Appendix F

Biodiversity development assessment report

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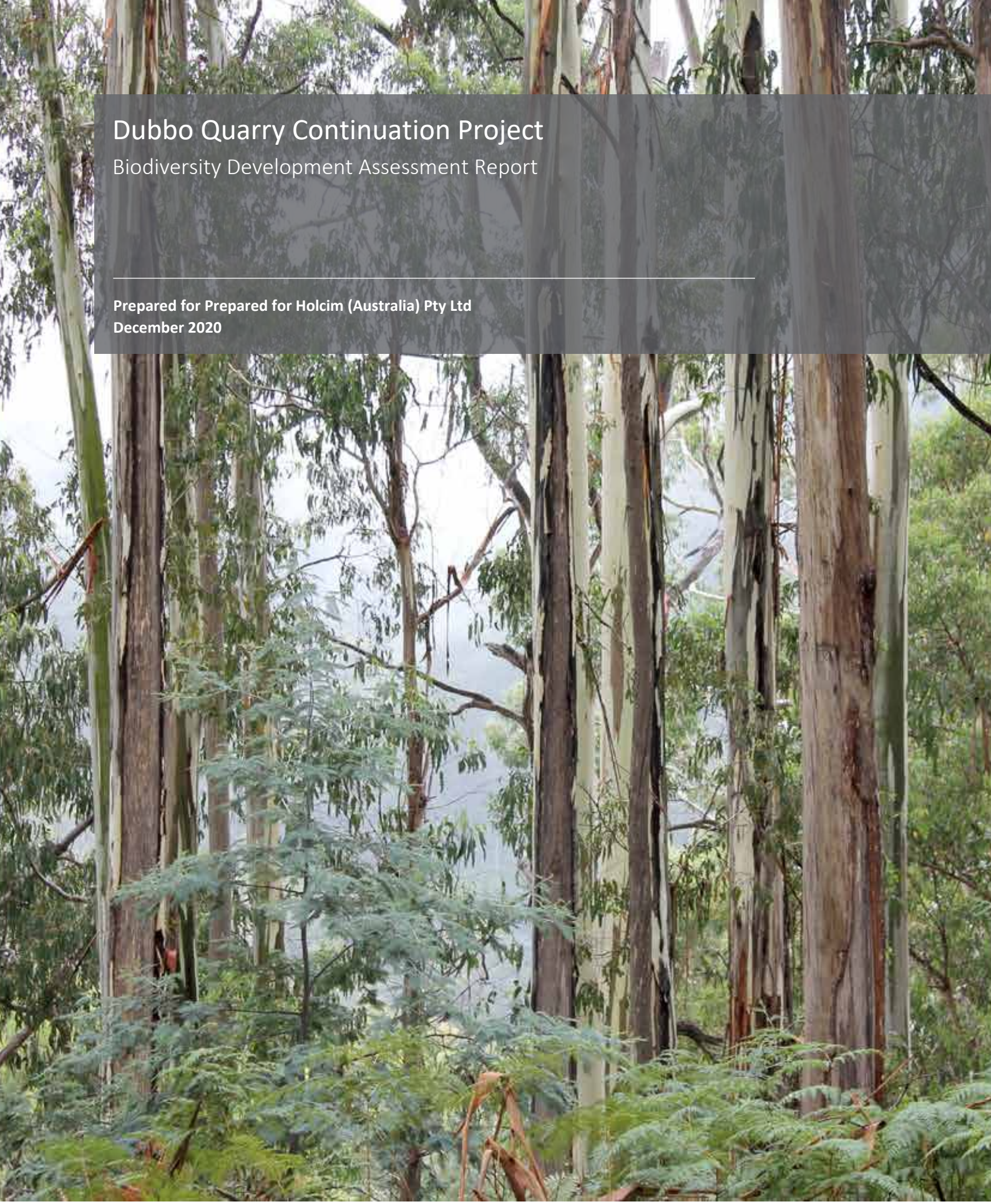
Dubbo Quarry Continuation Project

Biodiversity Development Assessment Report

Prepared for Prepared for Holcim (Australia) Pty Ltd
December 2020



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Dubbo Quarry Continuation Project

Biodiversity Development Assessment Report

Report Number

J180313 RP1

Client

Holcim (Australia) Pty Ltd

Date

23 December 2020

Version

v1 Final

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23 December 2020

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23 December 2020

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1 Introduction

1.1 Overview

Holcim (Australia) Pty Limited (Holcim) is the owner and operators of Dubbo Quarry (the quarry) located on Sheraton Road, Dubbo (refer to Figure 1.1). The quarry has operated since 1980 under a development consent granted by the former Talbragar Shire Council Dubbo Regional Council (DRC). Accessible basalt resources within the existing quarry boundary are close to exhaustion and planning approval is required to allow the quarry to continue operating. Holcim is, therefore, seeking approval for the Dubbo Quarry Continuation Project (henceforth referred to as 'the project') which involves the continued operation of the quarry through the development of two new resource areas to the south and west of the existing quarry boundary (refer to Figure 1.2).

The project is classified as State Significant Development (SSD) under Part 4, Division 4.1 of the NSW *Environmental Planning Assessment Act 1979* (EP&A Act).

This Biodiversity Development Assessment Report (BDAR) report will accompany the environmental impact statement (EIS) prepared for the project. It documents the biodiversity assessment methods and results, the initiatives built into the project design to avoid and minimise biodiversity impacts, and the additional mitigation and management measures proposed, including offset requirements, to address any residual impacts not able to be avoided.

1.2 The site

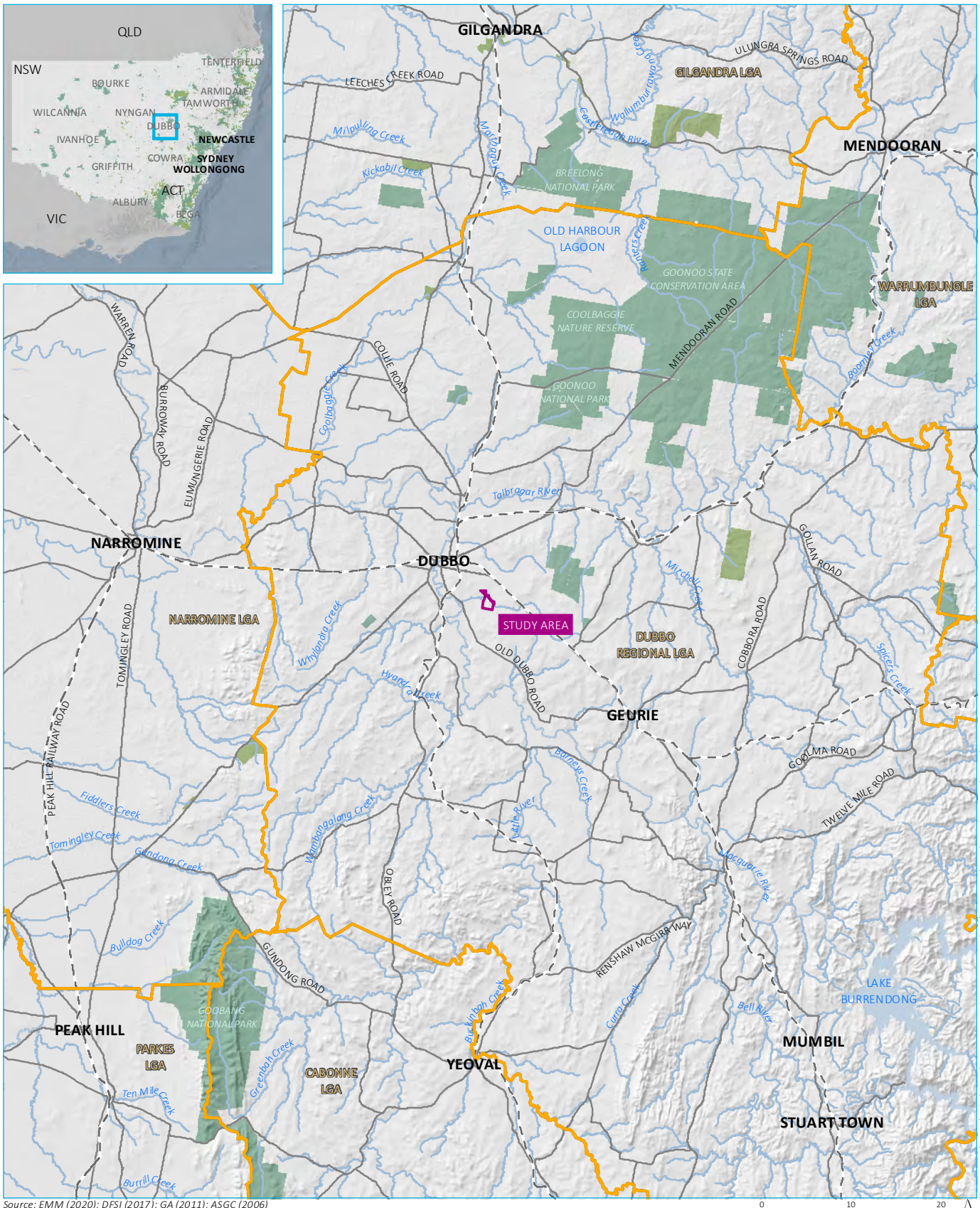
The quarry is located within Dubbo Regional Local Government Area (LGA) approximately 1.9 kilometres (km) west of the city of Dubbo. The quarry is accessed via Sheraton Road which connects to the Mitchell Highway approximately 2 km north-west of the quarry. The project area relates to the following land as shown on Figure 1.2:

- Lot 222 DP 1247780, owned by Holcim; and
- Part Lot 100 DP 628628, for which Holcim propose to enter into an Access Licence with the landowners.

Development consent for Dubbo Quarry was originally granted by the former Talbragar Shire Council on 18 March 1980 under SPR79/22 (the existing consent). This consent related to the establishment of a basalt quarry on former Portions 208 and 211, Parish Dubbo (the existing site) and contains eight conditions with no restrictions on production rates or operating hours. Holcim also holds Environment Protection Licence (EPL) No. 2212 for land-based extraction activities between 100,000 and 500,000 tonnes per annum (tpa).

On 16 August 2018, Council approved a development application (D2017-640) for a boundary adjustment to Lot 1 DP 623367 and Lot 22 DP 793541, along with associated relocation of the internal quarry access road and intersection off Sheraton Road. The consent allowed for consolidation of the separate land parcels located north of Eulomogo Creek on which future quarrying is proposed.

The quarry produces high quality aggregates for use in the construction industry, such as concrete and asphalt production, and for use as road base. Precoated sealing aggregates from crushed basalt are also produced at the quarry. The quarry produces many types of road base, both specification and non-specification, such as the premium road base product Heavy Duty DGB20 which is frequently used by local councils and Transport for NSW (TfNSW) for the construction and upgrade of roads.



Source: EMM (2020); DFSI (2017); GA (2011); ASGC (2006)

0 10 20 km

GDA 1994 MGA Zone 55

N

KEY

- Study area
- Rail line
- Major road
- Named watercourse
- Named waterbody
- Local government area
- NPWS reserve
- State forest

Regional location

Dubbo Quarry Continuation Project
Biodiversity Development Assessment Report
Figure 1.1

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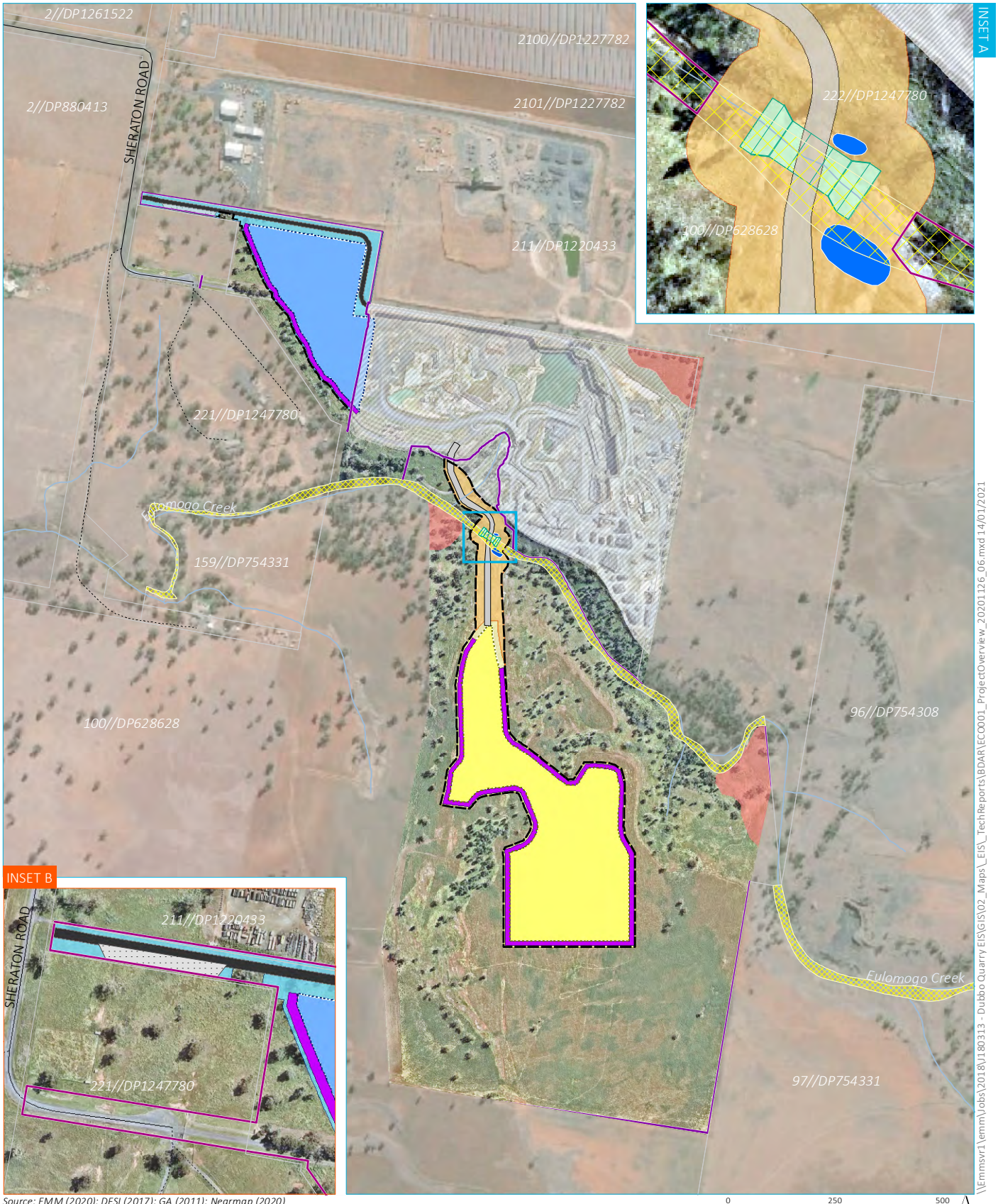

Source: EMM (2020); DFSI (2017); GA (2011); Nearmap (2020)

0 250 500 m

GDA 1994 MGA Zone 55

N

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KEY

- Study area
- Disturbance area
- Sediment pond
- Aboriginal protection zone
- Indicative existing disturbance area
- Proposed haul road
- Indicative proposed water crossing
- Bund wall
- Proposed access road
- Truck tarping area
- Western extension area
- Western disturbance area
- Haul road disturbance area
- Southern extension area
- Southern disturbance area
- Minor road
- Vehicular track
- Watercourse/drainage line
- Waterbody
- Cadastral boundary (data does not align with surveyed site boundary)
- Crown land

Project overview

Dubbo Quarry Continuation Project
Biodiversity Development Assessment Report
Figure 1.2

EMM creating opportunities

1.3 Assessment requirements

On 3 April 2020, Holcim received the Secretary's Environmental Assessment Requirements (SEARs). The relevant requirements of the SEARs, and where they are addressed in this report, are outlined in Table 1.1.

Table 1.1 Requirements of the SEARs and where they are addressed in this report

SEARs requirement	Where addressed in this report
Accurate predictions of any vegetation clearing on site;	Section 6.3.1
A detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with the Biodiversity Assessment Methodology and documented in a Biodiversity Development Assessment Report;	This BDAR
A strategy to offset any residual impacts of the development in accordance with the *Biodiversity Offset Scheme.*	Section 6.6

1.4 Development proposal

The project involves continued operations within the current site boundary and into two new resource areas as described below and shown in Figure 1.2:

- the existing quarry area within Lot 222 DP 1247780 (formerly Lot 1 DP 623367);
- the Western Extension Area (WEA) is west and north-west of the existing quarry boundary, located within Lot 222 DP 1247780 (formerly part Lot 22 DP 793541) (north and south of Sheraton Road); and
- the Southern Extension Area (SEA) is south of the existing quarry boundary on the southern side of Eulomogo Creek, located within part Lot 100 DP 628628.

Construction activities will consist of the following:

- a realigned private access road off Sheraton Road along the northern boundary of the WEA, connecting to the existing access road that extends to the processing facilities within the existing quarry area;
- a new haul road from the existing quarry area to the SEA across Eulomogo Creek; and
- modification/installation of water management infrastructure within the existing and extension areas.

Preliminary environmental constraints identification, in particular vegetation survey and mapping, along with initial consultation with the DPIE–Water have been considered in developing preliminary alignment and design options for the proposed watercourse crossing.

Consideration of each of these elements will continue through the assessment process and design requirements will be confirmed as part of ongoing design work for the project.

1.5 Sequencing

Extraction within the existing quarry area will continue in accordance with the existing consent. Over the next two to three years, extraction will be focussed predominantly within the south-eastern portion of the existing quarry, which will include relocation of some infrastructure and material stockpiles to facilitate access to the remaining resource. It is anticipated the remaining resource will be exhausted by approximately 2022, dependent on future production rates.

Extraction within the WEA would commence on receipt of development consent (year 1) and would continue to exhaustion of available resource within this area, which is estimated within approximately 7–8 years. Construction of the new access road and associated intersection, relocation of utilities, and modification/construction of new water management system components would be undertaken concurrently with staged extraction within this area.

Construction of the new haul road and watercourse crossing to provide access to the SEA would also commence in year 1 or year 2, with extraction from the SEA anticipated to commence in year 3 and continue for up to 25 years.

Processing infrastructure, maintenance and administrative facilities, are proposed to remain within the area of current extraction activities.

1.6 Terminology

Terminology used in this report is listed in Table 1.2.

Table 1.2 Terminology

Term	Definition
Disturbance area	The area directly impacted by the project.
Study area	The area over which surveys outlined in Section 4.2 and 5.3.3 were undertaken. This comprises the disturbance area, plus additional areas excluded due to avoidance of biodiversity values.
Search area	10 km buffer of the study area in which database searches were conducted.

1.7 Information sources

1.7.1 Publications and databases

In order to provide context for the development, information about flora and fauna species, populations, ecological communities and habitats was obtained from the following databases:

- Biodiversity Conservation Division (BCD) BioNet Atlas of NSW Wildlife (Bionet) for threatened species records listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act), within 10 km of the disturbance area (search undertaken 09/09/2020);
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) protected under the EPBC Act, including threatened species with potential to occur within the disturbance area (most recent search undertaken 09/09/2020); and
- the NSW Plant Community Types (PCT), as held within the Bionet Vegetation Classification System.

1.7.2 Spatial data

Spatial data encompassing the study area and disturbance area was provided by Holcim. Base map data was obtained from the Department of Finance, Services and Innovation (DFSI) NSW databases, with cadastral data obtained from DFSI digital cadastral database. Mapping for stream orders was obtained from DPI (2013).

The following spatial datasets were utilised during the development of this report:

- State Vegetation Type Map: Central West / Lachlan Region Version 1.3. VIS_ID 4468 (DPIE 2015);
- Mitchell Landscapes Version V3.1 (DPIE 2018);
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7 (DoEE 2018); and
- Directory of important wetlands (DAWE 2001).

Mapping undertaken during the site assessment was conducted using a hand-held GPS unit (GDA94), mobile tablet computer and aerial photo interpretation. Mapping has been produced using a Geographic Information System (GIS; ArcGIS 10.5).

2 Legislative context

This chapter provides a brief outline of the key biodiversity legislation and government policy considered in this assessment.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as MNES under the EPBC Act. These are:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, an action that may have a significant impact on a MNES is deemed to be a 'controlled action' and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially have a significant impact on a MNES is to be referred to DAWE for determination as to whether or not it is a controlled action. If deemed a controlled action the project is assessed under the EPBC Act for approval.

One Critically Endangered Ecological Community (CEEC) listed under the EPBC Act was recorded within the disturbance area. The impacts on the CEEC is not considered significant; however, the project has been referred for determination on a precautionary basis. The project will be referred as a non-controlled action. Further information is provided in Section 7.1 of this report.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the consideration and management of impacts of proposed development or land-use changes on the environment and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DPE).

The EP&A Act provides the overarching structure for planning in NSW; however, it is supported by other statutory environmental planning instruments, which are outlined below.

i Koala Habitat Protection SEPP 2019

This project is a State Significant Development and is therefore exempt from the Koala SEPP (DPIE 2020a).

2.2.2 Biodiversity Conservation Act 2016

The BC Act is the legislation responsible for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities. The BC Act, together with the Biodiversity Conservation Regulation 2017 (BC Regulation), established the Biodiversity Offsets Scheme (BOS).

The BOS includes establishment of the *Biodiversity Assessment Method* (the BAM, OEH 2017) for use by accredited persons in biodiversity assessment under the scheme. The purpose of the BAM is to assess the impact of actions on threatened species and threatened ecological communities, and their habitats and determine offset requirements. For major projects, use of the BAM is mandatory, unless a BDAR waiver is granted.

The BAM sets out the requirements for a repeatable and transparent assessment of terrestrial biodiversity values on land in order to:

- identify the biodiversity values on land subject to proposed development area;
- determine the impacts of a proposed development, following all measures to avoid, minimise and mitigate impacts; and
- quantify and describe the biodiversity credits required to offset the residual impacts of proposed development on biodiversity values.

The BC Act also identifies the concept of serious and irreversible impacts (SAII) and imposes various obligations on decision-makers in relation to impacts on biodiversity values that are considered SAII.

On 3 April 2020, Holcim received the Secretary's Environmental Assessment Requirements (SEARs). The relevant requirements of the SEARs, and where they are addressed in this report, are outlined in Table 1.1.As the project will impact on biodiversity values the BAM has been used to assess and offset impacts to biodiversity in accordance with the BC Act.

2.2.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) contains provisions for the conservation of fish stocks, key fish habitat, biodiversity, threatened species, populations and ecological communities. It regulates the conservation of fish, vegetation and some aquatic macroinvertebrates and the development and sharing of the fishery resources of NSW for present and future generations. The FM Act lists threatened species, populations and ecological communities, key threatening processes (KTPs) and declared critical habitat. Assessment guidelines to determine whether a significant impact is expected are detailed in section 220ZZ and 220ZZA of the FM Act.

Another objective of the FM Act is to conserve key fish habitat (KFH). These are defined as aquatic habitats that are important to the sustainability of recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. KFH is defined in Section 3.2.1 and 3.2.2 of the *Policy and Guidelines for Fish Conservation and Management* (DPI 2013).

A habitat assessment for entities listed under the FM is provided in Section 5.1.2 with the project assessed against the requirements of the FM Act in Section 7.2.

2.2.4 Biosecurity Act 2015

The Biosecurity Act has superseded the *Noxious Weeds Act 1993*, which is now been repealed. The primary object of the Biosecurity Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

The Biosecurity Act stipulates management arrangements for weed biosecurity risks in NSW, with the aim to prevent, eliminate and minimise risks. Management arrangements include:

- any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about;
- applies to all land within NSW and all waters within the limits of the State; and
- local strategic weed management plans will provide guidance on the outcomes expected to discharge duty for the weeds in that plan.

The Biosecurity Act is discussed further in Section 7.3.

3 Landscape features

The identification of landscape features at the disturbance area was determined using Section 4 of the BAM (OEH 2017), as summarised within this chapter. Landscape features are shown in Figure 3.1 and Figure 3.2.

3.1.1 Bioregions and landscapes

The disturbance area occurs within the Brigalow Belt South IBRA Bioregion and the Talbragar Valley Slopes IBRA subregion (Figure 3.1 and Figure 3.2). These were used in the assessment.

A total of two BioNet NSW Landscapes (formerly Mitchell Landscapes) intersect with the disturbance area:

- Dubbo Basalts; and
- Goonoo slopes.

Dubbo Basalts occupies the majority of the site at 92 %, with Goonoo Slopes representing 8 %. For the purposes of this assessment the Dubbo Basalts BioNet NSW Landscape was selected, given it occupies the largest area of the disturbance area and is most representative of the landscape recorded.

3.1.2 Waterways and wetlands

The study area is within the catchment system of the Macquarie River which is located approximately 2.7 km east of the project area.

The project area is bisected by Eulomogo Creek which is third-order watercourse within the study area. The creek is ephemeral and typically dry. The creek occurs within an agricultural landscape and is highly modified, with several farm dams occurring in its upper reaches.

No wetlands occur within or close to the study area, with the closest important wetland listed on the Directory of Important Wetlands in Australia (DIWA) being Lake Goran, over 180 km to the north-east.

3.1.3 Connectivity

The study area exists within an agricultural landscape and does not include any biodiversity corridors mapped by local council or by DPIE. The Dubbo Local Environmental Plan 2011 maps woodland areas within study area as of high biodiversity value; however, this is not linked to an identified connectivity corridor.

The disturbance area includes a woodland alongside Eulomogo Creek, which is part of a wooded patch approximately 60 ha in size. This patch includes partially cleared agricultural areas, limited to canopy vegetation and comparatively dense vegetation alongside Eulomogo Creek. The project will remove vegetation (refer to Section 6.1); however, this is anticipated to have a limited impact to connectivity given that vegetation will be retained outside of the project area, both in the proposed western disturbance area and the proposed southern disturbance area. This will maintain connectivity characteristics similar to those that currently exist. The exception to this is the proposed haul road of approximately 15 m wide between the southern disturbance area to the existing disturbance area. This will bisect woodland vegetation alongside Eulomogo Creek. This creek crossing has been situated to minimise clearance of woodland; however, the haul road will create a disconnect in woodland along Eulomogo Creek. This disruption to continuity of vegetation is unlikely to affect highly mobile species, with smaller and less mobile fauna species likely to be more affected.

3.1.4 Areas of geological significance and soil hazard features

The study area does not contain karst, caves, crevices, cliffs or other areas of geological significance. The existing quarry contains vertical rock faces; however, they are part of a working quarry with high levels of disturbance, minimising habitat value for fauna. The search area (1500 m) contains some rock outcropping in the valley associated with Eulomogo Creek. This area is slight upstream of the study area in an east direction. These areas of outcropping are likely to provide shelter for terrestrial fauna species; however, they are not extensive or high enough to provide cliff nesting habitat for birds, and there are no overhangs and sufficient crevices for cave roosting bats.

There are no soil hazard features identified within the disturbance area or search area.

3.1.5 Areas of outstanding biodiversity value

There are no areas of outstanding biodiversity value, as declared by the Minister for Energy and Environment (NSW Government) within the disturbance area or study area.

3.2 Assessment of site context

Site context has been assessed in accordance with Section 4.3 of BAM (OEH 2017) for site-based developments.

3.2.1 Native vegetation extent

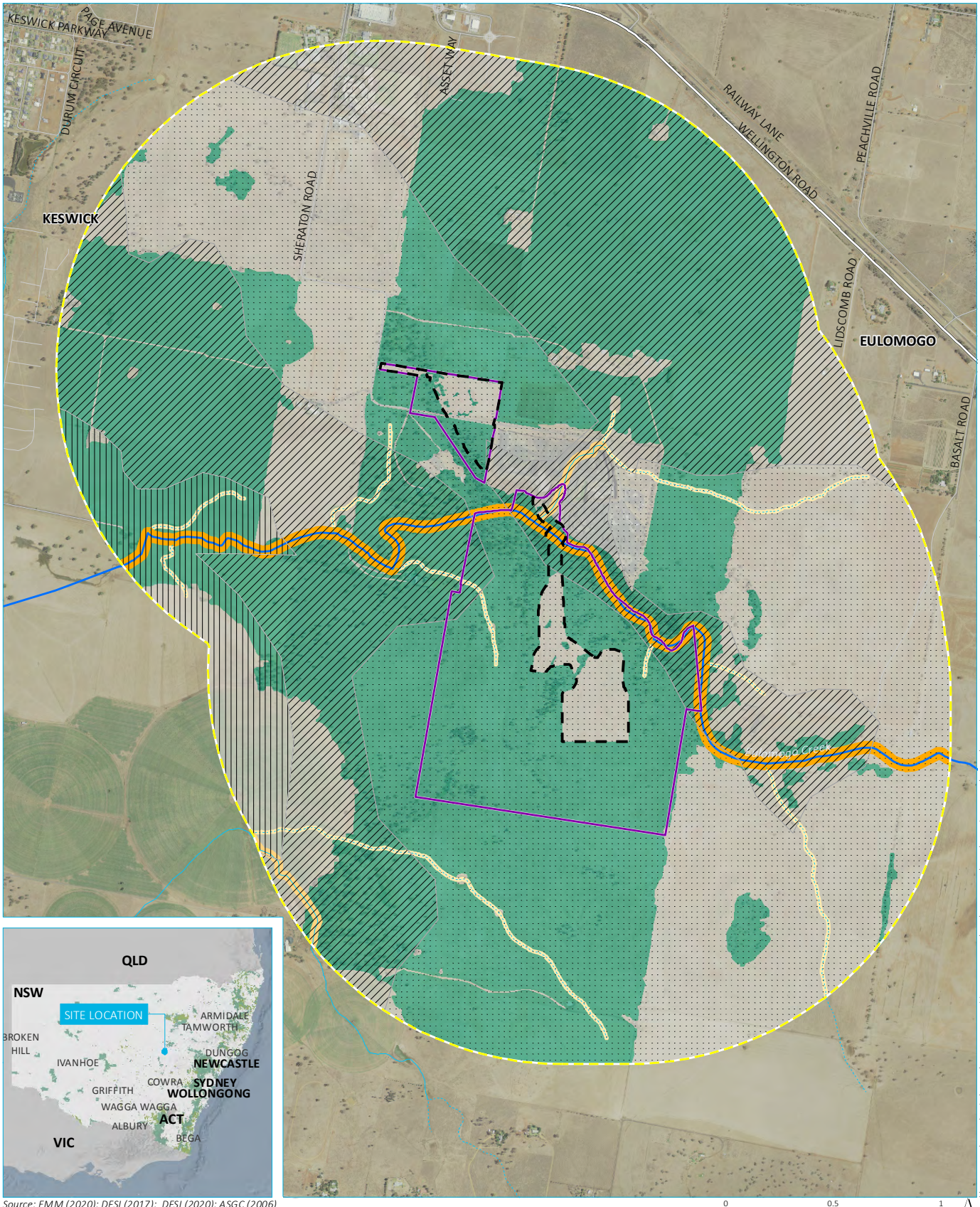
Mapping of native vegetation within a 1,500 m buffer of the disturbance area was undertaken using State Vegetation Type Map: CentWestLachSVM_v1p4_PCT_E_4468 (DPIE 2015).

Regional mapping of plant community types (PCTs) within the 1,500 m buffer includes:

- PCT 45 - Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion;
- PCT 76 - Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions;
- PCT 81 - Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion;
- PCT 248 - Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW
- PCT 267 - White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion;
- PCT 511 - Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion; and
- PCT 796 - Derived grassland of the NSW South Western Slopes.

Native vegetation within the disturbance area was primarily assessed and mapped through extensive field surveys, with aerial imagery used to assist with verification of PCT boundaries. Plots, undertaken in accordance with the BAM, were used to determine vegetation integrity scores across the vegetation types.

The total area of land within the 1,500 m buffer is 1467 ha. The native vegetation extent area of the combined disturbance area and the 1,500 m buffer is 864 ha; therefore, the percentage native vegetation cover is 59 %.



Source: EMM (2020); DFSI (2017); DFSI (2020); ASGC (2006)

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KEY

- Study area
- Disturbance area
- Disturbance area - 1,500m buffer
- Major road
- Minor road
- Non-native vegetation
- Native vegetation

Strahler stream order

- 1st order
- 2nd order
- 3rd order

Mitchell landscapes

- Dubbo Basalts
- Goonoo Slopes
- Macquarie Alluvial Plains

Riparian buffers

- 10 m
- 20 m
- 30 m

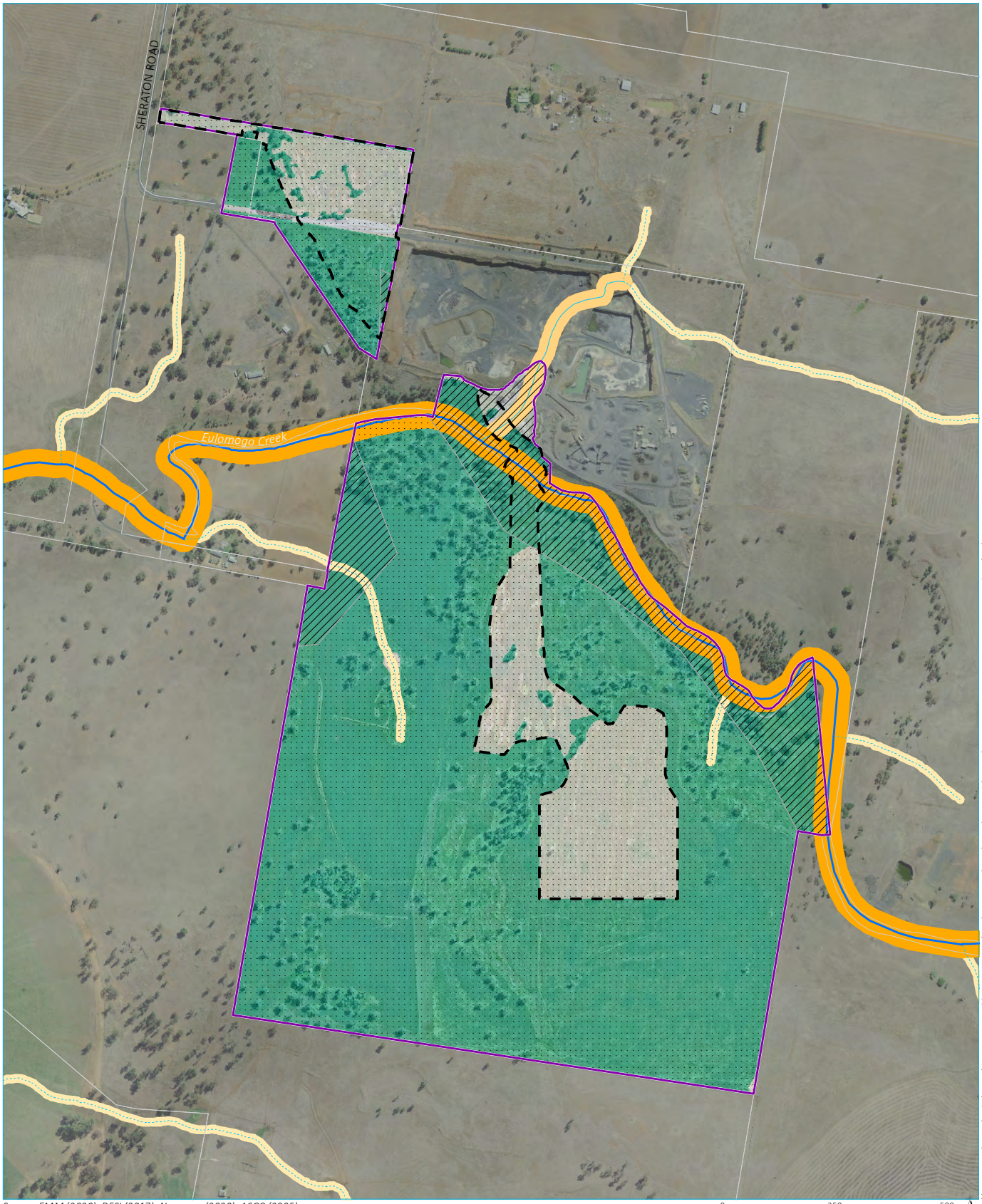
INSET KEY

- NPWS reserve
- State forest
- Cadastral boundary

Location map

Dubbo Quarry Continuation Project
Biodiversity Development Assessment Report
Figure 3.1

*Brigalow Belt South IBRA region and Talbragar Valley IBRA subregion occur across the entire 1,500m buffer area



Source: EMM (2020); DFSI (2017); Nearmap (2020); ASGC (2006)

0 250 500 m

GDA 1994 MGA Zone 55

N

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KEY

- Study area
- Disturbance area
- Minor road
- Cadastral boundary (data does not align with surveyed site boundary)
- Non-native vegetation
- Native vegetation

Strahler stream order

- 1st order
- 2nd order
- 3rd order

Mitchell landscapes

- Dubbo Basalts
- Goonoo Slopes

Riparian buffers

- 10 m
- 20 m
- 30 m

*Brigalow Belt South IBRA region and Talbragar Valley IBRA subregion occur across the study area

Site map

Dubbo Quarry Continuation Project
Biodiversity Development Assessment Report
Figure 3.2

EMM creating opportunities

4 Native vegetation

The extent of native vegetation within the disturbance area was determined using Section 5 of the BAM (OEH 2017), as summarised within this chapter.

4.1 Background review

A review of the State Vegetation Type Map: Central West / Lachlan Region Version 1.3. VIS_ID 4468 (DPIE 2015) was undertaken to inform the site investigations. Five PCTs were identified within the study area:

- PCT 45 - Plains Grass grassland on alluvial mainly clay soils in the Riverina Bioregion and NSW South Western Slopes Bioregion;
- PCT 76 - Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions;
- PCT 81 - Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion;
- PCT 511 - Queensland Bluegrass - Redleg Grass - Rats Tail Grass - spear grass - panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion; and
- PCT 796 - Derived grassland of the NSW South Western Slopes.

In addition to the five PCTs, several areas were mapped as non-native.

4.2 Methods

The field investigation was undertaken between 21 January 2019 and 15 May 2019. The field investigations included:

- vegetation mapping and condition assessment; and
- vegetation integrity assessment.

Survey methods are outlined further below.

4.2.1 Detailed vegetation mapping and habitat assessment

Preliminary vegetation mapping was undertaken during a three-day site inspection from 21 – 23 January 2019. Preliminary surveys included broad vegetation mapping and habitat assessments. A second trip was undertaken from 2 – 5 April 2019 to refine vegetation mapping further.

The study area was traversed on foot and by vehicle with vegetation mapped and aligned with NSW PCTs (refer to Section 4.3.3). These PCTs were stratified into vegetation zones based on their broad condition state and grouped according to their quality and levels of disturbance using the definitions in Table 4.1. Where PCTs were aligned with threatened ecological communities (TECs) the relevant listing advice was reviewed to determine which zones where aligned with the TEC.

Where there was some uncertainty about correct PCT alignment, or to justify PCT alignment, a series of rapid vegetation assessments (RVAs) were undertaken, with the three dominant species in the overstorey, midstory and groundcover recorded. Vegetation was mapped in the field using GPS-enabled tablet computers using Collector for ArcGIS™.

Table 4.1 Definitions used in delineation of vegetation zones

Condition class	Description
High	Largely intact with all stratum present and minimal disturbance (not present within Study Area).
Medium	Canopy vegetation largely intact, however the midstory is largely absent or dominated by exotic species. Groundcover is predominantly native.
Other	Evidence of selective clearance of canopy species and strong regeneration of White Cypress Pine (*Callitris columellaris*), leading to a modified community.
Poor	Remnant canopy vegetation is present. Midstory and ground cover are either cleared or predominantly exotic.
Derived native grassland (DNG)	Tree stratum and shrub stratum missing. Native vegetation restricted to groundcover
Exotic	Tree stratum and shrub stratum absent, ground cover dominated by exotic species.

4.2.2 Vegetation integrity assessment

Native vegetation integrity was assessed using data obtained via a series of plots as per the methodology outlined in Section 5 of the BAM (OEH 2017).

A total of 23 plots were collected within the study area. This includes six collected between 21 -23 January 2019, and sixteen between 2 – 5 April 2019. A single plot was undertaken on 15 May 2019. Of the plots collected, 14 were used for the vegetation integrity assessment, based on them being the most representative. These plots occur within the development area or within close proximity (refer to Figure 4.1). During assessment of the project, the development was refined making several plots redundant given they are geographically distant from the project area or representing PCTs or vegetation zones which are no longer included within the disturbance area.

At each plot location the following was undertaken:

- one 20 x 20 m plot for assessment of composition and structure; and
- one 20 x 50 m plots for assessment of function, including a series of five 1 x 1 m plots to assess average leaf litter cover.

The assessment of composition and structure, based on a 20 x 20 m plot, recorded species name, stratum, growth form, cover and abundance rating for each species present within the plot. Cover (foliage cover) was estimated for all species rooted in or overhanging the plot, and recorded using decimals (if less than 1%, rounded to whole number (1-5%) or estimated to the nearest 5% (5- 100%). Abundance was counted (up to 20) and estimated above 20 and recorded using the following intervals: 1, 2, 3, 4, 5, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc.

The assessment of function recorded the number of large trees, the presence of tree stem size class, tree regeneration, number of trees with hollows and length of fallen logs, as well as leaf litter cover within the 20 x 50 m plot and five 1 x 1 m subplots.

The minimum number of plots and transects per vegetation zone was determined using Table 4 of the BAM (OEH 2017). Compiled plot data is provided in Appendix A.

4.2.3 Paddock tree assessment

Paddock trees were assessed in accordance with Appendix 1 of the BAM (OEH 2017). Given that regulatory maps for Category 1 and Category 2 land are yet to be produced, native trees were included within the paddock tree assessment if:

- they were outside of mapped woodland zones (four or more trees, each separated by 50 m or less); and
- the ground cover was cropped or exotic grassland.

All paddock trees were assigned to the most likely PCT based on the tree species, landscape position and the surrounding mapped PCTs. Assigning a PCT enabled the determination of the large tree benchmark, used to calculate the category of paddock tree.

4.3 Results

4.3.1 Vegetation description

The majority of the proposed western disturbance area is exotic grassland and native pasture used for grazing livestock. Where woodland exists, it is patchy and highly modified by past agricultural practices. There is evidence of selective clearance of canopy species, with White Cypress Pine (*Callitris columellaris*) the dominant species remaining. The ground cover of the woodland areas and native pasture areas are dominated by grazing tolerant grasses and unpalatable shrubs. Native midstory species are entirely absent, instead the stratum dominated by the exotic African Boxthorn (*Lycium ferocissimum*).

The proposed southern disturbance area is almost entirely composed of cropped land, being regularly tilled and sown. Very small patches of woodland also occur, though the groundcover is dominated by exotic species.

The proposed haul road, linking the proposed southern disturbance area to the existing quarry includes areas of derived native grassland and areas of higher quality woodland associated with the vegetation either side of Eulomogo Creek. Canopy species include Blakely's Red Gum (*Eucalyptus blakelyi*), Yellow Box (*Eucalyptus melliodora*) and White Cypress Pine.

Vegetation condition is discussed in detail, assigned to PCTs and vegetation zones in the following sections.

4.3.2 Plant community types

Site investigations identified the presence of one PCT within the disturbance area. The PCT, vegetation formation and vegetation class (Keith and Simpson 2006) are described within Table 4.2. In addition to the PCT identified within the disturbance area, cropping and exotic vegetation were also mapped.

Table 4.2 Plant community types in the disturbance area and corresponding formation and class

Plant community type	Vegetation formation	Vegetation class	Area (ha)
599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Grassy woodlands	Western slopes grassy woodlands	11.52 ha

4.3.3 Vegetation zones

The PCT identified within the disturbance area was stratified into vegetation zones based on broad condition state, as per the method outlined in Section 4.2.1, and allocated a condition class. This process identified five vegetation zones as per the descriptions in Table 4.3.

Table 4.3 Vegetation zones mapped within the disturbance area

Vegetation zone	Plant community type	Ancillary code	Area (ha)
1	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Medium	0.64
2	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Other	1.25
3	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Poor	1.18
4	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	DNG	2.75
5*	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Exotic grassland	5.70

Note: * this zone is not considered native vegetation, however, has been assigned to a PCT to assess vegetation integrity score under the BAM.

Descriptions of each vegetation zone and exotic vegetation types are provided in Table 4.4, with their locations shown on Figure 4.1.

Table 4.4 Zone 1-5 vegetation description

599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	
PCT ID	599
Common name	Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
Condition class and extent within disturbance area	• Medium – 0.64 ha • Other – 1.25 ha • Poor – 1.18 ha • DNG – 2.75 ha • Exotic grassland – 5.70 ha
Description	Zone1 - Medium A woodland dominated by Blakely's Red Gum and Yellow Box. In addition, White Cypress Pine was also recorded occurring in dense stands, associated with areas of shallow soil, or where regeneration following historical clearance occurs. Occasional Kurrajong (*Brachychiton populneus* subsp. *populneus*) and Rough-barked Apple (*Angophora floribunda*) also occur. The midstory is devoid of native species. The exotic African Boxthorn is prevalent, often forming thickets around the base of canopy species.

Table 4.4 Zone 1-5 vegetation description

599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	
	The groundcover is relatively sparse consisting of grasses, forbs and some low shrubs. The most abundant grasses and sedges include; Purple Wire Grass (*Aristida personata*), Slender Bamboo Grass (*Austrostipa verticillata*), Knob Sedge (*Carex inversa*), Cotton Panic Grass (*Digitaria brownii*), a Speargrass (*Austrostipa scabra*) and Curly Windmill Grass (*Enteropogon acicularis*). Other groundcover species including forbs, low shrubs and trailing species include; Berry Saltbush (*Einadia hastata*), Climbing Saltbush (*Einadia nutans*), Tarvine (*Boerhavia dominii*), Native Geranium (*Geranium solanderi*), Kidney Weed (*Dichondra repens*) Corregated Sida (*Sida corrugata*) and Quena (*Solanum esuriale*) Exotic groundcover includes; Creeping Oxalis (*Oxalis corniculata*), Greater Beggar's Ticks (*Bidens subalternans*), Common Peppercress *(Lepidium africanum*) and Vervain (*Salvia verbenaca*). Zone 2 - Other This zone includes areas where White Cypress Pine is the dominant canopy species, likely due to historical clearance followed by strong regeneration of White Cypress Pine. Sporadic Blakely's Red Gum, Yellow Box and Rough-barked Apple also occur. This zone has a high occurrence of the exotic African Boxthorn, with no native midstory species. Groundcover contains similar species to Zone 1, however the coverage is dominated by more grazing tolerant species such as Purple Wire Grass, Slender Bamboo Grass and *Salsola australis*. There is also a high prevalence of exotic agricultural species including Barley (*Hordeum vulgare*) and Barley Grass (*Hordeum leporinum*). Zone 3 – Poor This zone includes areas where a canopy of the characteristic species occurs with a predominately exotic groundcover. Dominant exotic ground cover species include Barley, Small-flowered Mallow (*Malva parviflora*), Spear Thistle (*Cirsium vulgare*), White Horehound (*Marrubium vulgare*) and Cat-head (*Tribulus terrestris*). Zone 4 – DNG This zone includes predominantly native groundcover species (>50% cover) with a similar composition to Zone 1. The canopy and midstory are entirely cleared. Zone 5 – exotic These areas were cleared with predominately exotic groundcover with sparse to no native cover. These areas were included as part of the PCT so that the vegetation integrity score could be assessed to confirm that they are below the threshold for offsetting.
Survey effort	1. Medium – three plots; 10, 15, 19 2. Other – three plots; 6, 22, 23 3. Poor – three plot; 5, 11,14 4. DNG – two plots: 13, 21 5. Exotic grassland – three plots; 9, 12, 17
Condition description	Zone 1 – Medium The woodland is in medium condition. The canopy is reasonably intact; however, there has been historical clearance and thinning of canopy species. The midstory has been entirely removed, with the exotic African Boxthorn the only large shrub present. Whilst the groundcover is mostly native, there are also a number of exotic grasses and forbs present. Whilst this zone may have been grazed by livestock historically, current grazing pressure is mostly limited to macropods. Woody debris is present in several areas, however there is also evidence of partial clearance of woody debris. Zone 2 – Other These woodlands are in similar condition to zone 1; however, they are dominated by White Cypress Pine. This dominance is likely due to several factors; however, the most prominent is likely historical clearance, followed by subsequent strong regeneration of White Cypress Pine. Woody debris is present, although some removal is also likely.

Table 4.4 Zone 1-5 vegetation description

599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	
	Zone 3 – Poor These woodlands are small in patch size and are surrounded by cropping. These areas are highly disturbed with very little woody debris, a lack of leaf litter, high grazing pressure and invasion of exotic groundcover species. Zone 4 – DNG The derived native grasslands have been subjected to grazing; however, maintain a largely native groundcover. Native species richness is highest in rocky areas where the rock offers some protection from herbivores. Zone 5 – Exotic grassland These areas are cleared and dominated by exotic groundcover species and subject to grazing. Where native ground cover species occur they are not dominant. High threat weeds were recorded throughout the site and includes Khaki Weed (*Alternanthera pungens*), African Boxthorn, Saffron Thistle (*Carthamus lanatus*), and Bathurst Burr (*Xanthium spinosum*).
Characteristic species used for identification of PCT	Five of the eight characteristic upper stratum species listed in Bionet were recorded within this PCT. This represents a strong alignment and one of the key attributes used to assign the PCT. Given the midstory was cleared throughout the disturbance area, this was not considered a useful indicator of PCT fit. A total of 17 species recorded within the groundcover vegetation are aligned with the PCT in VIS. This is of a total of 54 species. The vegetation description in VIS describes a tall woodland dominated by Blakely's Red Gum and Yellow Box, matching the dominant canopy species within the disturbance area. The exception to this is patches where White Cypress Pine are dominant. Yellow Box and Blakely's Gum are still present albeit infrequently. This is likely as a combination of slightly shallower soils and historical clearance of the typical dominant species. Areas dominated by White Cypress Pine have been included in a separate zone 'other' to differentiate them. Analysis of other PCTs concluded that PCT 599 remained the best fit, given that the key characteristic canopy species are still present. There are no PCTs listed in Bionet which are dominated by White Cypress Pine and occupy the same landscape position and region. Other PCTs which list White Cypress Pine as a characteristic species are associated with White Box (*Eucalyptus albens*) and/or Grey Box (*E. microcarpa*), neither of which occur within the disturbance area.
Justification of evidence used to identify the PCT	PCT 599 is listed as occurring within the Brigalow Belt South IBRA subregion, in which the disturbance area occurs. The PCT can occur in a variety of landform elements including valley flats, hillslopes, drainage depressions, and plains, with the disturbance area including the aligned hillslopes and plains. The PCT can also occur in a wide variety of lithology including substrates derived from basalt as is the case within the disturbance area.

Table 4.4 Zone 1-5 vegetation description

599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion

Status	**BC Act** Zones 1-4 are considered to be aligned with White Box Yellow Box Blakely's Red Gum Woodland, listed as endangered under the BC Act. Disturbed remnants are considered to form part of the community, including where the vegetation would respond to assisted natural regeneration. Zone 5 is dominated by exotic species and is irrevocably altered; therefore, does not meet the listing criteria. **EPBC Act** The EPBC Act listing protects higher quality remnants of Box Gum Woodland; generally, areas where all vegetation layers are intact and/or contain a high diversity, abundance, and cover of native species (DEH 2006). Only zone 1 (medium) meet the EPBC definition, having characteristic canopy species, a native understory, a patch size of greater than 2 ha and more than 20 mature trees per hectare. Zone 2 (other) does not meet the listing given that the most common overstory species is White Cypress Pine, rather than one of the key overstory species listed in the determination. Zone 3 (poor) does not have a predominately native understory and, therefore, does not meet the listing. Zone 4 does not typically contain the required 12 or more native understory species (excluding grasses). The exception of was in one location where 14 native understory species were recorded. However, in order to meet the listing the community also is required to have one 'important species' as defined in Appendix 1 of the national recovery plan (DECCW 2010). None of the species recorded are considered 'important species'; therefore, the zone does not meet the TEC listing. Zone 5 is predominately exotic therefore does not meet the listing.
Estimate of percent cleared value of PCT	80%

Photograph 4.1 PCT 599_medium

Table 4.4 Zone 1-5 vegetation description

599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion

Photograph 4.2 PCT 599_other

Photograph 4.3 PCT 599_poor

Table 4.4 Zone 1-5 vegetation description

599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion

Photograph 4.4 PCT 599_DNG

Photograph 4.5 PCT 599_exotic grassland

4.3.4 Assessment of patch size

Patch size was assessed in accordance with Section 5.3.2 of the BAM (OEH 2017) and the Biodiversity Assessment Method Operational Manual – Stage 1 (OEH 2018). OEH (2018) states a patch is an area of intact vegetation that occurs on the subject land, with intact defined as containing all structural layers characteristic of the PCT. Three of the vegetation zones, DNG, Poor and Exotic, are not intact vegetation, given that at least one of their strata were absent. Patch size was therefore set to zero for these vegetation zones.

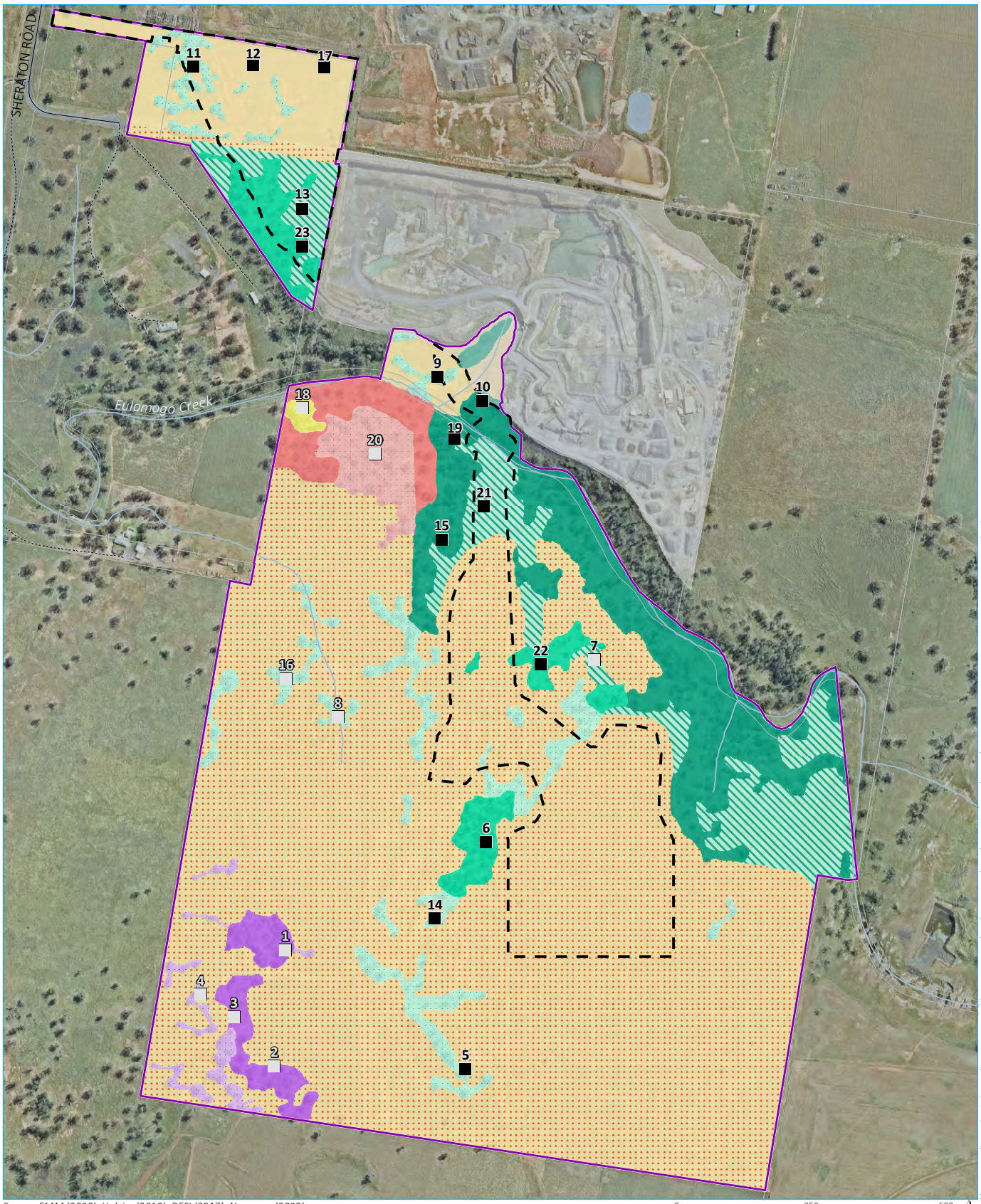
Whilst the 'medium' and 'other' zones are devoid of native shrubs/midstory and therefore could be considered not intact, the presence of African Boxthorn may provide a similar ecosystem function of a native midstory. Thus, a conservative assessment of patch size has been undertaken, assessed as greater than 100 ha, which is the largest BAM patch size class.

4.3.5 Vegetation integrity score

The vegetation integrity score for each vegetation zone is presented in Table 4.5.

Table 4.5 Vegetation zones mapped within the disturbance area

Vegetation zone	Plant community type	Ancillary code	Area (ha)	Vegetation integrity score
1	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Medium	0.64	64.3
2	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Other	1.25	58.6
3	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Poor	1.18	40.7
4	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	DNG	2.75	32.7
5	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Exotic grassland	5.55	3.4



Source: EMM (2020); Holcim (2019); DFSI (2017); Nearmap (2020)

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KEY

- Study area
- Disturbance area
- Indicative existing disturbance area
- Watercourse/drainage line
- Waterbody
- Minor road
- Vehicular track
- Cadastral boundary (data does not align with surveyed site boundary)

Biometric plot

- Included in BAM assessment
- Excluded from BAM assessment

Plant community types

- 201 - medium
- 435 - medium
- 435 - poor
- 599 - DNG
- 599 - medium
- 599 - other
- 599 - poor
- 81 - medium
- 81 - poor
- Cultivated land
- Exotic - grassland

Plant community types and vegetation zones within the disturbance area and study area, including plot locations

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Figure 4.1

EMM creating opportunities

4.3.6 Paddock tree assessment

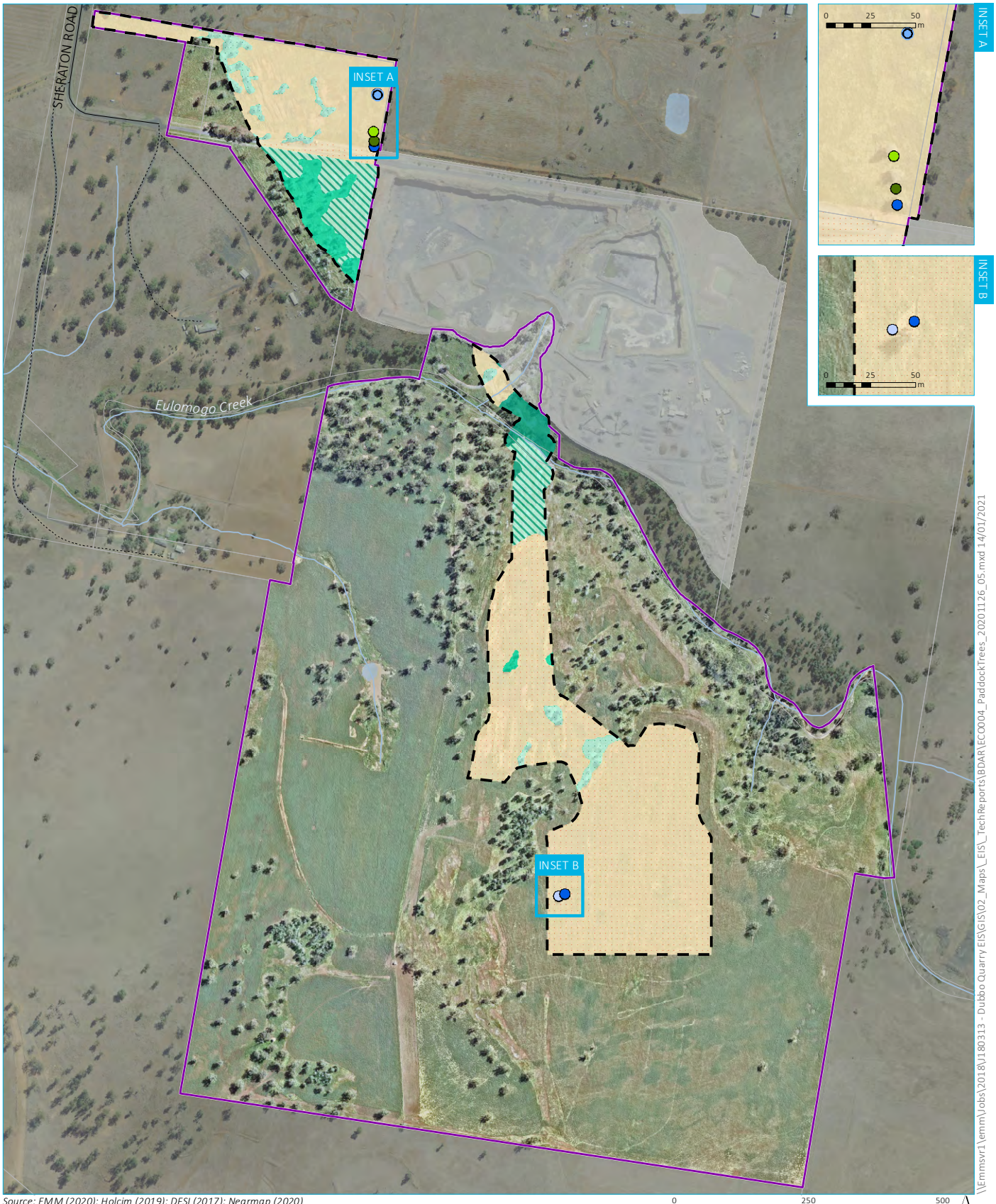
A total of six paddock trees were assessed within the disturbance area, comprising four Blakely's Red Gum and two White Cypress Pine. All paddock trees were assigned to PCT 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion given the prevalence of Blakely's Red Gum and the homogeneity of the landscape position with the surrounding disturbance area, all of which is mapped as PCT 599.

The paddock trees results, categorised according to the BAM (OEH 2017) is provided in Table 4.6, with the location shown on Figure 4.2.

Table 4.6 Paddock trees assigned in accordance with Appendix 1 of the BAM

Scientific name	Common name	DBH (cm)	Hollow bearing (Y/N)	BAM paddock tree category
Eucalyptus blakelyi	Blakely's Red Gum	19	N	1
Eucalyptus blakelyi	Blakely's Red Gum	31	Y	2
Eucalyptus blakelyi	Blakely's Red Gum	66	N	3
Eucalyptus blakelyi	Blakely's Red Gum	91	N	3
Callitris columellaris	White Cypress Pine	48	N	2
Callitris columellaris	White Cypress Pine	59	N	3

Note: Tree categories - 1 (0 - <20cm Diameter at Brest Height (DBH)); 2 (20 - <50 cm DBH); 3 (>50 cm DBH).



KEY

- Study area
- Disturbance area
- Indicative existing disturbance area
- Minor road
- Vehicular track
- Watercourse/drainage line
- Waterbody
- Cadastral boundary (data does not align with surveyed site boundary)

Paddock trees

Blakely's Red Gum

- Category 1 (no hollows observed)
- Category 2 (hollows observed)
- Category 3 (no hollows observed)

White Cypress Pine

- Category 2 (no hollows observed)
- Category 3 (no hollows observed)

- Cropped
- Exotic - grassland

599 - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion

- Poor
- Medium
- DNG
- Other

Paddock trees

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Figure 4.2

EMM creating opportunities

5 Threatened species

5.1 Habitat values

5.1.1 Terrestrial habitat

Concurrent with the vegetation mapping, a habitat assessment was undertaken seeking to identify the following fauna habitat features within the disturbance area:

- habitat trees including large hollow-bearing trees;
- availability of flowering shrubs and feed tree species;
- waterway condition;
- quantity of ground litter and logs; and
- searches for indirect evidence of fauna.

The majority of the disturbance area is cleared, consisting of cultivated and grazed land. These areas have low habitat value, with biodiversity values largely limited to the intermittent foraging resources for transient species such as seed eating birds. These areas are unlikely to provide important habitat for any threatened species.

Derived native grasslands are present within the disturbance area. These areas have the potential to provide foraging resources for insectivorous and seed eating birds. Diversity of the flora species is impacted within the disturbance area by grazing, with elevated abundance of grazing tolerant species. The areas of highest floristic diversity are those areas with surface rocks. The cracks and crevices provide microrefugia, allowing more palatable species to persist, albeit somewhat more stunted form. These rocky areas also provide potential shelter for reptiles.

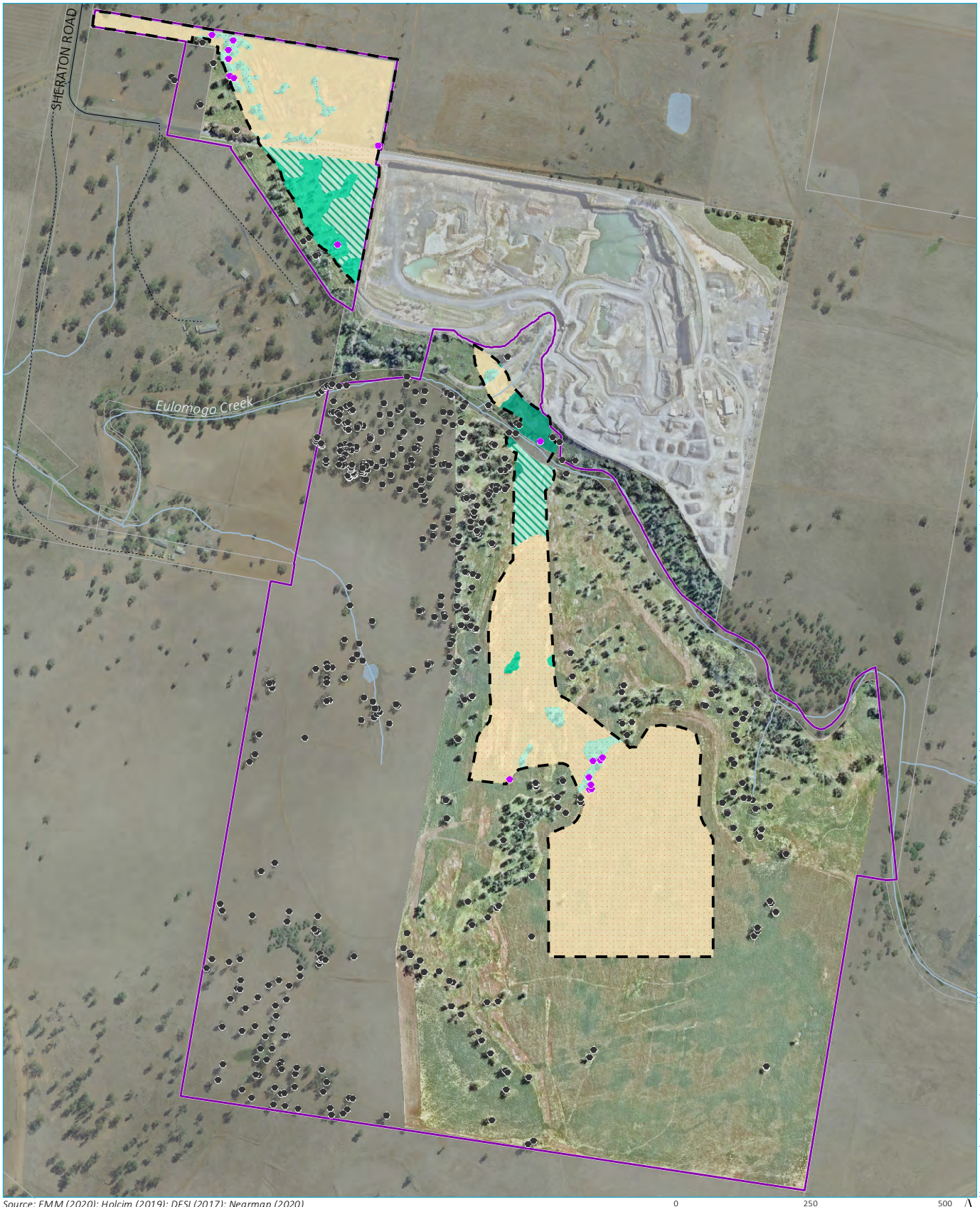
Woodland areas of the disturbance area comprise medium sized canopy species, dominated by Blakely's Red Gum, Yellow Box and White Cypress Pine. Hollows are present in several of the trees, mostly of small sizes, suited to nesting Eastern Rosellas (*Platycercus eximius*) and other smaller species. Few medium and large hollows are present, limiting the habitat value for larger arboreal mammals and hollow nesting birds. Both Blakely's Red Gum and Yellow Box are likely to provide intermittent foraging resources for nectivorous birds, when in flower.

Woodland within the disturbance area has been impacted by agricultural practices with grazing, partial clearance of canopy and complete clearance of midstory species. In many areas surface rocks and woody debris has also been cleared and placed in discrete stockpiles. As a consequence of this disturbance, structural complexity within the woodland areas has been reduced substantially and reducing its function for several threatened species. The non-native shrub, African Boxthorn, is prevalent which provides dense and thorny shelter for small birds such as the Superb Fairy Wren. The shrub is also known to provide shelter for invasive fauna such as European Fox (*Vulpes vulpes*) and European Rabbit (*Oryctolagus cuniculus*).

Hollow-bearing trees were prevalent within the broader study area with 526 hollow-bearing trees recorded (Figure 5.1). The disturbance footprint has largely avoided dense patches of hollow-bearing trees, with a total of 17 remaining within the disturbance area (Table 5.1). The size and characteristics of the hollow-bearing trees was used to inform assessment of threatened species and to target species surveys.

Table 5.1 Hollow-bearing trees within the disturbance area

Tree number	Hollow bearing tree species	Diameter at breast height (cm)	Size of hollows present		
			0-5cm	<5cm – 15cm	>15 cm
1	Yellow Box	100	8		1
2	Blakely's Red Gum	64	2	2	0
3	Blakely's Red Gum	83	1	3	0
4	Stag	62	2	2	0
5	Stag	64	1	1	0
	Stag	63	4	0	0
	Yellow Box	93	7	2	0
	Stag	63	5	0	0
	Rough-barked Apple	65	0	1	1
	Tree stump (dead)	53	0	0	1
	Blakely's Red Gum	50	5	0	0
	Blakely's Red Gum	57	3	1	0
	Blakely's Red Gum	60	6	0	0
	Blakely's Red Gum	113	3	3	3
	Blakely's Red Gum	53	2	0	0
	Blakely's Red Gum	67	4	0	0
	Stag	92	3	8	0
	Total number of hollows		**56**	**23**	**6**



Source: EMM (2020); Holcim (2019); DFSI (2017); Nearmap (2020)

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KEY

- Study area
- Disturbance area
- Indicative existing disturbance area
- Watercourse/drainage line
- Waterbody
- Cadastral boundary (data does not align with surveyed site boundary)
- Minor road
- Vehicular track

Hollow bearing tree

- Within disturbance area (17)
- Outside disturbance area (509)
- Cropped
- Exotic - grassland

599 - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion

- Poor
- Medium
- DNG
- Other

Hollow bearing trees

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Figure 5.1

EMM creating opportunities

5.1.2 Aquatic habitat

The largest watercourse within the disturbance area is Eulomogo Creek. This third-order watercourse has been substantially modified by a series of small dams in its upper reaches, which is likely to have substantially reduced the amount and duration of flow. During each of the site visits the majority of the creek bed was dry with water limited to small pools. The creek is likely to flow intermittently after heavy rainfall events, otherwise being predominately dry.

The project has largely avoided Eulomogo creek, with the exception of the proposed haul road crossing (refer to Figure 1.2) The proposed crossing location is in an area of bare basalt bedrock with no aquatic habitat present (refer to Photograph 5.1). The area is unvegetated with terrestrial species, mostly grasses, growing on the banks.

Immediately below the crossing point a series of small ephemeral pools were recorded (Photograph 5.2). These were all shallow, with no submerged aquatic vegetation recorded, with the banks dominated by the exotic weed Noogoora Burr (*Xanthium occidentale*). A single emergent species (Narrow-leaved Cumbungi, *Typha domingensis*) was recorded. Visual inspection of the pools identified Dragonfly nymphs (Family Odonata), Waterboatman (Family Corixidae), and Bloodworms (Midge larvae, Family Diptera). No fish were recorded. The Common Froglet (*Crinia signifera*) was recorded aurally downstream of the crossing site.

Eulomogo creek is not mapped as key fish habitat within the study area. In accordance with policy and guidelines for the fish habitat conservation and management (DPI 2013) the creek within and upstream of the development footprint is considered 'Class 4 - unlikely key fish habitat' given that there is intermittent flow following rain events, with little or no flow or free-standing water or pools post rain events. Downstream of the development footprint is better described as 'Class 3 – Minimal key fish habitat' as there are semi-permanent pools which remain for a period after rainfall events.

Given that the habitat within the proposed haul road crossing is Class 4 the minimum recommended crossing types in order of preference includes culverts, causeways or fords (DPI 2013). A concrete culvert will be constructed for the project which meets the preferred crossing type for both Class 3 and 4 waterways.

The aquatic habitat within the study area and development area was reviewed against the freshwater threatened species distribution maps (NSW DPI), with the Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) modelled within the Eulomogo Creek catchment. The species has not been recorded within the vicinity and given the ephemeral nature of the Creek it is ruled out from occurring on a habitat basis. No habitat for any other aquatic species was recorded.

Photograph 5.1 **Bedrock section of Eulomogo Creek, foreground is downstream of the proposed crossing location, with the midground/background the crossing location**

Photograph 5.2 **Pool within Eulomogo Creek, just downstream of the proposed crossing location.**

5.2 Ecosystem credit species assessment

A list of ecosystem credit species predicted to occur within the disturbance area, based on the PCTs present and generated by the calculator associated within the BAM (OEH 2017) is provided in Table 5.2. The potential for these species to occur within the disturbance area was assessed in accordance with Section 6.2 of the BAM (OEH 2017).

Table 5.2 Assessment of ecosystem credit species within the disturbance area

Scientific name	Common name	Justification for exclusion
Anthochaera phrygia	Regent Honeyeater (Foraging)	Excluded from zone 4 and 5 (grasslands) as no foraging resources (feed trees) are present.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	Excluded from all habitat/vegetation types as there are no feed trees present (No *Allocasuarina* or *Casuarina* species are present).
Chalinolobus picatus	Little Pied Bat	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Chthonicola sagittata	Speckled Warbler	Excluded from zone 4 and 5 (grasslands) as no woodland habitat is present.
Circus assimilis	Spotted Harrier	Not excluded.
Climacteris picumnus victoriae	Brown Treecreeper (Eastern subspecies)	Excluded from zone 4 and 5 (grasslands) as no woodland habitat is present.
Daphoenositta chrysoptera	Varied Sittella	Excluded from zone 4 and 5 (grasslands) as no woodland habitat is present.
Dasyurus maculatus	Spotted-tailed Quoll	Excluded from zone 4 and 5 (grasslands) as no woodland habitat is present.
Glossopsitta pusilla	Little Lorikeet	Excluded from zone 4 and 5 (grasslands) as no foraging resources (feed trees) are present.
Grantiella picta	Painted Honeyeater	Excluded from all zones as these do not have mistletoe occurring at greater than 5 per hectare (habitat constraint).
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	Excluded from all habitat/vegetation types as there are no foraging resources (suitable waterbodies and adjacent habitat) present.
Hieraaetus morphnoides	Little Eagle	Not excluded.
Lathamus discolor	Swift Parrot (foraging)	Excluded from zone 4 and 5 (grasslands) as no foraging resources (feed trees) are present.
Lophoictinia isura	Square-tailed Kite	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Melanodryas cucullata cucullata	Hooded Robin (South-eastern form)	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Species included for zone 1 and 2. Species filtered out by the BAM calculator for remaining zones based on patch size.
Miniopterus orianae oceanensis	Large Bent-winged Bat (foraging)	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.

Table 5.2 Assessment of ecosystem credit species within the disturbance area

Scientific name	Common name	Justification for exclusion
Neophema pulchella	Turquoise Parrot	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Ninox connivens	Barking Owl (Foraging)	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Petroica boodang	Scarlet Robin	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Petroica phoenicea	Flame Robin	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Nyctophilus corbeni	Corben's Long-eared Bat	Species included for zone 1 and 2. Species filtered out by the BAM calculator for remaining zones based on patch size.
Phascolarctos cinereus	Koala (foraging)	Excluded from zone 4 and 5 (grasslands) as no foraging resources (feed trees) are present.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Excluded from zone 4 and 5 (grasslands) as no woodland habitat is present.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Stagonopleura guttata	Diamond Firetail	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.
Tyto novaehollandiae	Masked Owl (Foraging)	Excluded from zone 5 given the lack of foraging habitat within exotic grassland.

5.3 Species credit species assessment

5.3.1 Geographic and habitat constraints assessment

An assessment of geographic and habitat constraints for threatened species was undertaken in accordance with Step 2 of Section 6.4 of the BAM (OEH 2017). For those threatened species predicted to occur and for which geographic or habitat constraints are listed, an assessment was undertaken of the presence of the geographic or habitat features within the disturbance area.

The species generated by the calculator with geographic or habitat constraints, as well as the results of the constraints assessment, are shown in Table 5.3.

Table 5.3 Assessment of habitat constraints and geographical features within the disturbance area

Scientific name	Common name	Geographic or habitat constraint	Sensitivity to gain	Geographic or habitat constraint present and justification
Regent Honeyeater (breeding)	*Anthochaera phrygia*	As per mapped areas	High	No. Mapped important areas are considered species credits under the BAM – Important Area Maps (DPIE 2020a). There are no mapped important areas close to the disturbance area.
Aprasia parapulchella	Pink-tailed Legless Lizard	Rocky areas; Or within 50m of rocky areas	High	Yes. The disturbance area contains rocky areas and requires further consideration.
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber including logs	High	Yes. Fallen/and standing dead timer is present within the site, therefore the species requires further consideration.
Glossy Black-Cockatoo (Breeding)	*Calyptorhynchus lathami*	Hollow bearing trees Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground	High	Yes. Suitable hollow bearing trees are present.
Large-eared Pied Bat	*Chalinolobus dwyeri*	Cliffs; Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	Very high	No. The disturbance footprint is not within 2km of suitable breeding habitat; caves, scarps, cliffs, rock overhangs and disused mines, therefore no further assessment is required.
White-bellied Sea-eagle (breeding)	*Haliaeetus leucogaster*	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	High	No. None of the habitat features required for breeding are present and the species presence is discounted in accordance with Step 2 of Section 6.4 of the BAM (OEH 2017).
Little Eagle (breeding)	*Hieraaetus morphnoides*	Nest trees - live (occasionally dead) large old trees within vegetation)	Moderate	Yes. Nest trees may occur, further surveys are required to determine if nest are present.
Swift Parrot (breeding)	*Lathamus discolor*	As per mapped areas	High	No. Mapped important areas are considered species credits under the BAM (OEH 2017). These areas do not require survey. The disturbance area is not within a mapped important area for the Swift Parrot.
Square-tailed Kite (Breeding)	*Lophoictinia isura*	Nest trees	Moderate	Yes. Nest trees may occur, further surveys are required to determine if nest are present.

Table 5.3 Assessment of habitat constraints and geographical features within the disturbance area

Scientific name	Common name	Geographic or habitat constraint	Sensitivity to gain	Geographic or habitat constraint present and justification
Large Bent-winged Bat (Breeding)	*Miniopterus orianae oceanensis*	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	Very high	No. No suitable breeding or roosting habitat exists within the disturbance area.
Barking Owl (Breeding)	*Ninox connivens*	Hollow bearing trees; Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground	High	Yes. Hollows of suitable size for breeding were recorded in the study area; therefore, the species was retained for further consideration.
Koala (Breeding)	*Phascolarctos cinereus*	Areas identified via survey as important habitat	High	Yes. Potential for important habitat areas.
Masked Owl (Breeding)	*Tyto novaehollandiae*	Hollow bearing trees; Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground	High	Yes. Hollows of suitable size for breeding were recorded in the study area; therefore, the species was retained for further consideration.

Geographic or habitat constraints were absent for the following species:

- Regent Honeyeater (breeding);
- Large-eared Pied Bat;
- White-bellied Sea-eagle (breeding);
- Swift Parrot (breeding); and
- Large Bent-winged Bat (Breeding).

These species do not require further assessment. The remaining species have the listed geographic or habitat constraint within the disturbance area; therefore, they require further assessment and are considered in Section 5.3.2.

5.3.2 Identifying candidate species credit species for further assessment

To develop a list of species credit species for further assessment, an assessment was undertaken in accordance with Step 3 of Section 6.4 of the BAM (OEH 2017), as shown in Table 5.4.

Table 5.4 Species credit species and status and habitat suitability assessment

Common name	Scientific name	Candidate species	Justification
Flora			
Bluegrass	*Dichanthium setosum*	Yes	The species is associated with heavy basaltic black soils and red-brown loams with clay subsoil. This species can occur in disturbed areas, including those which have been grazed. Potential habitat for the species exists within native grassland and woodland areas of the disturbance area.
Scant Pomaderris	*Pomaderris queenslandica*	Yes	This species is typically recorded in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. Given historical grazing within the disturbance area and the cleared midstory it is unlikely that the species occurs; however, the species has retained as a candidate species on a conservative basis.
Silky Swainson-pea	*Swainsona sericea*	Yes	Potential habitat for the species exists within native grassland and woodland areas of the disturbance area.
Tylophora linearis	*Tylophora linearis*	Yes	This species is typically recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii*. The species was retained as a candidate species on a conservative basis.
Mammals			
Squirrel Glider	*Petaurus norfolcensis.*	Yes	Potential woodland habitat exists within and adjacent to the disturbance area; therefore, the species has been included as a candidate species on a conservative basis.
Eastern Pygmy-possum	*Cercartetus nanus*	No	The habitat within the disturbance area is considered too degraded and disturbed to support the species. Native midstory species and shrubs are absent, with insufficient cover and foraging resources to support the species. Potential on site foraging resources are limited to the nectar and pollen of a very small number of Eucalypt species. These are sparsely distributed and would only offer seasonal resources when in flower. The project is also situated at the western limit of the species range further reducing the likelihood of occurrence.

Table 5.4 Species credit species and status and habitat suitability assessment

Common name	Scientific name	Candidate species	Justification
Koala (Breeding)	*Phascolarctos cinereus*	Yes	Potential habitat for this species exists within and adjacent to the disturbance area in woodland areas of PCT 599. The dominant species are Yellow Box and Blakely's Red Gum, both of which are listed as secondary food tree species within the Central and Southern Tablelands Koala management area (DECC 2008). No other feed tree species were recorded within the disturbance footprint; however, Western Grey Box was recorded in adjacent areas. This species requires further assessment.
Birds			
Bush Stone-curlew	*Burhinus grallarius*	Yes	Fallen/and standing dead timer is present within the some of the woodland areas of the site, especially those close to Eulomogo Creek and the species has been retained as a candidate species.
Glossy Black-Cockatoo (Breeding)	*Calyptorhynchus lathami*	Yes	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur (*Casuarina* and *Allocasuarina* species). Dependent on large hollow-bearing eucalypts for nest sites. Suitable breeding hollows are considered to be (i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees, and may be near-vertical or vertical (Bionet). Few *Casuarina* and *Allocasuarina* were recorded within the study area; however, suitably sized hollows were recorded. Whilst the habitat is not considered optimal, given the lack of feed trees, the presence of potential breeding hollow has resulted in this species being retained as a candidate species.
Little Eagle (breeding)	*Hieraaetus morphnoides*	Yes	Occupies open eucalypt forest, woodland or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch of open woodland or along tree-lined watercourses, where pairs build a large stick nest in winter. Given there is intact remnant woodland on tree lined watercourses adjacent to the disturbance area the species requires further consideration.
Square-tailed Kite (Breeding)	*Lophoictinia isura*	Yes	The species is found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses, with nest sites typically located along or near watercourses. Given there is intact remnant woodland on tree lined watercourses adjacent to the disturbance area the species requires further consideration.
Barking Owl (Breeding)	*Ninox connivens*	Yes	Hollows of suitable size for breeding were recorded in the study area therefore the species was retained for further consideration.

Table 5.4 Species credit species and status and habitat suitability assessment

Common name	Scientific name	Candidate species	Justification
Masked Owl (Breeding)	*Tyto novaehollandiae*	Yes	Hollows of suitable size for breeding were recorded in the study area therefore the species was retained for further consideration.
Reptiles			
Pink-tailed Legless Lizard	*Aprasia parapulchella*	Yes	The species inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. Given that native grassy groundlayers are present and scattered rocks are present, this species has potential to occur.
Pale-headed Snake	*Hoplocephalus bitorquatus*	No	The development area is also considered degraded due to thinning of canopy and removal of midstory. Habitat within the development footprint is considered degraded. In addition, the species is only known from preserved museum specimens in the region, with no recent records. The closest know occurrence of the species is 150 km north, in the Pilliga region.

The species habitat suitability assessment identified the following candidate species requiring further assessment:

- Flora:
  - Bluegrass;
  - Scant Pomaderris;
  - Silky Swainson-pea; and
  - *Tylophora linearis.*
- Fauna:
  - Squirrel Glider;
  - Koala (breeding);
  - Bush Stone-curlew;
  - Glossy Black-Cockatoo (breeding);
  - Little Eagle (breeding);
  - Square-tailed Kite (breeding);
  - Barking Owl (breeding);
  - Masked Owl (breeding); and
  - Pink-tailed Legless Lizard.

Targeted surveys were undertaken, and the presence or absence of these species in the disturbance area determined, in accordance with Section 6.4 of the BAM (OEH 2017). Survey methods and results for these candidate species are discussed further below.

5.3.3 Targeted survey methods

i Targeted flora surveys

Targeted surveys were undertaken for four flora species. These flora species and their survey period as per the Threatened Biodiversity Data Collection (TBDC) and timing for targeted surveys are shown in Table 5.5.

Table 5.5 Candidate flora species and survey period (grey) and timing of surveys (tick)

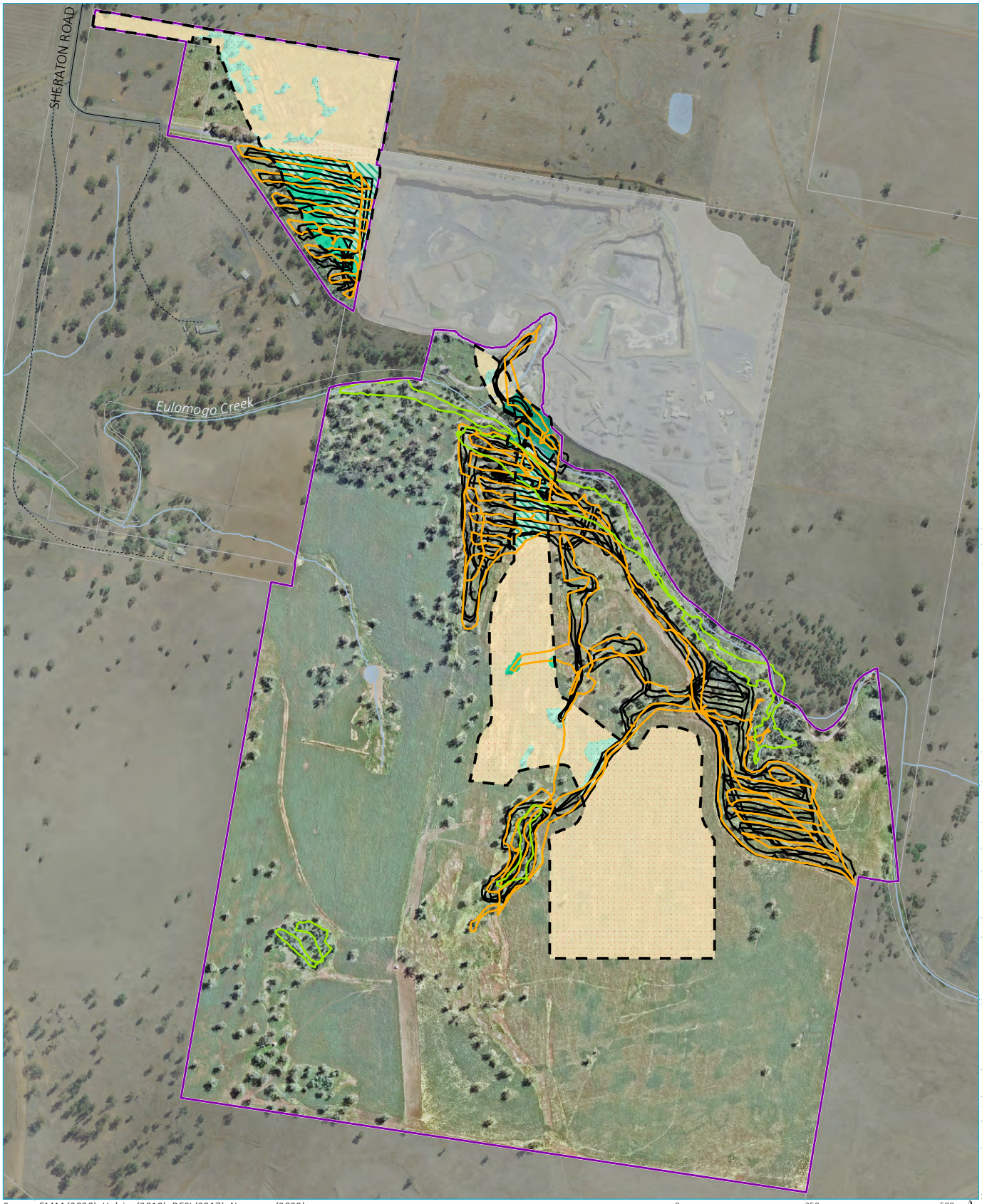
Common name	Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bluegrass	*Dichanthium setosum*	✓				✓							
Scant Pomaderris	*Pomaderris queenslandica*	✓				✓				✓			
Silky Swainson-pea	*Swainsona sericea*									✓			
Tylophora linearis	*Tylophora linearis*	✓				✓							

An initial habitat assessment and preliminary search for threated flora species was undertaken on 22 January 2019. This involved meander searches of approximately 3.8 km as shown in Figure 5.2 Candidate species detectable during this season included Bluegrass, Scant Pomaderris and *Tylophora linearis*.

The remainder of targeted flora surveys have been undertaken in accordance with OEH (2016b) guidelines, adopting systematic parallel transects spaced at intervals of 10 m. The transects are shown in Figure 5.2.

Field surveys were conducted on 14 and 15 May 2019 within all woodland and native grassland areas. The total transect length was 30.31 km within the study area of which 7.29 km was conducted within the development footprint. The survey targeted the Bluegrass, Scant Pomaderris and *Tylophora linearis*.

Field surveys were conducted on 16 and 17 September 2019 within all woodland and native grassland areas. The total transect length was 28.29 km within the study area of which 6.28 km was conducted within the development footprint. The survey targeted the Silky Swainson-pea and Scant Pomaderris.



Source: EMM (2020); Holcim (2019); DFSI (2017); Nearmap (2020)

0 250 500 m

GDA 1994 MGA Zone 55

N

KEY

- Study area
- Disturbance area
- Indicative existing disturbance area
- Watercourse/drainage line
- Waterbody
- Minor road
- Vehicular track
- Cadastral boundary (data does not align with surveyed site boundary)

Targeted flora surveys

- January 2019
- May 2019
- September 2019
- Cropped
- Exotic - grassland

599 - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion

- Poor
- Medium
- DNG
- Other

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Targeted flora survey

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Figure 5.2

EMM
creating opportunities

ii Targeted fauna surveys

Targeted surveys were undertaken for nine fauna species. These fauna species and their survey period as per the Threatened Biodiversity Data Collection (TBDC) and timing for targeted surveys are shown in Table 5.6.

Table 5.6 Candidate fauna species and survey period (grey) and timing of surveys (tick)

Common name	Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Squirrel Glider	*Petaurus norfolcensis.*				✓								
Koala	*Phascolarctos cinereus*					✓							
Bush Stone-curlew	*Burhinus grallarius*				✓								
Glossy Black-Cockatoo	*Calyptorhynchus lathami*				✓								
Little Eagle	*Hieraaetus morphnoides*									✓			
Square-tailed Kite	*Lophoictinia isura*									✓			
Barking Owl	*Ninox connivens*							✓					
Masked Owl	*Tyto novaehollandiae*							✓					
Pink-tailed Legless Lizard	*Aprasia parapulchella*										✓		

Survey methods are outlined below.

a Remote cameras

A total of eleven cameras were used to detect arboreal species including Squirrel Glider and Koala (refer to Figure 5.3). This aimed to supplement other spotlighting, trapping and scat searches.

DSE (2011a) recommends two cameras per 100 ha sampling unit (or part thereof) placed out for 30 days. A total of Eleven cameras were deployed over a period of at least one month and set for 24-hour operation, greatly exceeding minimum requirements. Cameras were attached trees, with the bait station attached 2-3m from a bait station. Bait was a mixture of oats honey and peanut butter. Honey solution was sprayed on and near the bait station then to ground level along the tree trunk/branches. Refer to Table 5.7 for a summary of survey effort.

Table 5.7 Remote camera survey effort

	Dates deployed	Effort (nights)	Number of photographs taken
1A - 0428	9 April – 15 May	37	15
1B - 3062	9 April – 15 May	37	5727
3B - 2753	9 April – 15 May	37	193
4A - 2769	9 April – 15 May	37	130
4B - 4956	9 April – 15 May	37	145
5A - 2744	9 April – 15 May	37	7299
5B - 5943	9 April – 15 May	37	25
6a - 2924	9 April – 15 May	37	125

Table 5.7 Remote camera survey effort

	Dates deployed	Effort (nights)	Number of photographs taken
7b - 0470	10 April – 14 May	35	156
8a - 5919	10 April – 15 May	36	812
8b - 8326	10 April – 5 May	27	14148
Total		**394**	**28,775**

Notes: 8b ceased recording early due to a large number of false triggers filling storage capacity.

b Arboreal trapping

Arboreal trapping was used to target the Squirrel Glider. Survey effort was focused on the most optimal areas of habitat, those areas with highest tree density and connectivity. Two transects of ten Elliot B or cage traps were placed at 2-4 m above the ground, approximately 50 m apart (refer to Figure 5.3).

DEC (2004) requires 24 trap nights over 3-4 consecutive days per 50 ha of stratification unit. Trapping was undertaken over four nights between 8 -12 April 2019 (80 trap nights), exceeding minimum survey effort guidelines.

The following process was followed.

- traps were baited with a mixture of peanut butter, rolled oats and honey;
- a mixture of water and honey was sprayed on tree trunk down to ground level;
- traps were checked early in the morning and closed for the day; and
- traps were re-opened and rebaited (as required) in the late afternoon.

c Spotlighting

Five spotlighting surveys were undertaken by two observers between 9 and 10 April 2019, with a total survey length of 4,871 m (refer to Figure 5.3) and an effort of five person hours.

Target species included Bush Stone-curlew, Squirrel Glider and Koala and Pale-headed Snake. Observers moved at a speed of 10 m per minute, with all animals observed recorded. DSEWPaC (2011a) recommends two 200 m transects per 5 ha site; therefore, given the smaller size of potential habitat present, survey guidelines have been exceeded.

d Threatened Owls – breeding surveys

Hollow bearing trees were mapped across the study area to assess habitat suitability for the Barking Owl and Masked Owl; those in living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. This was subsequently used to inform targeted survey effort.

A total of five hollows of sufficient size were identified within the study area, however three of these were lower than three metres and could be visually inspected for any breeding activity.

Under the BAM (OEH 2017) only breeding habitat needs to be surveyed for, with all breeding sites identified. To assess whether these potential breeding hollows are being utilised by the species five nights of survey were undertaken using a combination of listening around dusk (for males calling to females from nearby roost sites), late afternoon and nocturnal surveys to listen for active chicks calling to parents as well as call playback to see if Owls are active in the area. The surveys were undertaken between Monday 15 July to Friday 19 July and followed the following method:

- In the late afternoon, each hollow was attended to look for any signs of activity, including presence of adults in the hollow, or chicks calling.

- At dusk, active listening was undertaken to see if the male and female can be heard calling to each other. If either species are found to be present within the survey area, surveys will try to identify nesting sites by listening to roosting males calling to nesting females on dusk. Females calls would be triangulated, and nest searches undertaken in identified areas over several nights.

- Undertake call payback surveys for the Masked Owl and Barking Owl as follows:

    - Surveys are be undertaken at three locations (Figure 5.3); as these are considered suitable distances between survey sites.

    - Commence surveys with a 10-15 minute listening period. This will be followed by spotlighting for 10 minutes in the immediate vicinity.

    - Call playback is then undertaken with the call of each target species played intermittently for a 5 minutes period followed by a 10 minute listening period.

    - Following call payback a further 10 minutes of spotlighting is undertaken.

e Koala scat searches

Searches for Koala scats were based on the SAT Koala Survey Methodology (Phillips and Callaghan 2011) and undertaken during May 2019. Five SAT locations were selected (Figure 5.4) stratified across the study area, in areas where the relative chance of detection were highest; taking into account patch size, connectivity and the amount of feed tree species listed for Western Slopes and Plains koala management area.

f Hollow nesting diurnal birds – breeding surveys

Hollow bearing trees were mapped across the study area to assess habitat suitability for a range of threated species. This was subsequently used to inform targeted survey effort (refer to Figure 5.1).

DEC (2004) has not resolved nest search requirements and does not provide guidance on survey effort. DSEWPaC 2010a) was reviewed and sympatric species survey efforts indicated 8 hours over 4 days (2 hours per day) for sites less than 50 ha.

g Glossy Black Cockatoo

Surveys for Glossy Black-cockatoo were undertaken by two observers for approximately four hours. This was repeated over four consecutive days, exceeding minimum guidelines.

In order to increase likelihood of detection and meet seasonal breeding timing, Glossy Black Cockatoo surveys were conducted in April with 34 km covered by the two observers (Figure 5.4).

Observers focused the surveys in areas where there were suitably sized potential nesting hollows, visually inspecting hollows from the ground where possible. Observers also conducted more wide-ranging meanders through forested habitat to detect any individuals. If the targeted species were observed (particularly pairs) these were then followed to detect any nest sites. Bird surveys were conducted in the early morning or late afternoon, whilst birds are likely to be most active.

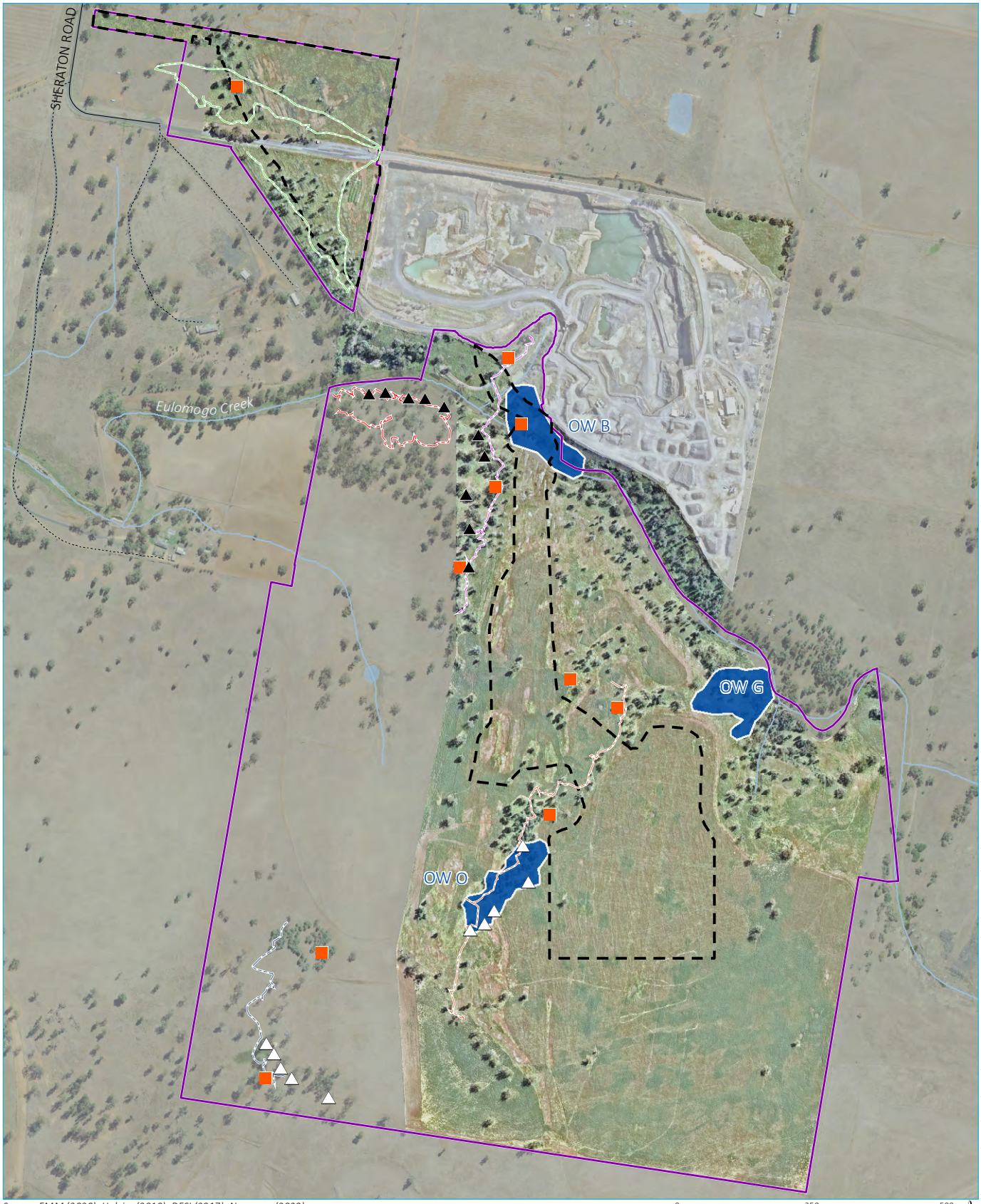
h Square-tailed Kite and Little Eagle nest survey

All trees within the disturbance footprint were searched for any large stick nests typical of the species. These surveys were conducted in September 2019 (refer to Figure 5.4).

i Pink-tailed Worm-lizard

Targeted surveys for the Pink-tailed Worm Lizard Rock were conducted within rocky areas of the study area, as shown on Figure 5.4. A total of 1,728 rock were turned, with all reptiles identified to species level. The surveys were conducted by two ecologists on 17 October 2019 between 09:00 to 13:00.

Survey effort and methodology followed Commonwealth survey guidelines for Australia's threatened reptiles (DSEWPC 2011b) in lieu of state based guidelines. It indicates that 150 – 200 rock need to be turned to be reasonably confident of determining the species presence in any area. The survey effort exceeded the recommended guidelines.



Source: EMM (2020); Holcim (2019); DFSI (2017); Nearmap (2020)

0 250 500 m

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Targeted survey effort for nocturnal species

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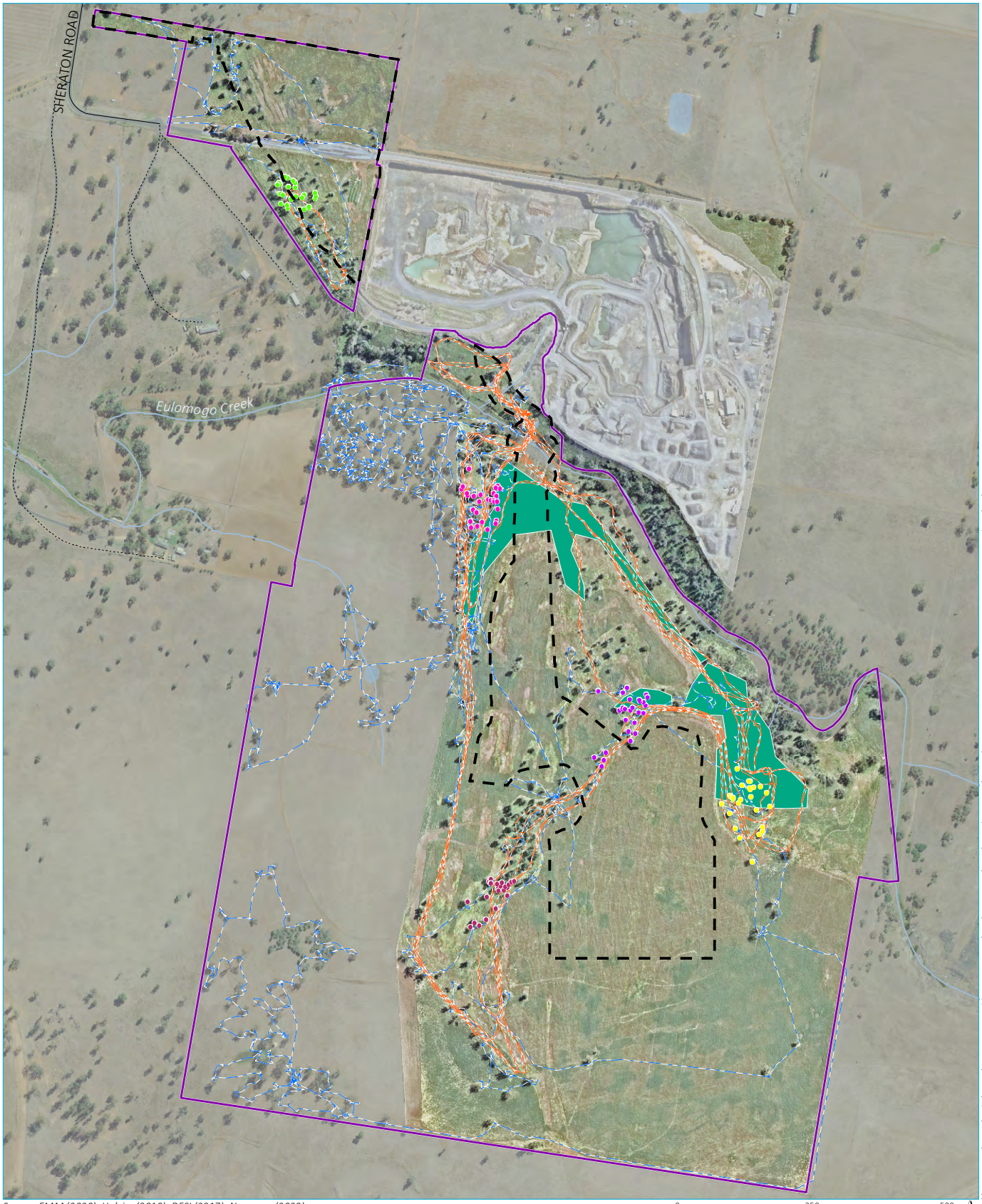
Figure 5.3

EMM creating opportunities



Source: EMM (2020); Holcim (2019); DFSI (2017); Nearmap (2020)

0 250 500 m

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KEY

- Study area
- Disturbance area
- Indicative existing disturbance area
- Minor road
- Vehicular track
- Watercourse/drainage line
- Waterbody

Koala SAT searches

- K1
- K2
- K3
- K4
- K5

- Raptor nest searches
- Glossy Black Cockatoo survey
- Pink-tailed Worm-lizard rock turning

Targeted survey effort for Pink-tailed Worm-lizard, diurnal birds and Koala SAT searches

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Biodiversity Development Assessment Report
Figure 5.4

EMM creating opportunities

5.3.4 Targeted survey results

i Targeted flora

No threatened species were recorded within the disturbance area opportunistically or during targeted surveys.

ii Remote cameras

None of the target species were recorded from the camera traps. Of the eleven cameras, six recorded fauna, with the remainder consisting of false triggers. Refer to Table 5.7 for the species recorded per camera. One threatened species, the Grey-crowned Babbler is listed vulnerable under the BC act, however it is an ecosystem credit species and does not generate species credits. Refer to Figure 5.5 for the locations recorded.

Table 5.8 Species recorded from camera traps.

Scientific name	Common name	Camera trap					
		3B	4A	4B	5A	6A	7B
Mammals							
Macropus giganteus	Eastern Grey Kangaroo		x			x	
Macropus robustus	Common Wallaroo			x			
*Vulpes vulpes**	Red Fox	x		x		x	
*Rattus rattus**	Black Rat				x		x
Microchiropteran spp.	*A microbat species*	x					
Birds							
Eolophus roseicapilla	Galah			x			
Pomastostomus temporalis	Grey-crowned Babbler		x	x	x		x
Corvus coroniodes/C. mellori	Australian Raven/Little Raven			x	x		
Manorina melanocephala	Noisy Miner		x				

Note: *denotes exotic species.

iii Arboreal trapping

No target species or any other species were recorded.

iv Spotlighting

None of the target species were observed. One threatened species, the Yellow-Bellied Sheathtail Bat, was recorded, which is listed vulnerable under the BC act. The Yellow-Bellied Sheathtail Bat is an ecosystem credit species and does not generate species credits. Refer to Figure 5.5 for the location recorded.

Other native species recorded include the Eastern Wallaroo (*Macropus robustus*), Southern Boobook (*Ninox boobook*), Masked Lapwing (*Vanellus miles*), Pied Butcher Bird (*Cracticus nigrogularis*) and Tree Dtella (*Gehyra variegata*).

v Threatened Owls

Neither the Barking Owl nor the Masked Owl were detected.

vi Hollow nesting diurnal birds

None of the target species were observed nesting. During the bird surveys and other surveys, the Grey Crowned Babbler (*Pomatostomus temporalis temporalis*) and their nests were frequently observed (Figure 5.5). Whilst listed Vulnerable under the BC act they are not a species credit species (Figure 5.5). Four Superb Parrot (*Lathamus discolor*), also listed Vulnerable under both the EPBC act and BC act were observed flying over the site in April, however this is outside of their nesting season and the species is not a candidate species for this assessment.

vii Square-tailed Kite and Little Eagle nest survey

No nests of either the Square-tailed Kite or the Little Eagle were recorded within the study area, further no individuals were observed. One disused Wedge-tailed Eagle nest was recorded outside of the development side. It was in a state of disrepair with no evidence of recent use.

viii Koala

The base of 150 trees were searched for Koala scats. No Koala scats were recorded during the SAT assessment, nor were any distinctive claw mark or 'poc' marks detected on the tree trunks. Ground visibility was generally very good, owing to a paucity of leaf litter and minimal midstory in most cases. No scats of any other arboreal mammals such as Brushtail Possum were recorded.

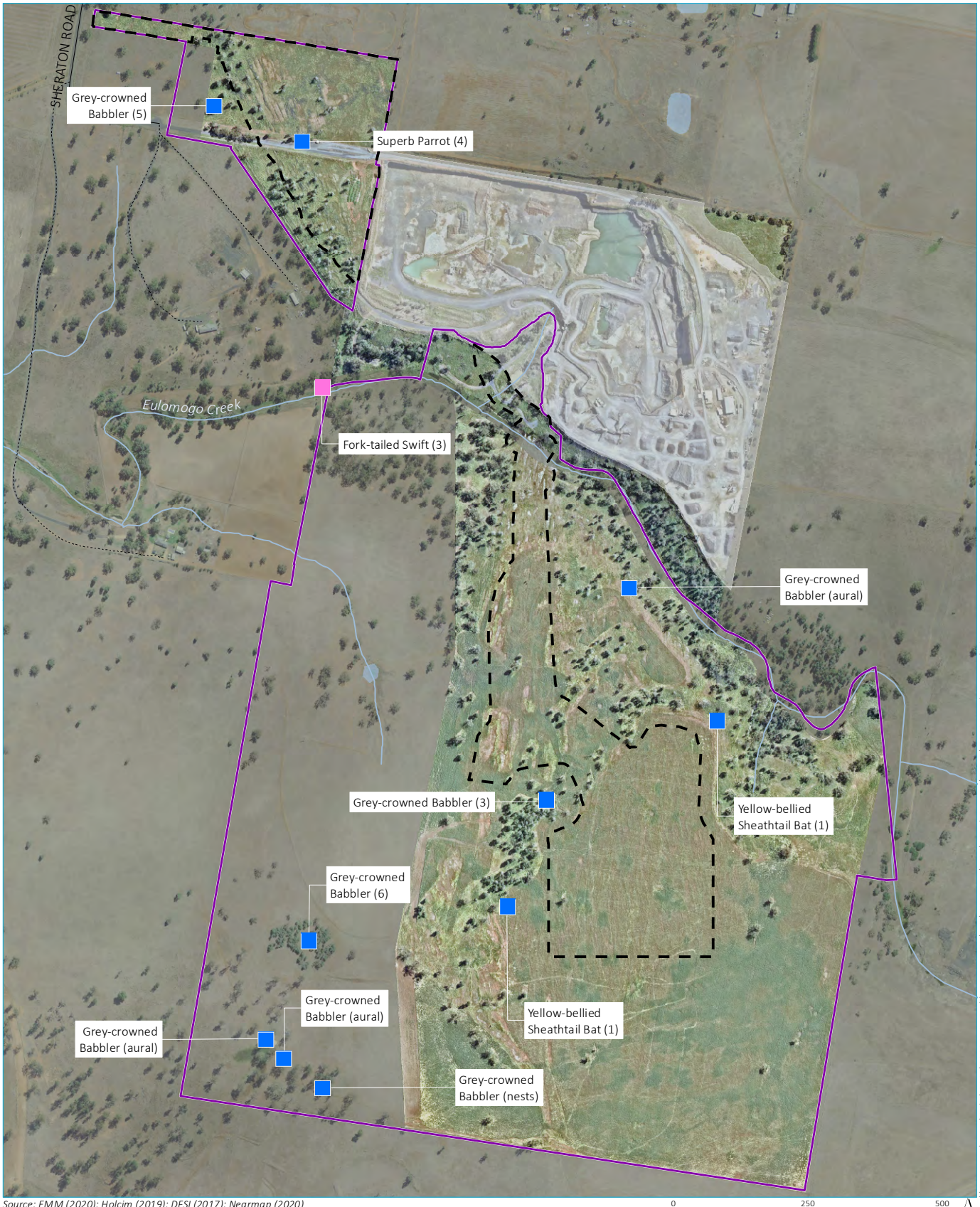
No primary feed tree species were recorded within the study area however several secondary food tree species were recorded; including Fuzzy Box (*Eucalyptus conica*), Western Grey Box, White Box, Yellow Box and Blakely's Red Gum. Secondary feed tree species within the disturbance area are restricted to Yellow Box and Blakely's Red Gum, though the most frequently recorded species is White Cypress Pine. A summary of the tree composition recorded in the SAT searches is provided in Table 5.9.

Table 5.9 Summary of Koala SAT survey results

SAT Survey	Tree species abundance					Average tree height (m)	Average DBH (cm)
	White Cypress Pine	Blakely's Red Gum	Yellow Box	White Box	Kurrajong		
1	30	-	-	-	-	9.1	43
2	10	-	19	-	1	8.4	60
3	17	13	-	-	-	7.8	56
4	10	7	13	-	-	7.4	50
5	26	3	-	1	-	7.9	42
Total	93	23	32	1	1		

ix Pink-tailed Worm-lizard

No Pink-tailed Worm-lizards were identified during the rock turning survey. A total of six Timid Slider (*Lerista timida*) were recorded.



Source: EMM (2020); Holcim (2019); DFSI (2017); Nearmap (2020)

0 250 500 m

GDA 1994 MGA Zone 55

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KEY

- Study area
- Disturbance area
- Indicative existing disturbance area
- Watercourse/drainage line
- Waterbody
- Minor road
- Vehicular track

Recorded fauna

- Migratory species
- Threatened species

Threatened and migratory fauna recorded

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Figure 5.5

EMM creating opportunities

A summary of species credit species predicted to occur within the disturbance area, based on the PCTs present and as predicted by the credit calculator is provided in Table 5.6. This includes an assessment of whether the disturbance area provides suitable habitat and whether the species will be impacted by the development. The potential for a species to occur within the disturbance area was assessed in accordance with Step 3 of Section 6.4 of the BAM (OEH 2017).

Table 5.10 Species credit species, habitat suitability and targeted survey results

Common name	Scientific name	Habitat present within the disturbance area	Recorded during field surveys	Impacted by development	Justification
Flora					
Bluegrass	*Dichanthium setosum*	Potential habitat exists within native grassland and woodland areas	No	No	Field surveys did not detect the species
Scant Pomaderris	*Pomaderris queenslandica*	Potential habitat exists within native grassland and woodland areas	No	No	Field surveys did not detect the species
Silky Swainson-pea	*Swainsona sericea*	Potential habitat exists within native grassland and woodland areas	No	No	Field surveys did not detect the species
Tylophora linearis	*Tylophora linearis*	Potential habitat exists within woodland areas	No	No	Field surveys did not detect the species
Mammals					
Squirrel Glider	*Petaurus norfolcensis*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species
Eastern Pygmy Possum	*Cercartetus nanus*	The habitat within the disturbance area is too degraded to support the species.	No	No	Habitat basis
Koala (Breeding)	*Phascolarctos cinereus*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species
Large-eared Pied Bat	*Chalinolobus dwyeri*	Habitat requirements absent	No	No	Habitat basis
Large Bent-winged Bat (Breeding)	*Miniopterus orianae oceanensis*	Habitat requirements absent	No	No	Habitat basis
Birds					
Regent Honeyeater (breeding)	*Anthochaera phrygia*	Not within mapped areas	No	No	Habitat basis
Bush Stone-curlew	Bush Stone-curlew *Burhinus grallarius*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species

Table 5.10 Species credit species, habitat suitability and targeted survey results

Common name	Scientific name	Habitat present within the disturbance area	Recorded during field surveys	Impacted by development	Justification
Glossy Black-Cockatoo (Breeding)	*Calyptorhynchus lathami*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species
Little Eagle (breeding)	*Hieraaetus morphnoides*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species
Square-tailed Kite (Breeding)	*Lophoictinia isura*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species
Barking Owl (Breeding)	*Ninox connivens*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species
Masked Owl (Breeding)	*Tyto novaehollandiae*	Potential habitat for this species exists within woodland areas	No	No	Field surveys did not detect the species
White-bellied Sea-eagle (breeding)	*Haliaeetus leucogaster*	Habitat requirements absent	No	No	Habitat basis
Swift Parrot (breeding)	*Lathamus discolor*	Not within mapped areas	No	No	Habitat basis
Reptiles					
Pink-tailed Legless Lizard	*Aprasia parapulchella*	Potential habitat for this species exists with rocky areas.	No	No	Field surveys did not detect the species
Pale-headed Snake	*Hoplocephalus bitorquatus*	The habitat is degraded and no recent records within 150 km.	No	No	Habitat basis

6 Impact assessment

This chapter identifies the potential impacts of the project upon biodiversity values (Section 6.1). Detail is provided on the iterative process that was undertaken to avoid and minimise impacts within the broader study area, resulting in the refined disturbance area. In addition, recommendations are provided, and aim to further reduce residual impacts (Section 6.2). The direct and indirect impacts of the project area are assessed in Section 6.5.

6.1 Potential direct, indirect and prescribed impacts

Potential direct impacts that could arise from the project, prior to any avoidance, minimisation, or mitigation, include:

- clearing of native vegetation and threatened species habitat; and
- disturbance of watercourse beds and banks during construction of the haul road.

Unmitigated, the project has the potential to result in minor indirect or minor prescribed impacts. Prescribed impacts, as per Section 8.2.1.2 of the BAM (OEH 2017), that could occur as a result of project include:

- fauna vehicle strike from construction traffic;
- impacts to surface water quality and quantity due to sediment runoff and/or contaminant runoff into adjacent watercourses;
- impacts to groundwater owing to water quality and quantity due to the quarry void; and
- fragmentation of habitats and associated impacts to connectivity and fauna movement.

Unmitigated indirect impacts that could occur as a result of the project include:

- increased noise, vibration and dust levels;
- artificial lighting impacting nocturnal species behaviour; and
- increase in weeds and pathogens.

These are discussed briefly below.

6.1.1 Fauna strike

Increased vehicle movements associated with the project have the potential to result in increased fauna vehicle strikes and associated fauna mortality. The risk of significant impacts is considered minor given the lack of threatened fauna recorded and the low general fauna abundance. Mitigation measures outlined in Section 6.2 will reduce this risk further.

6.1.2 Impacts on watercourses

Construction activities that take place in the vicinity of watercourses have the potential to impact on aquatic ecology by the release of sediment-laden water that could arise on-site following mobilisation of soils/sediments. The mobilisation of soils/sediments may occur during inclement weather over disturbed soils and sediments in areas where vegetation has been cleared and/or areas where soil and construction material has been stockpiled.

One mapped (unnamed) minor watercourse exists within current quarry footprint, which is irrevocably altered by the existing quarry working and used as part of the surface water management. These areas are already highly disturbed, with no discernible biodiversity values. As such the project will not cause any further impacts. Other mapped watercourses within the study area no longer have any discernible channel and have no surface water present for the majority of the time, due to extensive off-site alterations to their catchments, mainly owing to agriculture including damming.

Eulomogo Creek is the largest watercourse within the study area. Vegetation on either side of Eulomogo Creek has been retained, providing a significant buffer to the watercourse. The exception to this is the Eulomogo Creek Crossing, which will consist of a concrete culvert. This crossing will be situated on an area of bedrock, with little to no sediment or vegetation present. This bed rock is impervious and is highly resistant to erosion; as such the construction of the crossing is unlikely to change the characteristics of the creek bed significantly.

6.1.3 Potential groundwater impacts

The project does not require large inputs or storage of chemicals/liquids that pose a risk to groundwater contamination. Potential impacts are limited to low volume sources such as fuel and oil from construction equipment. Appropriate procedures will be included in the construction environmental management plan (CEMP) to reduce the chance of any spill occurring and minimise potential impacts if they were to occur.

Holcim has installed a network of groundwater monitoring bores across the site which has informed final design, avoiding interaction with groundwater. Vegetation within the disturbance area is not consider part of a groundwater dependant ecosystem and therefore impacts to groundwater are anticipated to be non-consequential. The project design has included a buffer area from the pit void to minimise impact to adjacent vegetation,

6.1.4 Habitat fragmentation

The removal of native vegetation has the potential to result in fragmentation of fauna habitat, with resultant effects on fauna species movement, reproduction and gene flow. The project will remove vegetation (refer to Section 6.1), however, the majority of the clearance is anticipated to have a limited impact, given that vegetation will be retained outside of the disturbance area, both in the proposed western disturbance area and the proposed southern disturbance area. This will maintain connectivity characteristics comparable to that which currently exist. The exception is the proposed haul road between the southern disturbance area to the existing disturbance area. This will bisect woodland vegetation alongside Eulomogo Creek. The haul road will create a disconnect in woodland along Eulomogo Creek of up to 15 m wide. This disruption to continuity of vegetation is unlikely to affect highly mobile species, however smaller and less mobile fauna species may be impacted disproportionately. Potential impacts include increased predation and reduced movements across the haul road.

6.1.5 Noise, vibration, dust, and lighting impacts

Construction activities will result in increased levels of noise and vibration over a greater extent than currently occurs, however operational hours will remain unchanged. No significant impacts are anticipated as the fauna abundance is low across the disturbance area and largely limited to highly mobile species. No threatened species are anticipated to rely on any of the habitats currently present and no sensitive receptors have been identified.

Night time quarrying operations are not proposed but there may be an occasional need for maintenance of plant or equipment at night. This is not expected to generate any substantive light spill as lighting would be localised and directional to the task area. It is noted that the installation of 4 m high perimeter earth bunds will also mitigate the spill of light or night glow. Significant impacts to fauna are not anticipated.

The results of the dispersion modelling for incremental particulate matter (TSP, PM10, PM2.5 and dust deposition), as summarised in the EIS, show that the predicted concentrations and deposition rates for are below the applicable impact assessment criteria at all assessment locations for both the existing and proposed scenarios. Impacts to biodiversity are considered negligible and will be minimised using dust suppression measure as outlined in Section 6.2.2.

6.1.6 Weeds and pathogens

Increased movement of vehicles has the potential to transport weeds and pathogens into the disturbance area and adjacent vegetation. Given the high levels of current disturbance within the disturbance area, there is also the risk that weeds may be transported off-site. Mitigation measures to reduce the chance of weed spread are outlined in Section 6.2.

Infection of native plants by *Phytophthora cinnamomi* is listed as a key threatening process under the BC Act and EPBC Act. *Phytophthora cinnamomi* can lead to death of trees and shrubs, resulting in devastation of native ecosystems (DECC 2008). As described by DoE (2014), infection of susceptible communities with *P. cinnamomi* can lead to:

- changes in the structure and composition of native plant communities;
- a significant reduction in primary productivity and functionality; and
- habitat loss and degradation for dependent flora and fauna.

Phytophthora cinnamomi is known to occur within the region; however, it is less common than east of the range and it is unknown if the pathogen currently exists within the disturbance area. No tree dieback has been recorded within the disturbance area.

6.2 Measures to avoid, minimise and mitigate impacts

Holcim in consultation with EMM, have undertaken significant steps to avoid, minimise and mitigate impacts, as per the process outlined below:

- identification of biodiversity values through comprehensive, rigorous and thorough biodiversity surveys;
- communication of identified values to the project team; and
- consultation between the design team and project ecologists to consider direct and indirect impacts and work through an iterative design process, with multiple iterations of the design footprint to achieve a feasible project with the least biodiversity impact.

6.2.1 Impact avoidance

A total of 46.42 ha of native vegetation has been avoided through iterative design; 43.74 ha of this is represented by BC Act listed TECs, of which 19.10 ha also conforms to EPBC Act listed TECs.

The original study area was approximately 153 ha, for which a biodiversity constraints assessment was completed, including vegetation mapping, habitat mapping and BAM plots. A number of targeted surveys were also undertaken. The detailed vegetation plots provided an estimate of the vegetation integrity score, which was used to assess the quality of vegetation present, in addition to the habitat-based assessment for threatened species. These assessments informed detailed design of the proposed quarry. The final design was significantly reduced in sized and avoided large areas of TECs. PCTs avoided through design and minimisation of the quarry footprint are provided in Figure 6.1 and Table 6.1.

Table 6.1 Avoidance areas of PCTs and vegetation zones within the study area

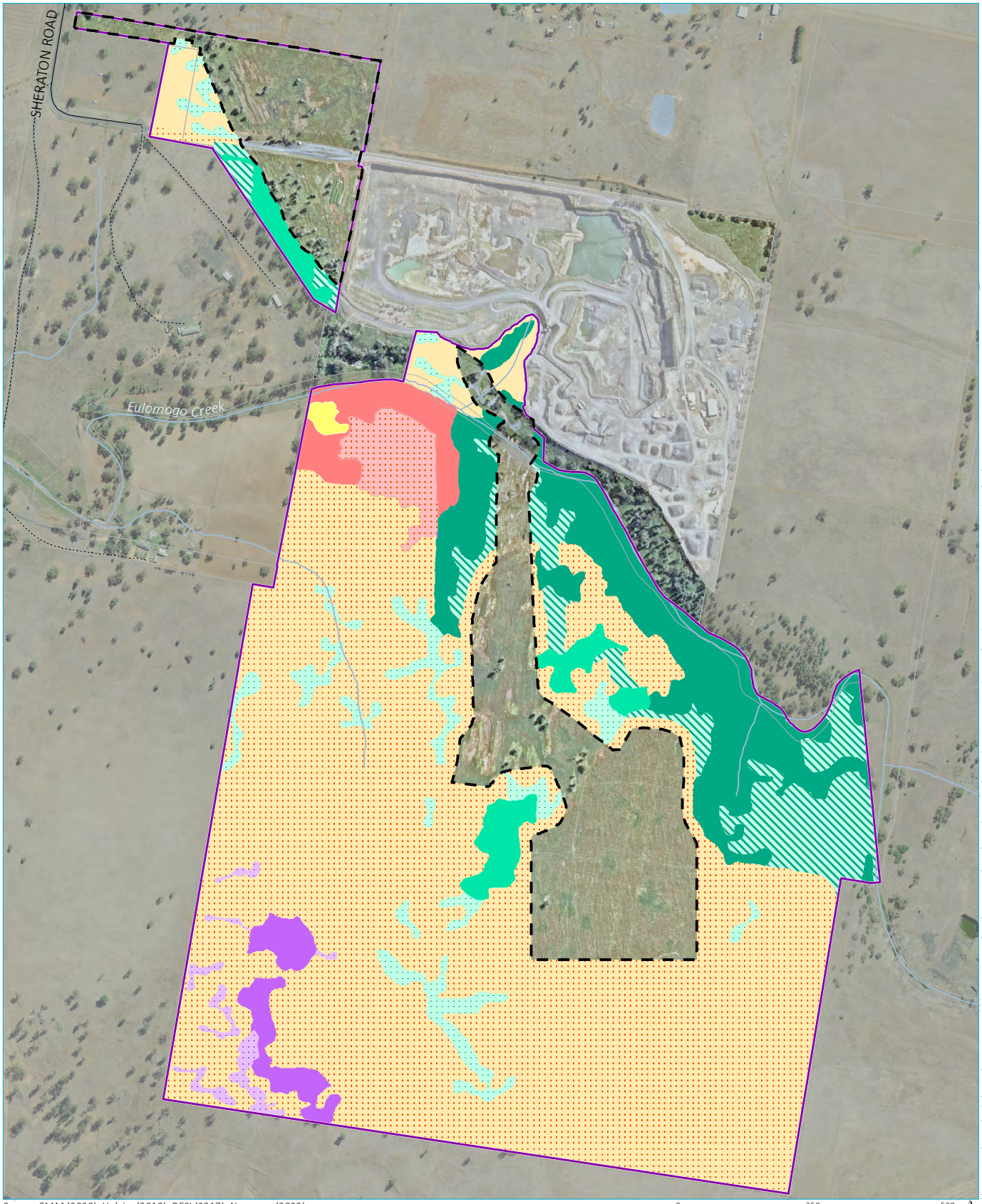
PCT zone	EPBC Act TEC	BC Act TEC	Area (ha)
PCT 81 Western Grey Box - cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion			
medium	EEC (Inland Grey Box)	EEC (Inland Grey Box)	2.99
poor	-	-	2.68
PCT 201 Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion			
medium	-	EEC (Fuzzy Box Woodland)	0.30
PCT 435 White Box - White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion			
medium	CEEC (Box Gum woodland)	CEEC (Box Gum woodland)	2.46
poor	-	CEEC (Box Gum woodland)	1.36
PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion			
medium	CEEC (Box Gum woodland)	CEEC (Box Gum woodland)	13.64
other	-	CEEC (Box Gum woodland)	4.81
poor	-	CEEC (Box Gum woodland)	7.30
DNG	-	CEEC (Box Gum woodland)	10.86
Total (ha)			**46.42**

Four PCTs were recorded within the study area, of which three were aligned with EPBC Act TECs. Areas of avoidance for theses TECs include;

- 2.99 ha of Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions; and
- 16.11 ha of White Box-Yellow Box- Blakely's Red Gum grassy woodlands and derived native grasslands.

All of the PCTs recorded within the study area are aligned with BC Act TECs. Areas of avoidance include:

- 2.99 ha of Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions;
- 0.30 ha of Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions; and
- 40.44 ha of White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.



Source: EMM (2020); Holcim (2019); DFSI (2017); Nearmap (2020)

0 250 500 m

GDA 1994 MGA Zone 55

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KEY

- Study area
- Disturbance area
- Indicative existing disturbance area
- Watercourse/drainage line
- Waterbody
- Minor road
- Vehicular track
- Cadastral boundary (data does not align with surveyed site boundary)

Plant community types

- 201 - medium
- 435 - medium
- 435 - poor
- 599 - DNG
- 599 - medium
- 599 - other
- 599 - poor
- 81 - medium
- 81 - poor
- Cultivated land
- Exotic - grassland

Avoidance of biodiversity values

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Biodiversity Development Assessment Report
Figure 6.1

EMM creating opportunities

6.2.2 Impact minimisation and mitigation

Measures to mitigate residual impacts are provided in Table 6.2. A site-specific CEMP will be prepared prior to the commencement of any construction or clearing works will include the measures outlined in Table 6.2.

Following completion of proposed extraction, project infrastructure will be decommissioned, buildings and other structures demolished, plant and equipment will be removed from the site, and groundwater monitoring bores capped. Dismantled and decommissioned infrastructure and equipment will be recycled where possible or disposed of at an approved waste management facility.

Progressive rehabilitation will be undertaken concurrently with extraction, with batters blasted and shaped at an approximate 3:1 slope. Rehabilitation requirements will be identified as part of the assessment process, and a rehabilitation management plan will be prepared for the site. Future land use for the disturbance area will be identified prior to decommissioning and would be consistent with the land zoning and strategic planning context at that time.

Table 6.2 Recommended mitigation measures for direct impacts and indirect impacts

Impact	Action and outcome	Responsibility	Timing
Direct impact/prescribed impact			
Clearing of native vegetation	Avoid and minimise clearing impacts to all native vegetation where possible. Clearing limits will be clearly marked to prevent unnecessary clearing beyond the extent of the disturbance area. Tree clearing and disturbance will be limited to the disturbance area. Appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' will be installed. Identify the location of any 'No Go Zones' in site inductions.	Construction site manager.	Prior to and during vegetation clearing.
Clearing of hollow bearing trees/habitat trees, resulting in fauna injury and mortality	Limit removal of trees (including dead trees) to that required within the disturbance area in support of the installation of project infrastructure. A clearing procedure will be implemented during the clearing of the disturbance area, as follows: • preclearance surveys will be completed to determine if any nesting birds are present; and • a suitably trained fauna handler will be present during hollow-bearing tree (including dead hollow-bearing trees) clearing to rescue and relocate displaced fauna if found on-site. Installation of appropriate exclusion fencing around trees and woodland to be retained within the disturbance area whilst construction is occurring. The radius of tree protection zone (TPZ) is calculated for each tree by multiplying its diameter at breast height (DBH) by 12 in accordance with the Standards Australia Committee (2009). Appropriate education will be provided to site personnel in site inductions regarding the purpose of exclusion fencing or no go zones.	Construction site manager and suitably trained fauna handler.	Prior to and during tree clearing.

Table 6.2 Recommended mitigation measures for direct impacts and indirect impacts

Impact	Action and outcome	Responsibility	Timing
Direct impact/prescribed impact			
Vehicle collision with fauna	Speed limits within the disturbance area will be limited to 40 km/hr and stated in the CEMP.	Construction site manager.	During construction and operation.
Disturbance of river/creek beds and banks during crossing construction (including construction of creek crossings).	Source controls, such as mulching, matting and sediment fences, will be utilised where appropriate. An erosion and sediment control (ESC) plan will be prepared in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) prior to commencement of construction. Disturbed areas will be stabilised and rehabilitated as soon as possible to reduce the exposure period. A specific creek crossing sub-plan will be included as part of the CEMP.	Construction site manager.	Design stage, during vegetation clearing and construction.
Indirect impact			
Transfer of weeds and pathogen to and from site.	Appropriate wash down facilities will be available to clean vehicles and equipment prior to arrival and when leaving site. In particular, ensure soils and seed material isn't transferred in accordance with the measures outlined in the CEMP.	Construction site manager.	Design stage, during vegetation clearing and construction.
Artificial lighting impacting fauna behaviour	Lighting to comply with Australian standard AS4282 (INT) 1997 – Control of Obtrusive Effects of Outdoor Lighting.	Construction site manager.	During construction and operation.

6.3 Identification of impacts requiring offsets

The disturbance area (extension area) of the quarry is approximately 28.48 ha. The majority of this area consists of cleared areas or exotic vegetation, with 5.82 ha represented by native vegetation. This section provides an assessment of the impacts requiring offsetting in accordance with Section 10 of the BAM (OEH 2017).

6.3.1 Native vegetation

A summary of the ecosystem credits required for all vegetation zones and paddock trees, including changes in vegetation integrity score, is provided in Table 6.3.

A total of 132 ecosystem credits are required to offset the residual impacts of the project, comprising 127 from vegetation communities and five from paddock trees. A credit report for area offsets and paddock trees is provided in Appendix D.

Offsets will be provided in accordance with the biodiversity offset framework outlined in Section 6.6.

Table 6.3 Summary of ecosystem credits required for all vegetation zones for the development area

PCT	Vegetation zone name	Area (ha)	Vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity score	Credits required
Zone 1: 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	medium	0.64	64.3	0.0	-64.3	21
Zone 2: 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	other	1.25	58.6	0.0	-58.6	37
Zone 2: 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	poor	1.18	40.7	0.0	-40.7	24
Zone 4: 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	DNG	2.75	32.7	0	-32.7	45
Paddock trees: 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Paddock trees	-	-	-	-	5
Total		**5.82**				**132**

6.3.2 Impacts on threatened species

No species credit species were recorded and as such there are no offsets generated.

6.4 Serious and irreversible impacts

White Box Yellow Box Blakely's Red Gum Woodland is considered a potential entity to meet the serious and irreversible impacts (SII) principle (refer *Appendix 3 - Guidance to assist a decision-maker to determine a serious and irreversible impact* of the BAM (OEH 2017)).

Four zones of PCT 599 meets the TEC listing of White Box Yellow Box Blakely's Red Gum Woodland (Box Gum Woodland), comprising a total of 5.82 ha (Table 6.3). This community is assessed in accordance with Section 10.2.2.1 of the BAM below:

the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII;

A total of 43.74 ha of Box Gum Woodland within the study area has been avoided through changes to the design of the quarry extension. Avoidance is discussed in Section 6.2 above.

the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone;

The condition of the four vegetation zones is described in detail in Section 4.3.5 with the vegetation integrity score and the areas directly impacted displayed in Table 6.4. Risks of indirect impacts to the TEC as a result of the project are consider negligible given the mitigation measures outlined in Section 6.2 and the provision of a bund and buffer area around the pit.

Table 6.4 Vegetation zones mapped within the disturbance area

Vegetation zone	Plant community type	Ancillary code	Area (ha)	Vegetation integrity score
1	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	medium	0.64	64.3
2	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	other	1.25	58.6
3	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	poor	1.18	40.7
4	599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	DNG	2.75	32.7

a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact;

No condition thresholds have been provided to date.

the extent and overall condition of the potential TEC within an area of 1000ha, and then 10,000ha, surrounding the proposed disturbance area

The Central West / Lachlan Region (Version 1.3. VIS_ID 4468) State Vegetation Type Map was used to calculate the area of PCTs that align with the TEC, with 58.92 ha mapped within a 1,000 ha buffer and 82.15 ha mapped within 10,000 ha. Based on this mapping the clearance of 5.82 ha will represent a loss of 9.88 % of the TEC within a 1,000 ha area and 7.08 % within a 10, 000 ha area.

The above values are likely to be an underestimation of the extent of Box Gum Woodland TEC within the 1,000 ha and 10,000 ha buffers, noting that:

- PCT 599 was not mapped in either buffer area according to the regional mapping, however it was observed in the development footprint and broader study area during the field surveys. In the state-wide mapping these areas were mapped as PCT 81, despite not being dominated by the characteristic species. Given that PCT 81 is not aligned with the TEC this error will result in an underestimation of the Box Gum Woodland extent; and

- Large areas (143 ha and 266 ha respectively) of PCT 796 is mapped within the 1000 and 10,000m buffers. This is a generic derived grassland (Derived grassland of the NSW South Western Slopes) that is not ascribed to an original woodland PCT and has not been taken into account when estimating the extent of Box Gum Woodland. However, it is likely that at least a portion of these derived grassland were originally PCT 599 or other PCTs aligned with the Box Gum Woodland and these areas would therefore conform to the Box Gum Woodland. PCT 796

Considering the above, it is likely the amount of Box Gum woodland mapped within the 1000 m and 10,000 m buffer is an underestimate of the amount of Box Gum Woodland actually present. Therefore the 9.88 % of the TEC within a 1,000 ha area and 7.08 % within a 10, 000 ha area is likely to be a substantial overestimate and the actual percentage clearance likely to be substantially lower.

an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration

Vegetation mapping to PCT level was obtained for the Talbragar IBRA subregion, of which 6,283.03 ha includes PCTs aligned with the TEC. The removal of 5.82 ha will contribute to a removal of 0.09 % of the TEC.

an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion

The total area of the TEC mapped within reserves of the IBRA region (State Vegetation Type Map) is 6,724 ha, with the 154 ha mapped within the subregion.

the development, clearing or biodiversity certification proposal's impact on:

abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns

The TEC is not considered a groundwater dependant ecosystem and therefore impacts to groundwater are anticipated to be non-consequential. The project design has included a buffer area from the pit void to minimise impact to adjacent vegetation, refer to Section 6.2. The project will have minimal abiotic influence on the TEC with groundwater and surface water unlikely to be significantly altered.

characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants

The ecosystem functioning of the TEC is already substantially altered given the surrounding agricultural land use (cropping and grazing) and quarrying. The extension of the quarry is unlikely to introduce any novel impacts beyond which already occur, with the impacts largely related to the direct removal of the community.

the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC

The extension of the quarry is unlikely to introduce any novel indirect impacts.

Mitigation measures outlined in Section 6.2 will reduce indirect impacts so that impacts to Box Gum woodland outside the disturbance footprint will be negligible. The TEC is currently impacted by cropping and grazing, with a high level of weed invasion and clearance.

direct or indirect fragmentation and isolation of an important area of the potential TEC

The removal of Box Gum vegetation will have a limited impact on the existing connectivity of the community given that vegetation will be retained outside of the disturbance area, both in the proposed western disturbance area and the proposed southern disturbance area. This will maintain connectivity characteristics similar to those that currently exist. The exception to this is the proposed haul road between the southern disturbance area to the existing disturbance area. This will bisect the Box Gum woodland vegetation alongside Eulomogo Creek providing an interruption of the community, approximately 15 m wide. This disruption to continuity of vegetation is unlikely to affect highly mobile species, however smaller and less mobile fauna species may be impacted disproportionately. Potential impacts include potential for increased predation and reduced movement across the haul road.

the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.

Box Gum woodland was avoided where possible, applying the highest avoidance priority to Box Gum woodland in moderate condition, resulting in minimal clearance. The other conditions classes are modified and degraded with no recruitment of canopy species, and are a poor representation of the TEC. All impact will be offset under the BAM which, will result in a net gain on the area and quality of the TEC where compared to that in the disturbance area.

6.5 Impacts not requiring offsets

Areas not requiring assessment in accordance with Section 10.4 of the BAM (OEH 2017) include:

- existing roads;
- cleared and highly disturbed land, particularly associated with cropping; and
- watercourses/dams.

A total of 5.70 ha of exotic grassland (zone 5) were mapped within the disturbance area, with a vegetation integrity score of 3.4. This is below the threshold for offsetting.

6.6 Biodiversity offset framework

The following section outlines several options available to Holcim to compensate the projects impacts. Holcim may opt to proceed with one offsetting option or a combination of options. The development of the overall offset strategy for the project is yet to be achieved, though Holcim are committed to satisfying all offset requirements prior to commencement of construction for the project.

Preparation of the offsetting approach will consider the following steps:

1. Identifying if suitable credits are available on the market to meet offset requirements;
2. Finding potential on-site or off-site offset sites with the biodiversity values required to compensate for the project's impacts; and
3. Payment into the Biodiversity Conservation Trust Fund.

6.6.1 Purchasing credits

Providing that suitable credits are available, Holcim may be able to purchase existing credits available on the market and retire these to satisfy offset obligations. Initially, like-for-like options must be fully investigated before any variation criteria is explored under Clause 6.2 of the BC Regulation. Application to apply the 'variation to trading rules' can only be considered after all reasonable steps to seek like-for-like credits are undertaken (in accordance with OEH, 2017) and suitable credits still cannot be sourced.

Like-for-like attributes for each of the PCTs are outlined below;

- PCT 599 requires hollows to be present in the offset vegetation;

- PCT 599 requires to be offset with PCTs which meet the TEC (this includes PCT's 2, 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 506, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1601, 1606, 1608, 1611, 1691, 1693, 1695, 1698); and

- Offset PCTs may include those from Talbragar Valley, Inland Slopes and Pilliga IBRA subregion, or any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.

6.6.2 Payment in the Biodiversity Conservation Fund

Payment to the Biodiversity Conservation Trust (BCT) can be achieved once conditions of consent are provided, which specify the number and type of credits to be retired. This option is low risk and removes any further obligation for Holcim once payment is made. It also removes any risk of the project not being able to meet offset obligations, other than any financial constraints. An administration fee and a risk loading fee are applied to credits purchased through the BCT, which may result in higher per credit costs.

The BAM calculator provides a current credit price for the ecosystem credits required. One ecosystem credit type is required for the project (PCT 599), which generates a price per credit of $7,519.83 exclusive of GST (based on pricing obtained in September 2020).

A total of 132 ecosystem credits are required to offset the project, therefore the total payment required is currently $992,617.56 (exclusive of GST). Note that these credit prices are market based and may fluctuate, typically updated on a quarterly basis. The next update to the pricing is likely on 1 February 2021.

6.6.3 Establishment of a biodiversity stewardship site

Holcim may wish to establish a biodiversity stewardship agreement by acquiring suitable land or using any existing land holdings. This involves permanent conservation and management of the biodiversity values on the land.

7 Assessment of biodiversity legislation

7.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the impacts of the project on MNES within the disturbance area was prepared to determine whether referral of the project to the Commonwealth Minister for the Environment is required. Matters of MNES relevant to the disturbance area are summarised in Table 7.1.

Assessments of significance have been completed for the following MNES (refer to Appendix E);

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland - Critically Endangered Ecological Community;
- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered species;
- Swift Parrot (*Lathamus discolor*) – Critically Endangered species;
- Superb Parrot (*Polytelis swainsonii*) – Vulnerable species;
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable species;
- White-throated Needletail (*Hirundapus caudacutus*); and
- Fork-tailed Swift (*Hirundapus caudacutus*) – Migratory species.

The assessments conclude that no significant impacts on threatened entities are predicted as a result of the project. On this basis the project is recommended to be a non-controlled action. A referral application for the project has been completed and will be submitted simultaneously with the EIS. The referral will be submitted on a conservative basis, allowing the Commonwealth to confirm that the project is non-controlled.

Table 7.1 Assessment of the project against the EPBC Act

MNES	Project specifics	Potential for significant impact
Threatened species	Four flora species and 17 fauna species have been recorded or are predicted to occur within the locality. The majority of these species are considered unlikely to occur within the disturbance area owing to the high levels of disturbance present or have been surveyed for and were not detected. One Vulnerable species was recorded flying over the study area, the Superb Parrot. Four other species; Regent Honeyeater, Swift Parrot, White-throated Needletail and Corben's Long-eared Bat are considered as having potential to occur. Assessments of significance have been completed for these five species, refer to Appendix E. The assessments concluded negligible impacts to the species given the sub-optional nature of the habitat present and the small quantum of clearance.	Significant impact unlikely to result from the project.

Table 7.1 Assessment of the project against the EPBC Act

MNES	Project specifics	Potential for significant impact
Threatened ecological communities	One critically endangered ecological community, listed under the EPBC Act, was recorded within the disturbance area, Box Gum Woodland CEEC. *PCT 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion_medium*, is aligned with Box Gum woodland CEEC and 0.64 ha is required to be cleared for the project. An assessment of significance concluded that the project will not have a significant impact given the small quantum of impact and the amount of retained community of equivalent condition.	Significant impact unlikely to result from the project.
Migratory species	Nine migratory species have been recorded or are predicted to occur within the locality. One species, Fork-tailed Swift was recorded flying over the periphery of the Study Area, for which an assessment was completed (Appendix E). The disturbance area does not provide important habitat for an ecologically significant proportion of any of these species.	Significant impact unlikely to result from the project.
Wetlands of international importance	The disturbance area does not contain or is adjacent to any wetlands of international (Ramsar) Importance. There are also none, downstream of the disturbance area. No Ramsar wetlands will be impacted.	Significant impact unlikely to result from the project.

7.2 Fisheries Management Act

No species under the *Fisheries Management Act 1994* are anticipated to occur within the disturbance area. For consideration of habitat value refer to Section 5.1.2.

7.3 Biosecurity Act

African Boxthorn was prevalent throughout the woodland areas of the site. The species is a weed of national significance (WoNS) and is also listed as a priority weed for the Central West. In addition to the general biosecurity duty, priority measures prohibit dealings, and it must not be imported into the state or sold.

8 Summary and conclusion

This assessment has been completed in accordance with the BAM (OEH 2017) on behalf of Holcim. The disturbance area will expand the existing quarry to the north-west and south. A second quarry (unrelated to Holcim's, exists to the north with the other land uses including cropping and pastoral farms. The landscape is partially cleared with patches of woodland and scattered tress reaming in the agricultural area. The largest patches of woodland are associated with Eulomogo Creek which bisects the study area.

Measures to avoid and minimise impacts to vegetation were considered during the initial design stages of the project, resulting in avoidance of significant biodiversity values and minimisation of impacts on other areas of native vegetation. Particular efforts were made to avoid those woodland areas with larger patch size and greater connectivity to other areas of habitat outside of the disturbance area. A total of 46.42 ha of native vegetation has been avoided within the study area.

Impacts to native vegetation requiring offsets are:

- 0.64 ha of 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion_medium, generating 21 credits;
- 1.25 ha of 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion_other, generating 37 credits;
- 1.18 ha of 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion_poor, generating 24 credits;
- 2.75 ha of 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion_DNG, generating 45 credits; and
- direct impacts to 6 paddock trees assigned to 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion, generating 5 credits.

The total number of ecosystem credits required to offset the project is 132.

Based on both habitat assessments and field surveys, the disturbance area has low importance for threatened flora or fauna species. Targeted surveys did not detect any threatened species and no species credits are required.

One candidate for SII, White Box Yellow Box Blakely's Red Gum Woodland was recorded within the disturbance area. The area impacted was reduced to 5.82 ha through iterative design. The majority of the community vegetation was highly degraded and of low quality. The highest quality woodland was considered 'medium' condition and 0.64 ha of this community will be impacted. The project is unlikely to cause serious and irreversible impacts to the TEC given most of the community is in poor condition and large areas of the community have been retained within the immediate vicinity.

An assessment of the impacts of the project on MNES within the disturbance area was prepared to determine whether referral of the project to the Commonwealth Minister for the Environment is required. The assessment concluded that no significant impacts on threatened entities are predicted to result from the project. Referral of the project to the Commonwealth Minister for the Environment will be undertaken on a conservative basis and the project will be recommended as a non-controlled action.

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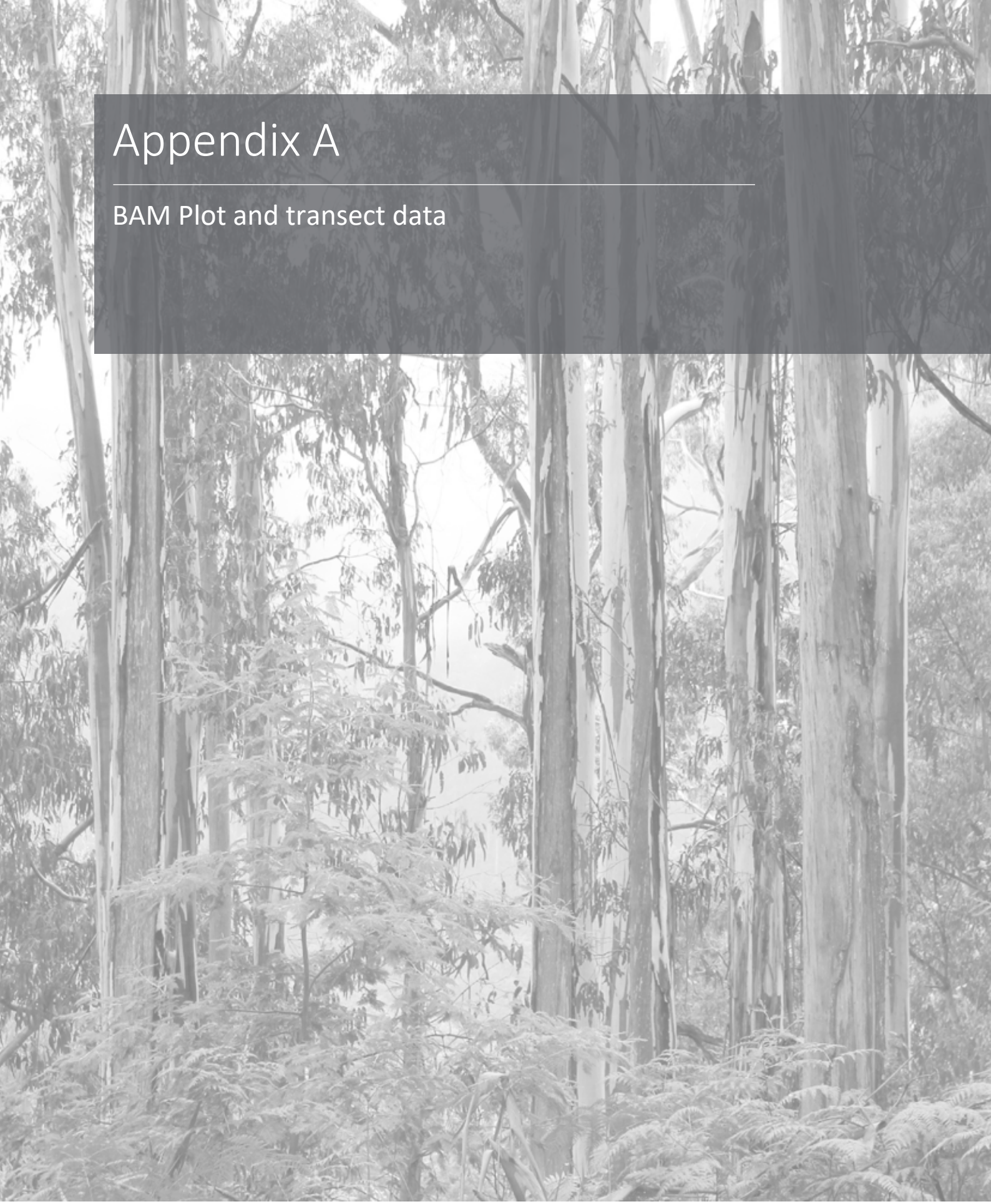


Appendix A

BAM Plot and transect data

plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns
10	599	0.53	101	Moderate_medium	55	655988	6427036	128	2	0	7	6	0	2	26.5	0.0	24.5	1.5	0.0
15	599	0.53	101	Moderate_medium	55	655911	6426778	150	2	1	6	13	0	1	15.0	0.1	4.7	8.2	0.0
19	599	0.53	101	Moderate_medium	55	655935	6426965	170	3	2	14	17	0	1	25.2	1.1	11.9	7.5	0.0
6	599	1.23	101	Moderate_other	55	655994	6426215	330	1	1	5	6	0	1	20.0	0.1	3.0	1.8	0.0
22	599	1.23	101	Moderate_other	55	656095	6426546	50	1	0	10	12	0	3	15.0	0.0	5.7	9.6	0.0
23	599	1.23	101	Moderate_other	55	655652	6427323	330	2	1	7	8	0	1	30.0	0.1	11.9	7.7	0.0
5	599	1.15	0	Moderate_poor	55	655956	6425794	290	1	1	1	3	0	0	30.0	0.1	0.1	0.7	0.0
11	599	1.15	0	Moderate_poor	55	655451	6427657	170	1	1	3	7	0	0	5.0	0.1	0.7	0.7	0.0
14	599	1.15	0	Moderate_poor	55	655898	6426073	165	3	1	6	9	0	2	17.1	0.1	1.0	18.3	0.0
13	599	2.75	0	Moderate_DNG	55	655651	6427393	35	0	0	8	7	1	0	0.0	0.0	16.4	8.6	0.1
21	599	2.75	0	Moderate_DNG	55	655990	6426839	75	0	0	8	11	1	2	0.0	0.0	45.0	13.1	0.1
9	599	5.50	0	Exotic_grassland	55	655903	6427080	300	0	0	6	10	0	0	0.0	0.0	10.9	2.3	0.0
12	599	5.50	0	Exotic_grassland	55	655560	6427659	90	0	0	2	3	0	0	0.0	0.0	2.1	0.3	0.0
17	599	5.50	0	Exotic_grassland	55	655694	6427656	100	0	0	1	6	1	0	0.0	0.0	0.1	1.4	0.1

plot	strucOther	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to9	funTreeStem10to19	funTreeStem20to29	funTreeStem30to49	funTreeStem50to79	funTreeRegen	funHighThreatExotic
10	0.3	1	0	90.0	5.0	0	1	0	0	0	0	0.4
15	1.0	2	0	20.0	4.0	0	0	1	1	1	0	3.0
19	0.5	4	4	88.0	40.0	0	0	0	1	1	0	15.0
6	0.8	3	0	40.0	25.0	0	1	1	1	1	0	8.0
22	1.3	0	1	71.0	4.0	0	0	1	1	0	0	5.2
23	0.1	4	1	81.0	38.0	0	0	0	1	1	0	30.0
5	0.0	3	0	25.0	4.0	0	0	0	0	0	0	0.3
11	0.0	1	0	5.0	6.0	0	0	0	1	1	0	4.0
14	0.2	1	1	10.0	5.0	0	0	0	1	0	0	5.8
13	0.0	0	0	0.0	0.0	0	0	0	0	0	0	0.0
21	0.3	0	0	14.0	0.0	0	0	0	0	0	0	1.0
9	0.0	0	0	2.0	1.0	0	0	0	0	0	0	0.4
12	0.0	0	0	5.0	1.0	0	0	0	0	0	0	0.1
17	0.0	0	0	0.4	0.0	0	0	0	0	0	0	0.1

PLOT 5

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Aizoaceae	*Zaleya galericulata*	Hogweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	4
Amaranthaceae	*Alternanthera pungens*	Khaki Weed	Not Listed	Not Listed		YES	YES		0.1	4
Amaranthaceae	*Amaranthus retroflexus*	Redroot Amaranth	Not Listed	Not Listed		YES			0.1	1
Asteraceae	*Cirsium vulgare*	Spear Thistle	Not Listed	Not Listed		YES			0.1	14
Boraginaceae	*Heliotropium europaeum*	Potato Weed	Not Listed	Not Listed		YES			0.1	1
Brassicaceae	*Hirschfeldia incana*	Buchan Weed	Not Listed	Not Listed		YES			0.1	30
Brassicaceae	*Lepidium spp.*	A Peppercress	Not Listed	Not Listed	YES			Forb (FG)	0.5	27
Brassicaceae	*Sisymbrium spp.*		Not Listed	Not Listed		YES			0.1	1
Fabaceae (Faboideae)	*Indigofera spp.*		Not Listed	Not Listed	YES			Shrub (SG)	0.1	1
Fabaceae (Faboideae)	*Medicago spp.*	A Medic	Not Listed	Not Listed		YES			2.0	5,000
Geraniaceae	*Geraniaceae indeterminate*	Geranium species	Not Listed	Not Listed	YES			Forb (FG)	0.1	4
Malvaceae	*Malva parviflora*	Small-flowered Mallow	Not Listed	Not Listed		YES			5.0	10,000
Myrtaceae	*Eucalyptus melliodora*	Yellow Box	Not Listed	Not Listed	YES			Tree (TG)	30.0	1
Poaceae	*Hordeum vulgare*	Barley	Not Listed	Not Listed		YES			4.0	10,000
Poaceae	*Paspalidium constrictum*	Knottybutt Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Solanaceae	*Lycium ferocissimum*	African Boxthorn	Not Listed	Not Listed		YES	YES		0.2	1
Zygophyllaceae	*Tribulus terrestris*	Cat-head	Not Listed	Not Listed		YES			0.1	6

PLOT 6

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Aizoaceae	Zaleya galericulata	Hogweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Asteraceae	Cirsium vulgare	Spear Thistle	Not Listed	Not Listed		YES			0.1	400
Asteraceae	Lactuca serriola	Prickly Lettuce	Not Listed	Not Listed		YES			0.1	1
Brassicaceae	Hirschfeldia incana	Buchan Weed	Not Listed	Not Listed		YES			0.4	800
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.1	1
Chenopodiaceae	Einadia hastata	Berry Saltbush	Not Listed	Not Listed	YES			Forb (FG)	0.8	200
Chenopodiaceae	Maireana microphylla	Small-leaf Bluebush	Not Listed	Not Listed	YES			Shrub (SG)	0.1	1
Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	YES			Forb (FG)	0.6	600
Cupressaceae	Callitris glaucophylla	White Cypress Pine	Not Listed	Not Listed	YES			Tree (TG)	20	11
Cyperaceae	Carex spp.		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	30
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil	Not Listed	Not Listed	YES			Other (OG)	0.8	800
Fabaceae (Faboideae)	Medicago minima	Woolly Burr Medic	Not Listed	Not Listed		YES			0.4	100
Geraniaceae indeterminate	Geraniaceae	Not Found	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Oxalidaceae	Oxalis spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	50
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	2.6	28
Poaceae	Bromus spp.	A Brome	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Hordeum vulgare	Barley	Not Listed	Not Listed		YES			1	10000
Poaceae	Hordeum vulgare	Barley	Not Listed	Not Listed		YES			0.1	10
Poaceae	Lolium spp.	A Ryegrass	Not Listed	Not Listed		YES			0.1	1
Poaceae	Paspalidium clementii		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	15
Poaceae	Rytidosperma spp.		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Polygonaceae	Rumex brownii	Swamp Dock	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		8	29
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			0.1	4

PLOT 9

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Aizoaceae	Zaleya galericulata	Hogweed	Not Listed	Not Listed	YES			Forb (FG)	0.5	30
Asteraceae	Centaurea spp.	Thistle	Not Listed	Not Listed		YES			0.1	3
Asteraceae	Vittadinia triloba		Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Boraginaceae	Heliotropium europaeum	Potato Weed	Not Listed	Not Listed		YES			0.1	4
Brassicaceae	Hirschfeldia incana	Buchan Weed	Not Listed	Not Listed		YES			5	800
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.1	1
Chenopodiaceae	Einadia hastata	Berry Saltbush	Not Listed	Not Listed	YES			Forb (FG)	1	50
Commelinaceae	Commelina cyanea	Native Wandering Jew	Not Listed	Not Listed	YES			Forb (FG)	0.1	6
Cyperaceae	Carex inversa	Knob Sedge	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.4	50
Fabaceae (Caesalpinioideae)	Senna barclayana	Smooth Senna	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Geraniaceae	Geranium solanderi	Native Geranium	Not Listed	Not Listed	YES			Forb (FG)	0.1	20
Lamiaceae	Marrubium vulgare	White Horehound	Not Listed	Not Listed		YES			0.5	11
Lamiaceae	Salvia verbenaca	Vervain	Not Listed	Not Listed		YES			0.1	1
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Oxalidaceae	Oxalis corniculata	Creeping Oxalis	Not Listed	Not Listed		YES			0.1	10
Poaceae	Anthosachne scabra	Wheatgrass, Common WH	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	3
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.3	3
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	5	12
Poaceae	Cenchrus clandestinus	Kikuyu Grass	Not Listed	Not Listed		YES			0.1	3
Poaceae	Paspalidium constrictum	Knottybutt Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	5	60
Poaceae	Urochloa subquadripara	Green Summer Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	5
Polygonaceae	Rumex brownii	Swamp Dock	Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Portulacaceae	Portulaca oleracea	Pigweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Scrophulariaceae	Verbascum virgatum	Twiggy Mullein	Not Listed	Not Listed		YES			0.1	3
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		0.4	2
Solanaceae	Solanum esuriale	Quena	Not Listed	Not Listed	YES			Forb (FG)	0.1	16
Verbenaceae	Verbena bonariensis	Purpletop	Not Listed	Not Listed		YES			0.1	4
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			50	800

PLOT 10

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Aizoaceae	Zaleya galericulata	Hogweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Amaranthaceae	Amaranthus retroflexus	Redroot Amaranth	Not Listed	Not Listed		YES			0.1	1
Asteraceae	Bidens subalternans	Greater Beggar's Ticks	Not Listed	Not Listed		YES			0.1	12
Asteraceae	Lactuca serriola	Prickly Lettuce	Not Listed	Not Listed		YES			0.1	1
Brassicaceae	Hirschfeldia incana	Buchan Weed	Not Listed	Not Listed		YES			4	75
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.1	1
Chenopodiaceae	Einadia hastata	Berry Saltbush	Not Listed	Not Listed	YES			Forb (FG)	1	5
Cyperaceae	Carex inversa	Knob Sedge	Not Listed	Not Listed	YES			Grass & grasslike (GG)	10	160
Fabaceae (Faboideae)	Glycine spp.		Not Listed	Not Listed	YES			Other (OG)	0.1	1
Geraniaceae	Geranium solanderi	Native Geranium	Not Listed	Not Listed	YES			Forb (FG)	0.1	30
Juncaceae	Juncus spp.	A Rush	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Lamiaceae	Marrubium vulgare	White Horehound	Not Listed	Not Listed		YES			1	5
Loranthaceae	Amyema pendula		Not Listed	Not Listed	YES			Other (OG)	0.2	1
Malvaceae	Brachychiton populneus	Kurrajong	Not Listed	Not Listed	YES			Tree (TG)	1.5	2
Malvaceae	Malva parviflora	Small-flowered Mallow	Not Listed	Not Listed		YES			0.1	1
Myrtaceae	Eucalyptus melliodora	Yellow Box	Not Listed	Not Listed	YES			Tree (TG)	25	1
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Oxalidaceae	Oxalis corniculata	Creeping Oxalis	Not Listed	Not Listed		YES			0.1	50
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	13	68
Poaceae	Austrostipa verticillata	Slender Bamboo Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	2
Poaceae	Avena spp.	Oats	Not Listed	Not Listed		YES			1	30
Poaceae	Bothriochloa decipiens	Pitted Bluegrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Digitaria brownii	Cotton Panic Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	1	15
Poaceae	Urochloa subquadripara	Green Summer Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	3
Polygonaceae	Rumex brownii	Swamp Dock	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		0.4	4
Solanaceae	Solanum esuriale	Quena	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			10	250

PLOT 11

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Amaranthaceae	*Amaranthus retroflexus*	Redroot Amaranth	Not Listed	Not Listed		YES			0.1	1
Asteraceae	*Cirsium vulgare*	Spear Thistle	Not Listed	Not Listed		YES			2	10000
Brassicaceae	*Hirschfeldia incana*	Buchan Weed	Not Listed	Not Listed		YES			0.1	2
Brassicaceae	*Lepidium africanum*	Common Peppercress	Not Listed	Not Listed		YES			0.1	1
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	0.1	30
Chenopodiaceae	*Sclerolaena birchii*	Galvinized Burr	Not Listed	Not Listed	YES			Shrub (SG)	0.1	2
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine	Not Listed	Not Listed	YES			Tree (TG)	5	2
Euphorbiaceae	*Euphorbiaceae indetermina*	Spurges	Not Listed	Not Listed		YES			0.1	30
Fabaceae (Caesalpinioideae)	*Senna barclayana*	Smooth Senna	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Geraniaceae	*Geraniaceae indeterminate*	Geranium species	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Lamiaceae	*Marrubium vulgare*	White Horehound	Not Listed	Not Listed		YES			3	40
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	Not Listed	Not Listed		YES			0.1	1
Oxalidaceae	*Oxalis spp.*		Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Poaceae	*Aristida personata*		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	15
Poaceae	*Austrostipa verticillata*	Slender Bamboo Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.4	12
Poaceae	*Poaceae indeterminate*	Grasses, reeds and bambo	Not Listed	Not Listed		YES			0.3	15
Poaceae	*Urochloa subquadripara*	Green Summer Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Polygonaceae	*Rumex brownii*	Swamp Dock	Not Listed	Not Listed	YES			Forb (FG)	0.1	4
Portulacaceae	*Portulaca oleracea*	Pigweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Solanaceae	*Lycium ferocissimum*	African Boxthorn	Not Listed	Not Listed		YES	YES		4	2
Solanaceae	*Solanum esuriale*	Quena	Not Listed	Not Listed	YES			Forb (FG)	0.1	15
Zygophyllaceae	*Tribulus terrestris*	Cat-head	Not Listed	Not Listed		YES			90	1600

PLOT 12

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Asteraceae	Carthamus lanatus	Saffron Thistle	Not Listed	Not Listed		YES	YES		0.1	3
Asteraceae	Cirsium vulgare	Spear Thistle	Not Listed	Not Listed		YES			9	10000
Asteraceae	Schkuhria pinnata	Dwarf Marigold	Not Listed	Not Listed		YES			0.5	130
Boraginaceae	Heliotropium europaeum	Potato Weed	Not Listed	Not Listed		YES			2	1600
Euphorbiaceae	Euphorbiaceae indetermina	Spurges	Not Listed	Not Listed		YES			2	1600
Fabaceae (Caesalpinioideae)	Senna barclayana	Smooth Senna	Not Listed	Not Listed	YES			Forb (FG)	0.1	15
Lamiaceae	Marrubium vulgare	White Horehound	Not Listed	Not Listed		YES			3	20
Malvaceae	Malva parviflora	Small-flowered Mallow	Not Listed	Not Listed		YES			2	2500
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Poaceae	Austrostipa verticillata	Slender Bamboo Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	2	10
Poaceae	Themeda triandra		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Solanaceae	Solanum esuriale	Quena	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			25	1600

PLOT 13

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Asteraceae	Cirsium vulgare	Spear Thistle	Not Listed	Not Listed		YES			0.1	1
Asteraceae	Schkuhria pinnata	Dwarf Marigold	Not Listed	Not Listed		YES			0.1	5
Asteraceae	Vittadinia triloba		Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Boraginaceae	Heliotropium europaeum	Potato Weed	Not Listed	Not Listed		YES			0.1	2
Brassicaceae	Hirschfeldia incana	Buchan Weed	Not Listed	Not Listed		YES			3	800
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			1	200
Chenopodiaceae	Dysphania pumilio	Small Crumbweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Chenopodiaceae	Einadia nutans	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Chenopodiaceae	Einadia spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Cyperaceae	Schoenus apogon	Fluke Bogrush	Not Listed	Not Listed	YES			Grass & grasslike (GG)	7	1000
Geraniaceae	Geraniaceae indeterminate	Not Found	Not Listed	Not Listed	YES			Forb (FG)	8	10000
Lamiaceae	Marrubium vulgare	White Horehound	Not Listed	Not Listed		YES			0.1	2
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	3	1000
Poaceae	Avena sativa	Oats	Not Listed	Not Listed		YES			0.1	1
Poaceae	Chloris truncata	Windmill Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Digitaria divaricatissima	Umbrella Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Enneapogon gracilis	Slender Nineawn	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Hordeum vulgare	Barley	Not Listed	Not Listed		YES			0.1	2
Poaceae	Rytidosperma spp.		Not Listed	Not Listed	YES			Grass & grasslike (GG)	3	1000
Poaceae	Tripogon loliiformis	Fiveminute Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	3	400
Poaceae	Urochloa subquadripara	Green Summer Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	14
Polygonaceae	Polygonum plebeium	Small Knotweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Portulacaceae	Portulaca oleracea	Pigweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Pteridaceae	Cheilanthes sieberi	Rock Fern	Not Listed	Not Listed	YES			Fern (EG)	0.1	10
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			15	5000

PLOT 14

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Amaranthaceae	Alternanthera pungens	Khaki Weed	Not Listed	Not Listed		YES	YES		5	200
Asteraceae	Centaurea solstitialis	St Barnabys Thistle	Not Listed	Not Listed		YES			0.1	6
Asteraceae	Cirsium spp.		Not Listed	Not Listed		YES			3	10000
Boraginaceae	Heliotropium europaeum	Potato Weed	Not Listed	Not Listed		YES			2	400
Brassicaceae	Hirschfeldia incana	Buchan Weed	Not Listed	Not Listed		YES			0.1	20
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.1	20
Campanulaceae	Wahlenbergia spp.	Bluebell	Not Listed	Not Listed	YES			Forb (FG)	0.1	6
Chenopodiaceae	Dysphania pumilio	Small Crumbweed	Not Listed	Not Listed	YES			Forb (FG)	5	800
Chenopodiaceae	Einadia nutans	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	10	1600
Chenopodiaceae	Salsola australis		Not Listed	Not Listed	YES			Shrub (SG)	0.1	1
Convolvulaceae	Convolvulus graminetinus		Not Listed	Not Listed	YES			Other (OG)	0.1	3
Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	YES			Forb (FG)	0.6	10
Cupressaceae	Callitris glaucophylla	White Cypress Pine	Not Listed	Not Listed	YES			Tree (TG)	8	1
Euphorbiaceae	Euphorbia drummondii	Caustic Weed	Not Listed	Not Listed	YES			Forb (FG)	0.3	60
Fabaceae (Caesalpinioideae)	Senna barclayana	Smooth Senna	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil	Not Listed	Not Listed	YES			Other (OG)	0.1	5
Fabaceae (Faboideae)	Medicago minima	Woolly Burr Medic	Not Listed	Not Listed		YES			5	1000
Juncaceae	Juncus spp.	A Rush	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	2
Malvaceae	Brachychiton populneus	Kurrajong	Not Listed	Not Listed	YES			Tree (TG)	0.1	1
Malvaceae	Malvaceae indeterminate	Mallows, jutes and lanter	Not Listed	Not Listed		YES			3	10000
Myrtaceae	Eucalyptus blakelyi	Blakely's Red Gum	Not Listed	Not Listed	YES			Tree (TG)	9	1
Oxalidaceae	Oxalis spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Chloris ventricosa	Tall Chloris	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	3
Poaceae	Eragrostis cilianensis	Stinkgrass	Not Listed	Not Listed		YES			0.1	3
Poaceae	Hordeum spp.	A Barley Grass	Not Listed	Not Listed		YES			0.1	2
Poaceae	Tragus australianus	Small Burrgrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	22
Poaceae	Urochloa subquadripara	Green Summer Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.5	100
Polygonaceae	Polygonum plebeium	Small Knotweed	Not Listed	Not Listed	YES			Forb (FG)	2	400
Polygonaceae	Rumex brownii	Swamp Dock	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		0.8	7
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			5	1600

PLOT 15

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Acanthaceae	Rostellularia adscendens va	Pink Tongues	Not Listed	Not Listed	YES			Forb (FG)	1	50
Aizoaceae	Zaleya galericulata	Hogweed	Not Listed	Not Listed	YES			Forb (FG)	2	100
Asteraceae	Cymbonotus lawsonianus	Bear's Ear	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Asteraceae	Vittadinia cuneata	A Fuzzweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Brassicaceae	Hirschfeldia incana	Buchan Weed	Not Listed	Not Listed		YES			1	50
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.1	2
Campanulaceae	Wahlenbergia spp.	Bluebell	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Caryophyllaceae	Petrorhagia nanteuilii	Proliferous Pink	Not Listed	Not Listed		YES			0.1	1
Chenopodiaceae	Dysphania pumilio	Small Crumbweed	Not Listed	Not Listed	YES			Forb (FG)	1	100
Chenopodiaceae	Einadia nutans	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	1	100
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	YES			Forb (FG)	2	100
Cupressaceae	Callitris glaucophylla	White Cypress Pine	Not Listed	Not Listed	YES			Tree (TG)	3	2
Fabaceae (Faboideae)	Desmodium varians	Slender Tick-trefoil	Not Listed	Not Listed	YES			Other (OG)	1	50
Fabaceae (Faboideae)	Medicago spp.	A Medic	Not Listed	Not Listed		YES			3	1000
Lamiaceae	Salvia verbenaca	Vervain	Not Listed	Not Listed		YES			1	200
Lomandraceae	Lomandra spp.	Mat-rush	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	3
Lomandraceae	Lomandra spp.	Mat-rush	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Malvaceae	Malva parviflora	Small-flowered Mallow	Not Listed	Not Listed		YES			0.1	10
Myoporaceae	Eremophila debilis	Amulla	Not Listed	Not Listed	YES			Shrub (SG)	0.1	1
Myrtaceae	Eucalyptus melliodora	Yellow Box	Not Listed	Not Listed	YES			Tree (TG)	12	3
Oxalidaceae	Oxalis corniculata	Creeping Oxalis	Not Listed	Not Listed		YES			0.1	15
Phormiaceae	Dianella porracea		Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	1	50
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	1	400
Poaceae	Chloris spp.		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.5	25
Poaceae	Rytidosperma spp.		Not Listed	Not Listed	YES			Grass & grasslike (GG)	2	30
Polygonaceae	Polygonum spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Polygonaceae	Rumex brownii	Swamp Dock	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		3	13
Solanaceae	Solanum esuriale	Quena	Not Listed	Not Listed	YES			Forb (FG)	0.5	50
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			0.1	1

PLOT 17

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Anthericaceae	Arthropodium spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	20
Asteraceae	Carthamus lanatus	Saffron Thistle	Not Listed	Not Listed		YES	YES		0.1	20
Asteraceae	Schkuhria pinnata	Dwarf Marigold	Not Listed	Not Listed		YES			1	50
Asteraceae	Vittadinia cuneata f. minor		Not Listed	Not Listed	YES			Forb (FG)	0.2	50
Boraginaceae	Heliotropium europaeum	Potato Weed	Not Listed	Not Listed		YES			5	50
Boraginaceae	Echium vulgare	Viper's Bugloss	Not Listed	Not Listed		YES			1	100
Brassicaceae	Brassica spp.	Brassica	Not Listed	Not Listed		YES			5	100
Euphorbiaceae	Euphorbia spp.		Not Listed	Not Listed	YES				30	1000
Fabaceae (Caesalpinioideae)	Senna barclayana	Smooth Senna	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Fabaceae (Faboideae)	Trifolium spp.	A Clover	Not Listed	Not Listed		YES			1	100
Fabaceae (Faboideae)	Medicago spp.	A Medic	Not Listed	Not Listed		YES			0.1	10
Lamiaceae	Marrubium vulgare	White Horehound	Not Listed	Not Listed		YES			0.2	100
Malvaceae	Malva parviflora	Small-flowered Mallow	Not Listed	Not Listed		YES			45	1000
Malvaceae	Sida corrugata	Corrugated Sida	Not Listed	Not Listed	YES			Forb (FG)	0.8	100
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Poaceae	Austrostipa verticillata	Slender Bamboo Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	5
Poaceae	Bromus spp.	A Brome	Not Listed	Not Listed	yes				0.2	50
Pteridaceae	Cheilanthes sieberi	Rock Fern	Not Listed	Not Listed	YES			Fern (EG)	0.1	3
Solanaceae	Solanum esuriale	Quena	Not Listed	Not Listed	YES			Forb (FG)	0.1	5
Zygophyllaceae	Tribulus terrestris	Cat-head	Not Listed	Not Listed		YES			0.1	50

PLOT 19

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Acanthaceae	Brunoniella australis	Blue Trumpet	Not Listed	Not Listed	YES			Forb (FG)	0.1	20
Acanthaceae	Rostellularia adscendens va	Pink Tongues	Not Listed	Not Listed	YES			Forb (FG)	0.1	30
Aizoaceae	Zaleya galericulata	Hogweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Asteraceae	Centaurea solstitialis	St Barnabys Thistle	Not Listed	Not Listed		YES			0.1	5
Asteraceae	Calotis lappulacea	Yellow Burr-daisy	Not Listed	Not Listed	YES			Forb (FG)	0.1	3
Asteraceae	Vittadinia spp.	Fuzzweed	Not Listed	Not Listed	YES			Forb (FG)	0.3	50
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.2	50
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard	Not Listed	Not Listed		YES			0.2	50
Casuarinaceae	Allocasuarina luehmannii	Bulloak	Not Listed	Not Listed	YES			Tree (TG)	0.2	2
Chenopodiaceae	Atriplex spinibractea	Spiny-fruit Saltbush	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Chenopodiaceae	Einadia nutans	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	2	300
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed	Not Listed	Not Listed	YES			Forb (FG)	0.1	2
Chenopodiaceae	Salsola australis		Not Listed	Not Listed	YES			Shrub (SG)	0.1	2
Chenopodiaceae	Sclerolaena birchii	Galvinized Burr	Not Listed	Not Listed	YES			Shrub (SG)	1	50
Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	YES			Forb (FG)	1	200
Cupressaceae	Callitris glaucophylla	White Cypress Pine	Not Listed	Not Listed	YES			Tree (TG)	5	1
Cyperaceae	Carex inversa	Knob Sedge	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.3	50
Euphorbiaceae	Euphorbia drummondii	Caustic Weed	Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Fabaceae (Caesalpinioideae)	Senna barclayana	Smooth Senna	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine	Not Listed	Not Listed	YES			Other (OG)	0.5	100
Lamiaceae	Salvia verbenaca	Vervain	Not Listed	Not Listed		YES			0.1	5
Lomandraceae	Lomandra filiformis subsp. f		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	5
Malvaceae	Sida corrugata	Corrugated Sida	Not Listed	Not Listed	YES			Forb (FG)	1	200
Myrtaceae	Eucalyptus melliodora	Yellow Box	Not Listed	Not Listed	YES			Tree (TG)	20	2
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	0.2	20
Oxalidaceae	Oxalis spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	20
Phormiaceae	Dianella porracea		Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Poaceae	Anthosachne scabra	Wheatgrass, Common WH	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	1	10
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	2	500
Poaceae	Austrostipa verticillata	Slender Bamboo Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	10
Poaceae	Bothriochloa decipiens	Pitted Bluegrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.5	50
Poaceae	Chloris ventricosa	Tall Chloris	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	2
Poaceae	Digitaria divaricatissima	Umbrella Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	20
Poaceae	Enneapogon gracilis	Slender Nineawn	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.3	40
Poaceae	Enteropogon acicularis	Curly Windmill Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	5	500
Poaceae	Eragrostis leptostachya	Paddock Lovegrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	1	100
Poaceae	Paspalidium constrictum	Knottybutt Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	1	100
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	5
Portulacaceae	Portulaca oleracea	Pigweed	Not Listed	Not Listed	YES			Forb (FG)	1	100
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		15	21
Zygophyllaceae	Tribulus spp.	Cat-head, Caltrop	Not Listed	Not Listed	YES			Forb (FG)	1	200

PLOT 21

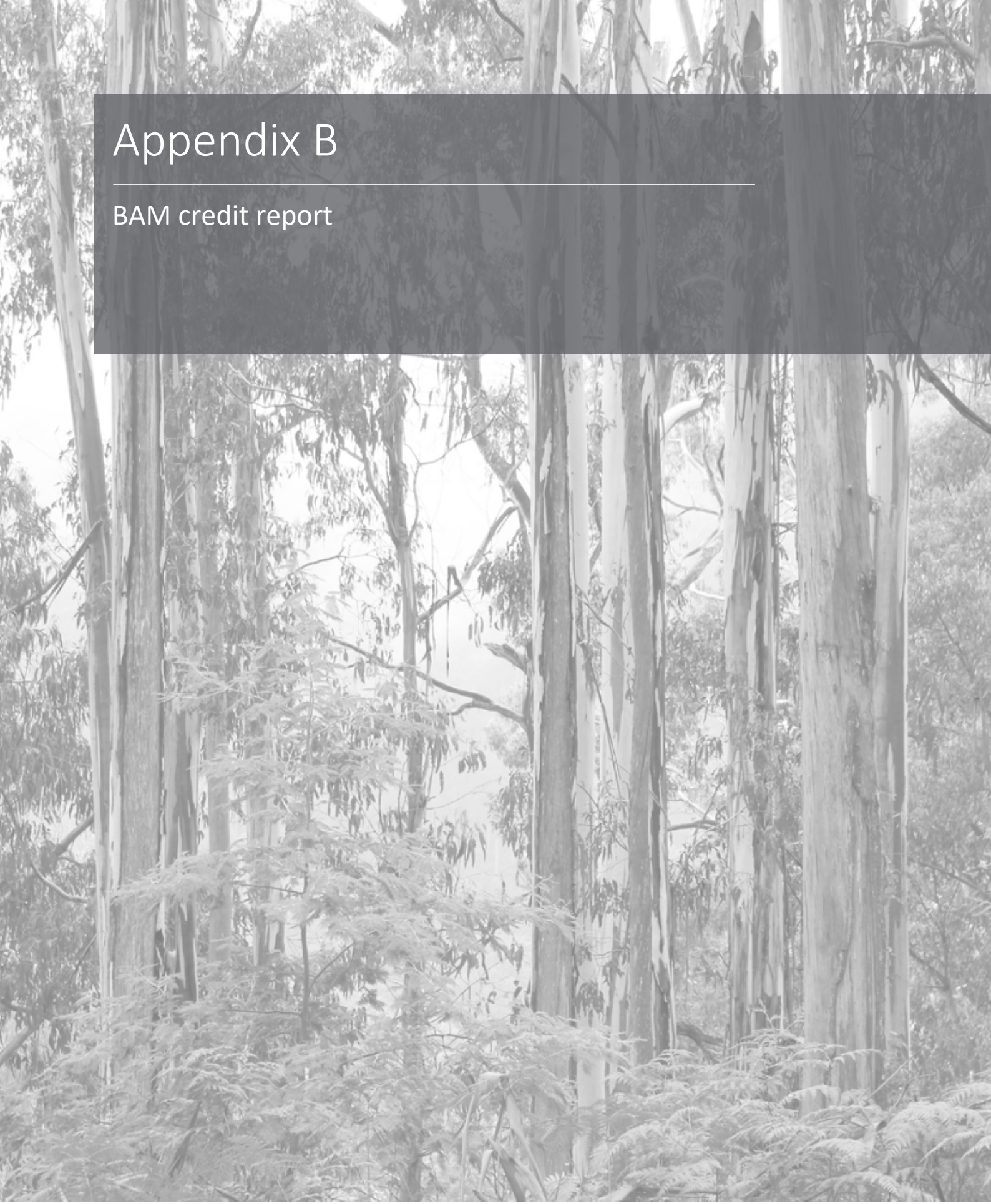
Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Asteraceae	Carthamus lanatus	Saffron Thistle	Not Listed	Not Listed		YES	YES		1	50
Asteraceae	Centaurea melitensis	Maltese Cockspur	Not Listed	Not Listed		YES			0.1	5
Asteraceae	Centaurea solstitialis	St Barnabys Thistle	Not Listed	Not Listed		YES			1	200
Asteraceae	Vittadinia spp.	Fuzzweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	5
Boraginaceae	Echium plantagineum	Patterson's Curse	Not Listed	Not Listed		YES			0.1	1
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.1	10
Brassicaceae	Sisymbrium officinale	Hedge Mustard	Not Listed	Not Listed		YES			0.2	10
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard	Not Listed	Not Listed		YES			0.1	5
Campanulaceae	Wahlenbergia communis	Tufted Bluebell	Not Listed	Not Listed	YES			Forb (FG)	0.1	20
Caryophyllaceae	Petrorhagia nanteuilii	Proliferous Pink	Not Listed	Not Listed		YES			0.2	100
Caryophyllaceae	Spergularia rubra	Sandspurry	Not Listed	Not Listed		YES			0.1	1
Chenopodiaceae	Dysphania pumilio	Small Crumbweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	20
Chenopodiaceae	Einadia nutans	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	0.1	5
Convolvulaceae	Convolvulus graminetinus		Not Listed	Not Listed	YES			Other (OG)	0.1	1
Euphorbiaceae	Euphorbia drummondii	Caustic Weed	Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Fabaceae (Caesalpinioideae)	Senna barclayana	Smooth Senna	Not Listed	Not Listed	YES			Forb (FG)	0.2	3
Fabaceae (Faboideae)	Trifolium angustifolium	Narrow-leaved Clover	Not Listed	Not Listed		YES			0.1	3
Fabaceae (Faboideae)	Glycine canescens	Silky Glycine	Not Listed	Not Listed	YES			Other (OG)	0.2	20
Malvaceae	Sida corrugata	Corrugated Sida	Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	2	500
Oxalidaceae	Oxalis spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Poaceae	Avena sativa	Oats	Not Listed	Not Listed		YES			3	500
Poaceae	Eragrostis cilianensis	Stinkgrass	Not Listed	Not Listed		YES			0.1	10
Poaceae	Urochloa panicoides	Urochloa Grass	Not Listed	Not Listed		YES			0.2	20
Poaceae	Aristida behriana	Bunch Wiregrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	1
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	10	100
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	30	2000
Poaceae	Digitaria brownii	Cotton Panic Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	2
Poaceae	Enneapogon gracilis	Slender Nineawn	Not Listed	Not Listed	YES			Grass & grasslike (GG)	4	400
Poaceae	Tragus australianus	Small Burrgrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	50
Poaceae	Tripogon loliiformis	Fiveminute Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	2
Poaceae	Urochloa subquadripara	Green Summer Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.5	50
Portulacaceae	Portulaca oleracea	Pigweed	Not Listed	Not Listed	YES			Forb (FG)	0.2	10
Pteridaceae	Cheilanthes sieberi	Rock Fern	Not Listed	Not Listed	YES			Fern (EG)	0.1	5
Zygophyllaceae	Tribulus spp.	Cat-head, Caltrop	Not Listed	Not Listed	YES			Forb (FG)	10	200

PLOT 22

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Aizoaceae	Zaleya galericulata	Hogweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Asteraceae	Carthamus lanatus	Saffron Thistle	Not Listed	Not Listed		YES	YES		0.1	5
Asteraceae	Centaurea melitensis	Maltese Cockspur	Not Listed	Not Listed		YES			0.1	10
Asteraceae	Centaurea solstitialis	St Barnabys Thistle	Not Listed	Not Listed		YES			0.5	15
Asteraceae	Xanthium spinosum	Bathurst Burr	Not Listed	Not Listed		YES	YES		0.1	1
Asteraceae	Vittadinia spp.	Fuzzweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	5
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.2	50
Brassicaceae	Sisymbrium irio	London Rocket	Not Listed	Not Listed		YES			1	50
Brassicaceae	Sisymbrium officinale	Hedge Mustard	Not Listed	Not Listed		YES			0.1	2
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard	Not Listed	Not Listed		YES			2	200
Caryophyllaceae	Petrorhagia nanteuilii	Proliferous Pink	Not Listed	Not Listed		YES			0.1	20
Chenopodiaceae	Dysphania pumilio	Small Crumbweed	Not Listed	Not Listed	YES			Forb (FG)	0.2	20
Chenopodiaceae	Einadia hastata	Berry Saltbush	Not Listed	Not Listed	YES			Forb (FG)	0.1	1
Chenopodiaceae	Einadia nutans	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	5	500
Convolvulaceae	Convolvulus graminetinus		Not Listed	Not Listed	YES			Other (OG)	0.1	5
Cupressaceae	Callitris glaucophylla	White Cypress Pine	Not Listed	Not Listed	YES			Tree (TG)	15	4
Euphorbiaceae	Euphorbia drummondii	Caustic Weed	Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Fabaceae (Faboideae)	Glycine canescens	Silky Glycine	Not Listed	Not Listed	YES			Other (OG)	0.2	30
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine	Not Listed	Not Listed	YES			Other (OG)	1	200
Malvaceae	Sida corrugata	Corrugated Sida	Not Listed	Not Listed	YES			Forb (FG)	0.1	5
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	0.5	200
Oxalidaceae	Oxalis spp.		Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Poaceae	Avena sativa	Oats	Not Listed	Not Listed		YES			0.1	2
Poaceae	Eragrostis cilianensis	Stinkgrass	Not Listed	Not Listed		YES			0.1	5
Poaceae	Hordeum leporinum	Barley Grass	Not Listed	Not Listed		YES			0.1	10
Poaceae	Vulpia spp.	Rat's-tail Fescue	Not Listed	Not Listed		YES			0.1	2
Poaceae	Aristida personata		Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.5	10
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	2	400
Poaceae	Austrostipa verticillata	Slender Bamboo Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	5
Poaceae	Digitaria brownii	Cotton Panic Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	5
Poaceae	Enneapogon gracilis	Slender Nineawn	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	20
Poaceae	Enteropogon acicularis	Curly Windmill Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	20
Poaceae	Eriochloa pseudoacrotricha	Early Spring Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.2	20
Poaceae	Paspalidium constrictum	Knottybutt Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	2	400
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	10
Poaceae	Tragus australianus	Small Burrgrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.3	50
Portulacaceae	Portulaca oleracea	Pigweed	Not Listed	Not Listed	YES			Forb (FG)	0.2	20
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		5	13
Solanaceae	Solanum esuriale	Quena	Not Listed	Not Listed	YES			Forb (FG)	0.1	10
Zygophyllaceae	Tribulus spp.	Cat-head, Caltrop	Not Listed	Not Listed	YES			Forb (FG)	3	300

PLOT 23

Family	Scientific Name	Common Name	NSW Status	Comm. Status	Native	Exotic	High Threat Weed	BAM Growth Form Group	Cover	Abundance
Asteraceae	Schkuhria pinnata var. abro	Dwarf Marigold	Not Listed	Not Listed		YES			0.1	3
Asteraceae	Sonchus oleraceus	Common Sowthistle	Not Listed	Not Listed		YES			0.1	1
Boraginaceae	Echium plantagineum	Patterson's Curse	Not Listed	Not Listed		YES			0.1	1
Brassicaceae	Lepidium africanum	Common Peppercress	Not Listed	Not Listed		YES			0.1	10
Brassicaceae	Sisymbrium irio	London Rocket	Not Listed	Not Listed		YES			0.2	30
Brassicaceae	Sisymbrium officinale	Hedge Mustard	Not Listed	Not Listed		YES			0.3	50
Brassicaceae	Sisymbrium orientale	Indian Hedge Mustard	Not Listed	Not Listed		YES			0.2	30
Chenopodiaceae	Dysphania pumilio	Small Crumbweed	Not Listed	Not Listed	YES			Forb (FG)	0.1	5
Chenopodiaceae	Einadia nutans	Climbing Saltbush	Not Listed	Not Listed	YES			Forb (FG)	1	100
Chenopodiaceae	Salsola australis		Not Listed	Not Listed	YES			Shrub (SG)	0.1	1
Commelinaceae	Commelina cyanea	Native Wandering Jew	Not Listed	Not Listed	YES			Forb (FG)	0.5	50
Convolvulaceae	Dichondra repens	Kidney Weed	Not Listed	Not Listed	YES			Forb (FG)	0.8	40
Cupressaceae	Callitris glaucophylla	White Cypress Pine	Not Listed	Not Listed	YES			Tree (TG)	20	3
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine	Not Listed	Not Listed	YES			Other (OG)	0.1	2
Malvaceae	Sida corrugata	Corrugated Sida	Not Listed	Not Listed	YES			Forb (FG)	0.1	20
Myrtaceae	Angophora floribunda	Rough-barked Apple	Not Listed	Not Listed	YES			Tree (TG)	10	1
Nyctaginaceae	Boerhavia dominii	Tarvine	Not Listed	Not Listed	YES			Forb (FG)	0.1	5
Poaceae	Bromus hordeaceus	Soft Brome	Not Listed	Not Listed		YES			0.1	1
Poaceae	Bromus rubens	Red Brome	Not Listed	Not Listed		YES			0.1	5
Poaceae	Hordeum leporinum	Barley Grass	Not Listed	Not Listed		YES			2	500
Poaceae	Urochloa panicoides	Urochloa Grass	Not Listed	Not Listed		YES			0.1	10
Poaceae	Austrostipa scabra	Speargrass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	20
Poaceae	Austrostipa verticillata	Slender Bamboo Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	3	90
Poaceae	Cynodon dactylon	Common Couch	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	3
Poaceae	Paspalidium constrictum	Knottybutt Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	8	1000
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	10
Poaceae	Rytidosperma racemosum	Wallaby Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.5	50
Poaceae	Urochloa subquadripara	Green Summer Grass	Not Listed	Not Listed	YES			Grass & grasslike (GG)	0.1	10
Rubiaceae	Asperula conferta	Common Woodruff	Not Listed	Not Listed	YES			Forb (FG)	0.1	30
Solanaceae	Lycium ferocissimum	African Boxthorn	Not Listed	Not Listed		YES	YES		30	100
Zygophyllaceae	Tribulus spp.	Cat-head, Caltrop	Not Listed	Not Listed	YES			Forb (FG)	5	400



Appendix B

BAM credit report

BAM Credit Summary Report

Proposal Details

Assessment Id 00014492/BAAS17009/19/00014493	Proposal Name J180131_Dubbo_Quarry_BAM_Calc	BAM data last updated * 07/12/2020
Assessor Name Eugene Dodd	Report Created 16/12/2020	BAM Data version * 34
Assessor Number BAAS17009	BAM Case Status Open	Date Finalised To be finalised
Assessment Revision 0	Assessment Type 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.

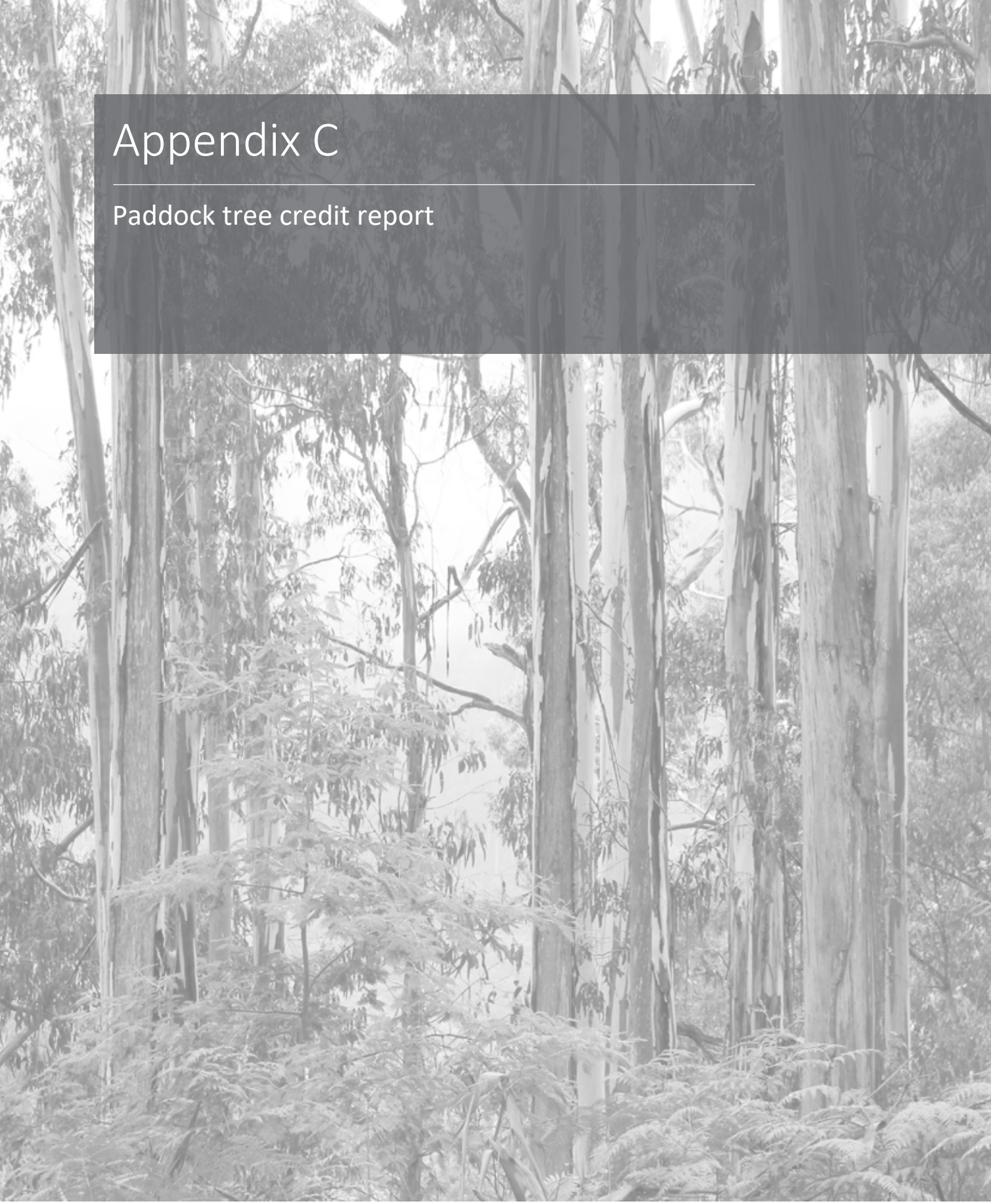
Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion											
1	599_Moderate_medium	White Box Yellow Box Blakely's Red Gum Woodland	64.3	64.3	0.64	Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.00	TRUE	21

2	599_Moderate_other	White Box Yellow Box Blakely's Red Gum Woodland	58.6	58.6	1.2	Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.00	TRUE	37
3	599_Moderate_poor	White Box Yellow Box Blakely's Red Gum Woodland	40.7	40.7	1.2	Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.00	TRUE	24
4	599_Moderate_DNG	White Box Yellow Box Blakely's Red Gum Woodland	32.7	32.7	2.8	Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.00	TRUE	45
5	599_Exotic_grassland	White Box Yellow Box Blakely's Red Gum Woodland	3.4	3.4	5.7	Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.00	TRUE	0
										Subtotal	**127**
										Total	**127**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits



Appendix C

Paddock tree credit report

BAM Credit Summary Report

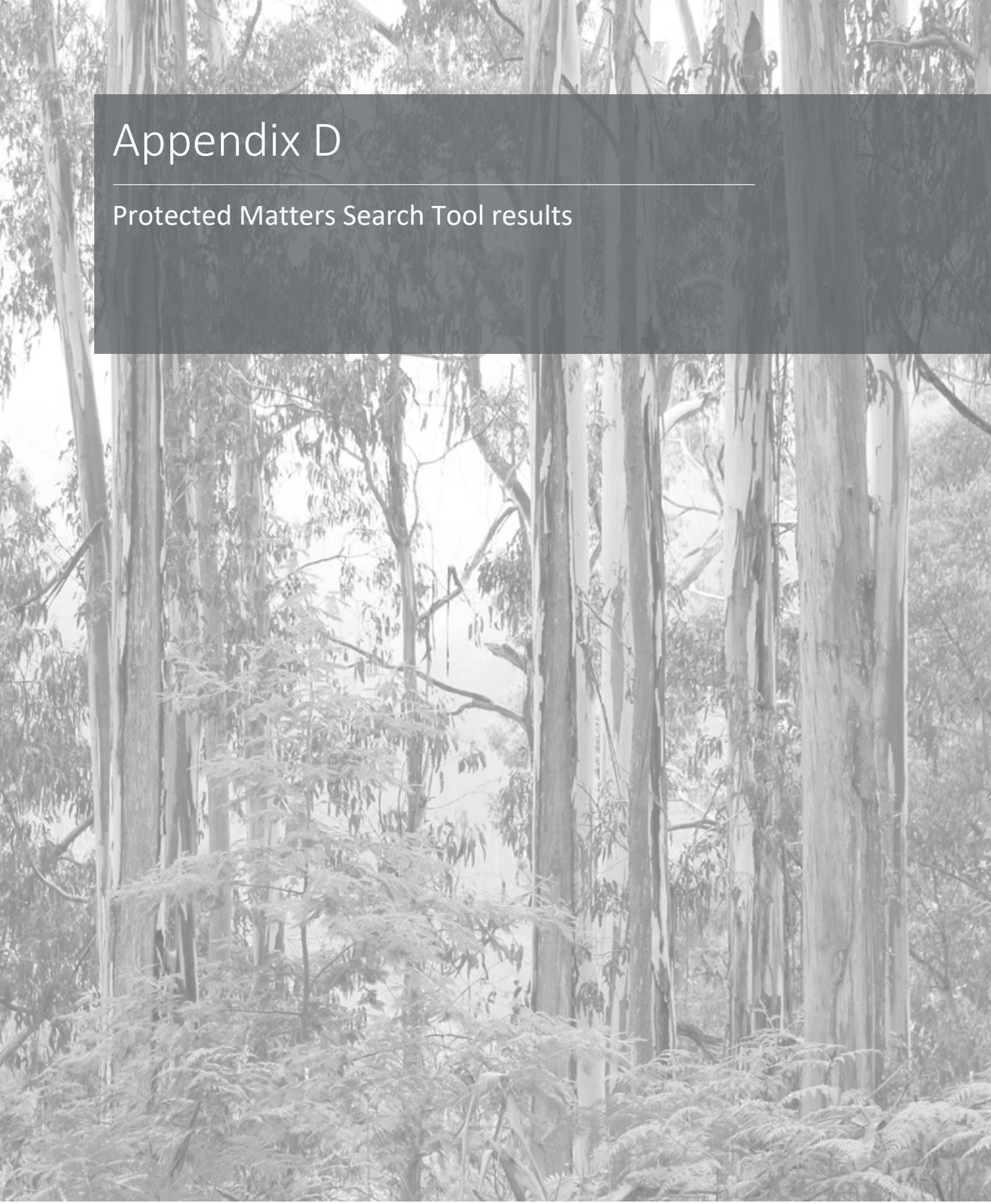
Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00014492/BAAS17009/20/00021933	J180313_Dubbo_Quarry_Paddock_Trees	20/08/2020
Assessor Name	Report Created	BAM Data version *
Eugene Dodd	18/09/2020	30
Assessor Number	BAM Case Status	Date Finalised
BAAS17009	Open	To be finalised
Assessment Revision	Assessment Type	
0	Paddock Trees	

* 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.

Paddock Trees Credit Requirement

Class	Contains hollows	Number of trees	Ecosystem credits
599-Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion			
2	True	1.0	1
3	False	2.0	2
2	False	1.0	1
3	False	1.0	1
			5
			5



Appendix D

Protected Matters Search Tool results

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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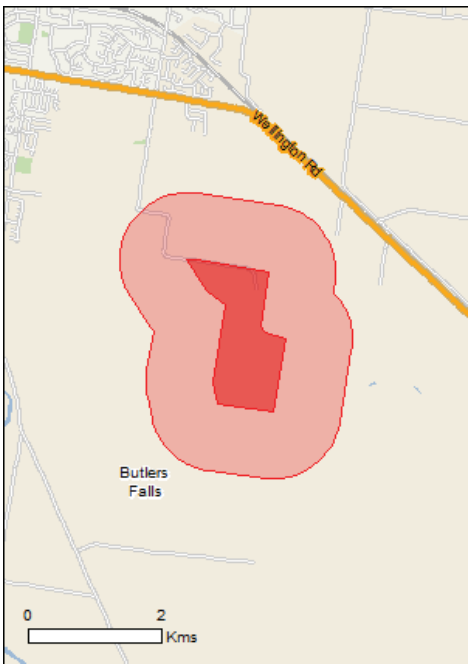

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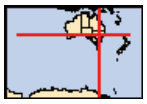

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	22
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	26
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Banrock station wetland complex	700 - 800km upstream
Riverland	700 - 800km upstream
The coorong, and lakes alexandrina and albert wetland	900 - 1000km upstream
The macquarie marshes	150 - 200km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	Community may occur within area
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Community likely to occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community may occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community may occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Polytelis swainsonii Superb Parrot [738]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Galaxias rostratus Flathead Galaxias, Beaked Minnow, Flat-headed Galaxias, Flat-headed Jollytail, Flat-headed Minnow [84745]	Critically Endangered	Species or species habitat may occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Plants		
Androcalva procumbens [87153]	Vulnerable	Species or species habitat may occur within area
Austrostipa wakoolica [66623]	Endangered	Species or species habitat may occur within area
Swainsona recta Small Purple-pea, Mountain Swainson-pea, Small Purple Pea [7580]	Endangered	Species or species habitat may occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area
Reptiles		
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-32.278259 148.650485,-32.278331 148.651816,-32.279565 148.661471,-32.285842 148.660484,-32.286458 148.661128,-32.287257 148.663703,-32.295455 148.662115,-32.294657 148.654648,-32.292045 148.653918,-32.283411 148.655678,-32.281706 148.653189,-32.278259 148.650485

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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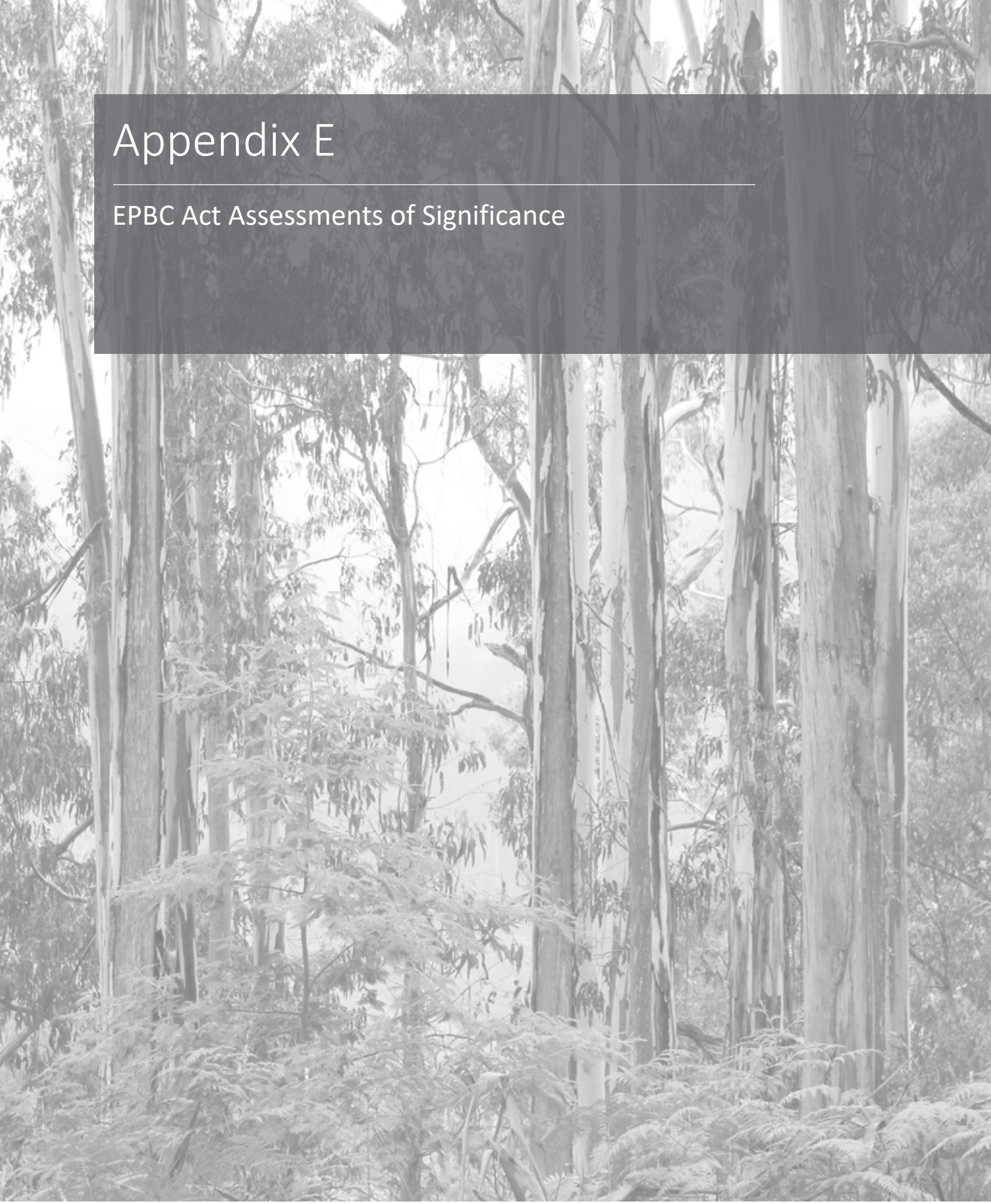

Appendix E

EPBC Act Assessments of Significance

E.1 Significant impact guidelines

In determining the significance of impacts associated with the project, the relevant criteria listed in the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DoE 2013) was applied. This assessment has been undertaken for the following threatened and migratory entities:

White Box - Yellow Box - Blakely's Red Gum grassy woodland and derived native grassland;

- Regent Honeyeater;
- Swift Parrot;
- Superb Parrot;
- Corben's Long-eared Bat;
- White-throated Needletail; and
- Fork-tailed Swift.

E.1.1 White Box - Yellow Box - Blakely's Red Gum grassy woodland and derived native grassland

Table E.1 provides an assessment of significance for the removal of 0.64 ha of the listed community, in accordance with the relevant assessment criteria for critically endangered communities.

Table E.1 Assessment of significance for White Box - Yellow Box - Blakely's Red Gum grassy woodland and derived native grassland

Criteria	Discussion
Reduce the extent of an ecological community	Approximately 0.64 ha of the listed community will be removed as a result of the project. The listed community has been previously mapped by EMM within the disturbance area (Figure 4.1). Note that only PCT 599-medium is in EPBC act condition. Approximately 16.11 ha of the listed community will be retained within the study area, comprising PCT 599 – medium and PCT 435 – medium (Refer to Figure 4.1and Table 6.1). Therefore, the 0.64 ha to be removed represents only 4 % of the community within the Dubbo Quarry study area. This avoidance of Box – Gum woodland was a key consideration when planning the final Quarry Design, resulting in a minor impact with relation to what will be retained. Statewide regional vegetation mapping to PCT level was obtained for the Talbragar IBRA subregion, of which 6,283.03 ha includes PCTs aligned with the TEC. The removal of 0.64 ha will contribute to a removal of 0.01 % of the TEC. It is acknowledged that the condition of the regional vegetation remains unknown and may not represent Box Gum woodland in EPBC condition. Notwithstanding the clearance of 0.64 ha is considered is only a small proportion of the community within the locality. It is considered unlikely that the proposed action will result in a significant reduction of the community extent.

Table E.1 Assessment of significance for White Box - Yellow Box - Blakely's Red Gum grassy woodland and derived native grassland

Criteria	Discussion
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The removal of Box Gum vegetation will have a limited impact to connectivity of the community given that vegetation will be retained outside of the disturbance area, both in the proposed western disturbance area and the proposed southern disturbance area. This will maintain connectivity characteristics similar to those that currently exist. The exception to this is the proposed haul road between the southern disturbance area to the existing disturbance area. This will bisect the Box Gum woodland vegetation alongside Eulomogo Creek providing an interruption of the community, approximately 15 m wide. Whilst this is a negative impact it is considered likely that genetic interchange will still occur over the 15 m wide haulage road and the Box Gum woodland on either side will not be significantly affected.
Adversely affect habitat critical to the survival of an ecological community	A national recovery plan has been developed (DECCW 2010) for this community, which states that all areas of the listed community which meet the minimum condition criteria outlined in Section 3 of the plan, should be considered critical to the survival of this listed ecological community. Approximately 0.64 ha of vegetation in the project area meets the above criteria. As the national recovery plan (DECCW 2010) states that all areas of the listed community which meet the minimum condition criteria outlined in Section 3 of the plan, should be considered critical to the survival of this listed ecological community, the project will adversely affect habitat critical to the survival of the community.
Modify or destroy abiotic factors necessary for an ecological community's survival	The listed community occurs directly adjacent to the existing quarry. Abiotic factors do not appear to have adversely affected retained areas of the listed community, with no detectable changes between the community directly adjacent or further away from the quarry boundary. No material changes in surface hydrology are expected to occur as a result of the project. No groundwater impacts are anticipated as the final quarry void will not extend below the existing groundwater level. Furthermore it is unlikely that this community is groundwater dependent. Mitigation measure to avoid indirect impacts include of a bund and buffer area around the pit and no significant abiotic impacts are anticipated to the listed community adjacent to the proposed area of direct impact.
Cause a substantial change in the species composition of an occurrence of an ecological community	The project will remove all habitat within the disturbance area, consequently, there will be no residual functionality of the listed community within the project area. Any areas of the listed community directly outside of the disturbance footprint are unlikely to be significantly impacted by indirect means, considering abiotic factors do not appear to have affected the community directly adjacent to the working quarry compared to the community further away. Therefore, functionality of any adjacent vegetation is likely to continue unchanged.
Cause a substantial reduction in quality or integrity of an occurrence of an ecological community.	The project will remove all habitat within the disturbance area; consequently, there will be no residual functionality of habitat within the project area. Areas outside of the project footprint have been subjected to the indirect impacts of vehicle movements and agricultural practices for a long period of time, for example the potential importation of invasive species or increased dust levels. This does not appear to have significantly impacted the listed community to date. The majority of weeds species within the listed community are exotic pasture species associated with surrounding historic and current agricultural land use rather than the quarry operation. Any indirect impacts from the quarry are anticipated to be negligible.

Table E.1 Assessment of significance for White Box - Yellow Box - Blakely's Red Gum grassy woodland and derived native grassland

Criteria	Discussion
Interfere with recovery of an ecological community.	A national recovery plan has been developed (DECCW 2010), with the objective to promote the recovery and minimise the risk of extinction of the ecological community through: • achieving no net loss in extent and condition of the ecological community throughout its geographic distribution; • increasing protection of sites in good condition; • increasing landscape function of the ecological community through management and restoration of degraded sites; • increasing transitional areas around remnants and linkages between remnants; and • bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland. The clearance of 0.64 ha of the listed community will directly contravene Point 1, by reducing the extent of the listed community. If offsets are accounted for, Point 1 will not be contravened. Holcim will implement a Biodiversity Offset Strategy for the project. If future proposed offsets are taken into account, the reduction in area of the community as a result of the development (0.64 ha) would be offset by an improvement in condition elsewhere of a much larger area of the community (within an offset site), thus no net loss. The project would not satisfy any other of the improvement measures listed, unless future biodiversity offsets were taken into account. It is noted that Holcim have actively sought to identify and avoid impact to Box Gum Grassy Woodland and Derived Grassland, which has resulted in the continual refinement of the disturbance area with a much smaller impact than originally proposed.
Conclusion	Although 0.64 ha of the listed community identified within the project area meets the minimum critical habitat criteria, as per the National Recovery Plan (DECCW 2010), the project will not significantly reduce the extent of the community as only a small proportion of its extent within the locality will be removed. The national recovery plan (DECCW 2010) states that all areas of the listed community which meet the minimum condition criteria outlined in Section 3 of the plan, should be considered critical to the survival of this listed ecological community, the project will adversely affect habitat critical to the survival of the community. Notwithstanding the quantum of impact has been reduced to 4% within the study area, which is considered unlikely to be significant. Furthermore the offsets under the BC act will result in larger areas of Box Gum woodland being protected in perpetuity.

E.2

E.3 Regent Honeyeater

Table E.2 provides an assessment of significance for the removal of 1.82 ha of potential Regent Honeyeater foraging habitat, in accordance with the relevant assessment criteria for critically endangered species.

Table E.2 Assessment of significance for Regent Honeyeater

Criteria	Discussion
Long-term decrease in population size	An action that would lead to a long-term decrease of the Regent Honeyeater population would be one that is undertaken in a breeding area, or one that removes key feed species when foraging resources are sparse. As the project area is not located in a known breeding area for the species, it is not expected to result in a long-term decrease in population size. The project area includes Yellow Box, identified as a key feed species in the National Recovery Plan for the Regent Honeyeater (DoE 2016). Yellow Box is present within the project area as scattered trees at low density. Suitable foraging species within disturbance area is largely limited to 0.64 ha of PCT 599_moderate and 1.18 ha of PCT_599 poor. In these areas Blakely's Red Gum is typically the dominant species with Yellow Box subdominant. PCT 599_other is considered poor habitat for the Regent Honeyeater given that the canopy species are largely limited to White Cypress Pine, which does not offer foraging potential for the Regent Honeyeater. The Regent Honeyeater was not recorded during the field surveys, however given their nomadic behaviour they have the potential to fly over or utilise seasonal foraging resources within the proposed disturbance area on occasion. It is unlikely that the species is reliant on foraging resources within the project area, nor are any substantial numbers of the species likely to occur within the project area. As such, there is not likely to be any population level impacts.
Reduce area of occupancy	A total area of 1.82 ha of potential foraging habitat that includes key tree species, Yellow Box, as identified in the National Recovery Plan (DoE 2016), will be removed as a result of the project. The Regent Honeyeater is wide ranging, typically occurring in areas where profuse flowering of feed trees is occurring. It is unlikely that the loss of a small area of potential foraging habitat will significantly reduce the occupancy of the species. The project area is not near any key breeding areas, as identified in the National Recovery Plan (DoE 2016), and the project area is unlikely to provide any potential breeding habitat, given current breeding areas as the national recovery plan.
Fragment a population	The Regent Honeyeater occurs as a single, contiguous population (DoE 2016). This species is highly mobile and able to cross open areas. As the project area would likely only form a small part of their wider occurrence, and the impact of loss of 1.82 ha of potential foraging habitat on the edge of a quarry operation, fragmentation of a single contiguous population is unlikely to occur.
Adversely affect critical habitat	Habitat critical to the survival of the Regent Honeyeater includes any breeding or foraging habitat in areas where the species is likely to occur, as defined in Figure 1 of the National Recovery Plan (DoE 2016); and any newly discovered breeding or foraging locations. The project area is not near any key breeding areas, as identified within the National Recovery Plan (DoE 2016). The habitat which will be removed has been historically cleared, resulting in a patchy woodland that contains only scattered Yellow Box trees. Therefore, the habitat consists of seasonal foraging habitat only. It is unlikely that the species is reliant on foraging resources within the project area nor are any substantial numbers of the species likely to occur within the project area. While Yellow Box, a key eucalypt feed species, is within the project area, it is unlikely to provide masses of nectar resources due to its disturbance history and low density. Therefore, the project will not affect any habitat critical to the survival of the Regent Honeyeater.
Disrupt the breeding cycle of a population	There is no key breeding habitat near the project area and it is considered unlikely that breeding would occur within the areas to be impacted by the project, due to past clearing practises resulting in a patchy woodland and lack of mature trees with rough bark.

Table E.2 Assessment of significance for Regent Honeyeater

Criteria	Discussion
Decrease availability or quality of habitat	The species have not been recorded within the project area or locality and if it does occur, it is likely to be on a transient basis only, passing through to more optimal areas of foraging habitat. The clearance of 1.82 ha of seasonal foraging habitat is not likely to cause any discernible impact to the species, and the species will remain unaffected by the project.
Result in invasive species	Abiotic factors do not appear to have affected the potential habitat directly adjacent to the working quarry compared to the community further away. Therefore, any areas of habitat directly outside of the disturbance footprint are unlikely to be significantly impacted by indirect means. Weed control protocols will be undertaken, in accordance with Holcim's relevant processes and procedures, to ensure plant entering the project area is weed free. Therefore, the project will not result in invasive species that are harmful to the species becoming established in the remaining habitat adjacent to the project.
Introduce disease	This species is not known to be particularly susceptible to disease and the project will not introduce any disease relevant to the Regent Honeyeater.
Interfere with recovery	The recovery of the Regent Honeyeater is closely linked the extent and quality of habitat, and actions include the protection of intact (high quality) areas of Regent Honeyeater breeding and foraging habitat (DoE 2016). The project area is not within a known breeding area and does not provide optimal breeding habitat. The project area is on the edge of edge of existing quarry operation, and potential habitat is not considered as intact. Although the habitat within the project area to be removed provides a potential foraging resource, including key eucalypt species Yellow Box, it is not considered high quality as the habitat is patchy due to past clearing practises. It is unlikely that any individuals are reliant on the habitat.
Conclusion	The habitat to be removed is unlikely to be important for the Regent Honeyeater and the project is not anticipated to have a significant impact as: • the project area is not within a known breeding area, and does not provide optimal breeding habitat for the species; and • if the species does occur, it is likely to be on a transient basis only, passing through to more optimal areas of foraging habitat.

E.4 Swift Parrot

Table E.3 provides an assessment of significance for the removal of 1.82 ha of potential Swift Parrot foraging habitat, in accordance with the relevant assessment criteria for critically endangered species.

Table E.3 Assessment of significance for Swift Parrot

Criteria	Discussion
Long-term decrease in population size	An action that would lead to a long-term decrease of the Swift Parrot population would be one that is undertaken in a breeding area, or one that removes key feed species when foraging resources are sparse. The species breeds in Tasmania therefore the project is not a breeding area. Favoured feed trees outlined in the national recovery plan for the species, includes Yellow Box (within the disturbance area), and White Box and Grey box (within the broader study area) (Saunders and Tzaros 2011). Yellow Box is present within the project area as scattered trees at low density. Suitable foraging species within disturbance area is largely limited to 0.64 ha of PCT 599_moderate and 1.18 ha of PCT_599 poor. In these areas Blakely's Red Gum is typically the dominant species with Yellow Box subdominant. PCT 599_other, is considered poor habitat for the Swift Parrot given that the canopy species are largely limited to White Cypress Pine, which does not offer foraging potential. The Swift Parrot was not recorded during the field surveys, however given their nomadic behaviour they have the potential to fly over or utilise seasonal foraging resources within the proposed disturbance area on occasion. It is unlikely that the species is reliant on foraging resources within the project area, nor are any substantial numbers of the species likely to occur within the project area. As such, there is not likely to be any population level impacts.
Reduce area of occupancy	A total area of 1.82 ha of potential foraging habitat that includes key tree species, Yellow Box, as identified in the National Recovery Plan (Saunders and Tzaros 2011), will be removed as a result of the project. The Swift Parrot is wide ranging, typically occurring in areas where profuse flowering of feed trees or significant lerp is occur. It is unlikely that the loss of a small area of potential foraging habitat will significantly reduce the occupancy of the species.
Fragment a population	This species is highly mobile and is able to cross open areas. On mainland Australia the species occurs as a large, mobile single population. The loss of 1.82 ha of potential foraging habitat, that occurs on the edge of an existing quarry working area, where clearing has historically taken place, will not cause any fragmentation effects.
Adversely affect critical habitat	Habitats of particular importance to the Swift Parrot are outlined in the recovery plan for the species (Saunders and Tzaros 2011); including: • for nesting; • by large proportions of the Swift Parrot population; • repeatedly between seasons (site fidelity), or • for prolonged periods of time (site persistence). As the project area is within mainland Australia, there is no potential for nesting to occur. The species has not been recorded within the study area with few records in the locality and there is no evidence of prolonged occurrence, repeat use or large number of the species occurring. Therefore, the project will not affect any habitat critical to the survival of the Swift Parrot.
Disrupt the breeding cycle of a population	As the Swift Parrot breeds within Tasmania, there is no potential to breed within the project area.
Decrease availability or quality of habitat	The species has not been recorded within the project area and if it does occur is likely to be on a transient basis only, passing through to more optimal areas of foraging habitat. The Swift Parrot is not considered to be dependent on habitat in the project area and the clearance of 1.82 ha of sub-optimal foraging habitat is not likely to cause any discernible impact to the Swift Parrot, and the species will remain largely unaffected by the project.

Table E.3 Assessment of significance for Swift Parrot

Criteria	Discussion
Result in invasive species	Weed invasion impacting on habitat regeneration and health, and aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners are two key threats that invasive species pose on the Swift Parrot. Abiotic factors do not appear to have affected the potential habitat directly adjacent to the working quarry compared to the community further away. Therefore, any areas of habitat directly outside of the disturbance footprint are unlikely to be significantly impacted by indirect means. Weed control protocols will be undertaken, in accordance with Holcim's relevant processes and procedures, to ensure plant entering the project area is weed free. Noisy Miners were recorded in the project area during the ecological investigations, however only in low numbers. The project will not result in invasive species that are harmful to the species becoming established in the habitat adjacent to the project area.
Introduce disease	This species is vulnerable to Psittacine Beak and Feather Disease however the proposed activity does not play a role in the introduction of this threat.
Interfere with recovery	The key action within the recovery plan for the Swift Parrot (Birds Australia 2011), which is relevant to the project, is the management and protection of Swift Parrot habitat at the landscape scale. The habitat within the project area is unlikely to be important for this species and there is expected to be no impact on its recovery as the result of the project.
Conclusion	It is unlikely that the species is reliant on foraging resources within the project area, therefore the habitat to be removed is unlikely to be important for the species and the project is not anticipated to have a significant impact on the Swift Parrot.

E.5 Superb Parrot

Table E.4 provides an assessment of significance for the removal of 3.07 ha of potential Superb Parrot foraging habitat, in accordance with the relevant assessment criteria for vulnerable species.

Table E.4 Assessment of significance for Superb Parrot

Criteria	Discussion
Long-term decrease in an important population size	The *National Recovery Plan for the Swift Parrot* (Baker - Gabb 2011) does not define an important population for the Superb Parrot. A single population of the species exists. There are numerous records of the Superb Parrot within the locality and four Superb Parrots were observed flying over the project area during the surveys in April 2019 (Figure 5.5). Bird surveys undertaken within areas of hollow bearing trees in study area did not record the species. The species is not likely to breed within the area given that the core breeding area is bounded by Molong, Rye Park, Yass, Coolac, Cootamundra and Young in NSW (Baker - Gabb 2011); The project will remove 3.07 ha of potential sub-optimal foraging habitat, comprising PCT 599 - medium, poor and other. It is considered unlikely that Superb Parrot would be reliant on the small amount of foraging habitat provided within the project area and therefore the project cannot lead to the decrease in size of an important population.
Reduce area of occupancy of an important population	As important populations have not been defined (Baker - Gabb 2011) and a single population of the species exists. It is unlikely that removal of 3.07 ha of potential foraging habitat would reduce the area of occupancy of the single population, as in the study area alone, 29.58 ha of Box Gum Woodland and 5.67 of Grey Box woodland will be retained.
Fragment a population	This species is highly mobile and is able to cross open areas. The loss of 3.07 ha of potential foraging habitat, that occurs on the edge of an existing quarry working area, where clearing has historically taken place, will not cause any fragmentation effects.
Adversely affect critical habitat	Habitat critical to the survival of the species has been defined by the National Recovery Plan (Baker - Gabb 2011) as breeding habitat that comprises riverine forests in the Riverina and Box Gum Woodlands on the tablelands and slopes and foraging habitat comprising Boree Woodlands between the Murrumbidgee and Murray Rivers, River Red Gum Forest, Box-Pine Woodland and White Cypress Pine Woodland. Breeding surveys within the correct time period (September) did not detect the species and the study area is outside the core breeding area which is bounded by Molong, Rye Park, Yass, Coolac, Cootamundra and Young in NSW (Baker - Gabb 2011). Vegetation in the Hall Quarry site boundary and project area does not represent an exemplary example of Box Gum Woodland as it is widely scattered and has been impacted by past agricultural activities. It is unlikely to represent foraging habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population	There are no records of breeding within the project area or surrounds. Hollow-bearing tree surveys were completed in the project area during the nesting season and did not record the species. The clearing of this habitat will not disrupt the breeding cycle of the species.
Decrease availability or quality of habitat	The project will remove 3.07 ha of potential foraging habitat for the Superb Parrot.
Result in invasive species	Soil disturbance for the project has potential to result in the spread of invasive weeds to retained areas of vegetation and potential habitat. Weed control will be completed as part of Holcim's environmental management plan in areas of retained native vegetation and habitat to minimise this risk.
Introduce disease	The Superb Parrot may be susceptible to Beak and Feather disease. Disease outbreaks usually occur in wild animal populations where significant stresses arise. The clearance of potential foraging habitat is unlikely to cause significant stress such that a disease outbreak would occur.

Table E.4 Assessment of significance for Superb Parrot

Criteria	Discussion
Interfere with recovery	Recovery actions for the Superb Parrot aim to determine population trends, increase knowledge of the species ecological requirements, develop and implement threat abatement strategies and increase community involvement and awareness of the recovery program (Baker - Gabb 2011). As recovery actions are focused on increasing knowledge of the species, the project will not interfere with recovery.
Conclusion	The clearance of 3.07 ha of potential Superb Parrot potential foraging habitat will not result in a significant impact and the species population will not be adversely affected. The area to be removed does not represent habitat critical to the survival of the species and the project will not interfere with recovery.

E.6 Corben's Long-eared Bat

Table E.3 provides an assessment of significance for the removal of 1.89 ha of potential Corben's Long-eared Bat foraging habitat, in accordance with the relevant assessment criteria for vulnerable species. PCT zones considered as having potential to support the species include PCT 599 – medium and PCT 599 – other. Other vegetation zones are considered too degraded given their sparse nature and lack of midstory. The majority of the development footprint is unsuitable for the species given cleared midstory and poor connectivity. Potential habitat for the species exists in the woodland along Eulomogo Creek, where connectivity values are higher, and more habitat complexity is present.

Table E.5 Assessment of significance for Corben's Long-eared Bat

Criteria	Discussion
Long-term decrease in an important population	There is no National Recovery Plan developed for the species, with a lack of information regarding important populations. It is considered that an important population is unlikely to occur within the study area given that this slow flying species prefers to habit and hunt in areas with a midstory. Midstory is absent from the disturbance area with the exception of the exotic African Boxthorn. This exotic shrub may also provide a physical threat to the species given its large sharp thorns. The species was included on a conservative basis and the clearance of 1.89 ha of sub-optimal habitat is unlikely to have any population level effects.
Reduce area of occupancy of an important population	Important populations have not been defined, given the sub-optional nature of the habitat it is considered very unlikely that an important population occurs within the disturbance area or broader study area. Furthermore the reduction of 1.89 ha is consider negligible given the amount of habitat retained within the study area.
Fragment a population	This species is a slow flying species, preferring well connected habitat and is therefore susceptible to fragmentation. The removal of Box Gum vegetation will have a limited impact to connectivity of woodland given that vegetation will be retained outside of the disturbance area, both in the proposed western disturbance area and the proposed southern disturbance area. This will maintain connectivity characteristics similar to those that currently exist. The exception to this is the proposed haul road between the southern disturbance area to the existing disturbance area. This will bisect the Box Gum woodland vegetation alongside Eulomogo Creek providing an interruption of the community, approximately 15 m wide. There is potential that this discontinuity may slightly increase predation pressure on the species (if present) however the haul road width is not considered sufficient to cause fragmentation of a population, especially given the existing woodland is fairly sparse with many of the gaps between tress greater than 15 m.
Adversely affect critical habitat	Habitat critical to the survival of the species has not been defined and there is a lack of a National Recovery Plan. The species occupies a wide range throughout south eastern Australia and the suboptimal habitat within the disturbance area is unlikely to constitute critical habitat.
Disrupt the breeding cycle of an important population	The disturbance area is unlikely to contain an important population This species typically breeds in hollow bearing trees. Hollow-bearing trees were prevalent within the broader study area with 526 hollow-bearing trees recorded (Figure 5.1). The disturbance footprint has largely avoided dense patches of hollow-bearing trees, with a total of 17 remaining within the disturbance area (Table 5.1). Of those hollow bearing trees within the disturbance area, very few are likely to be suitable breeding habitat given they occur within patchy and degraded areas of habitat. Two hollow bearing trees connected to the Eulomogo Creek woodland patch will be cleared and may offer potential breeding habitat. This impact is considered negligible and no population level impacts are anticipated.
Decrease availability or quality of habitat	The project will remove 1.89 ha of potential sub-optimal habitat for the species.

Table E.5 Assessment of significance for Corben's Long-eared Bat

Criteria	Discussion
Result in invasive species	Invasive species do not appear to be elevated directly adjacent to the working quarry compared to the community further away. Therefore, any areas of habitat directly outside of the disturbance footprint are unlikely to be significantly impacted by indirect means. Weed control protocols will be undertaken, in accordance with Holcim's relevant processes and procedures, to ensure plant entering the project area is weed free.
Introduce disease	The clearance of sub-optimal habitat is unlikely ly to cause significant stress such that a disease outbreak would occur. The extension will not likely introduce any novel impacts given it is already an operation quarry.
Interfere with recovery	The are no recovery actions specified for the species, however key impacts for the species are likely to clearance of vegetation and removal of hollow bearing trees. Vegetation clearance will be minimal and limited to 1.89 ha of suboptimal habitat. The species was included as have potential to occur within the disturbance area on a conservative basis. Hollow bearing tree removal will be limited with large numbers of hollow bearing trees retained in the locality. It is unlikely that the project will interfere with recovery of the species.
Conclusion	The clearance of 1.89 ha of potential sub-optimal habitat will not result in a significant impact and the species population will not be adversely affected. The area to be removed does not represent habitat critical to the survival of the species and the project will not interfere with recovery.

E.7 White-throated Needletail

Table E.6 provides an assessment of significance for the removal of 5.82 ha of potential White-throated Needletail foraging habitat, in accordance with the relevant assessment criteria for vulnerable species. An aerial insectivore, this species has the potential to forage over a wide range of habitats, therefore all native vegetation within the study area is considered potential habitat for the species.

Table E.6 Assessment of significance for White-throated Needletail

Criteria	Discussion
Long-term decrease in an important population	This migratory species is part of a single population, whilst in Australia. It is a very wide-ranging species able to forage over almost all habitat types within south east Australia, except the most arid inland areas. Woodland habitat is preferred however the removal of 5.82 ha of potential and unremarkable habitat will not have any species level effects, let alone population level impacts.
Reduce area of occupancy of an important population	The species is widespread throughout eastern and south-eastern Australia during the appropriate season, and occur in a very wide range of habitats. The removed of 5.82 ha of potential habitat is negligible and will not impact the population.
Fragment a population	This species is fast flying and predominately aerial with the ability to cover large distances including over open areas. The proposed vegetation removal will not fragment the single population of the species.
Adversely affect critical habitat	No critical habitat for the species has been declared. The species is an aerial insectivore and is not tied to specific habitat types whilst in Australia. The habitat within the disturbance area, whilst offering potential foraging habitat, is not important for the species. No critical habitat will be impacted.
Disrupt the breeding cycle of an important population	Breeding does not occur in Australia. The loss of potential foraging habitat is considered inconsequential for the species and population and will not impact the species ability to obtain sufficient food for migration back to breeding areas in the northern hemisphere. Similar and more optimal foraging resources are widespread throughout south east Australia
Decrease availability or quality of habitat	The project will remove 5.82 ha of potential sub-optimal habitat for the species; however this is considered negligible as the species has very broad habitat requirements.
Result in invasive species	Invasive species do not appear to be elevated directly adjacent to the working quarry compared to the community further away. Therefore, any areas of habitat directly outside of the disturbance footprint are unlikely to be significantly impacted by indirect means. Weed control protocols will be undertaken, in accordance with Holcim's relevant processes and procedures, to ensure plant entering the project area is weed free.
Introduce disease	The clearance of sub-optimal habitat is unlikely to cause significant stress such that a disease outbreak would occur. The extension will not likely introduce any novel impacts given it is already an operation quarry.
Interfere with recovery	The are no recovery actions specified for the species, however key impacts for the species are likely to clearance of vegetation. The project will remove 5.82 ha of native e vegetation, which is potential foraging habitat; however this is considered negligible as the species has very broad habitat requirements.
Conclusion	The clearance of 5.82 ha of potential habitat will not result in a significant impact and the species population will not be adversely affected. The area to be removed does not represent habitat critical to the survival of the species and the project will not interfere with recovery.

E.8 Fork-tailed Swift

Table E.7 provides an assessment of significance for the removal of 5.82 ha of potential White-throated Needletail foraging habitat, in accordance with the relevant assessment criteria for migratory species. An aerial insectivore, this species has the potential to forage over a wide range of habitats, therefore all native vegetation within the study area is considered potential habitat for the species.

Table E.7 Assessment of significance for Fork-tailed Swift

Criteria	Discussion
Substantially modify destroy or isolate an area of important habitat.	The species has been recorded within the study area, however it has very broad habitat requirements occurring in almost all habitat types, favouring open and dry areas. The project area does not contain any features which provide important habitat for the species, beyond that in the surrounding region.
Result in an invasive species becoming established in an area of important habitat.	The project area does not contain important habitat for this species. Abiotic factors do not appear to have affected the potential habitat directly adjacent to the working quarry compared to the community further away. Therefore, any areas of habitat directly outside of the disturbance footprint are unlikely to be significantly impacted by indirect means. Weed control protocols will be undertaken, in accordance with Holcim's relevant processes and procedures, to ensure plant entering the project area is weed free.
Disrupt the breeding cycle of a population	If the species occurs within the project area, is anticipated to be on an intermittent basis only, and not include significant proportions of a population at any given time. There are no attributes of the project area which would cause large aggregations of individuals to occur. This species will not breed within the project area as the species breeds in the northern hemisphere.
Conclusion	The project will not have a significant impact on the species, as: • the area does not contain important habitat; • no breeding habitat will be impacted; • foraging habitat is ubiquitous and found through much of south east Australia and considered unimportant within the landscape; and • no large aggregations of the species are likely to occur within the disturbance area specifically.