (mm)
1/08/2017	5.3	16.5	0	21/09/2017	4.3	26.7	0
2/08/2017	3.4	18.8	0.2	22/09/2017	7.1	30.7	0
3/08/2017	6.4	21.2	19	23/09/2017	10.2	34.2	0
4/08/2017	7.6	14.3	0	24/09/2017	16.9	32.2	0.8
5/08/2017	7.9	17.9	0	25/09/2017	12.7	28.1	0
6/08/2017	4.5	18.7	0	26/09/2017	11.1	28.5	0
7/08/2017	3.1	17.7	0	27/09/2017	14.5	33.2	0
8/08/2017	2.2	17.2	0	28/09/2017	15.6	28.8	0.4
9/08/2017	-0.6	18.4	0	29/09/2017	10.6	26.9	0.2
10/08/2017	1.7	22.1	0	30/09/2017	13.1	20.1	0.2
11/08/2017	10	24	0	9/10/2017	15.6	30	0.6
12/08/2017	2.8	19.4	0	10/10/2017	16.4	32.8	0
13/08/2017	2.3	20.8	0	11/10/2017	17.3	33.7	0.8
14/08/2017	3.7	21.6	0	12/10/2017	15.9	26.1	5.2
15/08/2017	6.6	25.8	0	13/10/2017	9.8	30.9	0
16/08/2017	13.4	25.4	0	14/10/2017	12	28.9	0
17/08/2017	5.9	21.4	0	15/10/2017	13.3	26.7	0
18/08/2017	5.2	16.8	0	16/10/2017	13.7	27.5	0
19/08/2017	-0.3	15.5	0	17/10/2017	14.9	29	0
20/08/2017	-1.7	15.8	0	18/10/2017	14.2	31.2	0
21/08/2017	4.1	14.3	0	19/10/2017	13.4	30.2	0
22/08/2017	4.7	22.4	0	20/10/2017	15.4	23.6	4.2
23/08/2017	4.4	23.5	0	21/10/2017	12.7	22.7	13
24/08/2017	2.2	21.4	0	22/10/2017	9.9	26.2	0
25/08/2017	1.4	18	0	23/10/2017	9.6	25.7	0
26/08/2017	3.6	18.6	0	24/10/2017	11.1	28.1	0
27/08/2017	5.2	20	0	25/10/2017	16.2	31.3	1.8
28/08/2017	1.9	15.4	0	26/10/2017	15.9	33.6	0.2
29/08/2017	0.1	18.9	0	27/10/2017	11.8	28.4	0
30/08/2017	1	20	0	28/10/2017	14.2	29.9	0
31/08/2017	2.3	18.8	0	29/10/2017	15.5	33.7	2.4
1/09/2017	2.6	19.5	0	30/10/2017	16.6	35.9	0
2/09/2017	2.3	23.9	0	31/10/2017	8.9	24.8	0
3/09/2017	5	27.6	0	1/11/2017	6	25.1	0
4/09/2017	5	21.3	0	2/11/2017	8.4	29.9	0
5/09/2017	3.7	19.3	0	3/11/2017	9.6	31.7	0
6/09/2017	2.2	19.9	0	4/11/2017	15.1	31.1	0
7/09/2017	1.5	20.3	0	5/11/2017	15.3	30.6	0
8/09/2017	1.4	19.6	0	6/11/2017	15.6	30.5	4.4
9/09/2017	3	20.3	0	7/11/2017	9.3	26.6	0
10/09/2017	2.3	23	0	8/11/2017	12.8	26.3	0
11/09/2017	2.9	25.3	0	9/11/2017	9.9	27.4	0
12/09/2017	4.7	28.4	0	10/11/2017	13.5	27.2	0
13/09/2017	13.7	32.7	0	11/11/2017	13.5	28.5	0
14/09/2017	2.8	18.5	7.6	12/11/2017	13.6	28.4	0
15/09/2017	0.7	21.2	0	13/11/2017	15	29.3	0
16/09/2017	2.4	23	0	14/11/2017	14.9	29.7	0
17/09/2017	4.9	23.4	0	15/11/2017	15	31	0
18/09/2017	3.1	26.2	0	16/11/2017	17.2	25.5	17.2
19/09/2017	6.9	28.4	0	17/11/2017	15.6	29.5	9.2
20/09/2017	3.9	24.4	0	18/11/2017	16	20.6	16

Date	Temp °C (min)	Temp °C (max)	Rainfall (mm)	Date	Temp °C (min)	Temp °C (max)	Rainfall (mm)
19/11/2017	16	26.4	3.6	14/09/2019	5.6	28	0
20/11/2017	14.3	28.2	0	15/09/2019	6.4	28.8	0
21/11/2017	14.2	27.8	1.8	16/09/2019	6.1	30	0
22/11/2017	13.3	29.8	0	17/09/2019	7.3	21.1	1.2
23/11/2017	14.3	29	0	18/09/2019	5.4	23.3	0
19/02/2018	19.4	38	23.2	19/09/2019	10.8	25.8	0
20/02/2018	18	27.5	0.2	20/09/2019	12.9	28.8	0
17/06/2019	3.4	16.7	0	21/09/2019	19	27.7	0
8/07/2019	11	13.8	14.6	22/09/2019	17.8	25.5	1.8
9/07/2019	5.6	17.6	0.2	23/09/2019	11.2	23.3	0
10/07/2019	3.2	14.8	0.4	24/09/2019	6.2	22.5	0
11/07/2019	5.9	18.8	0	25/09/2019	6.7	24.6	0
12/07/2019	3.8	18.3	0	26/09/2019	8.7	26.3	0
29/07/2019	4.9	20	0	27/09/2019	6	27.9	0
30/07/2019	8.2	20.1	1.2	28/09/2019	7.9	29.1	0
31/07/2019	6.3	18.9	0	29/09/2019	8.6	26.9	0
1/08/2019	6.2	19	0	30/09/2019	9.2	26.3	0
2/08/2019	6.4	19.7	0	1/10/2019	12.6	26.9	0
3/08/2019	3.8	21.1	0	2/10/2019	9.4	27.3	0
4/08/2019	3.2	22	0	3/10/2019	10.1	29.1	0
5/08/2019	2.7	21.8	0	4/10/2019	11	32.4	0
6/08/2019	1.5	21.9	0	5/10/2019	13.4	29.6	0
7/08/2019	3.2	21.5	0	6/10/2019	15.6	35	0
8/08/2019	7.7	22.9	0	7/10/2019	22.7	38.1	0
9/08/2019	5.4	18.1	0	8/10/2019	13.1	27.9	0
10/08/2019	5.7	14.9	0	9/10/2019	4.6	22.7	0
11/08/2019	1.7	13	0.6	10/10/2019	10.2	23.5	0
12/08/2019	-0.1	14.7	0.2	11/10/2019	11.2	22.2	8
13/08/2019	1.1	18.1	0	12/10/2019	8.9	21.6	0
14/08/2019	3	20.7	0	13/10/2019	9.3	24.8	0
15/08/2019	1.8	21.9	0	14/10/2019	12.7	29.9	0
16/08/2019	3.9	23.9	0	15/10/2019	17	33.3	0
17/08/2019	4.9	25.2	0	16/10/2019	14.9	35.8	0.4
18/08/2019	6.2	26.3	0	17/10/2019	14.3	31.7	0
19/08/2019	6.8	21.7	0	18/10/2019	9.6	27.6	0
20/08/2019	-0.7	18.9	0	19/10/2019	6.7	29.3	0
21/08/2019	1.8	19.4	0	20/10/2019	11.7	24.8	0
22/08/2019	8.7	19.2	0	21/10/2019	12.8	27.4	0
23/08/2019	5	20.1	0	22/10/2019	14.4	29.6	0
24/08/2019	3.3	23.5	0	23/10/2019	18.5	30.9	0
25/08/2019	9.7	25.5	0	24/10/2019	14.4	32	0
26/08/2019	5.8	24.9	0	25/10/2019	16.2	34.3	0
27/08/2019	7.1	23.8	0	26/10/2019	19.9	34.9	0
28/08/2019	8.2	22.6	0	9/12/2019	21.8	38.4	0
29/08/2019	3	19.2	0	10/12/2019	23.7	40.8	0
30/08/2019	6.1	19.6	0	11/12/2019	26.1	41.8	0.6
31/08/2019	5.9	20.9	0	12/12/2019	23.8	38.4	0
1/09/2019	8.3	23.7	0	13/12/2019	19.4	35.2	0
2/09/2019	5.2	25.7	0	14/12/2019	18.9	35.9	0
3/09/2019	4	28	0	28/01/2020	25.2	36.6	0
4/09/2019	10.1	30.6	0	29/01/2020	27.2	38.8	0
5/09/2019	9.2	32.1	0	30/01/2020	25.2	39.5	0
6/09/2019	12.6	32.9	0				
7/09/2019	5.6	18.7	0				
8/09/2019	3.5	18.7	0				
9/09/2019	5.6	16.1	0				
10/09/2019	2	18.8	0				
11/09/2019	6.4	21.7	0				
12/09/2019	3.4	25	0				
13/09/2019	7.4	25.7	0				

3 Results

3.1 Broad Fauna Habitat Types and Condition

Eleven broad habitat types were identified in the study area (Table 3.1). The study area comprises remnant dry woodland habitats and habitats with a recent history of agricultural disturbance. Those habitats found in the western portion of the study area represent the majority of the dry woodland habitats. Most of these areas are part of the Jacks Creek State Forest and have a history of timber harvesting (Section 1.7). There is also evidence of large fire scars within these areas. Otherwise, the habitats were in a relatively undisturbed, good condition.

Most habitats within the agricultural land were highly disturbed. Grazing, by both Cattle *(Bos taurus*) and Sheep (*Ovis aries*), continues within these areas. Drainage has been modified by the construction of farm dams. The majority of these areas had been cleared and form either DNGs or exotic grasslands. Small areas of remnant or regenerating woodlands exist in these areas, especially along drainage lines and on rocky hills. Some agricultural properties have remnant woodland buffers between the cleared habitats and the State Forest.

The western portion of the study area is well connected with large areas of woodland to the west, forming the Pilliga Forest. Connectivity within the agricultural areas is more interrupted and facilitated primarily through lightly vegetated drainage systems with remnant Eucalyptus trees.

Descriptions of each broad habitat type are provided below, and the broad habitat types are displayed on Figure 3.1.

Table 3.1 Broad habitat types

Broad Habitat Type	PCT (AMBS 2020)	Area (ha)
Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (404)	1,605.0
Derived Native Grassland	Derived vegetation of various PCTs (55, 88, 244, 405, 435)	1,215.1
Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath	White Bloodwood – Red Ironbark – Black Cypress Pine Woodland (405)	674.3
Exotic Grassland	-	512.0
Rocky Outcrops and Hills with Open Woodland and Dense Shrubland		396.1
	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (406)	
Box Woodland	Pilliga Box – Buloke Woodland (88)	529.0
	Poplar Box Grassy Woodland (244)	
	White Box – White Cypress Woodland (435)	
Shallow, Undefined Drainage Channels	Red Gum – Tea Tree Creek Woodland (399)	264.6
	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (404)	
	White Bloodwood – Red Ironbark – Black Cypress Pine Woodland (405)	
	Broombush – Wattle Tall Shrubland (141)	
Red Gum Woodland (Sandy)	Dirty Gum – White Cypress Woodland on Sand Monkeys (206)	68.5
	Rough-barked Apple Sand Flat Woodland (401)	
	Dirty Gum Shrubby Woodland (408)	
Belah Woodland	Belah Woodland (55)	60.1
Red Gum Woodland (Rocky)	Dwyer's Red Gum Shrubby Woodland (432)	25.8
Dams	-	14.9

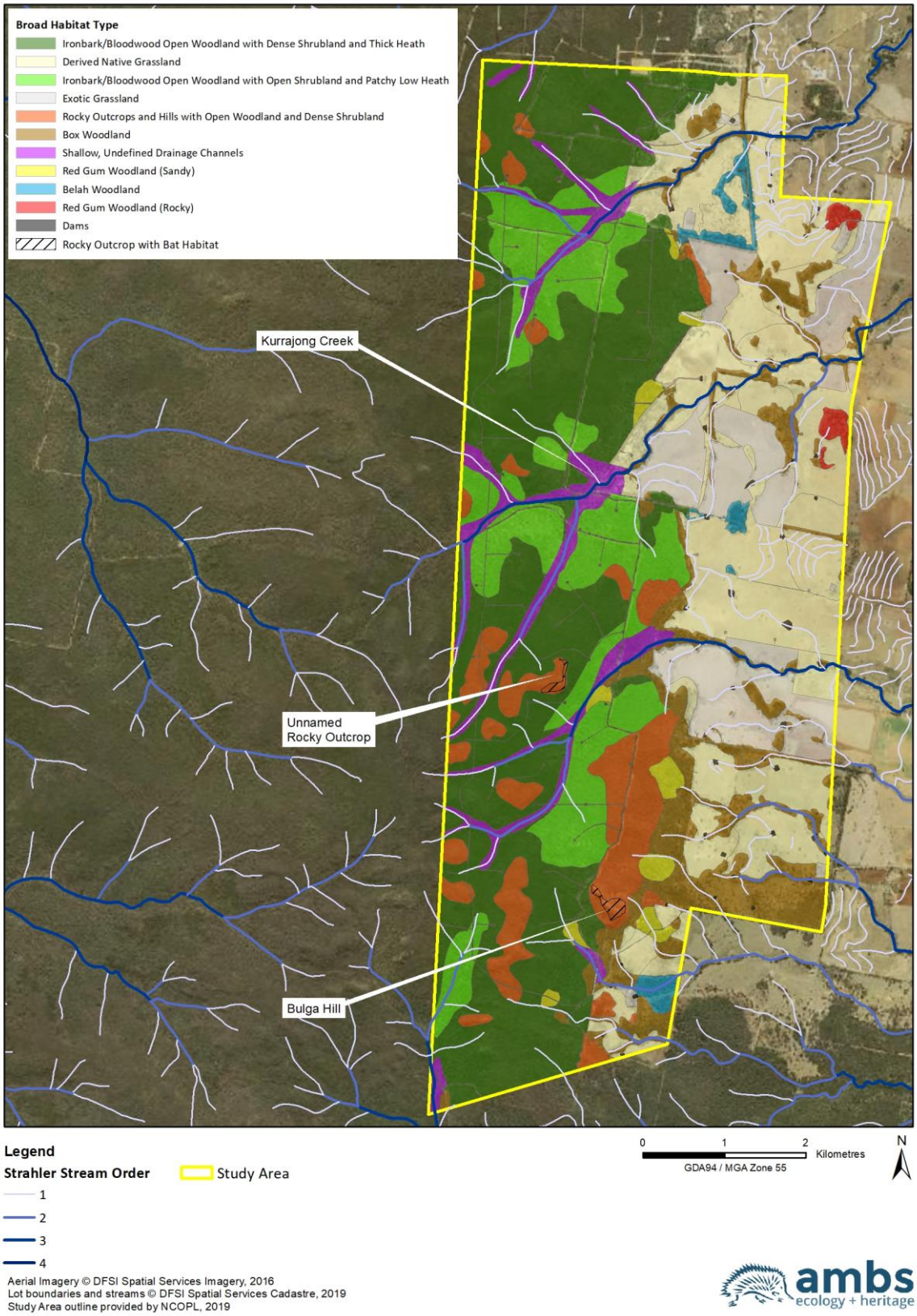


Figure 3.1 Broad fauna habitat types in the study area

3.1.1 Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath

Fauna Habitat Type: Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath
Extent in the study area: 1,605.0 ha
Description: The broad habitat type incorporates areas of the following PCT:

- PCT 404 - *Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland.*

This habitat type was the most dominant in the study area. This broad habitat type was characterised by an open woodland of medium height with patchy *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia trachyphloia* (White Bloodwood). In some areas *Callitris glaucophylla* (White Cypress Pine) or *Callitris endlicheri* (Black Cypress Pine) formed the dominant canopy species. The shrub layer was variable and often dense with a high diversity of species. *Acacia burrowii* (Burrow's Wattle), which proliferates after fire, grew in dense thickets within this broad habitat type, often accompanied by equally dense thickets of *Philotheca difformis* (Small-leaf Wax-flower)*, Philotheca salsolifolia, Philotheca ciliata* and *Calytrix tetragona* (Common Fringe Myrtle). Other common shrub species included *Melichrus urceolatus* (Ruby Urn Heath), *Xanthorrhoea acaulis* and *Harmogia densifolia*. The ground layer was sparse but included grasses like *Thyridolepis mitchelliana* (Mulga Mitchell Grass)*, Aristida ramosa* (Purple Wiregrass)*, Cleistochloa rigida* and sedges such as *Schoenus kennyi* and *Gahnia aspera* (Rough Saw-sedge). Forb species commonly present included *Gonocarpus elatus, Goodenia rotundifolia, Pomax umbellata* and *Actinotus gibbonsii*. The majority of the broad habitat type was in good condition.

Canopy height ranged from approximately 6-8 m. Tree hollows were sparse (i.e. thinly dispersed/scattered or uncommon) and generally confined to older Corymbia trees. Large hollows with entrance widths greater than 15 cm were present but were very sparsely dotted throughout the landscape. Smaller hollows (less than 15 cm) were more common, but still sparse. Decorticating bark was generally absent. Nectar-producing trees (Bloodwood, Ironbark) and shrubs (*Grevillea* sp.) were scattered throughout. Ground habitat features such as logs, leaf litter and bush rock were sparse but present. Mistletoe was detected with low frequency in this habitat type. Other habitat features such as termite mounds, caves and cliffs were absent.

Signs of feral animal presence was relatively common throughout the habitat type. There were frequent signs of Feral Pig (*Sus scrofa*), Goat (*Capra hircus*), Cat (*Felis catus*) and Red Fox (*Vulpes vulpes*). There was little evidence of livestock grazing, with only areas of the broad habitat type that fringed agricultural properties likely to have been grazed recently. Evidence of historic fire was common, though most likely greater than ten years ago. Signs of timber harvesting were scarce.

The source of several un-named minor tributaries of Kurrajong Creek incorporates areas of this broad habitat type. Despite this, there was little evidence of permanent or semi-permanent waterbodies throughout the broad habitat type.

3.1.2 Derived Native Grassland

Fauna Habitat Type: Derived Native Grassland
Extent in the study area: 1,215.1 ha
Description: The broad habitat type incorporates areas of the following PCTs:

- PCT 55 - *Belah Woodland*;
- PCT 88 - *Pilliga Box – White Cypress Pine – Buloke Shrub-Grass Woodland*;
- PCT 244 - *Poplar Box Grassy Woodland*;
- PCT 405 - *White Bloodwood – Red Ironbark – Black Cypress Pine Woodland*; and
- PCT 435 - *White Box – White Cypress Woodland*.

The DNGs of the study area were extensive. They were characterised by very sparse to absent canopy trees and mid-storey shrubs. Otherwise they were dominated by native and exotic ground cover species including grasses, forbs and chenopods.

Grass species varied depending on the PCT from which they were derived. Regularly recorded species included *Austrostipa verticillata* (Slender Bamboo Grass), *Enteropogon acicularis* (Curly Windmill Grass), *Aristida ramosa* (Purple Wiregrass), *Austrostipa scabra* (Spear Grass), *Bothriochloa decipiens* (Redleg Grass), *Aristida caput-medusae* (Many-headed Wiregrass), *Thyridolepis mitchelliana* (Mulga Mitchell Grass), *Cymbopogon refractus* (Barbed Wire Grass) and *Rytidosperma racemosum* (Wallaby Grass).

Chenopod shrubs were patchy and included *Sclerolaena birchii* (Galvanised Burr), *S. muricata* (Black Rolypoly), *Enchylaena tomentosa* (Ruby Saltbush) and *Einadia nutans* (Climbing Saltbush). Forb species were also uncommon and sparse and included *Brunoniella australis* (Blue Trumpet), *Sida corrugata* (Corrugated Sida), *Wahlenbergia communis* (Tufted Bluebell) and *Glycine tabacina*.

When present, paddock trees ranged in height between 6-18 m. Some paddock trees have tree hollows, including hollows with a 15 cm entrance diameter. Decorticating bark was present on some trees. Ground habitat features such as logs and leaf litter were uncommon to absent. Nectar-producing trees were sparse but present. Nectar-producing shrubs were absent. Mistletoe was present on most paddock trees. Surface rock was present in some areas of the broad habitat type. There were often large cracks in the soil that can be suitable refuge for a wide variety of native fauna species. Termite mounds and ant mounds were generally absent.

The broad habitat type was characterised by heavy disturbance including clearing, grazing and erosion. Tracks were prevalent throughout. There was no obvious history of fire. There was evidence of introduced species including Red Fox and Feral Cat.

The broad habitat type fringed many minor drainage lines and artificial dams. Many areas of the broad habitat type also had artificial berms, which are used to direct water into artificial water points.

3.1.3 Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath

Fauna Habitat Type: Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath
Extent in the study area: 674.3 ha
Description: The broad habitat type incorporates areas of the following PCT:

- PCT 405 - *White Bloodwood – Red Ironbark – Black Cypress Pine Woodland*.

This broad habitat type was characterised by an open woodland of medium height dominated by *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia trachyphloia* (White Bloodwood) with occasional *Eucalyptus chloroclada* (Dirty Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus dwyeri* (Dwyer's Red Gum), *Callitris glaucophylla* (White Cypress Pine) or *Callitris endlicheri* (Black Cypress Pine).

The shrub layer was predominantly open with occasional dense patches and supported a high diversity of species. *Acacia burrowii* (Burrow's Wattle), which proliferates after fire, was present but did not form extensive thickets as it did elsewhere in the study area. Other common shrub species included *Calytrix tetragona* (Common Fringe Myrtle), *Acacia deanei* (Dean's Wattle), *Melichrus urceolatus* (Urn Heath), *Xanthorrhoea acaulis* and *Harmogia densifolia*. The ground layer

was sparse and dominated by a range of grass species, including *Aristida ramosa* (Purple Wire Grass), *Cymbopogon refractus* (Barbed Wire Grass) and *Austrostipa scabra* (Spear Grass). A range of forbs, including *Solenogyne bellioides*, *Chrysocephalum apiculatum* (Common Everlasting Daisy) and *Goodenia rotundifolia* were regularly recorded. In some areas, *Triodia mitchellii* was the dominant ground layer species.

Canopy height ranged from approximately 8-12 m. The prevalence of tree hollows varied depending on the height and age of the woodland. Hollows were common in areas with older Corymbia and Ironbark trees. Large hollows with entrance widths greater than a 15 cm entrance diameter were sparse but present. Smaller hollows were more frequent and were present in older growth Corymbia and Ironbark trees. Nectar-producing trees, shrubs (including *Xanthorrhoea acaulis*) and *Allocasuarina* sp. were scattered throughout. Ground habitat features such as logs were present but not abundant. Mistletoe was detected with low frequency in this habitat type. Termite and ant mounds were sparse. Other habitat features, such as caves and cliffs, were absent.

Signs of feral animal presence were relatively common throughout the habitat type. There were frequent signs of Feral Pig, Goat, Cat and Red Fox. There was little evidence of livestock grazing, with only areas of the broad habitat type that fringed agricultural properties likely to have been grazed recently. Evidence of historic fire was common, although it most likely occurred longer than ten years ago. Signs of timber harvesting were absent.

The source of several un-named minor tributaries of Kurrajong Creek incorporates areas of this broad habitat type. Despite this, there was little evidence of permanent or semi-permanent waterbodies throughout the broad habitat type.

3.1.4 Exotic Grassland

Fauna Habitat Type: Exotic Grassland
Extent in the study area: 512.0 ha
Description: The broad habitat type is not associated with any PCTs.

On the study area, these areas were represented by heavily grazed paddocks with few native grass species and dominant exotic species. Exotic grass genera included *Avena* sp., *Cenchrus* sp., *Eleusine* sp., *Eragrostis* sp., *Hordeum* sp., *Hyparrhenia* sp., *Lolium* sp., *Paspalum* sp., *Sporobolus* sp., *Urochloa* sp. and *Vulpia* sp.

The canopy was generally absent and primarily consisted of paddock trees. The height ranged between 6-18 m. Tree hollows were less common in comparison to other habitat types within the study area, but most remnant large paddock trees had some hollows, including hollows with a 15 cm entrance diameter. Decorticating bark was present on some trees. Ground habitat features such as logs and leaf litter were absent. Nectar producing trees were sparse but present. Nectar producing shrubs were absent. Mistletoe was present on most paddock trees. Surface rock was present in some areas of the broad habitat type. There were often large cracks in the soil that can be suitable refuge for a wide variety of native fauna species. Termite mounds and ant mounds were generally absent.

The broad habitat type was characterised by heavy disturbance including clearing, grazing and erosion. Tracks were prevalent throughout. There was no obvious history of fire. There was evidence of introduced species including Red Fox and Feral Cat.

The broad habitat type fringed many minor drainage lines and artificial dams. Many areas of the broad habitat type also had artificial berms, which are used to direct water into artificial water points.

3.1.5 Rocky Outcrops and Hills with Open Woodland and Dense Shrubland

Fauna Habitat Type: Rocky Outcrops and Hills with Open Woodland and Dense Shrubland
Extent in the study area: 396.1 ha
Description: The broad habitat type incorporates the following PCT:

- PCT 406 - *White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland*.

This broad habitat type incorporates most of the areas of outcropping sandstone in the study area and some of the woodlands adjacent to the outcrops. The landforms range from small isolated stony hills with limited outcropping rock to larger, steeper sandstone hills with extensive outcropping, caves, crevices and boulder fields. The broad habitat type was characterised by a shrubby open woodland with a canopy dominated by Red Ironbark, often in association with White Bloodwood. Woodlands adjacent to the rocky hills were generally open with a denser shrub layer.

There was also a smaller tree layer dominated by *Acacia cheelii* (Motherumbah). *Eucalyptus dwyeri* (Mallee Red Gum) and *Alphitonia excelsa* (Red Ash) were commonly recorded either on the outcrops or on the slopes adjacent.

The shrub layer was dense and dominated by a diverse range of tall shrubs such as *Philotheca difformis* (Small-leaf Wax-flower)*, Philotheca salsolifolia, Philotheca ciliata, Phebalium squamulosum* (Scaly Phebalium) and *Calytrix tetragona* (Common Fringe Myrtle). *Bertya opponens* (Coolabah Bertya) was dominant in some areas. A sparse low shrub layer comprising of *Homoranthus flavescens* and *Melichrus urceolatus* (Ruby Urn Heath) was also occasionally present. The ground layer was variable in structure, being sparse on the larger rocky outcrops or dense in the smaller rocky outcrops. Common grass species included *Cleistochloa rigida*, *Thyridolepis mitchelliana* (Mulga Mitchell Grass) and *Aristida ramosa* (Purple Wiregrass).

Canopy height ranged between approximately 6-12 m. Tree hollows were less common in comparison to other habitat types within the study area; however, they were present in low numbers, including hollows with a 15 cm entrance diameter. Decorticating bark was present on some Red Ironbark trees. Ground habitat features such as logs were uncommon but scattered throughout. Leaf litter was abundant. Mistletoe was present, generally in low density but abundant in some small areas. Arboreal and terrestrial termite mounds were rare.

Two outcrops, Bulga Hill and an unnamed rocky outcrop with bat habitat, are covered by this broad habitat type.

Bulga Hill is a large sandstone outcrop with a roughly east/west alignment. It is comprised of two tiers. The top tier forms the most prominent expression of the outcrop with some large cliff faces, areas of very steep relief and a saddle in the middle. It is fringed by open woodland. A second tier of cliffs and boulder scree slopes occurs to the west of the main outcrop.

Bulga Hill is a complex sandstone structure with numerous caves, crevices and boulder scree slopes. The western edge of Bulga Hill is less complex than the remaining structure and supports only small caves and overhangs, which could provide temporary roosting or night roosting habitats for microbat species. There are crevices and small holes throughout this area, similar to other structures on Bulga Hill, where roosting microbat species were detected.

More complex caves become more common throughout the eastern two-thirds of Bulga Hill. Several caves with mouth entrances greater than 4 m, and some had depths estimated as greater than 8 m, occur throughout these sections (Plate 3.1). The roofs of most caves greater than 8 m long were between 1 m and 1.5 m high. Some of these caves had other chambers that could not be inspected safely and, as such, depth could not be estimated. Three caves with mouth entrances greater than 4 m or depths greater than 8 m were observed on the lower tier of Bulga Hill. At least seven caves with mouth entrances greater than 4 m or depths greater than 8 m were observed on the first tier. Other caves with smaller mouth entrances were also present, some of which could not be explored safely and, therefore, depth could not be confirmed (Plate 3.2). Many of these caves could provide suitable roosting or breeding habitat for cave roosting species.

In addition, the eastern two-thirds of Bulga Hill supported extensive deep crevices and multiple small hole structures (Plate 3.3). Four threatened microbats (two Large-eared Pied Bats and two Eastern Cave Bats) were located using these structures during the January 2020 survey. These structures were so common throughout this area that they were difficult to quantify.

Plate 3.1: Cave with mouth width greater than 4 m and depth greater than 8 m.

Plate 3.2: Cave located on the top tier of Bulga Hill. Cave entrance less than 4 m but with a depth greater than 8 m. A secondary chamber of unknown depth can be observed above the main entrance.

Plate 3.3: Eastern Cave Bat in a small hole on the top tier of Bulga Hill.

The unnamed rocky outcrop had less complexity in both caves and crevicing (Plate 3.4), though both were present (Plate 3.5). No caves with mouth widths greater than 4 m were observed. Of the caves that were present, two had depths of approximately 3 m while another two had depths of up to 2 m. Numerous crevices were present with unknown depths. It is likely that this rocky outcrop could provide temporary night roosts, or even occasional daytime roosts, to some species.

There was no evidence of recent disturbance from tracks or erosion. Old fire scars were observed. Grazing, primarily from Goats, was extensive in some areas, including Bulga Hill. Evidence of other introduced species, including Red Fox and Feral Cat, was also detected. Little evidence of logging was recorded.

No permanent water sources were identified in this broad habitat type.

Plate 3.4: Unnamed rocky outcrop relief with low complexity and lacking large caves.

Plate 3.5: Small cave on the unnamed rocky outcrop with a depth of approximately 4 metres and with crevicing.

3.1.6 Box Woodland

Fauna Habitat Type: Box Woodland
Extent in the study area: 529.0 ha
Description: The broad habitat type incorporates the following PCTs:

- 88 - Pilliga Box – White Cypress Pine – Buloke Shrub-Grass Woodland;
- 244 - *Poplar Box Grassy Woodland*; and
- 435 - *White Box – White Cypress Woodland*.

The broad habitat type was primarily found on the eastern slopes of the Pilliga East State Forest as it transitioned east into the alluvial floodplains of the Namoi River catchment, along eastern portions of the drainage lines of the study area and in patches within the agricultural landscape of the study area.

The habitat type was characterised by moderate to tall woodland or open forest dominated by *Eucalyptus pilligaensis* (Pilliga Box), *Eucalyptus albens* (White Box) or *Eucalyptus populnea* (Poplar Box) often with *Callitris glaucophylla* (White Cypress Pine), *Allocasuarina luehmannii* (Buloke) or *Casuarina cristata* (Belah). The more easterly expressions of this broad habitat type, especially areas adjacent to drainage systems, also support *Eucalyptus chloroclada* (Dirty Gum) and *Angophora floribunda* (Rough-barked Apple).

Shrubs in these areas were sparse to absent, depending on the condition. A range of tall shrubs and small trees, including *Geijera parviflora* (Wilga), *Eremophila mitchellii* (Budda), *Acacia implexa* (Hickory Wattle), *Dodonaea viscosa* (Sticky Hop Bush), *Teucrium betchei* and *Alectryon oleifolius* (Western Rosewood) were recorded in some areas. Common low shrubs include *Maireana microphylla* (Small-leaf Bluebush)*, Sclerolaena birchii* (Galvanised Burr) and *Rhagodia spinescens* (Thorny Saltbush), especially in the more disturbed grazed areas. The ground layer was comprised of grasses though their abundance was low, owing to the prevailing dry conditions.

Canopy height ranged from approximately 10-20 m, depending on whether the broad habitat type was on the rocky slopes (lower canopy height) or on the alluvial plains (higher canopy). Tree hollows were common in areas with older trees. Large hollows with entrance widths exceeding 15 cm were regularly recorded in both the woodland and in paddock trees found in areas mapped as DNG. Smaller hollows and decorticating bark were also common. Nectar-producing trees (White Box, Poplar Box, Dirty Gum, Rough-barked Apple) and nectar- and fruit-producing shrubs (Western Rosewood, Budda, False Orange) were abundant but not flowering/fruiting at the time of the survey. Ground habitat features such as logs and leaf litter were common throughout areas with less grazing impact, but were rare to absent in areas where grazing was prolific. On the alluvial plains, some areas of the broad habitat type hosted surface rock, which was suitable for some burrowing lizard and snake species. Mistletoe was abundant throughout the broad habitat type, though not flowering during the survey. Arboreal termite mounds were rare but occasionally recorded, including two which hosted nesting Sacred Kingfishers (*Todiramphus sanctus*) during the survey. No caves, cliffs or rocky outcrops were identified within the broad habitat type.

The majority of this broad habitat type had been impacted by grazing (Cattle and Sheep) and was in moderate or poor condition. Some areas in the southern portion of the study area were in good condition. Signs of introduced species were prolific, including European Brown Hare (*Lepus europaeus*), Pig, Cat, Fox and Goat. Large erosion scars were present in some areas, usually associated with ephemeral drainage features fringed by the broad habitat type.

Some of this broad habitat type fringed minor tributaries of Kurrajong Creek. Several artificial dams had been created adjacent to the drainage lines, some of which still held water during the survey. No water was located within the drainage features themselves.

3.1.7 Shallow, Undefined Drainage Channels

Fauna Habitat Type: Shallow, Undefined Drainage Channels
Extent in the study area: 264.6 ha
Description: The broad habitat type incorporates areas of the following PCTs:

- PCT 399 - *Red Gum – Tea Tree Creek Woodland*;
- PCT 141 - *Broombush – Wattle Tall Shrubland*;
- PCT 404 - *Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland* (part); and
- PCT 405 - *White Bloodwood – Red Ironbark – Black Cypress Pine Woodland* (part).

The broad habitat type is confined to the western portion of the study area. The broad habitat type is expressed as a linear band of open woodland and very open shrubland, fringed in some places by areas of thick shrubland comprised of *Melaleuca* or *Leptospermum.* The drainage system forms broad linear sandy depressions that facilitate surface water movement in times of high rainfall. These broad drainage systems are mostly tributaries of Kurrajong Creek. PCT 399 is the dominant plant community. A small area of PCT 141 fringes an area of this PCT in the very northern extent of the study area. Small areas of PCTs 404 and 405 are also mapped over the broad habitat type. Along these drainage lines, the woodland and shrubland structure of PCT 404 and 405 changes so,

even though the canopy, mid-storey and ground cover species that define these PCTs are still present, the fauna habitat they provide compared to other forms of the PCT in the study area is different. The broad habitat type grades into the Box Gum Woodland broad habitat type further down the catchment.

While the structure is repeatable throughout its area, the broad habitat type has a variable floristic composition. Closer to the source of each tributary, the broad habitat type is defined by a tall open woodland of *Eucalyptus fibrosa* (Red Ironbark) with occasional sparse *Corymbia trachyphloia* (White Bloodwood), *Eucalyptus chloroclada* (Dirty Gum) and *Callitris glaucophylla* (White Cypress) Pine. These species are similar to the broad habitat types described in Sections 3.1.1 and 3.1.2. However, the structure is notably different, as it forms a dense tall open woodland as opposed to the sparse short woodland described in Section 3.1.1 or the sparse open woodland in Section 3.1.3. A comparison between the woodland structure of this broad habitat type, and that found in adjacent areas of PCT 404 is highlighted in Plate 3.6 and Plate 3.7. PCT 405 (not shown in plates) has similar structural differences between its expression in the undefined shallow drainage areas and the more common expression elsewhere. Further from the source, the dominant canopy species changes to *Eucalyptus chloroclada* (Dirty Gum) with occasional *Eucalyptus fibrosa* (Red Ironbark), *Corymbia trachyphloia* (White Bloodwood), *Casuarina cristata* (Belah) and *Allocasuarina luehmannii* (Buloke).

Plate 3.6: Broad habitat type – Shallow, Undefined Drainage Channel mapped as PCT 404.

Plate 3.7: Broad habitat type – Red Ironbark/White Bloodwood Open Woodland with Dense Shrubland and Thick Heath mapped as PCT 404.

Close to the source of the tributaries, the mid-storey is very open and sparse, with species including *Calytrix tetragona* (Common Fringe Myrtle), *Persoonia sericea*, *Brachyloma daphnoides* (Daphne Heath) and *Acacia ixiophylla* (Sticky-leaved Wattle). In a small area to the north of the study area, the mid-story is dominated by a dense shrubland of *Melaleuca uncinata* (Broombush). In areas where the *Eucalyptus chloroclada* (Dirty Gum) becomes more dominant, *Leptospermum polygalifolium* (Tantoon) forms dense thickets in the mid-storey, sometimes in association with *Melaleuca diosmatifolia* (Rosy Honey-myrtle). A comparison between the shrubland structure of this broad habitat type, and that found in the adjacent areas of PCT 404 and 405, can be viewed in Plate 3.6 and Plate 3.7.

The ground cover was very sparse to absent. When present, it included species such as *Microlaena stipoides* (Weeping Grass), *Gahnia aspera* (Rough Saw-sedge), *Lomandra leucocephala* (Woolly Mat-rush), Barbed Wire Grass, *Laxmannia gracilis* (Slender Wire Lily) and *Glycine clandestine*.

Canopy height ranged from approximately 15-22 m. Large hollows with entrance widths exceeding 15 cm were regularly recorded in both the Ironbark Woodland and the Red Gum Woodland. Hollows greater than 15cm were not observed in the Broombush – Wattle Tall Shrubland component of this broad habitat type. Smaller hollows and decorticating bark were abundant.

Primary Koala feeding trees were recorded throughout the broad habitat type, though they were more common further from the source of the drainage lines. Koala scats were collected at several locations within the broad habitat type, including areas of Ironbark. Nectar feeding trees were abundant (Red Ironbark, Dirty Gum). Nectar and fruiting trees were more abundant in areas where *Eucalyptus chloroclada* (Dirty Gum) became more dominant. Mistletoes were locally abundant, though again there were more in the areas dominated by *Eucalyptus chloroclada* (Dirty Gum). Terrestrial termite mounds and ant mounds were sparse but present. No arboreal termite nests

were observed. *Allocasuarina* sp. were generally absent. Large and small hollow logs were common throughout the broad habitat type. Surface rock, rocky outcrops and caves were absent.

There was no evidence of disturbance from tracks, grazing or erosion. Evidence of feral animals, including Goats, Feral Pig, Red Fox and Cat was commonly observed. Fire scars were present in some areas of the broad habitat type. They were estimated to be greater than ten years of age.

Despite being associated with drainage, no waterbodies were located throughout the broad habitat type. This is explained by their ephemeral condition, sandy substrate and the low profile that lacked stream banks.

3.1.8 Red Gum Woodland (Sandy)

Fauna Habitat Type: Red Gum Woodland (Sandy)
Extent in the study area: 68.5 ha
Description: The broad habitat type incorporates areas of the following PCTs:

- PCT 206 - *Dirty Gum – White Cypress Woodland on Sand Monkeys*;
- PCT 401 - *Rough-barked Apple Sand Flat Woodland*; and
- PCT 408 - *Dirty Gum Shrubby Woodland*.

This broad habitat type has a variable floristic composition but is primarily characterised by the presence of large Red Gum tree species (either *Eucalyptus chloroclada* [Dirty Gum] or *Eucalyptus blakelyi* [Blakely's Red Gum]) on sandy loams or sands. The broad habitat type occurs as isolated patches throughout the study area. Most areas are in moderate or good condition. It is expressed in a variety of landforms including sand monkeys, sandy loam hill slopes and sandy flats. Other regularly occurring tree species include *Angophora floribunda* (Rough-barked Apple), *Callitris endlicheri* (Black Cypress) and *Callitris glaucophylla* (White Cypress Pine).

The shrub layer was typically sparse and variable depending on the prevailing landform. Sand monkeys often included *Notelaea microcarpa* (Native Olive), *Geijera parviflora* (Wilga) and *Alstonia constricta* (Quinine bush). Hill slopes and sand plain expressions were characterised by a lower shrub layer comprised of *Melichrus urceolatus* (Urn Heath), *Brachyloma daphnoides* (Daphne Heath), *Calytrix tetragona* (Common Fringe Myrtle), *Persoonia sericea* and *Boronia glabra. Brachychiton populneus* (Kurrajong) was also often present.

The ground layer was usually grassy with common grass species including *Aristida ramosa* (Purple Wire Grass), *Microlaena stipoides* (Weeping Grass), *Cymbopogon refractus* (Barbed Wire Grass) and *Aristida vagans* (Threeawn Speargrass). Other common ground layer species included *Lomandra leucocephala* (Woolly Mat-rush), *Lomandra filiformis* (Wattle Mat-rush), *Lomandra longifolia* (Spiny-headed Mat-rush), *Cheilanthes sieberi* (Poison Rock Fern) and *Gonocarpus elatus*.

Canopy height ranged from approximately 10-15 m. Hollow-bearing trees were relatively common, including hollows with a 15 cm entrance diameter. Decorticating bark was generally absent. Nectar producing trees and shrubs were common and dense in areas. Ground habitat such as leaf litter and large logs were common. Mistletoe species were present and occasionally abundant in these habitats. Other habitat features such as termite mounds, cliffs/rocky outcrops and surface rock were not observed.

There was no evidence of disturbance from tracks, fire or erosion. Evidence of feral animals including Goats, Feral Pig, Red Fox and Cat were commonly observed. Some areas had been grazed by livestock. There was no evidence of waterbodies.

3.1.9 Belah Woodland

Fauna Habitat Type: Belah Woodland
Extent in the study area: 60.1 ha
Description: The broad habitat type incorporates the following PCT:

- PCT 55 - *Belah Woodland*.

This community occurred on hard brown clay soils on floodplains adjacent to the drainage lines. The broad habitat type was characterised by a dense woodland community dominated by *Casuarina cristata* (Belah). There were also very sparse *Eucalyptus albens* (White Box) and *Eucalyptus pilligaensis* (Pilliga Box). There was a sparse very open mid-storey comprised of a range of tall shrubs including *Geijera parviflora* (Wilga), *Alectryon oleifolius* (Western Rosewood), *Eremophila mitchellii* (Budda), *Apophyllum anomalum* (Warrior Bush) and *Capparis mitchellii* (Wild Orange). The mid-storey was sparse and included occasional *Myoporum montanum* (Western Boobialla), *Rhagodia spinescens* (Spiny Rhagodia) and *Maireana enchylaenoides* (Wingless Bluebush). The ground layer was also sparse with occasional grasses such as *Austrostipa verticillata* (Slender Bamboo Grass) and *Enteropogon acicularis* (Curly Windmill Grass), and forbs including *Brunoniella australis* (Blue Trumpet) and *Sida corrugata* (Corrugated Sida). The condition of this broad habitat type was variable, with some areas heavily grazed and in poor condition while other areas were in moderate or good condition.

Hollows were uncommon but were still present within older Belah trees. Some hollows were large with entrances over 15 cm in diameter. Mistletoe was present in some areas, though it was sparse. There were low densities of coarse woody debris and leaf litter was negligible. Flowering trees were generally absent and there were only very limited nectar providing shrub species. Termite mounds, rocky outcrops, bush rock, caves and cliffs were absent.

There was little evidence of fire or erosion within the broad habitat type. Many areas of this broad habitat type were regularly grazed. There were many signs of the presence of introduced species including Horses (*Equus caballus*), Pigs, Feral Cats and Red Fox. Many of the broad habitat type areas had tracks through them as they were on active grazing properties.

Some of the areas of this broad habitat type enclosed artificial dams. No natural waterbodies or water sources were identified within this broad habitat type during the survey despite the broad habitat type often being associated with minor drainage systems.

3.1.10 Red Gum Woodland (Rocky)

Fauna Habitat Type: Red Gum Woodland (Rocky)
Extent in the study area: 25.8 ha
Description: The broad habitat type incorporates the following PCT:

- PCT 432 - *Dwyer's Red Gum Shrubby Woodland*.

The broad habitat type occurred in isolated patches along the eastern fringe of the study area. The predominant landform was rocky hills. It occurred as an open woodland with a sparse to absent shrub layer.

The woodland was dominated by *Eucalyptus dwyeri* (Dwyer’s Red Gum) and *Callitris glaucophylla* (White Cypress). The small trees *Alphitonia excelsa* (Red Ash) and *Acacia cheelii* (Motherumbah) were also present. The shrub layer was sparse and included *Melichrus urceolatus* (Peach Urn Heath), *Geijera parviflora* (Wilga), *Solanum ferocissimum* and *Solanum parvifolium*. The ground

cover was sparse and included the grasses *Aristida caput-medusae* (Many-headed Wiregrass) and *Thyridolepis mitchelliana* (Mulga Mitchell Grass).

Canopy height ranged from approximately 5-8 m. Hollow-bearing trees were uncommon and the hollows recorded were generally small, although there were occasional hollows with entrances approaching 15 cm. Decorticating bark was generally absent. Nectar-producing trees and shrubs were present but sparse. Ground habitat such as leaf litter and large logs were present but sparse. Mistletoe species were present and occasionally abundant in these habitats. Other habitat features such as termite mounds and cliffs/rocky outcrops were not observed, but surface rock was present.

The majority of the broad habitat type occurred within the agricultural landscape of the eastern portions of the study area. There were tracks and evidence of logging throughout. The broad habitat type showed signs of extensive grazing from domestic livestock, Goats and European Rabbits (*Oryctolagus cuniculus*). Evidence of other feral animals, including Feral Pig, Red Fox and Cat, was commonly observed.

3.1.11 Dams

Fauna Habitat Type: Dams
Extent in the study area: 14.9 ha
Description: The broad habitat type is not associated with any PCTs and has been mapped as exotic.

On the study area, the broad habitat type was represented by artificial farm dams. The majority were located adjacent to or within drainage lines. At the time of the survey, several still held water despite the prevailing dry conditions. This indicates that some of the farm dams are charged by groundwater flows. Three farm dams supported macrophytes, including *Typha* sp., Eel Grass and *Eleocharis* sp.

The dams were generally in poor condition. Banks were heavily disturbed by grazing livestock and feral animals including Pigs. Dams that held water superficially appeared to have low water quality, with high turbidity and livestock faeces being characteristic. Despite this, a diverse range of native fauna including many native waterbirds were recorded utilising the habitats during the survey.

3.2 Native and Introduced Fauna Species

Two-hundred and eight species of vertebrate fauna were recorded during the surveys, comprising nine frogs, 25 reptiles, 131 birds and 43 mammals (Appendix B).

Twelve of the species were introduced, including the Common Myna (*Acridotheres tristis*), Common Starling (*Sturnus vulgaris*), Cattle, Goat, Sheep, Feral Pig, Dog (*Canis lupus*), Red Fox, Feral Cat, European Brown Hare, European Rabbit and the House Mouse (*Mus musculus*).

3.3 Threatened Fauna Species Recorded

Nineteen of the fauna species recorded are listed as threatened on the schedules of the BC Act and six are listed as threatened on the schedules of the EPBC Act (Table 3.2).

The locations of threatened species recorded during surveys for this Project are shown on Figure 3.2[1]. Additional details regarding the threatened species records are provided in Table 3.2 and descriptions are provided below.

[1] Species records within the study area from other databases (e.g. Squirrel Glider [DPIE 2019a]) are not shown on the figure.

Table 3.2 Threatened fauna recorded in the study area

Common Name	Scientific name	Conservation Status		Biodiversity Credit Class[3]	Description
		BC Act[1]	EPBC Act[2]		
BIRDS					
White-throated Needletail	*Hirundapus caudacutus*	-	V, M	Ecosystem	Recorded once by ELA during their surveys in the study area between 2017-2018. Also recorded by AMBS during summer 2019. Approximately 250 individuals were observed low above the south-east corner of Bulga Hill just after dawn, indicating probable roosting nearby.
Speckled Warbler	*Chthonicola sagittata*	V	-	Ecosystem	Recorded on five occasions by ELA in 2017 during a diurnal bird survey. Recorded on ten occasions by AMBS, five times during diurnal bird surveys and twice during spotlighting, with the remainder on remote camera footage.
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Ecosystem	Recorded on one occasion by ELA in 2017 during a diurnal bird survey.
Diamond Firetail	*Stagonopleura guttata*	V	-	Ecosystem	Recorded on one occasion by ELA in 2017 during a diurnal bird survey.
Painted Honeyeater	*Grantiella picta*	V	V	Ecosystem	Recorded on one occasion incidentally in 2019 by AMBS during flora surveys.
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Ecosystem	Recorded on seven occasions by ELA in 2017 during bird surveys and one incidental sighting. Recorded on four occasions by AMBS in 2019 during diurnal bird surveys.
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-	Ecosystem	Recorded opportunistically on one occasion by ELA in 2017.
Scarlet Robin	*Petroica boodang*	V	-	Ecosystem	Recorded on one occasion by ELA in 2017 during a diurnal bird survey.
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	Ecosystem	Recorded on at least 39 occasions by ELA in 2017, 15 of which were opportunistic sightings and the remainder diurnal bird surveys. AMBS recorded the species on 22 occasions in 2019, mostly during bird surveys as well as one record from a remote camera.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	Species/ Ecosystem	Recorded on at least 30 occasions by ELA in 2017, 22 of which were opportunistic sightings, with eight records from diurnal bird surveys or remote camera footage. Recorded on eight occasions by AMBS in 2019, four times during bird surveys, once during spotlighting, and three incidental records. Sightings have included observations of flocks of birds including juveniles.
Little Lorikeet	*Glossopsitta pusilla*	V	-	Ecosystem	Recorded on three occasions by ELA in 2017, twice during a diurnal bird survey and once opportunistically.
MAMMALS					
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	V	-	Ecosystem	Recorded by ELA at eleven sites from Song Meters and while spotlighting. Recorded by AMBS in 2019 at seven sites while spotlighting, and at Bulga Hill and an unnamed rocky outcrop from Anabat detectors.

Common Name	Scientific name	Conservation Status		Biodiversity Credit Class[3]	Description
		BC Act[1]	EPBC Act[2]		
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Species	Recorded on Anabat detectors by AMBS at Bulga Hill and an unnamed rocky outcrop in December 2019 to January 2020. Four individuals were caught in harp traps at Bulga Hill, and one individual was hand-caught roosting in a small horizontal hole in the rock. One individual was potentially a juvenile (<6 months old) on the basis that it had very small nipples indicating it had not bred in its lifetime, and the wings were relatively unscarred.
Little Pied Bat	*Chalinolobus picatus*	V	-	Ecosystem	Recorded at one site by ELA in 2017 from Song Meters. Recorded by AMBS in 2019 at Bulga Hill from Anabat detectors.
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	Ecosystem	ELA captured the species in harp traps at seven of their survey sites and also recorded the species opportunistically on one occasion. Recorded by AMBS in 2019 at the unnamed rocky outcrop in harp traps. Adults and juveniles were captured.
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	In December 2019 and January 2020, AMBS captured two individuals in harp traps, and one individual was hand-caught roosting in a small horizontal hole in the rock. Two of the individuals were juvenile (<6 months old) males on the basis of the elongated wing joints.
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	Species	Recorded by ELA at three survey sites in 2017, from spotlighting, Elliot traps, and pitfall traps. AMBS recorded the species at one site while spotlighting in 2019.
Black-striped Wallaby	*Macropus dorsalis*	E	-	Ecosystem	Recorded opportunistically on six occasions by ELA in 2017. Recorded by AMBS from four remote cameras in 2019, as well as two incidental sightings.
Koala	*Phascolarctos cinereus*	V	V	Species	Recorded by AMBS in three general locations in 2019. Scats were found at the base of nine trees within the Shallow, Undefined Drainage Channel broad habitat type.
Pilliga Mouse	*Pseudomys pilligaensis*	V	V	Ecosystem	Recorded by ELA at five survey sites in 2017, from Elliot traps and pitfall traps.

Note:

[1] Conservation status under the BC Act (current as at April 2020). E = Endangered, V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at April 2020). V = Vulnerable, M = Migratory.

[3] Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE 2020a) (current as at April 2020).

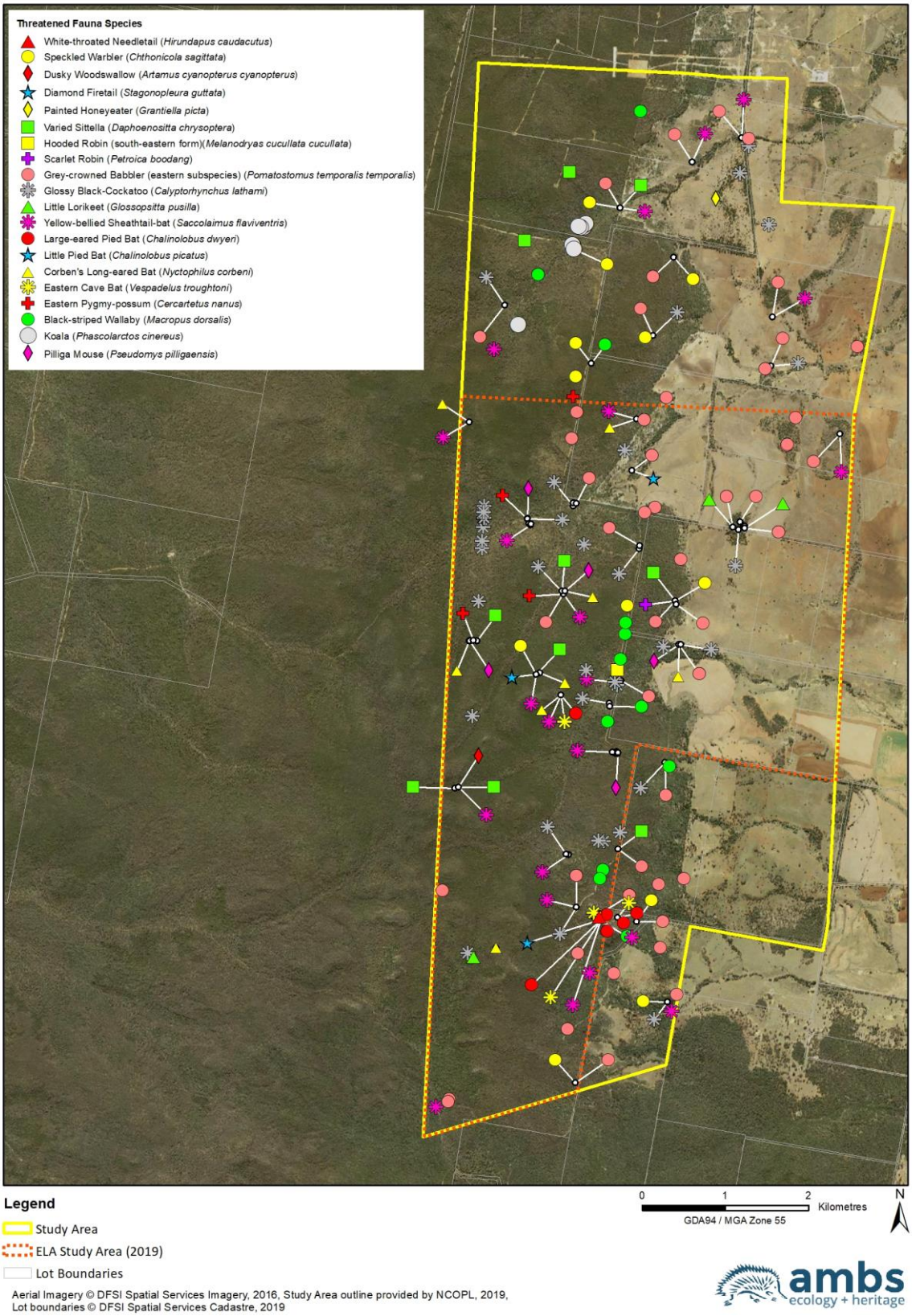


Figure 3.2 Location of threatened fauna

3.4 Summary of Fauna Species Credit Species

Threatened species that are 'ecosystem credit species' and/or 'species credit species' are pre-determined by DPIE in the *Threatened Biodiversity Data Collection* (DPIE, 2020). The BAM (OEH 2017) section 6.2.1.1 states (emphasis added):

> *Threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection, are identified in the Threatened Biodiversity Data Collection as ecosystem credit species. Targeted survey is not required for these species.*
>
> …
>
> *Species credit species are threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits.*

In accordance with Section 6.4 of the BAM (OEH 2017), the habitat constraints for each species credit species were investigated (Table 3.3). Table 3.3 provides a discussion as to whether suitable habitat for each species occurs within the study area. Five species credit species have been recorded during the surveys between 2017 and 2019:

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) (breeding);
- Koala (*Phascolarctos cinereus*);
- Eastern Pygmy-possum (*Cercartetus nanus*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*); and
- Eastern Cave Bat (*Vespadelus troughtoni*).

A further two species are highly likely to occur in the study area, the Pale-headed Snake (*Hoplocephalus bitorquatus*) and Squirrel Glider (*Petaurus norfolcensis*). The Pale-headed Snake was not recorded by ELA or AMBS within the Stage 3 study area, but this species has been previously recorded in ML 1609 during recent surveys by AMBS (2019), indicating that this species is present in the locality and is likely to use similar (and connecting) potential habitat in the study area. A database record for the Squirrel Glider also occurs within the study area, which was obtained during a flora and fauna survey undertaken throughout the Pilliga in 2011 (Landmark Ecological Services 2012, DPIE 2019a). For these two species, a description of potential habitat within the study area is also provided below.

3.4.1 Pale-headed Snake (Hoplocephalus bitorquatus)

The Pale-headed Snake is patchily distributed from north-east Queensland to the north-eastern quarter of NSW (DPIE 2020b, Fitzgerald *et al.* 2010). Within NSW, the majority of records are from areas with lower elevation, mainly in dry sclerophyll forests and woodlands and cypress forest (DPIE 2020b). In drier environments they appear to favour habitat close to riparian areas (DPIE 2020b, Fitzgerald *et al.* 2010). They are nocturnal, sheltering during the day in a range of habitats including loose bark, tree trunks, hollows and limbs of dead trees (DPIE 2020b, Fitzgerald *et al.* 2010). They are a very cryptic species, which may spend several weeks hidden, for example within tree hollows (Fitzgerald *et al.* 2010). Their main prey is tree frogs, although lizards and small mammals are also consumed (DPIE 2020b). The *Threatened Biodiversity Data Collection* (DPIE 2020a) identifies the species as being known to use Paddock Trees.

The Pale-headed Snake is a species credit species. It was recorded by AMBS (2019) approximately 3.6 km to the north of the study area within similar habitat (i.e. near the boundary of PCT 404 and PCT 405, Red Ironbark – White Bloodwood Woodland) and contiguous habitat. Based on known information for the species (DPIE 2020b), potential habitat is likely to occur throughout most of the study area, including potential Paddock Trees. Potential foraging and day-time sheltering habitat is likely to occur throughout the study area given the presence of hollow-bearing trees

within all PCTs, including PCT 435, which are not listed as associated with the species in the *Threatened Biodiversity Data Collection* (DPIE 2020a) but are likely to contain suitable foraging and shelter resources.

Given that there are nearby recent records in similar and contiguous habitat, it is likely the species (which is often difficult to detect even when present) would occur in the study area despite not being recorded during surveys between 2017-2019. A species polygon for the Pale-headed Snake has been mapped, which occupies an area of 3,944.0 ha in the study area and is shown in Figure 3.3.

Table 3.3 Species credit species associated with PCTs in the study area

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraint (DPIE 2020a)	Survey Result
		BC Act[1]	EPBC Act[2]			
Reptiles						
Border Thick-tailed Gecko	*Uvidicolus sphyrurus*	V	V	Species	-	No survey records for the species in the study area.
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	Species	-	Species was recorded 3.6 km to the north of the study area (AMBS, 2019).
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	*Rocky areas, or within 50 m of rocky areas.*	No survey records for the species in the study area.
Birds						
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	Species/Ecosystem	*Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines.*	Species not recorded and study area is not within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines. No evidence of raptor nests used by this species within the study area.
Black-breasted Buzzard	*Hamirostra melanosternon*	V	-	Species/Ecosystem	*Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts.*	Species not recorded and the study area is not within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts. No evidence of raptor nests used by this species within the study area.
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/Ecosystem	*Nest trees – live (occasionally dead) large old trees within vegetation.*	Species not recorded and no evidence of raptor nests used by this species within the study area.
Square-tailed Kite	*Lophoictinia isura*	V	-	Species/Ecosystem	*Nest trees.*	Species not recorded and no evidence of raptor nests used by this species within the study area.
Bush Stone-curlew	*Burhinus grallarius*	V	-	Species	*Fallen/standing dead timber including logs.*	No survey records for the species in the study area.
Curlew Sandpiper	*Calidris ferruginea*	E	CE	Species/Ecosystem	*As per mapped areas.*	DPIE confirmed that the area is not within a mapped habitat area for this species. No survey records for the species in the study area.
Australian Bustard	*Ardeotis australis*	E	-	Species	-	No survey records for the species in the study area.

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraint (DPIE 2020a)	Survey Result
		BC Act[1]	EPBC Act[2]			
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species/Ecosystem	*Mapped important habitat areas.*	The study area is not within a mapped important habitat area for this species. No records for the species within the study area.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	Species/Ecosystem	*Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground.*	Species was recorded within the study area by ELA and AMBS, with all broad habitat types (except PCT 141) containing suitable-sized tree hollows.
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	V	-	Species/Ecosystem	*Living or dead tree with hollows greater than 10 cm diameter.*	No records for the species within the study area.
Swift Parrot	*Lathamus discolor*	E	CE	Species/Ecosystem	*Foraging habitat in OEH mapped important habitat areas.*	The study area is not within a mapped important habitat area for this species. No records for the species within the study area.
Superb Parrot	*Polytelis swainsonii*	V	V	Species/Ecosystem	*Living or dead E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta with hollows greater than 5 cm diameter; greater than 4 m above ground or trees with a DBH of greater than 30 cm.*	Superb Parrots' core breeding area is well-known, and roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west (DPIE 2020b). The study area occurs well outside the breeding area. No records for the species within the study area.
Barking Owl	*Ninox connivens*	V	-	Species/Ecosystem	*Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.*	No records for the species within the study area and no evidence of nests used by this species.
Masked Owl	*Tyto novaehollandiae*	V	-	Species/Ecosystem	*Living or dead trees with hollows greater than 20 cm diameter.*	No records for the species within the study area and no evidence of nests used by this species.
Mammals						
Large Bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-	Species/Ecosystem	*Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC – in cave;" observation type code "E nest-roost;" with numbers of individuals >500.*	No records of this species within the study area.
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Species/Ecosystem	*Breeding camps.*	No records for the species within the study area. No nearby camps, the

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	Habitat Constraint (DPIE 2020a)	Survey Result
		BC Act[1]	EPBC Act[2]			
						nearest known Grey-headed Flying-fox camp is near Tamworth.
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Species	*Within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels.*	The species was recorded in habitat within 100 m of Bulga Hill, and 100 m of an unnamed rocky outcrop, both of which contain rocky areas, caves, overhangs, outcrops and crevices. No breeding individuals were recorded.
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	*Caves; within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within 2 km of old mines, tunnels, old buildings or sheds.*	The species was recorded in habitat within 100 m of Bulga Hill, which contains rocky areas, caves, overhangs, outcrops and crevices. Juvenile bats of this species were recorded.
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	Species	*Hollow-bearing trees.*	No records for the species within the study area. Species is considered exceptionally unlikely to occur based on historical records.
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	Species		Species was recorded within the study area by ELA and AMBS.
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	Species	*Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines.*	No survey records for the species in the study area.
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species	-	*BioNet Atlas* (DPIE 2019a) record of the species within the study area.
Koala	*Phascolarctos cinereus*	V	V	Species/Ecosystem	*Areas identified via survey as important habitat ("important" habitat is defined by the density of koalas and quality of habitat determined by on-site survey).*	Evidence of species (scats) was recorded within the study area by AMBS.
Rufous Bettong	*Aepyprymnus rufescens*	V	-	Species	-	No survey records for the species in the study area.

Note:

[1] Conservation status under the BC Act (current as at April 2020). CE = Critically Endangered, E = Endangered, V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at April 2020). CE = Critically Endangered, V = Vulnerable.

[3] Biodiversity credit class under the *Threatened Biodiversity Data Collection* (DPIE 2020a) (current as at April 2020).

[4] DPIE have advised that the Liverpool plains subregion is a predicted occurrence and its exceptionally unlikely the species would be found there based on lack of historical records. The inclusion of the Liverpool plains subregion for the predicted occurrence of the Brush-tailed Phascogale is under review.

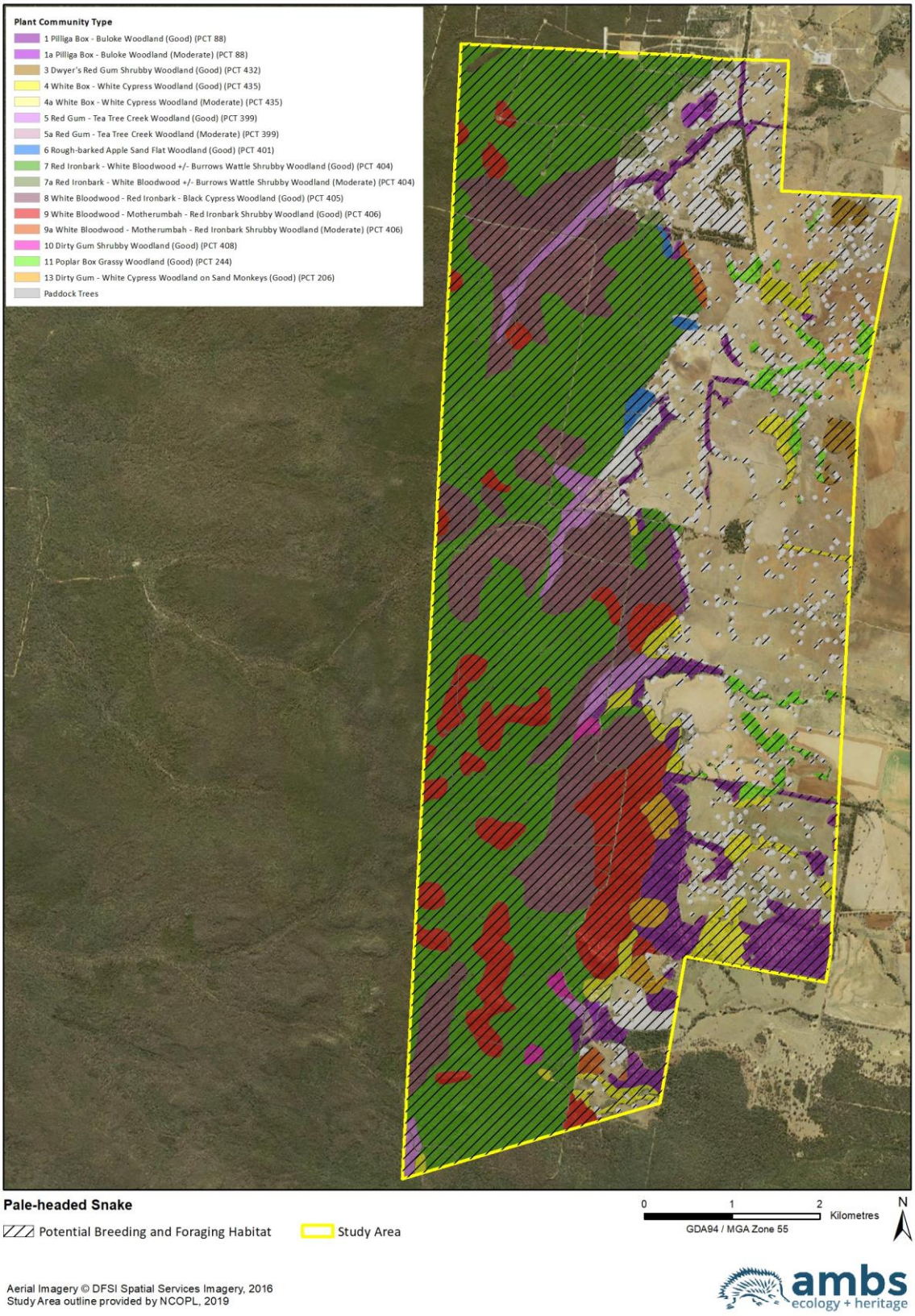


Figure 3.3 Pale-headed Snake Species Polygon

3.4.2 Glossy Black-Cockatoo (Calyptorhynchus lathami) (breeding)

The Glossy Black-Cockatoo is uncommon but widely spread throughout eastern Australia. It is known to occur from Queensland to Victoria, and inland to the southern tableland and central western plains of NSW (DPIE 2020b). An isolated population occurs on Kangaroo Island in South Australia (DPIE 2020b). Throughout its range the species generally occupies open forest and woodlands where stands of *Allocasuarina* sp. and *Casuarina* sp. occur (DPIE 2020b). They feed almost exclusively on sheoaks, with the targeted tree species varying throughout the distribution of the cockatoos. For example, *Allocasuarina littoralis* (Black Sheoak) and *Allocasuarina torulosa* (Forest Sheoak) are important species on the coast and the Great Dividing Range, while inland populations feed on *Allocasuarina diminuta* (Drooping Sheoak) and *Allocasuarina gymnanthera* (Mallee Sheoak) (DPIE 2020b). For some populations, Belah (*Casuarina cristata*) is considered an important food source (DPIE 2020b). Glossy Black-Cockatoos require large hollow-bearing eucalypts for nest sites (DPIE 2020a), with a single egg laid between March and May (DPIE 2020b). The *Threatened Biodiversity Data Collection* (DPIE 2020a) identifies the species as being known to use Paddock Trees.

The Glossy Black-Cockatoo is a dual credit species, where foraging habitat is encompassed by ecosystem credits and breeding habitat is classified as “species credit”. The species was recorded on multiple occasions within the study area between 2017 and 2019. Foraging resources (*A. diminuta* and *A. luehmannii*) were recorded in four broad habitat types in the study area while chewed cones were found at one site. Observations of the species occurred in August 2017 and August 2019 within the breeding season specified by the *Threatened Biodiversity Data Collection* (DPIE 2020a).

Potential nesting sites are considered to be living or dead trees with tree hollows greater than 15 cm diameter and at least 5 m above ground (DPIE 2020a). Habitat assessments undertaken by AMBS confirmed that such tree hollows occur in all broad habitat types within the study area, with the exception of PCT 141. While PCT 141 did support Red Ironbark trees, they were smaller than in other areas and the hollows recorded were all less than 15 cm in diameter. As such, PCT 141 was not identified as a potential breeding habitat. Consequently, given that there have been regular sightings of the species in the study area (including flocks of birds with juveniles) during the breeding season, suitable foraging resources and tree hollows greater than 15 cm diameter, known foraging and potential breeding habitat is likely to occur throughout the study area (with the exception of PCT 141), including potential Paddock Trees. A species polygon for the Glossy Black-Cockatoo has been mapped which occupies an area of 4,004.1 ha in the study area and is shown in Figure 3.4.

3.4.3 Eastern Pygmy-possum (Cercartetus nanus)

The Eastern Pygmy-possum is found throughout eastern Australia from Southern Queensland to Tasmania (DPIE 2020b). Within NSW the species occurs from the coast to as far inland as the Pilliga (DPIE 2020b). Preferred habitat type appears to be heath and woodlands, but are also known to occur in rainforest and dry sclerophyll forest (DPIE 2020b). They feed mostly on nectar and pollen collected from banksias, eucalypts and bottlebrushes, but may also feed on insects throughout the year, particularly where flowers are less abundant (DPIE 2020b). They shelter in a range of habitat features including tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, possum dreys or thickets of vegetation (DPIE 2020b).

The Eastern Pygmy-possum has been recorded by ELA and AMBS during surveys within the study area. Records from within the study area are from PCT 404 and PCT 405, in the vicinity of alluvial drainage lines. In these locations, dominant canopy trees included *Eucalyptus fibrosa* (Red Ironbark) and *Corymbia trachyphloia* (White Bloodwood) and in some areas there was a heathy understorey. Another fauna survey in the Pilliga recorded the Eastern Pygmy-possum in woodlands

of *Eucalyptus fibrosa* (Red Ironbark)*, Corymbia trachyphloia* (White Bloodwood) and *Callitris endlicheri* (Black Cypress Pine) and Red Gum/Rough-barked Apple (*Eucalyptus blakelyi/ Angophora floribunda*) woodlands (NPWS 2000).

Within the study area, the species is associated with all PCTs except PCTs 55, 141, 206 and 435. However, suitable habitat is not likely to occur for the species within *Poplar Box Grassy Woodland* (PCT 244) or *Dwyer's Red Gum Shrubby Woodland* (PCT 432), given the overall degraded state of these PCTs and a lack of diverse understorey vegetation. Further, suitable habitat is likely to occur within *Dirty Gum – White Cypress Woodland on Sand Monkeys* (PCT 206), owing to the presence of suitable roosting hollows, nectar producing shrub and tree species and its connectivity with other previously identified suitable habitats.

On the basis of the information outline above, potential habitat for the Eastern Pygmy-possum within the study area is likely to occur in Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath (PCT 404), Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath (PCT 405), Box Woodland (PCT 88 only), Rocky Outcrops and Hills with Open Woodland and Dense Shrubland (PCT 406 only), Shallow, Undefined Drainage Channels (PCT 399), and Red Gum Woodland (Sandy) (PCTs 206, 401 and 408). A species polygon for the species has been mapped that occupies an area of 3,273.3 ha in the study area and is shown on Figure 3.5.

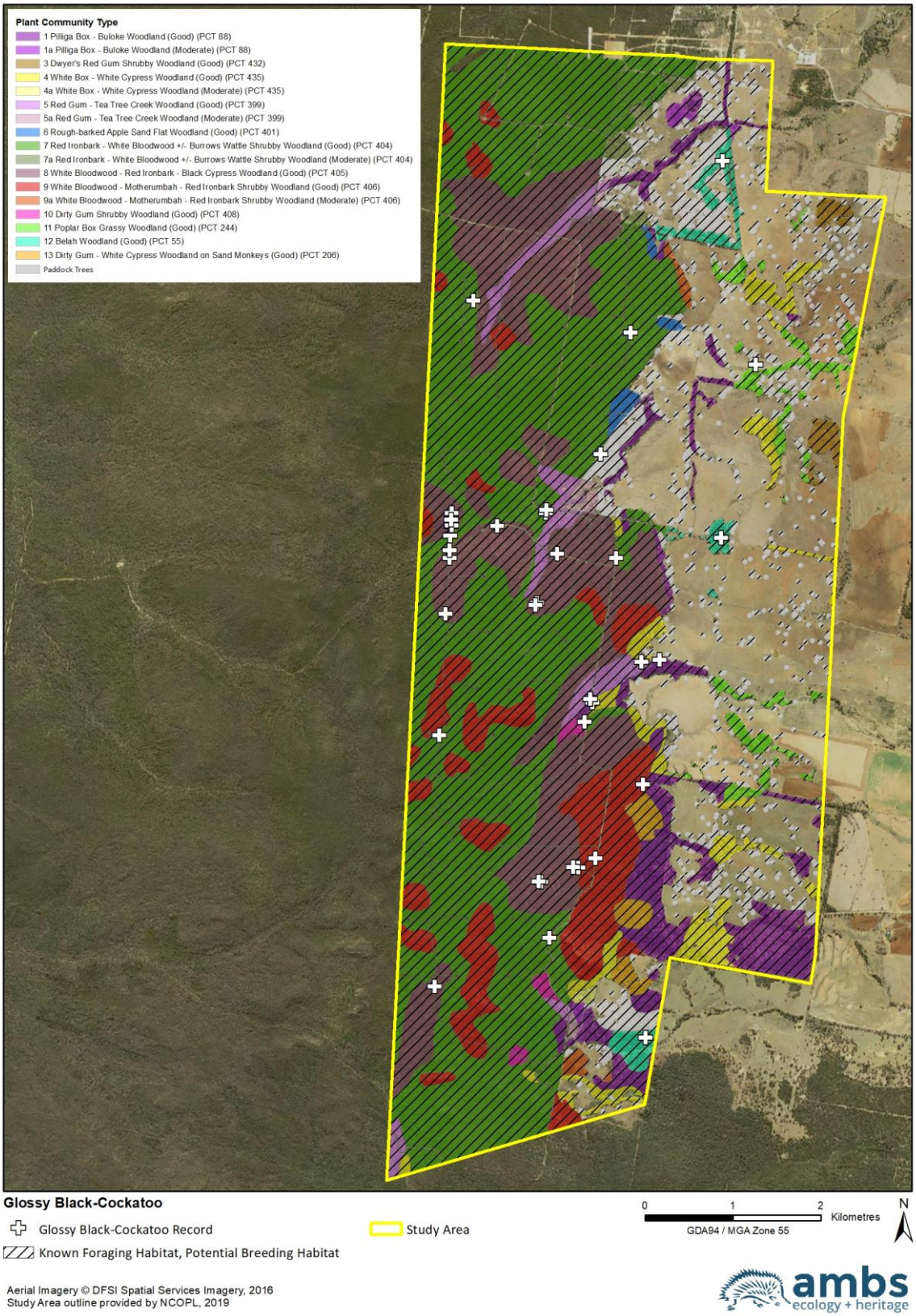


Figure 3.4 Glossy Black-Cockatoo Species Polygon

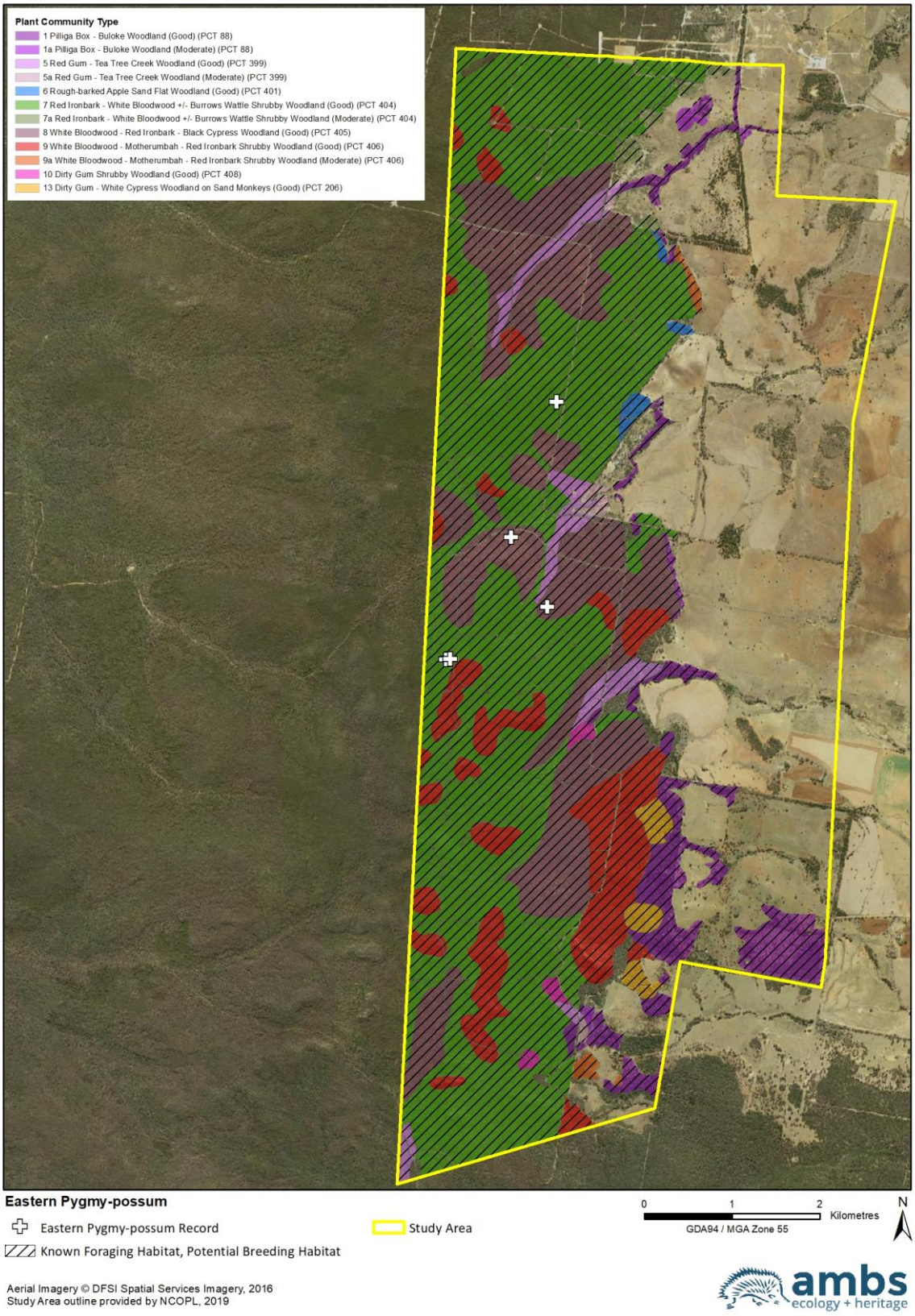


Figure 3.5 Eastern Pygmy-possum Species Polygon

3.4.4 Koala (Phascolarctos cinereus)

The Koala is a dual "Species/Ecosystem" species, where "*important habitat is defined by the density of koalas and quality of habitat determined by on-site survey – contact OEH for more information".* DPIE have advised that "*Important habitat mapping for koalas is being developed. In the meantime, koalas should be treated as a species credit and surveyed in accordance with Section 6 of the BAM".*

The Koala inhabits eucalypt woodlands and forests throughout eastern Australia, from north-east Queensland to South Australia (DPIE 2020b). In NSW, Koala populations are found along the coast and the Great Dividing Range, with smaller populations on the plains west of the range (DPIE 2020b). The species feeds on the foliage of over 70 eucalypt species and 30 non-eucalypt species, with preferred browse species varying throughout their range (DPIE 2020b). Home range-size varies with the quality of habitat and can range from less than 2 ha to several hundred hectares in size (DPIE 2020b).

Koala scats were recorded in the Shallow, Undefined Drainage Channel habitat type within the study area by AMBS in 2019. Five tree species that occur in the study area, *Eucalyptus chloroclada* (Dirty Gum), *Eucalyptus pilligaensis* (Pilliga Box), *Eucalyptus populnea* (Poplar Box), *Eucalyptus albens* (White Box) and *Eucalyptus dwyeri* (Dwyer's Red Gum) are considered key food trees for the Koala in the Western Slopes and Plains and the Pilliga (Kavanagh *et al.* 2007, Department of Environment and Climate Change 2008, OEH 2018b). Other tree species identified as important in Schedule 2 of SEPP 2019 include *Angophora floribunda* (Rough-barked Apple), *Callitris glaucophylla* (White Cypress Pine), *Casuarina cristata* (Belah), *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus fibrosa* (Broad-leaved Red Ironbark), which are likely to be utilised by Koalas as shelter trees rather than key feed trees (Kavanagh *et al.* 2007, OEH 2018b). The *Threatened Biodiversity Data Collection* (DPIE 2020a) identifies the species as being known to use Paddock Trees.

In the study area, the broad habitat types that contain suitable densities of key feed tree species are the Belah Woodland (PCT 55), Box Woodland (PCTs 88, 244 and 435), Red Gum Woodlands (PCTs 206, 401, 408 and 432), and Shallow, Undefined Drainage Channels (PCTs 399, PCT 141 and a subset of PCTs 404 and 405 [see Section 3.1.7]). Elsewhere throughout the study area key feed trees are rare and usually small (i.e. mostly saplings or young trees with limited crown development); however, potential shelter trees listed on SEPP 2019 do occur in these locations including Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath (subset of PCT 404), Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath (subset of PCT 405), and Rocky Outcrops and Hills with Open Woodland and Dense Shrubland (406), which are listed as associated with the Koala in the *Threatened Biodiversity Data Collection* (DPIE 2020a). Based on the information outlined above, known foraging and potential breeding habitat for the Koala within the study area occurs throughout all PCTs, including potential Paddock Trees. A species polygon for the Koala has been mapped on this basis, which occupies an area of 4,008.4 ha and is shown in Figure 3.6.

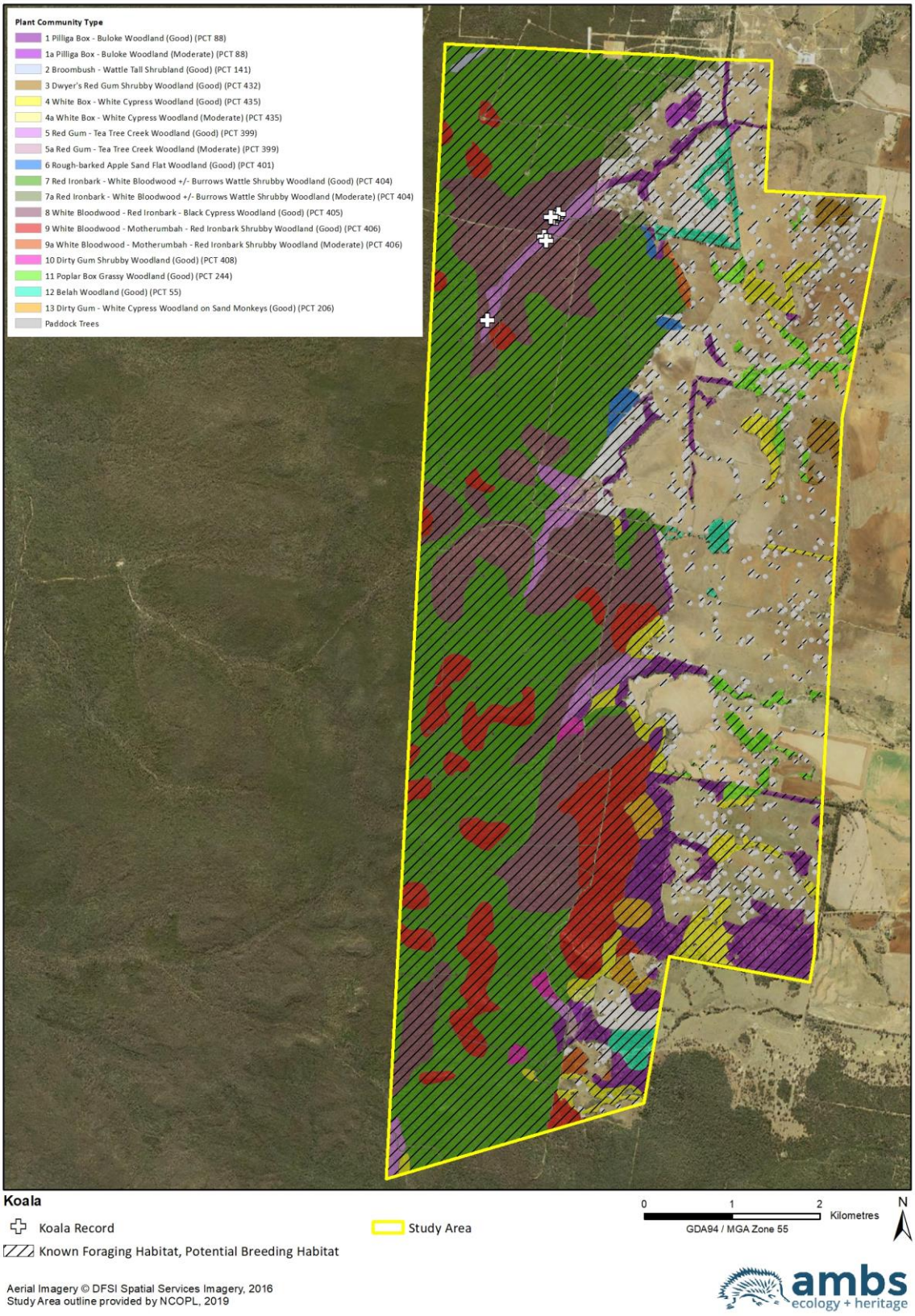


Figure 3.6 Koala Species Polygon

3.4.5 Squirrel Glider (Petaurus norfolcensis)

The Squirrel Glider is found across eastern Australia from North Queensland to Western Victoria. In NSW, the species occupies forests and woodlands from the coast to the western slopes and along the Murray River. Old growth forest is preferred (presumably due to the higher availability of roosting resources), but they are occasionally detected in younger forests. West of the Great Dividing Range they are most commonly recorded in forests dominated by River Red Gum. They feed primarily on nectar, flowers and sap. Invertebrates will seasonally form a component of their diet. They roost in hollows, building a leaf or bark nest at the bottom of the hollow. They may occupy several hollows within a loosely defined territory. The *Threatened Biodiversity Data Collection* (DPIE 2020a) identifies the species as being known to use Paddock Trees.

Within the study area, the species is associated with all PCTs except PCTs 55, 141, 206 and 244. AMBS notes that the woodland dominating PCT 404 in the study area is very sparse, with a dense mid-storey of *Acacia burrowii* (Burrow's Wattle) being the dominant component. The trees that are present offer few suitable roosting hollows for the species. The exceptions to this observation are those areas of PCT 404 that occur within Shallow, Undefined Drainage lines. Within these areas, Red Ironbark forms tall open forests with multiple hollows. Given the structure of PCT 404 in the study area, it is concluded that most of this community is not suitable for the species. However, PCT 206 and PCT 244 are considered to be potentially suitable. The open PCT 206 and PCT 244 host numerous hollows suitable for roosting and have multiple potential food tree species including *Angophora floribunda* (Rough-barked Apple), *Eucalyptus blakelyi* (Blakely's Red Gum), *Eucalyptus albens* (White Box), *Eucalyptus populnea* (Poplar Box), *Eucalyptus pilligaensis* (Pilliga Box) and *Eucalyptus trachyphloia* (White Bloodwood). PCT 141 supports a Woodland of Red Ironbark (*Eucalyptus fibrosa*) with hollows that are considered suitable for roosting. As part of the Undefined Drainage Channel broad habitat type, it has good connectivity with other areas of suitable habitat. Seasonally, the nectar producing Red Ironbark (*Eucalyptus fibrosa*) and Broom Bush (*Melaleuca uncinata*) would provide suitable foraging resources for the species.

The Squirrel Glider was not recorded during surveys by ELA or AMBS within the study area. However, the species was recorded in the study area during a flora and fauna survey undertaken throughout the Pilliga in 2011 (Landmark Ecological Services 2012, DPIE 2019a). Landmark Ecological Services (2012) also recorded the Squirrel Glider in two other locations in the Pilliga more than 10 km from the study area, and there is a record from the *BioNet Atlas* from 2015 approximately 3 km north-east of the study area.

Based on the information outlined above, known foraging and potential breeding habitat for the Squirrel Glider within the study area constitutes those areas with suitable woodland structure that supports both feed trees and suitable roosting resources, including potential Paddock Trees. This includes Shallow, Undefined Drainage Channels (PCT 399, PCT 141, and a subset of PCT 404 and PCT 405), Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath (PCT 405), Box Woodland (PCT 88, PCT 244, PCT 435), Rocky Outcrops and Hills with Open Woodland and Dense Shrubland (PCT 406) and Red Gum Woodland (Rocky) (PCT 432). Given that there is a previous record for the species within the study area, as well as several other records either nearby or in contiguous habitat, it is likely that the species (which can be difficult to detect) would occur in the study area, despite not being recorded during surveys between 2017-2019. A species polygon for the Squirrel Glider has been mapped on this basis, following broad habitat type boundaries to account for the fact that the majority of PCT 404 is not suitable for the species. The species polygon occupies an area of 2,343.2 ha and is shown in Figure 3.6.

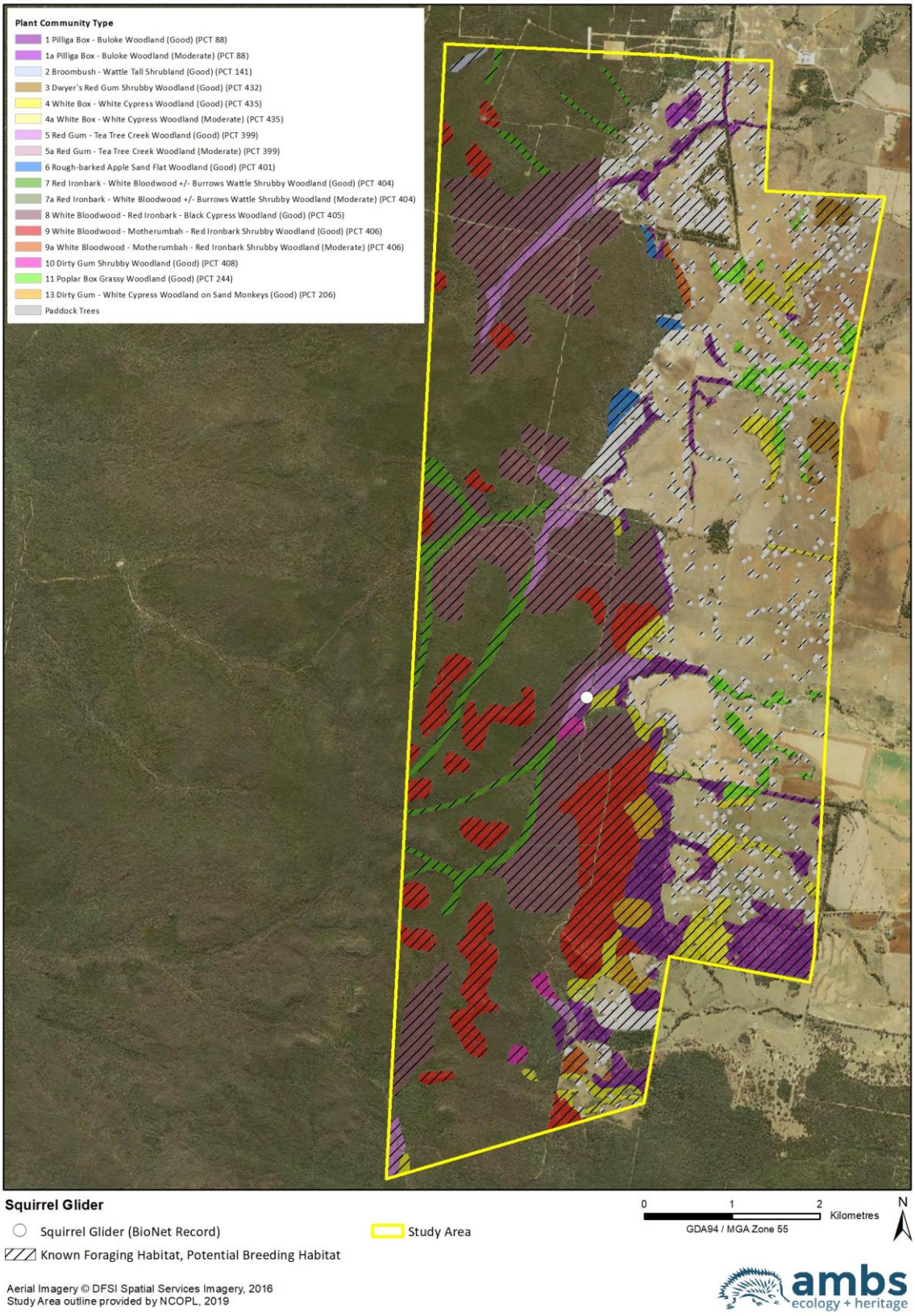


Figure 3.7 Squirrel Glider Species Polygon

3.4.6 Large-eared Pied Bat (Chalinolobus dwyeri)

The Large-eared Pied Bat occurs from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands (DPIE 2020b). It is generally rare with a very patchy distribution in NSW, occurring mainly in areas with extensive cliffs and caves (DPIE 2020b). There are scattered records from the New England Tablelands and North West Slopes. The species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*) (DPIE 2020b). They generally inhabit low- to mid-elevation dry open forest and woodland close to roosting features, but also well-timbered areas containing gullies (DPIE 2020b). Females are known to raise young in maternity roosts from November through to January, often in roof domes in sandstone caves and overhangs (DPIE 2020b). The species is known to show site fidelity to the same cave over many years (DPIE 2020b). Recent monitoring of a maternity roost as part of DPIE's *Saving Our Species Program*, recorded atypical breeding behaviour, with some bats appearing to have given birth approximately three months early, and others appeared to have not raised any young this year.

The Large-eared Pied Bat was recorded by AMBS during surveys within the study area. All records were within 100 m of Bulga Hill or an unnamed rocky outcrop, given that this was the focus of the targeted survey effort. The species was recorded on Anabat detectors by AMBS at Bulga Hill and the unnamed rocky outcrop in December 2019 and January 2020. Four individuals were caught in harp traps at Bulga Hill, and one individual was hand caught roosting in a small horizontal hole in the rock. One individual was potentially a juvenile female (<6 months old); however, the age of the individual is not definitive.

Individual was not a newborn and not dependent. It was close to adult size with usual colouration. The wing joints appeared fused and did not show cartilage bands. The individual was able to fly and was close to or at adult size. Teeth were not obviously worn. The fur and wing membrane was relatively clean, lacking scarring. The wing joints did not show cartilage bands or blood vessels. The individual was female and the nipples were minute, indicating the bat had not bred.

There is some evidence to suggest the individual was sub-adult and other evidence to suggest that the individual was a young adult. Given that a potential juvenile animal has been recorded within 100 m of Bulga Hill, the area should be considered potential breeding habitat.

On the basis of the information outlined above, potential breeding habitat for the Large-eared Pied Bat occurs at Bulga Hill. In accordance with the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitat* (OEH 2018a), a species polygon is habitat associated with PCTs as per the *Threatened Biodiversity Data Collection* (DPIE 2020a) (i.e. PCTs 88, 206, 399, 401, 404, 405, 406, 408, 432, 435) within a 2 km radius of Bulga Hill and the unnamed rocky outcrop. A species polygon for the species has been mapped that occupies an area of 1,905.6 ha in the study area and is shown on Figure 3.8. PCTs 55 and 244 have also been included because of their proximity to the cave habitat and other areas of suitable habitat (i.e. PCTs associated with the species).

Within the study area, potential habitat is represented more broadly by all PCTs because the species is listed under the BC Act and the EPBC Act (Figure 3.8). Under the EPBC Act, potential foraging habitat for the Large-eared Pied Bat is not limited to locations within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within 2 km of old mines or tunnels. Potential foraging habitat throughout the study area has been mapped that occupies an area of 3,623.3 ha, and is shown on Figure 3.8.

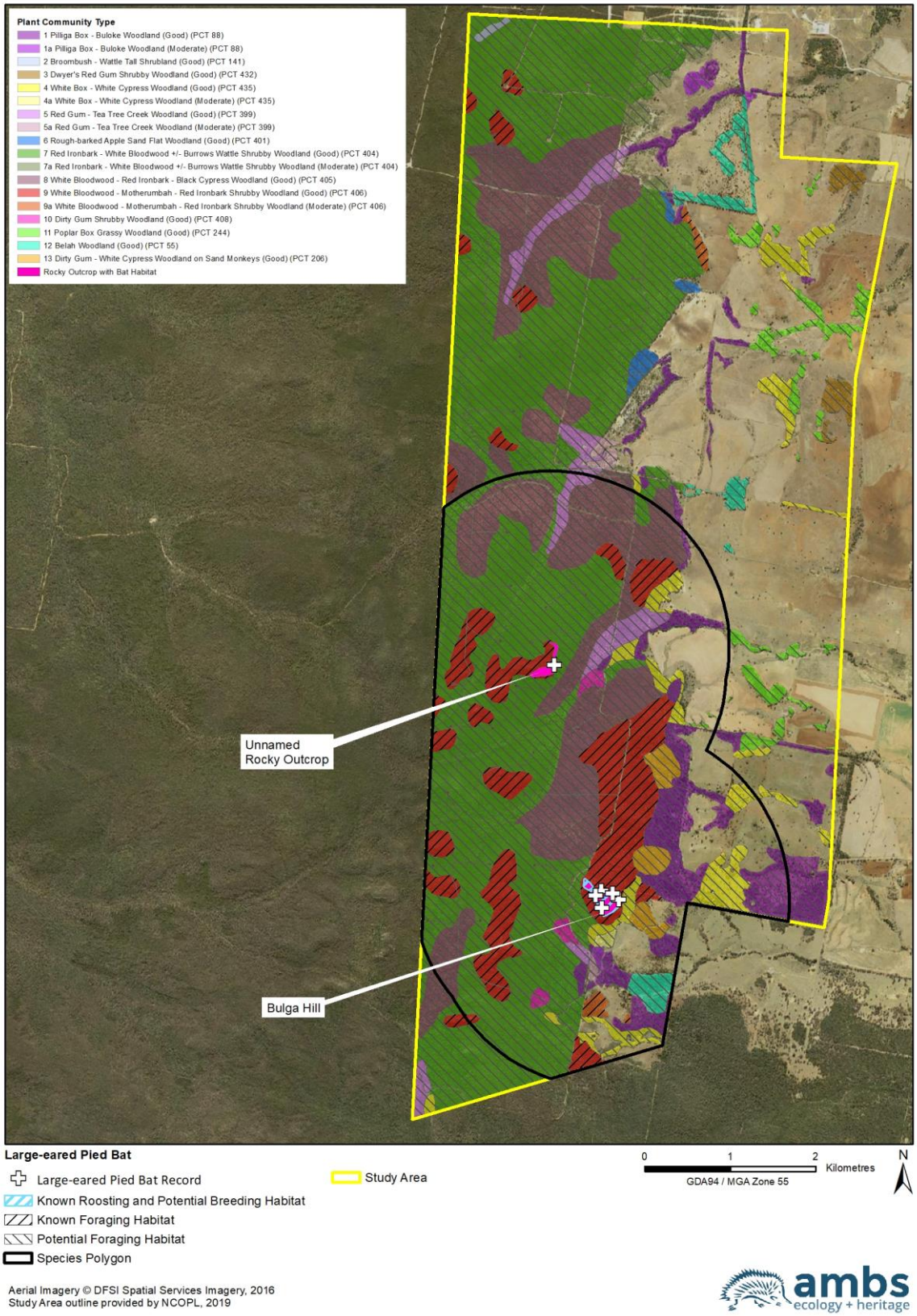


Figure 3.8 Large-eared Pied Bat Species Polygon

3.4.7 Eastern Cave Bat (Vespadelus troughtoni)

The Eastern Cave Bat occurs on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW (DPIE 2020b). The species is very uncommon, and little is known about its biology (DPIE 2020b). Eastern Cave Bats roost in caves, cliffs, and rocky overhangs, which are usually found in dry open forest or woodland, and occasionally wet eucalypt forest and rainforest (DPIE 2020b). They have also been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals (DPIE 2020b). Little is understood of its feeding or breeding requirements or behaviour (DPIE 2020b).

The Eastern Cave Bat was recorded by AMBS during surveys within the study area. All records were within 100 m of Bulga Hill given that this was the focus of the targeted survey effort, although they were not recorded at the unnamed rocky outcrop. In January 2020, AMBS captured two individuals in harp traps, and one individual was hand caught roosting in a small horizontal hole in the rock (Plate 3.3). Two of the individuals were juvenile (<6 months old) males on the basis of their elongated wing joints and visible bands of cartilage. Given that two juvenile animals have been recorded within 100 m of Bulga Hill, the area should be considered breeding habitat.

There are two other bat species that have potential to occur in the area and are similar to the Eastern Cave Bat, namely the Little Forest Bat (*Vespadelus vulturnus*) and the Large Forest Bat (*Vespadelus darlingtoni*). When compared with the Little Forest Bat, the Eastern Cave Bat has a longer forearm length, along with darker forearm skin and dark ear tragus. The Large Forest Bat is similar in colour; however, its forearm is usually larger than the Eastern Cave Bat and the penis shape is distinctly different.

On the basis of the information outlined above, breeding habitat for the Eastern Cave Bat occurs at Bulga Hill. In accordance with the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitat* (OEH 2018a), a species polygon is habitat associated with PCTs as per the *Threatened Biodiversity Data Collection* (DPIE 2020a) (i.e. PCTs 88, 206, 399, 401, 404, 405, 406, 408, 432, 435) within a 2 km radius of Bulga Hill. A species polygon for the species has been mapped that occupies an area of 1,118.7 ha in the study area and is shown on Figure 3.9. PCT 55 has also been included because of its proximity to the cave habitat and other areas of suitable habitat (i.e. PCTs associated with the species).

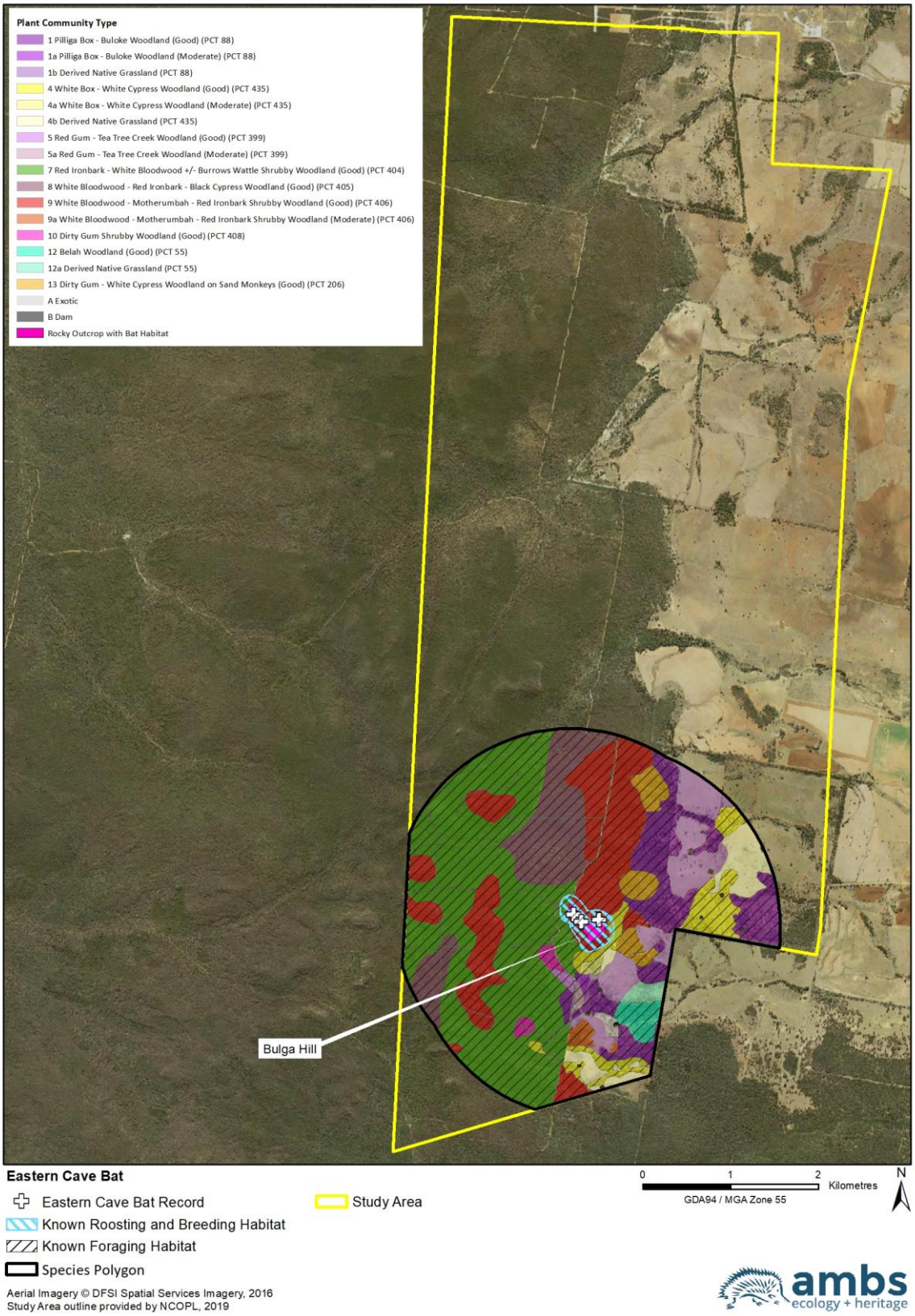


Figure 3.9 Eastern Cave Bat Species Polygon

3.5 Summary of EPBC Act Species

Six threatened fauna species listed under the EPBC Act also require assessment, as required by the Department of Agriculture, Water and the Environment, as well as the Painted Honeyeater (*Grantiella picta*), which was recorded by AMBS during surveys in 2019. In this section, the ecology and habitat within the study area is discussed for six of the relevant threatened species:

- Superb Parrot (*Polytelis swainsonii*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Painted Honeyeater (*Grantiella picta*);
- Corben's Long-eared Bat (*Nyctophilus corbeni*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*); and
- Pilliga Mouse (*Pseudomys pilligaensis*).

The Koala and Large-eared Pied Bat have been discussed previously in Section 3.4.

3.5.1 Superb Parrot (Polytelis swainsonii)

The Superb Parrot occurs in south-eastern Australia within NSW and northern Victoria. Their breeding areas are well-known and occur in two general locations, on the South-western Slopes and in the Riverina (DPIE 2020b). On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west (DPIE 2020b). Individuals breeding in this region migrate north (outside of the breeding area) to the region of the upper Namoi and Gwydir Rivers (DPIE 2020b). In the Riverina, the main breeding sites are along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round (DPIE 2020b).

Superb Parrots tend to inhabit Box-Gum, Box-Cypress-Pine and Boree Woodlands and River Red Gum Forest (DPIE 2020b). They nest in hollows of large trees (dead or alive), in tall riparian forest, open Box-Gum Woodland or isolated paddock trees (DPIE 2020b). Tree species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box (DPIE 2020b). Breeding occurs between September and January, and they may forage up to 10 km from nesting sites, primarily in grassy box woodland (DPIE 2020b). The Superb Parrot's diet consists mainly of grass seeds and herbaceous plants, but they will also eat fruits, berries, nectar, buds, flowers, insects and grain (DPIE 2020b).

The species has not been recorded in the study area, but has been recorded previously at two locations approximately 3 km north in 2009 (Ecotone, 2009). On the basis of the information outline above, the study area does not provide breeding habitat for the Superb Parrot, but may provide occasional foraging habitat. The species is a generalist foraging species, taking a wide variety of seeds, fruits and forbs from a wide variety of canopy, mid-story and ground species. It is regularly recorded foraging in Box Woodlands and Box Cypress woodlands. As such, foraging habitat for the species within the study area could occur in the Belah Woodland (PCT 55), Shallow, Undefined Drainage Channels (PCT 141, PCT 399 and a subset of PCTs 404 and 405), Box Woodland (PCTs 88, 244 and 435), Red Gum Woodland (Sandy) (PCTs 206, 401 and 408), and grassland areas derived from the above-mentioned PCTs. Potential foraging habitat for the Superb Parrot has been mapped on this basis, which occupies an area of 2,674.6 ha and is shown in Figure 3.10.

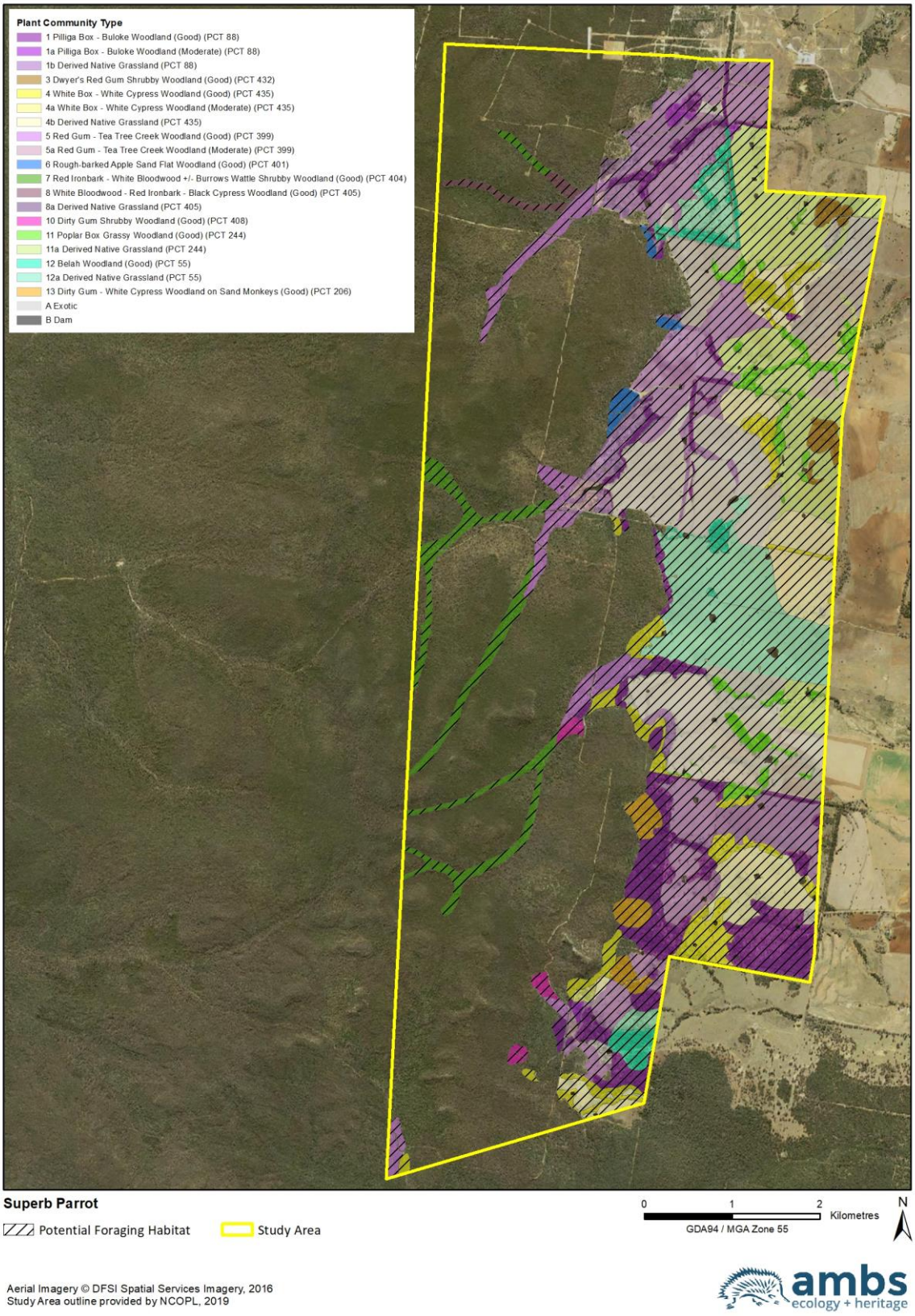


Figure 3.10 Superb Parrot Potential Foraging Habitat

3.5.2 Regent Honeyeater (Anthochaera phrygia)

The Regent Honeyeater tends to occur in woodlands and open forests the inland slopes of south-east Australia, with birds sometimes found in drier coastal woodlands and forests in some years (DPIE 2020b). The species range has contracted dramatically and now only occurs between north-eastern Victoria and south-eastern Queensland (DPIE 2020b). There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region (DPIE 2020b). Breeding is occasionally recorded elsewhere, for example a breeding pair were detected in Mulgoa, Sydney in the 2019 breeding season, and the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events (DPIE 2020b). In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands, although in some years flocks converge on flowering coastal woodlands and forests (DPIE 2020b).

Habitat for the species is mainly dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak (DPIE 2020b). Woodlands where the species occurs usually have large numbers of mature trees, high canopy cover and an abundance of mistletoes (DPIE 2020b). The Regent Honeyeater is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar (DPIE 2020b). Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany (DPIE 2020b). Flowering of other species as *Eucalyptus eugenioides* (Thin-leaved Stringybark) and other Stringybark species, and *Eucalyptus fibrosa* (Red Ironbark) can also contribute important nectar flows at times (DPIE 2020b). Nectar and fruit from the mistletoes are also utilised (DIE 2019b). When nectar is scarce lerp and honeydew can comprise a large proportion of the diet, while insects make up about 15 per cent of the total diet and are important components of the diet of nestlings (DPIE 2020b).

The species has not been previously recorded in the study area. On the basis of the information outlined above, the study area is unlikely to provide breeding habitat for the Regent Honeyeater, but may provide occasional foraging habitat. The potential foraging habitat in the study area is defined by the presence of known feed species, including trees (Red Ironbark, White Box) and/or Mistletoes (from the genus *Amyema* including *Amyema linophylla*, *Amyema cambagei* and *Amyema miquelii*). Foraging habitat for the species within the study area could occur within Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath (PCT 404) and Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath (PCT 405), Belah Woodland (PCT 55), Shallow, Undefined Drainage Channels (PCT 399), Box Woodland (PCTs 88, 244 and 435) and Red Gum Woodland (Sandy) (PCTs 206, 401 and 408). Potential habitat for the Regent Honeyeater has been mapped on this basis, which occupies an area of 3,638.2 ha and is shown in Figure 3.11.

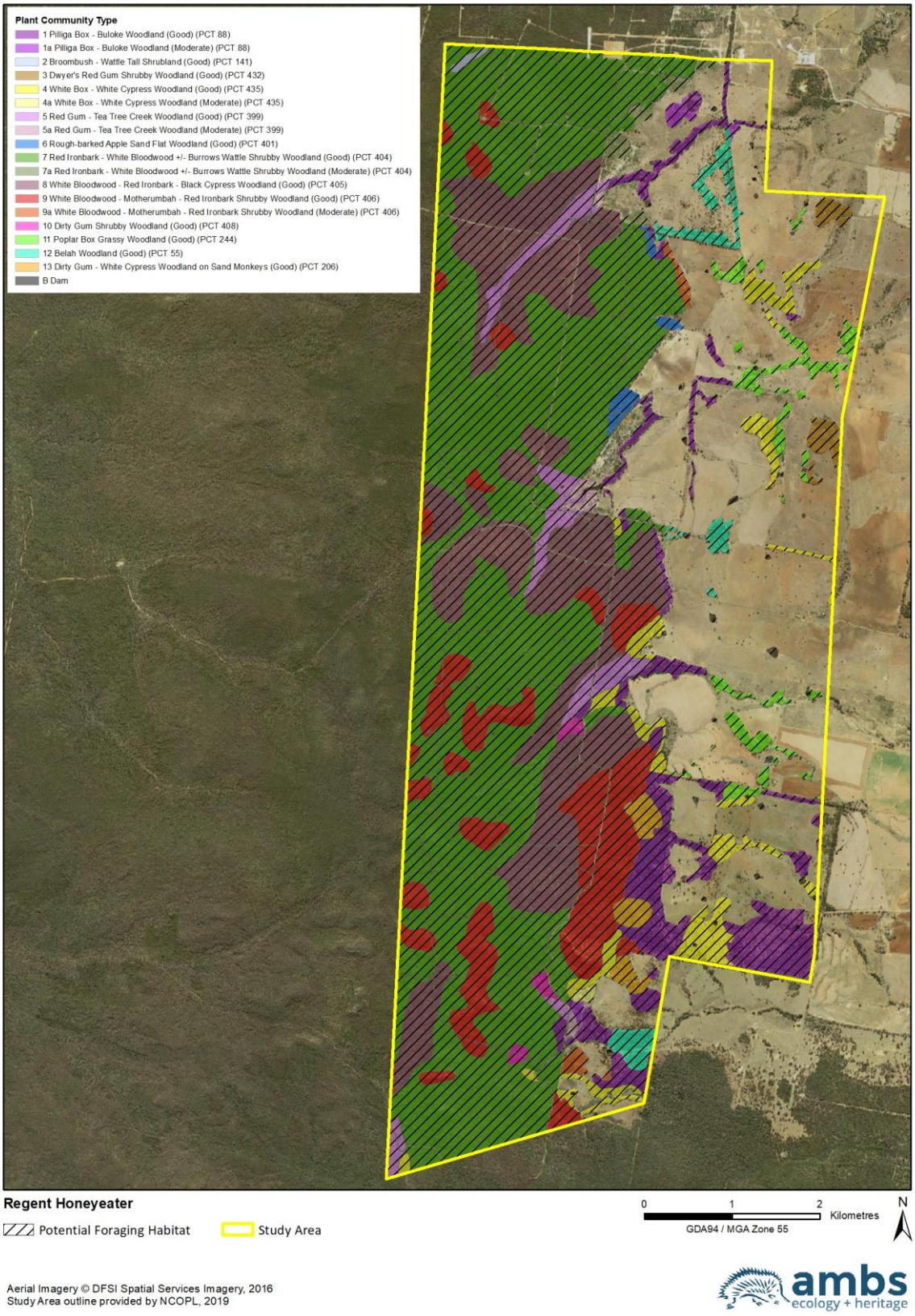


Figure 3.11 Regent Honeyeater Potential Foraging Habitat

3.5.3 Painted Honeyeater (Grantiella picta)

The Painted Honeyeater is nomadic and occurs at low densities throughout its range (DPIE 2020b). Almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland, from spring to autumn, with the greatest concentrations of birds found in these areas (DPIE 2020b). They are more likely to be located in the north of its distribution in winter (DPIE 2020b).

Painted Honeyeaters tend to inhabit *Acacia pendula* (Boree/Weeping Myall), *Acacia harpophylla* (Brigalow) and Box-Gum Woodlands and Box-Ironbark Forests (DPIE 2020b). They are a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring mistletoes of the genus *Amyema* (DPIE 2020b). Insects and nectar from mistletoe or eucalypts are occasionally eaten (DPIE 2020b). Vegetation associations for the species within the *Threatened Biodiversity Data Collection* (DPIE 2020, 2019a) include all PCTs except Broombush – Wattle Tall Shrubland (PCT 141).

The species has been recorded in the study area on one occasion by AMBS in 2019. On the basis of the information outlined above, potential foraging and breeding habitat for the species could occur within all PCTs except Broombush – Wattle Tall Shrubland (PCT 141). Potential habitat for the Painted Honeyeater has been mapped on this basis, which occupies an area of 3,634.0 ha and is shown in Figure 3.12.

3.5.4 Pilliga Mouse (Pseudomys pilligaensis)

The Pilliga Mouse occurs only within the Pilliga region of NSW (DPIE 2020b). They typically occur at low densities, although evidence exists of population fluctuations (DPIE 2020b). The species tends to occur in low-nutrient deep sand soils that support Pilliga Scrub, appearing to prefer areas with sparse ground cover (DPIE 2020b). Recent studies have found they occur in greatest abundance in recently burnt moist gullies, in habitat dominated by *Melaleuca uncinata* (Broombush) and areas containing an understorey of *Acacia burrowii* (Burrow's Wattle) with a *Corymbia trachyphloia* (White Bloodwood) overstorey (DPIE 2020b). In one location, habitats were described as containing high plant species richness, moderate to high density of low-level shrub cover; and a moist ground cover of plants, litter and fungi (DPIE 2020b). The gully where the highest rates of capture were encountered had an extensive cover of low grasses and sedges, with little shrub cover and large areas of ash-covered ground (DPIE 2020b). The species is nocturnal and shelters in burrows (DPIE 2020b).

The species has been recorded on several occasions within the study area, within Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath (PCT 404) and Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath (PCT 405). Vegetation associations for the species within the *Threatened Biodiversity Data Collection* (DPIE 2020a) include Box Woodland (PCTs 88 and 244), Rocky Outcrops and Hills with Open Woodland and Dense Shrubland (PCTs 141 and 406), Shallow, Undefined Drainage Channels (PCT 399), Red Gum Woodland (Sandy) (PCTs 401 and 408). Some patches of these broad habitat types that occur in the eastern portion of the study area are unlikely to provide suitable habitat where they are isolated, small, and often heavily grazed, with little mid-storey or ground cover. Habitat condition in these locations is poor.

On this basis, potential habitat for the Pilliga Mouse has been mapped to include all habitat types mentioned above, while excluding smaller patches in poor condition and with low connectivity, that are unlikely to provide habitat for this species. Potential habitat for the species occupies an area of 3,259.4 ha and is shown in Figure 3.13.

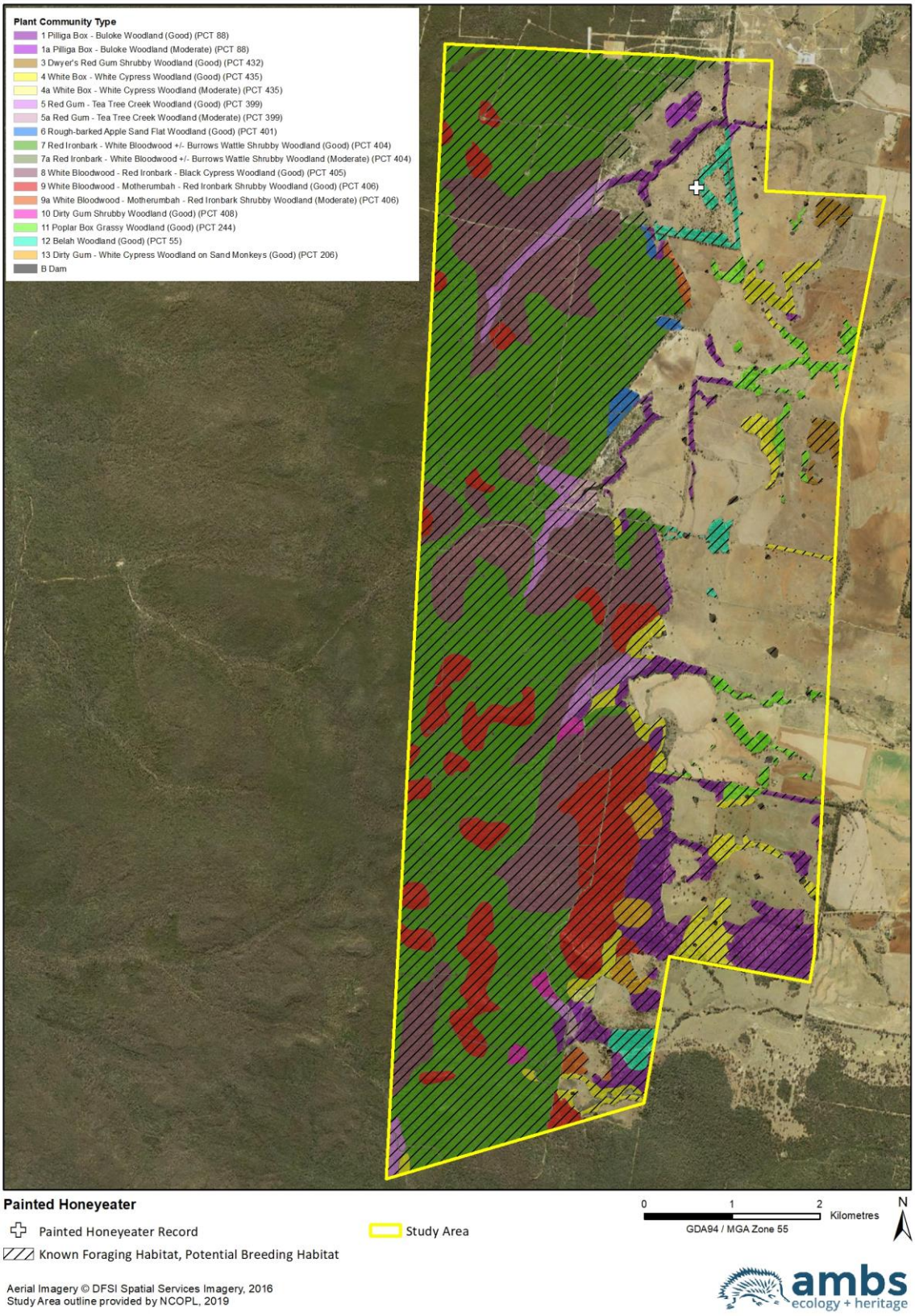


Figure 3.12 Painted Honeyeater Potential Habitat

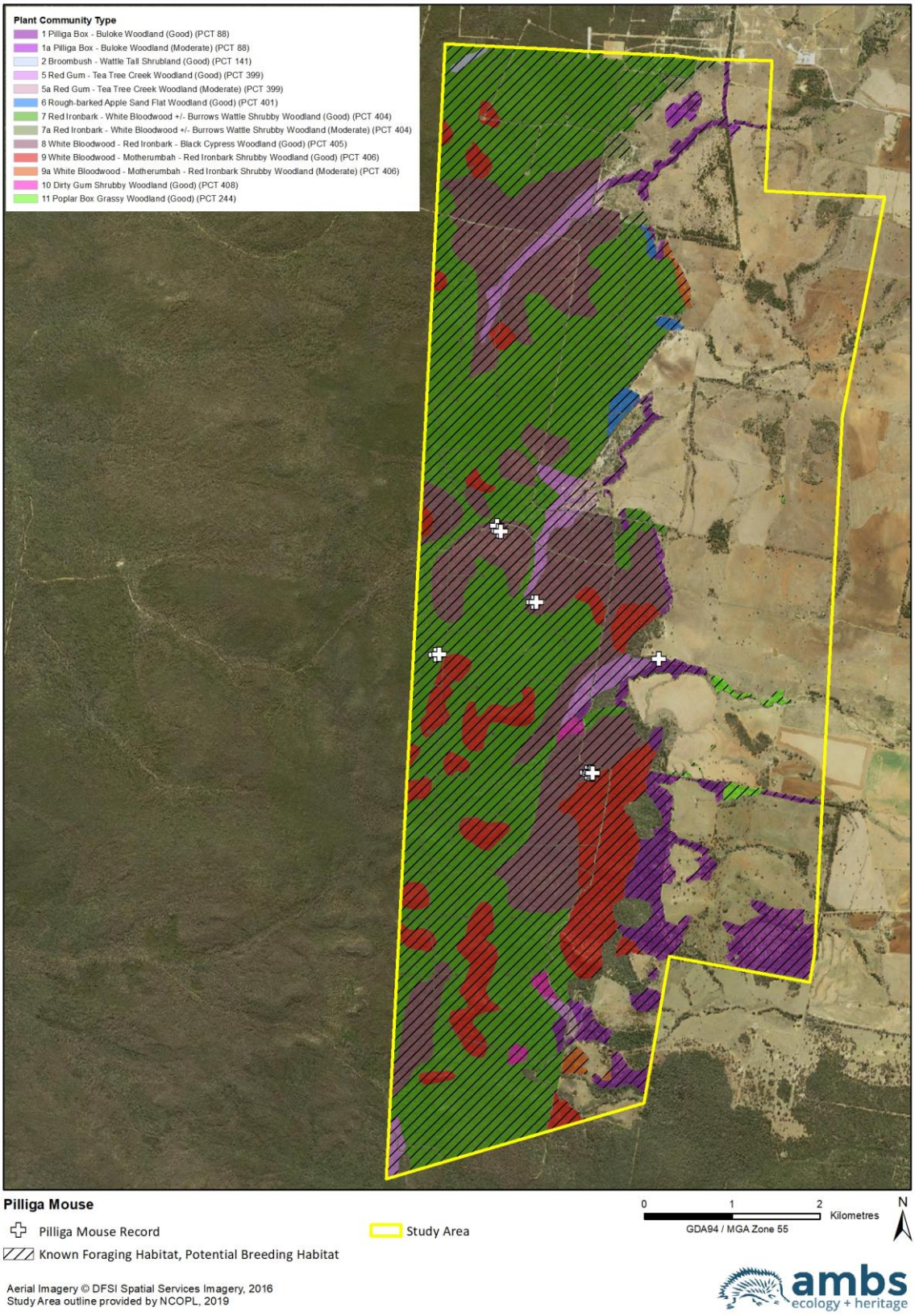


Figure 3.13 Pilliga Mouse Potential Habitat

3.5.5 Corben's Long-eared Bat (Nyctophilus corbeni)

The Corben's Long-eared Bat occurs throughout south-eastern Australia, with its distribution aligning approximately with the Murray Darling Basin, while the Pilliga Scrub region is considered a distinct stronghold for this species (DPIE 2020b). The species inhabits a variety of vegetation types, including mallee, *Allocasuarina luehmannii* (Buloke) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland (DPIE 2020b). They roost in tree hollows, crevices, and under loose bark (DPIE 2020b). Mating takes place in autumn with one or two young born in late spring to early summer (DPIE 2020b).

The species has been recorded on several occasions within the study area, within Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath (PCT 404), Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath (PCT 405) and Red Gum Woodland (Sandy) (PCT 408). On the basis of the information outline above, potential habitat for the Corben's Long-eared Bat is likely to occur throughout all woodland and forest habitats within the study area. Potential habitat has been mapped on this basis, which occupies an area of 3,623.4 ha and is shown in Figure 3.14

3.6 SEPP (Koala Habitat Protection) 2019

In relation to SEPP 2019 the following is relevant to the Project:

- the Narrabri LGA is one of the LGAs listed on Schedule 1 of SEPP 2019;
- the study area is on the Koala Development Application Map;
- the study area has an area of at least 1 ha;
- there is no approved Koala plan of management applying to the study area; and
- there are records of the Koala within the study area and, therefore, core Koala habitat occurs.

Feed tree species listed in Schedule 2 of SEPP 2019 (Northwest Slopes Koala management area) that occur in the study area include:

- *Angophora floribunda* (Rough-barked Apple);
- *Callitris glaucophylla* (White Cypress Pine);
- *Casuarina cristata* (Belah);
- *Eucalyptus albens* (White Box);
- *Eucalyptus chloroclada* (Dirty Gum);
- *Eucalyptus crebra* (Narrow-leaved Ironbark);
- *Eucalyptus dwyeri* (Dwyer's Red Gum);
- *Eucalyptus fibrosa* (Broad-leaved Red Ironbark);
- *Eucalyptus pilligaensis* (Pilliga Box); and
- *Eucalyptus populnea* (Poplar Box).

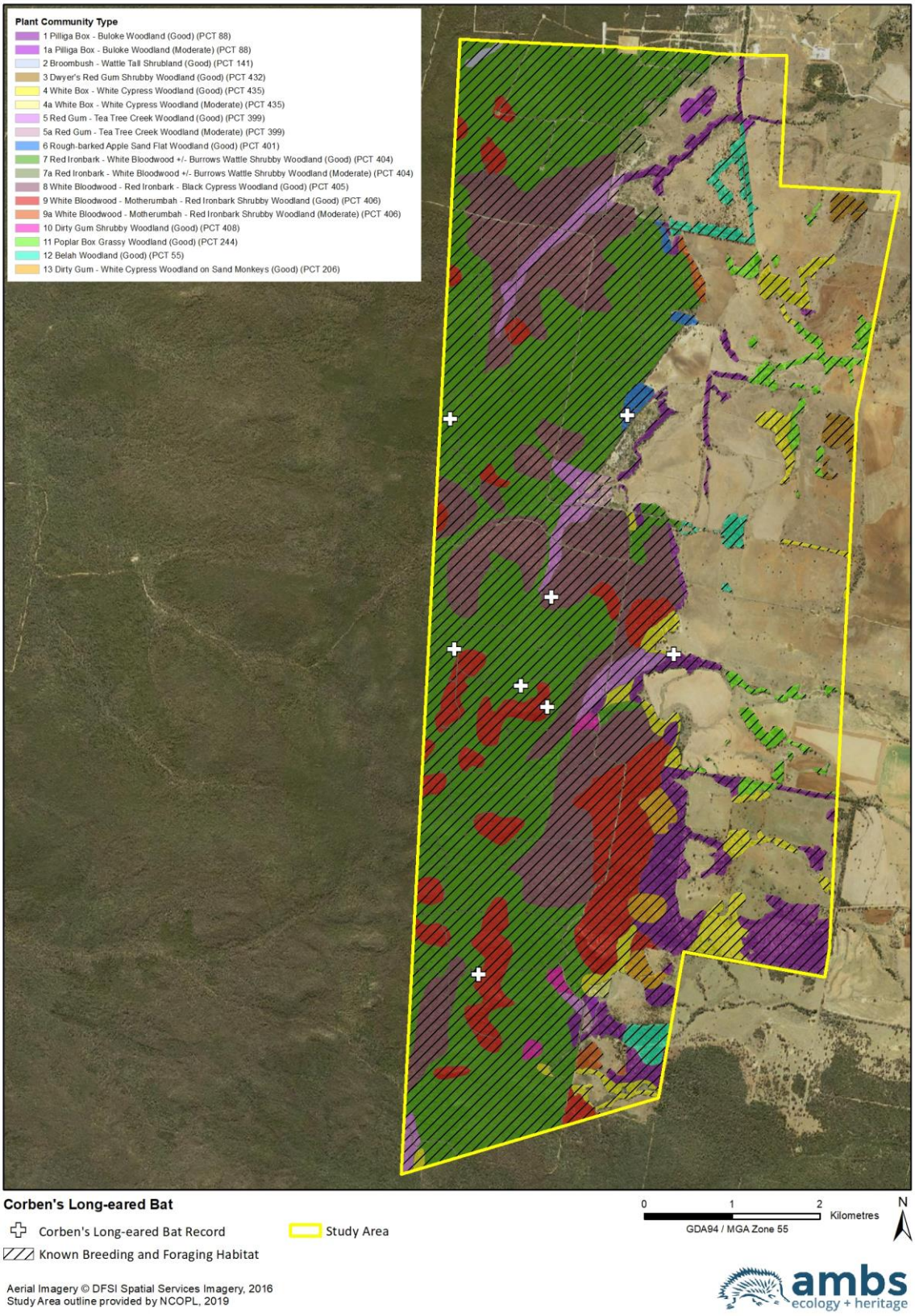


Figure 3.14 Corben's Long-eared Bat Potential Habitat

4 Summary and Conclusion

Eleven broad habitat types were recorded within the study area:

- Ironbark/Bloodwood Open Woodland with Dense Shrubland and Thick Heath;
- Derived Native Grassland;
- Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath;
- Exotic Grassland;
- Rocky Outcrops and Hills with Open Woodland and Dense Shrubland;
- Box Woodland;
- Shallow, Undefined Drainage Channels;
- Red Gum Woodland (Sandy);
- Belah Woodland;
- Red Gum Woodland (Rocky); and
- Dams.

The study area comprises remnant dry woodland habitats and habitats with a recent history of agricultural disturbance. Those habitats found in the western portion of the study area represent the majority of the dry woodland habitats and were in good condition with good connectivity. Most habitats within the agricultural land were highly disturbed and remnant habitat patches had poor connectivity. Suitable habitat for a range of threatened species occurs throughout the study area, with resources such as tree hollows, logs and key feed trees observed in varying abundances.

Two-hundred and eight species of vertebrate fauna were recorded during the surveys, comprising nine frogs, 25 reptiles, 131 birds and 43 mammals. Twelve species were introduced.

Nineteen of the fauna species recorded are listed as threatened on the schedules of the BC Act and six are listed as threatened on the schedules of the EPBC Act:

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*) (BC Act – Vulnerable);
- Little Lorikeet (*Glossopsitta pusilla*) (BC Act – Vulnerable);
- White-throated Needletail (*Hirundapus caudacutus*) (EPBC Act – Vulnerable);
- Speckled Warbler (*Chthonicola sagittata*) (BC Act – Vulnerable);
- Painted Honeyeater (*Grantiella picta*) (BC Act – Vulnerable, EPBC Act – Vulnerable);
- Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*) (BC Act – Vulnerable);
- Scarlet Robin (*Petroica boodang*) (BC Act – Vulnerable);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) (BC Act – Vulnerable);
- Varied Sittella (*Daphoenositta chrysoptera*) (BC Act – Vulnerable);
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) (BC Act – Vulnerable);
- Diamond Firetail (*Stagonopleura guttata*) (BC Act – Vulnerable);
- Koala (*Phascolarctos cinereus*) (BC Act – Vulnerable, EPBC Act – Vulnerable);
- Eastern Pygmy-possum (*Cercartetus nanus*) (BC Act – Vulnerable);
- Black-striped Wallaby (*Macropus dorsalis*) (BC Act – Endangered);
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) (BC Act – Vulnerable);
- Corben's Long-eared Bat (*Nyctophilus corbeni*) (BC Act – Vulnerable, EPBC Act – Vulnerable);
- Large-eared Pied Bat (*Chalinolobus dwyeri*) (BC Act – Vulnerable, EPBC Act – Vulnerable);
- Little Pied Bat (*Chalinolobus picatus*) (BC Act – Vulnerable);
- Eastern Cave Bat (*Vespadelus troughtoni*) (BC Act – Vulnerable); and
- Pilliga Mouse (*Pseudomys pilligaensis*) (BC Act – Vulnerable, EPBC Act – Vulnerable).

Five of the recorded threatened species are classified as species credit species, namely the Glossy Black-Cockatoo, Koala, Eastern Pygmy-possum, Large-eared Pied Bat and the Eastern Cave Bat. A further two species credit species are considered to potentially be present in the study area, namely the Pale-headed Snake and Squirrel Glider.

A summary of the habitat for each species credit species in the study area includes:

- Pale-headed Snake: all of the broad fauna habitat types in the study area represent potential habitat for the Pale-headed Snake, given potential foraging and sheltering habitat (i.e. hollow-bearing trees) occur within all PCTs.
- Glossy Black-Cockatoo: all of the broad fauna habitat types in the study area represent potential foraging and breeding habitat for the Glossy Black-Cockatoo due to the occurrence of suitable hollow-bearing trees.
- Koala: potential habitat for the Koala included locations with recognised Koala feed tree species (primarily drainage lines and alluvial floodplains) and areas that contained important feed trees identified in SEPP 2019. Habitat within the study area is classified as "core koala habitat" under SEPP 2019.
- Eastern Pygmy-possum: the majority of the broad habitat types found in the study area represent suitable potential habitat for the Eastern Pygmy-possum, with the exception of some of the open woodland habitat types that are degraded and lack a thick mid-storey shrub layer.
- Squirrel Glider: potential habitat occurs mainly along drainage lines and alluvial floodplains, with the addition of the Ironbark/Bloodwood Open Woodland with Open Shrubland and Patchy Low Heath broad habitat type.
- Large-eared Pied Bat: potential breeding habitat for the species occurs at Bulga Hill, while foraging habitat occurs in most broad habitat types within a 2-km radius of Bulga Hill and an unnamed rocky outcrop with bat habitat.
- Eastern Cave Bat: breeding habitat for the species occurs at Bulga Hill. Foraging habitat occurs in most broad habitat types within a 2-km radius of Bulga Hill.

Habitat for species listed under the EPBC Act and recorded in the study area (i.e. the Koala, Corben's Long-eared Bat, Large-eared Pied Bat, Pilliga Mouse and the Painted Honeyeater) has been mapped. Potential foraging habitat for the remaining two species (Superb Parrot and Regent Honeyeater) has also been mapped according to broad habitat types.

Bibliography

AMBS Ecology & Heritage (2019). Narrabri Underground Mine Longwalls 110 and 111 – Baseline Fauna Survey. Consultancy report to Whitehaven Coal Limited.

AMBS Ecology & Heritage (2020). Narrabri Underground Mine Stage 3 Extension Project – Flora Survey. Consultancy report to Whitehaven Coal Limited.

BirdLife Australia (2019a). The BirdLife Australia Working List of Australian Birds; Version 2.1 Downloaded from http://www.birdlife.org.au/documents/BWL.

BirdLife Australia (2019b). BirdLife Australia Website. Database search within 10 km of the study area boundary. [Accessed: November 2019].

Bureau of Meteorology (2020). Climate statistics for the Narrabri West Post Office (Station ID 053030) and Narrabri Airport Automatic Weather Station (AWS) (Station ID 054038). Accessed from the Bureau of Meteorology Website: http://www.bom.gov.au/climate/averages/tables/cw_050017.shtml [Accessed December 2019].

Cogger, H. (2014). Reptiles and Amphibians of Australia. Seventh edition, published by CSIRO Publishing.

Department of Environment and Climate Change (2008). Recovery Plan for the Koala (*Phascolarctos cinereus*). Published by the New South Wales Department of Environment and Climate Change, November 2008.

Department of Environment and Conservation (2004). Threatened Species Survey and Assessment: Guidelines for Developments and Activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, New South Wales.

Department of the Environment and Energy (2019a). EPBC Protected Matters Search Tool. Commonwealth Department of the Environment and Energy. Search area within 10 km of study area. Website: http://www.environment.gov.au/epbc/pmst/index.html. [Accessed December 2019].

Department of the Environment and Energy (2019b). Interim Biogeographic Regionalisation for Australia (IBRA), Version 7.

Department of the Environment, Water, Heritage and the Arts (2010). Survey Guidelines for Australia's Threatened Birds - Guidelines for Detecting Birds Listed as Threatened Under the *Environment Protection and Biodiversity Conservation Act 1999.* Department of the Environment, Water, Heritage and the Arts. Commonwealth of Australia.

Department of Planning, Industry and Environment (2019a). New South Wales BioNet Atlas Search. Database search within 10 km of the study area boundary. [Accessed: November 2019].

Department of Planning, Industry and Environment (2019b). Border Rivers Gwydir/Namoi Region 2.0 VIS 4467 vegetation map. New South Wales Office of Environment and Heritage, Sydney, Australia.

Department of Planning, Industry and Environment (2020a). Threatened Biodiversity Data Collection.
Website: https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

Department of Planning, Industry and Environment (2020b). Threatened Species Profile Database.
Website: https://www.environment.nsw.gov.au/threatenedspeciesapp/. Viewed in December 2019.

Department of Sustainability, Environment, Water, Population and Communities (2011a). Survey Guidelines for Australia's Threatened Reptiles. Department of Sustainability, Environment, Water, Population and Communities.

Department of Sustainability, Environment, Water, Population and Communities (2011b). Survey Guidelines for Australia's Threatened Mammals. Department of Sustainability, Environment, Water, Population and Communities.

Eco Logical Australia (2012a). Narrabri Mine LW 101 – 103: Biodiversity Management - Baseline Monitoring. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2012b). North-east Pilliga Forest - targeted threatened flora survey. Prepared for Santos Limited.

Eco Logical Australia (2014). Narrabri Coal Mine Stage 1 and 2 Biodiversity Offset Strategy. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015a). Narrabri Mine LW101-LW106: Biodiversity Management - 2015 Monitoring Report (Volume 1). Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2015b). Narrabri Mine LW101-105: Biodiversity Management - 2014 Monitoring Report (Volumes 1 and 2). Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016a). Narrabri Mine Biodiversity Offsets- 2016 Monitoring Report. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016b). Narrabri Mine LW101-LW106 Biodiversity - 2016 Monitoring Report. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2016c). Narrabri Gas Project: Ecological Impact Assessment. Prepared by Eco Logical Australia Pty Ltd for Santos NSW (Eastern) Pty Ltd, November 2016.

Eco Logical Australia (2018a). Narrabri Mine LW101-LW106 Biodiversity – 2017 Monitoring Report. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2018b). Narrabri South Exploration Program Flora and Fauna Impact Assessment. Prepared for Narrabri Coal Operations Pty Ltd.

Eco Logical Australia (2019). Fauna Surveys South of the Narrabri Underground Mine. Prepared for Whitehaven Coal Ltd.

Ecotone (2007). Narrabri Coal Project Ecological Assessment. Prepared by Ecotone Ecological Consultants Pty Ltd for Narrabri Coal Pty Ltd.

Ecotone (2009). Narrabri Coal Mine Stage 2 Longwall Project, Flora and Fauna Impact Assessment. Prepared by Ecotone Ecological Consultants Pty Ltd for R.W. Corkery & Co. Pty Ltd, November 2009.

Fitzgerald, M., Lazell, B., & Shine, R. (2010). Ecology and Conservation of the Pale-headed Snake (Hoplocephalus bitorquatus, Elapidae). Australian Zoologist 35 (2): 283 – 290.

Forestry Corporation of New South Wales (2019). Forestry Corporation of New South Wales Data provided to NCOPL.

Kavanagh, R. P., Stanton, M. A. and Brassil, T. (2007). Koalas Continue to Occupy Their Previous Home-Ranges After Selective Logging in Callitris-Eucalyptus Forest. *Wildlife Research*, 34: 94-107.

Keith D. (2006). Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT. New South Wales National Parks and Wildlife Service, Sydney.

Landmark Ecological Services (2012). The Ecological Values of the Pilliga East Forest and the Threats Posed by Coal Seam Gas Mining 2011-2012. A report prepared for the Northern Inland Council for the Environment and the Coonabarabran and Upper Castlereagh Catchment and Landcare Group.

National Parks and Wildlife Service (2000). Brigalow Belt South: Regional Assessment (Stage 1) Report on Preliminary Fauna Survey of Pilliga and Goonoo Forests, November 1999 to January 2000.

National Parks and Wildlife Service (2019). NPWS Fire History – Wildfires and Prescribed Burns Dataset. Published by the Department of Planning, Industry and Environment [Accessed November 2019].

Narrabri Coal Operations Pty Limited (2018). Narrabri Mine 2017 Annual Review.

Office of Environment and Heritage (2017). Biodiversity Assessment Methodology, prepared by the New South Wales Office of Environment and Heritage, August 2017.

Office of Environment and Heritage (2018a). 'Species Credit' Threatened Bats and Their Habitats. New South Wales survey guide for the Biodiversity Assessment Method.

Office of Environment and Heritage (2018b). A Review of Koala Tree Use Across New South Wales. Published by the New South Wales Office of Environment and Heritage, July 2018.

Phillips, S. and Callaghan, J. (2011). The Spot Assessment Technique: A Tool for Determining Localised Levels of Habitat Use by Koalas *Phascolarctos cinereus*. Australian Zoologist: 2011, Vol. 35, No. 3, pp. 774-780.

Reardon, T.B., McKenzie, N.L., Cooper, S.J.B., Appleton, B., Carthew, S. and Adams, M. (2014). A Molecular and Morphological Investigation of Species Boundaries and Phylogenetic Relationships in Australian Free-tailed Bats Mormopterus (Chiroptera: Molossidae). Australian Journal of Zoology, 62: 109-136.

Thackway, R. and Cresswell, I.D. (1995). An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program, Version 4.0. Australian Nature Conservation Agency, Canberra.

Van Dyck, S., Gynther, I. and Baker, A. (2013). Field Companion to the Mammals of Australia. Published by New Holland.

Wilson, S. and Swan, G. (2017). A Complete Guide to Reptiles of Australia. Fifth Edition. Published by Reed New Holland Publishers.

Appendix A: Fauna survey locations

AMBS survey locations

Survey site	Easting	Northing	Season	Technique
CPB01	772698	6619428	Winter	Call Playback - Owls
CPB02	775027	6619214	Winter	Call Playback - Owls and Bush Stone-curlew
CPB03	773763	6619334	Winter	Call Playback - Owls and Bush Stone-curlew
CPB04	772577	6618261	Winter	Call Playback - Owls
CPB05	774354	6617802	Winter	Call Playback - Owls
CPB06	773015	6616520	Winter	Call Playback - Owls and Bush Stone-curlew
CPB07	775005	6614976	Winter	Call Playback - Owls
CPB08	773689	6614647	Winter	Call Playback - Owls
CPB09	771712	6610383	Winter	Call Playback - Owls
CPB10	773731	6612304	Winter	Call Playback - Owls and Bush Stone-curlew
CPB11	773503	6611390	Winter	Call Playback - Owls
CPB12	773231	6610544	Winter	Call Playback - Owls and Bush Stone-curlew
CPB13	774339	6610968	Winter	Call Playback - Owls
CPB14	773149	6613856	Winter	Call Playback - Owls
CPB15	774434	6613447	Winter	Call Playback - Owls
CPB17	772841	6615590	Winter	Call Playback - Owls
CPB18	773922	6616212	Winter	Call Playback - Owls and Bush Stone-curlew
CPB19	775313	6616764	Winter	Call Playback - Owls
CPB20	773167	6617378	Winter	Call Playback - Owls
CPB21	772000	6617180	Winter	Call Playback - Owls
CPB22	771751	6611224	Winter	Call Playback - Owls
CPB23	772229	6614843	Winter	Call Playback - Owls
CPB24	771933	6613912	Winter	Call Playback - Owls
CPB25	771857	6612530	Winter	Call Playback - Owls
CPB26	772885	6612792	Winter	Call Playback - Owls
CQ01	775361	6617733	Winter	Camera Trap- Quoll
CQ02	776440	6617119	Winter	Camera Trap- Quoll
CQ03	773014	6618334	Winter	Camera Trap- Quoll
CQ04	772188	6617857	Winter	Camera Trap- Quoll
CQ05	773609	6618874	Winter	Camera Trap- Quoll
CQ06	773825	6619960	Winter	Camera Trap- Quoll
CQ07	772894	6619260	Winter	Camera Trap- Quoll
CQ08	773884	6617232	Winter	Camera Trap- Quoll
CQ09	773229	6616920	Winter	Camera Trap- Quoll
CQ10	773174	6617896	Winter	Camera Trap- Quoll
CQ11	772126	6616819	Winter	Camera Trap- Quoll
CQ12	772240	6618227	Winter	Camera Trap- Quoll
CQ13	772594	6617990	Winter	Camera Trap- Quoll
CQ14	775036	6619627	Winter	Camera Trap- Quoll
CQ15	774872	6611165	Winter	Camera Trap- Quoll
CQ16	774143	6611018	Winter	Camera Trap- Quoll
CQ17	774177	6612060	Winter	Camera Trap- Quoll
CQ18	775991	6610200	Winter	Camera Trap- Quoll
CQ19	773503	6610074	Winter	Camera Trap- Quoll
CQ20	773140	6608283	Winter	Camera Trap- Quoll
SP01	774449	6619347	Spring	Superb Parrot Targeted Point Survey
SP02	775418	6617479	Spring	Superb Parrot Targeted Point Survey
SP03	775330	6616853	Spring	Superb Parrot Targeted Point Survey
SP04	774175	6609224	Spring	Superb Parrot Targeted Point Survey
Ano01	774449	6619347	Spring	Reptile Targeted Survey
Ano02	775418	6617479	Spring	Reptile Targeted Survey
Ano03	773705	6610056	Spring	Reptile Targeted Survey
Ano04	774220	6618998	Spring	Reptile Targeted Survey
Ano05	774244	6610015	Spring	Reptile Targeted Survey
Ano06	773503	6609568	Spring	Reptile Targeted Survey
Ano07	775400	6616892	Spring	Reptile Targeted Survey

Survey site	Easting	Northing	Season	Technique
Ano08	775330	6616853	Spring	Reptile Targeted Survey
SAT01	773705	6610056	Spring	Koala SAT Survey
SAT02	773013	6618354	Spring	Koala SAT Survey
SAT03	774449	6619347	Spring	Koala SAT Survey
SAT04	775418	6617479	Spring	Koala SAT Survey
SAT05	774224	6618201	Spring	Koala SAT Survey
SAT06	774119	6612110	Summer	Koala SAT Survey
SAT07	774047	6610644	Summer	Koala SAT Survey
T01	774224	6618201	Spring	Pitfall Traps
T02	773977	6617255	Spring	Pitfall Traps
T03	772969	6619226	Spring	Pitfall Traps
T04	773044	6616764	Spring	Pitfall Traps
T05	773134	6618422	Spring	Pitfall Traps
T06	772430	6618399	Spring	Pitfall Traps
T07	772188	6617623	Spring	Pitfall Traps
T08	772156	6616826	Spring	Pitfall Traps
T09	774119	6612110	Summer	Pitfall Traps
T10	774047	6610644	Summer	Pitfall Traps
T11	773780	6610192	Summer	Pitfall Traps
T12	774148	6609226	Summer	Pitfall Traps
RS01	774224	6618201	Spring	Diurnal Reptile Search
RS02	773977	6617255	Spring	Diurnal Reptile Search
RS03	772969	6619226	Spring	Diurnal Reptile Search
RS04	773044	6616764	Spring	Diurnal Reptile Search
RS05	773134	6618422	Spring	Diurnal Reptile Search
RS06	772430	6618399	Spring	Diurnal Reptile Search
RS07	772188	6617623	Spring	Diurnal Reptile Search
RS08	772156	6616826	Spring	Diurnal Reptile Search
RS09	774119	6612110	Summer	Diurnal Reptile Search
RS10	774047	6610644	Summer	Diurnal Reptile Search
RS11	773780	6610192	Summer	Diurnal Reptile Search
RS12	774148	6609226	Summer	Diurnal Reptile Search
BC01	774449	6619347	Spring	Diurnal Bird Survey
BC02	775418	6617479	Spring	Diurnal Bird Survey
BC03	775330	6616853	Spring	Diurnal Bird Survey
BC04	774224	6618201	Spring	Diurnal Bird Survey
BC05	773977	6617255	Spring	Diurnal Bird Survey
BC06	772969	6619226	Spring	Diurnal Bird Survey
BC07	773044	6616764	Spring	Diurnal Bird Survey
BC08	773134	6618422	Spring	Diurnal Bird Survey
BC09	772430	6618399	Spring	Diurnal Bird Survey
BC10	772188	6617623	Spring	Diurnal Bird Survey
BC11	772156	6616826	Spring	Diurnal Bird Survey
BC12	774119	6612110	Summer	Diurnal Bird Survey
BC13	774047	6610644	Summer	Diurnal Bird Survey
BC14	773780	6610192	Summer	Diurnal Bird Survey
BC15	774148	6609226	Summer	Diurnal Bird Survey
C01	774224	6618201	Spring	Camera Trap - All Fauna
C02	773977	6617255	Spring	Camera Trap - All Fauna
C03	772969	6619226	Spring	Camera Trap - All Fauna
C04	773044	6616764	Spring	Camera Trap - All Fauna
C05	773134	6618422	Spring	Camera Trap - All Fauna
C06	772430	6618399	Spring	Camera Trap - All Fauna
C07	772188	6617623	Spring	Camera Trap - All Fauna
C08	772156	6616826	Spring	Camera Trap - All Fauna
C09	774119	6612110	Spring	Camera Trap - All Fauna
C10	774047	6610644	Spring	Camera Trap - All Fauna
C11	773780	6610192	Spring	Camera Trap - All Fauna
C12	774148	6609226	Spring	Camera Trap - All Fauna
T01	774224	6618201	Spring	Elliott Traps Ground
T02	773977	6617255	Spring	Elliott Traps Ground

Survey site	Easting	Northing	Season	Technique
T03	772969	6619226	Spring	Elliott Traps Ground
T04	773044	6616764	Spring	Elliott Traps Ground
T05	773134	6618422	Spring	Elliott Traps Ground
T06	772430	6618399	Spring	Elliott Traps Ground
T07	772188	6617623	Spring	Elliott Traps Ground
T08	772156	6616826	Spring	Elliott Traps Ground
T09	774119	6612110	Summer	Elliott Traps Ground
T10	774047	6610644	Summer	Elliott Traps Ground
T11	773780	6610192	Summer	Elliott Traps Ground
T12	774148	6609226	Summer	Elliott Traps Ground
T01	774224	6618201	Spring	Funnel Traps
T02	773977	6617255	Spring	Funnel Traps
T03	772969	6619226	Spring	Funnel Traps
T04	773044	6616764	Spring	Funnel Traps
T05	773134	6618422	Spring	Funnel Traps
T06	772430	6618399	Spring	Funnel Traps
T07	772188	6617623	Spring	Funnel Traps
T08	772156	6616826	Spring	Funnel Traps
T09	774119	6612110	Summer	Funnel Traps
T10	774047	6610644	Summer	Funnel Traps
T11	773780	6610192	Summer	Funnel Traps
T12	774148	6609226	Summer	Funnel Traps

AMBS Superb Parrot transects

Transect	Easting (start)	Northing (start)	Easting (end)	Northing (end)	Technique
SPT01	774469	6619257	774336	6619195	Superb Parrot transect
SPT02	775390	6617742	775626	6617364	Superb Parrot transect
SPT03	775755	6616882	775380	6616865	Superb Parrot transect
SPT04	773568	6618788	773507	6618541	Superb Parrot transect
SPT05	775028	6619788	774519	6619287	Superb Parrot transect
SPT06	772440	6617521	772063	6617089	Superb Parrot transect
SPT07	773916	6609094	774275	6609330	Superb Parrot transect
SPT08	773788	6610138	773715	6610004	Superb Parrot transect
SPT09	773726	6618922	773580	6618799	Superb Parrot transect
SPT10	773755	6610015	774132	6609705	Superb Parrot transect
SPT11	773942	6609583	773567	6609382	Superb Parrot transect
SPT12	775404	6616891	774752	6616577	Superb Parrot transect

ELA Survey Locations

Site name	Easting	Northing	Technique
WB1	772932	6615750	Winter bird survey
WB2	773054	6615232	Winter bird survey
WB3	772934	6608843	Winter bird survey
WB4	771517	6608052	Winter bird survey
WB5	771744	6609813	Winter bird survey
WB6	771788	6616261	Winter bird survey
WB7	771932	6614910	Winter bird survey
WB8	771866	6612802	Winter bird survey
WB9	771754	6611823	Winter bird survey
WB10	771940	6611464	Winter bird survey
WB11	772636	6611904	Winter bird survey
WB12	773814	6614724	Winter bird survey
WB13	772461	6615054	Winter bird survey
WB14	774241	6614059	Winter bird survey
WB15	773171	6613196	Winter bird survey
WB16	773541	6613043	Winter bird survey
WB17	772897	6614143	Winter bird survey
WB18	773595	6612312	Winter bird survey
WB19	773662	6611676	Winter bird survey
WB20	773554	6611070	Winter bird survey

Site name	Easting	Northing	Technique
WB21	772985	6610965	Winter bird survey
WB22	773155	6610485	Winter bird survey
WB23	773069	6609810	Winter bird survey
WB24	772391	6615916	Winter bird survey
WB25	773039	6608250	Winter bird survey
WB26	772346	6609135	Winter bird survey
WB27	771437	6610566	Winter bird survey
WB28	771852	6613575	Winter bird survey
WB29	771895	6614286	Winter bird survey
WB30	773873	6616242	Winter bird survey
WB31	774974	6614975	Winter bird survey
WB32	773722	6615631	Winter bird survey
WB33	772612	6613195	Winter bird survey
WB34	773270	6614704	Winter bird survey
WB35	773672	6613950	Winter bird survey
WB36	772444	6616542	Winter bird survey
WB37	775619	6614843	Winter bird survey
WB38	776232	6615942	Winter bird survey
WB39	775704	6615930	Winter bird survey
WB40	774611	6616016	Winter bird survey
FA01	771763	6616214	Elliott traps, hair tubes, camera traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA02	772504	6614987	Elliott traps, hair tubes, camera traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA03	772085	6609877	Elliott traps, hair tubes, camera traps, pitfall traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA05	773778	6616253	Elliott traps, hair tubes, camera traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA06	771808	6613585	Elliott traps, hair tubes, camera traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA07	775598	6615944	Elliott traps, hair tubes, camera traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA08	776233	6616072	Elliott traps, hair tubes, camera traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA09	774940	6614949	Elliott traps, hair tubes, camera traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA10	774310	6613531	Elliott traps, hair tubes, camera traps, pitfall traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA11	772567	6613172	Elliott traps, hair tubes, camera traps, pitfall traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA12	772916	6614175	Elliott traps, hair tubes, camera traps, pitfall traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA13	772929	6611006	Elliott traps, hair tubes, camera traps, pitfall traps, funnel traps, Song Meters, harp traps,

Site name	Easting	Northing	Technique
			diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA14	773488	6612238	Elliott traps, hair tubes, camera traps, pitfall traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA20	773051	6610366	Elliott traps, hair tubes, camera traps, pitfall traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA21	771631	6611815	Elliott traps, hair tubes, camera traps, pitfall traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA22	771356	6607962	Elliott traps, hair tubes, camera traps, pitfall traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
FA23	773215	6609571	Elliott traps, hair tubes, camera traps, pitfall traps, funnel traps, Song Meters, harp traps, diurnal bird surveys, reptile surveys, spotlighting, call playback.
Additional harp traps	773219	6610297	Harp traps, spotlighting
Long-term IR camera 1	771521	6608059	Camera Trap - All Fauna
Long-term IR camera 2	771813	6609766	Camera Trap - All Fauna
Long-term IR camera 3	772936	6608913	Camera Trap - All Fauna
Long-term IR camera 4	771991	6614971	Camera Trap - All Fauna
Long-term IR camera 5	773520	6613083	Camera Trap - All Fauna
SAT1	775620	6616027	Koala SAT Survey
SAT2	776245	6616048	Koala SAT Survey
SAT3	773837	6616273	Koala SAT Survey
SAT4	772965	6614918	Koala SAT Survey
SAT5	771969	6614939	Koala SAT Survey
SAT6	773121	6615292	Koala SAT Survey
SAT7	773202	6609325	Koala SAT Survey
SAT8	771308	6608046	Koala SAT Survey

Appendix B: Fauna species list

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
Amphibia	Hylidae	Green Tree Frog	*Litoria caerulea*		
		Broad-palmed Frog	*Litoria latopalmata*		
		Peron's Tree Frog	*Litoria peronii*		
		Desert Tree Frog	*Litoria rubella*		
	Limnodynastidae	Spotted Grass Frog	*Limnodynastes tasmaniensis*		
		Northern Banjo Frog	*Limnodynastes terraereginae*		
		Sudell's Frog	*Neobatrachus sudelli*		
		Ornate Burrowing Frog	*Platyplectrum ornatum*		
	Myobatrachidae	Eastern Sign-bearing Froglet	*Crinia parinsignifera*		
Reptilia	Agamidae	Burns' Dragon	*Amphibolurus burnsi*		
		Jacky Lizard	*Amphibolurus muricatus*		
		Common Nobbi Dragon	*Diporiphora nobbi*		
		Common Bearded Dragon	*Pogona barbata*		
	Carphodactylidae	Common Thick-tailed Gecko	*Underwoodisaurus milii*		
	Diplodactylidae	Eastern Stone Gecko	*Diplodactylus vittatus*		
		Ocellated velvet gecko	*Oedura monilis*		
		Eastern Spiny-tailed Gecko	*Strophurus williamsi*		
	Elapidae	Red-naped Snake	*Furina diadema*		
		Blue-bellied Black Snake	*Pseudechis guttatus*		
	Gekkonidae	Dubious Dtella	*Gehyra dubia*		
		Bynoe's Gecko	*Heteronotia binoei*		
	Scincidae	Ragged Snake-eyed Skink	*Cryptoblepharus pannosus*		
		Eastern Striped Ctenotus	*Ctenotus robustus*		
		Tree Skink	*Egernia striolata*		
		Grass Skink	*Lampropholis guichenoti*		
		Bougainville's Slider	*Lerista bougainvillii*		
		Eastern Robust Slider	*Lerista punctatovittata*		
		Dwarf Three-toed Slider	*Lerista timida*		
		White's Skink	*Liopholis whitii*		
		Tree-base Litter-skink	*Lygisaurus foliorum*		
		Common Dwarf Skink	*Menetia greyii*		
		Boulenger's Morethia	*Morethia boulengeri*		
	Varanidae	Gould's Goanna	*Varanus gouldii*		
		Lace Monitor	*Varanus varius*		
Aves	Accipitridae	Brown Goshawk	*Accipiter fasciatus*		
		Wedge-tailed Eagle	*Aquila audax*		
		Pacific Baza	*Aviceda subcristata*		

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
	Anatidae	Grey Teal	*Anas gracilis*		
		Pacific Black Duck	*Anas superciliosa*		
		Australian Wood Duck	*Chenonetta jubata*		
		Plumed Whistling-duck	*Dendrocygna eytoni*		
	Aegothelidae	Australian Owlet-nightjar	*Aegotheles cristatus*		
	Apodidae	White-throated Needletail	*Hirundapus caudacutus*		V, M
	Eurostopodidae	White-throated Nightjar	*Eurostopodus mystacalis*		
	Podargidae	Tawny Frogmouth	*Podargus strigoides*		
	Charadriidae	Black-fronted Dotterel	*Elseyornis melanops*		
		Masked Lapwing	*Vanellus miles*		
		Banded Lapwing	*Vanellus tricolor*		
	Turnicidae	Painted Button-quail	*Turnix varius*		
	Columbidae	Bar-shouldered Dove	*Geopelia humeralis*		
		Peaceful Dove	*Geopelia placida*		
		Crested Pigeon	*Ocyphaps lophotes*		
		Common Bronzewing	*Phaps chalcoptera*		
	Alcedinidae	Laughing Kookaburra	*Dacelo novaeguineae*		
		Sacred Kingfisher	*Todiramphus sanctus*		
	Meropidae	Rainbow Bee-eater	*Merops ornatus*		
	Cuculidae	Fan-tailed Cuckoo	*Cacomantis flabelliformis*		
		Horsfield's Bronze-Cuckoo	*Chalcites basalis*		
		Shining Bronze-Cuckoo	*Chalcites lucidus*		
		Black-eared Cuckoo	*Chalcites osculans*		
		Pallid Cuckoo	*Heteroscenes pallidus*		
		Channel-billed Cuckoo	*Scythrops novaehollandiae*		
	Falconidae	Brown Falcon	*Falco berigora*		
	Phasianidae	Stubble Quail	*Coturnix pectoralis*		
	Acanthizidae	Inland Thornbill	*Acanthiza apicalis*		
		Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		
		Striated Thornbill	*Acanthiza lineata*		
		Yellow Thornbill	*Acanthiza nana*		
		Brown Thornbill	*Acanthiza pusilla*		
		Buff-rumped Thornbill	*Acanthiza reguloides*		
		Chestnut-rumped Thornbill	*Acanthiza uropygialis*		
		Chestnut-rumped Heathwren	*Calamanthus pyrrhopygius*		
		Speckled Warbler	*Chthonicola sagittata*	V	
		Western Gerygone	*Gerygone fusca*		
		White-throated Gerygone	*Gerygone olivacea*		
		White-browed Scrubwren	*Sericornis frontalis*		

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
		Weebill	*Smicrornis brevirostris*		
	Artamidae	Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	
		Masked Woodswallow	*Artamus personatus*		
		White-browed Woodswallow	*Artamus superciliosus*		
		Pied Butcherbird	*Cracticus nigrogularis*		
		Grey Butcherbird	*Cracticus torquatus*		
		Australian Magpie	*Gymnorhina tibicen*		
		Pied Currawong	*Strepera graculina*		
	Campephagidae	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*		
		Cicadabird	*Edolisoma tenuirostris*		
		White-winged Triller	*Lalage tricolor*		
	Cinclosomatidae	Spotted Quail-thrush	*Cinclosoma punctatum*		
	Climacteridae	White-throated Treecreeper	*Cormobates leucophaea*		
	Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*		
		Apostlebird	*Struthidea cinerea*		
	Corvidae	Australian Raven	*Corvus coronoides*		
		Little Raven	*Corvus mellori*		
		Torresian Crow	*Corvus orru*		
	Dicaeidae	Mistletoebird	*Dicaeum hirundinaceum*		
	Estrildidae	Diamond Firetail	*Stagonopleura guttata*	V	
		Double-barred Finch	*Taeniopygia bichenovii*		
		Zebra Finch	*Taeniopygia guttata*		
	Hirundinidae	Welcome Swallow	*Hirundo neoxena*		
		Tree Martin	*Petrochelidon nigricans*		
	Locustellidae	Rufous Songlark	*Cincloramphus mathewsi*		
		Little Grassbird	*Poodytes gramineus*		
	Maluridae	Superb Fairy-wren	*Malurus cyaneus*		
		Variegated Fairy-wren	*Malurus lamberti*		
		White-winged Fairy-wren	*Malurus leucopterus*		
	Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*		
		Eastern Spinebill	*Acanthorhynchus tenuirostris*		
		Red Wattlebird	*Anthochaera carunculata*		
		Yellow-faced Honeyeater	*Caligavis chrysops*		
		Blue-faced Honeyeater	*Entomyzon cyanotis*		
		Singing Honeyeater	*Gavicalis virescens*		
		Painted Honeyeater	*Grantiella picta*	V	V
		Brown Honeyeater	*Lichmera indistincta*		
		Yellow-throated Miner	*Manorina flavigula*		
		Noisy Miner	*Manorina melanocephala*		

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
		Brown-headed Honeyeater	*Melithreptus brevirostris*		
		White-naped Honeyeater	*Melithreptus lunatus*		
		Scarlet Honeyeater	*Myzomela sanguinolenta*		
		White-eared Honeyeater	*Nesoptilotis leucotis*		
		Little Friarbird	*Philemon citreogularis*		
		Noisy Friarbird	*Philemon corniculatus*		
		Striped Honeyeater	*Plectorhyncha lanceolata*		
		White-plumed Honeyeater	*Ptilotula penicillata*		
	Monarchidae	Magpie-lark	*Grallina cyanoleuca*		
		Restless Flycatcher	*Myiagra inquieta*		
		Leaden Flycatcher	*Myiagra rubecula*		
	Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	V	
	Oriolidae	Olive-backed Oriole	*Oriolus sagittatus*		
	Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*		
		Golden Whistler	*Pachycephala pectoralis*		
		Rufous Whistler	*Pachycephala rufiventris*		
	Pardalotidae	Spotted Pardalote	*Pardalotus punctatus*		
		Striated Pardalote	*Pardalotus striatus*		
	Petroicidae	Eastern Yellow Robin	*Eopsaltria australis*		
		Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	
		Jacky Winter	*Microeca fascinans*		
		Scarlet Robin	*Petroica boodang*	V	
		Red-capped Robin	*Petroica goodenovii*		
	Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*		
		Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	
	Ptilonorhynchidae	Spotted Bowerbird	*Ptilonorhynchus maculatus*		
	Rhipiduridae	Grey Fantail	*Rhipidura fuliginosa*		
		Willie Wagtail	*Rhipidura leucophrys*		
	Sturnidae	Common Myna *	*Acridotheres tristis*		
		Common Starling *	*Sturnus vulgaris*		
	Zosteropidae	Silvereye	*Zosterops lateralis*		
	Ardeidae	White-faced Heron	*Egretta novaehollandiae*		
	Threskiornithidae	Glossy Ibis	*Plegadis falcinellus*		M
	Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*		
	Cacatuidae	Sulphur-crested Cockatoo	*Cacatua galerita*		
		Little Corella	*Cacatua sanguinea*		
		Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	
		Galah	*Eolophus roseicapilla*		
		Yellow-tailed Black-Cockatoo	*Zanda funereus*		
	Psittaculidae	Australian King-Parrot	*Alisterus scapularis*		

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
		Red-winged Parrot	*Aprosmictus erythropterus*		
		Australian Ringneck	*Barnardius zonarius*		
		Musk Lorikeet	*Glossopsitta concinna*		
		Little Lorikeet	*Glossopsitta pusilla*	V	
		Blue Bonnet	*Northiella haematogaster*		
		Crimson Rosella	*Platycercus elegans*		
		Eastern Rosella	*Platycercus eximius*		
		Red-rumped Parrot	*Psephotus haematonotus*		
	Strigidae	Southern Boobook	*Ninox boobook*		
	Casuariidae	Emu	*Dromaius novaehollandiae*		
Mammalia	Bovidae	Cattle *	*Bos taurus*		
		Goat *	*Capra hircus*		
		Sheep *	*Ovis aries*		
	Suidae	Pig *	*Sus scrofa*		
	Canidae	Dog *	*Canis lupus*		
		Red Fox *	*Vulpes vulpes*		
	Felidae	Cat *	*Felis catus*		
	Emballonuridae	Yellow-bellied Sheathtail-Bat	*Saccolaimus flaviventris*	V	
	Molossidae	White-striped Free-tailed Bat	*Austronomus australis*		
		Inland Free-tailed Bat	*Mormopterus (Ozimops) petersi*		
		South-eastern Free-tailed bat	*Mormopterus (Ozimops) planiceps*		
	Rhinolophidae	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*		
	Vespertilionidae	Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
		Gould's Wattled Bat	*Chalinolobus gouldii*		
		Chocolate Wattled Bat	*Chalinolobus morio*		
		Little Pied Bat	*Chalinolobus picatus*	V	
		Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V
		Lesser Long-eared Bat	*Nyctophilus geoffroyi*		
		Gould's Long-eared Bat	*Nyctophilus gouldi*		
		Inland Broad-nosed Bat	*Scotorepens balstoni*		
		Little Broad-nosed Bat	*Scotorepens greyii*		
		Eastern Broad-nosed Bat	*Scotorepens orion*		
		Eastern Cave Bat	*Vespadelus troughtoni*	V	
		Little Forest Bat	*Vespadelus vulturnus*		
	Dasyuridae	Yellow-footed Antechinus	*Antechinus flavipes*		
		Fat-tailed Dunnart	*Sminthopsis crassicaudata*		
	Burramyidae	Eastern Pygmy-possum	*Cercartetus nanus*	V	

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
	Macropodidae	Black-striped Wallaby	*Macropus dorsalis*	E	
		Eastern Grey Kangaroo	*Macropus giganteus*		
		Common Wallaroo	*Macropus robustus*		
		Red-necked Wallaby	*Macropus rufogriseus*		
		Red Kangaroo	*Macropus rufus*		
		Swamp Wallaby	*Wallabia bicolor*		
	Petauridae	Sugar Glider	*Petaurus breviceps*		
	Phalangeridae	Common Brushtail Possum	*Trichosurus vulpecula*		
	Phascolarctidae	Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	*Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)*	V	V
	Pseudocheiridae	Common Ringtail Possum	*Pseudocheirus peregrinus*		
	Vombatidae	Common Wombat	*Vombatus ursinus*		
	Leporidae	European Brown Hare *	*Lepus europaeus*		
		European Rabbit *	*Oryctolagus cuniculus*		
	Tachyglossidae	Short-beaked Echidna	*Tachyglossus aculeatus*		
	Muridae	House Mouse *	*Mus musculus*		
		Pilliga Mouse	*Pseudomys pilligaensis*	V	V

Note:

[1] Conservation status under the *Biodiversity Conservation Act 2016* (current as at April 2020). E = Endangered, V = Vulnerable.

[2] Conservation status under the *Environment Protection and Biodiversity Conservation Act 1999* (current as at April 2020). V = Vulnerable, M = Migratory.

* = Non-native species, including livestock and domestic animals.

The Central Bearded Dragon (*Pogona vitticeps*) was recorded by ELA but is unlikely to occur in the area. It was probably misidentified and should be the Common Bearded Dragon (*Pogona barbata*).

ATTACHMENT D1

VEGETATION INTEGRITY (SITE CONDITION) DATA (AMBS, 2020a)

Table D1
Vegetation Integrity (Site Condition) Data

Plot Number	Plot ID	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Regeneration	High Threat Exotic
1	ELA0054	55	DNG	55	774616	6614655	110	0	2	3	6	0	1	0	2	12	2	0	0	0	0	95.2	0	0	0	0	0	0	0	4
2	ELA0085	55	DNG	55	774905	6614626	90	1	5	10	10	0	1	0	6	37	1	0	0	0	0	33	0	0	0	0	0	0	1	1
3	ELA0086	55	DNG	55	775045	6613593	90	0	6	11	10	1	3	0	2	53	1	0	0	0	0	31	0	0	0	0	0	0	0	1
4	ELA0087	55	DNG	55	775729	6613440	0	0	5	7	10	1	2	0	1	48	3	1	0	0	0	38	0	0	0	0	0	0	0	1
5	ELA0103	55	DNG	55	775446	6614337	90	0	3	10	5	0	1	0	1	36	1	0	0	0	0	57	0	0	0	0	0	0	0	2
6	ELA0104	55	DNG	55	775385	6614644	40	0	5	10	6	0	1	0	1	8	1	0	0	0	0	19	0	0	0	0	0	0	0	0
7	N3BP0078	55	DNG	55	774690	6618471	337	2	5	8	9	0	2	2.1	0.5	27.2	0.9	0	0.2	2	0	18	0	0	0	0	1	0	1	0.4
8	ELA0002	55	Good	55	774983	6614969	350	2	5	3	11	0	8	25	1	12	2	0	1	0	0	76.8	130	0	1	1	1	0	0	2
9	ELA0053	55	Good	55	774981	6614844	40	2	5	7	10	0	2	30	2	31	6	0	0	1	0	88.8	10	1	1	1	1	0	0	2
10	ELA0084	55	Good	55	774988	6615047	0	1	10	9	6	0	2	15	1	16	1	0	0	0	0	74	122	0	1	1	1	0	0	1
11	N3BP0059a	55	Good	55	775156	6618683	0	2	8	4	3	0	3	15.2	9.6	0.4	0.4	0	0.3	16	1	56	102	1	1	1	1	0	0	0.3
12	N3BP0076	55	Good	55	775061	6618272	261	1	7	3	7	0	3	35	1.6	2.4	0.7	0	0.3	10	2	66.6	109	1	1	1	1	1	1	0.1
13	ELA0039	88	DNG	55	773671	6615668	215	2	3	15	18	1	1	0	1	53	3	0	0	0	0	73	29	1	0	0	0	0	1	2
14	ELA0040	88	DNG	55	773858	6616060	54	2	5	11	10	1	3	43	2	2	2	1	0	0	0	72	8	1	1	1	1	0	1	1
15	ELA0041	88	DNG	55	774012	6616291	0	3	5	14	14	1	4	21	1	7	2	0	1	0	1	94	35	1	1	1	1	0	1	0
16	ELA0042	88	DNG	55	774200	6616020	50	0	1	9	9	1	0	0	1	43	2	1	0	0	0	80.4	1	0	0	0	0	0	0	3
17	ELA0081	88	DNG	55	774563	6616161	160	0	2	8	5	0	2	0	0	61	1	0	0	0	0	66	0	0	0	0	0	0	1	1
18	ELA0082	88	DNG	55	774611	6615472	0	1	10	11	4	0	4	5	3	36	0	0	1	0	0	53	4	0	1	0	1	0	0	2
19	ELA0083	88	DNG	55	773709	6615324	270	2	1	11	2	1	1	1	0	74	0	1	0	0	0	44	0	0	0	0	0	0	1	1
20	ELA0107	88	DNG	55	773650	6615636	200	2	2	10	3	1	1	0	0	13	1	0	0	0	0	51	5	1	1	1	0	0	1	2

Table D1 (Continued)
Vegetation Integrity (Site Condition) Data

Plot Number	Plot ID	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Regeneration	High Threat Exotic
21	ELA0108	88	DNG	55	773790	6615956	20	3	2	9	4	0	0	6	1	16	7	0	0	0	0	22.6	0	1	1	0	0	0	1	1
22	ELA0109	88	DNG	55	773991	6616208	20	0	3	9	3	0	1	0	1	1	5	0	0	0	0	24	0	1	1	1	0	0	1	0
23	ELA0111	88	DNG	56	774820	6615894	100	0	2	17	4	1	2	0	0	27	1	0	0	0	0	63	0	0	0	0	0	0	0	1
24	N3BP0069a	88	DNG	55	774266	6619723	140	0	0	5	10	1	0	0	0	47.6	1	0.1	0	0	0	18.6	0	0	0	0	0	0	0	0
25	ELA0027	88	Good	55	773883	6615087	8	5	5	15	14	2	3	14	12	7	2	1	1	2	3	96.6	70	1	1	1	1	1	1	1
26	ELA0043	88	Good	55	774102	6616125	37	4	4	14	17	1	1	16	1	12	2	0	0	0	0	89.6	72	1	1	1	1	0	1	1
27	ELA0058	88	Good	55	774795	6613397	265	4	4	4	11	1	2	52	14	14	7	3	0	1	1	93	20	1	1	1	0	1	1	1
28	ELA0060	88	Good	55	774276	6612695	155	7	9	4	9	2	1	48	17	16	8	2	2	0	6	95.4	83	1	1	1	1	0	1	1
29	ELA0065	88	Good	55	773436	6612919	345	3	13	5	10	1	4	25	51	16	2	0	2	0	9	95.4	35	1	1	1	1	0	1	0
30	ELA0093	88	Good	55	773880	6615170	340	4	5	9	6	0	2	19	3	17	1	0	0	0	2	67	16	1	1	1	1	0	1	0
31	ELA0110	88	Good	55	773845	6615622	30	6	3	19	6	1	1	27	1	5	1	0	0	0	0	45.6	55	1	1	1	1	0	1	0
32	N3BP0058a	88	Good	55	774447	6619231	238	5	9	12	8	1	3	45.3	10.9	7.1	1.1	0.1	0.3	3	2	77	29	1	1	1	1	1	1	0.2
33	N3BP2004	88	Good	55	775266	6610173	175	6	15	6	7	1	1	20.6	16.9	3.4	0.7	0.1	0.1	2	2	44	49	1	1	0	1	1	1	0.2
34	N3BP2006	88	Good	55	774300	6610361	178	2	6	3	5	1	4	20.1	20.5	0.3	0.5	0.1	0.4	0	0	52	30.5	1	1	1	1	0	1	0.1
35	N3BP0067a	88	Moderate	55	774560	6619822	258	1	1	5	7	1	0	45	2	0.7	0.7	1	0	0	0	17.4	7	1	1	1	0	0	1	0
36	N3BP0068a	88	Moderate	55	774532	6619711	242	1	2	3	3	1	0	55	0.6	0.7	0.3	0.2	0	1	0	27.8	6	1	1	0	0	1	1	0.1
37	N3BP0072	141	Good	55	772321	6620480	212	1	6	4	7	1	2	2	76.5	0.4	0.7	0.1	0.2	0	0	84.6	5	1	1	1	1	0	1	0
38	N3BP0073	141	Good	55	772003	6620250	348	2	8	3	7	1	0	15	45.7	1.6	0.7	0.5	0	0	0	64	38	1	1	1	1	0	1	0
39	N3BP0000a	206	Good	55	773860	6610704	213	4	7	7	6	1	4	35.7	1.3	12.6	0.6	0.1	0.4	3	4	39.8	42	1	1	1	1	1	1	0
40	N3BP0060a	206	Good	55	774133	6610714	175	6	5	6	9	1	3	36.2	0.6	16.4	1	0.1	0.3	1	7	41	14	1	1	1	1	0	1	0.2

Table D1 (Continued)
Vegetation Integrity (Site Condition) Data

Plot Number	Plot ID	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Regeneration	High Threat Exotic
41	ELA0062	244	DNG	55	775826	6613184	100	1	2	7	7	1	2	1	1	52	2	2	0	0	0	76.2	0	0	0	0	0	0	1	1
42	N3BP0051a	244	DNG	55	776045	6618574	204	2	0	9	10	1	1	0.2	0	9.2	1.1	0.1	0.1	0	0	11	0	1	0	0	0	0	1	1.1
43	N3BP2000	244	DNG	55	775439	6619314	164	2	3	8	11	1	3	0.2	0.5	2.7	1.1	0.1	0.3	0	0	0.3	0	0	0	0	0	0	1	0.2
44	N3BP2001	244	DNG	55	775377	6618262	348	0	4	5	7	0	1	0	0.4	0.5	0.7	0	0.1	0	0	0	0	0	0	0	0	0	0	0
45	N3BP2007	244	DNG	55	775330	6617075	165	1	3	9	11	1	1	0.1	0.3	2.8	1.2	0.1	0.1	0	0	6	0	0	0	0	0	0	1	0
46	ELA0059	244	Good	55	775267	6612686	120	4	7	10	9	1	4	33	50	15	2	1	1	0	4	82.2	67	1	1	1	1	0	1	1
47	ELA0061	244	Good	55	776068	6613152	95	3	2	13	10	0	1	46	2	26	10	0	0	1	0	75	66	1	1	1	1	1	1	1
48	N3BP2002	244	Good	55	775163	6617940	155	2	3	5	5	1	1	0.3	0.3	0.5	0.5	0.1	0.1	0	0	2.8	30	0	1	0	0	0	1	0
49	N3BP2003	244	Good	55	775298	6616698	326	3	3	8	9	2	1	11	0.3	12.6	0.9	0.2	0.1	1	0	26	2	1	1	1	1	1	0	0
50	ELA0020	399	Good	55	772939	6614638	165	3	13	6	4	1	0	16	27	3	3	0	0	1	2	35	58	1	1	1	0	1	1	0
51	ELA0022	399	Good	55	772977	6614907	40	4	12	16	8	1	1	12	32	11	2	0	0	0	4	56	134	0	1	1	1	0	1	0
52	ELA0024	399	Good	55	773038	6615182	180	3	8	12	14	1	1	11	12	15	4	0	0	0	4	51	45	1	1	1	1	0	1	0
53	ELA0067	399	Good	55	773507	6613299	265	3	10	6	15	1	3	35	35	32	21	1	1	0	0	88.6	44	1	1	1	1	0	1	0
54	N3BP0050a	399	Good	55	772997	6618321	186	2	10	8	8	1	2	15.5	43.4	3.6	5.7	0.1	0.2	0	5	54	20	1	1	1	1	0	1	0
55	N3BP0090	399	Good	55	773182	6618469	24	3	12	7	4	0	2	25.3	27.2	1.1	0.4	0	0.2	1	7	75	47	1	1	1	1	1	1	0
56	ELA0038	399	Moderate	55	773529	6615555	50	1	3	14	14	1	2	0	3	40	2	1	1	0	0	98	19	1	1	0	0	0	1	1
57	ELA0106	399	Moderate	55	773475	6615303	30	2	2	3	2	1	0	7	2	7	4	0	0	0	0	7.8	3	1	1	1	0	0	1	0
58	N3BP0091	399	Moderate	55	773575	6618772	91	3	8	4	5	1	2	7.1	15.8	6.6	0.5	0.5	0.2	0	0	19	0	1	1	1	1	0	1	0
59	ELA0037	401	Good	55	773869	6616361	335	4	9	11	8	1	3	32	2	2	1	0	0	2	1	90	40	1	1	1	1	1	1	1
60	ELA0094	401	Good	55	773837	6616272	0	5	4	11	5	1	1	32	0	7	1	0	0	0	0	84	29	1	1	1	1	0	1	0

Table D1 (Continued)
Vegetation Integrity (Site Condition) Data

Plot Number	Plot ID	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Regeneration	High Threat Exotic
61	N3BP0084	401	Good	55	774015	6616495	232	4	6	9	10	1	3	30.5	0.8	26.8	1	0.1	0.3	0	4	79	44	1	1	1	0	0	1	0
62	ELA0001	404	Good	55	774002	6615189	270	4	2	11	9	1	4	50	0	3	1	0	0	1	0	92	44	0	1	1	1	0	1	1
63	ELA0006	404	Good	55	772935	6616334	250	4	4	6	3	0	0	28	22	1	7	0	0	0	1	57.8	67	1	1	1	0	0	1	0
64	ELA0008	404	Good	55	772222	6616039	20	2	2	1	3	0	1	30	35	0	10	0	0	0	0	80	60	1	1	1	0	0	1	0
65	ELA0010	404	Good	55	772043	6615391	140	2	19	9	7	1	0	21	17	4	4	0	0	2	3	78	41	1	1	1	1	1	1	0
66	ELA0011	404	Good	55	771623	6614087	260	2	11	7	5	1	1	21	15	3	5	1	0	3	4	18.4	58	1	1	1	1	1	1	0
67	ELA0012	404	Good	55	772158	6613789	110	4	9	4	6	0	0	20	16	21	3	0	0	1	7	58.4	63	1	1	1	1	1	1	0
68	ELA0014	404	Good	55	771626	6612343	207	4	6	10	6	1	1	27	2	9	3	1	0	0	4	48	119	1	1	1	1	0	1	0
69	ELA0016	404	Good	55	771582	6611059	235	4	2	2	3	0	0	34	6	15	16	0	0	0	1	59	0	1	1	1	1	0	1	0
70	ELA0017	404	Good	55	772307	6613460	30	4	14	10	4	1	0	17	15	3	4	0	0	3	2	65	122	1	1	1	1	1	1	0
71	ELA0021	404	Good	55	772730	6615176	150	4	12	16	8	1	1	12	32	11	2	0	0	1	3	64	70	1	1	1	1	1	0	0
72	ELA0033	404	Good	55	771933	6610453	40	4	5	6	4	0	0	34	21	4	11	0	0	0	1	81	23	1	1	1	1	0	1	0
73	ELA0034	404	Good	55	772909	6612082	163	3	6	14	4	1	0	12	8	3	5	0	0	2	2	92	40	1	1	1	1	1	1	0
74	ELA0035	404	Good	55	772368	6611864	284	4	3	1	3	1	1	36	5	0	2	0	0	0	1	82	61	1	1	1	1	0	1	0
75	ELA0036	404	Good	55	773534	6615851	230	4	8	16	24	1	4	20	2	5	5	0	1	0	3	90.4	33	1	1	1	1	0	1	1
76	ELA0047	404	Good	55	772709	6613469	333	4	4	2	4	0	0	42	56	0	35	0	0	0	0	92	52	1	1	0	0	0	1	0
77	ELA0073	404	Good	55	772881	6610267	180	4	6	2	7	1	0	42	8	1	40	0	0	0	0	98.8	66	1	1	1	1	0	1	0
78	ELA0076	404	Good	55	773374	6614020	190	3	3	4	3	1	0	46	55	1	8	0	0	0	2	94.6	41	1	1	1	0	0	1	0
79	ELA0095	404	Good	55	772872	6615811	330	3	14	10	5	1	0	27	33	21	1	0	0	0	1	81	7	1	1	1	1	0	1	0
80	ELA0096	404	Good	55	772248	6615088	260	1	9	10	4	1	1	30	41	8	1	0	0	1	3	84	29	1	1	1	1	1	1	0

Table D1 (Continued)
Vegetation Integrity (Site Condition) Data

Plot Number	Plot ID	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Regeneration	High Threat Exotic
81	ELA0097	404	Good	55	771749	6614728	230	2	7	18	3	1	1	20	56	27	1	0	0	0	0	77	29	1	1	1	1	0	1	0
82	N3BP0009a	404	Good	55	771929	6617214	140	4	4	1	3	1	1	43	49.1	0.1	0.3	0.1	0.1	0	0	64	13	1	1	1	0	0	1	0
83	N3BP0063a	404	Good	55	774043	6620306	88	3	3	4	9	1	0	11	0.4	12.3	0.9	0.2	0	0	0	34	13	1	1	0	1	0	1	0
84	N3BP0064a	404	Good	55	772191	6619726	242	5	10	5	3	1	1	40.1	26.2	0.7	0.3	0.1	0.1	0	3	65	27	1	1	1	1	0	1	0
85	N3BP0066a	404	Moderate	55	773771	6619348	327	6	4	12	5	1	2	17.4	0.9	7.1	1.4	0.1	0.2	0	0	34	26	1	1	1	1	0	1	0
86	N3BP0070a	404	Moderate	55	773890	6619435	250	3	2	5	6	1	1	12.1	2.1	3.4	0.6	0.1	0.1	0	0	54	15	1	1	1	1	0	1	0
87	N3BP0071	404	Moderate	55	774089	6619745	241	1	4	8	10	1	0	5	2.6	22.2	2.2	0.3	0	0	0	12.4	0	1	0	1	0	0	1	0
88	N3BP0074	404	Moderate	55	774812	6620377	263	2	0	5	2	1	0	35	0	5.6	0.2	0.1	0	0	0	26	0	1	1	0	0	0	1	0.1
89	N3BP0075	404	Moderate	55	774521	6620107	238	4	3	3	10	1	0	15.3	5.3	14	1	0.1	0	1	2	42.4	12	1	1	1	1	1	1	0
90	N3BP0065a	405	DNG	55	773707	6619127	40	3	6	4	4	1	0	7.1	21.4	4.2	0.4	0.1	0	0	0	14	3	1	0	1	1	0	1	0
91	N3BP0092	405	DNG	55	773793	6619210	335	1	5	4	13	1	1	5	2.3	16.3	1.7	0.1	0.1	0	0	44.4	0	1	1	0	0	0	1	0
92	ELA0007	405	Good	55	772553	6614905	95	4	14	4	8	0	2	8	26	4	1	0	0	7	3	60	8	1	1	1	1	0	1	0
93	ELA0019	405	Good	55	772882	6614270	335	3	11	8	8	1	0	8	16	4	2	0	0	0	1	43	71	1	1	1	1	0	1	0
94	ELA0023	405	Good	55	773446	6615084	0	5	10	7	15	1	2	29	3	2	2	0	0	0	0	61	94	1	1	1	1	0	1	1
95	ELA0025	405	Good	55	772871	6615936	270	3	10	2	5	0	0	8	13	16	2	0	0	1	3	26	9	1	1	1	0	1	1	0
96	ELA0032	405	Good	55	771770	6609819	28	4	10	7	4	0	1	22	2	2	2	0	1	0	4	97.2	35	1	1	1	1	0	1	0
97	ELA0055	405	Good	55	774275	6614320	250	9	7	7	10	1	3	66	23	19	4	1	0	0	12	93.6	57	1	1	1	1	0	1	0
98	ELA0063	405	Good	55	773678	6612499	340	4	3	5	5	0	0	25	3	1	53	0	0	0	1	98	118	1	1	1	1	0	1	0
99	ELA0075	405	Good	55	773134	6610948	85	4	18	2	6	0	0	34	26	5	16	0	0	0	5	96.2	30	1	1	1	1	0	1	0
100	N3BP0003a	405	Good	55	773507	6617874	341	4	11	6	5	1	0	29	5.5	2.4	0.6	0.1	0	0	3	82	9	1	1	1	1	0	1	0

Table D1 (Continued)
Vegetation Integrity (Site Condition) Data

Plot Number	Plot ID	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Regeneration	High Threat Exotic
101	ELA0009	406	Good	55	774043	6614080	215	7	6	8	8	1	3	17	7	7	3	0	0	0	2	86.6	173	0	1	1	1	0	1	0
102	ELA0013	406	Good	55	771767	6613101	290	3	8	3	4	0	0	22	12	15	1	0	0	0	3	78.8	30	1	1	1	1	0	1	0
103	ELA0015	406	Good	55	771559	6610795	260	3	3	1	3	0	0	34	4	2	1	0	0	0	0	73	55	1	1	0	1	0	1	0
104	ELA0018	406	Good	55	772418	6612898	265	4	5	6	4	1	1	27	7	11	1	1	0	0	4	72.6	41	1	1	1	1	0	1	0
105	ELA0056	406	Good	55	774207	6614072	135	7	10	4	13	1	2	50	26	22	20	1	0	1	1	93.4	87	1	1	1	1	1	1	0
106	ELA0074	406	Good	55	773365	6610179	105	6	2	6	8	1	1	38	3	3	1	0	0	0	0	44	133	1	1	1	0	0	0	1
107	ELA0091	406	Good	55	773602	6611668	340	3	11	4	6	0	0	43	23	1	2	0	0	0	0	85	7	1	1	1	0	0	0	0
108	ELA0092	406	Good	55	773657	6614043	270	3	7	5	4	0	0	19	36	1	1	0	0	0	1	91	39	1	1	1	0	0	1	0
109	N3BP0077	406	Moderate	55	774669	6617602	338	4	5	3	7	1	1	0.5	31.4	2.7	0.7	0.1	0.1	1	1	39	41	1	1	1	1	1	1	0.3
110	ELA0064	408	Good	55	773317	6612741	130	3	13	5	10	1	4	25	51	16	2	0	2	0	3	88.6	32	1	1	1	1	0	1	0
111	ELA0050	435	DNG	55	775728	6614378	205	0	3	4	9	0	1	0	5	14	4	0	0	0	0	47.6	0	0	0	0	0	0	0	1
112	ELA0088	435	DNG	55	775818	6614256	0	0	3	6	6	0	1	0	1	66	1	0	0	0	0	59	0	0	0	0	0	0	0	1
113	ELA0102	435	DNG	55	775815	6614965	315	0	2	5	5	0	1	0	0	30	1	0	0	0	0	51	0	0	0	0	0	0	0	2
114	N3BP0087	435	DNG	55	775652	6617522	288	0	2	8	11	1	1	0	7	1.9	1.1	0.1	0.1	0	0	13	0	0	0	0	0	0	0	0.5
115	N3BP2005	435	DNG	55	775199	6610904	161	0	1	1	1	0	1	0	0.1	0.1	0.1	0	0.1	0	0	0.3	0	0	0	0	1	0	0	0
116	N3BP2008	435	DNG	55	775295	6616420	125	0	3	10	9	1	1	0	0.5	2.6	1	0.2	0.1	0	0	1.2	0	0	0	0	0	0	0	0
117	ELA0004	435	Good	55	775612	6616115	140	1	0	7	12	1	4	3	0	1	1	0	0	0	1	73	15	1	1	1	0	0	1	1
118	ELA0026	435	Good	55	773798	6615115	110	3	7	15	16	1	4	12	14	2	2	0	0	1	4	86	62	1	1	1	1	1	1	1
119	ELA0051	435	Good	55	775730	6614787	270	3	5	7	11	0	2	37	11	34	2	0	0	3	6	91.8	60	1	1	1	1	1	1	2
120	ELA0052	435	Good	55	776171	6614700	90	2	5	5	14	1	1	32	9	42	2	1	0	2	6	80	43	1	1	1	1	1	0	2

Table D1 (Continued)
Vegetation Integrity (Site Condition) Data

Plot Number	Plot ID	PCT	Condition Class	Zone	Easting	Northing	Bearing	Composition Tree	Composition Shrub	Composition Grass	Composition Forbs	Composition Ferns	Composition Other	Structure Tree	Structure Shrub	Structure Grass	Structure Forbs	Structure Ferns	Structure Other	Large Trees	Hollow Trees	Litter Cover	Length Fallen Logs	Tree Stem 5 to 9 cm	Tree Stem 10 to 19 cm	Tree Stem 20 to 29 cm	Tree Stem 30 to 49 cm	Tree Stem 50 to 79 cm	Tree Regeneration	High Threat Exotic
121	ELA0057	435	Good	55	774203	6613563	180	7	3	9	9	2	1	60	14	33	1	5	0	0	5	77	29	1	1	1	1	0	1	1
122	ELA0066	435	Good	55	773593	6612994	20	1	5	10	10	1	1	35	24	11	3	2	0	1	9	96.2	113	1	1	1	1	1	1	0
123	ELA0098	435	Good	55	775475	6616168	60	1	3	13	10	1	2	15	1	15	1	1	0	0	0	54	8	1	1	1	1	0	1	1
124	ELA0099	435	Good	55	775583	6615913	70	1	1	11	9	1	1	30	0	15	1	0	0	0	0	74	14	1	1	1	0	0	1	2
125	N3BP0053a	435	Good	55	775618	6617628	217	4	3	7	14	0	4	45.3	0.4	0.8	1.4	0	0.4	2	0	67	8	1	1	1	1	1	1	0.1
126	N3BP2009	435	Good	55	774874	6610272	154	3	2	13	12	2	2	3.3	1.1	8.6	1.5	0.6	0.2	1	0	27	7	0	0	0	0	1	1	0

ATTACHMENT D2

VEGETATION INTEGRITY SCORE DETAIL

Table D2
Vegetation Integrity (VI) (Site Condition) Scores

Phase	Number	PCT	Condition Class	Composition Condition Score	Structure Condition Score	Function Condition Score	Current VI Score	Future VI Score	Change in VI Score	Total Change in VI Score
Phase 1	1	55	DNG	68.9	34	26.9	39.8	0	-39.8	-39.8
	2	55	Good	73.5	33.5	92.6	61.1	0	-61.1	-61.1
	3	88	DNG	55	31.2	24.1	34.6	28.7 (ETL) 0 (Clearance)	--5.9 (ETL) -34.6 (Clearance)	-32.8
	4	88	Good	95.8	45.1	74.7	68.6	0	-68.6	-68.6
	5	88	Moderate	40.9	46.7	34.7	40.5	0	-40.5	-40.5
	6	244	DNG	78.3	1	14	10.2	1.9 (ETL) 0 (Clearance)	-8.3 (ETL) -10.2 (Clearance)	-9.8
	7	244	Good	81.6	4.5	31	22.4	0	-22.4	-22.4
	8	401	Good	88.9	51	62.1	65.5	0	-65.5	-65.5
	9	404	Good	81.8	26.3	60.5	50.7	0	-50.7	-50.7
	10	404	Moderate	49.2	32.6	59.1	45.6	0	-45.6	-45.6
	11	406	Moderate	66.1	26.5	93.6	54.7	0	-54.7	-54.7
	12	435	DNG	60.1	9.4	7	15.8	15.2 (ETL) 0 (Clearance)	-0.7 (ETL) -15.8 (Clearance)	-14.8
	13	435	Good	73	17.5	50.3	40	0	-40	-40
Phase 2	1	55	DNG	71.8	42	16.3	36.6	32.7 (ETL) 0 (Clearance)	-3.9 (ETL) -36.6 (Clearance)	-31.2
	2	55	Good	90.9	65.3	42.6	65	0	-65	-65
	3	88	DNG	68.1	29.2	17.6	32.7	28.8 (ETL) 0 (Clearance)	-3.9 (ETL) --32.7 (Clearance)	-31.2
	4	88	Good	92.2	65.5	63.2	74.8	0	-74.8	-74.8
	5	244	Good	98.6	52.9	59.2	67.6	0	-67.6	-67.6
	6	435	DNG	40.8	0.1	0.4	1.3	0.2 (ETL) 0 (Clearance)	-1 (ETL) -1.3 (Clearance)	-1.2
	7	435	Good	68.7	12	44.1	33.1	0	-33.1	-33.1

Table D2 (Continued)
Vegetation Integrity (VI) (Site Condition) Scores

Phase	Number	PCT	Condition Class	Composition Condition Score	Structure Condition Score	Function Condition Score	Current VI Score	Future VI Score	Change in VI Score	Total Change in VI Score
Phase 3	1	88	DNG	53	31.5	18.9	31.6	0	-31.6	-31.6
	2	88	Good	98.7	51.6	85.6	75.8	0	-75.8	-75.8
	3	399	DNG	91	44.7	79.8	68.7	0	-68.7	-68.7
	4	401	Good	90.8	46.2	90.5	72.4	0	-72.4	-72.4
	5	404	Good	90.5	44.2	56.8	61	0	-61	-61
	6	404	Moderate	70.6	16.1	41	36	0	-36	-36
	7	405	DNG	64.3	21.4	34.1	36.1	0	-36.1	-36.1
	8	405	Good	89.7	26.6	70.1	55.1	0	-55.1	-55.1
Phase 4	1	55	DNG	41.8	18	15	22.4	0	-22.4	-22.4
	2	55	Good	73.9	45.2	43.9	52.7	0	-52.7	-52.7
	3	88	DNG	75.9	36.5	38.5	47.4	0	-47.4	-47.4
	4	88	Good	97.7	63	65	73.7	0	-73.7	-73.7
	5	206	Good	96.3	39.9	81.9	68	0	-68	-68
	6	399	Good	94.3	87.1	63.3	80.4	0	-80.4	-80.4
	7	401	Good	71.9	39	56.5	54.1	0	-54.1	-54.1
	8	404	Good	81.4	44.1	73.3	64.1	0	-64.1	-64.1
	9	405	Good	90.7	59.7	65	70.6	0	-70.6	-70.6
	10	406	Good	94.4	74.3	71.8	79.6	0	-79.6	-79.6
	11	435	Good	93	70.1	68.9	76.6	0	-76.6	-76.6

Table D2 (Continued)
Vegetation Integrity (VI) (Site Condition) Scores

Phase	Number	PCT	Condition Class	Composition Condition Score	Structure Condition Score	Function Condition Score	Current VI Score	Future VI Score	Change in VI Score	Total Change in VI Score
Phase 5	1	88	DNG	71.5	36.5	39.6	46.9	0	-46.9	-46.9
	2	88	Good	97.7	50.6	66	68.8	0	-68.8	-68.8
	3	206	Good	91.1	38.2	95.1	69.2	0	-69.2	-69.2
	4	399	Good	96.2	58.5	69.5	73.1	0	-73.1	-73.1
	5	399	Moderate	58.8	22.7	42.6	38.4	0	-38.4	-38.4
	6	401	Good	71.9	39	56.5	54.1	0	-54.1	-54.1
	7	404	Good	81.5	55.6	78.1	70.7	0	-70.7	-70.7
	8	405	Good	90	36.3	65	59.7	0	-59.7	-59.7
	9	406	Good	77.8	59.1	52.9	62.4	0	-62.4	-62.4
	10	408	Good	91.8	67.3	58.3	71.2	0	-71.2	-71.2
	11	435	Good	93.3	70.1	68.9	76.6	0	-76.6	-76.6
Phase 6	1	55	DNG	77.7	42.1	15	36.6	36.7 (Cracking) 0 (Clearance)	0.1 (Cracking) -36.6 (Clearance)	-12.6
	2	88	DNG	62.6	28.9	19.7	32.9	29.6 (Cracking) 0 (Clearance)	-3.3 (Cracking) -32.9 (Clearance)	-29.8
	3	88	Good	91.1	63.8	68.7	73.6	46.5 (Cracking) 0 (Clearance)	-27.1 (Cracking) -73.6 (Clearance)	-33.7
	4	141	Good	71	23.2	53.5	44.5	0	-44.5	-44.5
	5	244	DNG	77	39.8	27.9	44.1	0	-44.1	-44.1
	6	244	Good	96.2	71.6	66.5	77.1	47 (Cracking) 0 (Clearance)	-30.1 (Cracking) -77.1 (Clearance)	-35.7
	7	399	Good	94.9	42.2	78.2	67.9	0	-67.9	-67.9
	8	404	Good	81	61.2	95.4	77.9	0	-77.9	-77.9
	9	405	Good	86.8	23.5	92.1	57.3	0	-57.3	-57.3
	10	406	Good	52.4	39.9	62.6	50.8	0	-50.8	-50.8
	11	435	DNG	33.5	25.8	13.5	22.7	22.5 (Cracking) 0 (Clearance)	-0.1 (Cracking) -22.7 (Clearance)	-10.8
	12	435	Good	83.7	51.2	87.2	72	42.3 (Cracking) 0 (Clearance)	-29.7 (Cracking) -72 (Clearance)	-62

ATTACHMENT E

THREATENED FLORA AND FAUNA SPECIES KNOWN OR PREDICTED TO OCCUR IN THE WIDER LOCALITY

Table E1
Threatened Flora and Fauna Species Known or Predicted to Occur in the Wider Locality

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Database Records				ELA (2019d and 2019e)	AMBS (2020a and 2020b)	Ecotone (2007)	Ecotone (2009)	FloraSearch (2009)	Recorded Surveys undertaken by ELA (2012 to 2018)[8]	Potentially Associated with PCTs in the Development Footprint
		BC Act[1]	EPBC Act[2]		BioNet Atlas[4]	Atlas of Living Australia[5]	Birdlife Australia[6]	Protected Matters Search[7]							
Flora															
Bertya opponens	Coolabah Bertya	V	V	Species	●	-	-	Predicted	●	●	-	-	●	I	Yes
Cadellia pentastylis	Ooline	V	V	Species	-	-	-	Predicted	-	-	-	-	-	-	No
Commersonia procumbens (syn. Androcalva procumbens)	-	V	V	Species	-	-	-	Predicted	-	-	-	-	-	-	Yes
Dichanthium setosum	Bluegrass	V	V	Species	-	-	-	Predicted	-	-	-	-	-	-	No
Diuris tricolor	Pine Donkey Orchid	V	-	Species	-	-	-	-	-	-	-	-	-	-	Yes
Lepidium aschersonii	Spiny Peppercress	V	V	Species	●	-	-	-	●	-	-	-	-	D, E, F	No
Pomaderris queenslandica	Scant Pomaderris	E	-	Species	●	-	-	-	●	●	-	-	-	-	Yes
Prasophyllum sp. Wybong (C. Phelps ORG 5269)	A Leek Orchid	-	CE	Species	-	-	-	Predicted	-	-	-	-	-	-	No
Pterostylis cobarensis	Greenhood Orchid	V	-	Species	-	-	-	-	-	-	-	-	-	-	Yes
Tylophora linearis	-	V	E	Species	●	-	-	Predicted	●	●	-	-	-	E	Yes
Amphibians															
Litoria booroolongensis	Booroolong Frog	E	E	Species	-	●	-	-	-	-	-	-	-	-	No
Reptiles															
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V	Species	-	●	-	-	-	-	-	-	-	-	No
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Species	-	-	-	Predicted	-	-	-	-	-	-	Yes
Anomalopus mackayi	Five-clawed Worm-skink	E	V	Ecosystem	-	●	-	-	-	-	-	-	-	-	No
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	Species	●	-	-	-	-	●	-	●	-	-	Yes

Table E1 (Continued)
Threatened Flora and Fauna Species Known or Predicted to Occur in the Wider Locality

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Database Records				ELA (2019d and 2019e)	AMBS (2020a and 2020b)	Ecotone (2007)	Ecotone (2009)	FloraSearch (2009)	Recorded Surveys undertaken by ELA (2012 to 2018)[8]	Potentially Associated with PCTs in the Development Footprint
		BC Act[1]	EPBC Act[2]		BioNet Atlas[4]	Atlas of Living Australia[5]	Birdlife Australia[6]	Protected Matters Search[7]							
Birds															
Alectura lathami	Australian Brush-turkey population in the Nandewar and Brigalow Belt South Bioregions	E	-	Species	-	-	-	-	-	-	-	-	-	-	No
Leipoa ocellata	Malleefowl	E	V	Ecosystem	-	●	-	Predicted	-	-	-	-	-	-	Yes
Anseranas semipalmata	Magpie Goose	V	-	Ecosystem	-	-	-	-	-	-	-	-	-	-	No
Stictonetta naevosa	Freckled Duck	V	-	Ecosystem	-	-	-	-	-	-	-	-	-	F, I	No
Botaurus poiciloptilus	Australasian Bittern	E	E	Ecosystem	-	●	-	-	-	-	-	-	-	-	No
Falco subniger	Black Falcon	V	-	Ecosystem	-	-	-	-	-	-	-	-	-	-	No
Lophoictinia isura	Square-tailed Kite	V	-	Species/ Ecosystem	-	-	-	-	-	●	-	-	-	-	Yes
Hamirostra melanosternon	Black-breasted Buzzard	V	-	Species/ Ecosystem	-	-	-	-	-	-	-	-	-	-	Yes
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/ Ecosystem	●	-	-	-	-	-	-	-	-	-	Yes
Circus assimilis	Spotted Harrier	V	-	Ecosystem	-	-	-	-	-	-	-	-	-	B, E, I	Yes
Hieraaetus morphnoides	Little Eagle	V	-	Species/ Ecosystem	●	-	-	-	-	-	-	-	-	A, B, E	Yes
Burhinus grallarius	Bush Stone-curlew	E	-	Species	-	-	-	-	-	-	-	-	-	-	Yes
Rostratula australis	Australian Painted Snipe	E	E	Ecosystem	-	-	●	Predicted	-	-	-	-	-	-	No
Pedionomus torquatus	Plains-wanderer	E	CE	Species/ Ecosystem	-	●	-	-	-	-	-	-	-	-	No

Table E1 (Continued)
Threatened Flora and Fauna Species Known or Predicted to Occur in the Wider Locality

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Database Records				ELA (2019d and 2019e)	AMBS (2020a and 2020b)	Ecotone (2007)	Ecotone (2009)	FloraSearch (2009)	Recorded Surveys undertaken by ELA (2012 to 2018)[8]	Potentially Associated with PCTs in the Development Footprint
		BC Act[1]	EPBC Act[2]		BioNet Atlas[4]	Atlas of Living Australia[5]	Birdlife Australia[6]	Protected Matters Search[7]							
Calidris ferruginea	Curlew Sandpiper	E	CE	Species/ Ecosystem	-	-	-	Predicted	-	-	-	-	-	-	No
Geophaps scripta scripta	Squatter Pigeon	CE	V	Species	-	●	-	-	-	-	-	-	-	-	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Species/ Ecosystem	●	-	-	-	●	●	-	●	-	B, C, D, E, F, G, I	Yes
Glossopsitta pusilla	Little Lorikeet	V	-	Ecosystem	●	-	-	-	●	-	-	-	-	B, E, F, I	Yes
Neophema pulchella	Turquoise Parrot	V	-	Ecosystem	●	-	-	-	-	●	-	●	-	C	Yes
Lathamus discolor	Swift Parrot	E	CE	Species/ Ecosystem	-	●	-	-	-	-	-	-	-	-	Yes
Polytelis swainsonii	Superb Parrot	V	V	Species/ Ecosystem	●	●	●	Predicted	-	-	-	●	-	-	Yes
Tyto novaehollandiae	Masked Owl	V	-	Species/ Ecosystem	-	-	-	-	-	-	-	-	-	-	Yes
Ninox connivens	Barking Owl	V	-	Species/ Ecosystem	-	-	-	-	-	-	-	-	-	-	Yes
Hirundapus caudacutus	White-throated Needletail	-	V	Species	●	●	●	Predicted	●	●	-	●	-	A, I	No
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Ecosystem	●	-	-	-	-	-	-	-	-	A, B, D, E	Yes
Chthonicola sagittata	Speckled Warbler	V	-	Ecosystem	●	-	-	-	●	●	-	●	-	B, E, F, G, I	Yes
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/ Ecosystem	-	●	●	Predicted	-	-	-	-	-	-	No
Grantiella picta	Painted Honeyeater	V	V	Ecosystem	-	●	●	Predicted	-	-	-	-	-	B, D, E, F	Yes
Epthianura albifrons	White-fronted Chat	V	-	Ecosystem	-	-	-	-	-	-	-	-	-	-	No
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Ecosystem	-	-	-	-	●	-	-	-	-	-	Yes

Table E1 (Continued)
Threatened Flora and Fauna Species Known or Predicted to Occur in the Wider Locality

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Database Records				ELA (2019d and 2019e)	AMBS (2020a and 2020b)	Ecotone (2007)	Ecotone (2009)	FloraSearch (2009)	Recorded Surveys undertaken by ELA (2012 to 2018)[8]	Potentially Associated with PCTs in the Development Footprint
		BC Act[1]	EPBC Act[2]		BioNet Atlas[4]	Atlas of Living Australia[5]	Birdlife Australia[6]	Protected Matters Search[7]							
Petroica boodang	Scarlet Robin	V	-	Ecosystem	-	-	-	-	●	-	-	-	-	-	Yes
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Ecosystem	●	-	-	-	●	●	●	●	-	A, B, C, E, F, G, I	Yes
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem	●	-	-	-	●	●	-	-	-	A, B, D, E, F, G, I	Yes
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Ecosystem	●	-	-	-	●	-	-	-	-	-	Yes
Stagonopleura guttata	Diamond Firetail	V	-	Ecosystem	●	-	-	-	●	-	-	●	-	E, F, I	Yes
Mammals															
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Ecosystem	-	-	-	Predicted	-	-	-	-	-	-	Yes
Phascolarctos cinereus	Koala	V	V	Species/ Ecosystem	●	●	-	Predicted	-	●	-	●	-	-	Yes
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species	●	-	-	-	●	-	-	●	-	-	Yes
Petaurus norfolcensis	Squirrel Glider	V	-	Species	●	-	-	-	-	-	-	-	-	H	Yes
Macropus dorsalis	Black-striped Wallaby	E	-	Ecosystem	●	-	-	-	●	-	-	●	-	G	Yes
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/ Ecosystem	-	-	-	Predicted	-	-	-	-	-	-	Yes
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	●	-	-	-	●	●	-	●	-	A, B, C, E, F, I	Yes
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Ecosystem	-	-	-	-	-	-	-	-	-	F	No
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/ Ecosystem	-	-	-	-	-	-	-	-	-	A, B, C, E, F, I	Yes

Table E1 (Continued)
Threatened Flora and Fauna Species Known or Predicted to Occur in the Wider Locality

Scientific Name	Common Name	Conservation Status		Biodiversity Credit Class[3]	Database Records				ELA (2019d and 2019e)	AMBS (2020a and 2020b)	Ecotone (2007)	Ecotone (2009)	FloraSearch (2009)	Recorded Surveys undertaken by ELA (2012 to 2018)[8]	Potentially Associated with PCTs in the Development Footprint
		BC Act[1]	EPBC Act[2]		BioNet Atlas[4]	Atlas of Living Australia[5]	Birdlife Australia[6]	Protected Matters Search[7]							
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Ecosystem	●	●	-	Predicted	●	●	-	●	-	B, D, E, I	Yes
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	-	-	-	Predicted	-	●	-	-	-	E	Yes
Chalinolobus picatus	Little Pied Bat	V	-	Ecosystem	-	-	-	-	●	-	-	●	-	B, F, I	Yes
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Ecosystem	-	-	-	-	-	-	-	-	-	B	No
Vespadelus troughtoni	Eastern Cave Bat	V	-	Species	-	-	-	-	-	-	-	-	-	B, C, E, F, I	Yes
Pseudomys pilligaensis	Pilliga Mouse	V	V	Ecosystem	●	-	-	Predicted	●	-	-	●	-	-	Yes

Note: Highlighted species are species recorded in MLA 1 and/or MLA 2.

1 Conservation status under the BC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; Ex = Presumed Extinct; V = Vulnerable.

2 Conservation status under the EPBC Act (current as at October 2020). CE = Critically Endangered; E = Endangered; Ex = Presumed Extinct; V = Vulnerable.

3 Biodiversity credit class under the *BioNet Threatened Biodiversity Data Collection* (DPIE, 2020d) (current as at October 2020).

4 DPIE (2020a).

5 ALA (2019).

6 Birdlife Australia (2019).

7 DAWE (2020d).

8 Previous survey results recorded from the Narrabri Underground Mine and surrounds have been sourced from the following:

A = ELA (2012).

B = ELA (2013a).

C = ELA (2013b).

D = ELA (2015a).

E = ELA (2015c).

F = ELA (2016a).

G = ELA (2016b).

H = ELA (2016c).

I = ELA (2018a).

ATTACHMENT F

HABITAT DISTURBANCE AREAS

Table F1
Coolabah Bertya Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (hNumber of Individualsa)	Area of Potential Ponding (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	Area of Potential Cracking Impacts on Vegetation (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Area of Potential Cracking Impacts on Vegetation (Number of Individuals)
1	Pilliga Box – Buloke Woodland (Good)	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2*	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,297	0	0	1,297	1,297	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3a	Derived Native Grassland	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7*	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	0	0	0	0	0	0	0	0	1,297	0	1,297	0	0	0	0	0	19,886	0	0	19,886	21,183	0	0	0

Table F1 (Continued)
Coolabah Bertya Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (hNumber of Individualsa)	Area of Potential Ponding (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	Area of Potential Cracking Impacts on Vegetation (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Area of Potential Cracking Impacts on Vegetation (Number of Individuals)
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8*	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	865	0	0	865	865	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9*	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,594	0	0	2,594	2,594	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F1 (Continued)
Coolabah Bertya Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (hNumber of Individualsa)	Area of Potential Ponding (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	Area of Potential Cracking Impacts on Vegetation (Number of Individuals)	Total Area (Number of Individuals)	Clearance Area (Number of Individuals)	Area of Potential Ponding (Number of Individuals)	ETL Management (Number of Individuals)	Area of Potential Cracking Impacts on Vegetation (Number of Individuals)
Total Area (ha) Woodland			0	0	0	0	0	0	0	0	1,297	0	1,297	0	0	0	0	0	24,642	0	0	24,642	25,939	0	0	0
Total Area (ha) Derived Native Grassland			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Area (ha) Native Vegetation			0	0	0	0	0	0	0	0	1,297	0	1,297	0	0	0	0	0	24,642	0	0	24,642	25,939	0	0	0

* AMBS (2020a) (Attachment B) identified part of this vegetation zone as providing habitat for this species.

Table F2
Spiny Peppercress Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F2 (Continued)
Spiny Peppercress Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Area (ha) Woodland			**8.8**	**0.2**	**0**	**9**	**24.6**	**0.2**	**0**	**24.8**	**0.5**	**0.3**	**0.8**	**7.3**	**7.3**	**1.3**	**0**	**1.3**	**2.2**	**0**	**13.4**	**15.6**	**44.7**	**0.7**	**0**	**13.4**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**8.8**	**0.2**	**0**	**9**	**24.6**	**0.2**	**0**	**24.8**	**0.5**	**0.3**	**0.8**	**7.3**	**7.3**	**1.3**	**0**	**1.3**	**2.2**	**0**	**13.4**	**15.6**	**44.7**	**0.7**	**0**	**13.4**

Table F3
Tylophora linearis Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impact on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0.6	0.6	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0

Table F3 (Continued)
Tylophora linearis Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impact on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0

Table F3 (Continued)
Tylophora linearis Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impact on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Area (ha) Woodland			**23.2**	**0.2**	**0**	**23.4**	**39.4**	**0.2**	**0**	**39.6**	**54.4**	**0.6**	**55**	**33.6**	**33.6**	**81.4**	**0.6**	**82**	**195.9**	**1.1**	**13.8**	**210.8**	**427.9**	**2.7**	**0**	**13.8**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**23.2**	**0.2**	**0**	**23.4**	**39.4**	**0.2**	**0**	**39.6**	**54.4**	**0.6**	**55**	**33.6**	**33.6**	**81.4**	**0.6**	**82**	**195.9**	**1.1**	**13.8**	**210.8**	**427.9**	**2.7**	**0**	**13.8**

Table F4
Pale-headed Snake Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	10.3^	0	0.5^	10.8^	5.4^	0	0.3^	5.7^	2.2^	0	2.2^	1.1^	1.1^	2.5^	0	2.5^	0.6^	0	0.9^	1.5^	22.1^	0	0.8^	0.9^
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0.7^	0	0.1^	0.8^	1.3^	0	0	1.3^	0	0	0	0	0	0	0	0	1.3^	0	2^	3.3^	3.3^	0	0.1^	2^
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F4 (Continued)
Pale-headed Snake Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0.6^	0	0.6^	0	0	0	0	0	0	0	0	0	0.6^	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	3.7^	0	0.9^	4.6^	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2^	0.2^	3.7^	0	0.9^	0.2^

Table F4 (Continued)
Pale-headed Snake Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**26**	**0.2**	**0**	**26.2**	**42.5**	**0.4**	**0**	**42.9**	**54.4**	**0.6**	**55**	**35.5**	**35.5**	**81.5**	**0.6**	**82.1**	**196.6**	**1.3**	**24.8**	**222.7**	**436.5**	**3.1**	**0**	**24.8**
Total Area (ha) Derived Native Grassland			**14.7^**	**0**	**1.5^**	**16.2^**	**6.7^**	**0**	**0.3^**	**7^**	**2.8^**	**0**	**2.8^**	**1.1^**	**1.1^**	**2.5^**	**0**	**2.5^**	**1.9^**	**0**	**3.1^**	**5^**	**29.7^**	**0**	**1.8^**	**3.1^**
Total Area (ha) Native Vegetation			**40.7**	**0.2**	**1.5**	**42.4**	**49.2**	**0.4**	**0.3**	**49.9**	**57.2**	**0.6**	**57.8**	**36.6**	**36.6**	**84**	**0.6**	**84.6**	**198.5**	**1.3**	**27.9**	**227.7**	**466.2**	**3.1**	**1.8**	**27.9**

^ Area associated with Paddock Trees (AMBS, 2020b) (Attachment C).

Table F5
Glossy Black-Cockatoo Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	10.3^	0	0.5^	10.8^	5.4^	0	0.3^	5.7^	2.2^	0	2.2^	1.1^	1.1^	2.5^	0	2.5^	0.6^	0	0.9^	1.5^	22.1^	0	0.8^	0.9^
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0.7^	0	0.1^	0.8^	1.3^	0	0	1.3^	0	0	0	0	0	0	0	0	1.3^	0	2^	3.3^	3.3^	0	0.1^	2^
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0

Table F5 (Continued)
Glossy Black-Cockatoo Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0.6^	0	0.6^	0	0	0	0	0	0	0	0	0	0.6^	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	3.7^	0	0.9^	4.6^	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2^	0.2^	3.7^	0	0.9^	0.2^
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	2.1^	0	0	2.1^	2.2^	0	0.1^	2.3^	0	0	0	0.5^	0.5^	0	0	0	0.8^	0	1.6^	2.4^	5.6^	0	0.1^	1.6^
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0

Table F5 (Continued)
Glossy Black-Cockatoo Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
Total Area (ha) Woodland			29	0.2	0	29.2	46.7	0.4	0	47.1	54.4	0.6	55	35.9	35.9	81.5	0.6	82.1	196.6	1.3	24.8	222.7	444.1	3.1	0	24.8
Total Area (ha) Derived Native Grassland			16.8^	0	1.5^	18.3^	8.9^	0	0.4^	9.3^	2.8^	0	2.8^	1.6^	1.6^	2.5^	0	2.5^	2.7^	0	4.7^	7.4^	35.3^	0	1.9^	4.7^
Total Area (ha) Native Vegetation			45.8	0.2	1.5	47.5	55.6	0.4	0.4	56.4	57.2	0.6	57.8	37.5	37.5	84	0.6	84.6	199.3	1.3	29.5	230.1	479.4	3.1	1.9	29.5

^ Area associated with Paddock Trees (AMBS, 2020b) (Attachment C).

Table F6
Superb Parrot Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	38.4	0	2.6	41	14.2	0	0.8	15	3.6	0	3.6	2.1	2.1	3	0	3	2.6	0	5.8	8.4	63.9	0	3.4	5.8
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	9.3	0	0.7	10	2.8	0	0.2	3	0	0	0	0	0	0	0	0	4.7	0.1	5.3	10.1	16.8	0.1	0.9	5.3
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0
7*	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	0	2.5	11.1	0.5	0	11.6	13.6	0.5	0	0

Table F6 (Continued)
Superb Parrot Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8*	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	0.7	0	0.7	0	0	0	0	0	1	0	0	1	1.7	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0.7	0	0.7	0	0	0	0	0	0	0	0	0	0.7	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	16.2	0	4.4	20.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	3.3	16.2	0	4.4	3.3
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	2.6	0	0	2.6	21.4	0	4.2	25.6	0	0	0	1.6	1.6	0	0	0	6.7	0.4	13.5	20.6	32.3	0.4	4.2	13.5
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0

Table F6 (Continued)
Superb Parrot Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
Total Area (ha) Woodland			16.6	0.2	0	16.8	46.7	0.4	0	47.1	5.2	0.6	5.8	13.6	13.6	11.6	0.5	12.1	20.3	1.3	24.8	46.4	114	3	0	24.8
Total Area (ha) Derived Native Grassland			66.5	0	7.7	74.2	38.4	0	5.2	43.6	4.3	0	4.3	3.7	3.7	3	0	3	14	0.5	27.9	42.4	129.9	0.5	12.9	27.9
Total Area (ha) Native Vegetation			83.1	0.2	7.7	91	85.1	0.4	5.2	90.7	9.5	0.6	10.1	17.3	17.3	14.6	0.5	15.1	34.3	1.8	52.7	88.8	243.9	3.5	12.9	52.7

* AMBS (2020b) (Attachment C) identified part of this vegetation zone as providing habitat for this species.

Table F7
Regent Honeyeater Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0.6	0.6	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F7 (Continued)
Regent Honeyeater Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F7 (Continued)
Regent Honeyeater Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**197.2**	**1.3**	**24.8**	**223.3**	**444.7**	**3.1**	**0**	**24.8**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**197.2**	**1.3**	**24.8**	**223.3**	**444.7**	**3.1**	**0**	**24.8**

Table F8
Painted Honeyeater Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F8 (Continued)
Painted Honeyeater Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F8 (Continued)
Painted Honeyeater Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**196.6**	**1.3**	**24.8**	**222.7**	**444.1**	**3.1**	**0**	**24.8**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**196.6**	**1.3**	**24.8**	**222.7**	**444.1**	**3.1**	**0**	**24.8**

Table F9
Koala Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	10.3^	0	0.5^	10.8^	5.4^	0	0.3^	5.7^	2.2^	0	2.2^	1.1^	1.1^	2.5^	0	2.5^	0.6^	0	0.9^	1.5^	22.1^	0	0.8^	0.9^
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0.6	0.6	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0.7^	0	0.1^	0.8^	1.3^	0	0	1.3^	0	0	0	0	0	0	0	0	1.3^	0	2^	3.3^	3.3^	0	0.1^	2^
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F9 (Continued)
Koala Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0.6^	0	0.6^	0	0	0	0	0	0	0	0	0	0.6^	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	3.7^	0	0.9^	4.6^	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2^	0.2^	3.7^	0	0.9^	0.2^

Table F9 (Continued)
Koala Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	2.1^	0	0	2.1^	2.2^	0	0.1^	2.3^	0	0	0	0.5^	0.5^	0	0	0	0.8^	0	1.6^	2.4^	5.6^	0	0.1^	1.6^
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**197.2**	**1.3**	**24.8**	**223.3**	**444.7**	**3.1**	**0**	**24.8**
Total Area (ha) Derived Native Grassland			**16.8^**	**0**	**1.5^**	**18.3^**	**8.9^**	**0**	**0.4^**	**9.3^**	**2.8^**	**0**	**2.8^**	**1.6^**	**1.6^**	**2.5^**	**0**	**2.5^**	**2.7^**	**0**	**4.7^**	**7.4^**	**35.3^**	**0**	**1.9^**	**4.7^**
Total Area (ha) Native Vegetation			**45.8**	**0.2**	**1.5**	**47.5**	**55.6**	**0.4**	**0.4**	**56.4**	**57.2**	**0.6**	**57.8**	**37.5**	**37.5**	**84**	**0.6**	**84.6**	**199.9**	**1.3**	**29.5**	**230.7**	**480**	**3.1**	**1.9**	**29.5**

^ Area associated with Paddock Trees (AMBS, 2020b) (Attachment C).

Table F10
Eastern Pygmy-possum Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1*	Pilliga Box – Buloke Woodland (Good)	88	3.5	0.1	0	3.6	19.9	0.2	0	20.1	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	12.3	14.5	34.3	0.6	0	12.3
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F10 (Continued)
Eastern Pygmy-possum Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F10 (Continued)
Eastern Pygmy-possum Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**16.8**	**0.2**	**0**	**17**	**19.9**	**0.2**	**0**	**20.1**	**54.4**	**0.6**	**55**	**32.5**	**32.5**	**80.5**	**0.6**	**81.1**	**194.6**	**0.5**	**12.3**	**207.4**	**398.7**	**2.1**	**0**	**12.3**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**16.8**	**0.2**	**0**	**17**	**19.9**	**0.2**	**0**	**20.1**	**54.4**	**0.6**	**55**	**32.5**	**32.5**	**80.5**	**0.6**	**81.1**	**194.6**	**0.5**	**12.3**	**207.4**	**398.7**	**2.1**	**0**	**12.3**

* AMBS (2020b) (Attachment C) identified part of this vegetation zone as providing habitat for this species.

Table F11
Squirrel Glider Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	10.3^	0	0.5^	10.8^	5.4^	0	0.3^	5.7^	2.2^	0	2.2^	1.1^	1.1^	2.5^	0	2.5^	0.6^	0	0.9^	1.5^	22.1^	0	0.8^	0.9^
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0.6	0.6	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0.7^	0	0.1^	0.8^	1.3^	0	0	1.3^	0	0	0	0	0	0	0	0	1.3^	0	2^	3.3^	3.3^	0	0.1^	2^
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F11 (Continued)
Squirrel Glider Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7*	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	0	0	0	0	0	0	0	0	0.5	0	0.5	0	0	2.5	0	2.5	11.9	0.5	0	12.4	14.9	0.5	0	0
7a*	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0	0	0	0	0	0	0	0	0.2	0	0.2	0	0	0	0	0	0	0	0	0	0.2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0.6^	0	0.6^	0	0	0	0	0	0	0	0	0	0.6^	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	3.7^	0	0.9^	4.6^	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2^	0.2^	3.7^	0	0.9^	0.2^

Table F11 (Continued)
Squirrel Glider Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**14.5**	**0.2**	**0**	**14.7**	**42.5**	**0.4**	**0**	**42.9**	**15.4**	**0.6**	**16**	**30.9**	**30.9**	**60.6**	**0.5**	**61.1**	**82.1**	**1.3**	**24.8**	**108.2**	**246**	**3**	**0**	**24.8**
Total Area (ha) Derived Native Grassland			**14.7^**	**0**	**1.5^**	**16.2^**	**6.7^**	**0**	**0.3^**	**7^**	**2.8^**	**0**	**2.8^**	**1.1^**	**1.1^**	**2.5^**	**0**	**2.5^**	**1.9^**	**0**	**3.1^**	**5^**	**29.7^**	**0**	**1.8^**	**3.1^**
Total Area (ha) Native Vegetation			**29.2**	**0.2**	**1.5**	**30.9**	**49.2**	**0.4**	**0.3**	**49.9**	**18.2**	**0.6**	**18.8**	**32**	**32**	**63.1**	**0.5**	**63.6**	**84**	**1.3**	**27.9**	**113.2**	**275.7**	**3**	**1.8**	**27.9**

* AMBS (2020b) (Attachment C) identified part of this vegetation zone as providing habitat for this species.

^ Area associated with Paddock Trees (AMBS, 2020b) (Attachment C).

Table F12
Corben's Long-eared Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1	Pilliga Box – Buloke Woodland (Good)	88	5.7	0.1	0	5.8	20.4	0.2	0	20.6	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	37	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0.6	0.6	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	4.2	0	0	4.2	19	0	0	19	0	0	0	3	3	1	0	1	0.7	0.6	0.4	1.7	27.9	0.6	0	0.4
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F12 (Continued)
Corben's Long-eared Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	2.8	0	0	2.8	3.1	0.2	0	3.3	0	0	0	0	0	0	0	0	1.3	0.2	11	12.5	7.2	0.4	0	11
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F12 (Continued)
Corben's Long-eared Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12	Belah Woodland (Good)	55	3	0	0	3	4.2	0	0	4.2	0	0	0	0.4	0.4	0	0	0	0	0	0	0	7.6	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**197.2**	**1.3**	**24.8**	**223.3**	**444.7**	**3.1**	**0**	**24.8**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**29**	**0.2**	**0**	**29.2**	**46.7**	**0.4**	**0**	**47.1**	**54.4**	**0.6**	**55**	**35.9**	**35.9**	**81.5**	**0.6**	**82.1**	**197.2**	**1.3**	**24.8**	**223.3**	**444.7**	**3.1**	**0**	**24.8**

Table F13
Large-eared Pied Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1*	Pilliga Box – Buloke Woodland (Good)	88	0	0	0	0	18.6	0.2	0	18.8	0	0	0	6.3	6.3	0.8	0	0.8	1.6	0	11.6	13.2	27.3	0.2	0	11.6
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4*	White Box – White Cypress Woodland (Good)	435	0	0	0	0	17.6	0	0	17.6	0	0	0	3	3	0.5	0	0.5	0.2	0	0	0.2	21.3	0	0	0
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5*	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	0	0	0	1	1	3.6	0.2	3.8	1	0	0	1	5.6	0.2	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F13 (Continued)
Large-eared Pied Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7*	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	19.4	0.1	19.5	65	0.2	0	65.2	84.4	0.3	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8*	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	0	0	0	6.2	6.2	31.9	0	31.9	18.5	0	0	18.5	56.6	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9*	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	11.6	0	0	11.6	35.6	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10*	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11*	Poplar Box Grassy Woodland (Good)	244	0	0	0	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F13 (Continued)
Large-eared Pied Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
13*	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0
Total Area (ha) Woodland			**0**	**0**	**0**	**0**	**36.3**	**0.2**	**0**	**36.5**	**0**	**0**	**0**	**28.3**	**28.3**	**70.4**	**0.3**	**70.7**	**97.9**	**0.2**	**11.6**	**109.7**	**232.9**	**0.7**	**0**	**11.6**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**0**	**0**	**0**	**0**	**36.3**	**0.2**	**0**	**36.5**	**0**	**0**	**0**	**28.3**	**28.3**	**70.4**	**0.3**	**70.7**	**97.9**	**0.2**	**11.6**	**109.7**	**232.9**	**0.7**	**0**	**11.6**

* AMBS (2020b) (Attachment C) identified part of this vegetation zone as providing habitat for this species.

Table F14
Eastern Cave Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1*	Pilliga Box – Buloke Woodland (Good)	88	0	0	0	0	17.5	0	0	17.5	0	0	0	5.3	5.3	0.3	0	0.3	1.6	0	11.6	13.2	24.7	0	0	11.6
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1b*	Derived Native Grassland	88	0	0	0	0	6.4	0	0.2	6.6	0	0	0	0	0	0	0	0	0	0	0	0	6.4	0	0.2	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4*	White Box – White Cypress Woodland (Good)	435	0	0	0	0	17.5	0	0	17.5	0	0	0	0.7	0.7	0.4	0	0.4	0.2	0	0	0.2	18.8	0	0	0
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b*	Derived Native Grassland	435	0	0	0	0	2.6	0	0	2.6	0	0	0	0	0	0	0	0	3.5	0	2.8	6.3	6.1	0	0	2.8
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7*	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	31.2	0	0	31.2	41.2	0	0	0

Table F14 (Continued)
Eastern Cave Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8*	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	0	0	0	0	0	9.7	0	9.7	2.7	0	0	2.7	12.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9*	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	7	7	12.3	0	12.3	6	0	0	6	25.3	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Poplar Box Grassy Woodland (Good)	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13*	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	1.9	1.9	0.1	0	0.1	0	0	0	0	2	0	0	0

Table F14 (Continued)
Eastern Cave Bat Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
Total Area (ha) Woodland			0	0	0	0	35	0	0	35	0	0	0	14.9	14.9	32.8	0	32.8	41.7	0	11.6	53.3	124.4	0	0	11.6
Total Area (ha) Derived Native Grassland			0	0	0	0	9	0	0.2	9.2	0	0	0	0	0	0	0	0	3.5	0	2.8	6.3	12.5	0	0.2	2.8
Total Area (ha) Native Vegetation			0	0	0	0	44	0	0.2	44.2	0	0	0	14.9	14.9	32.8	0	32.8	45.2	0	14.4	59.6	136.9	0	0.2	14.4

* AMBS (2020b) (Attachment C) identified part of this vegetation zone as providing habitat for this species.

Table F15
Pilliga Mouse Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
1*	Pilliga Box – Buloke Woodland (Good)	88	3.5	0.1	0	3.6	19.9	0.2	0	20.1	0.5	0.3	0.8	6.9	6.9	1.3	0	1.3	2.2	0	13.4	15.6	27.4	0.6	0	13.4
1a	Pilliga Box – Buloke Woodland (Moderate)	88	0.1	0.1	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0.1	0	0
1b	Derived Native Grassland	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Broombush – Wattle Tall Shrubland (Good)	141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0.6	0.6	0	0	0
3	Dwyer's Red Gum Shrubby Woodland (Good)	432	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	White Box – White Cypress Woodland (Good)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4a	White Box – White Cypress Woodland (Moderate)	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4b	Derived Native Grassland	435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Red Gum – Tea Tree Creek Woodland (Good)	399	0	0	0	0	0	0	0	0	1.1	0.3	1.4	1	1	5.5	0.5	6	4	0	0	4	11.6	0.8	0	0
5a	Red Gum – Tea Tree Creek Woodland (Moderate)	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0.9	0	0	0	0	0.9	0	0	0
6	Rough-barked Apple Sand Flat Woodland (Good)	401	0.8	0	0	0.8	0	0	0	0	2.9	0	2.9	0.4	0.4	0.2	0	0.2	0	0	0	0	4.3	0	0	0

Table F15 (Continued)
Pilliga Mouse Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
7	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Good)	404	11	0	0	11	0	0	0	0	38.2	0	38.2	4.6	4.6	23.4	0.1	23.5	127	0.5	0	127.5	204.2	0.6	0	0
7a	Red Ironbark – White Bloodwood +/- Burrows Wattle Shrubby Woodland (Moderate)	404	0.5	0	0	0.5	0	0	0	0	1.5	0	1.5	0	0	0	0	0	0	0	0	0	2	0	0	0
8	White Bloodwood – Red Ironbark – Black Cypress Woodland (Good)	405	0	0	0	0	0	0	0	0	10.2	0	10.2	7.8	7.8	35	0	35	47.4	0	0	47.4	100.4	0	0	0
8a	Derived Native Grassland	405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Good)	406	0	0	0	0	0	0	0	0	0	0	0	9.9	9.9	14	0	14	14	0	0	14	37.9	0	0	0
9a	White Bloodwood – Motherumbah – Red Ironbark Shrubby Woodland (Moderate)	406	0.9	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0
10	Dirty Gum Shrubby Woodland (Good)	408	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0	0	0
11*	Poplar Box Grassy Woodland (Good)	244	0	0	0	0	2.1	0.2	0	2.3	0	0	0	0	0	0	0	0	0.6	0.2	3.4	4.2	2.7	0.4	0	3.4
11a	Derived Native Grassland	244	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Belah Woodland (Good)	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table F15 (Continued)
Pilliga Mouse Species Polygon Habitat Composition

Veg Zone	Vegetation Community (AMBS, 2020a) (Attachment B)	PCT ID	Phase 1				Phase 2				Phase 3			Phase 4		Phase 5			Phase 6				Overall Impacts			
			Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	Area of Potential Cracking Impacts on Vegetation (ha)	Total Area (ha)	Clearance Area (ha)	Area of Potential Ponding (ha)	ETL Management (ha)	Area of Potential Cracking Impacts on Vegetation (ha)
12a	Derived Native Grassland	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Dirty Gum – White Cypress Woodland on Sand Monkeys (Good)	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Area (ha) Woodland			**16.8**	**0.2**	**0**	**17**	**22**	**0.4**	**0**	**22.4**	**54.4**	**0.6**	**55**	**30.6**	**30.6**	**80.4**	**0.6**	**81**	**195.8**	**0.7**	**16.8**	**213.3**	**400**	**2.5**	**0**	**16.8**
Total Area (ha) Derived Native Grassland			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Area (ha) Native Vegetation			**16.8**	**0.2**	**0**	**17**	**22**	**0.4**	**0**	**22.4**	**54.4**	**0.6**	**55**	**30.6**	**30.6**	**80.4**	**0.6**	**81**	**195.8**	**0.7**	**16.8**	**213.3**	**400**	**2.5**	**0**	**16.8**

* AMBS (2020b) (Attachment C) identified part of this vegetation zone as providing habitat for this species.

ATTACHMENT G1
BAM BIODIVERSITY CREDIT REPORT – PHASE 1

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00021836/BAAS17080/20/00021837	Narrabri Footprint - Phase 1 final	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
Jamie Gleeson	09/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17080	Open	To be finalised
Assessment Revision	**Assessment Type**	
2	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.								
1	55_DNG	39.8	2.6	0.25	High Sensitivity to Potential Gain	2.00		52
2	55_Good	61.1	3	0.25	High Sensitivity to Potential Gain	2.00		92

							Subtotal	**144**
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion								
3	88_DNG	32.8	41	0.25	High Sensitivity to Potential Gain	1.50		504
4	88_Good	68.6	5.8	0.25	High Sensitivity to Potential Gain	1.50		149
5	88_Moderate	40.5	0.2	0.25	High Sensitivity to Potential Gain	1.50		3
							Subtotal	**656**
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).								
6	244_DNG	9.8	20.6	0.25	High Sensitivity to Potential Gain	2.00		0
7	244_Good	22.4	2.8	0.25	High Sensitivity to Potential Gain	2.00		31
							Subtotal	**31**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests								
9	404_Good	50.7	11	0.25	High Sensitivity to Potential Gain	1.50		209
10	404_Moderate	45.6	0.5	0.25	High Sensitivity to Potential Gain	1.50		9
							Subtotal	**218**
Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region								
8	401_Good	65.5	0.8	0.25	High Sensitivity to Potential Gain	1.50		20
							Subtotal	**20**
White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests								
11	406_Moderate	54.7	0.9	0.25	High Sensitivity to Potential Gain	1.50		18
							Subtotal	**18**

White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion								
12	435_DNG	14.8	10	0.25	High Sensitivity to Potential Gain	1.75		0
13	435_Good	40.0	4.2	0.25	High Sensitivity to Potential Gain	1.75		74
							Subtotal	**74**
							Total	**1161**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
55_DNG	39.8	2.1	0.25	2	False	42
55_Good	61.1	3	0.25	2	False	92
88_DNG	32.8	10.8	0.25	2	False	177
88_Good	68.6	5.8	0.25	2	False	199
88_Moderate	40.5	0.2	0.25	2	False	4
244_DNG	9.8	4.6	0.25	2	False	22
244_Good	22.4	2.8	0.25	2	False	31
401_Good	65.5	0.8	0.25	2	False	26
404_Good	50.7	11	0.25	2	False	279
404_Moderate	45.6	0.5	0.25	2	False	11
406_Moderate	54.7	0.9	0.25	2	False	25
435_DNG	14.8	0.8	0.25	2	False	6

435_Good	40.0	4.2	0.25	2	False	84
					Subtotal	**998**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
88_Good	68.6	3.6	0.25	2	False	123
88_Moderate	40.5	0.2	0.25	2	False	4
401_Good	65.5	0.8	0.25	2	False	26
404_Good	50.7	11	0.25	2	False	279
404_Moderate	45.6	0.5	0.25	2	False	11
406_Moderate	54.7	0.9	0.25	2	False	25
					Subtotal	**468**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
88_DNG	32.8	10.8	0.25	2	False	177
88_Good	68.6	5.8	0.25	2	False	199
88_Moderate	40.5	0.2	0.25	2	False	4
244_DNG	9.8	4.6	0.25	2	False	22
244_Good	22.4	2.8	0.25	2	False	31
401_Good	65.5	0.8	0.25	2	False	26
404_Good	50.7	11	0.25	2	False	279
404_Moderate	45.6	0.5	0.25	2	False	11
406_Moderate	54.7	0.9	0.25	2	False	25

435_DNG	14.8	0.8	0.25	2	False	6
435_Good	40.0	4.2	0.25	2	False	84
					Subtotal	**864**
Lepidium aschersonii / Spiny Peppercress (Flora)						
55_Good	61.1	3	0.25	2	False	92
88_Good	68.6	5.8	0.25	2	False	199
88_Moderate	40.5	0.2	0.25	2	False	4
					Subtotal	**295**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
88_DNG	32.8	10.8	0.25	2	False	177
88_Good	68.6	5.8	0.25	2	False	199
88_Moderate	40.5	0.2	0.25	2	False	4
244_DNG	9.8	4.6	0.25	2	False	22
244_Good	22.4	2.8	0.25	2	False	31
401_Good	65.5	0.8	0.25	2	False	26
406_Moderate	54.7	0.9	0.25	2	False	25
435_DNG	14.8	0.8	0.25	2	False	6
435_Good	40.0	4.2	0.25	2	False	84
					Subtotal	**574**
Phascolarctos cinereus / Koala (Fauna)						
55_DNG	39.8	2.1	0.25	2	False	42

55_Good	61.1	3	0.25	2	False	92
88_DNG	32.8	10.8	0.25	2	False	177
88_Good	68.6	5.8	0.25	2	False	199
88_Moderate	40.5	0.2	0.25	2	False	4
244_DNG	9.8	4.6	0.25	2	False	22
244_Good	22.4	2.8	0.25	2	False	31
401_Good	65.5	0.8	0.25	2	False	26
404_Good	50.7	11	0.25	2	False	279
404_Moderate	45.6	0.5	0.25	2	False	11
406_Moderate	54.7	0.9	0.25	2	False	25
435_DNG	14.8	0.8	0.25	2	False	6
435_Good	40.0	4.2	0.25	2	False	84
					Subtotal	**998**
Tylophora linearis / Tylophora linearis (Flora)						
88_Good	68.6	5.8	0.25	2	False	199
88_Moderate	40.5	0.2	0.25	2	False	4
401_Good	65.5	0.8	0.25	2	False	26
404_Good	50.7	11	0.25	2	False	279
404_Moderate	45.6	0.5	0.25	2	False	11
406_Moderate	54.7	0.9	0.25	2	False	25
435_Good	40.0	4.2	0.25	2	False	84

					Subtotal	**628**

ATTACHMENT G2
BAM BIODIVERSITY CREDIT REPORT (LIKE FOR LIKE) – PHASE 1

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00021836/BAAS17080/20/00021837	Proposal Name Narrabri Footprint - Phase 1 final	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Names	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 2	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	5.6	144.00
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	47.0	656.00
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	Not a TEC	23.4	31.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	0.8	20.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	11.5	218.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	0.9	18.00

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	14.2	74.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	47.5	998.00
Cercartetus nanus / Eastern Pygmy-possum	17.0	468.00
Hoplocephalus bitorquatus / Pale-headed Snake	42.4	864.00
Lepidium aschersonii / Spiny Peppercress	9.0	295.00
Petaurus norfolcensis / Squirrel Glider	30.9	574.00
Phascolarctos cinereus / Koala	47.5	998.00
Tylophora linearis / Tylophora linearis	23.4	628.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	406_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

	435_Good	**Like-for-like credit retirement options**
		Spp / IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo / Any in NSW
	55_DNG	**Like-for-like credit retirement options**
		Spp / IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo / Any in NSW
	55_Good	**Like-for-like credit retirement options**
		Spp / IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo / Any in NSW
	88_DNG	**Like-for-like credit retirement options**
		Spp / IBRA region

		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
Cercartetus nanus/ Eastern Pygmy-possum	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW

Cercartetus nanus/ Eastern Pygmy-possum	401_Good		
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	406_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	88_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	88_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
Hoplocephalus bitorquatus/ Pale-headed Snake	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

Hoplocephalus bitorquatus/ Pale-headed Snake	244_Good		
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

Hoplocephalus bitorquatus/ Pale-headed Snake	406_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
Lepidium aschersonii/ Spiny Peppercress	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW

Lepidium aschersonii/ Spiny Peppercress	55_Good		
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW
	88_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW
Petaurus norfolcensis/ Squirrel Glider	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	244_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	406_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

435_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Petaurus norfolcensis/Squirrel Glider	Any in NSW
88_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Petaurus norfolcensis/Squirrel Glider	Any in NSW
88_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Petaurus norfolcensis/Squirrel Glider	Any in NSW
88_Moderate	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
Phascolarctos cinereus/ Koala	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Phascolarctos cinereus/ Koala	401_Good		
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	406_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Phascolarctos cinereus/ Koala	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	55_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Phascolarctos cinereus/Koala	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Tylophora linearis/ Tylophora linearis	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	406_Moderate	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	88_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW

ATTACHMENT G3
BAM BIODIVERSITY CREDIT REPORT (VARIATIONS) – PHASE 1

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00021836/BAAS17080/20/00021837	Narrabri Footprint - Phase 1 final	20/08/2020
Assessor Name	Assessor Number	BAM Data version *
Jamie Gleeson	BAAS17080	30
Proponent Name(s)	Report Created	BAM Case Status
	09/10/2020	Open
Assessment Revision	Assessment Type	Date Finalised
2	Major Projects	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	5.6	144.00
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	47.0	656.00
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	Not a TEC	23.4	31.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	0.8	20.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	11.5	218.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	0.9	18.00

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	14.2	74.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Semi-arid Woodlands (Grassy sub-formation)	Tier 4 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Grassy Woodlands	Tier 4 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	47.5	998.00
Cercartetus nanus / Eastern Pygmy-possum	17.0	468.00
Hoplocephalus bitorquatus / Pale-headed Snake	42.4	864.00
Lepidium aschersonii / Spiny Peppercress	9.0	295.00
Petaurus norfolcensis / Squirrel Glider	30.9	574.00
Phascolarctos cinereus / Koala	47.5	998.00
Tylophora linearis / Tylophora linearis	23.4	628.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Cercartetus nanus/ Eastern Pygmy-possum	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Cercartetus nanus/ Eastern Pygmy-possum	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hoplocephalus bitorquatus/ Pale-headed Snake	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Lepidium aschersonii/ Spiny Peppercress	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Petaurus norfolcensis/ Squirrel Glider	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Phascolarctos cinereus/ Koala	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Tylophora linearis/ Tylophora linearis	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

ATTACHMENT H1
BAM BIODIVERSITY CREDIT REPORT – PHASE 2

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022109/BAAS17080/20/00022110	Narrabri Underground Mine Stage 3 Extension Project Phase 2	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
Jamie Gleeson	09/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17080	Open	To be finalised
Assessment Revision	**Assessment Type**	
2	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.								
1	55_DNG	31.2	25.6	0.25	High Sensitivity to Potential Gain	2.00		400

2	55_Good	65.0	4.2	0.25	High Sensitivity to Potential Gain	2.00		136
							Subtotal	**536**
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion								
3	88_DNG	31.2	15	0.25	High Sensitivity to Potential Gain	1.50		175
4	88_Good	74.8	20.6	0.25	High Sensitivity to Potential Gain	1.50		578
							Subtotal	**753**
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).								
5	244_Good	67.6	3.3	0.25	High Sensitivity to Potential Gain	2.00		111
							Subtotal	**111**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion								
6	435_DNG	1.2	3	0.25	High Sensitivity to Potential Gain	1.75		0
7	435_Good	33.1	19	0.25	High Sensitivity to Potential Gain	1.75		275
							Subtotal	**275**
							Total	**1675**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
55_DNG	31.2	2.3	0.25	2	False	36
55_Good	65.0	4.2	0.25	2	False	136
88_DNG	31.2	5.7	0.25	2	False	89

88_Good	74.8	20.6	0.25	2	False	770
244_Good	67.6	3.3	0.25	2	False	111
435_DNG	1.2	1.3	0.25	2	False	1
435_Good	33.1	19	0.25	2	False	315
					Subtotal	**1458**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
88_Good	74.8	20.1	0.25	2	False	751
					Subtotal	**751**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
88_Good	74.8	18.8	0.25	3	True	1054
244_Good	67.6	0.1	0.25	3	True	5
435_Good	33.1	17.6	0.25	3	True	437
					Subtotal	**1496**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
88_DNG	31.2	5.7	0.25	2	False	89
88_Good	74.8	20.6	0.25	2	False	770
244_Good	67.6	3.3	0.25	2	False	111
435_DNG	1.2	1.3	0.25	2	False	1
435_Good	33.1	19	0.25	2	False	315
					Subtotal	**1286**

Lepidium aschersonii / Spiny Peppercress (Flora)						
55_Good	65.0	4.2	0.25	2	False	136
88_Good	74.8	20.6	0.25	2	False	770
					Subtotal	**906**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
88_DNG	31.2	5.7	0.25	2	False	89
88_Good	74.8	20.6	0.25	2	False	770
244_Good	67.6	3.3	0.25	2	False	111
435_DNG	1.2	1.3	0.25	2	False	1
435_Good	33.1	19	0.25	2	False	315
					Subtotal	**1286**
Phascolarctos cinereus / Koala (Fauna)						
55_DNG	31.2	2.3	0.25	2	False	36
55_Good	65.0	4.2	0.25	2	False	136
88_DNG	31.2	5.7	0.25	2	False	89
88_Good	74.8	20.6	0.25	2	False	770
244_Good	67.6	3.3	0.25	2	False	111
435_DNG	1.2	1.3	0.25	2	False	1
435_Good	33.1	19	0.25	2	False	315
					Subtotal	**1458**

Tylophora linearis / Tylophora linearis (Flora)						
88_Good	74.8	20.6	0.25	2	False	770
435_Good	33.1	19	0.25	2	False	315
					Subtotal	**1085**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)						
88_DNG	31.2	6.6	0.25	3	True	154
88_Good	74.8	17.5	0.25	3	True	981
435_DNG	1.2	2.6	0.25	3	True	2
435_Good	33.1	17.5	0.25	3	True	435
					Subtotal	**1572**

ATTACHMENT H2
BAM BIODIVERSITY CREDIT REPORT (LIKE FOR LIKE) – PHASE 2

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00022109/BAAS17080/20/00022110	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 2	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Names	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 2	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat

Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	29.8	536.00
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	35.6	753.00
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	Not a TEC	3.3	111.00

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	22.0	275.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	56.4	1458.00
Cercartetus nanus / Eastern Pygmy-possum	20.1	751.00
Chalinolobus dwyeri / Large-eared Pied Bat	36.5	1496.00
Hoplocephalus bitorquatus / Pale-headed Snake	49.9	1286.00
Lepidium aschersonii / Spiny Peppercress	24.8	906.00
Petaurus norfolcensis / Squirrel Glider	49.9	1286.00
Phascolarctos cinereus / Koala	56.4	1458.00

Tylophora linearis / Tylophora linearis	39.6	1085.00
Vespadelus troughtoni / Eastern Cave Bat	44.2	1572.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

Calyptorhynchus lathami/ Glossy Black-Cockatoo	55_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
Cercartetus nanus/ Eastern Pygmy-possum	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
Chalinolobus dwyeri/ Large-eared Pied Bat	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW

Chalinolobus dwyeri/ Large-eared Pied Bat	435_Good		
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
Hoplocephalus bitorquatus/ Pale-headed Snake	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
Lepidium aschersonii/ Spiny Peppercress	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW

Lepidium aschersonii/ Spiny Peppercress	55_Good		
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW
Petaurus norfolcensis/ Squirrel Glider	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

Petaurus norfolcensis/ Squirrel Glider	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
Phascolarctos cinereus/ Koala	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Phascolarctos cinereus/Koala	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	55_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
Tylophora linearis/ Tylophora linearis	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Tylophora linearis/Tylophora linearis	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
Vespadelus troughtoni/ Eastern Cave Bat	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

Vespadelus troughtoni/ Eastern Cave Bat	435_Good		
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

ATTACHMENT H3
BAM BIODIVERSITY CREDIT REPORT (VARIATIONS) – PHASE 2

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id 00022109/BAAS17080/20/00022110	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 2	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Name(s)	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 2	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	29.8	536.00
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	35.6	753.00
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	Not a TEC	3.3	111.00

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	22.0	275.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Semi-arid Woodlands (Grassy sub-formation)	Tier 4 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Grassy Woodlands	Tier 4 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Liverpool Plains,Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	56.4	1458.00
Cercartetus nanus / Eastern Pygmy-possum	20.1	751.00
Chalinolobus dwyeri / Large-eared Pied Bat	36.5	1496.00
Hoplocephalus bitorquatus / Pale-headed Snake	49.9	1286.00
Lepidium aschersonii / Spiny Peppercress	24.8	906.00
Petaurus norfolcensis / Squirrel Glider	49.9	1286.00
Phascolarctos cinereus / Koala	56.4	1458.00
Tylophora linearis / Tylophora linearis	39.6	1085.00
Vespadelus troughtoni / Eastern Cave Bat	44.2	1572.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	244_Good	**Like-for-like options**	
		Spp	IBRA region

		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Cercartetus nanus/ Eastern Pygmy-possum	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Chalinolobus dwyeri/ Large-eared Pied Bat	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Hoplocephalus bitorquatus/ Pale-headed Snake	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or	IBRA region

			higher category of listing under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Lepidium aschersonii/ Spiny Peppercress	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Petaurus norfolcensis/ Squirrel Glider	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Phascolarctos cinereus/ Koala	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Tylophora linearis/ Tylophora linearis	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Tylophora linearis/ Tylophora linearis	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Vespadelus troughtoni/ Eastern Cave Bat	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

ATTACHMENT I1
BAM BIODIVERSITY CREDIT REPORT – PHASE 3

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022111/BAAS17080/20/00022112	Narrabri Underground Mine Stage 3 Extension Project Phase 3 final	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
Jamie Gleeson	09/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17080	Open	To be finalised
Assessment Revision	**Assessment Type**	
2	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion								
1	88_DNG	31.6	3.6	0.25	High Sensitivity to Potential Gain	1.50		43

2	88_Good	75.8	0.8	0.25	High Sensitivity to Potential Gain	1.50		23
							Subtotal	**66**
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion								
3	399_Good	68.7	1.4	0.25	High Sensitivity to Potential Gain	1.50		36
							Subtotal	**36**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests								
5	404_Good	61.0	38.2	0.25	High Sensitivity to Potential Gain	1.50		874
6	404_Moderate	36.0	1.5	0.25	High Sensitivity to Potential Gain	1.50		20
							Subtotal	**894**
Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region								
4	401_Good	72.4	2.9	0.25	High Sensitivity to Potential Gain	1.50		79
							Subtotal	**79**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions								
7	405_DNG	36.1	0.7	0.25	High Sensitivity to Potential Gain	1.50		9
8	405_Good	55.1	10.2	0.25	High Sensitivity to Potential Gain	1.50		211
							Subtotal	**220**
							Total	**1295**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits

Bertya opponens / Coolabah Bertya (Flora)						
404_Good	N/A	1297	0.25	2	False	2594
					Subtotal	**2594**
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
88_DNG	31.6	2.2	0.25	2	False	35
88_Good	75.8	0.8	0.25	2	False	30
399_Good	68.7	1.4	0.25	2	False	48
401_Good	72.4	2.9	0.25	2	False	105
404_Good	61.0	38.2	0.25	2	False	1165
404_Moderate	36.0	1.5	0.25	2	False	27
405_DNG	36.1	0.6	0.25	2	False	11
405_Good	55.1	10.2	0.25	2	False	281
					Subtotal	**1702**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
88_Good	75.8	0.8	0.25	2	False	30
399_Good	68.7	1.4	0.25	2	False	48
401_Good	72.4	2.9	0.25	2	False	105
404_Good	61.0	38.2	0.25	2	False	1165
404_Moderate	36.0	1.5	0.25	2	False	27
405_Good	55.1	10.2	0.25	2	False	281

					Subtotal	**1656**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
88_DNG	31.6	2.2	0.25	2	False	35
88_Good	75.8	0.8	0.25	2	False	30
399_Good	68.7	1.4	0.25	2	False	48
401_Good	72.4	2.9	0.25	2	False	105
404_Good	61.0	38.2	0.25	2	False	1165
404_Moderate	36.0	1.5	0.25	2	False	27
405_DNG	36.1	0.6	0.25	2	False	11
405_Good	55.1	10.2	0.25	2	False	281
					Subtotal	**1702**
Lepidium aschersonii / Spiny Peppercress (Flora)						
88_Good	75.8	0.8	0.25	2	False	30
					Subtotal	**30**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
88_DNG	31.6	2.2	0.25	2	False	35
88_Good	75.8	0.8	0.25	2	False	30
399_Good	68.7	1.4	0.25	2	False	48
401_Good	72.4	2.9	0.25	2	False	105
404_Good	61.0	0.5	0.25	2	False	15
404_Moderate	36.0	0.2	0.25	2	False	4

405_DNG	36.1	0.6	0.25	2	False	11
405_Good	55.1	10.2	0.25	2	False	281
					Subtotal	**529**
Phascolarctos cinereus / Koala (Fauna)						
88_DNG	31.6	2.2	0.25	2	False	35
88_Good	75.8	0.8	0.25	2	False	30
399_Good	68.7	1.4	0.25	2	False	48
401_Good	72.4	2.9	0.25	2	False	105
404_Good	61.0	38.2	0.25	2	False	1165
404_Moderate	36.0	1.5	0.25	2	False	27
405_DNG	36.1	0.6	0.25	2	False	11
405_Good	55.1	10.2	0.25	2	False	281
					Subtotal	**1702**
Tylophora linearis / Tylophora linearis (Flora)						
88_Good	75.8	0.8	0.25	2	False	30
399_Good	68.7	1.4	0.25	2	False	48
401_Good	72.4	2.9	0.25	2	False	105
404_Good	61.0	38.2	0.25	2	False	1165
404_Moderate	36.0	1.5	0.25	2	False	27
405_Good	55.1	10.2	0.25	2	False	281
					Subtotal	**1656**

ATTACHMENT I2
BAM BIODIVERSITY CREDIT REPORT (LIKE FOR LIKE) – PHASE 3

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00022111/BAAS17080/20/00022112	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 3 final	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Names	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 2	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	4.4	66.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	1.4	36.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	2.9	79.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	39.7	894.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	10.9	220.00

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Bertya opponens / Coolabah Bertya	1297.0	2594.00
Calyptorhynchus lathami / Glossy Black-Cockatoo	57.8	1702.00
Cercartetus nanus / Eastern Pygmy-possum	55.0	1656.00
Hoplocephalus bitorquatus / Pale-headed Snake	57.8	1702.00
Lepidium aschersonii / Spiny Peppercress	0.8	30.00
Petaurus norfolcensis / Squirrel Glider	18.8	529.00
Phascolarctos cinereus / Koala	57.8	1702.00
Tylophora linearis / Tylophora linearis	55.0	1656.00

Bertya opponens/ Coolabah Bertya	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Bertya opponens/Coolabah Bertya	Any in NSW
Calyptorhynchus lathami/ Glossy Black-Cockatoo	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

Calyptorhynchus lathami/ Glossy Black-Cockatoo	399_Good		
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	405_DNG	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

Cercartetus nanus/ Eastern Pygmy-possum	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW

Cercartetus nanus/ Eastern Pygmy-possum	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
Hoplocephalus bitorquatus/ Pale-headed Snake	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

405_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
405_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
88_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
88_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region

		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
Lepidium aschersonii/ Spiny Peppercress	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW
Petaurus norfolcensis/ Squirrel Glider	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

Petaurus norfolcensis/ Squirrel Glider	401_Good		
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	405_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	405_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
Phascolarctos cinereus/ Koala	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Phascolarctos cinereus/ Koala	399_Good		
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Phascolarctos cinereus/ Koala	405_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Phascolarctos cinereus/Koala	Any in NSW
Tylophora linearis/ Tylophora linearis	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW

Tylophora linearis/ Tylophora linearis	404_Good		
	404_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW

ATTACHMENT I3
BAM BIODIVERSITY CREDIT REPORT (VARIATIONS) – PHASE 3

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022111/BAAS17080/20/00022112	Narrabri Underground Mine Stage 3 Extension Project Phase 3 final	20/08/2020
Assessor Name	**Assessor Number**	**BAM Data version ***
Jamie Gleeson	BAAS17080	30
Proponent Name(s)	**Report Created**	**BAM Case Status**
	12/10/2020	Open
Assessment Revision	**Assessment Type**	**Date Finalised**
2	Major Projects	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	4.4	66.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	1.4	36.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	2.9	79.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	39.7	894.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	10.9	220.00

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Variation options			
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Bertya opponens / Coolabah Bertya	1297.0	2594.00
Calyptorhynchus lathami / Glossy Black-Cockatoo	57.8	1702.00
Cercartetus nanus / Eastern Pygmy-possum	55.0	1656.00
Hoplocephalus bitorquatus / Pale-headed Snake	57.8	1702.00
Lepidium aschersonii / Spiny Peppercress	0.8	30.00
Petaurus norfolcensis / Squirrel Glider	18.8	529.00
Phascolarctos cinereus / Koala	57.8	1702.00
Tylophora linearis / Tylophora linearis	55.0	1656.00

		Like-for-like options	
Bertya opponens/ Coolabah Bertya	404_Good	Spp	IBRA region
		Bertya opponens/Coolabah Bertya	Any in NSW

Bertya opponens/ Coolabah Bertya	404_Good	**Variation options**		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Calyptorhynchus lathami/ Glossy Black-Cockatoo	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Cercartetus nanus/ Eastern Pygmy-possum	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Hoplocephalus bitorquatus/ Pale-headed Snake	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or	IBRA region

			higher category of listing under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	405_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Lepidium aschersonii/ Spiny Peppercress	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Tylophora linearis/ Tylophora linearis	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

ATTACHMENT J1
BAM BIODIVERSITY CREDIT REPORT – PHASE 4

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022113/BAAS17080/20/00022114	Narrabri Underground Mine Stage 3 Extension Project Phase 4	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
Jamie Gleeson	09/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17080	Open	To be finalised
Assessment Revision	**Assessment Type**	
1	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.								
1	55_DNG	22.4	1.6	0.25	High Sensitivity to Potential Gain	2.00		18

2	55_Good	52.7	0.4	0.25	High Sensitivity to Potential Gain	2.00		11
							Subtotal	**29**
Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion								
5	206_Good	68.0	1.9	0.25	High Sensitivity to Potential Gain	1.75		57
							Subtotal	**57**
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion								
3	88_DNG	47.4	2.1	0.25	High Sensitivity to Potential Gain	1.50		37
4	88_Good	73.7	6.9	0.25	High Sensitivity to Potential Gain	1.50		191
							Subtotal	**228**
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion								
6	399_Good	80.4	1	0.25	High Sensitivity to Potential Gain	1.50		30
							Subtotal	**30**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests								
8	404_Good	64.1	4.6	0.25	High Sensitivity to Potential Gain	1.50		110
							Subtotal	**110**
Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region								
7	401_Good	54.1	0.4	0.25	High Sensitivity to Potential Gain	1.50		8
							Subtotal	**8**

White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests							
10	406_Good	79.6	9.9	0.25	High Sensitivity to Potential Gain	1.50	295
						Subtotal	**295**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions							
9	405_Good	70.6	7.8	0.25	High Sensitivity to Potential Gain	1.50	207
						Subtotal	**207**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion							
11	435_Good	76.6	3	0.25	High Sensitivity to Potential Gain	1.75	100
						Subtotal	**100**
						Total	**1064**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
55_DNG	22.4	0.5	0.25	2	False	6
55_Good	52.7	0.4	0.25	2	False	11
88_DNG	47.4	1.1	0.25	2	False	26
88_Good	73.7	6.9	0.25	2	False	254
206_Good	68.0	1.9	0.25	2	False	65
399_Good	80.4	1	0.25	2	False	40
401_Good	54.1	0.4	0.25	2	False	11

404_Good	64.1	4.6	0.25	2	False	147
405_Good	70.6	7.8	0.25	2	False	275
406_Good	79.6	9.9	0.25	2	False	394
435_Good	76.6	3	0.25	2	False	115
					Subtotal	**1344**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
88_Good	73.7	6.9	0.25	2	False	254
206_Good	68.0	1.9	0.25	2	False	65
399_Good	80.4	1	0.25	2	False	40
401_Good	54.1	0.4	0.25	2	False	11
404_Good	64.1	4.6	0.25	2	False	147
405_Good	70.6	7.8	0.25	2	False	275
406_Good	79.6	9.9	0.25	2	False	394
					Subtotal	**1186**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
88_Good	73.7	6.3	0.25	3	True	348
206_Good	68.0	1.9	0.25	3	True	97
399_Good	80.4	1	0.25	3	True	60
405_Good	70.6	6.2	0.25	3	True	328
406_Good	79.6	9.9	0.25	3	True	591
435_Good	76.6	3	0.25	3	True	172

					Subtotal	**1596**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
88_DNG	47.4	1.1	0.25	2	False	26
88_Good	73.7	6.9	0.25	2	False	254
206_Good	68.0	1.9	0.25	2	False	65
399_Good	80.4	1	0.25	2	False	40
401_Good	54.1	0.4	0.25	2	False	11
404_Good	64.1	4.6	0.25	2	False	147
405_Good	70.6	7.8	0.25	2	False	275
406_Good	79.6	9.9	0.25	2	False	394
435_Good	76.6	3	0.25	2	False	115
					Subtotal	**1327**
Lepidium aschersonii / Spiny Peppercress (Flora)						
55_Good	52.7	0.4	0.25	2	False	11
88_Good	73.7	6.9	0.25	2	False	254
					Subtotal	**265**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
88_DNG	47.4	1.1	0.25	2	False	26
88_Good	73.7	6.9	0.25	2	False	254
206_Good	68.0	1.9	0.25	2	False	65
399_Good	80.4	1	0.25	2	False	40

401_Good	54.1	0.4	0.25	2	False	11
405_Good	70.6	7.8	0.25	2	False	275
406_Good	79.6	9.9	0.25	2	False	394
435_Good	76.6	3	0.25	2	False	115
					Subtotal	**1180**
Phascolarctos cinereus / Koala (Fauna)						
55_DNG	22.4	0.5	0.25	2	False	6
55_Good	52.7	0.4	0.25	2	False	11
88_DNG	47.4	1.1	0.25	2	False	26
88_Good	73.7	6.9	0.25	2	False	254
206_Good	68.0	1.9	0.25	2	False	65
399_Good	80.4	1	0.25	2	False	40
401_Good	54.1	0.4	0.25	2	False	11
404_Good	64.1	4.6	0.25	2	False	147
405_Good	70.6	7.8	0.25	2	False	275
406_Good	79.6	9.9	0.25	2	False	394
435_Good	76.6	3	0.25	2	False	115
					Subtotal	**1344**
Tylophora linearis / Tylophora linearis (Flora)						
88_Good	73.7	6.9	0.25	2	False	254
399_Good	80.4	1	0.25	2	False	40

401_Good	54.1	0.4	0.25	2	False	11
404_Good	64.1	4.6	0.25	2	False	147
405_Good	70.6	7.8	0.25	2	False	275
406_Good	79.6	9.9	0.25	2	False	394
435_Good	76.6	3	0.25	2	False	115
					Subtotal	**1236**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)						
88_Good	73.7	5.3	0.25	3	True	293
206_Good	68.0	1.9	0.25	3	True	97
406_Good	79.6	7	0.25	3	True	418
435_Good	76.6	0.7	0.25	3	True	40
					Subtotal	**848**

ATTACHMENT J2
BAM BIODIVERSITY CREDIT REPORT (LIKE FOR LIKE) – PHASE 4

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00022113/BAAS17080/20/00022114	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 4	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Names	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 1	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	2.0	29.00
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	9.0	228.00

206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Not a TEC	1.9	57.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	1.0	30.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	0.4	8.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	4.6	110.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	7.8	207.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	9.9	295.00
435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	3.0	100.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	No	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion				
206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Alluvial Sand Woodlands This includes PCT's: 71, 206, 227, 376, 428	North-west Alluvial Sand Woodlands >=50% and <70%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	No	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	No	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	37.5	1344.00
Cercartetus nanus / Eastern Pygmy-possum	32.5	1186.00
Chalinolobus dwyeri / Large-eared Pied Bat	28.3	1596.00
Hoplocephalus bitorquatus / Pale-headed Snake	36.6	1327.00
Lepidium aschersonii / Spiny Peppercress	7.3	265.00
Petaurus norfolcensis / Squirrel Glider	32.0	1180.00
Phascolarctos cinereus / Koala	37.5	1344.00

Tylophora linearis / Tylophora linearis	33.6	1236.00
Vespadelus troughtoni / Eastern Cave Bat	14.9	848.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

Calyptorhynchus lathami/ Glossy Black-Cockatoo	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	55_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
Cercartetus nanus/ Eastern Pygmy-possum	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW

	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
Chalinolobus dwyeri/ Large-eared Pied Bat	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW

Hoplocephalus bitorquatus/ Pale-headed Snake	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

Hoplocephalus bitorquatus/ Pale-headed Snake	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
Lepidium aschersonii/ Spiny Peppercress	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW

Lepidium aschersonii/ Spiny Peppercress	55_Good		
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW
Petaurus norfolcensis/ Squirrel Glider	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	401_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
Phascolarctos cinereus/ Koala	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Phascolarctos cinereus/ Koala	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Phascolarctos cinereus/Koala	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	55_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

	55_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
Tylophora linearis/ Tylophora linearis	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Tylophora linearis/Tylophora linearis	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW

	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
Vespadelus troughtoni/ Eastern Cave Bat	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

ATTACHMENT J3
BAM BIODIVERSITY CREDIT REPORT (VARIATIONS) – PHASE 4

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022113/BAAS17080/20/00022114	Narrabri Underground Mine Stage 3 Extension Project Phase 4	20/08/2020
Assessor Name	**Assessor Number**	**BAM Data version ***
Jamie Gleeson	BAAS17080	30
Proponent Name(s)	**Report Created**	**BAM Case Status**
	09/10/2020	Open
Assessment Revision	**Assessment Type**	**Date Finalised**
1	Major Projects	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	2.0	29.00
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	9.0	228.00

206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Not a TEC	1.9	57.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	1.0	30.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	0.4	8.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	4.6	110.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	7.8	207.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	9.9	295.00
435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	3.0	100.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	No	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Semi-arid Woodlands (Grassy sub-formation)	Tier 4 or higher	No	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Alluvial Sand Woodlands This includes PCT's: 71, 206, 227, 376, 428	North-west Alluvial Sand Woodlands >=50% and <70%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Semi-arid Woodlands (Shrubby sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	No	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	No	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	No	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	No	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	37.5	1344.00
Cercartetus nanus / Eastern Pygmy-possum	32.5	1186.00
Chalinolobus dwyeri / Large-eared Pied Bat	28.3	1596.00

Hoplocephalus bitorquatus / Pale-headed Snake	36.6	1327.00
Lepidium aschersonii / Spiny Peppercress	7.3	265.00
Petaurus norfolcensis / Squirrel Glider	32.0	1180.00
Phascolarctos cinereus / Koala	37.5	1344.00
Tylophora linearis / Tylophora linearis	33.6	1236.00
Vespadelus troughtoni / Eastern Cave Bat	14.9	848.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Calyptorhynchus lathami/ Glossy Black-Cockatoo	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Cercartetus nanus/ Eastern Pygmy-possum	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Chalinolobus dwyeri/ Large-eared Pied Bat	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hoplocephalus bitorquatus/ Pale-headed Snake	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Hoplocephalus bitorquatus/ Pale-headed Snake	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Lepidium aschersonii/ Spiny Peppercress	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Tylophora linearis/ Tylophora linearis	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Vespadelus troughtoni/ Eastern Cave Bat	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

ATTACHMENT K1
BAM BIODIVERSITY CREDIT REPORT – PHASE 5

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022115/BAAS17080/20/00022116	Narrabri Underground Mine Stage 3 Extension Project Phase 5	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
Jamie Gleeson	09/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17080	Open	To be finalised
Assessment Revision	**Assessment Type**	
2	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion								
3	206_Good	69.2	0.1	0.25	High Sensitivity to Potential Gain	1.75		3
							Subtotal	**3**
Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland on of the Pilliga forests and surrounding region								
10	408_Good	71.2	0.1	0.25	High Sensitivity to Potential Gain	1.50		3
							Subtotal	**3**
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion								
1	88_DNG	46.9	3	0.25	High Sensitivity to Potential Gain	1.50		53
2	88_Good	68.8	1.3	0.25	High Sensitivity to Potential Gain	1.50		34
							Subtotal	**87**
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion								
4	399_Good	73.1	6	0.25	High Sensitivity to Potential Gain	1.50		165
5	399_Moderate	38.4	0.9	0.25	High Sensitivity to Potential Gain	1.50		13
							Subtotal	**178**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests								
7	404_Good	70.7	23.5	0.25	High Sensitivity to Potential Gain	1.50		623
							Subtotal	**623**

Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region							
6	401_Good	54.1	0.2	0.25	High Sensitivity to Potential Gain	1.50	4
						Subtotal	**4**
White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests							
9	406_Good	62.4	14	0.25	High Sensitivity to Potential Gain	1.50	328
						Subtotal	**328**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions							
8	405_Good	59.7	35	0.25	High Sensitivity to Potential Gain	1.50	783
						Subtotal	**783**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion							
11	435_Good	76.6	1	0.25	High Sensitivity to Potential Gain	1.75	33
						Subtotal	**33**
						Total	**2042**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
88_DNG	46.9	2.5	0.25	2	False	59
88_Good	68.8	1.3	0.25	2	False	45
206_Good	69.2	0.1	0.25	2	False	3
399_Good	73.1	6	0.25	2	False	219

399_Moderate	38.4	0.9	0.25	2	False	17
401_Good	54.1	0.2	0.25	2	False	5
404_Good	70.7	23.5	0.25	2	False	831
405_Good	59.7	35	0.25	2	False	1044
406_Good	62.4	14	0.25	2	False	437
408_Good	71.2	0.1	0.25	2	False	4
435_Good	76.6	1	0.25	2	False	38
					Subtotal	**2702**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
88_Good	68.8	1.3	0.25	2	False	45
206_Good	69.2	0.1	0.25	2	False	3
399_Good	73.1	6	0.25	2	False	219
399_Moderate	38.4	0.9	0.25	2	False	17
401_Good	54.1	0.2	0.25	2	False	5
404_Good	70.7	23.5	0.25	2	False	831
405_Good	59.7	35	0.25	2	False	1044
406_Good	62.4	14	0.25	2	False	437
408_Good	71.2	0.1	0.25	2	False	4
					Subtotal	**2605**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
88_Good	68.8	0.8	0.25	3	True	41

206_Good	69.2	0.1	0.25	3	True	5
399_Good	73.1	3.8	0.25	3	True	208
404_Good	70.7	19.5	0.25	3	True	1034
405_Good	59.7	31.9	0.25	3	True	1427
406_Good	62.4	14	0.25	3	True	655
408_Good	71.2	0.1	0.25	3	True	5
435_Good	76.6	0.5	0.25	3	True	29
					Subtotal	**3404**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
88_DNG	46.9	2.5	0.25	2	False	59
88_Good	68.8	1.3	0.25	2	False	45
206_Good	69.2	0.1	0.25	2	False	3
399_Good	73.1	6	0.25	2	False	219
399_Moderate	38.4	0.9	0.25	2	False	17
401_Good	54.1	0.2	0.25	2	False	5
404_Good	70.7	23.5	0.25	2	False	831
405_Good	59.7	35	0.25	2	False	1044
406_Good	62.4	14	0.25	2	False	437
408_Good	71.2	0.1	0.25	2	False	4
435_Good	76.6	1	0.25	2	False	38
					Subtotal	**2702**

Lepidium aschersonii / Spiny Peppercress (Flora)						
88_Good	68.8	1.3	0.25	2	False	45
					Subtotal	**45**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
88_DNG	46.9	2.5	0.25	2	False	59
88_Good	68.8	1.3	0.25	2	False	45
206_Good	69.2	0.1	0.25	2	False	3
399_Good	73.1	6	0.25	2	False	219
399_Moderate	38.4	0.9	0.25	2	False	17
401_Good	54.1	0.2	0.25	2	False	5
404_Good	70.7	2.5	0.25	2	False	88
405_Good	59.7	35	0.25	2	False	1044
406_Good	62.4	14	0.25	2	False	437
408_Good	71.2	0.1	0.25	2	False	4
435_Good	76.6	1	0.25	2	False	38
					Subtotal	**1959**
Phascolarctos cinereus / Koala (Fauna)						
88_DNG	46.9	2.5	0.25	2	False	59
88_Good	68.8	1.3	0.25	2	False	45
206_Good	69.2	0.1	0.25	2	False	3

399_Good	73.1	6	0.25	2	False	219
399_Moderate	38.4	0.9	0.25	2	False	17
401_Good	54.1	0.2	0.25	2	False	5
404_Good	70.7	23.5	0.25	2	False	831
405_Good	59.7	35	0.25	2	False	1044
406_Good	62.4	14	0.25	2	False	437
408_Good	71.2	0.1	0.25	2	False	4
435_Good	76.6	1	0.25	2	False	38
					Subtotal	**2702**
Tylophora linearis / Tylophora linearis (Flora)						
88_Good	68.8	1.3	0.25	2	False	45
399_Good	73.1	6	0.25	2	False	219
399_Moderate	38.4	0.9	0.25	2	False	17
401_Good	54.1	0.2	0.25	2	False	5
404_Good	70.7	23.5	0.25	2	False	831
405_Good	59.7	35	0.25	2	False	1044
406_Good	62.4	14	0.25	2	False	437
408_Good	71.2	0.1	0.25	2	False	4
435_Good	76.6	1	0.25	2	False	38
					Subtotal	**2640**

Vespadelus troughtoni / Eastern Cave Bat (Fauna)						
88_Good	68.8	0.3	0.25	3	True	15
206_Good	69.2	0.1	0.25	3	True	5
404_Good	70.7	10	0.25	3	True	531
405_Good	59.7	9.7	0.25	3	True	434
406_Good	62.4	12.3	0.25	3	True	576
435_Good	76.6	0.4	0.25	3	True	23
					Subtotal	**1584**

ATTACHMENT K2
BAM BIODIVERSITY CREDIT REPORT (LIKE FOR LIKE) – PHASE 5

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00022115/BAAS17080/20/00022116	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 5	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Names	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 2	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	4.3	87.00
206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Not a TEC	0.1	3.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	6.9	178.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	0.2	4.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	23.5	623.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	35.0	783.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	14.0	328.00
408-Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland on of the Pilliga forests and surrounding region	Not a TEC	0.1	3.00

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	1.0	33.00

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region
Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region

	North-west Alluvial Sand Woodlands This includes PCT's: 71, 206, 227, 376, 428	North-west Alluvial Sand Woodlands >=50% and <70%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	No	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

408-Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland on of the Pilliga forests and surrounding region	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	84.6	2702.00
Cercartetus nanus / Eastern Pygmy-possum	81.1	2605.00
Chalinolobus dwyeri / Large-eared Pied Bat	70.7	3404.00
Hoplocephalus bitorquatus / Pale-headed Snake	84.6	2702.00
Lepidium aschersonii / Spiny Peppercress	1.3	45.00
Petaurus norfolcensis / Squirrel Glider	63.6	1959.00
Phascolarctos cinereus / Koala	84.6	2702.00

Tylophora linearis / Tylophora linearis	82.0	2640.00
Vespadelus troughtoni / Eastern Cave Bat	32.8	1584.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	399_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

Calyptorhynchus lathami/ Glossy Black-Cockatoo	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	408_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
Cercartetus nanus/ Eastern Pygmy-possum	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	399_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW

	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	408_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
Chalinolobus dwyeri/ Large-eared Pied Bat	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW

406_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
408_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
435_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
88_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
Hoplocephalus bitorquatus/ Pale-headed Snake	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	399_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

Hoplocephalus bitorquatus/ Pale-headed Snake	399_Moderate		
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

Hoplocephalus bitorquatus/ Pale-headed Snake	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	408_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
Lepidium aschersonii/ Spiny Peppercress	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW
Petaurus norfolcensis/ Squirrel Glider	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

Petaurus norfolcensis/ Squirrel Glider	206_Good		
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	399_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	404_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	408_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

Phascolarctos cinereus/ Koala	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	399_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Phascolarctos cinereus/Koala	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

408_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Phascolarctos cinereus/Koala	Any in NSW
435_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Phascolarctos cinereus/Koala	Any in NSW
88_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Phascolarctos cinereus/Koala	Any in NSW
88_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region

		Phascolarctos cinereus/Koala	Any in NSW
Tylophora linearis/ Tylophora linearis	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	399_Moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	401_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW

Tylophora linearis/ Tylophora linearis	401_Good		
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	408_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
Vespadelus troughtoni/ Eastern Cave Bat	206_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

Vespadelus troughtoni/ Eastern Cave Bat	206_Good		
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

Vespadelus troughtoni/ Eastern Cave Bat	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

ATTACHMENT K3
BAM BIODIVERSITY CREDIT REPORT (VARIATIONS) – PHASE 5

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id 00022115/BAAS17080/20/00022116	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 5	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Name(s)	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 2	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	4.3	87.00
206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	Not a TEC	0.1	3.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	6.9	178.00
401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	Not a TEC	0.2	4.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	23.5	623.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	35.0	783.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	14.0	328.00
408-Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland on of the Pilliga forests and surrounding region	Not a TEC	0.1	3.00

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	1.0	33.00

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

206-Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Alluvial Sand Woodlands This includes PCT's: 71, 206, 227, 376, 428	North-west Alluvial Sand Woodlands >=50% and <70%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Semi-arid Woodlands (Shrubby sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

401-Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	No	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	No	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

408-Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland on of the Pilliga forests and surrounding region	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Calyptorhynchus lathami / Glossy Black-Cockatoo	84.6	2702.00
Cercartetus nanus / Eastern Pygmy-possum	81.1	2605.00
Chalinolobus dwyeri / Large-eared Pied Bat	70.7	3404.00
Hoplocephalus bitorquatus / Pale-headed Snake	84.6	2702.00
Lepidium aschersonii / Spiny Peppercress	1.3	45.00
Petaurus norfolcensis / Squirrel Glider	63.6	1959.00
Phascolarctos cinereus / Koala	84.6	2702.00
Tylophora linearis / Tylophora linearis	82.0	2640.00
Vespadelus troughtoni / Eastern Cave Bat	32.8	1584.00

Calyptorhynchus lathami/ Glossy Black-Cockatoo	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	399_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	408_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Cercartetus nanus/ Eastern Pygmy-possum	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	408_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Chalinolobus dwyeri/ Large-eared Pied Bat	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	408_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hoplocephalus bitorquatus/ Pale-headed Snake	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	399_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	408_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Lepidium aschersonii/ Spiny Peppercress	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	399_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	408_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	408_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Tylophora linearis/ Tylophora linearis	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Moderate	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing	IBRA region

			under Part 4 of the BC Act shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	401_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	408_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Vespadelus troughtoni/ Eastern Cave Bat	206_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

ATTACHMENT L1
BAM BIODIVERSITY CREDIT REPORT – PHASE 6

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022117/BAAS17080/20/00022118	Narrabri Underground Mine Stage 3 Extension Project Phase 6	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
Jamie Gleeson	09/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
BAAS17080	Open	To be finalised
Assessment Revision	**Assessment Type**	
1	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.								
1	55_DNG	12.6	20.6	0.25	High Sensitivity to Potential Gain	2.00		130
							Subtotal	**130**
Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion								
4	141_Good	44.5	0.6	0.25	High Sensitivity to Potential Gain	1.50		10
							Subtotal	**10**
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion								
2	88_DNG	29.8	8.4	0.25	High Sensitivity to Potential Gain	1.50		94
3	88_Good	33.7	15.6	0.25	High Sensitivity to Potential Gain	1.50		197
							Subtotal	**291**
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).								
5	244_DNG	44.1	3.3	0.25	High Sensitivity to Potential Gain	2.00		73
6	244_Good	35.7	12.5	0.25	High Sensitivity to Potential Gain	2.00		223
							Subtotal	**296**
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion								
7	399_Good	67.9	4	0.25	High Sensitivity to Potential Gain	1.50		102
							Subtotal	**102**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests								
8	404_Good	77.9	127.5	0.25	High Sensitivity to Potential Gain	1.50		3726
							Subtotal	**3726**

White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests							
10	406_Good	50.8	14	0.25	High Sensitivity to Potential Gain	1.50	267
						Subtotal	**267**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions							
9	405_Good	57.3	47.4	0.25	High Sensitivity to Potential Gain	1.50	1019
						Subtotal	**1019**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion							
11	435_DNG	10.8	10.1	0.25	High Sensitivity to Potential Gain	1.75	48
12	435_Good	62.0	1.7	0.25	High Sensitivity to Potential Gain	1.75	46
						Subtotal	**94**
						Total	**5935**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Bertya opponens / Coolabah Bertya (Flora)						
141_Good	N/A	1297	0.25	2	False	2594
404_Good	N/A	19886	0.25	2	False	39772
405_Good	N/A	865	0.25	2	False	1730
406_Good	N/A	2594	0.25	2	False	5188
					Subtotal	**49284**

Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
55_DNG	12.6	2.4	0.25	2	False	15
88_DNG	29.8	1.5	0.25	2	False	22
88_Good	33.7	15.6	0.25	2	False	263
244_DNG	44.1	0.2	0.25	2	False	4
244_Good	35.7	12.5	0.25	2	False	223
399_Good	67.9	4	0.25	2	False	136
404_Good	77.9	127.5	0.25	2	False	4968
405_Good	57.3	47.4	0.25	2	False	1358
406_Good	50.8	14	0.25	2	False	355
435_DNG	10.8	3.3	0.25	2	False	18
435_Good	62.0	1.7	0.25	2	False	53
					Subtotal	**7415**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
88_Good	33.7	14.5	0.25	2	False	244
399_Good	67.9	4	0.25	2	False	136
404_Good	77.9	127.5	0.25	2	False	4968
405_Good	57.3	47.4	0.25	2	False	1358
406_Good	50.8	14	0.25	2	False	355
					Subtotal	**7061**

Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
88_Good	33.7	13.2	0.25	3	True	333
399_Good	67.9	1	0.25	3	True	51
404_Good	77.9	65.2	0.25	3	True	3811
405_Good	57.3	18.5	0.25	3	True	795
406_Good	50.8	11.6	0.25	3	True	442
435_Good	62.0	0.2	0.25	3	True	9
					Subtotal	**5441**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
88_DNG	29.8	1.5	0.25	2	False	22
88_Good	33.7	15.6	0.25	2	False	263
244_DNG	44.1	0.2	0.25	2	False	4
244_Good	35.7	12.5	0.25	2	False	223
399_Good	67.9	4	0.25	2	False	136
404_Good	77.9	127.5	0.25	2	False	4968
405_Good	57.3	47.4	0.25	2	False	1358
406_Good	50.8	14	0.25	2	False	355
435_DNG	10.8	3.3	0.25	2	False	18
435_Good	62.0	1.7	0.25	2	False	53
					Subtotal	**7400**

Lepidium aschersonii / Spiny Peppercress (Flora)						
88_Good	33.7	15.6	0.25	2	False	263
					Subtotal	**263**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
88_DNG	29.8	1.5	0.25	2	False	22
88_Good	33.7	15.6	0.25	2	False	263
141_Good	44.5	0.6	0.25	2	False	13
244_DNG	44.1	0.2	0.25	2	False	4
244_Good	35.7	12.5	0.25	2	False	223
399_Good	67.9	4	0.25	2	False	136
404_Good	77.9	12.4	0.25	2	False	483
405_Good	57.3	47.4	0.25	2	False	1358
406_Good	50.8	14	0.25	2	False	355
435_DNG	10.8	3.3	0.25	2	False	18
435_Good	62.0	1.7	0.25	2	False	53
					Subtotal	**2928**
Phascolarctos cinereus / Koala (Fauna)						
55_DNG	12.6	2.4	0.25	2	False	15
88_DNG	29.8	1.5	0.25	2	False	22
88_Good	33.7	15.6	0.25	2	False	263

141_Good	44.5	0.6	0.25	2	False	13
244_DNG	44.1	0.2	0.25	2	False	4
244_Good	35.7	12.5	0.25	2	False	223
399_Good	67.9	4	0.25	2	False	136
404_Good	77.9	127.5	0.25	2	False	4968
405_Good	57.3	47.4	0.25	2	False	1358
406_Good	50.8	14	0.25	2	False	355
435_DNG	10.8	3.3	0.25	2	False	18
435_Good	62.0	1.7	0.25	2	False	53
					Subtotal	**7428**
Tylophora linearis / Tylophora linearis (Flora)						
88_Good	33.7	15.6	0.25	2	False	263
141_Good	44.5	0.6	0.25	2	False	13
399_Good	67.9	4	0.25	2	False	136
404_Good	77.9	127.5	0.25	2	False	4968
405_Good	57.3	47.4	0.25	2	False	1358
406_Good	50.8	14	0.25	2	False	355
435_Good	62.0	1.7	0.25	2	False	53
					Subtotal	**7146**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)						
88_Good	33.7	13.2	0.25	3	True	333

404_Good	77.9	31.2	0.25	3	True	1823
405_Good	57.3	2.7	0.25	3	True	116
406_Good	50.8	6	0.25	3	True	228
435_DNG	10.8	6.3	0.25	3	True	51
435_Good	62.0	0.2	0.25	3	True	9
					Subtotal	**2560**

ATTACHMENT L2
BAM BIODIVERSITY CREDIT REPORT (LIKE FOR LIKE) – PHASE 6

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00022117/BAAS17080/20/00022118	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 6	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Names	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 1	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	20.6	130.00

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	24.0	291.00
141-Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	Not a TEC	0.6	10.00
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	Not a TEC	15.8	296.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	4.0	102.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	127.5	3726.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	47.4	1019.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	14.0	267.00
435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	11.8	94.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	No	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion				
141-Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	No	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Like-for-like credit retirement options			
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Like-for-like credit retirement options			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Bertya opponens / Coolabah Bertya	24642.0	49284.00
Calyptorhynchus lathami / Glossy Black-Cockatoo	230.1	7415.00
Cercartetus nanus / Eastern Pygmy-possum	207.4	7061.00
Chalinolobus dwyeri / Large-eared Pied Bat	109.7	5441.00
Hoplocephalus bitorquatus / Pale-headed Snake	227.7	7400.00
Lepidium aschersonii / Spiny Peppercress	15.6	263.00
Petaurus norfolcensis / Squirrel Glider	113.2	2928.00

Phascolarctos cinereus / Koala	230.7	7428.00
Tylophora linearis / Tylophora linearis	210.8	7146.00
Vespadelus troughtoni / Eastern Cave Bat	59.6	2560.00

Bertya opponens/ Coolabah Bertya	141_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Bertya opponens/Coolabah Bertya	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Bertya opponens/Coolabah Bertya	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Bertya opponens/Coolabah Bertya	Any in NSW

Bertya opponens/ Coolabah Bertya	405_Good		
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Bertya opponens/Coolabah Bertya	Any in NSW
Calyptorhynchus lathami/ Glossy Black-Cockatoo	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	399_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW

435_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
435_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
55_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
88_DNG	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW
Cercartetus nanus/ Eastern Pygmy-possum	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW

Cercartetus nanus/ Eastern Pygmy-possum	404_Good		
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW

Chalinolobus dwyeri/ Large-eared Pied Bat	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
Hoplocephalus bitorquatus/ Pale-headed Snake	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

Hoplocephalus bitorquatus/ Pale-headed Snake	244_DNG		
	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	405_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW

	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW
Lepidium aschersonii/ Spiny Peppercress	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Lepidium aschersonii/Spiny Peppercress	Any in NSW

Petaurus norfolcensis/ Squirrel Glider	141_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Petaurus norfolcensis/Squirrel Glider	Any in NSW

435_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Petaurus norfolcensis/Squirrel Glider	Any in NSW
435_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Petaurus norfolcensis/Squirrel Glider	Any in NSW
88_DNG	**Like-for-like credit retirement options**	
	Spp	IBRA region
	Petaurus norfolcensis/Squirrel Glider	Any in NSW
88_Good	**Like-for-like credit retirement options**	
	Spp	IBRA region

		Petaurus norfolcensis/Squirrel Glider	Any in NSW
Phascolarctos cinereus/ Koala	141_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	244_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	244_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Phascolarctos cinereus/ Koala	244_Good		
	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	406_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	55_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

	88_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
Tylophora linearis/ Tylophora linearis	141_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW

Tylophora linearis/ Tylophora linearis	399_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Tylophora linearis/Tylophora linearis	Any in NSW
	435_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Tylophora linearis/Tylophora linearis	Any in NSW
Vespadelus troughtoni/ Eastern Cave Bat	404_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

Vespadelus troughtoni/ Eastern Cave Bat	404_Good		
	405_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	406_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	435_DNG	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	435_Good	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW
	88_Good	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW

ATTACHMENT L3
BAM BIODIVERSITY CREDIT REPORT (VARIATIONS) – PHASE 6

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id 00022117/BAAS17080/20/00022118	Proposal Name Narrabri Underground Mine Stage 3 Extension Project Phase 6	BAM data last updated * 20/08/2020
Assessor Name Jamie Gleeson	Assessor Number BAAS17080	BAM Data version * 30
Proponent Name(s)	Report Created 09/10/2020	BAM Case Status Open
Assessment Revision 1	Assessment Type Major Projects	Date Finalised To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat
Chalinolobus dwyeri / Large-eared Pied Bat

Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat
Vespadelus troughtoni / Eastern Cave Bat

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	Not a TEC	20.6	130.00

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	24.0	291.00
141-Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	Not a TEC	0.6	10.00
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	Not a TEC	15.8	296.00
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	Not a TEC	4.0	102.00
404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	Not a TEC	127.5	3726.00
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	Not a TEC	47.4	1019.00
406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	Not a TEC	14.0	267.00
435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	Not a TEC	11.8	94.00

55-Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Floodplain Woodlands This includes PCT's: 55	North-west Floodplain Woodlands >=70% and <90%	No	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Semi-arid Woodlands (Grassy sub-formation)	Tier 4 or higher	No	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
141-Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	No	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

141-Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 7 or higher	No	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
244-Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Grassy Woodlands	Tier 4 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
399-Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

404-Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	**Variation options**			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
405-White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

406-White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771	Western Slopes Dry Sclerophyll Forests <50%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 7 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
435-White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	North-west Slopes Dry Sclerophyll Woodlands This includes PCT's: 228, 429, 435, 517, 527, 529, 564, 588, 594, 595, 597, 598, 856, 1165, 1306, 1308, 1317, 1387, 1586, 1607	North-west Slopes Dry Sclerophyll Woodlands >=50% and <70%	Yes	Pilliga,Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 6 or higher	Yes (including artificial)	IBRA Region: Brigalow Belt South, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Bertya opponens / Coolabah Bertya	24642.0	49284.00
Calyptorhynchus lathami / Glossy Black-Cockatoo	230.1	7415.00
Cercartetus nanus / Eastern Pygmy-possum	207.4	7061.00
Chalinolobus dwyeri / Large-eared Pied Bat	109.7	5441.00
Hoplocephalus bitorquatus / Pale-headed Snake	227.7	7400.00
Lepidium aschersonii / Spiny Peppercress	15.6	263.00
Petaurus norfolcensis / Squirrel Glider	113.2	2928.00
Phascolarctos cinereus / Koala	230.7	7428.00
Tylophora linearis / Tylophora linearis	210.8	7146.00
Vespadelus troughtoni / Eastern Cave Bat	59.6	2560.00

Bertya opponens/ Coolabah Bertya	141_Good	**Like-for-like options**		
		Spp	IBRA region	
		Bertya opponens/Coolabah Bertya	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Bertya opponens/Coolabah Bertya	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Bertya opponens/Coolabah Bertya	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Bertya opponens/Coolabah Bertya	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Calyptorhynchus lathami/ Glossy Black-Cockatoo	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Calyptorhynchus lathami/Glossy Black-Cockatoo	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Cercartetus nanus/ Eastern Pygmy-possum	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Cercartetus nanus/Eastern Pygmy-possum	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Chalinolobus dwyeri/ Large-eared Pied Bat	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Hoplocephalus bitorquatus/ Pale-headed Snake	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or	IBRA region

			higher category of listing under Part 4 of the BC Act shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Hoplocephalus bitorquatus/Pale-headed Snake	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Lepidium aschersonii/ Spiny Peppercress	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Lepidium aschersonii/Spiny Peppercress	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	141_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Petaurus norfolcensis/ Squirrel Glider	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Petaurus norfolcensis/Squirrel Glider	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	141_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	244_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	244_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	55_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Tylophora linearis/ Tylophora linearis	141_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	399_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Tylophora linearis/Tylophora linearis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Vespadelus troughtoni/ Eastern Cave Bat	404_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	405_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	406_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	435_DNG	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	435_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act	IBRA region

			shown below	
		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	88_Good	**Like-for-like options**		
		Spp	IBRA region	
		Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Pilliga, Bogan-Macquarie, Castlereagh-Barwon, Inland Slopes, Kerrabee, Liverpool Plains, Liverpool Range, Pilliga Outwash and Talbragar Valley. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

ATTACHMENT M
BAM BIODIVERSITY CREDIT REPORT – IMPACT REDUCTION AREA

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00020114/BAAS17080/20/00020115	Narrabri Underground Mine Stage 3 Extension Project Impact Reduction Area	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
	04/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion								
1	88_DNG	17.0	0.1	0.25	High Sensitivity to Potential Gain	1.50		1
							Subtotal	**1**
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion								
2	399_Good	68.7	0.5	0.25	High Sensitivity to Potential Gain	1.50		13
3	399_Moderate	38.6	0.1	0.25	High Sensitivity to Potential Gain	1.50		1
							Subtotal	**14**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests								
4	404_Good	57.3	9.5	0.25	High Sensitivity to Potential Gain	1.50		204
5	404_Moderate	32.8	0.2	0.25	High Sensitivity to Potential Gain	1.50		2
							Subtotal	**206**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions								
6	405_DNG	36.1	0.1	0.25	High Sensitivity to Potential Gain	1.50		1
7	405_Good	51.7	3.6	0.25	High Sensitivity to Potential Gain	1.50		70
							Subtotal	**71**
							Total	**292**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)						
399_Good	68.7	0.5	0.25	2	False	17

399_Moderate	38.6	0.1	0.25	2	False	2
404_Good	57.3	9.5	0.25	2	False	272
404_Moderate	32.8	0.2	0.25	2	False	3
405_Good	51.7	3.6	0.25	2	False	93
					Subtotal	**387**
Cercartetus nanus / Eastern Pygmy-possum (Fauna)						
399_Good	68.7	0.5	0.25	2	False	17
399_Moderate	38.6	0.1	0.25	2	False	2
404_Good	57.3	9.5	0.25	2	False	272
404_Moderate	32.8	0.2	0.25	2	False	3
405_Good	51.7	3.6	0.25	2	False	93
					Subtotal	**387**
Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)						
399_Good	68.7	0.5	0.25	2	False	17
399_Moderate	38.6	0.1	0.25	2	False	2
404_Good	57.3	9.5	0.25	2	False	272
404_Moderate	32.8	0.2	0.25	2	False	3
405_Good	51.7	3.6	0.25	2	False	93
					Subtotal	**387**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
399_Good	68.7	0.5	0.25	2	False	17

399_Moderate	38.6	0.1	0.25	2	False	2
404_Good	57.3	0.3	0.25	2	False	9
405_Good	51.7	3.6	0.25	2	False	93
					Subtotal	**121**
Phascolarctos cinereus / Koala (Fauna)						
399_Good	68.7	0.5	0.25	2	False	17
399_Moderate	38.6	0.1	0.25	2	False	2
404_Good	57.3	9.5	0.25	2	False	272
404_Moderate	32.8	0.2	0.25	2	False	3
405_Good	51.7	3.6	0.25	2	False	93
					Subtotal	**387**
Tylophora linearis / Tylophora linearis (Flora)						
399_Good	68.7	0.5	0.25	2	False	17
399_Moderate	38.6	0.1	0.25	2	False	2
404_Good	57.3	9.5	0.25	2	False	272
404_Moderate	32.8	0.2	0.25	2	False	3
405_Good	51.7	3.6	0.25	2	False	93
					Subtotal	**387**

ATTACHMENT N

BAM BIODIVERSITY CREDIT REPORT – MINE SITE ECOLOGICAL REHABILITATION PHASE 1

BAM Credit Summary Report - Stewardship Agreement

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022160/BAAS17080/20/00022161	Narrabri Underground Mine Stage 3 Rehabilitation Phase 1	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
	06/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Stewardship (for offset sites)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Ecosystem credits
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.					
1	55_Good	9.3	3	0.25	7
				Subtotal	**7**

Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion					
2	88_Good	11.5	5.5	0.25	16
				Subtotal	**16**
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).					
3	244_Good	8.3	2.5	0.25	5
				Subtotal	**5**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests					
5	404_Good	7.0	11	0.25	19
				Subtotal	**19**
Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region					
4	401_Good	6.8	0.5	0.25	1
				Subtotal	**1**
White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests					
7	406_Good	6.5	0.5	0.25	1
				Subtotal	**1**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion					
6	435_Good	6.9	4	0.25	7
				Subtotal	**7**
				Total	**56**

Species credits for threatened species

BAM Credit Summary Report - Stewardship Agreement

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)				
88_Good	11.5	5.5	0.25	16
401_Good	6.8	0.5	0.25	1
404_Good	7.0	11	0.25	19
406_Good	6.5	0.5	0.25	1
			Subtotal	**37**
Petaurus norfolcensis / Squirrel Glider (Fauna)				
88_Good	11.5	5.5	0.25	16
244_Good	8.3	2.5	0.25	5
401_Good	6.8	0.5	0.25	1
404_Good	7.0	11	0.25	19
435_Good	6.9	4	0.25	7
406_Good	6.5	0.5	0.25	1
			Subtotal	**49**
Phascolarctos cinereus / Koala (Fauna)				
55_Good	9.3	3	0.25	7
88_Good	11.5	5.5	0.25	16
244_Good	8.3	2.5	0.25	5
401_Good	6.8	0.5	0.25	1
404_Good	7.0	11	0.25	19

435_Good	6.9	4	0.25	7
406_Good	6.5	0.5	0.25	1
			Subtotal	**56**

ATTACHMENT O

BAM BIODIVERSITY CREDIT REPORT – MINE SITE ECOLOGICAL REHABILITATION PHASE 2

BAM Credit Summary Report - Stewardship Agreement

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022162/BAAS17080/20/00022163	Narrabri Underground Mine Stage 3 Rehabilitation Phase 2	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
	06/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Stewardship (for offset sites)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Ecosystem credits
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.					
1	55_Good	9.3	4	0.25	9
				Subtotal	**9**

Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion					
2	88_Good	11.5	20	0.25	57
				Subtotal	**57**
Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).					
3	244_Good	8.3	3	0.25	6
				Subtotal	**6**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion					
4	435_Good	6.9	19	0.25	33
				Subtotal	**33**
				Total	**105**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)				
88_Good	11.5	20	0.25	57
			Subtotal	**57**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)				
88_Good	11.5	20	0.25	57
244_Good	8.3	3	0.25	6
435_Good	6.9	19	0.25	33
			Subtotal	**96**

Petaurus norfolcensis / Squirrel Glider (Fauna)				
88_Good	11.5	20	0.25	57
244_Good	8.3	3	0.25	6
435_Good	6.9	19	0.25	33
			Subtotal	**96**
Phascolarctos cinereus / Koala (Fauna)				
55_Good	9.3	4	0.25	9
88_Good	11.5	20	0.25	57
244_Good	8.3	3	0.25	6
435_Good	6.9	19	0.25	33
			Subtotal	**105**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)				
88_Good	11.5	20	0.25	57
435_Good	6.9	19	0.25	33
			Subtotal	**90**

ATTACHMENT P

BAM BIODIVERSITY CREDIT REPORT – MINE SITE ECOLOGICAL REHABILITATION PHASE 3

BAM Credit Summary Report - Stewardship Agreement

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022164/BAAS17080/20/00022165	Narrabri Underground Mine Stage 3 Rehabilitation Phase 3	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
	06/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Stewardship (for offset sites)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Ecosystem credits
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion					
1	399_Good	10.4	1	0.25	3
				Subtotal	**3**

Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests					
3	404_Good	7.0	39.5	0.25	69
				Subtotal	**69**
Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region					
2	401_Good	6.8	2.5	0.25	4
				Subtotal	**4**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions					
4	405_Good	7.1	10	0.25	18
				Subtotal	**18**
				Total	**94**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)				
399_Good	10.4	1	0.25	3
401_Good	6.8	2.5	0.25	4
404_Good	7.0	39.5	0.25	69
405_Good	7.1	10	0.25	18
			Subtotal	**94**
Petaurus norfolcensis / Squirrel Glider (Fauna)				
399_Good	10.4	1	0.25	3

401_Good	6.8	2.5	0.25	4
404_Good	7.0	39.5	0.25	69
405_Good	7.1	10	0.25	18
			Subtotal	**94**
Phascolarctos cinereus / Koala (Fauna)				
399_Good	10.4	1	0.25	3
401_Good	6.8	2.5	0.25	4
404_Good	7.0	39.5	0.25	69
405_Good	7.1	10	0.25	18
			Subtotal	**94**

ATTACHMENT Q

BAM BIODIVERSITY CREDIT REPORT – MINE SITE ECOLOGICAL REHABILITATION PHASE 4

BAM Credit Summary Report - Stewardship Agreement

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022166/BAAS17080/20/00022167	Narrabri Underground Mine Stage 3 Rehabilitation Phase 4	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
	06/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Stewardship (for offset sites)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Ecosystem credits
Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion					
2	206_Good	6.7	1.5	0.25	3
				Subtotal	**3**

Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion					
1	88_Good	11.5	6.5	0.25	19
				Subtotal	**19**
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion					
3	399_Good	10.4	1	0.25	3
				Subtotal	**3**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests					
4	404_Good	7.0	4.5	0.25	8
				Subtotal	**8**
White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests					
6	406_Good	6.5	9.5	0.25	15
				Subtotal	**15**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions					
5	405_Good	7.1	7.5	0.25	13
				Subtotal	**13**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion					
7	435_Good	6.9	3	0.25	5
				Subtotal	**5**
				Total	**66**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)				
88_Good	11.5	6.5	0.25	19
206_Good	6.7	1.5	0.25	3
399_Good	10.4	1	0.25	3
404_Good	7.0	4.5	0.25	8
405_Good	7.1	7.5	0.25	13
406_Good	6.5	9.5	0.25	15
			Subtotal	**61**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)				
88_Good	11.5	6.5	0.25	19
206_Good	6.7	1.5	0.25	3
399_Good	10.4	1	0.25	3
405_Good	7.1	7.5	0.25	13
406_Good	6.5	9.5	0.25	15
435_Good	6.9	3	0.25	5
			Subtotal	**58**
Petaurus norfolcensis / Squirrel Glider (Fauna)				
88_Good	11.5	6.5	0.25	19
206_Good	6.7	1.5	0.25	3
399_Good	10.4	1	0.25	3

404_Good	7.0	4.5	0.25	8
405_Good	7.1	7.5	0.25	13
406_Good	6.5	9.5	0.25	15
435_Good	6.9	3	0.25	5
			Subtotal	**66**
Phascolarctos cinereus / Koala (Fauna)				
88_Good	11.5	6.5	0.25	19
206_Good	6.7	1.5	0.25	3
399_Good	10.4	1	0.25	3
404_Good	7.0	4.5	0.25	8
405_Good	7.1	7.5	0.25	13
406_Good	6.5	9.5	0.25	15
435_Good	6.9	3	0.25	5
			Subtotal	**66**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)				
88_Good	11.5	6.5	0.25	19
206_Good	6.7	1.5	0.25	3
406_Good	6.5	9.5	0.25	15
435_Good	6.9	3	0.25	5
			Subtotal	**42**

ATTACHMENT R

BAM BIODIVERSITY CREDIT REPORT – MINE SITE ECOLOGICAL REHABILITATION PHASE 5

BAM Credit Summary Report - Stewardship Agreement

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022168/BAAS17080/20/00022169	Narrabri Underground Mine Stage 3 Rehabilitation Phase 5	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
	06/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Stewardship (for offset sites)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Ecosystem credits
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion					
1	88_Good	11.5	1	0.25	3
				Subtotal	**3**

Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion					
2	399_Good	10.4	6	0.25	16
				Subtotal	**16**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests					
3	404_Good	7.0	23	0.25	40
				Subtotal	**40**
White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests					
5	406_Good	6.5	14	0.25	23
				Subtotal	**23**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions					
4	405_Good	7.1	35	0.25	62
				Subtotal	**62**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion					
6	435_Good	6.9	1	0.25	2
				Subtotal	**2**
				Total	**146**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)				
88_Good	11.5	1	0.25	3

399_Good	10.4	6	0.25	16
404_Good	7.0	23	0.25	40
405_Good	7.1	35	0.25	62
406_Good	6.5	14	0.25	23
			Subtotal	**144**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)				
88_Good	11.5	1	0.25	3
399_Good	10.4	6	0.25	16
404_Good	7.0	23	0.25	40
405_Good	7.1	35	0.25	62
406_Good	6.5	14	0.25	23
435_Good	6.9	1	0.25	2
			Subtotal	**146**
Petaurus norfolcensis / Squirrel Glider (Fauna)				
88_Good	11.5	1	0.25	3
399_Good	10.4	6	0.25	16
404_Good	7.0	23	0.25	40
405_Good	7.1	35	0.25	62
406_Good	6.5	14	0.25	23
435_Good	6.9	1	0.25	2
			Subtotal	**146**

Phascolarctos cinereus / Koala (Fauna)				
88_Good	11.5	1	0.25	3
399_Good	10.4	6	0.25	16
404_Good	7.0	23	0.25	40
405_Good	7.1	35	0.25	62
406_Good	6.5	14	0.25	23
435_Good	6.9	1	0.25	2
			Subtotal	**146**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)				
88_Good	11.5	1	0.25	3
404_Good	7.0	23	0.25	40
405_Good	7.1	35	0.25	62
406_Good	6.5	14	0.25	23
435_Good	6.9	1	0.25	2
			Subtotal	**130**

ATTACHMENT S

BAM BIODIVERSITY CREDIT REPORT – MINE SITE ECOLOGICAL REHABILITATION PHASE 6

BAM Credit Summary Report - Stewardship Agreement

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00022170/BAAS17080/20/00022171	Narrabri Underground Mine Stage 3 Rehabilitation Phase 6	20/08/2020
Assessor Name	**Report Created**	**BAM Data version ***
	06/10/2020	30
Assessor Number	**BAM Case Status**	**Date Finalised**
	Open	To be finalised
Assessment Revision	**Assessment Type**	
0	Stewardship (for offset sites)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Ecosystem credits
Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion					
1	88_Good	11.5	2	0.25	6
				Subtotal	**6**

Poplar Box grassy woodland on alluvial clay-loam soils mainly in the temperate (hot summer) climate zone of central NSW (wheatbelt).					
2	244_Good	8.3	1	0.25	2
				Subtotal	**2**
Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion					
3	399_Good	10.4	4	0.25	10
				Subtotal	**10**
Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests					
4	404_Good	7.0	127	0.25	223
				Subtotal	**223**
White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests					
6	406_Good	6.5	14	0.25	23
				Subtotal	**23**
White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions					
5	405_Good	7.1	47	0.25	84
				Subtotal	**84**
White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion					
7	435_Good	6.9	0.5	0.25	1
				Subtotal	**1**
				Total	**349**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Species credits
Cercartetus nanus / Eastern Pygmy-possum (Fauna)				
88_Good	11.5	2	0.25	6
399_Good	10.4	4	0.25	10
404_Good	7.0	127	0.25	223
405_Good	7.1	47	0.25	84
406_Good	6.5	14	0.25	23
			Subtotal	**346**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)				
88_Good	11.5	2	0.25	6
399_Good	10.4	4	0.25	10
404_Good	7.0	127	0.25	223
405_Good	7.1	47	0.25	84
406_Good	6.5	14	0.25	23
435_Good	6.9	0.5	0.25	1
			Subtotal	**347**
Petaurus norfolcensis / Squirrel Glider (Fauna)				
88_Good	11.5	2	0.25	6
244_Good	8.3	1	0.25	2
399_Good	10.4	4	0.25	10
404_Good	7.0	127	0.25	223

405_Good	7.1	47	0.25	84
406_Good	6.5	14	0.25	23
435_Good	6.9	0.5	0.25	1
			Subtotal	**349**
Phascolarctos cinereus / Koala (Fauna)				
88_Good	11.5	2	0.25	6
244_Good	8.3	1	0.25	2
399_Good	10.4	4	0.25	10
404_Good	7.0	127	0.25	223
405_Good	7.1	47	0.25	84
406_Good	6.5	14	0.25	23
435_Good	6.9	0.5	0.25	1
			Subtotal	**349**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)				
88_Good	11.5	2	0.25	6
404_Good	7.0	127	0.25	223
405_Good	7.1	47	0.25	84
406_Good	6.5	14	0.25	23
435_Good	6.9	0.5	0.25	1
			Subtotal	**337**