Appendix 7

Biodiversity

Brandy Hill Expansion Project

Environmental Impact Statement

Appendix 7A

Biodiversity

Biodiversity Assessment Report

Brandy Hill Expansion Project

Environmental Impact Statement

Brandy Hill Quarry Expansion
Biodiversity Assessment Report

Draft Report prepared for Hanson Construction Materials Pty Ltd

8 November 2016

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Glossary

AFD	Australian Faunal Directory
ANZECC	Australian and New Zealand Environment and Conservation Council
APZ	Asset Protection Zone
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
BAR	Biodiversity Assessment Report
BBAM	BioBanking Assessment Methodology
BMP	Biodiversity Management Plan
BHQ	Brandy Hill Quarry
BOM	Bureau of Meteorology
CMA	Catchment Management Authority
CBD	Central Business District
CkPoM	Comprehensive Koala Plan of Management
DA	Department Application
DBH	Diameter at Breast Height
DO	Dissolved Oxygen
DoE	Department of the Environment
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DGEARs	Director General Environmental Assessment Requirements now called Secretary's Environmental Assessment Requirements (SEARs)
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement

EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
GDEs	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GPS	Global Positioning System
HBT	Hollow-bearing Tree
IBRA	Interim Biogeographic Regionalisation for Australia
KTP	Key Threatening Process
LEP	Local Environment Plan
LGA	Local Government Area
LHCREMS	Lower Hunter & Central Coast Regional Environmental Management Strategy
Matters of NES	Matters of National Environmental Significance listed under the EPBC Act
NSW	New South Wales
NV Act	*Native Vegetation Act 2003*
NW Act	*Noxious Weed Act 1993*
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
Project area	The Project area comprises the study area and the current Brandy Hill Quarry working and is the subject of the SSD Project Application
PVP	Property Vegetation Plan
REF	Review of Environmental Factors
RoTAP	Rare or Threatened Australian Plants
SEPP 44	State Environmental Planning Policy No. 44 – Koala Habitat Protection
SIC	Significant Impact Criteria

SIS	Species Impact Statement
SIX	Spatial Information eXchange
SPRAT	Species Profile and Threats Database
SSD	State Significant Development
study area	The study area, defined by the extent of vegetation clearance required to support the Project
Tg value	The ability of a species to respond to improvements in site or habitat values, determined by the Office of Environment and Heritage.
TSC Act	*Threatened Species Conservation Act 1995*
TSPD	*Threatened Species Profile Database*
Vegetation Zone	An area of native vegetation on a development site that is the same PCT and has a similar broad condition state
VIS	Vegetation Information System

Summary

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry (BHQ), located at 979 Clarence Town Road, Seaham (Figure 1) to increase the rate of production by 1.5 million tonnes per annum (the Project). The Project has been deemed a State Significant Development (SSD) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The existing BHQ is a major local supplier of Rhyodacite hard rock aggregates to the region (Hanson 2012). Currently, the site encompasses 561 hectares across 22 lots of land privately owned by Hanson. The proposed BHQ Expansion Project will increase this area by a further 53.67 hectares.

This Biodiversity Assessment Report (BAR) is being prepared to support Hanson's Environmental Impact Statement (EIS). In line with the Secretary's Environmental Assessment Requirements issued on 11 November 2014 the Project is being assessed under the *NSW OEH interim policy on assessing and offsetting biodiversity impacts, State significant development (SSD) and State significant infrastructure (SS/) projects* (OEH 2011) and this report has been prepared in accordance with the NSW BioBanking Assessment Methodology (OEH 2014).

The study area encompasses 48.62 hectares of native vegetation, while the remaining 5.03 hectares consist of waterways (dams) and cleared areas i.e. roads, buildings and carparks located within the Hanson Property Boundary (Figure 1). Also within the Hanson Property Boundary features Deadmans Creek which meanders along the north eastern Project area boundary before its confluence with Williams Creek which flows south and joins the Hunter River.

Ecological values

Key ecological values identified within the study area include:

- Presence of Deadman's Creek, a third order stream, immediately adjacent to but outside the study area, and presence of a first order section of Bartie's Creek within the study area.
- A total of six Plant Community Types (PCTs) covering 48.62 hectares.
- The identification of two threatened ecological communities, including:
  - 0.67 hectares of Swamp Sclerophyll Forest On Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.
  - 1.67 hectares of Hunter lowland Redgum forest in the Sydney Basin and NSW North Coast Bioregions.
- 45.8 hectares of Koala habitat across the study area.

Recommendations

The primary measure for the development to minimise impacts to ecological values outlined above where possible and avoid any impact to surrounding adjoining vegetation. Where vegetation losses are unavoidable for the development offsets are proposed in alignment with the interim policy (OEH 2011).

Project specific recommendations include:

- Development of a Biodiversity Management Plan (BMP) to guide; pre-clearance surveys, onsite management of water, threatened fauna such as Koala, noxious weeds, personnel inductions as well management of other native threatened and non-threatened fauna.

- Vegetated boundaries of the Project area to be clearly fenced off and signed posted to exclude access from personnel or equipment. Exclusion fencing to be discussed during all site inductions and routinely checked by an environmental representative.
- Hanson to develop a strict erosion and sediment control plan for the expansion to ensure that erosion and sediment is contained on site.
- Noxious weeds, Fire weed and Pampas Grass to be sprayed and/or removed and appropriately disposed of in an appropriate waste facility as required by NSW DPI through the Port Stephens Council under the NW Act.
- Where possible, implement a minimum 30 metre buffer to Deadmans creek to the east of the study area.
- Minimise the removal of native vegetation adjacent to waterbodies and watercourses.
- Lighting associated with night works to be directed away from adjoining vegetation (to be retained).
- A Biodiversity Offset Strategy has been prepared and is presented in Section 8. Hanson propose to meet their credit requirements by purchasing and retiring credits under the NSW BioBanking scheme. Upon approval Hanson proposes to fulfil its credit obligations.

Government legislation and policy

An assessment of the Project against key biodiversity legislation and policy is provided and summarised below (Table 1).

Table 1 Key biodiversity legislation and policy

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required
Environment Protection and Biodiversity Conservation Act 1999	Seven Significant Impact Criteria Assessments were prepared for the following species (Appendix 6): • Small-flower Grevillea • Tall Knotweed • Koala • Grey-headed Flying-fox • Spotted-tail Quoll • Regent Honeyeater • Swift Parrot	These assessments determined that a significant impact was unlikely to result from the Project for all species except the Koala. The Koala has been recorded within the study area. The project has been referred to the Commonwealth department of the Environment and Energy and has been declared a controlled action.
Threatened Species Conservation Act 1995	Two EECs: • Hunter Lowland Redgum Forest • Swamp Sclerophyll Forest on Coastal Floodplains Habitat for the Koala.	The project has been assessed in accordance with the BioBanking Assessment methodology (BBAM) with offsets provided in accordance with the interim policy (OEH 2011). No further permits or approvals are required.
Fisheries Management Act 1994	No habitat for *Fisheries Management Act 1994* (FM Act). listed species was located within the study area.	No further permits or approvals required.

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required
Noxious Weeds Act 1993	The following noxious weeds are present within the study area: • Fireweed (Class 4) • Pampas Grass (Class 3)	Land owners within the study area have an obligation under the *Noxious Weeds Act 1993* to control all noxious weeds on their land according to the specified control class.

Note: Guidance provided in this report does not constitute legal advice.

Stage 1 – Biodiversity assessment

1 Introduction

1.1 Project background

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry (BHQ), located at 979 Clarence Town Road, Seaham, to increase the rate of production by 1.5 million tonnes per annum (the Project). The Project has been deemed a State Significant Development (SSD) under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Biosis Pty Ltd was commissioned to undertake a biodiversity assessment and prepare a Biodiversity Assessment Report (BAR) for the Project which would support the Environmental Impact Statement (EIS) and cover the requirements for the Project as set out by the Director General's Environmental Assessment Requirements (DGEARs) (SSD 5899), issued by DPE on 9 July 2015.

1.2 Development proposal

The existing BHQ was approved by Port Stephens Shire Council (Development Application No 1920) on the 22 December 1983. The quarry is a major local supplier of Rhyodacite hard rock aggregates to the region (Hanson 2012). Currently, the site encompasses 561 hectares across 22 lots of land privately owned by Hanson. Of this, 18.6 hectares are occupied by the existing quarry, 11.1 hectares by the plant and 5.3 hectares by the stockpile area.

The proposed BHQ Expansion Project, covering a further 53.67 hectares, will involve:

- Expanding the existing quarry to extract and process up to 1.5 million tonnes of hard rock material a year for 30 years.
- Use of blasting (8 am to 5 pm weekdays).
- Constructing and operating additional infrastructure including a concrete batching plant (15,000 m^3 per year), mobile pug mill and pre-coat plant.
- 24 hour operations, sales and despatch.
- Transporting quarry products off-site and receiving 20,000 tonnes of concrete waste for recycling via public roads.
- Site rehabilitation.

The proposed quarry expansion is permissible as the subject land is zoned 1(a) Rural Agricultural "A" Zone as outlined within the Port Stephens Local Environmental Plan 2000 (LEP 2000).

1.3 Site description

The study area is located within the Upper Hunter subregion of the North Coast Interim Biogeographic Regionalisation for Australia (IBRA) bioregion in NSW. The development site is situated on a low ridge on the eastern flank of Brandy Hill, approximately 3.5 kilometres west of Seaham and 175 kilometres north of Sydney (Figure 1).

The BHQ is located north of Clarence Town Road on land owned by Hanson, and includes the following lots:

- Lot 100 DP 712886

- Lot 101 DP 712886
- Lot 56 DP 752487
- Lot 59 DP 752487
- Lot 58 DP 752487
- Lot 57 DP 752487
- Lot 36 DP 752487
- Lot 236 DP 752487
- Lot 19 DP 752487
- Lot 20 DP 752487
- Lot 21 DP 752487
- Lot 1 DP 737844
- Lot 2 DP 737844

The study area, which includes the proposed expansion footprint, is located to the south and west of the existing quarry (Figure 2).

Brandy Hill is an elevated suburb of the Port Stephens Local Government Area (LGA) and primarily consists of large, residential blocks overlooking the lower Hunter River floodplain. The Hunter River forms a prominent feature to the south of the study area and is a major river system in NSW joined by ten tributaries upstream and an additional thirty-one tributaries downstream providing significant flora and fauna habitat for the region.

1.4 Information sources

1.4.1 Publications and databases

In order to provide a context for the study area, information about flora and fauna from within 10 kilometres (the 'locality') was obtained from relevant public databases. Aquatic fauna records were searched from Hunter/Central Rivers Catchment Management Authority (CMA) management area.

Records from the following databases were collated and reviewed:

- Department of Environment and Energy (DoEE) Protected Matters Search Tool for matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- NSW BioNet - the database for the Atlas of NSW Wildlife.
- NSW Department of Primary Industries (DPI) Threatened and protected species – records viewer.
- PlantNET (The Royal Botanic Gardens and Domain Trust 2013) for Rare or Threatened Australian Plants (RoTAP).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013 (BirdLife Australia 2014).
- Groundwater Dependent Ecosystems Atlas. Australian Government's Bureau of Meteorology (Bureau of Meteorology 2014).
- Noxious weed declarations for Port Stephens Council. NSW Department of Primary Industries (DPI 2014a)

Relevant literature and vegetation mapping were reviewed, including:

- OEH Vegetation Information System (VIS) Mapping through the Spatial Information eXchange (SIX) Vegetation Map Viewer.
- Vegetation Survey, Classification and Mapping, Lower Hunter & Central Coast Regional Biodiversity Conservation (LHCCREMS 2003).
- Plant Community Types for the Hunter-Central Rivers Catchment Management Authority – reviewed via the Spatial Information eXchange (SIX) vegetation Map Viewer.
- Port Stephens Comprehensive Koala Plan of Management (Port Stephens Council 2002).
- Seasonal Threatened Plant Survey Brandy Hill Investigation Area (Anderson Environment & Planning 2013).
- NSW State Groundwater Dependent Ecosystem Policy (DLWC 2002).
- Environmental Impact Statement for a hard rock quarry and processing plant at Brandy Hill near Seaham (Resource Planning 1983).
- Policy and Guidelines - Aquatic Habitat Management and Fish Conservation (DPI 2013a).
- Policy and guidelines for fish habitat conservation and management (DPI 2013b).
- Key Fish Habitat maps: Port Stephens LGA. NSW Department of Primary Industries (DPI 2014b).

1.4.2 Spatial data

Spatial data showing the proposed expansion footprint and existing quarry were supplied by Hanson.

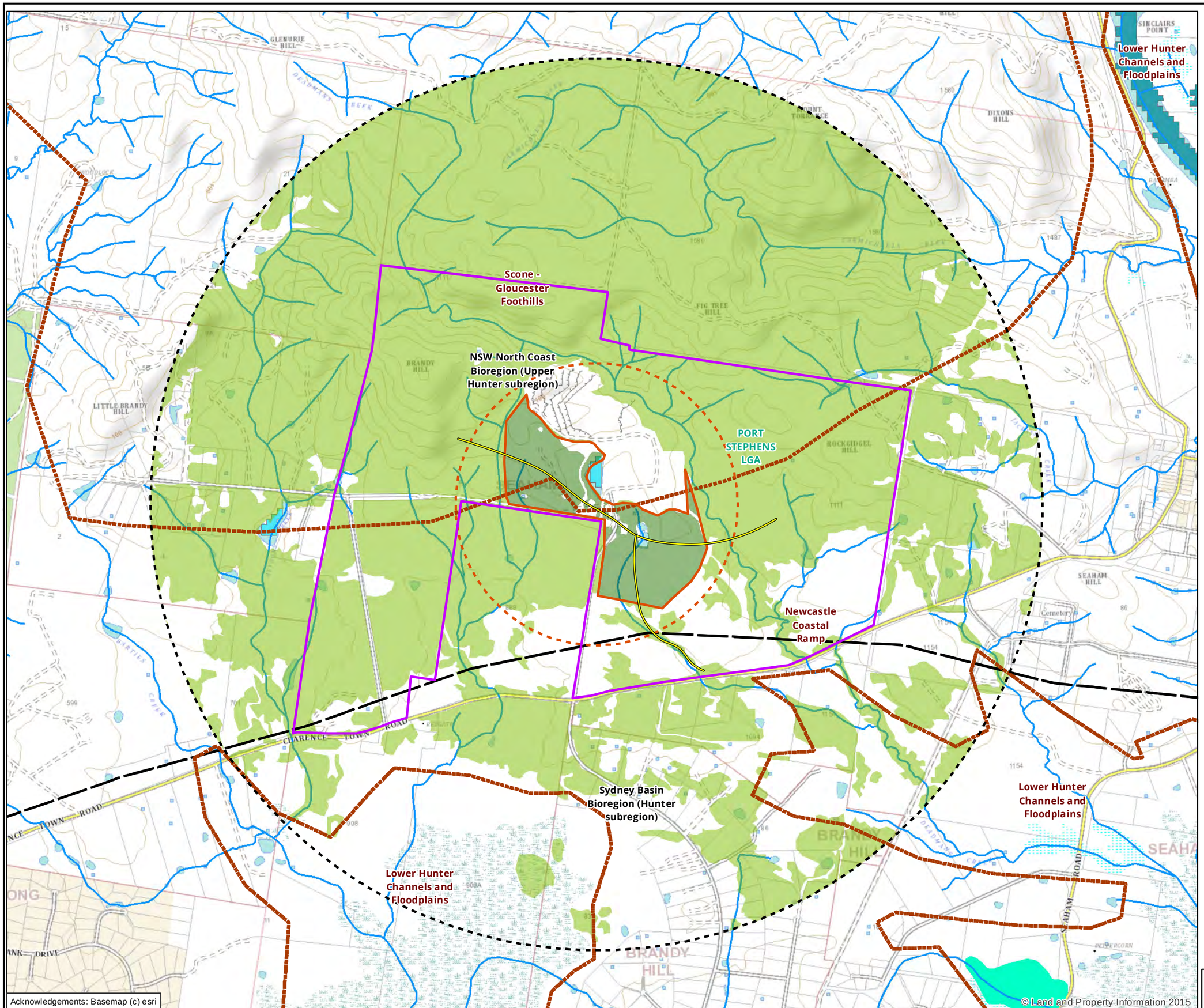
Aerial photography were sourced from NearMaps (dated 2014). Mapping was conducted using hand-held (uncorrected) GPS units (GDA94) and aerial photo interpretation of recently captured, high resolution imagery. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

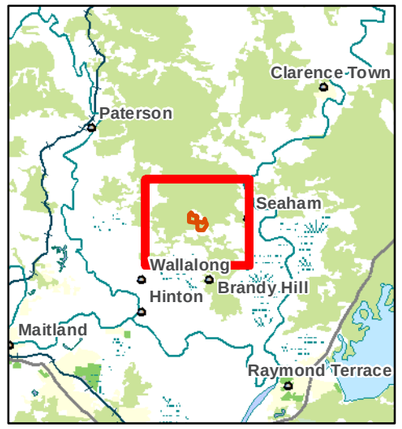
Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files containing the relevant flora and fauna spatial data are available; however this mapping may not be sufficiently precise for detailed design purposes.

1.5 Additional legislative requirements

The Project has been assessed against key biodiversity legislation and government policy, including:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Water Management Act 2000* (WM Act)
- *Native Vegetation Act 2003* (NV Act)
- *Noxious Weeds Act 1993* (NW Act)





Legend

- Hanson property boundary
- Study area

Assessment circles

- Inner
- Outer

Native vegetation

- Native vegetation (LHCCREMS 2003)
- Native vegetation (Biosis (2016)
- Connective links

Landscape features

- Mitchell Landscapes
- IBRA Bioregions (and subregions)
- Waterways
- Wetland listed on the DOIW
- SEPP14 Coastal wetlands
- Local Government Area

Figure 1: Location of the study area, Seaham NSW

0 200 400 600 800 1,000

Metres
Scale: 1:20,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 20369
Date: 29 September 2016,
Checked by: NMG, Drawn by: JMS/ANP, Last edited by: ngarvey
Location:P:\23000s\23069\Mapping\23069_F1_LocationMap_20160923

Legend

- Project area
- Study area
- Cadastre

Streams

- 1st Order
- 2nd Order
- 3rd Order
- Stream buffers

Local wetland

- Dam
- Local wetland buffer

Figure 2: Site Map

0 50 100 150 200 250

Metres
Scale: 1:5,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne,
Sydney, Wangaratta & Wollongong

Matter: 18371
Date: 20 September 2016,
Checked by: EC, Drawn by: JMS/ANP, Last edited by: apritchard
Location:P:\23000s\23069\Mapping
23069_F2_SiteMap_20160920

2 Legislative context

This section provides an overview of key biodiversity legislation and government policy considered in this assessment. Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Nine Matters of NES are identified under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (also known as 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, activities that have potential to result in significant impacts on Matters of NES must be referred to the Commonwealth Minister for the Environment for assessment.

Matters of NES relevant to the current Project include nationally threatened species and ecological communities, migratory species and Ramsar wetlands. Threatened communities are discussed in Section 4, while threatened species are outlined in Section 5 and Appendix 5. Ramsar wetlands are considered in Section 3.2. Significant impact criteria (SIC) assessments are provided in 7 .

An assessment of potential impacts to all Matters of NES under the provisions of the EPBC Act, and whether referral of the Project to the Commonwealth Minister for the Environment for assessment is required, provided in Section9.1.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

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

The EP&A Act provides the overarching structure for planning in NSW; however is supported by other statutory environmental planning instruments. Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

Assessment of Significance (Section 5A)

Section 5A of the EP&A Act requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and FM Act. Section 5A (and Section 9A of the TSC Act) outlines seven factors that must be taken into account in an Assessment of Significance (formally known as the "7-part test"). Where any Assessment of Significance (AoS) determines that a development will result in a significant effect to a threatened species, population or community a Species Impact Statement (SIS) is required.

As the Project was assessed in accordance with the BioBanking Assessment Methodology (OEH 2014a) AoS's were not undertaken for the Project.

Local Environment Plans (Part 3 Division 4)

Local Environment Plans (LEP) apply either to the whole, or part of, a Local Government Area and make provision for the protection or utilisation of the environment through zoning of land.

The study area is subject to the Port Stephens Local Environment Plan 2013 and is zoned RU2 Rural Landscape. This zoning provides for:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- To maintain the rural landscape character of the land.
- To provide for a range of compatible land uses, including extensive agriculture.

Elements of the LEP objectives are relevant to this assessment and are discussed further in the main EIS.

State Environmental Planning Policies (Part 3 Division 2)

State Environmental Planning Policies (SEPPs) outline policy objectives relevant to state wide issues. SEPPs relevant to the current development are discussed below.

State Environmental Planning Policy No 44—Koala Habitat Protection

SEPP 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in councils listed in Schedule 1 to the SEPP.

SEPP 44 does not apply to Projects that are being assessed as SSD. However, SEPP 44 Koala habitat definitions have been used to determine whether potential and/or core Koala habitat areas (as defined under SEPP 44) occur within the study area.

2.2.2 Threatened Species Conservation Act 1995

The TSC Act is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and ecological communities and the declaration and mapping of their critical habitats, as well as the identification of key threatening processes.

The TSC Act also establishes a system for biodiversity certification and establishes the Biodiversity Banking and Offsets Scheme.

Biodiversity Banking and Offsets Scheme

Part 7A of the TSC Act establishes the Biodiversity Banking and Offsets Scheme, which enables the establishment of biodiversity banking sites, the creation and trading of biodiversity credits and the use of credits to offset development otherwise impacting on biodiversity values. Development for which a BioBanking statement is issued is taken to be development that is not likely to significantly affect any threatened species, population or ecological community under this Act, or its habitat.

This assessment was undertaken using the BioBanking Assessment Methodology (OEH 2014a); however, a BioBanking statement is not being sought for the development. As per the input from the NSW Office of Environment and Heritage (OEH) the BioBanking Assessment Methodology has been used to assess the impacts of the Project and to determine required offsets.

Threatened species and communities are discussed in Sections 5 and 4 respectively, with a list of threatened species considered during the assessment and their likelihood of occurrence in the study area provided in Appendix 5. Biodiversity credit requirements are outlined in Section 7

2.2.3 Fisheries Management Act 1994

The FM Act provides for the protection and conservation of aquatic species and their habitat throughout NSW. Impacts to threatened species, populations and communities, and critical habitats listed under the FM Act must be assessed through the AoS process under Section 220ZZ of the FM Act and Section 5A of the EP&A Act (see Section2.2.1). There are seven key threatening processes (KTPs) listed under the FM Act.

Two key objectives of the FM Act are to; conserve fish stocks and key fish habitats, and conserve threatened species, populations and ecological communities of fish and marine vegetation. When reviewing applications, Department of Primary Industries (DPI) will assess the likelihood of impacts to waterways in relation to their sensitivity (TYPE) and waterway class (CLASS).

Aquatic habitats and threatened species are outlined in Section 5.4.3. An assessment of the Project against the requirements of the FM Act is provided in Section 9.2.

2.2.4 Native Vegetation Act 2003

The NV Act provides for, encourages and promotes the management of native vegetation on a regional basis and regulates the clearing of native vegetation on land in NSW. Under the NV Act no clearing of native vegetation is allowed except in accordance with prior development consent from the relevant Council or under a Property Vegetation Plan (PVP) approved by the relevant Catchment Management Authority.

The Project is being assessed as SSD under the EP&A Act, and as such the provisions of the NV Act do not apply.

2.2.5 Noxious Weeds Act 1993

The NW Act was enacted to provide for the identification, classification and control of noxious weeds. The NW Act aims to reduce the negative impact of weeds on the economy, community and environment of NSW by:

- Establishing control mechanists to prevent the establishment of significant new weeds in NSW.
- Preventing, eliminating or restricting the spread of particular significant weeds in NSW.
- Effectively managing widespread significant weeds in NSW.

Plants declared as noxious weeds are currently listed under Noxious Weeds (Weed Control) Order 2014 published in the NSW Government Gazette No. 23. The NW Act is supported by a number of regulations and is administered by the DPI. Noxious weeds are discussed further in Section 9.3.

3 Landscape

3.1 Bioregions and landscapes regions

The study area occurs within the North Coast IBRA bioregion and the Upper Hunter IBRA subregion (Figure 1). The Upper Hunter IBRA subregion covers the entire development site and is the subregion is used in this assessment. The Hunter IBRA subregion and Sydney Basin IBRA region are located to the south of the study area, and within the inner assessment circle (Figure 1).

The majority of the study area is located within the Newcastle Coastal Ramp Mitchell Landscape and this is the Mitchell Landscape identified in the assessment. The northern portion of the study area is located within the Scone-Gloucester Foothills Mitchell Landscape, while the Lower Hunter Channels and Floodplains Mitchell Landscapes is located to the south of the study area within the outer assessment circle (Figure 1).

3.2 Waterways and wetlands

The study area is located within the Hunter River catchment. The Hunter is the largest coastal catchment in NSW, with an area of about 21,500 square kilometres. Elevations across the catchment vary from over 1,500 metres in the high mountain ranges north of the catchment, to less than 50 metres on the floodplains of the lower valley.

The study area is within the catchment of two local waterways; Deadmans Creek and Barties Creek. Deadmans Creek is a tributary of Williams Creek which flows south to its confluence with the Hunter River approximately 10 kilometres south of the study area. It is located outside of the study area, immediately to the east, where the creek is a third order (Strahler 1957) ephemeral stream flowing from north to south (Figure 1) with a first order tributary of Deadmans Creek located within the eastern section of the study area (Figure 2). The southern downstream portion of Deadmans Creek was flowing during the winter survey (Plate 1); however upstream sections to the north were dry (Plate 2). During the spring survey, the entire creek line was found to be dry, highlighting the ephemeral nature of this minor creek. In the study area, the tributary of Deadmans Creek forms an eroded channel that was dry during the assessment period (Plate 3).

Barties Creek is a tributary of the Hunter River, with the confluence of these two waterways approximately 7 kilometres south of the study area. The headwaters of this waterway are located within and to the west of the study area (Figure 1), with a first order (Strahler 1957) section of the waterway located within the western section of the study area (Figure 2). In the study area this creek is highly ephemeral and was observed to be dry during the survey periods.

Plate 1 **Deadmans Creek adjacent to the study area**

Plate 2 **Deadmans Creek upstream of the study area**

Plate 3 **Deadmans Creek adjacent to the study area**

A large man-made storage dam is located in the centre of the study area. It is bound on all sides by vehicle access roads, with a narrow strip of riparian vegetation. Macrophytes were noted along the edges of the dam which provide breeding and refuge habitat for frogs and fish. Three smaller settlement dams are located to the east of this larger dam.

3.3 Native vegetation extent

In order to encompass the entire impact area, an inner assessment circle of 200 hectares and an outer assessment of 2000 hectares have been used. Vegetation cover is shown in Figure 1 and Table 2.

A large portion of the outer assessment circle to the north of the study area is vegetated, whilst south of Clarence Town Road has been partially cleared. Within the inner assessment circle, the study area contains a number of areas that have been cleared as a part of previous approvals for the Brandy Hill Quarry. These areas include the site office and carpark facility, the workshop and yard, the load inspection area and a number of access roads. Assessment of landscape value

3.4 Assessment of landscape value

Landscape value has been calculated using the method for site-based developments, outlined in Appendix 4 of the BBAM (OEH 2014a).

3.4.1 Assessment of the current extent of native vegetation cover

The amount of native vegetation within the inner and outer assessment circles has been derived from the highest resolution vegetation mapping available. In this instance the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS 2003) mapping was used to determine vegetation extent outside the study area, with irrelevant or exotic vegetation map units discounted. Detailed mapping undertaken for this assessment was used within the study area. To determine proportion of native vegetation following the Project, the area of native vegetation within the study area was subtracted from the pre-expansion calculations. The values that were calculated using GIS are outlined in Table 2.

Table 2 Extent of native vegetation cover before and after development

Assessment Circle	Before Development		After Development	
	Area (ha)	Per cent	Area (ha)	Per cent
Outer assessment circle	1394	70 (66-70)	1340	67 (66-70)
Inner assessment circle	144	72 (71-75)	90	45 (41-45)

3.4.2 Assessment of connectivity value

The study area does not support any of the following:

- An area identified as being part of a state significant biodiversity link.
- A riparian buffer 50 metres either side of a 6th order stream.
- A riparian buffer 50 metres around an important wetland or estuarine area.
- An area identified as being part of a regionally significant biodiversity link.
- A riparian buffer 20 metres either side of a 4th or 5th order stream,

Therefore, the proposed development will not impact on any state significant biodiversity links or regionally significant biodiversity links.

Connectivity is the measure of the degree to which areas of native vegetation are linked to other areas of vegetation. The connectivity value of the study area was assessed in accordance with Appendix 4 of the BBAM. The study area was assessed as being part of two connective links (Figure 1). One connective link runs east to west within the southern portion of the study area and provides connectivity between patches of vegetation to the east and west of the quarry. The connectivity width assessment determined that the most limiting width within this connective link is 340 metres, placing it in the >100-500 metres (wide) linkage width class. A second connective link runs connects the first connective link to remnant native vegetation to the south of the study area. The most limiting width for this connective link currently occurs outside the study area with a width of approximately 27 metres, placing it in the >5-30 metres (narrow) width class. This is the most limited connective link and was used in the current assessment. It is worth noting that this connective link is transected by Clarencetown Road, south of the quarry, with no connective structures. Following development both connective links will be removed by the Project, reducing the width class to 0-5 metres (very narrow).

Table 3 outlines the linkage condition both before and after development.

Table 3 Connectivity condition classes

Strata	Before Development	After Development
Overstorey condition	PFC at BM	No native overstorey
Midstorey/Ground cover condition	PFC of midstorey/ground cover at BM	No midstorey/groundstorey cover

Based on this assessment the loss of linkage condition/width score is 12.

3.4.3 Assessment of patch size

Patch size was assessed using a Geographic Information System (GIS). All vegetation not defined as low condition and separated by a distance of less than 100 metres (woody vegetation) or less than 30 metres (grasslands) was mapped sequentially using a selection process in ArcGIS software.

Using this method, vegetation within the study area forms part of a large expanse of relatively intact native bushland that extends approximately 14 kilometres north towards the town of Martins Creek. The study area was assessed as having a patch size of > 1001 hectares. All vegetation zones within the study area have a patch size greater than 1000 hectares and therefore sits within the extra large patch size class.

4 Native vegetation

The extent of native vegetation within the study area was determined using Section 5 of the BBAM (OEH 2014a).

General classification of native vegetation in NSW used in this report is based on the Vegetation Information System (VIS) classification. Vegetation communities are separated into Plant Community Types (PCTs) based on the form, floristic composition landscape position, soils and geographical location. Information on the PCTs is accessed through the VIS database which contains all of the information required to positively identify a given community. This system is based on the Keith (2004) system which uses three groupings of vegetation: vegetation formation, vegetation class and vegetation type, with vegetation type the finest grouping. Most PCTs have an equivalent vegetation type and both have been referred to in the first instance.

Detailed mapping of vegetation within the study area was undertaken for this assessment. The methodology is outlined in Section 4.1 and results presented in Section 4.2.

4.1 Methods

4.1.1 Site investigation

An initial flora assessment of the study area was undertaken in winter from the 11 to 15 August 2014 by two ecologists. An additional flora assessment was undertaken in spring on the13 and 14 November 2014 by two ecologists.

Detailed mapping of vegetation communities was undertaken on during the initial assessment with minor revision during the second visit. Vegetation mapping was conducted using hand-held (uncorrected) GPS units and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration. Mapping has been produced using a GIS.

Delineation of PCTs was undertaken by walking the boundaries of these communities. Areas containing dams, sealed roads or no vegetation cover were excluded from the vegetation mapping. Identification of PCTs within the study area was confirmed using descriptions provided in the VIS and through analysis of dominant species.

PCTs were stratified into vegetation zones based on condition (low or moderate/good) and ancillary code (where relevant). Following stratification of vegetation zones, site value was assessed using plot and transect survey data, as per the methodology outlined in Section 5 of the BBAM (OEH 2014a). Surveys included:

- A 20 metre x 50 metre quadrat and 50 m transect for assessment of site attributes.
- A 20 metre x 20 metre quadrat, nested within the quadrat outlined above, for full floristic survey to determine native plant species richness.

The minimum number of plots/transects per vegetation zone was determined using Table 3 of OEH (2014a). A total of 19 plots/transects were completed within the study area (Figure 3). Spot locations for incidental observations and random meanders (Cropper 1993) were also used to determine the vegetation types present within the study area. The general condition of native vegetation was observed as well as the effects of current seasonal conditions. Notes were made on specific issues such as noxious weed infestations, evidence of management works, current grazing impacts and the regeneration capacity of the vegetation.

A list of flora species was compiled for each vegetation type (Appendix 3). Records of threatened flora species will be submitted to OEH for incorporation into the Atlas of NSW Wildlife.

4.2 Results

4.2.1 Vegetation description

The vegetation of the Project area comprises either grassy, shrub/grassy or shrubby open forest with one swamp forest vegetation community (Table 4).

Table 4 Plant Community Types of the study area and corresponding formation and class (Keith 2004)

Plant community type	Vegetation formation	Vegetation class
HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	Dry Sclerophyll Forest (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests
HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	Dry Sclerophyll Forest (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests
HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064)	Forested Wetlands	Coastal Swamp Forests
HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	Dry Sclerophyll Forest (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests
HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	Forested Wetlands	Coastal Floodplain Wetlands
HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)	Wet Sclerophyll Forest (Grassy sub-formation)	Northern Hinterland Wet Sclerophyll Forests

4.2.2 Plant community types

A total of six distinct PCTs were identified in the study area. All native vegetation within the study area was deemed to be in moderate/good condition with all PCTs in the same broad condition. Thus, no ancillary codes were assigned and the six PCTs were identified as individual vegetation zones (Figure 3). A summary of these is provided inTable 5, with a detailed description of each of the identified PCTs in Table 6 to Table 9 below.

In addition to the native PCTs identified two non-vegetated map units were recorded including; *Cleared* and *Water* (Figure 3). The Water map unit is comprised of the man made storage and settlement dams that occur in the central portion of the study area. The Cleared map unit is comprised of access roads, haul roads, carparks and maintenance areas that are devoid of all vegetation.

Table 5 PCT and corresponding vegetation zones mapped within the study area.

Vegetation zone (VZ)	Plant community type	Condition	Ancillary code	Area (ha)
VZ1	HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	Moderate-Good	No ancillary code assigned	17.1
VZ2	HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	Moderate-Good	No ancillary code assigned	25.9
VZ3	HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)	Moderate-Good	No ancillary code assigned	0.67
VZ4	HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	Moderate-Good	No ancillary code assigned	1.12
VZ5	HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	Moderate-Good	No ancillary code assigned	1.67
VZ6	HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584).	Moderate-Good	No ancillary code assigned	2.16
TOTAL				48.62

Table 6 Vegetation zone 1 community description

Vegetation zone 1: Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	
PCT ID	1600
Biometric vegetation type ID	HU814
Extent within Project area (hectares)	Approximately 17.1 hectares of HU814 was recorded within the study area, predominantly in the southwestern portion.
Estimate of percent cleared value of PCT	66%

Description	HU814 is characterized by a canopy of Spotted Gum *Corymbia maculata*, Narrow Leaved Ironbark *Eucalyptus crebra,* Grey Box *Eucalyptus moluccana* and, to a lesser extent, Red Ironbark *Eucalyptus fibrosa* and Forest Red Gum *Eucalyptus tereticornis.* Prickly Leaved Paperbark *Melaleuca nodosa* formed dense thickets through the southern central portion of the study area. Grey Box was more abundant in the eastern portion with Forest Red Gum more prevalent to the west. Where canopy has been historically thinned and cleared in some areas, pockets of derived native grasslands were identified. Given that these areas still meet the threshold of moderate/good condition and these formed small pockets scattered amongst the more intact vegetation, stratification of this vegetation into a separate vegetation zone was not considered appropriate. The shrub strata composition was largely similar to that observed in HU816, with prickly shrubs such as Prickly Beard-heath *Leucopogon juniperinus*, Gorse Bitter Pea *Daviesia ulicifolia*, Prickly Moses *Acacia ulicifolia* and Native Blackthorn *Bursaria spinosa* dominant. Native understory species included Wiry Panic *Entolasia stricta*, Threeawn Speargrass *Aristida vagans*, Forest Hedgehog Grass *Echinopogon ovatus*, Blady Grass *Imperata cylindrica*, Wallaby Grass *Rytidosperma fulva,* Barbed Wire Grass *Cymbopogon refractus,* Weeping Grass *Microlaena stipoides*, Raspwort *Gonocarpus teucrioides*, Leafy Purple-flag *Patersonia glabrata* Spiny-headed Mat-rush *Lomandra longifolia*, Whiteroot *Pratia purpurascens*, Native Geranium *Geranium solanderi*, Kidney Weed, *Goodenia bellidifolia*, Germander *Gonocarpus teucrioides* and *Dianella prunina.*
Vegetation Formation and Class	Dry Sclerophyll Forest (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Condition	The community is in moderate/good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the relatively low level of exotic species recruitment, particularly in the less edge affected areas. At the southern extent of the study area, historic clearing for grazing has lead to lower density canopy of lower age class trees. Furthermore, exotic grasses and herbs such as Narrow-leafed Carpet Grass *Axonopus fissifolius*, Scarlet Pimpernel *Anagallis arvensis* and Rhodes Grass *Chloris gayana* were noted.
Justification of evidence used to identify a PCT	The vegetation observed was considered to best fit HU814 based on the co-dominance of Spotted Gum, Narrow-leaved Ironbark Grey Box and Red Ironbark in the canopy, the presence of a suite of characteristic shrub and ground cover species and occurrence on hillsllopes.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: HU814 was considered to align with the final determination for the EEC Lower Hunter Spotted Gum –Ironbark Forest in the Sydney Basin Bioregion based on the species composition of the canopy, which had a higher influence of Red Ironbark, and the presence of Prickly-leaved Paperbark thickets which are characteristic of the EEC (NSW Scientific Committee 2011a). However, as the study area is located within the North Coast Bioregion it does not align with the final determination of this EEC (NSW Scientific Committee 2011a).

Picture: Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	

Table 7 Vegetation zone 2 community description

Vegetation zone 2: Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	
PCT ID	1602
Biometric vegetation type ID	HU816
Extent within Project area (hectares)	Approximately 25.9 ha of HU816 was recorded across the majority of the study area. This PCT extends across the elevated ridges in both the northern and southern section, grading into other Spotted Gum – Ironbark variants on the lower slopes.
Estimate of percent cleared value of PCT	54%
Description	HU816 is characterised by a canopy of Spotted Gum, Narrow-leaved Ironbark and White Mahogany *Eucalyptus acmenoides* which was dominant in a number of locations. Other canopy species were recorded throughout the community; however these three were typically dominant. Other recorded canopy species include White Stringybark *Eucalyptus globoidea*, Sydney Red Gum *Angophora costata*, Red Ironbark and Rough-barked Apple *Angophora floribunda* in the south-eastern portion of the study area and Grey Gum *Eucalyptus punctata* and Grey Ironbark *Eucalyptus siderophloia* in the north-western portion of the study area. Where the influence of exotic species was low, HU816 typically had an open understory of shrubs including Prickly Beard-heath, Gorse Bitter Pea, Prickly Moses, Hickory Wattle *Acacia implexa*, Large Mock-olive *Notelaea longifolia*, Native Blackthorn and Coffee Bush *Breynia oblongifolia.* Native herbs, grasses and graminoids recorded include; Wiry Panic, Brown's Lovegrass *Eragrostis brownii*, Blady Grass, Weeping Grass, Wattle Matt-rush *Lomandra filiformis*, Spiny-headed Mat-rush, Stinkweed *Opercularia diphylla*, Pomax *Pomax umbellata*, Thyme Spurge

	Phyllanthus hirtellus, Whiterood and Kidney Weed *Dichondra repens*.
Vegetation Formation and Class	Dry Sclerophyll Forest (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests
Condition	The community is in moderate/good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the relatively low level of exotic species recruitment. Lantana *Lantana camara* was noted as a problematic weed, forming relatively dense stands in places, particularly in the south-eastern portion of the study area.
Justification of evidence used to identify a PCT	The vegetation observed was considered to best fit HU816 based on the dominance of Spotted Gum and Narrow-leaved Ironbark in the canopy, and the presence of a suite of characteristic shrub and ground cover species.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: the VIS database notes that HU816 can form a part of the endangered ecological community (EEC) Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion. However, since the study area is located within the North Coast Bioregion it does not align with the final determination of this EEC (NSW Scientific Committee 2011a).
Picture: Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	

Table 8 Vegetation zone 3 community description

Vegetation zone 3: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.	
PCT ID	1064
Biometric vegetation type ID	HU591

Extent within Project area (ha)	Approximately 0.67 ha of HU591 was recorded within the study area, immediately upstream of the three settlement dams in the south-eastern portion of the study area. The patch is bisected by a small drainage channel the flows north to south, into the first settlement dam.
Estimate of percent cleared value of PCT	75%
Description	HU591 was characterized by a canopy of Swamp Oak *Casuarina glauca* and Forest Red Gum with scattered Narrow-leaved Ironbark and White Stringybark on the outer fringes. Prickly-leaved Tea Tree *Melaleuca styphelioides* was characteristic of the midstorey along with Cheese Tree *Glochidion ferdinandi,* Hickory Wattle *Acacia falcata,* Golden Wattle *Acacia longifolia*, Native Blackthorn, Prickly Moses and Hairy Clerodendrum *Clerodendrum tomentosum.* The understory was typically comprised of native grassed forbs and vines including; Wiry Panic Grass, Blady Grass, Two-colour Panic Grass *Panicum simile*, Old Man's Beard *Clematis aristata,* Whiteroot, Wombat Berry *Eustrephus latifolius*, Scrambling Lily *Geitonoplesium cymosum*, Snake vine *Stephania japonica*, Small St John's Wort *Hypericum gramineum*, Indian Pennywort *Centella asiatica* and Common Silkpod *Parsonsia straminea.* Sedges were common throughout the drainage channel with recorded species including Rough Saw-sedge *Gahnia aspera,* Bare Twigrush *Baumea juncea, Eleocharis acuta* and *Schoenoplectus validus.*
Vegetation Formation and Class	Forested Wetlands Coastal Swamp Forests
Condition	HU591 is in moderate to good condition for the purpose of the FBA, and was considered to be in moderate condition overall based on the edge affected nature of the patch. The community was recorded adjacent to the heavily disturbed stockpile area which has allowed recruitment of exotic species within this wetter, more nutrient enriched community. Species recorded include Fireweed *Senecio madagascariensis,* Fleabane *Conyza* sp., Common Sowthistle *Sonchus oleraceus,* Cobbler's Pegs *Bidens pilosa,* Catsear *Hypochaeris radicata* and the grasses Pampas Grass *Cortaderia selloana,* Rhodes Grass and Slender Pigeon Grass *Setaria gracilis.*
Justification of evidence used to identify a PCT	This vegetation community was determined to align with HU591 based on the presence of Swamp Oak and Forest Red Gum in the canopy and the dominance of Prickly-leaved Tea Tree in the midstorey. Additionally, the landscape position is consistent with poorly drained sites along creek banks. The patch of HU591 was relatively small and it graded into the HU816 as the soils became drier away from the drainage line. As such species composition shifted towards a higher influence of Ironbarks and Spotted Gum in this transitional zone.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Endangered Justification: HU591 was considered to align with the final determination for the EEC Swamp Sclerophyll Forest On Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (NSW Scientific Committee 2004). This was based on the species composition of the canopy which had a high influence of Swamp Oak and Forest Red Gum with a dominance of Prickly-leaved Tea Tree in the midstorey and Blady Grass as a ground cover.

Picture: Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	

Table 9 Vegetation zone 4 community description

Vegetation zone 4: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	
PCT ID	1592
Biometric vegetation type ID	HU806
Extent within Project area (ha)	Approximately 1.12 hectares of HU806 was recorded within the study area, along the northern boundary of the south-eastern portion of the study area. This community forms a small patch that adjoins HU816 but that is floristically distinct.
Estimate of percent cleared value of PCT	44%
Description	HU806 was characterized by an overstory dominated by Red Ironbark with scattered Spotted Gum. Red Ironbark was recorded as an associated canopy species elsewhere in the study area but not at the same abundance that was noted within HU806. Shrub and understory stratum species composition was similar to other grassy woodlands within the study area. Species recorded include Prickly Beard-heath, Prickly-leaved Paperbark, Downy Dodder-laurel *Cassytha pubescens*, Many-flowered Mat-rush *Lomandra multiflora*, Coffee Bush, Wiry Panic, Blady Grass, Threeawn Speargrass, Barbed Wire Gras, Wiry Panic, Blady Grass, Kangaroo Grass *Themeda australis,* Narrow-leaved Geebung *Persoonia linearis*, Sandfly Zieria *Zieria smithii* and Kurrajong *Brachychiton populneus*.
Vegetation Formation and Class	Dry Sclerophyll Forest (Shrub/grass sub-formation) Hunter-Macleay Dry Sclerophyll Forests

Condition	HU806 is in moderate/good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the edge affected nature of the patch. The community was recorded adjacent to a recently expanded access track along the north-eastern edge of the study area. Exotic species recorded were limited to patches of Lantana scattered throughout.
Justification of evidence used to identify a PCT	The dominance of Red Ironbark in the canopy was the driving factor in the delineation of HU806. Elsewhere in the study area Narrow-leaved Ironbark has been more dominant; however this was far less abundant within this community.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: HU806 was considered to align with the final determination for the EEC Lower Hunter Spotted Gum –Ironbark Forest in the Sydney Basin Bioregion based on the species composition of the canopy which had a high influence of Red Ironbark in the canopy and Prickly-leaved Paperbark in the shrub strata. However, as the study area is located within the North Coast Bioregion it does not align with the final determination of this EEC (NSW Scientific Committee 2011a).
Picture: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	

Table 10 Vegetation zone 5 community description

Vegetation zone 5: Forest Red Gum grassy open forest on floodplains of the lower Hunter	
PCT ID	1598
Biometric vegetation type ID	HU812
Extent within Project area (ha)	Approximately 1.67 hectares of HU812 was recorded within the study area, predominantly fringing the bank of the large dam in the centre of the study area. This community occurred on lower slopes on soils where alluvial deposits are more prevalent.

Estimate of percent cleared value of PCT	Unknown
Description	HU812 was characterized by a tall canopy of Forest Red Gum, Rough-barked Apple and Grey Ironbark with scattered Grey Gum intergrade *Eucalyptus punctata X canaliculata* and Broad-leaved White Mahogany *Eucalyptus umbra.* Species composition of the shrub strata was similar to the grassy woodland communities within the study area, species include; Prickly Beard-heath, Prickly Moses, Dolly Bush *Cassinia aculeata*, Swamp Wattle *Acacia elongata*, Large Mock-olive, Sandfly Zieria, Coffee Bush, Cheese Tree, Native Blackthorn, Narrow-leaved Geebung and Kurrajong. Native grasses were common in the understoery, including Bordered Panic, Wiry Panic and Blady Grass in addition to the native forbs, vines and gaminoids Small-leaf Glycine *Glycine microphylla*, Whiteroot, Wattle Matt-rush, Wombat Berry, *Dianella caerulea* var. *cinerascens* and Water Vine.
Vegetation Formation and Class	Forested Wetlands Coastal Floodplain Wetlands
Condition	HU812 is in moderate to good condition for the purpose of this assessment, and was considered to be in moderate condition overall based on the edge affected nature of the patch. The community was recorded between an existing dam and a haul road leading to the quarry. As such, weed recruitment has lead to patches of Lantana scattered throughout.
Justification of evidence used to identify a PCT	This community was considered to be consistent with HU812 based on the species composition, particularly in the canopy, in conjunction with the landscape position on low slopes adjacent to a permanent waterbody.
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Endangered Justification: HU812 was considered to align with the final determination for the EEC Hunter lowland Redgum forest in the Sydney Basin and NSW North Coast Bioregions (NSW Scientific Committee 2002). The justification for this was the dominance of Forest Red Gum in the canopy, in addition to other characteristic species in each stratum. Landscape position attributes were also equivalent, with HU812 occurring on the lower slopes and flats adjacent to a permanent water body.

Picture: Forest Red Gum grassy open forest on floodplains of the lower Hunter	

Table 11 Vegetation zone 6 community description

Vegetation zone 6: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	
PCT ID	1584
Biometric vegetation type ID	HU798
Extent within Project area (ha)	Approximately 2.16 ha of HU798 was recorded within the study area, in the north-western portion. This community was recorded within moist gullies between ridgelines, typically adjacent to ephemeral drainage lines and seepage points.
Estimate of percent cleared value of PCT	42%
Description	HU798 was characterized by a dense canopy of Grey Myrtle *Backhousia myrtifolia* with an understory of mesic shrubs, vines and epiphytes. Emergent sclerophyllous canopy species including White Mahogany, Grey Gum and Spotted Gum were scattered amongst the community. Dominant shrubs included Creek Sandpaper Fig *Ficus coronate*, Large Mock-olive, Cheese Tree, White Supplejack *Ripogonum album*, Willow Bottlebrush *Callistemon salignus,* Rough Fruit Pittosporum *Pittosporum revolutum* and *Myrsine variabilis*. Vines and scramblers were common throughout HU798, with recorded species including Water Vine *Cissus Antarctica*, Lawyer Vine *Smilax australis*, Milk Vine *Marsdenia rostrata,* Giant Water Vine *Cissus hypoglauca*, Settler's Twine *Gymnostachys anceps*, Scrambling Lily and Sweet Morinda *Morinda jasminoides.* The understory also contained a large number of ferns and their allies, including Elkhorn Fern *Platycerium bifurcatum*, Common Maidenhair *Adiantum aethiopicum, Pellaea paradoxa*, Giant Maidenhair *Adiantum formosum,* Rough Maidenhair *Adiantum hispidulum,* Swamp Water Fern *Blechnum*

	indicum and Prickly Rasp Fern *Doodia aspera.*
Vegetation Formation and Class	Wet Sclerophyll Forest (Grassy sub-formation) Northern Hinterland Wet Sclerophyll Forests
Condition	The community is in moderate/good condition for the purpose of this assessment, and was considered to be in good condition overall based on the low level of exotic species recruitment. The area of HU798 recorded on the western boundary was less edge affected than that recorded closer to the existing quarry on the northern boundary. Species richness was below benchmark, potentially indicating some level of historic disturbance.
Justification of evidence used to identify a PCT	The observed vegetation community was determined to align with this PCT based on the close correlationof the floristics, in conjunction with the landscape position (gullies and lower slopes of the Central and Lower Hunter Valley).
Threatened ecological community	Commonwealth EPBC Act: Not listed NSW TSC Act: Not listed Justification: HU798 was assessed against the profile and final determination for the vulnerable ecological community (VEC) Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions. Close consideration of these documents determined that HU798 is not consistent based on the canopy and shrubstorey floristics. Furthermore, the study area is outside of the typical range of this community, which typically occurs further north on the carboniferous sediments of the Barrington footslopes.
Picture: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	

4.2.3 Site value scores

Plots and transect survey data was entered into the BioBanking credit calculator to determine site value scores. Plot and transect survey data is presented in 2. Current site value for each vegetation zone is outlined in Table 12.

Table 12 Site value scores for all Vegetation Zones.

Vegetation zone	Plant community type	Area (ha)	Site score
01	HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	17.1	69.27
02	HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	25.9	69.27
03	HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064)	0.67	84.67
04	HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	1.12	68.23
05	HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	1.67	81.33
06	HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)	2.16	55.90

4.3 Threatened Ecological Communities

Two endangered ecological communities (EECs) listed under the TSC Act have been identified within the study area, including:

- . Swamp Sclerophyll Forest On Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (0.67 hectares).
- Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions (1.67 hectares).

Justification for the determination of these EECS is provided in Table 8 and Table 10 respectively.

P2
P3
P17
P18
P1
P16
P15
P7
P6
P14
P19
P4
P13
P9
P12
P11
P8
P5
P10

Acknowledgements: Imagery (c) Nearmap 2014

nearmap

Legend

- Study area
- Project area
- Flora plot and transect

Plant Community Types

- VZ1 - HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)
- VZ2 - HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)
- VZ3 - HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)
- VZ4 - HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)
- VZ5 - HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)
- VZ6 - HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)
- Cleared
- Water

Figure 3: Vegetation Zones and BioBanking Plots/Transects

0 50 100 150 200 250

Metres
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 23069
Date: 29 September 2016,
Checked by: EC, Drawn by: JMS/ANP, Last edited by: ngarvey
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5 Threatened species

5.1 Methods

Initial flora and fauna assessments of the study area were undertaken in winter from the 11 to 15 August 2014 and in spring on the 13 and 14 November 2014. Weather observation for each survey data are shown in Table 13.

Table 13 Weather observations during flora and fauna surveys (Williamtown RAAF)

Survey date	Temperature (°C)		Rain (mm)
	Minimum	Maximum	
11 August 2014	4.6	15.3	0.2
12 August 2014	4.1	16.1	0
13 August 2014	8.8	17.2	0
14 August 2014	3.4	18.0	0
15 August 2014	6.3	18.5	0
13 November 2014	12.9	27.0	0
14 November 2014	14.9	40.1	0

5.1.1 Targeted threatened flora survey

Flora surveys have included a variety of survey techniques, including 20 x 20 metre quadrats, BioBanking plots/transect surveys, spot locations and random meanders. Flora survey effort is shown in Figure 4.

The method for undertaking 20 x 20 metre quadrats and plots/transect surveys is outlined in Section 4.1.1. In addition, the site was traversed by random meander and included 14 person days across the entire study area.

5.1.2 Targeted threatened fauna survey

A habitat-based fauna assessment of the study area was undertaken in winter from the 11 to 15 August 2014, with an additional fauna assessment undertaken in spring on the 13 and 14 November 2014 , to determine its values for fauna. These values were determined primarily on the basis of the types and qualities of habitat(s) present. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. Particular attention was given to searching for threatened species and their habitats. Fauna species were recorded with a view to characterising the values of the study area.

Targeted surveys for fauna were undertaken in both August and November 2014, and included a wide variety of survey techniques consistent with the BBAM and the draft NSW *Threatened Biodiversity Survey and Assessment Guidelines* (DECC 2004). Targeted surveys included survey within and adjacent to the study area to provide a context for any identified local populations given connectivity with larger areas of vegetation. Targeted survey methods and survey effort are outlined in Table 14, with survey locations shown in Figure 4.

Given a known Koala population occurs in the locality and individuals and scats were located during the winter and spring survey periods, a targeted Koala habitat assessment and survey was undertaken in

accordance with the *EPBC Act Referral Guidelines for the vulnerable koala* (DoE 2014) using the Spot Assessment technique (SAT [Phillips and Callaghan 2011]). This assessment report is provided in Appendix 8.

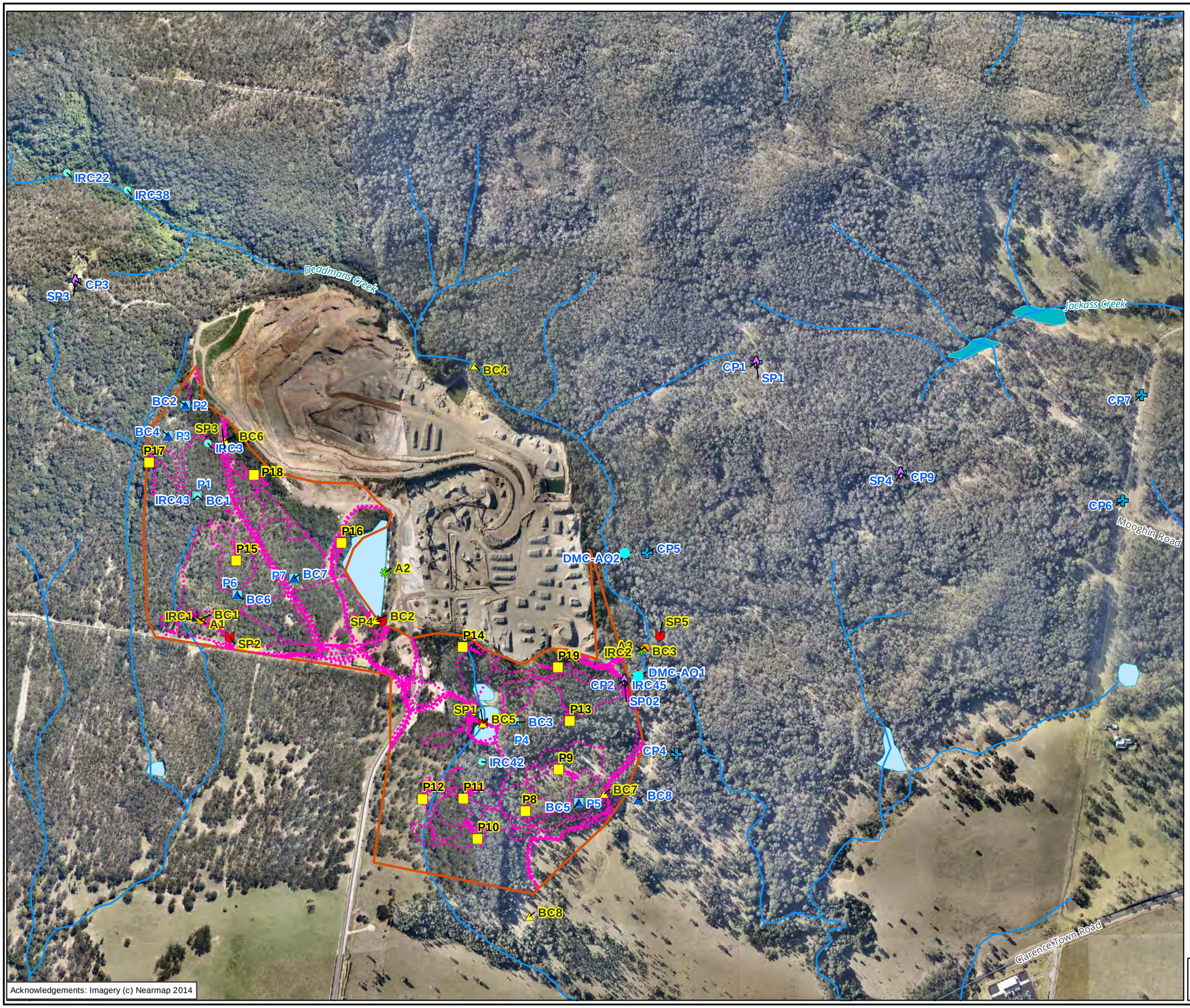
Terrestrial fauna records will be submitted to OEH for incorporation into the NSW BioNet Wildlife Atlas and aquatic fauna records will be submitted to NSW DPI Fisheries.

Table 14 Summary of fauna survey effort.

Survey method	Target species	Description of survey methodology	Date	Survey effort
Elliot trapping	Brush-tailed Phascogale, Eastern Chestnut Mouse, Eastern Pygmy-possum, Common Planigale	A total of 25 small Elliot traps were placed approximately 10 metres apart along each of three transects, resulting in a total of 300 trap nights (75 traps x four nights). Elliot traps were baited with a mixture of peanut butter, rolled oats and honey.	11 to 15 August 2014	4 nights
Motion-triggered cameras	Brush-tailed Phascogale, Eastern Chestnut Mouse, Eastern Pygmy-possum, Common Planigale	A total of six cameras were deployed for four nights during winter surveys (at each end of three Elliot trapping transects). A total of three cameras were deployed for two nights at various locations within the study area adjacent to dams (two cameras) and ephemeral drainage lines (1 camera). Cameras were baited with chicken carcasses.	11 to 15 August 2014	4 nights
Diurnal bird surveys	Red-backed Button-quail, Regent Honeyeater	A total of eight locations were surveyed in winter and eight locations (four of which were surveyed on two separate days) were surveyed in spring. Each diurnal bird survey was conducted for 0.5 hours by one ecologist. All birds seen and/or heard were recorded.	11 to 15 August 2014 and 12 to 14 November 2014	8 days
Nocturnal fauna surveys	Green and Golden Bell Frog, Barking Owl, Sooty Owl, Masked Owl, Powerful Owl, Bush Stone-curlew, Squirrel Glider, Yellow-bellied Glider, Koala, Spotted-tailed Quoll	Nocturnal fauna surveys consisted of spotlight transects and call playback. Spotlight searches for nocturnal amphibians, reptiles, birds and mammals were carried out along a total of three transects (surveyed from a moving vehicle) and at nine points (surveyed on foot). Spotlighting was undertaken by two ecologists using powerful (maximum 700 lumen) focused-beam hand-held torches. Call playback was employed at a total of 14 separate locations. Call playback involved playing of recorded calls of target threatened fauna species over a period of five minutes through a 10 watt minimum output megaphone. The broadcasting of calls was followed by a five minute listening period. Spotlighting was conducted following the final listening period.	12 and 13 August 2014 and 12 and 13 November 2014	6 nights
Ultrasonic call recording	Microbat species	Calls recorded were then analysed by a qualified and experienced ecologist, using appropriate software and call reference libraries.	12 and 13 November 2014	2 nights

Survey method	Target species	Description of survey methodology	Date	Survey effort
Targeted Koala Surveys	Koala	Surveys were conducted by one ecologist with two field assistants for a maximum of eight hours per day. Points were selected systematically by overlaying a 200 metre interval grid over an aerial image of the study area. The intercept points of the grid were selected as potential survey sites. Potential survey points were discarded if they occurred in cleared land or within the quarry workings. A total of 29 points were surveyed. At each survey point searches for Koala scats within 1 metre of the trunk were undertaken of a central tree and the closest 29 surrounding trees with a diameter at breast height (DBH) for a maximum of two minutes. Each survey site was given a score based on the presence/absence of Koala scats at each tree. A map was then generated using this data showing relative levels of Koala activity as "High", "Medium" and "Low". In addition to scat searches, the central tree and all trees within a 25 metre radius (providing a total search area of 0.125 hectares) were surveyed for individual Koalas for a maximum of 5 minutes. The results of the Koala searches were used to determine a Koala population density estimate for the study area. The timing of the surveys was considered appropriate for detecting both Koalas and signs of Koala activity, as stipulated in the EPBC Act Referral Guidelines for the vulnerable koala (DoE 2014). The targeted survey was guided by key documents: • EPBC Act Referral Guidelines for the vulnerable koala (DoE 2014). • The Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus (Phillips and Callaghan 2011). • DRAFT NSW Threatened Biodiversity Survey and Assessment Guidelines (DEC 2004).	9 to 11 December 2014.	3 days

Survey method	Target species	Description of survey methodology	Date	Survey effort
Hollow-bearing tree and fallen log assessment	Pale-headed Snake	The relative abundance of hollow-bearing trees and fallen logs was obtained from within a total of 19 representative 20 x 50 metre plots across the study area using the BioBanking methodology. This methodology counts the total number of hollow-bearing trees within the plot, where hollows were visible from the ground. Fallen logs were recorded as the total length of logs ≥ 10 centimetre diameter within the plot. Active searching under rocks and logs and in hollows was undertaken to determine if any species were using these habitats.	11 to 15 August 2014 and 13 to 14 November 2014	7 days



Legend

Study area

Flora survey effort

Random meanders

Winter flora survey effort

Flora plot and transect

Spring flora survey effort

Flora plot and transect

Fauna survey effort

Winter fauna survey effort

- Bird Census
- Call Playback
- IR Camera
- Spotlight Point

Spring fauna survey effort

- Anabat
- Bird Census
- IR Camera
- Spotlight Point

Aquatic survey effort

Aquatic survey locations

Figure 4: Flora and fauna survey effort

0 80 160 240 320 400

Metres
Scale: 1:8,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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5.2 Geographic /habitat features

An assessment of the occurrence of geographic habitat features, in accordance with Section 6.3 of the BBAM (OEH 2014a), was undertaken along with a determination of whether impacts to these habitat features will result from the proposed development. The species generated by the calculator, along with the results of this assessment, are outlined in Table 15.

Table 15 Assessment of geographic habitat features within the study area.

Common name	Scientific name	Geographic feature present in study area	Feature	Justification
Green and Golden Bell Frog	*Litoria aurea*	Yes	land within 100 m of emergent aquatic or riparian vegetation	Suitable habitat present. Several permanent dams and Deadmans Creek support emergent and/or riparian vegetation.
Large-eared Pied Bat	*Chalinolobus dwyeri*	No	land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels	The study area does not support cliffs, caves, deep crevices or mine shafts suitable as roosting habitat for the Large-eared Pied Bat. The species was not recorded during targeted surveys in spring.
Heath Wrinklewort	*Rutidosis heterogama*	No	heath on sandy soils, or moist areas in open forest	The study area does not support heath on sandy soils or most areas in open forest.
Pale-headed Snake	*Hoplocephalus bitorquatus*	Yes	land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber	Suitable habitat present. Riparian areas along Deadmans Creek to the east of the study area support hollow-bearing trees, loose bark and fallen timber.
Comb-crested Jacana	*Irediparra gallinacea*	No	land within 40 m of permanent wetlands with a good surface cover of floating vegetation	Although permanent waterbodies are present, these settling ponds do not support a good surface cover of floating vegetation.
Black Bittern	*Ixobrychus flavicollis*	No	land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation or emergent aquatic vegetation	The study area does not support permanent wetlands with dense emergent aquatic vegetation
Charmhaven Apple	*Angophora inopina*	No	land within 5 km of Wallaroo Nature Reserve in Upper Hunter CM	The study area is not located within 5km of Wallaroo Nature Reserve in Upper Hunter CMA. Not historically recorded within 5 kilometres of the study area.

5.3 Ecosystem credit species

A list of ecosystem credit species predicted to occur within the study area, based on the PCTs present and generated by the calculator associated with the BBAM (OEH 2014a), along with an assessment of whether they occur within the study area is provided in Table 16. The potential for these species to occur within the study area was assessed in accordance with Section 6.3 of the BBAM (OEH 2014a).

Table 16 Assessment of ecosystem credit species within the study area.

Scientific Name	Common Name	TS offset multiplier	Habitat on site
Ninox connivens	Barking Owl	3	Yes
Melithreptus gularis* subsp. *gularis	Black-chinned Honeyeater (eastern subspecies)	1.3	Yes
Climacteris picumnus subsp. victoriae	Brown Treecreeper (eastern subspecies)	2	Yes
Stagonopleura guttata	Diamond Firetail	1.3	Yes
Falsistrellus tasmaniensis	Eastern False Pipistrelle	2.2	Yes
Mormopterus norfolkensis	Eastern Freetail-bat	2.2	Yes
Petroica phoenicea	Flame Robin	1.3	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo	2	Yes
Calyptorhynchus lathami	Glossy Black-Cockatoo	1.8	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	2.2	Yes
Pomatostomus temporalis* subsp. *temporalis	Grey-crowned Babbler (eastern subspecies)	1.3	Yes
Melanodryas cucullata* subsp. *cucullata	Hooded Robin (south-eastern form)	1.7	Yes
Hieraaetus morphnoides	Little Eagle	1.4	Yes
Glossopsitta pusilla	Little Lorikeet	1.8	Yes
Tyto novaehollandiae	Masked Owl	3	Yes
Ninox strenua	Powerful Owl	3	Yes
Ptilinopus regina	Rose-crowned Fruit-dove	1.3	Yes
Petroica boodang	Scarlet Robin	1.3	Yes
Tyto tenebricosa	Sooty Owl	3	Yes
Chthonicola sagittata	Speckled Warbler	2.6	Yes
Dasyurus maculatus	Spotted-tailed Quoll	2.6	Yes
Petaurus norfolcensis	Squirrel Glider	2.2	Yes
Lathamus discolor	Swift Parrot	1.3	Yes

Scientific Name	Common Name	TS offset multiplier	Habitat on site
Neophema pulchella	Turquoise Parrot	1.8	Yes
Daphoenositta chrysoptera	Varied Sittella	1.3	Yes
Petaurus australis	Yellow-bellied Glider	2.3	Yes
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	2.2	Yes

The TS offset multiplier (or Tg value) for ecosystem credit species represents the ability of these species to respond to improvements in site or habitat values. Based on this assessment, all of the predicted ecosystem credit species are considered to have at least one habitat feature present within the study area, therefore the TS offset multipliers for each vegetation zone remain unchanged.

5.4 Species credit species

5.4.1 Flora species

A list of species credit species (flora) predicted to occur within the study area, based on the PCTs present, along with an assessment of whether the study area provides suitable habitat and whether the species will be impacted by the development is provided in Table 17. The potential for a species to occur within the study area was assessed in accordance with Section 6.5 of the NSW BBAM (OEH2014a).

A number of flora species were identified as candidate species for further assessment, in accordance with Section 6.5 of the NSW BBAM (OEH2014a). Targeted surveys for these species carried out as outlined in Section 5.1 did not record any threatened flora species within the study area.

Table 17 Species credit species (flora) and status within the study area

Common name	Scientific name	Habitat present in the study area	Justification	Recorded during targeted surveys	Impacted by development
Black-eyed Susan	*Tetratheca juncea*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Netted Bottle Brush	*Callistemon linearifolius*	No	Typically occurs in dry sclerophyll shrubby forest on sandstone. This associated vegetation was not present within the study area.	N/A	No
Slaty Red Gum	*Eucalyptus glaucina*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
White-flowered Wax Plant	*Cynanchum elegans*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No

5.4.2 Fauna species

A list of species credit species (fauna) predicted to occur within the study area, based on the PCTs present, along with an assessment of whether the study area provides suitable habitat and whether the species will be impacted by the development is provided in Table 18. The potential for a species to occur within the study area was assessed in accordance with Section 6.5 of the BBAM (OEH 2014a).

A number of fauna species were identified as candidate species for further assessment, in accordance with Section 6.5 of the NSW BBAM (OEH 2014a). Targeted surveys for these species recorded the presence of Koala within the study area (refer to Appendix 8).

Table 18 Species credit species (fauna) and status within the study area.

Common name	Scientific name	Habitat present in the study area	Justification	Recorded during targeted surveys	Impacted by development
Brush-tailed Phascogale	*Phascogale tapoatafa*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Eastern Chestnut Mouse	*Pseudomys gracilicaudatus*	No	Suitable habitat in the form of heathlands, wet heath or swamps, does not occur within the study area.	N/A	No
Eastern Pygmy-possum	*Cercartetus nanus*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Golden Tipped Bat	*Kerivoula papuensis*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Green and Golden Bell Frog	*Litoria aurea*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Koala	*Phascolarctos cinereus*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	Yes	Yes
Pale-headed Snake	*Hoplocephalus bitorquatus*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No
Red-backed Button-quail	*Turnix maculosus*	No	Suitable habitat in the form of grasslands or grassy woodlands with an open ground layer near waterare not present in the study area.	N/A	No
Regent Honeyeater	*Anthochaera phrygia*	Yes	Species not recorded during targeted survey in accordance with Section 6.6 of BBAM (OEH 2014a). No further assessment required.	No	No

5.4.3 Species polygon

The Koala was recorded within the study area during targeted surveys (see Appendix 8) and will be impacted by the Project. A species polygon was created in accordance with Section 6.5.1.19 of BBAM (OEH 2014a).

The Koala species polygon was determined using a combination of the Threatened Species Profile Database (TSPD) and targeted Koala survey results. Any PCTs where the Koala is predicted to occur by the TSPD, or any PCTs where more than 15 percent of the trees at any SAT location are considered Koala feed trees under State Environmental Planning Policy 44 – Koalas and Koala habitat (SEPP) or Port Stephens Council (2002) were mapped as Koala habitat.

The Koala species polygon is shown in Figure 5 and totals 45.8 hectares. This area was used to determine species credit requirements.

5.5 Aquatic habitat and threatened species

5.5.1 Aquatic survey methods

An aquatic habitat assessment (including *in situ* water quality measurement) was undertaken at two sites located along Deadmans Creek, adjacent to and downstream from the study area (Figure 4). The details of each site surveyed and the methods utilised are outlined below and shown in Table 19.

Water Quality Assessments

Water quality sampling was undertaken at two locations adjacent to the study area, one at the upstream extent and one immediately adjacent to the study area. The sampling site locations are outlined in Table 19. Sampling was carried out using a Horiba Multiparameter Water Probe, calibrated prior to sampling. Where possible, measurements were taken between 15 to 30 centimetres below the surface. Variables measured within Deadmans Creek included; pH, dissolved oxygen (DO), temperature, turbidity and electrical conductivity (EC). Water quality sampling provides an insight into current baseline conditions of aquatic habitats and assists in determining the suitability of habitats for fish and other aquatic biota.

Table 19 Water quality site codes and locations

Site Code	Location (decimal degrees)	Site Description
DMC-AQ1	-32.663236, 151.694585	Deadmans Creek at the upstream extent of the study area.
DMC-AQ2	-32.660686, 151.694286	Deadmans Creek alongside the study area.

Stream Order

The Strahler (1957) method was used to determine the stream order of Deadmans Creek flowing adjacent to the study area. The Maitland topographic map 1:25,000 (second edition 9232-4-S) was referred to when calculating stream order using the Strahler method.

HABSCORE

A HABSCORE assessment was completed at Deadmans Creek to provide a measure of the relative health of aquatic habitat. Barbour et al. (1999) describes HABSCORE as a 'visually based habitat assessment that

evaluates the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community'.

HABSCORE assessments utilise visually based habitat characteristics to classify the quality of the water resource and the condition of the resident aquatic community. HABSCORE's range from Poor to Optimal condition and reflect the current category condition of the water resource. Categories are derived from the sum of scores divided by the sum of the characters assessed. This provides an ecological indicator that produces information on the water resources available.

HABSCORE assessments are based on the presence and condition of the following features:

- Pool substrate characterisation.
- Pool variability.
- Channel flow status.
- Bank vegetation (score for each bank).
- Bank stability (score for each bank).
- Width of riparian zone (score for each bank).
- Epifaunal substrate / available cover.

The aquatic habitat within the study area was described in terms of four category types (Fairfull and Witheridge 2003, Barbour et al. 1999). The four categories used to evaluate habitat value were Optimal, Suboptimal, Marginal or Poor, as detailed below:

Optimal: watercourses that contain numerous large, permanent pools and generally have flow connectivity except during prolonged drought. They provide extensive and diverse aquatic habitat for aquatic flora and fauna;

Suboptimal: watercourses that contain some larger permanent and semi-permanent refuge pools, which would persist through prolonged drought although, become greatly reduced in extent. These watercourses should support a relatively diverse array of aquatic biota including some fish, freshwater crayfish and aquatic macroinvertebrates. There may also be some aquatic plant species present;

Marginal: watercourses that contain some small semi-permanent refuge pools which are unlikely to persist through prolonged drought. Flow connectivity would only occur during and following significant rainfall. These pools may provide habitat for some aquatic species including aquatic macroinvertebrates and freshwater crayfish; and,

Poor: water courses or drainages that only flow during and immediately after significant rainfall. Permanent or semi-permanent pools that could provide refuge for aquatic biota during prolonged dry weather are absent.

General observations were also recorded, including water characteristics such as flow rates and colour, the presence of spawning areas (e.g. gravel beds, riparian vegetation, snags), refugia (e.g. deep pools) and presence of natural or artificial barriers to fish passage and the type of existing waterway crossing (roads/culverts) if present.

5.5.2 Aquatic results

Site description

Deadmans Creek is ephemeral in nature and measured approximately two metres in width from bank to bank and 25 centimetres in depth from top of bank at the sampling locations adjacent to the study area. The creek was also assessed approximately 1.5 kilometres upstream of the study area but was found to be dry. The channel contained little in the way of true macrophytes; however large tussocks of Spiny-headed Mat-rush were recorded along the banks and in the channel. The substrate was predominantly sandy with a small amount of gravel and pebble material throughout. Some larger pools were scattered along the creek, however the channel was predominantly shallow with little flow at the time of survey. The riparian vegetation was dense in all strata, with an overstorey per cent foliage cover of approximately 60 per cent. Native Blackthorn formed a dense shrub stratum, with some large infestations of Lantana throughout the riparian corridor. Seasoned snags were uncommon; however, there were some leaf packs and smaller woody debris recorded. Undercut banks and overhanging vegetation provide sheltering habitat for fish, along the majority of the wetted creek.

Plate 4 DMC-AQ1 facing downstream

Plate 5 DMC AQ2 facing upstream

Fish habitat

The aquatic assessment focused on Deadmans Creek, a third order tributary (Strahler 1957) of Williams Creek which flows south to its confluence with the Hunter river approximately 10 kilometres south of the study area. Deadmans Creek is considered to provide Key Fish Habitat as defined by the NSW DPI (2014b) and is classified as a Class 3 minimal fish habitat, being a third order creek sustaining ephemeral flow and semi - permanent pools providing habitat for aquatic species (Fairfull and Witheridge 2003).

Aquatic fauna

Given that the survey effort focused on a habitat-based aquatic assessment, with no targeted surveys, aquatic fauna encounters were limited to incidental observations. As such, no aquatic fauna was recorded during the field survey. However, the survey resulted in general observations on the availability of limited habitat for aquatic fauna. Some shelter and nursery habitat was found to be available in the surveyed reach; however this is considered to be of limited value given the ephemeral nature of the creek. At the time of the spring survey, Deadmans Creek was found to be dry. Further, there were no disconnected pools to provide fish habitat during these drier months.

There are no FM Act listed threatened fish species previously recorded or are predicted to occur within the study area, therefore, a targeted aquatic habitat assessment was not required or undertaken. Instead, a more general habitat assessment was completed to determine any particular aquatic constraints and condition of Deadmans Creek as well as the manmade storage and settlement dams. It is important to note that Deadmans Creek falls outside the expansion area and flow impacts on the stream were already assessed in an aquatic ecological impacts and mitigation advice.

HABSCORE

The habitat features at both the upstream and downstream sampling locations are considered to be Optimal as assessed using the HABSCORE habitat assessment methodology (Barbour et al. 1999). The summary of results for the HABSCORE analysis is shown in Table 20.

Table 20 HABSCORE results for the surveyed reach

Characteristic	Score	
	DMC-AQ1	DMC-AQ2
Low Gradient		
Pool substrate characterisation	17	17
Pool variability	16	12
High and Low Gradient		
Channel Flow Status	16	14
Bank vegetation – Left	9	9
Bank vegetation – Right	8	8
Bank Stability – Left	9	9
Bank Stability - Right	9	9
Width of riparian zone – Left	10	10
Width of riparian zone - Right	9	8
Epifaunal substrate / available cover	17	15
HABSCORE Result	86%	79%
Rating	Optimal	Optimal

1 < 25 – Poor, 26 to 50 – Marginal, 51 to 75 – Suboptimal, >76 – Optimal

High scores were recorded for the majority of parameters at both sampling locations. The riparian vegetation score was high due to the presence of relatively undisturbed remnant bush land to the east of Deadmans Creek (left bank). The banks were generally well vegetated with few areas of bare ground. These well vegetated banks were generally stable with a looser sand substrate causing instability in some areas, particularly where erosion was evident. The pool variability score was lower at DMC-AQ2 where the reach was characterised by shallower sections of slow flow. The presence of some snags and leaf litter in conjunction with some overhanging riparian vegetation provides habitat for epifauna. The pool substrate composition was also generally high owing to the good mix of substrate sizes and the presence of cobble, pebble and gravels at both sites.

Water Quality

The physio-chemical water quality results for this survey are detailed in Table 21. The water quality data is compared with guideline values including ANZECC guidelines for the Protection of Aquatic Ecosystems (ANZECC 2000).

The weather during the survey was seasonally warm and sunny with cool water temperature of around 11 degrees. Oxygenation, turbidity and electrical conductivity levels were found to be within the ANZECC guidelines for lowland rivers. The pH values were within ANZECC guidelines for DMC-AQ1 but very slightly higher for DMC-AQ2.

Table 21 ANZECC guidelines and water quality data for the two assessment sites

Parameter	ANZECC Guideline	DMC-AQ1	DMC-AQ2
Temp (°C)	-	11.15	10.96
pH	6.5 – 8	7.97	8.06
Conductivity (mS/cm)	0.125-2.2	0.897	1.03
D.O. (ppm)	-	11.65	10.17
Saturation (%)	85– 110	109.6	95.2
Turbidity (NTU)	6 – 50	15.9	7.4

The water quality parameters measured provide a snapshot of conditions at a given point in time. Some of these parameters typically exhibit a high degree of temporal variation and can change substantially over small periods of time such as weeks, days and even hours, particularly in response to significant rainfall events. A second replicate of both the water chemistry data and HABSCORE was due to be collected during the spring survey effort; however Deadmans Creek was found to be dry along the entire length of the study area. It is likely that this was due to environmental factors as rainfall was below average for September, October and November.

Stage 2 – Impact assessment (biodiversity values)

6 Impact assessment (biodiversity values)

This section identifies the potential impacts of proposed development on the ecological values of the study area and includes recommendations to assist Hanson to design and construct a development that minimises impacts on biodiversity within and surrounding the study area.

This impact assessment is based on clearing of native vegetation and fauna habitat. It includes an assessment of all potential impacts arising from the Project, during construction and ongoing operation.

6.1 Avoidance and minimisation

6.1.1 Recommendations to avoid, minimise and mitigate impacts

Hanson has endeavoured to avoid and minimise ecological impacts associated with the proposed Project. Hanson has assessed the feasibility of using alternative quarry material, sites, extraction boundaries, operating hours and operation, and has endeavoured to avoid or minimise Project impacts, whilst maximising the economic recovery associated with material extraction. Table 22 outlines the recommended measures to be implemented before, during and after construction to avoid, minimise and mitigate the impacts of the Project, including action, outcome, timing and responsibility.

Table 22 Recommendations to minimise ecological impacts

Ecological Values	Project Impacts	Recommendations / Mitigation Measures	Responsibility
Native vegetation clearance	Removal of 48.62 hectares of native vegetation.	• Biodiversity Management Plan (BMP) to be prepared to outline the clearance procedure. • Pre clearance surveys will be conducted prior to any vegetation clearance in areas of identified threatened species habitat to ensure that threatened species are not present prior to vegetation removal. • Vegetated boundaries of the Project area to be clearly fenced off and signposted to ensure no access from personnel or equipment. • Exclusion fencing to be discussed during all site inductions. • Exclusion fencing to be routinely checked by quarry personnel. • Exclusion fence footings to be free of stockpiles soils and vegetation to allow routine checks and to ensure that the boundary fence and adjoining vegetation e.g. root zones of trees to be retained does not get smothered with soil. • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8).	Environmental representative Project Ecologist
Impacts to Threatened Ecological Communities and threatened species habitat	• Removal of 0.67 hectares of Swamp Sclerophyll Forest. • Removal of 1.67 hectares of Hunter Lowland Redgum Forest. • Removal of 45.8 hectares of Koala habitat.	• BMP to be prepared to outline measures to avoid or mitigate impacts to EECs. • Pre clearance surveys will be conducted prior to any vegetation clearance to confirm presence/absence of EEC's prior to removal • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8).	Environmental representative Project Ecologist
Adjoining vegetation and waterways	Erosion and sedimentation	• Hanson to develop a strict erosion and sediment control plan for the expansion to ensure that erosion and sediment is contained on site. • Sediment fencing to be placed inside the exclusion fencing and routinely checked for sediment breeches and to ensure structural integrity is maintained through vegetation clearance activities.	Environmental representative

Ecological Values	Project Impacts	Recommendations / Mitigation Measures	Responsibility
Koala	Displacement, loss of habitat and fatality of Koalas during construction and operation.	• BMP to be prepared to outline the clearance procedure, protocols for Koala finds and incidents and include an educational brochure for all workers to review prior to working at BHQ. • Ecologist to undertake pre-clearance surveys immediately prior to the removal of any vegetation to give the clearance go ahead. • Ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on Koalas displaced or injured during clearing. • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8). • Fencing around remnant native vegetation. • Comply and enforce site speed limits. • Maintain general adherence to constructed site haul roads.	Environmental representative/Project Ecologist
Threatened fauna	Displacement, loss of habitat and fatality of threatened fauna during construction and operation.	• BMP to be prepared to outline the clearance procedure, protocols for threatened fauna finds and incidents and include an educational brochure for all workers to review prior to working at BHQ. • Ecologist to undertake pre-clearance surveys in accordance with the BMP immediately prior to the removal of any vegetation to give the clearance go ahead. • Ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on threatened fauna displaced or injured during clearing. • A Biodiversity Offset Strategy has been prepared to offset the residual impacts to biodiversity arising from the Project (Section 8).	Environmental representative/Project Ecologist
Pests and pathogens	Spread of noxious weeds due to soil disturbance and equipment movement. Spread of pathogens to adjoining native vegetation or fauna.	• Noxious weeds, including Fire weed and Pampas Grass recorded within vegetation clearance areas to be removed and management outlined in a BMP. These noxious weeds must be removed and appropriately disposed of in an appropriate waste facility as required by NSW DPI through the Port Stephens Council under the NW Act. • BMP to outline pathogen management controls associated with vehicle movements and vegetation clearance	Environmental representative

Ecological Values	Project Impacts	Recommendations / Mitigation Measures	Responsibility
In stream / aquatic habitat	Loss of, or alterations to, aquatic / in-stream habitat within and in the vicinity of the study area via hydrological change, deterioration in water quality, sedimentation and creation of threatened barriers to fish and other aquatic biota. Changes to aquatic fauna community structures due to alterations degradation/loss of riparian and in stream habitat.	• Within a relevant management plan, develop water management actions to prevent or mitigate the discharge of contaminated water arising from increased quarrying operations and manage potential water quality associated with new infrastructure. • Where possible, implement a minimum 30 metre buffer to Deadmans creek to the east of the study area. • Minimise the removal of native vegetation adjacent to waterbodies and watercourses. The existing dams to be developed would be excluded.	Environmental representative
Water quality downstream	Downstream impacts to the Hunter River.	• It is recommended for the appropriate plan for the site to include water quality management strategies in accordance with the ANZECC and ARMCANZ Guidelines (2000). • Water quality management strategies to cover management of water storage, dewatering and discharge of water to Deadmans Creek.	Environmental representative
Adjoining vegetation and fauna	24-hour operation causing noise, dust, vibration and lighting impact	• Lighting associated with night works to be directed away from adjoining vegetation. • Heavy vehicle/machinery use to be limited to standard hours of operation as per Project Approval conditions.	Environmental representative

The final Project footprint (impact area) is the entire study area, as shown in Figure 5.

6.1.2 Residual impacts

Following the implementation of the aforementioned mitigation measures, the residual impacts to biodiversity include:

- The removal of 48.62 hectares of native vegetation.
- The permanent removal of 1.67 hectares of HU812 – Forest Red Gum grassy open forest on floodplains of the lower Hunter (PCT 1598), equivalent to Hunter Lowland Redgum Forest EEC (TSC Act only).
- The permanent removal of 0.67 hectares of HN591- Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064), equivalent to Swamp Sclerophyll Forest on CoastalEEC (TSC Act).
- Removal of 45.8 hectares of Koala habitat.

6.2 Impact summary

6.2.1 Impact to Red Flag areas

This section identifies red flag areas in accordance with Section 9.2 of the NSW Biobanking Assessment Methodology (OEH 0214). Red flag areas are mapped in Figure 5.

Landscape features

The study area does not support any 4th, 5th or 6th order streams, estuarine areas, important wetlands, or state or regional biodiversity links.

Native vegetation

HN591- Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) and HU812 – Forest Red Gum grassy open forest on floodplains of the lower Hunter (PCT 1598) have been mapped within the study area. HU591 and HU812 are equivalent to Swamp Sclerophyll Forest on Coastal Floodplain Forest and Hunter Lowland Redgum Forest respectively and both TECs under the TSC Act. Furthermore these PCTs are estimated to be more than 70 per cent cleared within the Hunter/Central Rivers CMA and are therefore eligible for red flag status for both of these criteria.

No other areas were red flags, as they are not considered >EECs and are less than 70 per cent cleared.

Threatened species and populations

The study area does not support threatened species or populations that cannot withstand further loss, a threatened species not previously recorded in the IBRA subregion or critical habitat listed under Section 55 of the TSC Act.

6.2.2 Highly cleared vegetation types

The BBAM defined highly cleared vegetation types as any PCT that is more than 90 per cent cleared within the relevant major catchment area. All PCTs identified on site are less than 75 per cent cleared within Hunter/Central Rivers major catchment area, therefore the Project will not impact on any highly cleared vegetation types.

6.2.3 Impacts to Plant Community Types

This section provides an assessment of PCTs requiring offsets in accordance with Section 9.3 of the BBAM (OEH2014a). PCTs requiring offsets are mapped in Figure 5.

Six Management Zones (identical to the Vegetation Zones) have been delineated (Table 23), based on the PCT, condition and future land use.

Table 23 Impacts to Plant Community Types, including Management Zones

Management zone	Vegetation zone	Total area (ha)	Plant Community Type	Condition	Ancillary code
MZ01	1	17.1	HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)	Moderate/ Good	No ancillary code assigned
MZ02	2	25.9	HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)	Moderate/ Good	No ancillary code assigned
MZ03	3	0.67	HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)	Moderate/ Good	No ancillary code assigned
MZ04	4	1.12	HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)	Moderate/ Good	No ancillary code assigned
MZ05	5	1.67	HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)	Moderate/ Good	No ancillary code assigned
MZ06	6	2.16	HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584).	Moderate/ Good	No ancillary code assigned

All vegetation within the development site and associated management zones (Figure 5, Table 23) will be cleared, with all site attribute scores set to 0 to represent total loss.

6.2.4 Impacts to threatened species

This section provides an assessment of threatened species requiring offsets in accordance with Section 9.3 of the BBAM (OEH2014a).

Based on the outcomes of Section 5.4, offsets are required for loss of 45.8 hectares of known habitat for Koala. The quantum of credits is outlined in Section 7. No other threatened species were determined to require offsets.

6.2.5 Areas not requiring assessment

This section provides an assessment of those areas that do not require an offset in accordance with Section 9.4 of BBAM (OEH 2014a). These areas include the following:

- Cleared areas that have been subject to varying levels of disturbance.
- Water bodies are considered areas not requiring assessment.
- These areas are shown in Figure 5 and do not require further assessment.

Legend

- Project area
- Study area
- Areas not requiring assessment
- Red flag area

Vegetation requiring offsets

- VZ1 - HU814 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter (PCT 1600)
- VZ2 - HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter (PCT 1602)
- VZ3 - HU591 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin (PCT 1064)
- VZ4 - HU806 Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (PCT 1592)
- VZ5 - HU812 Forest Red Gum grassy open forest on floodplains of the Lower Hunter (PCT 1598)
- VZ6 - HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley (PCT 1584)

Species polygon

- Koala

Figure 5: Impact summary for the Project

0 50 100 150 200 250

Metres
Scale: 1:5,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

N

Matter: 18371
Date: 30 September 2016,
Checked by: EC, Drawn by: JMS/ANP, Last edited by: ngarvey
Location: P:\23000s\23069\Mapping\23069_F5_ImpactSummary_20160920

7 Biodiversity credits

This section provides a summary of biodiversity credits required to impact on the biodiversity values within the study area, following consideration of measures to avoid, minimise and mitigate impacts.

Table 24 provides a summary of ecosystem credits resulting from the proposed development while Table 25 provides a summary of species credits resulting from the proposed development. The full credit profile is provided in Appendix 7.

Table 24 Summary of ecosystem credits for all management zones

Vegetation Zone	PC type code	Plant community type name	Red flag	Management zone area (ha)	Loss in landscape value	Loss in site value score	EEC offset multiplier	Credits req for TS	TS with highest credit req	TS offset multiplier	Ecosystem credits required
VZ1	HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	No	17.1	22.40	69.27	1	984	Barking Owl	3	984
VZ2	HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	No	25.9	22.40	69.27	1	1491	Barking Owl	3	1491
VZ3	HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Yes	0.67	22.40	84.67	3	46	Sooty Owl	3	46
VZ4	HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	No	1.12	22.40	68.23	1	64	Barking Owl	3	64
VZ5	HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	Yes	1.67	22.40	81.33	3	111	Barking Owl	3	111
VZ6	HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	No	2.16	22.40	55.90	1	103	Barking Owl	3	103

Table 25 Summary of species credits for all management zones

Scientific name	Common name	Species polygon area (ha)	Red flag	TS offset multiplier	Species credits required
Phascolarctos cinereus	Koala	45.8	No	2.6	1191

8 Biodiversity Offset Strategy

8.1 Credit requirements

A total of 2799 ecosystem credits would be required to offset the impacts of the Project, as shown in Table 26.

Table 26 Ecosystem credits required to offset impacts of the Project

PC type code	Plant community type name	Management zone area (ha)	Ecosystem credits required
HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	17.1	984
HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	25.9	1491
HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	0.67	46
HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	1.12	64
HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	1.67	111
HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	2.16	103
TOTAL			**2799**

A total of 1191 Koala species credits would be required to offset the impacts of the Project, as shown in Table 27.

Table 27 Species credits required to offset impacts of the Project

Common name	Scientific name	Extent of impact (individuals)	Species credits required
Koala	*Phascolarctos cinereus*	45.8	1191
TOTAL			**1191**

8.2 Offset strategy

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the required biodiversity credits. In line with the Secretary's Environmental Assessment Requirements issued on 11 November 2014 the Project is being assessed under the *NSW OEH interim policy on assessing and offsetting biodiversity impacts, State significant development (SSD) and State significant infrastructure (SSI) projects* (OEH 2011). Using these criteria credits are available for all PCTs within the study area. Credit requirements and proposed offset options are shown in Table 28. This includes an assessment of which tier of the OEH (2011) policy is being met.

Table 28 Required biodiversity credits and proposed offset options

Credit requirements				Offset options			
Ecosystem credits							
PCT code	**PCT name**	**Red flag?**	**Credits required**	**PCT code**	**PCT name**	**Credits available**	**Tier**
HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	No	984	HU802	Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	160	1
				HU815	Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter	55	1
				HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	769	1
HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	No	1491	HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	46	1
				HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	15	1
				HU815	Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter	295	1
				HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	1135	1

Credit requirements				Offset options			
HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Yes	46	NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	46	3
HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	No	64	HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804)	64	1
HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	Yes	111	NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	45	3
				NR254	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	66	3
HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	No	103	HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	103	1
Species credits							
Koala		No	1191	Koala		1191	1

Where possible, credits have been provided to meet Tier 1 (improve or maintain) outcome outlined in the interim policy (OEH 2011). This was achieved by providing credits as per the offset options outlined in the BioBanking credit report (Appendix 7). The offset strategy will fulfil the Tier 1 requirements for four of the six PCTs recorded within the study area.

Due to the presence of two EECs with a site value score of more than 34 (red flags) within the study area Tier 1 offsets could not be provided for HU591 and HU812. For these communities Tier 2 (no net loss) offsets were investigated. However, no offsets that meet the offset options outlined in the BioBanking credit report (Appendix 7) were found to be available. For these two PCTs variation criteria A, as outlined in the interim policy (OEH 2011) was applied to achieve a Tier 3 (mitigated net loss) outcome. Credits from the same vegetation formation and the same IBRA region were investigated. Both PCTs are part of the Forested Wetlands vegetation formation, and the study area is located within the NSW North Coast IBRA region. Preliminary offset investigations have identified available credits which satisfy the Project's offsetting requirements.

Koala credits will be purchased, fulfilling a Tier 1 outcome. This will ensure any offsets for the Koala fulfil the direct offset requirements of the EPBC Act Environmental Offsets Policy (DSEWPaC 2012)

Therefore, the variation rules do not apply.

All credit requirements can be fulfilled by purchasing and retiring credits. Upon approval Hanson proposes to fulfil its credit obligations.

9 Assessment of biodiversity legislation

9.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the impacts of the proposed development on Matters of NES, against heads of consideration outlined in Matters of National Environmental Significance - Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (DoE 2013), was prepared to determine whether referral of the Project to the Commonwealth Minister for the Environment is required. Matters of NES relevant to the Project are summarised in Table 29.

Table 29 Assessment of the Project against the EPBC Act.

Matter of NES	Project specifics	Potential for significant impact
Threatened species (flora and fauna)	Background research indicates that 15 flora species and 17 fauna species have been recorded or are predicted to occur in the locality. An assessment of the likelihood of these species occurring in the study area is provided in Appendix 5; Table 35 (flora) and Table 36 (fauna). This assessment determined that two flora species and three fauna had a moderate likelihood of occurrence in the study area, with one additional fauna species having a high likelihood of occurrence in the study area. The Koala was considered to have a high likelihood to occur and was recorded within the study area. The rest of these species are not considered to have a medium or high likelihood of occurrence within the study area.	The following threatened biota are considered to have the potential to occur within the study area: • Small-flower Grevillea • Tall Knotweed • Regent Honeyeater • Spotted-tailed Quoll • Swift Parrot • Grey-headed Flying-fox SIC assessments were prepared for these species (Appendix 6). These assessments determined that a significant impact was unlikely to result from the Project. The Koala was recorded within the study area and a SIC assessment was prepared (Appendix 6). This assessment concluded a significant impact was likely; hence an EPBC Referral has been prepared and submitted to DoEE and the project has been declared a controlled action. In accordance with the EPBC Act Offsets Policy (DSEWPaC 2012), offsets will be provided for this species. Credits are not required for any other species as the project will not result in a significant impact.
Threatened ecological communities	No EPBC Act EECs were recorded within the study area.	N/A
Migratory species	Thirty-one migratory species have been recorded or are predicted to occur in the locality (Table 37).	While some of these species would be expected to use the study area on occasion, some may do so regularly and others may be resident, the study area does not provide important habitat for an

Matter of NES	Project specifics	Potential for significant impact
		ecologically significant proportion of any of these species.
Wetlands of international importance (Ramsar sites)	There are 12 Ramsar sites in NSW, the closest to the study area being the Hunter Estuary Wetlands within the estuary at the mouth of the Hunter River.	The study area is located approximately 18 kilometres northwest of this Ramsar site and Deadmans Creek is a tributary of the Hunter River. However, as an ephemeral creek line, it is considered unlikely that the Project will have any direct impacts on this Ramsar Site. Deadmans Creek is also considered to provide only a minor contribution of flow into this Ramsar Site.

On the basis of potential for significant impacts on the Koala, the EPBC Act is triggered and referral of the proposed action to the Australian Government Minister for the Environment has been undertaken. The Project has been deemed a controlled action and is currently being assessed by DoEE.

9.2 Fisheries Management Act 1994

Based on the proposed impact area, and the lack of impact on waterways, no FM Act KTPS were considered to be relevant to the Project.

9.3 Noxious Weeds Act 1993

Exotic species were recorded across the entire study area and were particularly abundant at the southern extent. Two weeds listed as noxious within the Port Stephens LGA were recorded, the class and legal requirements of which are outlined in Table 30. Treatment for the noxious weeds listed above is recommended within NSW DPI (2011).

Table 30 Noxious weeds recorded within the study area.

Common Name	Scientific Name	Class	Legal Requirement
Pampas grass	*Cortaderia species*	3	*The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed*
Fireweed	*Senecio madagascariensis*	4	*The plant must not be sold, propagated or knowingly distributed*

10 Conclusion

This assessment has been completed in accordance with the BBAM (OEH 2014a) on behalf of Hanson.

The biodiversity assessment report of the BHQ SSD Project found that a total of 48.62 hectares native vegetation, comprising six PCTs and two EECs, and associated ecological values are likely to be impacted as result of the Project. The Project will result in impacts to 45.8 hectares of Koala habitat. In addition, the Project area falls close to one of the creek meanders of Deadmans Creek outside the study area, which ultimately joins with the Hunter River. Ecological values of the study area are outlined in Section 4.2, 5.3, 5.4, and 5.5.

The primary measure for the development to minimise impacts to ecological values outlined above is to avoid, where possible, any impact to surrounding adjoining vegetation and offset remaining residual impacts. Residual impacts, following implementation of recommendations to avoid and minimise impact are outlined in Section 6.1.

Impacts are summarised in Section 6.2. Ecosystem credits for all PCTs and species credits for the Koala will be required to offset the residual impacts of the Project. The impacts to native vegetation and species habitat will require retirement of 2799 ecosystem credits across six PCTs, and 1191 Koala credits, as summarised in Table 31.

Table 31 Summary of ecosystem credits requirements

PCT code	Plant community type name	Ecosystem credits required
HU814	Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	984
HU816	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	1491
HU591	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	46
HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	64
HU812	Forest Red Gum grassy open forest on floodplains of the lower Hunter	111
HU798	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	103
Koala	Koala	1191

A Biodiversity Offset Strategy has been prepared and is presented in Section 8. Hanson propose to meet their credit requirements by purchasing and retiring credits under the NSW BioBanking scheme. Upon approval Hanson proposes to fulfil its credit obligations.

An assessment of the Project against the requirements of key biodiversity legislation concluded that the Project will result in a significant impact to the Koala. Since the project has been deemed a controlled action under the EPBC Act, the project will require approval from the Commonwealth Department of Environment and Energy.

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Appendices

Appendix 1 Survey methods

A1.1 Nomenclature

The flora taxonomy (classification) used in this report follows the most recent Flora of NSW (Harden 1990, Harden 1991, Harden 1992, Harden 1993, Harden 2002). All doubtful species names were verified with the on-line Australian Plant Name Index (Australian National Botanic Gardens 2007). Flora species, including threatened species and introduced flora species, are referred to by both their common and then scientific names when first mentioned. Subsequent references to flora species cite the common names only, unless there is no common name, for which scientific name will be used. Common names, where available, have been included in threatened species tables and the complete flora list in Appendix 3.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the Commonwealth Department of Environment (DoE) (DEWHA 2009a). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only.

A1.2 Permits and lisences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by the Office of Environment and Heritage under the National Parks and Wildlife Act 1974 (SL100758, expiry date 31 March 2017). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2017). The BioBanking Assessment was carried out by Accredited BioBanking Assessor Nathan Garvey (No. 0103).

Aquatic fauna survey was conducted under NSW DPI Fisheries - Licence Numbers PO05/0016 & OUT10/4198, NSW National Parks and Wildlife Act 1974 - License Number S10318 and a Certificate of Approval under the NSW Animal Research Act 1985.

A1.3 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, ephemeral status of waterbodies and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The current flora and fauna assessment was conducted in winter during cool and rainy weather, which is not suitable time to determine the presence of most threatened species. However, since the Project will not impact on any mapped native vegetation a desktop and habitat based surveys were sufficient to assess the general values of the study area and inform likelihood of occurrence for threatened species.

There are other external factors which limit the results.

Database searches, and associated conclusions on the likelihood of species to occur within the study area, are reliant upon external data sources and information managed by third parties.

Appendix 2 Native vegetation data (BioBanking)

A2.1 Plot and transect summary

Table 32 Plot scores for each vegetation zone within the development site

Benchmark details	Site value score	Site attributes											
		Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over-storey regen	Total length of fallen logs	Degraded (yes/no)	Out of benchmark
Vegetation zone 1													
Benchmark	N/A	>=38	15.0 to 40.0	4.0 to 40.0	30.0 to 60.0	3.0 to 15.0	10.0 to 25.0	N/A	>=1	1.00	>=10		
Plot 5	72.4	29	27.5	8.5	64	0	10	0	0	1	0		
Plot 8		26	30.5	1	74	2	18	0	0	1	0		
Plot 9		25	18	1	80	0	24	0	0	1	6		
Plot 10		28	32	3	62	10	28	11	0	1	54		
Plot 11		29	32.5	26.5	68	24	14	28	0	1	37		
Plot 12		20	23.5	0	90	2	26	6	0	1	6		
Plot 15		41	22.5	17.5	80	18	16	7	1	1	6		
Vegetation zone 2													
Benchmark	N/A	>=38	15.0 to 40.0	4.0 to 40.0	30.0 to 60.0	3.0 to 15.0	10.0 to 25.0	N/A	>=1	1.00	>=10		
Plot 1	76.56	36	52	16	62	36	78	14	0	1	6		
Plot 2		22	46	5	62	6	58	6	3	1	3		

Benchmark details	Site value score	Site attributes											
		Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over-storey regen	Total length of fallen logs	Degraded (yes/no)	Out of benchmark
Plot 3		27	20	18	56	14	34	0	0	1	54		
Plot 4		26	27.5	2.5	24	8	48	30	0	1	6		
Plot 6		36	27.5	15	64	24	58	20	1	1	24		
Plot 7		35	30.5	8	22	24	42	6	0	1	40		
Plot 13		39	29.5	6.5	56	28	32	5	0	1	14		
Vegetation zone 3													
Benchmark	N/A	>=24	15.0 to 70.0	10.0 to 60.0	5.0 to 50.0	5.0 to 30.0	5.0 to 40.0	N/A	>=0	1.00	>=5		
Plot 14	84.67	31	15.0	19.5	34.0	6.0	32.0	28.50	0	0.50	3		
Vegetation zone 4													
Benchmark	N/A	>=38	15.0 to 40.0	4.0 to 40.0	30.0 to 60.0	3.0 to 15.0	10.0 to 25.0	N/A	>=1	1.00	>=10		
Plot 19	68.23	29	33.0	7.0	62.0	8	22.0	1.50	0	1.00	22		
Vegetation zone 5													
Benchmark	N/A	>=15	15.0 to 65.0	0.0 to 50.0	0.0 to 90.0	1.0 to 15.0	2.0 to 90.0	N/A	>=0	1.00	>=10		
Plot 16	81.33	33	29.5	15.0	54.0	0.0	34.0	8	1	0.75	56		
Vegetation zone 6													

Benchmark details	Site value score	Site attributes											
		Native plant species	Native over-storey cover	Native mid-storey cover	Native ground cover (grass)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Over-storey regen	Total length of fallen logs	Degraded (yes/no)	Out of benchmark
Benchmark	N/A	>=51	22.0 to 45.0	5.0 to 40.0	5.0 to 25.0	10.0 to 20.0	5.0 to 20.0	N/A	>=1	1.00	>=20		
Plot 17	55.90	28	70.0	17.0	0.00	18.0	68.0	0.00	13	0.66	0.00		
Plot 18		15	0.75	64.0	6.00	26.0	20.0	3.0	0	0.66	8		

Red cells indicate the site attributes that are below 50% of the benchmark, while blue cells represent those site attributes that are greater than 150% of the benchmark

Appendix 3 Flora

A3.1 Flora species recorded from the study area

Table 33 Flora species recorded from the study area

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Acanthaceae	*Brunoniella australis*	Blue Trumpet		X					
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair						X	
Adiantaceae	*Adiantum formosum*	Giant Maidenhair						X	
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair						X	
Adiantaceae	*Cheilanthes sieberi*	Rock Fern	X	X					
Adiantaceae	*Pellaea paradoxa*							X	
Anthericaceae	*Dichopogon strictus*	Chocolate Lily	X	X					
Anthericaceae	*Thysanotus sp*	Fringe-lily	X						
Apiaceae	*Centella asiatica*	Indian Pennywort			X				
Apocynaceae	*Marsdenia rostrata*	Milk Vine						X	
Apocynaceae	*Parsonsia straminea*	Common Silkpod		X	X		X		
Araceae	*Gymnostachys anceps*	Settler's Twine						X	
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax					X		

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy	X						
Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy	X						
Asteraceae	*Cassinia aculeata*	Dolly Bush					X		
Asteraceae	*Cassinia arcuata*	Sifton Bush		X					
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	X						
Asteraceae	*Epaltes australis*	Spreading Nut-heads	X						
Asteraceae	*Lagenophora gracilis*	Slender Lagenophora	X						
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	X	X		X			
Blechnaceae	*Blechnum indicum*	Swamp Water Fern			X				
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern						X	
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	X						
Casuarinaceae	*Casuarina glauca*	Swamp Oak			X				
Celastraceae	*Maytenus silvestris*	Narrow-leaved Orangebark		X		X		X	
Clusiaceae	*Hypericum gramineum*	Small St John's Wort			X				
Convolvulaceae	*Dichondra repens*	Kidney Weed	X	X	X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Cyperaceae	*Baumea juncea*				X				
Cyperaceae	*Carex appressa*	Tall Sedge						X	
Cyperaceae	*Eleocharis acuta*				X				
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge	X	X	X	X			
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	X	X		X		X	
Cyperaceae	*Schoenoplectus validus*				X				
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower	X	X					
Dioscoreaceae	*Dioscorea transversa*	Native Yam						X	
Ericaceae	*Leucopogon juniperinus*	Prickly Beard-heath	X	X		X	X		
Ericaceae	*Trochocarpa laurina*	Tree Heath						X	
Fabaceae (Faboideae)	*Chorizema parviflorum*	Eastern Flame Pea	X						
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea	X	X					
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*			X					

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	X	X					
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine	X	X					
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine	X				X		
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine	X	X					
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		X					
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood		X					
Fabaceae (Faboideae)	*Pultenaea flexilis*			X					
Fabaceae (Mimosoideae)	*Acacia elongata*	Swamp Wattle	X				X		
Fabaceae (Mimosoideae)	*Acacia falcata*		X	X	X	X		X	
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle	X				X		

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Fabaceae (Mimosoideae)	*Acacia irrorata*	Green Wattle		X					
Fabaceae (Mimosoideae)	*Acacia longifolia*			X	X				
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	X	X	X		X		
Flacourtiaceae	*Scolopia braunii*	Flintwood						X	
Geraniaceae	*Geranium solanderi*	Native Geranium		X					
Goodeniaceae	*Goodenia bellidifolia*		X						
Goodeniaceae	*Goodenia heterophylla*		X	X					
Haloragaceae	*Gonocarpus teucrioides*	Germander Raspwort		X					
Iridaceae	*Patersonia glabrata*	Leafy Purple-flag	X						
Iridaceae	*Patersonia sericea*	Silky Purple-Flag		X					
Juncaceae	*Juncus usitatus*		X						
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum			X				
Lauraceae	*Cassytha glabella*			X					

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Lauraceae	*Cassytha pubescens*	Downy Dodder-laurel		X		X	X		
Lobeliaceae	*Pratia purpurascens*	Whiteroot	X	X	X		X		
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	X	X			X		
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush		X		X			
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	X	X		X	X		
Loranthaceae	*Amyema spp.*	Mistletoe	X	X					
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	X	X	X		X	X	
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	X	X	X	X		X	
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine						X	
Menispermaceae	*Stephania japonica*	Snake vine			X				
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea						X	
Moraceae	*Ficus coronata*	Creek Sandpaper Fig						X	
Myrsinaceae	*Myrsine variabilis*			X				X	
Myrtaceae	*Angophora costata*	Sydney Red Gum	X	X					
Myrtaceae	*Angophora floribunda*	Rough-barked Apple					X		X

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle						X	
Myrtaceae	*Baeckea diosmifolia*	Fringed Baeckea				X			
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush						X	
Myrtaceae	*Corymbia maculata*	Spotted Gum	X	X		X		X	
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany	X	X				X	
Myrtaceae	*Eucalyptus canaliculata*	Large-fruited Grey Gum		X					
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	X	X	X	X	X		
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	X	X		X	X		
Myrtaceae	*Eucalyptus globoidea*	White Stringybark		X	X				
Myrtaceae	*Eucalyptus moluccana*	Grey Box	X						
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark		X					
Myrtaceae	*Eucalyptus punctata*	Grey Gum		X				X	
Myrtaceae	*Eucalyptus punctata X canaliculata intergrade*						X		
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark	X	X			X		

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	X		X		X		
Myrtaceae	*Eucalyptus umbra*	Broad-leaved White Mahogany		X			X		
Myrtaceae	*Leptospermum polygalifolium*	Tantoon		X				X	
Myrtaceae	*Leptospermum sp*			X					
Myrtaceae	*Melaleuca nodosa*		X	X		X	X		
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree			X				
Oleaceae	*Notelaea longifolia*	Large Mock-olive	X	X			X		
Oleaceae	*Notelaea longifolia*	Large Mock-olive		X		X		X	
Oleaceae	*Notelaea ovata*			X					
Oleaceae	*Notelaea venosa*	Veined Mock-olive		X					
Orchidaceae	*Acianthus sp*			X					
Orchidaceae	*Corybas aconitiflorus*	Spurred Helmet Orchid		X					
Orchidaceae	*Cryptostylis sp*	Tartan Tongue Orchid		X					
Orchidaceae	*Cyanicula caerulea*	Blue Caladenia		X					
Orchidaceae	*Petalochilus curtisepalus*		X						

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Orchidaceae	*Pterostylis concinna*	Trim Greenhood		X					
Orchidaceae	*Pterostylis sp*			X					
Phormiaceae	*Dianella caerulea*	Blue Flax-lily		X					
Phormiaceae	*Dianella caerulea var. cinerascens*		X	X	X		X		
Phormiaceae	*Dianella caerulea var. producta*		X	X	X	X	X	X	
Phormiaceae	*Dianella prunina*		X	X		X			
Phormiaceae	*Dianella revoluta*	Blueberry Lily	X	X	X	X			
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	X	X		X	X		
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree	X	X	X		X		
Phyllanthaceae	*Phyllanthus gunnii*			X					
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge		X					
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	X	X					
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn	X	X	X		X		
Pittosporaceae	*Citriobatus pauciflorus*	Orange Thorn		X					
Pittosporaceae	*Pittosporum revolutum*	Rough Fruit Pittosporum		X				X	

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Poaceae	*Aristida vagans*	Threeawn Speargrass	X	X		X			
Poaceae	*Austrostipa pubescens*			X					
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	X	X		X			
Poaceae	*Cynodon dactylon*	Common Couch	X						X
Poaceae	*Dichelachne crinita*	Longhair Plumegrass	X						
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass	X						
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	X	X					
Poaceae	*Entolasia marginata*	Bordered Panic		X			X		
Poaceae	*Entolasia stricta*	Wiry Panic	X	X	X	X	X		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	X	X					X
Poaceae	*Imperata cylindrica*	Blady Grass		X	X	X	X		
Poaceae	*Microlaena stipoides*	Weeping Grass	X	X					
Poaceae	*Oplismenus aemulus*		X	X					
Poaceae	*Oplismenus imbecillis*			X					
Poaceae	*Panicum simile*	Two-colour Panic	X	X	X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Poaceae	*Rytidosperma fulva*	Wallaby Grass	X	X					
Poaceae	*Themeda australis*	Kangaroo Grass	X	X		X			
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn Fern						X	
Proteaceae	*Hakea sericea*	Needlebush	X	X					
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	X	X		X	X		
Ranunculaceae	*Clematis aristata*	Old Man's Beard			X				
Ranunculaceae	*Clematis glycinoides*	Headache Vine		X					
Rhamnaceae	*Alphitonia excelsa*	Red Ash		X					
Ripogonaceae	*Ripogonum album*	White Supplejack						X	
Rubiaceae	*Galium sp*	Goosegrass		X					
Rubiaceae	*Morinda jasminoides*	Sweet Morinda						X	
Rubiaceae	*Opercularia diphylla*	Stinkweed	X						
Rubiaceae	*Pomax umbellata*	Pomax	X						
Rutaceae	*Asterolasia correifolia*			X					
Rutaceae	*Crowea exalata*		X	X				X	

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Rutaceae	*Zieria smithii*	Sandfly Zieria	X	X		X	X		
Santalaceae	*Exocarpos strictus*	Dwarf Cherry		X					
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	X						
Smilacaceae	*Smilax australis*	Lawyer Vine						X	
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsparilla		X					
Solanaceae	*Solanum brownii*	Violet Nightshade	X	X		X			
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	X	X			X	X	
Sterculiaceae	*Brachychiton populneus*	Kurrajong	X	X		X	X		
Vitaceae	*Cayratia clematidea*	Native Grape		X					
Vitaceae	*Cissus antarctica*	Water Vine		X			X	X	
Vitaceae	*Cissus hypoglauca*	Giant Water Vine		X				X	
Xanthorrhoeaceae	*Xanthorrhoea macronema*		X			X		X	
Xanthorrhoeaceae	*Xanthorrhoea minor*			X					
Apiaceae	*Ciclospermum leptophyllum*	Slender Celery			X				
Asteraceae	*Bidens pilosa*	Cobbler's Pegs			X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Asteraceae	*Conyza spp.*	A Fleabane		X	X				
Asteraceae	*Erechtites valerianifolia*	Brazilian Fireweed			X				
Asteraceae	*Hypochaeris radicata*	Catsear			X				
Asteraceae	*Senecio madagascariensis*	Fireweed	X		X				X
Asteraceae	*Sonchus oleraceus*	Common Sowthistle			X				
Gentianaceae	*Centaurium erythraea*	Common Centaury			X				
Juncaceae	*Juncus acutus*				X				X
Myrsinaceae	*Anagallis arvensis*	Scarlet Pimpernel			X				
Oleaceae	*Olea europaea subsp. cuspidata*	African Olive							
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	X						
Poaceae	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	X						
Poaceae	*Chloris gayana*	Rhodes Grass			X				
Poaceae	*Cortaderia selloana*	Pampas Grass			X				
Poaceae	*Digitaria sp*			X					
Poaceae	*Panicum maximum*	Guinea Grass			X				

Family	Scientific Name	Common Name	VZ1	VZ2	VZ3	VZ4	VZ5	VZ6	Incidental
Poaceae	*Setaria gracilis*	Slender Pigeon Grass			X				
Poaceae	*Stenotaphrum secundatum*	Buffalo Grass							X
Verbenaceae	*Lantana camara*	Lantana	X	X	X	X	X	X	
Verbenaceae	*Verbena bonariensis*	Purpletop		X					
Vitaceae	*Vitis vinifera*	Grape Vine		X					

Appendix 4 Fauna

Fauna species in these tables are listed in alphabetical order within their taxonomic group.

A4.1 Fauna species recorded from the study area

Below is a list of fauna species recorded from the study area during the present assessment and a list of significant fauna species recorded or predicted to occur within 10 kilometres of the study area.

Notes to table:

EPBC Act:
EX - Extinct
CR - Critically Endangered
EN - Endangered
VU - Vulnerable
CD - Conservation dependent

TSC Act:
C1 – critically endangered
E1 – endangered species (Part 1, Schedule 1)
E2 – endangered population (Part 2, Schedule 1)
E4 – presumed extinct (Part 4, Schedule 1)
V1 – vulnerable (Part 1, Schedule 2)

FM Act:
C1 – critically endangered
E1 – endangered
E2 – endangered
E4 – presumed extinct
V1 – vulnerable

* - introduced species

Table 34 Vertebrate fauna recorded from the study area (current assessment)

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
Amphibians					
	Crinia signifera	Common Eastern Froglet		x	
	Litoria fallax	Eastern Sedge Frog		x	
	Litoria latopalmata	Broad-palmed Rocket-frog		x	
	Litoria nasuta	Striped Rocket-frog		x	
	Litoria peroni	Peron's Tree Frog		x	
	Litoria tyleri	Tyler's Tree Frog		x	
	Litoria wilcoxi	Stony Creek Frog		x	
	Pseudophryne bibroni	Bibron's Toadlet		x	
	Uperoleia laevigata	Smooth Toadlet		x	
Reptiles					
	Eulamprus quoyii	Eastern Water Skink		x	
	Morelia spilota	Carpet Python		x	

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
	Myzomela sanguinolenta	Scarlet Honeyeater		X	X
Birds					
	Acanthiza lineata	Striated Thornbill		X	X
	Acanthiza nana	Yellow Thornbill		x	
	Acanthiza pusilla	Brown Thornbill		x	
	Acanthiza reguloides	Buff-rumped Thornbill			
	Acanthorhynchus tenuirostris	Eastern Spinebill			X
	Accipiter cirrocephalus	Collared Sparrowhawk		X	
	Accipiter fasciatus	Brown Goshawk			
	Anas superciliosa	Pacific Black Duck		x	
	Anthochaera carunculata	Red Wattlebird		x	
Mi	*Ardea ibis*	Cattle Egret		x	
	Ardea intermedia	Intermediate Egret		x	
	Aythya australis	Hardhead		x	
	Cacomantis flabelliformis	Fan-tailed Cuckoo		X	
	Cacomantis flabelliformis	Fan-tailed Cuckoo		x	
	Chalcites lucidus	Shining Bronze-cuckoo		x	
	Chenonetta jubata	Australian Wood Duck		x	
	Colluricincla harmonica	Grey Shrike-thrush		X	X
	Coracina novaehollandiae	Black-faced Cuckoo-shrike		x	
	Coracina tenuirostris	Cicadabird		x	
	Cormobates leucophaea	White-throated Treecreeper		X	
	Corvus coronoides	Australian Raven	X	X	
	Cracticus nigrogularis	Pied Butcherbird		x	
	Cracticus tibicen	Australian Magpie	X	X	
	Cracticus torquatus	Grey Butcherbird	X	X	
	Dacelo novaeguineae	Laughing Kookaburra		X	
V	*Daphoenositta chrysoptera*	Varied Sittella		x	
	Dicaeum hirundinaceum	Mistletoebird		x	
	Egretta novaehollandiae	White-faced Heron		x	
	Eopsaltria australis	Eastern Yellow Robin		X	X

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
V	*Falco subniger*	Black Falcon	X	X	
	Geopelia humeralis	Bar-shouldered Dove		X	X
	Gerygone mouki	Brown Gerygone		X	X
V	*Glossopsitta pusilla*	Little Lorikeet		X	X
Mi	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	X	X	
	Hirundo neoxena	Welcome Swallow	X	X	
	Leucosarcia picata	Wonga Pigeon		X	
	Lichenostomus chrysops	Yellow-faced Honeyeater		x	
	Lichenostomus melanops	Yellow-tufted Honeyeater		x	
V	*Lophoictinia isura*	Square-tailed Kite		X	
	Malurus cyaneus	Superb Fairy-wren		X	
	Malurus lamberti	Variegated Fairy-wren		X	
	Meliphaga lewinii	Lewin's Honeyeater		X	X
	Melithreptus brevirostris	Brown-headed Honeyeater		X	
	Melithreptus lunatus	White-naped Honeyeater		X	X
Mi	*Monarcha melanopsis*	Black-faced Monarch		x	
	Myiagra rubecula	Leaden Flycatcher		x	
	Neochmia temporalis	Red-browed Finch		X	X
	Ninox novaeseelandiae	Southern Boobook			X
	Oriolus sagittatus	Olive-backed Oriole		x	
	Pachycephala pectoralis	Golden Whistler		X	X
	Pachycephala rufiventris	Rufous Whistler		x	
	Pardalotus punctatus	Spotted Pardalote		X	X
	Pardalotus striatus	Striated Pardalote		x	
	Petrochelidon nigricans	Tree Martin		x	
	Petroica rosea	Rose Robin		x	
	Phalacrocorax sulcirostris	Little Black Cormorant		x	
	Philemon corniculatus	Noisy Friarbird		X	
	Podargus strigoides	Tawny Frogmouth		X	X
	Psophodes olivaceus	Eastern Whipbird		X	X
	Rhipidura albiscapa	Grey Fantail		X	X
	Scythrops novaehollandiae	Channel-billed Cuckoo		x	

Status	Scientific Name	Common Name	Quarry workings	Study area	Offset
	Sericornis frontalis	White-browed Scrubwren		X	
	Smicrornis brevirostris	Weebill		X	
	Strepera graculina	Pied Currawong		x	
	Trichoglossus haematodus	Rainbow Lorikeet		x	
	Zosterops lateralis	Silvereye		X	X
Mammals					
	Acrobates pygmaeus	Feathertail Glider			X
	Antechinus stuartii	Brown Antechinus		X	X
*	*Canis lupus familiaris/dingo*	Dog/Dingo		x	
	Chalinolobus gouldii	Gould's Wattled Bat		x	
	Chalinolobus morio	Chocolate Wattled Bat		x	
	Macropus giganteus	Eastern Grey Kangaroo		x	x
	Macropus robustus	Euro		x	
	Macropus rufogriseus	Red-necked Wallaby	X	X	X
V	*Miniopterus australis*	Little Bentwing-bat		x	
V	*Miniopterus orianae oceanensis*	Eastern Bentwing-bat		x	
VU, V, E2	*Phascolarctos cinereus*	Koala	X	x	
	Pseudocheirus peregrinus	Common Ringtail Possum		x	
V, V	*Pteropus poliocephalus*	Grey-headed Flying-fox		x	
	Rattus fuscipes	Bush Rat			X
	Rhinolophus megaphyllus	Eastern Horseshoe Bat		x	
	Tachyglossus aculeatus	Short-beaked Echidna	x	x	x
	Tadarida australis	White-striped Freetail-bat	X	X	X
	Trichosurus vulpecula	Common Brushtail Possum		x	
	Vespadelus vulturnus	Little Forest Bat		x	
*	*Vulpes vulpes*	Red Fox		x	
	Wallabia bicolor	Swamp Wallaby		x	x

Appendix 5 Threatened species

A5.1 Threatened flora species

The following table includes a list of the threatened flora species and ecological communities that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas (OEH 2014f) and the Protected Matters Search Tool (DoE 2014), accessed on 06/08/2014.

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria
High	• Species/ecological communities recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within 10 kilometres or from the relevant catchment/basin.
Medium	• Records of terrestrial biota within 10 kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within 10 kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality and extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table 35 Threatened flora species recorded/predicted within 10 kilometres of the study area

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Allocasuarina defungens	Dwarf Heath Casuarina	EN	E1	#	Low	Not typically observed in grassy woodland communities and no tall heath on sandy soils within the study area. Also not historically recorded within 5 kilometres of the study area.	*Allocasuarina defungens* is found only in the Hunter/Central Rivers, and Northern Rivers Catchments, ranging from the Nabiac area, north-west of Forster, to Byron Bay on the NSW north coast. *Allocasuarina defungens* grows mainly in tall heath on sand, but can also occur on clay soils and sandstone. The species also extends onto exposed nearby-coastal hills or headlands adjacent to sandplains. Vegetation communities associated with the species, includes: Dry Scleropyhll Forests, Forested Wetlands, Grassy Woodlands, and Heathlands.
Angophora inopina	Charmhaven Apple	VU	V	#	Low	No potential habitat or associated species within the study area. Also not historically recorded within 5 kilometres of the study area.	Occurs in the Hunter/Central Rivers Catchment, endemic to the Central Coast region of NSW. Occurs in open woodland with a dense shrub understorey on deep white sandy soils over sandstone. Most frequently occuring in four main vegetation communities: (i) *Eucalyptus haemastoma*, *Corymbia gummifera*, *Angophora inopina* woodland/forest; (ii) *Hakea teretifolia, Banksia oblongifolia* wet heath; (iii) E*ucalyptus resinifera, Melaleuca sieberi, Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata, Corymbia gummifera, Angophora inopina* woodland/forest. Is lignotuberous, allowing vegetative growth to occur following disturbance. Flowering appears to take place principally between mid-December and mid-January, but is generally poor and sporadic.
Asperula	Trailing	VU	V	2009/#	Low	A single recent record	Found in damp areas often found growing along river banks.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
asthenes	Woodruff					is located approximately 8 kilometres southwest of the study area. Typically this species is found in riparian vegetation aong creek banks. There are no creeklines within the study area, and Deadmans Creek, adjacent to the study area is a minor ephemeral creekline.	
Asterolasia elegans		EN	E1	#	Low	The study area is outside of the typical range for this species and none of the associated vegetation occurs within the study area.	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford LGA. Known from only six populations in the catchments of the Colo and Hawkesbury Rivers, only one of which is wholly within a conservation reserve. Found in sheltered forests on mid- to lower slopes and valleys which support sheltered forest on Hawkesbury Sandstone. The canopy at known sites includes *Syncarpia glomulifera, Angophora costata, Eucalyptus piperita, Allocasuarina torulosa* and *Ceratopetalum gummiferum*. The species is considered to be fire sensitive and reliant on seed germination after disturbance to maintain populations. A soil seedbank appears to be established by this species, so for a number of years following fire or other disturbance the

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							species may not be apparent, but be present only as seed in the soil. The size of the seedbank depends not only on the amount of seed contributed by mature plants each season, but on the level of dormancy of the seed which can vary from year to year. The longevity of each crop of seed in the soil is perhaps 5 - 10 years.
Cryptostylis hunteriana	Leafless Tongue Orchid	VU	V	#	Low	Not previously recorded within 10 kilometres of the study area and none of the typical habitat preferences for this species were noted within the study area.	This species typically grows in swamp-heath on sandy soils chiefly in coastal districts but has also been recorded on steep bare hillsides. Within the Central Coast bioregion, this species has been recorded within Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland. This species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by *Eucalyptus sclerophylla, E. sieberi, Corymbia gummifera* and *Allocasuarina littoralis*; appears to prefer open areas in the understorey of this community and is often found in association with the *Cryptostylus subulata*. It occurs in the following Catchment Management Regions Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers and Southern Rivers. Inconsistent flowering times Dec-February; Jan-February (in Victoria)
Cymbidium canaliculatum	Tiger Orchid		E2	1926	Low	Outside of known range, this species is associated with the central and upper Hunter and not with	Epiphytic orchid found in dry sclerophyll forest or woodland where it grows in tree hollows, in clumps of fern or sometimes on rocks.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						the vegetation communities of the study area.	
Eucalyptus glaucina	Slaty Red Gum	VU	V	1998/#	Low	Typically found further west in the Central Hunter. Some marginal potential habitat occurs at the southern, flatter section of the study area however based on location and soil preferences it is considered unlikely to occur.	Occurs near Casino and from Taree to Broke where it is locally common but very sporadic. Found in grassy woodland on deep, moderately fertile and well watered soil.
Eucalyptus parramattensis subsp. decadens		VU	V	#	Low	No associated species or habitat within the study area and the species is not typically found this far north.	There are two separate meta-populations of *E. parramattensis subsp. decadens*. The Kurri Kurri meta-population is bordered by Cessnock/Kurri Kurri in the north and Mulbring/Abedare in the south. Large aggregations of the sub-species are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							heathland. Often where this species occurs, it is a community dominant. In the Kurri Kurri area, *E. parramattensis subsp. decadens* is a characteristic species of 'Kurri Sand Swamp Woodland in the Sydney Basin Bioregion', an endangered ecological community under the TSC Act. In the Tomago Sandbeds area, the species is usually associated with the 'Tomago Swamp Woodland' as defined by NSW NPWS. Flowers from November to January.
Euphrasia arguta		CE	E4A	#	Low	The study area is south and east of the range of this species.	Grows in grassy areas near rivers.
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	VU	V	2005/#	Medium	Potential habitat and associated species were recorded within the study area.	Located in Hawkesbury/Nepean, Hunter/Central Rivers and Sydney Metropolitan Catchment. Sporadically distributed throughout the Sydney Basin with the main occurrence centred in Picton, Appin, Wedderburn and Bargo. Northern populations are found in the Lower Hunter Valley. To the west of Sydney, small populations occur at Kemps Creek & Voyager Point. *Grevillea parviflora ssp. parviflora* grows on sandy clay loam soils, often with ironstone gravels. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine-grained sandstones. *Grevillea parviflora subsp. parviflora* is found on crests, upper slopes or flat plains in both low-lying areas and on higher topography. The plant prefers open habitat conditions with the largest populations in open woodland and along exposed roadside areas. *G. parviflora subsp. parviflora* has been recorded in a range of

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							vegetation types from heath and shrubby woodland to open forest. Canopy species vary greatly with community type but generally are species that favour soils with a strong lateritic influence including *Eucalyptus fibrosa, E. parramattensis, Angophora bakeri* and *Eucalyptus sclerophylla*. Flowering has been recorded between July - December as well as April-May.
Maundia triglochinoides			V	2009	Medium	Previously recorded close to the study area and potential habitat in the form of dams and a creek.	*Maundia triglochinoides* is restricted to Coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Catchment Regions include Hunter/Central Rivers, Northern Rivers and Sydney Metro
Melaleuca biconvexa	Biconvex Paperbark	VU	V	#	Low	Not previously recorded within 10 kilometres of the study area and limited habitat present within the study area.	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Catchment regions include: Hunter/Central Rivers, Hawkesbury/Nepean, Southern Rivers, and Northern River Catchments. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October.
Persicaria elatior	Tall Knotweed	VU	V	1996/#	Medium	Previously recorded close to the study area and potential habitat in the form of	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						dams and a creek.	is known from Raymond Terrace and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.
Phaius australis	Southern Swamp Orchid	EN	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was recorded.	Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Historically, it extended farther south, to Port Macquarie. Found in swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.
***Prasophyllum* sp. Wybong**	A Leek Orchid	CE		#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was recorded.	Leek orchids are generally found in shrubby and grassy habitats in dry to wet soil. *Prasophyllum* sp. Wybong is known to occur in open eucalypt woodland and grassland. *Prasophyllum* sp. Wybong is endemic to NSW. It is known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield. *Prasophyllum* sp. Wybong occurs within the Border Rivers (Gwydir, Namoi, Hunter), Central Rivers and Central West Natural Resource Management Regions. The species occurs within the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes Interim Biogeographic Regionalisation for Australia Bioregions.
Pterostylis gibbosa	Illawarra Greenhood	EN	E1	#	Low	This species has not historically been recorded	Known from a small number of populations in the Hunter region, the Illawarra region and the Shoalhaven region. It is apparently extinct in western Sydney which is the area where it was first collected (1803).

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by *Eucalyptus tereticornis, E. longifolia* and *Melaleuca decora*. Near Nowra, the species grows in an open forest of *Corymbia maculata, E.tereticornis* and *E. paniculata*. In the Hunter region, the species grows in open woodland dominated by *E. crebra*, Forest Red Gum and *Callitris endlicherii*. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer/spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber late summer, followed by the flower stem in winter. The Illawarra Greenhood can survive occasional burning/grazing because of its capacity to reshoot from an underground tuber.
Streblus pendulinus	Whalebone Tree	EN		#	Low	No suitable rainforest habitat within the study area.	The species is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest.

* - habitat descriptions have been adapted by qualified ecologists (botanists) from the DoE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

A5.2 Threatened fauna species

The following table includes a list of the threatened fauna species that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas (OEH 2014f), BirdLife Australia data search (Birdlife Australia 2014) and the Protected Matters Search Tool (DoE 2014), accessed on 06/08/2014.

Notes to table:

#	species predicted to occur by the DoE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched
Year	recorded on databases listed above
2014	recorded during current survey

Likelihood of occurrence	Potential criteria
High	• Species recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within 10 kilometres or from the relevant catchment/basin.
Moderate	• Records of terrestrial species within 10 kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within 10 kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat presents (low quality and extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table 36 Threatened fauna species recorded/predicted within 10 kilometres of the study area

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Birds							
Anseranas semipalmata	Magpie Goose		V	2013	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. They are often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level. Nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.
Anthochaera phrygia	Regent Honeyeater	EN	E4A	2012/#	Medium	Not recorded during targeted surveys in winter and spring. Suitable forage habitat present. Recorded from the locality of the study area.	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: E. microcarpa, E. punctata, E. polyanthemos, E. mollucana, Corymbia robusta, E. crebra, E. caleyi, C. maculata, E. mckieana, E. macrorhyncha, E. laevopinea and Angophora floribunda. Nectar and fruit from the mistletoes A. miquelii, A. pendula, A. cambagei are also eaten during the breeding season. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also nest in mistletoe haustoria. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Botaurus poiciloptilus	Australasian Bittern	EN	E1	2004/#	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including Typha spp. and Eleoacharis spp.. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.
Burhinus grallarius	Bush Stone-curlew		E1	2006	Low	Not recorded during targeted surveys in winter/spring. Suitable habitat present but impacts from feral predators (cats and foxes) likely to be high.	Lightly timbered open forest and woodland, or partly cleared farmland with remnants of woodland, with a ground cover of short sparse grass and few or no shrubs where fallen branches and leaf litter are present.
Calidris ferruginea	Curlew Sandpiper		E1	2013	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland.
Callocephalon fimbriatum	Gang-gang Cockatoo		V	1993	Low	Not recorded during targeted surveys. No	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	2010	Low	Not recorded during targeted surveys in winter and spring. No stands of Allocasuarina sp. were recorded within the study area.	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.
Chthonicola sagittata	Speckled Warbler		V	2013	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	This species occurs in eucalypt and cypress woodlands on the hills and tablelands of the Great Dividing Range. They prefer woodlands with a grassy understorey, often on ridges or gullies. The species is sedentary, living in pairs or trios and nests on the ground in grass tussocks, dense litter and fallen branches. They forage on the ground and in the understorey for arthropods and seeds. Home ranges vary from 6-12 hectares.
Circus assimilis	Spotted Harrier		V	2012	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Spotted Harrier is found throughout Australia but rarely in densely forested and wooded habitat of the escarpment and coast. Preferred habitat consists of open and wooded country with grassland nearby for hunting. Habitat types include open grasslands, acacia and mallee remnants, spinifex, open shrublands, saltbush, very open woodlands, crops and similar low vegetation. The Spotted Harrier is more common in drier inland areas, nomadic part migratory and dispersive, with movements linked to the abundance of prey species. Nesting occurs in open or remnant woodland and unlike other harriers, the Spotted Harrier nests in trees.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)		V	2013	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Lives in eucalypt woodlands, especially areas of relatively flat open woodland typically lacking a dense shrub layer, with short grass or bare ground and with fallen logs or dead trees present.
Daphoenositta chrysoptera	Varied Sittella		V	2014	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
Dasyornis brachypterus	Eastern Bristlebird	EN	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was observed.	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands.
Ephippiorhynchus asiaticus	Black-necked Stork		E1	2014	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the	Found in swamps, mangroves and mudflats. Can also occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						study area.	
Epthianura albifrons	White-fronted Chat		V	2009	Low	Not recorded during targeted winter and spring surveys. No suitable habitat present.	Sydney Metropolitan CMA: The White-fronted Chat occupies foothills and lowlands below 1000 m above sea level. In NSW it occurs mostly in the southern half of the state, occurring in damp open habitats along the coast, and near waterways in the western part of the state. The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, they are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the species is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways. In Victoria White-fronted Chats have been observed breeding from late July through to early March. Nests are built in low vegetation and in the Sydney region nests have also been observed in low isolated mangroves. An Endangered Population occurs in the Sydney Metropolitan CMA area, at Newington Nature Reserve near Homebush and at Towra Point Nature Reserve.
Falco hypoleucos	Grey Falcon		E1	1993	Low	Not recorded within the study area during	Found over open country and wooded lands of tropical and temperate Australia. Mainly found on sandy and stony

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						targeted surveys in winter and spring. No suitable habitat present.	plains of inland drainage systems with lightly timbered acacia scrub.
Falco subniger	Black Falcon		V	2013	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	Mainly occur in woodlands and open country where can hunt. Often associated with swamps, rivers and wetlands. Nest in tall trees along watercourses.
Glossopsitta pusilla	Little Lorikeet		V	2014	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.
Hieraaetus morphnoides	Little Eagle		V	2012	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.
Irediparra gallinacea	Comb-crested Jacana		V	2012	Low	Not recorded during targeted winter and spring surveys. No	Occurs in freshwater wetlands, lagoons, Billabongs, swamps, lakes, rivers and reservoirs, generally with abundant floating aquatic vegetation.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						suitable wetland habitat was recorded within the study area.	
Ixobrychus flavicollis	Black Bittern		V	2004	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.
Lathamus discolor	Swift Parrot	EN	E1	2012/#	Medium	Not recorded during targeted surveys in winter and spring. Suitable forage habitat present. Recorded from the locality of the study area.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Limosa limosa	Black-tailed Godwit		V	2012	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Mainly coastal, usually in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats.
Lophoictinia isura	Square-tailed Kite		V	2013	High	Recorded within the study area during winter and spring surveys. Suitable habitat throughout the study area.	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, Corymbia maculata, E. elata, or E. smithii. Individuals appear to occupy large hunting ranges of more than 100 kilometres2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)		V	1998	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	This species lives in a wide range of temperate woodland habitats, and a range of woodlands and shrublands in semi-arid areas.
Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)		V	2011	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Found mostly in open forests and woodlands dominated by box and ironbark eucalypts. It is rarely recorded east of the Great Dividing Range.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
Neophema pulchella	Turquoise Parrot		V	2002	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs. Generally found in the foothills of the Great Divide, including steep rocky ridges and gullies. Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies that are moist.
Ninox connivens	Barking Owl		V	2008	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country. Territories are typically 2000 ha in NSW habitats.
Ninox strenua	Powerful Owl		V	2013	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. It has a large home range of between 450 and 1450 ha.
Oxyura australis	Blue-billed Duck		V	2007	Low	Not recorded during targeted winter and spring surveys. No	Almost wholly aquatic, preferring deep water in large, permanent wetlands with an abundant aquatic flora.

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						suitable wetland habitat was recorded within the study area.	
Pachycephala olivacea	Olive Whistler		V	2012	Low	Not recorded during targeted winter and spring surveys. No suitable habitat was recorded within the study area.	Found in a range of habitats including alpine thickets, wetter rainforest/woodlands, riparian vegetation and heaths.
Pandion cristatus	Osprey		V	1992	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 kilometres inland along larger rivers. It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
Petroica boodang	Scarlet Robin		V	2013	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	During the breeding season the Scarlet Robin is found in eucalypt forests and temperate woodlands, often on ridges and slopes. During autumn and winter it moves to more open and cleared areas. It has dispersive or locally migratory seasonal movements. The Scarlet Robin forages amongst logs and woody debris for insects which make up the majority of its diet. The nest is an open cup of plant fibres and cobwebs, sited in the fork of a tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground. It is

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							conspicuous in open and suburban habitats.
Petroica phoenicea	Flame Robin		V	2005	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South Australian border. The species is also found in Tasmania. The preferred habitat in summer includes moist eucalyptus forests and open woodlands, whilst in winter prefers open woodlands and farmlands. It is considered migratory. The Flame Robin breeds from about August to January.
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)		V	2014	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Grey-crowned Babbler is found in dry, open forests, scrubby woodlands, trees bordering roads and farmland with isolated trees.
Ptilinopus magnificus	Wompoo Fruit-Dove		V	2009	Low	Not recorded during targeted winter and spring surveys. No suitable habitat present.	Mainly occurs in large undisturbed patches of tall tropical or subtropical rainforest. Occasionally occurs in patches of monsoon forest, closed gallery forest, wet sclerophyll forest, tall open forest, open woodland or vine thickets near rainforest.
Ptilinopus regina	Rose-crowned Fruit-Dove		V	2007	Low	Not recorded during targeted winter and spring surveys. No suitable habitat present.	Occurs in tall tropical and subtropical, evergreen or semi-deciduous rainforest, especially with dense growth of vines. Prefers large patches of rainforest, but sometimes occurs in remnant patches surrounded by suboptimal habitat including farmlands.
Rostratula australis	Australian Painted Snipe	EN	E1	#	Low	Not recorded during targeted winter and spring surveys. No	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						suitable wetland habitat was recorded within the study area.	permanent, although they have been recorded in brackish waters.
Stagonopleura guttata	Diamond Firetail		V	2000	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Found in a range of habitat types including open eucalypt forest, mallee and acacia scrubs. Often occur in vegetation along watercourses.
Sternula nereis nereis	Fairy Tern	VU		#	Negligible	Not previously recorded within 10 kilometres of the study area and no potential coastal habitat occurs.	The Fairy Tern nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. This species will also frequent embayments, estuarine habitats, wetlands and mainland coastlines.
Stictonetta naevosa	Freckled Duck		V	2014	Low	Not recorded during targeted winter and spring surveys. No suitable wetland habitat was recorded within the study area.	The Freckled Duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits.
Turnix maculosus	Red-backed Button-quail		V	2010	Low	Not recorded during targeted surveys in winter and spring. No suitable habitat present.	Red-backed Button-quail inhabit grasslands, woodlands and cropped lands of warm temperate areas that annually receive 400 mm or more of summer rain. Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands. Red-backed Button-quail usually breed in dense

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							grass near water, and nests are made in a shallow depression sparsely lined with grass and ground litter.
Tyto longimembris	Eastern Grass Owl		V	1983	Low	Not recorded during targeted surveys in winter and spring. No suitable habitat present.	Occurs mainly in open tussock grassland, usually in treeless areas. Can also occur in marshy areas with tall dense tussocks of grass. Occasionally occurs in densely vegetated agricultural lands such as sugarcane fields.
Tyto novaehollandiae	Masked Owl		V	1952	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Masked Owl may be found across a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. It has mostly been recorded in open forests and woodlands adjacent to cleared lands. They nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. The nest hollows are usually located within dense forests or woodlands. Masked Owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet. It has a large home range of between 500 to 1000 ha.
Mammals							
Cercartetus nanus	Eastern Pygmy-possum		V	2005	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Patchily distributed from the coast to the Great Dividing Range, and as far as Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Soft fruits are eaten when flowers are unavailable and it also feeds on insects. Will often nest in tree hollows, but can also construct its own nest. Because of its small size it

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							is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5 ha area over a 5 month period. It is mainly solitary, and each individual uses several nests. Home ranges of males are generally less than 0.75 ha, and those of females are smaller.
Chalinolobus dwyeri	Large-eared Pied Bat	VU	V	2013/#	Low	Not recorded during targeted surveys in spring. No suitable habitat present.	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran.
Dasyurus maculatus	Spotted-tailed Quoll	EN	V	2006/#	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs along the east coast of Australia and the Great Dividing Range. Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger home ranges of between 2000 and 5000 ha. Breeding occurs from May to August.
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. Prefers wet high-altitude sclerophyll and coastal mallee habitat, preferring wet forests with a dense understorey but being found in open forests at lower altitudes. Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails. Has a large foraging range, up to 136 ha. Records show movements of up to 12 kilometres between roosting and foraging sites.
Kerivoula papuensis	Golden-tipped Bat		V	1999	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs in a narrow band down the coast from Cape York to Eden, in moist, closed forest that receives high rainfall. Important habitat features includes forest ecotones, streams and an abundance of vines. Primarily feeds on web-building spiders. Most nightly movements occur within 2 kilometres of the roost. Roosts in the nests of Yellow-throated Scrubwren and Brown Gerygone, as well as in tree hollows, foliage and roofs of houses.
Miniopterus australis	Little Bentwing-bat		V	2013	High	Recorded within the study area during spring	Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						surveys. Suitable forage habitat present. No roosting or breeding habitat present (e.g. caves, culverts).	structures including caves, tunnels and stormwater drains. Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing bat forages for small insects (such as moths, wasps and ants) beneath the canopy of densely vegetated habitats.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		V	2010	High	Recorded within the study area during spring surveys. Suitable forage habitat present. No roosting or breeding habitat present (e.g. caves, culverts).	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways.
Mormopterus norfolkensis	Eastern Freetail-bat		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph

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							poles. Foraging generally occurs within a few kilometres of roosting sites.
Myotis macropus	Southern Myotis		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects.
Petaurus australis	Yellow-bellied Glider		V	2005	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Restricted to tall native forests in regions of high rainfall along the coast of NSW. Bago Plateau: Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows. Critical elements of habitat include sap-site trees, winter flowering eucalypts, mature trees suitable for den sites and a mosaic of different forest types. Live in family groups of 2-6 individuals which commonly share a number of tree hollows. Family groups are territorial with exclusive home ranges of 30-60 ha. Very large expanses of forest (>15,000 ha) are required to conserve viable populations.
Petaurus norfolcensis	Squirrel Glider		V	2008	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Wagga Wagga and Barrenjoey peninsula (north syd): Sparsely distributed along the east coast and immediate inland areas as far west as Coonabarabran in the northern part of the state and as far west as Tocumwal along the southern border of the state. Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range. Requires abundant hollow-bearing trees and a mix of

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							eucalypts, banksias and acacias. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. They live in family groups of 2-10 individuals and maintain home ranges of 0.65 and 10.5 ha, varying according to habitat quality and food resource availability. Family groups occupy multiple hollows over time.
Petrogale penicillata	Brush-tailed Rock-wallaby	VU	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no potential habitat was observed.	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha.
Phascogale tapoatafa	Brush-tailed Phascogale		V	2010	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	The Brush-tailed Phascogale had a scattered distribution centred around the Great Dividing Range. It prefers open forests with a sparse ground cover, but also inhabits mallee and rainforests. It feeds on insects and nectar, particularly in rough-barked trees. The Brush-tailed Phascogale will Nests and shelter in tree hollows, tree stumps and occasionally birds nests, and can use more than 40 nests in a year. Suitable tree hollows have entrances 25-40 mm wide. Females have exclusive territories of approximately 20 - 60 ha, while males have overlapping territories of up to 100 ha. Breeding occurs

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							from May to July, after which all the males die.
Phascolarctos cinereus	Koala	VU	V, E2	2013	High	Species recorded within the study area during the current Biosis (2014) surveys.	Pittwater LGA and Hawks nest: In NSW the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include Eucalyptus robusta, E. tereticornis, E. punctata, E. haemostoma and E. signata. They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid country they are usually discrete and around 100 ha.
Potorous tridactylus tridactylus	Long-nosed Potoroo	VU	V	#	Low	Not recorded during targeted surveys in winter and spring. No habitat present.	Cobaki Lakes and Tweed Heads West population: Occurs from Queensland to Victoria, normally within 50 kilometres of the coast. Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, buts tends to aggregate in small groups. It has two breeding seasons, one in late winter-early spring and the other in late summer. This species appears to benefit from a lack of recent disturbance.
Pseudomys novaehollandiae	New Holland Mouse	VU		2005/#	Low	Not recorded during targeted surveys in winter and spring. No habitat present.	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
Pseudomys oralis	Hastings River Mouse	EN	E1	#	Low	Not recorded during targeted surveys in winter and spring. No habitat present.	Occurs in upland forests (at altitudes between 300-1250 m) from Barrington Tops to Queensland. Inhabits open forests and woodlands with a grass, sedge, rush or heath understorey. The Hastings River Mouse nests within cavities in root systems of trees, holes in the ground, rock piles, hollow logs and epiphytes near the ground. Native grasses and sedges for a large part of the diet. Legumes, seeds, fruits, moss, fungi and insects are also eaten. Females have a home range of 1 ha, and males up to 2 ha. The species occurs at low densities (often <per 1 ha).
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V	2011/#	High	Species recorded within the study area during the current Biosis (2014) surveys.	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							within 15 kilometres of the day roost although some individuals may travel up to 70 kilometres.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V	2009	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Found throughout NSW. They have been reported from southern Australia between January and June. Reported from a wide range of habitats throughout eastern and northern Australia, including wet and dry sclerophyll forest, open woodland, acacia shrubland, mallee, grasslands and desert. They roost in tree hollows in colonies of up to 30 (but more usually two to six) and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs of rock. It is high-flying, making it difficult to detect. It forages above the canopy of eucalypt forests, but comes lower to the ground in mallee or open country.
Scoteanax rueppellii	Greater Broad-nosed Bat		V	2010	Medium	Not recorded during targeted surveys in spring. Suitable habitat present. Recorded from the locality of the study area.	Occurs along the Great Dividing Range, generally at 500 m but up to 1200 m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30 m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches.
Vespadelus troughtoni	Eastern Cave Bat		V	2013	Medium	Not recorded during targeted surveys in spring. Suitable forage habitat present. Recorded from	Found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. It roosts in small groups, often in well-lit overhangs and caves, mine tunnels, road culverts, and occasionally in

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
						the locality of the study area.	buildings.
Reptiles							
Hoplocephalus bitorquatus	Pale-headed Snake		V	1994	Medium	Not recorded during targeted surveys in winter and spring. Suitable habitat present. Recorded from the locality of the study area.	Found in a variety of habitats from wet sclerophyll forest to dry eucalypt forest on the western slopes of NSW. Feeds largely on frogs and lizards.
Hoplocephalus bungaroides	Broad-headed Snake	VU	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no suitable sandstone habitat occurs within the study area.	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer.
Amphibians							
Litoria aurea	Green and Golden Bell Frog	VU	E1	1992/#	Low	Not recorded during targeted surveys in winter and spring. No habitat present.	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks , although the species has also been

Scientific name	Common name	EPBC Act	TSC Act	Most recent record	Likelihood of occurrence	Rationale for likelihood	Habitat description
							recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop , feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.
Mixophyes balbus	Stuttering Frog	VU	E1	#	Low	Not previously recorded within 10 kilometres of the study area and no suitable preferred habitat occurs within the study area.	This species is usually associated with mountain streams, wet mountain forests and rainforests. It rarely moves very far from the banks of permanent forest streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains.

* - habitat descriptions have been adapted by qualified ecologists (zoologists) from the DoEE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

A5.3 Migratory species (EPBC Act listed)

Includes records from the following sources:

OEH NSW BioNet Wildlife Atlas (OEH 2014f; accessed on 06/08/2014)

DoE Protected Matters Search Tool database (DoE 2014; accessed on 06/08/2014)

BirdLife Australia data search (Birdlife Australia 2014)

Current survey

Bold denotes species recorded in the study area during the current assessment.

Table 37 Migratory fauna species recorded/predicted within 10 kilometres of the study area

Scientific name	Common name	EPBC Act	TSC Act	Most recent record
Anthochaera phrygia	Regent Honeyeater	EN	E4A	2012/#
Apus pacificus	Fork-tailed Swift			2004
Ardea ibis	Cattle Egret			2014
Ardea modesta	Eastern Great Egret			2014
Calidris acuminata	Sharp-tailed Sandpiper			2014
Calidris ferruginea	Curlew Sandpiper		E1	2013
Calidris melanotos	Pectoral Sandpiper			2009
Calidris ruficollis	Red-necked Stint			2013
Chalcophaps indica	Emerald Dove			2012
Charadrius bicinctus	Double-banded Plover			2006
Chlidonias leucopterus	White-winged Black Tern			2011
Gallinago hardwickii	Latham's Snipe			2013
Haliaeetus leucogaster	White-bellied Sea-Eagle			2013
Hirundapus caudacutus	White-throated Needletail			2013
Hydroprogne caspia	Caspian Tern			2013
Limosa lapponica	Bar-tailed Godwit			2012
Limosa limosa	Black-tailed Godwit		V	2012
Merops ornatus	Rainbow Bee-eater			2013
Monarcha melanopsis	Black-faced Monarch			2013
Myiagra cyanoleuca	Satin Flycatcher			2008
Numenius madagascariensis	Eastern Curlew			1993
Pandion cristatus	Osprey		V	1992

Scientific name	Common name	EPBC Act	TSC Act	Most recent record
Plegadis falcinellus	Glossy Ibis			2013
Pluvialis fulva	Pacific Golden Plover			2013
Rhipidura rufifrons	Rufous Fantail			2013
Rostratula australis	Australian Painted Snipe	EN	E1	#
Sterna hirundo	Common Tern			2011
Symposiachrus trivirgatus	Spectacled Monarch			2009
Tringa glareola	Wood Sandpiper			1986
Tringa nebularia	Common Greenshank			2012
Tringa stagnatilis	Marsh Sandpiper			2014

Appendix 6 Significant Impact Criteria assessments

The following Significant Impact Criteria (SIC) assessment has been prepared in accordance with the Matters of National Environmental Significance, Significant Impact Criteria guidelines 1.1 Environment Protection and Biodiversity Conservation Act (DoE 2013) for species determined to have a medium or greater likelihood of occurrence within the study area. This applied to a total of two flora species and five fauna species including:

- Small-flower Grevillea *Grevillea parviflora subsp. parviflora* (Vulnerable)
- Tall Knotweed *Persicaria elatior* (Vulnerable)
- Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable)
- Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable)
- Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered)
- Blossom-dependent birds including:
  - Regent Honeyeater *Anthochaera Phrygia* (Critically Endangered)
  - Swift Parrot *Lathamus discolour* (Endangered)

Small-flower Grevillea *Grevillea parviflora* subsp. *parviflora*

Small-flower Grevillea *Grevillea parviflora subsp. parviflora* is listed as Vulnerable under the EPBC Act and Vulnerable under the TSC Act. It is a low spreading to erect shrub which sporadically occurs throughout the Sydney Basin (OEH 2013). Main occurrences of Small-flower Grevillea are located south of Sydney in the Appin – Wedderburn – Picton – Bargo districts associated with the Nepean and Georges Rivers and separately and in the Hunter within the Cessnock - Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast (OEH 2013). Generally, Small-flower Grevillea occurs on sandy clay loam soils often with lateritic ironstone gravels. Soils are derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine grained sandstones (DoE 2015a). Small-flower Grevillea grows in range of vegetation types varying from heath and shrubby woodland to open forest however, it sometimes also occurs in open, slightly disturbed sites such as the edge of tracks (OEH 2013). In the Sydney area the species has been recorded in Shale Sandstone Transition Forest and Coastal Foothills Spotted Gum Ironbark Forest (NPWS 2002).

This vulnerable species has been assessed in accordance with the aforementioned significant impact guidelines (DoE 2013) using the following significant impact criteria:

- *Lead to a long-term decrease in the size of an important population of a species.*
- *Reduce the area of occupancy of an important population.*
- *Fragment an existing important population into two or more populations.*
- *Adversely affect habitat critical to the survival of a species.*
- *Disrupt the breeding cycle of an important population.*
- *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.*
- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.*

- *Introduce disease that may cause the species to decline, or*
- *Interfere substantially with the recovery of the species.*

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will lead to a long-term decrease in the size of an important population of a species

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity.
- Populations that are near the limit of the species range.

No individuals or important populations of small-flower Grevillea were recorded within the locality. The closest records of Small-flower Grevillea are approximately 10 kilometres east of the study area, near Wallaroo State Forest (OEH 2014f). However none of the populations within the Hunter-Central Rivers CMA are considered 'important populations'. Based on the lack of an important population in the locality, the Project will not lead to a long-term decrease in the size of an important population of Small-flower Grevillea.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will reduce the area of occupancy of an important population

No small-flower Grevillea was recorded within or immediately surrounding the study area and no important populations of Small-flower Grevillea were identified. The nearest location of Small-flower Grevillea is located approximately 10 kilometres east of the study area (OEH 2014f). Further, there are no recorded important populations in the locality. It is therefore considered an unlikely that the Project will reduce the area of occupancy of an important population of this species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will fragment an existing important population into two or more populations

No important populations of Small-flower Grevillea were identified within the locality. The nearest location of an individual record was recorded approximately 10 kilometres from the study area and will not be fragmented by the proposed works.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will adversely affect habitat critical to the survival of a species

Despite none being identified during the winter and spring targeted survey, in total approximately 48.62 hectares of potentially suitable habitat will be cleared for the Project. However, within the Hunter-Central Rivers region, Small-flower Grevillea has been found associated with a number of vegetation formations, classes and types (OEH 2013). In particular, Small-flower Grevillea has been found within vegetation communities of Hunter-Macleay Dry Sclerophyll Forests, Coastal Floodplain Woodlands and Coastal Swamp Forest (identified within the study area)

Habitat clearing associated with the proposed works is unlikely to adversely affect habitat critical to the survival of the species given that the species is often associated with a wide range of vegetation formations classes and types occurring in the locality and given no individuals were found within the study area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will disrupt the breeding cycle of an important population

There is no real chance or possibility of significant impact to Small-flower Grevillea as no individuals or important populations of Small-flower Grevillea were identified within the study area, hence disruptions to regeneration and dispersal are unlikely.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

In total approximately 48.62 hectares of potentially suitable habitat for Small-flower Grevillea will be cleared for the Project. However as some of this habitat contained Blady Grass *Imperata cylindrical* and Tick Bush *Kunzea ambigua* which are known to reduce the quality and availability of suitable habitat for Small-flower Grevillea (DoE 2015a) the habitat whilst being potential habitat is considered marginal. In addition, as this species was not located during targeted survey effort, habitat removal is unlikely to cause further decline of the species given that the habitat is marginal and no individuals were recorded.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Exotic species, such as Lantana, as well as natives, such as Blady Grass and Tick Bush, considered harmful to Small-flower Grevillea were identified throughout the areas of impact (habitat to be cleared). It is therefore unlikely that the works will exacerbate the current proportion of these harmful species or result in a recruitment of other harmful species as this vegetation is planned for clearance. However, adjoining vegetation to be monitored for establishment of weeds as the Project begins and continues, and controlled as per Section 5 of the BAR.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will introduce disease that may cause the species to decline,

There are no known diseases at this current time, likely to impact Small-flower Grevillea.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result interfere substantially with the recovery of the species.

There is currently no recovery plan for this species. However, there is a targeted strategy for managing and assisting the recovery of Small-flower Grevillea. This has been developed within the site-managed species stream of the Saving Our Species program (OEH 2013). The site-managed species stream means that 5 management sites where conservation activities are needed most have been identified. The study area is not listed as a management site for Small-flower Grevillea as there is no population known to occur there. Therefore, the proposed clearing does not conflict with or interfere substantially with the recovery of the species.

Conclusion

Based on the above assessment the Project will not significantly impact Small-flower Grevillea as:

- The species was not recorded within the study area.

- There are no associated impacts to important populations of Small-flower Grevillea.
- Vegetation to be cleared is considered marginal and the nearest located individuals are located 10 kilometers east of the study area.

Tall Knotweed *Persicaria elatior*

Tall Knotweed *Persicaria elatior* is listed as Vulnerable under the EPBC Act and as Vulnerable under the TSC Act. It is an erect short-lived, herbaceous species with known individuals and/or populations occurring from the North Coast, Central Coast and South Coast Botanical Subdivisions in New South Wales (DoE 2015b). It prefers damp habitat including; coastal swamps, along watercourses, streams and lakes, swamp forest and disturbed areas (DoE 2015b). It is generally found associated with *Melaleuca linearifolia, Melaleuca quinquenervia, Lophostemon suaveolens, Casuarina glauca, Corymbia maculata, Pseudognaphalium luteoalbum* and *Polygonum hydropiper* (Quinn et al. 1995). Tall Knotweed grows rapidly, flowers and sets seeds within six months of germinating, flowering mostly in summer (Quinn et al. 1995).

This vulnerable species has been assessed in accordance with the aforementioned significant impact guidelines using the following significant impact criteria:

- *Lead to a long-term decrease in the size of an important population of a species.*
- *Reduce the area of occupancy of an important population.*
- *Fragment an existing important population into two or more populations.*
- *Adversely affect habitat critical to the survival of a species.*
- *Disrupt the breeding cycle of an important population.*
- *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.*
- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.*
- *Introduce disease that may cause the species to decline, or*
- *Interfere substantially with the recovery of the species.*

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will lead to a long-term decrease in the size of an important population of a species

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity.
- Populations that are near the limit of the species range.

No Tall Knotweed was recorded within the study area, however the dams and ephemeral wet soaks were considered to provide potential habitat for the species. The study area is not located at the limit of the range of Tall Knotweed, which is distributed from from Mt Dromedary in south east NSW to Grafton in the north. The closest records of Tall Knotweed is approximately 4 kilometres from the study area (OEH 2014i). The Project will therefore not lead to a long-term decrease in the size of an important population of Tall Knotweed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will reduce the area of occupancy of an important population

No Tall Knotweed were recorded within the study area and no important populations of Tall Knotweed were identified within 10 kilometres from the study area (OEH 2014i). If the species is currently dormant within the seed bank or there are inconspicuous individuals present within the study area, the survey effort to date suggests that their occurrence limited in number and extent and not part of an important population. It is therefore considered unlikely that the Project will reduce the area of occupancy for an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will fragment an existing important population into two or more populations

No individuals or important populations of Tall Knotweed were identified within the study area. Habitat for Tall Knotweed is typically ephemeral wet soaks, creek lines and dams. These features are usually scattered across the landscape and therefore fragmented in their distribution. The nearest population has recorded approximately 4 kilometres from the study area and will not become fragmented by the proposal.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will adversely affect habitat critical to the survival of a species

Habitat critical to the survival of a species is defined as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

In total approximately 1.69 hectares of potentially suitable habitat will be cleared for the Project, including:

- 0.67 of Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.
- 1.02 ha of offline dams.

Habitat clearing associated with the proposed works is unlikely to adversely affect habitat critical to the survival of the species given that no habitat fitting this description was recorded within the study area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will disrupt the breeding cycle of an important population

Tall Knotweed appears to be short-lived however germinates readily and grows rapidly, setting seeds within six months of germination (DoE 2015b). There is no real chance or possibility of significant impact as no individuals or populations were identified within the study area, hence disruptions to regeneration and dispersal are unlikely.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

Approximately 1.69 hectares of potentially suitable habitat will be cleared for the proposal. There are larger areas of higher quality habitat within the broader region, already known to support individuals or populations of Tall Knotweed. Therefore, the proposal is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The NSW threatened species profile for Tall Knotweed lists a number of species that are harmful to the species including:

- Longleaf Primrose Willow *Ludwigia longifolia.*
- Black-berry Nightshade *Solanum nigrum.*
- Buffalo grass *Stenotaphrum secundatum.*
- Grazers generally.

No individuals of Tall Knotweed were identified within the study area. Potential habitat for the species within the study area will be removed therefore the impacts of these harmful species will be negligible. On a broader scale, the Project is unlikely to cause the introduction or exacerbation of these harmful species into any existing populations of Tall Knotweed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will introduce disease that may cause the species to decline,

There are no known diseases at this time, likely to impact Tall Knotweed.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result interfere substantially with the recovery of the species.

There is currently no recovery plan for this species. Furthermore the Project will not interfere substantially with the long-term recovery of this species given that a targeted strategy for managing and assisting the recovery of Tall Knotweed has been developed within the site-managed species stream of the Saving Our Species program (OEH 2013i). The site-managed species stream means that 5 management sites where conservation activities are needed most have been identified. The study area is not listed as a management site for Tall Knotweed which includes:

- Mallanganee - Kyogle LGA
- Gibberagee - Clarence Valley LGA
- Wanda wetlands - Port Stephens LGA
- Bevian swamp - Eurobodalla LGA
- An additional un-named translocation site.

Conclusion

Based on the above assessment the Project will not significantly impact Tall Knotweed as:

- No individuals were recorded within the study area.
- There are no associated impacts to important populations of Tall Knotweed.

- Vegetation to be cleared is considered marginal and the nearest located individuals are located 4 kilometers from the study area.

Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory)

The Koala is listed as Vulnerable under the EPBC Act and Vulnerable under the TSC Act. It is an arboreal folivore inhabiting eucalypt forests and woodlands throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia (DoE 2015c; OEH 2014j).

Habitat suitability and the home range of Koalas depends on the size and species of trees present, soil nutrients, climate and rainfall. Generally, home ranges are between 1 hectare and 500 hectares and dispersal distances vary from between 3.5 kilometres and 16 kilometres per day (DoE 2015c).

Koalas feed almost exclusively on the leaves of *Eucalyptus*, *Corymbia* and *Angophora* species, although it has been recorded feeding from other tree species including, on occasions, exotic species (DoE 2015c). Primary feed trees include; *Eucalyptus robusta, E. tereticornis, E. punctata, E. haemastoma* and *E. signata* (Department of Planning, 1995). Additional feed trees include some species of *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp. (DoE 2015c).

Approximately 45.8 hectares of suitable Koala habitat was identified within the study area. Koalas and/or signs of Koala activity were recorded throughout the study area. However, the results of targeted surveys indicate that the study area supports a relatively low density of Koalas (≤ 0.1 Koala per hectare). Further, there was no evidence of breeding Koalas (e.g. females with young).

Is there is a real chance or possibility that the action will lead to a long-term decrease in the size of an important population of a species?

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- Key source populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

Koalas were recorded twice within the study area during surveys. One individual was recorded during winter surveys, and one individual was recorded during spring surveys. It is uncertain whether this represents two records of the same individual or two separate animals. No Koalas were recorded during targeted surveys for this species in summer.

There was no evidence of breeding (in the form of females with young) recorded during the survey period. Targeted SAT surveys indicated that the study area supports only a low density of Koalas (≤0.1 Koala per hectare) (Appendix 4). Given the low population density and the absence of breeding females it is unlikely that the study area supports an important population of Koalas. The action will not therefore lead to a long-term decrease in the size of an important population of Koalas.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

As outlined above, Koalas within the study area do not represent an important population. The Project will not therefore reduce the area of occupancy of an important population.

Is there a real chance or possibility that the action will fragment an existing important population into two or more populations?

As outlined above, Koalas within the study area do not represent an important population. The Project will not therefore reduce the area of occupancy of an important population.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Habitat critical to the survival of a species or ecological community' is defined by DoE (2013) as areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal.
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- to maintain genetic diversity and long term evolutionary development.
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to habitat identified within the recovery plan for the species and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act (DoE 2013).

To date, no areas of critical habitat have been listed for the Koala. However, in accordance with EPBC Act Referral Guidelines (DoE 2014) for the vulnerable Koala the removal of Koala habitat resulting from the Project will adversely affect habitat critical to the survival of the species.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

As outlined above, Koalas within the study area do not represent an important population. The Project will not therefore reduce the area of occupancy of an important population.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Approximately 45.8 hectares of Koala habitat will be removed for the Project. It is therefore likely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent the species is likely to decline locally.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

Feral dogs *Canis lupus familiaris* were recorded within the study area during field surveys. Dog attack is known to be a significant cause of koala mortality (DoE 2015c). However, the Project is unlikely to result in an increase of invasive species, including feral dogs.

An action is likely to have a significant impact on a vulnerable species is there a real chance or possibility that the action will introduce disease that may cause the species to decline,

The most well-known disease affecting koala populations is associated with particular strains of *Chlamydia* (DoE 2015c). Many koalas carry *Chlamydia* but do not always show clinical symptoms, however for those that do, the symptoms include; eye, urinary tract, respiratory track and reproductive tract infections. It is

unknown whether the two koalas identified within the study area, or individuals recorded in the broader area have this disease (DoE 2015c). Another well-known disease is Koala Retrovirus (KoRV). This disease is transmitted genetically and from koala to koala via close contact. Up to 100% of koalas in Queensland and NSW are thought to have KoRV (DoE 2015c). Neither of these diseases will increase or lead to species decline as a result of the Project.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result interfere substantially with the recovery of the species.

An approved recovery plan was prepared for the Koala in November 2008 (DECC 2008). The objectives of both the National Koala Conservation Strategy (ANZECC 1998) and the Approved Koala Plan (DECC 2008) are provided below:

- Objective 1: To conserve Koalas in their existing habitat.
- Objective 2: To rehabilitate and restore Koala habitat and populations.
- Objective 3: To develop a better understanding of the conservation biology of Koalas.
- Objective 4: To ensure that the community has access to factual information about the distribution, conservation and management of Koalas at a national, state and local scale.
- Objective 5: To manage captive, sick or injured Koalas and orphaned wild Koalas to ensure consistent and high standards of care.
- Objective 6: To manage over browsing to prevent both Koala starvation and ecosystem damage in discrete patches of habitat.
- Objective 7: To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

The Project is likely to conflict with Objective 1.

Conclusion

Based on the above assessment it is likely that Koalas will be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is recommended for this species.

Grey-headed Flying-Fox *Pteropus poliocephalus*

The Grey-headed Flying-Fox *Pteropus poliocephalus* is listed as Vulnerable under the EPBC Act and as Vulnerable under the TSC Act. Grey-headed Flying-Fox is a canopy-feeding frugivore, blossom-eater and a nectarivore of rainforests, tall sclerophyll forests and woodlands, heaths and swamps, gardens and cultivated fruit crops (DoE 2015d).

They forage opportunistically, often at distances up to 30 kilometres from camps, and occasionally up to 60–70 kilometres per night, in response to patchy food resources (NSW Scientific Committee 2001). The species congregates in large numbers at roosting sites (camps). Individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (OEH 2014k).

One Grey-headed Flying-fox was recorded foraging within the study area during current surveys. The study area provides approximately 48.62 hectares of suitable forage habitat for this species. However, suitable forage habitat is abundant throughout the wider locality.

No roosting or breeding camps of the Grey-headed Flying-fox were recorded within the study area during the current surveys.

Is there is a real chance or possibility that the action will lead to a long-term decrease in the size of an important population of a species?

An 'important population' is defined by DoE (2013) as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in Recovery Plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

During the field survey Grey-headed Flying Foxes were recorded within the study area. Additionally, background searches revealed that approximately 23 individuals had been previously recorded approximately 3.5 kilometres of the study area (OEH 2014f). The Project will remove 48.62 hectares of forage habitat for the Grey-headed Flying-fox. However, given the extent of suitable forage habitat in the locality, the mobility of the species and the absence of roost or breeding camps within or in proximity to the study area it is unlikely that the Project will adversely decrease the size of these populations.

Is there a real chance or possibility that the action will reduce the area of occupancy of an important population?

The study area is not considered to support an important population of the Grey-headed Flying-fox. Approximately 48.62 hectares of forage habitat will be cleared for the Project. This clearing is unlikely to significantly reduce the area of occupancy given that no known breeding or roosting camps were within the study area.

Is there a real chance or possibility that the action will fragment an existing important population into two or more populations?

Grey-headed Flying-foxes are highly mobile animals. Clearing of approximately 48.62 hectares of forage habitat will not fragment the local population.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species or ecological community' is defined by DoE (2013) as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long term evolutionary development.
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to habitat identified within the recovery plan for the species and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act (DECCW 2009b; DoE 2013).

To date, no areas of critical habitat have been listed for the Grey-headed flying-fox. The study area provides forage habitat only for Grey-headed Flying-fox. There are many known examples of better quality and better-suited habitat within the broader area. Given that the Grey-headed Flying-foxes is a highly mobile species,

habitat clearing associated with the Project is unlikely to adversely affect habitat critical to the survival of the species.

Is there a real chance or possibility that the action will disrupt the breeding cycle of an important population?

No known breeding or roosting camps of the Grey-headed flying-fox were found within the study area. Given that individuals generally exhibit a high fidelity to traditional camps and return annually to give birth and rear offspring (OEH 2014k), clearing of the vegetation in the study area would not disrupt the breeding cycle of the local population.

Is there a real chance or possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Approximately 48.62 hectares of forage habitat for Grey-headed flying-fox will be cleared for the Project. There are other suitable habitats within the broader region already known to support Grey-headed Flying-fox populations. Therefore, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

There are no specific invasive species known to be harmful to Grey-headed Flying Foxes therefore the Project is unlikely to have a significant impact.

Is there is a real chance or possibility that the action will introduce disease that may cause the species to decline?

The effects of the diseases such as Australian bat Lyssavirus (ABL), Bat Paramyxovirus and Menangle Pig virus on the Grey-headed Flying-fox are unknown (DoE 2015d). However, the Project is unlikely to introduce disease that may cause species decline.

Is there a real chance or possibility that it will result interfere substantially with the recovery of the species?

There is a draft national recovery plan for the Grey-headed flying fox (DECCW 2009). Objectives of the recovery plan include:

- To reduce the impact of threatening processes.
- To arrest decline throughout their range.
- To conserve their functional roles in seed dispersal and pollination of native plants.
- To improve the comprehensiveness and reliability of information available to guide recovery.

- The Project is unlikely to conflict with any of these objectives and will therefore unlikely interfere substantially with the recovery of the species.

Conclusion

Based on the above assessment the Grey-headed Flying-fox is unlikely to be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population)

The Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) is listed as Endangered under the EPBC Act and as Vulnerable under the TSC Act. It is a nocturnal, carnivorous marsupial with reddish-brown fur and distinctive white spots (DoE 2015e).

It is recorded across a range of habitat such as; rainforest, open forest, woodland, coastal heath, inland riparian forest, the sub-alpine zone to the coastline in eastern NSW, eastern Victoria, south-east and north-eastern Queensland and Tasmania (DoE 2015e; OEH 2014l).

Spotted-tailed Quolls use hollow-bearing trees, fallen logs, caves, rock outcrops and rocky-cliff faces as den sites and have an average litter size of five (OEH 2014l). They are a generalist predator, preying on; gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, domestic foul, reptiles and insects (OEH 2014l).

Spotted-tailed Quolls were not recorded within the study area during the current surveys, despite the use of survey methods targeting this species. Given the proximity of records of the Spotted-tailed Quoll from the wider locality, combined with habitat assessment it is assumed that the Project will remove approximately 48.62 hectares of potential habitat for this species.

Is there a real chance or possibility that it will lead to a long-term decrease in the size of a population?

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations, or
- A population, or collection of local populations, that occurs within a particular bioregion.

- Despite targeted surveys, no Spotted-tailed Quolls were found within the study area. However, 30 recent Spotted-tailed Quoll records occur within 10 kilometres of the study area (OEH 2014f). Within the study area, approximately 48.62 hectares of suitable habitat for the Spotted-tailed Quoll will be cleared for the Project. However, clearing this habitat is unlikely to lead to a long-term decrease in the size of a population given that no population was identified within the study area, and there are known populations and alternative habitat within the broader area.

Is there a real chance or possibility that the action will reduce the area of occupancy of the species?

Vegetation clearance is likely to remove approximately 48.62 hectares of potentially suitable habitat for Spotted-tailed Quoll, however given that no individuals were observed during the field survey it is unlikely to reduce the area of occupancy of the species. There are known areas of occupancy within the wider locality that will not be impacted by the Project.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

Despite targeted surveys, no Spotted-tailed Quolls were found within the study area. The removal of habitat is therefore not anticipated to have a significant impact causing population fragmentation.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

'Habitat critical to the survival of a species' is defined by DoE (2013) as areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal.
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators).
- To maintain genetic diversity and long term evolutionary development, or
- For the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to habitat identified within the recovery plan for the species and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act (DoE 2013).

To date, no areas of critical habitat have been listed for the Spotted-tailed Quoll. The Project will not therefore adversely affect habitat critical to the survival of the Spotted-tailed Quoll.

Is there a real chance or possibility that the action will disrupt the breeding cycle of a population?

The Spotted-tailed Quoll requires suitable den sites (such as hollow logs, tree hollows, rock outcrops or caves) for breeding (DoE 2015e; OEH 2014m). Within the study area, hollow-bearing trees and hollow logs provide potential breeding habitat for this species. The Spotted-tailed Quoll was not recorded within the study area during the current surveys. Although the study area provides suitable potential breeding habitat for this species, more extensive similar or better quality habitat occurs in the wider locality. Suitable habitat in surrounding lands will not be impacted by the Project.

Given the absence of records of this species and the occurrence of suitable habitat in the wider locality, the Project will not disrupt the breeding cycle of a population of the Spotted-tailed Quoll.

Is there a real chance or possibility that the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

In total approximately 48.62 hectares of potentially suitable habitat will be cleared for the Project. Habitat clearing associated with the Project is unlikely to adversely affect habitat critical to the survival of the species for the following reasons:

- The species is often associated with a wide range of vegetation formations, classes and types (OEH 2014l).
- The species is highly mobile and there are is other suitable habitat within the broader area.
- No individuals were recorded found within the study area.

Is there a real chance or possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

Despite targeted surveys, no Spotted-tailed Quolls were found within the study area. However, Red Foxes *Vulpes vulpes* and Dogs *Canis lupus familiaris,* which are major threats to the Spotted-tailed Quoll (DoE 2015e) were observed in the study area and may affect populations of Spotted-tailed Quolls within the broader area. The Project is unlikely to result in an increase of invasive species, including dogs and foxes.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

There are no known diseases likely to impact Spotted-tailed Quoll.

Is there a real chance or possibility that the action will interfere with the recovery of the species?

To date, there is currently no recovery plan for the Spotted-tailed Quoll however OEH lists 4 activities to assist with the recovery of this species:

- Consult with OEH/NPWS if Spotted-tailed Quolls are raiding poultry, rather than taking direct action.
- Consult with OEH/NPWS if poison baiting is planned in or near areas where Spotted-tailed Quolls are known or likely to occur.
- Undertake cat and fox control using poison-baiting techniques least likely to affect quolls.
- Retain and protect large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understorey or dense vegetation along drainage lines.

- The Project is not considered to significantly impact or interfere with the recovery of Spotted-tailed Quolls.

Conclusion

Based on the above assessment the Spotted-tailed Quoll is unlikely to be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is not recommended for this species.

Blossom-dependent birds: Regent Honeyeater *Anthochaera phrygia* and Swift Parrot *Lathamus discolor*

The Regent Honeyeater *Anthochaera phrygia* is listed as Endangered under the EPBC Act and Critically Endangered under the TSC Act. The Regent Honeyeater inhabits temperate woodlands, open forests and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak (DoE 2015f; OEH 2014n).

It occurs mainly within vegetation communities that have a significantly high abundance and species richness of bird species as well as a large number of mature trees, high canopy cover and an abundance of mistletoes (OEH 2014n). They are distributed mainly in vegetation communities on inland slopes of south-east Australia but can sometimes be found in drier coastal woodlands and forests some years (OEH 2014n).

The Regent Honeyeater is a generalist forager, feeding on nectar from a wide range of *Eucalyptus* species and mistletoes (DoE 2015f; OEH 2014n).

The Swift Parrot *Lathamus discolor* is listed as Endangered under the EPBC Act and as Endangered under the TSC Act. The Swift Parrot is a highly nomadic species that inhabits dry sclerophyll eucalypt forests and woodlands in New South Wales (DoE 2015g; OEH 2014o). It migrates in response to food availability and seasonal changes. It is often recorded in New South Wales between May and August and breeds in Tasmania during the warmer seasons (DoE 2015g; OEH 2014o).

The Swift Parrot is mainly an arboreal forager, feeding on nectar (mainly from eucalypts) as well as psyllid insects and lerps, seeds and fruits. Favoured feed trees include winter-flowering species such as *Eucalyptus robusta, E. albens, E. sideroxylon*, *Corymbia maculata* and *C. gummifera*. Commonly used lerp-infested trees include *Eucalyptus microcarpa*, *E. moluccana* and *E. pilularis* (DoE 2015g).

Targeted surveys in winter and spring did not record the Regent Honeyeater or the Swift Parrot within the study area. Given the proximity of recent records combined with the results of habitat assessment it is considered that the Project will remove 48.62 hectares of potential foraging habitat for both of these species. However, more extensive areas of similar or better quality habitat for the Regent Honeyeater and the Swift Parrot occurs throughout the wider locality.

Is there a real chance or possibility that the action will lead to a long-term decrease in the size of a population?

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations, or

- A population, or collection of local populations, that occurs within a particular bioregion.

Despite targeted surveys, neither the Regent Honeyeater nor Swift Parrot were recorded within the study area. However, both species may occasionally utilise seasonal forage habitat within the study area, albeit infrequently. Wildlife Atlas data indicates that the closest record for the Regent Honeyeater is approximately 4.5 kilometres while the closest record for the Swift Parrot is 5 kilometres from the study area (OEH 2014o). Within the Hunter-Central region, both the Regent Honeyeater and Swift Parrot are associated with a range of vegetation formations, classes and types with extensively recorded 'known' distributions outside the study area. It is therefore considered unlikely that the Project will lead to a long-term decrease in the size of a population (OEH 2014n; OEH 2014o).

Is there a real chance or possibility that the action will reduce the area of occupancy of the species?

The study area does not lie at or near the limit of the area of occupancy of the Swift Parrot, which extends from south east Queensland through New South Wales, Victoria to South Australia and Tasmania (Pizzey and Knight 2012). In addition, the study area does not lie near the limit of the area of occupancy of the Regent Honeyeater, which extends from South-east Queensland to Victoria (Pizzey and Knight 2012). Given the absence of records of these species within the study area, the extent of suitable habitat in the wider locality and the high mobility of these species, it is considered unlikely that the proposal would reduce the area of occupancy of the Regent Honeyeater and/or Swift Parrot.

Is there a real chance or possibility that the action will fragment an existing population into two or more populations?

Clearing of approximately 48.62 hectares of potential forage habitat for the Project will not fragment an existing population of either species into two or more populations give:

- Regent Honeyeaters and Swift Parrots have not been recorded within the study area.
- Larger areas of similar or better quality forage habitat for these species occurs throughout the wider locality.
- The Regent Honeyeater and the Swift Parrot are highly mobile blossom nomads.

Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of a species?

Approximately 48.62 hectares of potential forage habitat for the Regent Honeyeater and the Swift Parrot will be removed for the Project. Given the absence of records of these species within the study area and the extent of suitable forage habitat in the wider locality it is considered unlikely that the Project will adversely affect habitat critical to the survival of the Regent Honeyeater and/or the Swift Parrot.

Is there a real chance or possibility that the action will disrupt the breeding cycle of a population?

The Project will remove approximately 48.62 hectares of potential foraging habitat for the Regent Honeyeater and Swift Parrot. However, given the extensive habitat occurring outside the study area provided that both species are highly mobile (frequently migrating in response to food availability and seasonal changes) (DoE 2015f; DoE 2015g). It therefore considered unlikely that the Project would disrupt the breeding cycle of a population of either of these species.

Is there is a real chance or possibility that the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Project will remove approximately 48.62 hectares of potential foraging habitat for the Regent Honeyeater and Swift Parrot. More extensive areas of similar or better habitat for these species occur in the wider

locality. These species have not been recorded within the study area, and are both highly mobile species. It is therefore unlikely that the Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat for either the Regent Honeyeater or the Swift Parrot to the extent that either of these species is likely to decline.

Is there is a real chance or possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The Regent Honeyeater and Swift Parrot would be susceptible to predation by foxes and feral dogs (which were recorded within the study area) however the impact of predation from these species is noted as being low and is not a focus of recovery actions (DoE 2015f; DoE 2015g). The Project is unlikely to increase the number of invasive predatory species that will significantly impact on the Regent Honeyeater and/or Swift Parrot.

Is there a real chance or possibility that the action will introduce disease that may cause the species to decline?

There are no known diseases impacting Regent Honeyeater.

Infection by *Psittacine circoviral* (beak and feather) disease (PCD) affecting endangered psittacine species is listed as a key threatening process (DoE 2015g). Swift parrots are considered to have a high potential for being adversely impacted by PCD due to their low population numbers and the fact that PCD has been recorded in wild birds in New South Wales (DoE 2015g). The Project is unlikely to result in the introduction of PCD into the study area, or increase the incidence of PCD in birds in New South Wales.

Is there a real chance or possibility that the action will interfere with the recovery of the species?

A recovery plan exists for the Regent Honeyeater and was developed in 1999 (Menkhorst et al. 1999).

A national recovery plan for the Swift Parrot was developed in 2011 (Saunders and Tzaros 2011). The overall objective of the plan is to; prevent further population decline of the Swift Parrot, to achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat and to increase carrying capacity. Main recovery actions implemented to achieve these objectives are (Saunders and Tzaros 2011):

- Objective 1: To identify and prioritise habitats and sites used by the species across its range, on all land tenures.
- Objective 2: To implement management strategies to protect and improve habitats and sites on all land tenures
- Objective 3: To monitor and manage the incidence of collisions, competition and Beak and Feather Disease (BFD).
- Objective 4: To monitor population trends and distribution throughout the range.

The Project is unlikely to conflict or interfere with the recovery of the Regent Honeyeater and/or the Swift Parrot.

Conclusion

Based on the above assessment the Regent Honeyeater and the Swift Parrot are unlikely to be significantly impacted by the Project and as such, a Referral under the provisions of the EPBC Act is not recommended for either of these species.

Appendix 7 Credit profile report

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 30/09/2016 Time: 1:26:31PM Calculator version: v4.0

Development details

Proposal ID:	0103/2016/3971D
Proposal name:	Brandy Hill Quarry Expansion BBA
Proposal address:	979 Clarence Town Road Seaham NSW 2324
Proponent name:	Hanson Construction Materials Pty Ltd
Proponent address:	Level 5 75 George Street Parramatta NSW 2150
Proponent phone:	02 9354 2638
Assessor name:	Nathan Garvey
Assessor address:	8 Tate Street WOLLONGONG NSW 2500
Assessor phone:	4229 5222
Assessor accreditation:	0103

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Forest Red Gum grassy open forest on floodplains of the lower Hunter	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report...

- [x] Request for additional gain in site value
- [ ] Predicted threatened species not on site
- [ ] Change threatened species response to gain (Tg value)

Ecosystem credits summary

Plant Community type	Area (ha)	Credits required	Red flag
Forest Red Gum grassy open forest on floodplains of the lower Hunter	1.67	111.22	Yes
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	0.67	46.30	Yes
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	25.90	1,491.00	No
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	1.12	64.00	No
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	17.10	984.00	No
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	2.16	103.00	No
Total	48.62	2,800	

Credit profiles

1. White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798)

Number of ecosystem credits created	103
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798) Blackbutt - Tallowwood dry grassy open forest of the southern NSW North Coast Bioregion, (HU511) Tallowwood - Small-fruited Grey Gum - Kangaroo Grass grassy tall open forest on foothills of the lower North Coast, (HU762) Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast, (HU770) Pink Bloodwood - Thin-leaved Stringybark - Grey Ironbark shrub - grass open forest on ranges of the lower North Coast, (HU772)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806)

Number of ecosystem credits created	64
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814)

Number of ecosystem credits created	984
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816)

Number of ecosystem credits created	1,491
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	

5. Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion, (HU591)

Number of ecosystem credits created	46
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion, (HU591) Melaleuca biconvexa - Swamp Mahogany - Cabbage Palm swamp forest of the Central Coast, (HU937)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Forest Red Gum grassy open forest on floodplains of the lower Hunter, (HU812)

Number of ecosystem credits created	111
IBRA sub-region	Upper Hunter

Offset options - vegetation types	Offset options - CMA sub-regions
Forest Red Gum grassy open forest on floodplains of the lower Hunter, (HU812) Coastal floodplain sedgelands, rushlands, and forblands of the North Coast, (HU532) Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion, (HU635) Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter, (HU808) Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula, (HU865) Prickly-leaved Paperbark - Flax-leaved Paperbark swamp forest on poorly drained soils of the Central Coast, (HU929) Cabbage Gum - Forest Red Gum - Flax-leaved Paperbark Floodplain Forest of the Central Coast, (HU934) Swamp Oak - Sea Rush - Baumea juncea swamp forest on coastal lowlands of the Central Coast and Lower North Coast, (HU941) Swamp Oak - Prickly Paperbark - Tall Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast, (HU942) Grey Gum - Red Gum - Paperbark shrubby open forest on coastal lowlands of the Northern Sydney Basin and Lower North Coast, (HU963)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	45.80	1,191

Appendix 8 Targeted Koala Survey Report

Brandy Hill Quarry Expansion

Targeted Threatened Species Survey –

Koala *Phascolarctos cinereus*

Prepared for Hanson Construction Materials Pty Ltd

17 March 2015

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Document information

Report to:	Pip Cox of Hanson
Prepared by:	Carl Corden
Biosis project no.:	19323

File name: 19323.AttachmentB.Targeted.Koala.Survey.FIN01.20150317

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Draft version 01	Brian Wilson	09.01.2014
Draft version 02	Carl Corden	20.01.2015
Final version 01	Jane Murray	24.02.2015

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- Pip Cox and Simon Jones of Hanson

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- Carl Corden for field surveys and reporting
- James Shepherd for mapping
- Jane Murray and Brian Wilson for quality assurance

Contents

1 Introduction

1.1 Background

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry located at 979 Clarence Town Rd, Seaham (the Project). The Project will be assessed against Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as a State Significant Development (SSD). To support the design and approval of the Project, Hanson is preparing an Environmental Impact Statement (EIS).

While undertaking the flora and fauna assessments to support the EIS, Biosis identified the presence of the Koala *Phascolarctos cinereus* within the Project area. The Koala is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). The presence of Koalas within the Project area was deemed likely to trigger the requirement to submit a referral for impacts on Commonwealth Matters of National Environmental Significance (NES). A Significant Impact Criteria assessment was therefore undertaken for the Koala, and the results of the assessment confirmed that the Project was likely to result in a significant impact on Koalas.

Targeted Koala and Koala habitat utilisation surveys were recommended to provide additional information for inclusion with the Commonwealth EPBC Act referral for the Project. The need for additional targeted surveys is stipulated by the *EPBC Act referral guidelines for the vulnerable Koala* (Commonwealth of Australia 2014). Biosis Pty Ltd was commissioned by Hanson to undertake targeted Koala surveys to provide additional information to support the Commonwealth EPBC Act referral for the Project.

The following definitions apply to the Project and are used throughout this document:

The **Project area** includes the area that forms the SSD application as per Attachment 1 (Figure 1 and Figure 2) of the EPBC Referral.

The **study area** encompasses the area within the Project area comprising vegetation to be removed, as well as adjacent areas supporting potential Koala habitat (Figure 1 below).

The **Koala** refers to the combined populations of the Koala in Queensland, New South Wales and the Australian Capital Territory, which were determined to be a single population for the purposes of the Vulnerable listing for this species under the Commonwealth EPBC Act.

1.2 Scope of works

The scope of works for this study involved targeted surveys for the Koala using the Spot Assessment Technique (SAT) in conjunction with point searches for Koalas, in line with relevant species survey guidelines (DoE 2013). Surveys were undertaken in December to meet the optimal survey period for this species, and were conducted by an ecologist experienced in Koala survey methods. Following the field survey, the following tasks were completed:

- Identified and mapped koala habitat, activity and recorded the number and location of any Koalas observed.
- Prepared and analysed data in accordance with the SAT to determine habitat utilisation by Koalas within the study area.
- Prepared an EPBC Act referral for the Minister of the Environment.

This report was prepared to provide an addendum to the Biodiversity Assessment Report (Biosis 2015) prepared to support the EIS.

1.3 Objectives of the report

The occurrence of Koalas at the proposed quarry expansion at Brandy Hill was confirmed from sightings of Koalas in addition to detection of scats during both the winter and spring fauna assessments of the Project area. To provide DoE with adequate information to support the determination of whether Project, a state significant development (SSD) under the *Environmental Planning and Assessment Act 1979* (EP&A Act), may potentially become a 'controlled action', Biosis completed targeted Koala surveys using the SAT developed by the Australian Koala Foundation (Phillips and Callaghan 2011) in conjunction with point searches for Koalas.

The objectives of the survey were to establish population density and habitat utilisation within the Project area and the adjacent study area (vegetation to be cleared as part of the proposed SSD and surrounding suitable habitat).

The tasks of the project are identified as follows:

- Undertake a targeted Koala surveys and Koala activity surveys within the Project area and suitable adjoining habitat (study area).
- Determine the potential for the Project area to provide habitat for the Koala.

Given the scope of works outlined above, and relevant species survey guidelines and requirements for the Koala, this report documents the following:

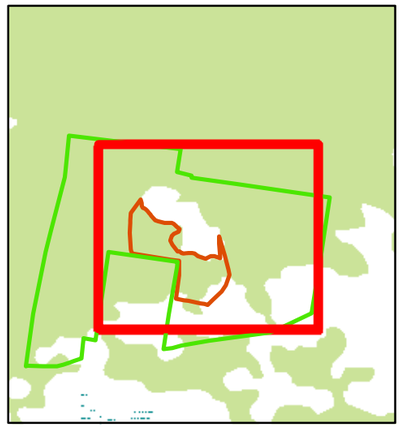
- Background information.
- Survey methodology.
- Survey limitations.
- Results of the field survey.
- Survey conclusion.

Following the survey an EPBC Act referral to the Minister has been prepared, of which this report forms Attachment B, including the details of the proposed SDD works and findings of the targeted Koala surveys and relevant components of the flora and fauna assessment.

1.4 Literature and database review

The following policies, documents and databases were reviewed to provide background information for this report:

- *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capitol Territory)* (Commonwealth of Australia 2014).
- NSW BioNet - the database for the Atlas of NSW Wildlife (OEH 2015).
- State Environmental Planning Policy (SEPP) No. 44 – Koala Habitat Protection.
- *Port Stephens Comprehensive Koala Plan of Management* (CKPoM) (Port Stephens Council 2002).



Legend

- Koala Survey Grid 200m
- Koala Survey Grid Extent
- Vegetation clearing area

Figure 1: Study area and SAT survey points

0 75 150 225 300 375

Metres
Scale: 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

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Date: 05 January 2015,
Checked by: CAC, Drawn by: LDM, Last edited by: jshepherd
Location:P:\19300s\19323\Mapping
19323_F3_KoalaSatSurvey

2 Background

2.1 Habitat and ecology

Koalas are generally solitary animals inhabiting eucalypt woodlands and forests. They have been known to feed on the foliage of more that 100 eucalypt and non-eucalypt species, though they prefer only a few browse species in any one location. Koalas are inactive for most of the day, spending most of their time in trees and feeding and moving between trees at night. They display complex social hierarchies and territories, with their home range varying between less than two hectares to several hundred hectares, depending on habitat quality (DoE SPRAT 2014).

SEPP 44 defines potential Koala habitat as *"areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component"*. Core Koala habitat is defined as *"land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population"*.

SEPP 44 does not apply to Major Projects that are being assessed as SSD. However, SEPP 44 Koala habitat definitions have been used to determine potential and core Koala habitat areas for the study area. The Port Stephens CKPoM mapping was also used to identify Koala habitat within the study area.

2.2 Species distribution

The Koala has a sparse and fragmented distribution throughout the central and north coasts of NSW, and throughout eastern Australia from Queensland to the Eyre Peninsula in South Australia, with some populations occurring west of the Great Dividing Range (DoE SPRAT 2014).

NSW OEH Bionet data indicates a total of 6,749 Koala records from within the Port Stephens LGA, as at 20 January 2015 (OEH 2015). Figure 2 shows the locality of historical records of the species in the immediate locality of the study area (NSW OEH Bionet 2015).

Legend

- Koala records (OEH Bionet)
- Search area
- Study area

Figure 2: Koala records within 10km of the study area

0 860 1,720 2,580 3,440 4,300

Metres

Scale: 1:86,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

N

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Date: 20 January 2015,
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Location:P:\19300s\19323\Mapping
19323_F2_KoalaRecords

3 Methodology

All Biosis field surveys were conducted by a qualified and competent zoologist under the authority of a current NSW *National Parks and Wildlife Act, 1974* Scientific Licence (SL100758) to harm/trap/pick/hold/study protected fauna and native flora, and a current Animal Research Authority (ARA) (TRIM 14/271#4) issued under the NSW *Animal Research Act, 1985* Certificate of Approval by the Animal Ethics Committee (AEC) of the Director-General of NSW Agriculture to conduct fauna survey work carried out as part of Environmental Impact Statements, Species Impact Statements and general wildlife research.

3.1 Previous Surveys

Comprehensive flora and fauna surveys were conducted within the study area in winter and spring. These surveys included vegetation mapping (identifying the occurrence of Koala feed trees) and targeted threatened fauna searches, including diurnal and nocturnal searches for Koalas. Methods used to search for Koalas included:

- Diurnal searches of trees for Koalas within bird census and BioBanking plots.
- Diurnal incidental searches beneath Koala feed trees within bird census and vegetation survey plots for signs of Koalas (scats and scratches).
- Diurnal incidental searches of trees for Koalas and signs of Koala activity while traversing the Project area and the study area.
- Nocturnal spotlighting and call playback for Koalas throughout the Project area and study area.

3.2 Current SAT and point surveys

Targeted Koala and Koala activity surveys were conducted 9 to 11 December 2014. Surveys were conducted by 3 or 4 staff for a maximum of 8 hours on each day. The timing of the surveys was considered appropriate for detecting both Koalas and signs of Koala activity as stipulated in the Draft Koala Referral Guidelines (DoE 2013). The targeted survey was guided by key documents:

- *Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DoE 2013).
- The *Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus* (Phillips and Callaghan 2011).
- DRAFT NSW *Threatened Biodiversity Survey and Assessment Guidelines* (DEC 2004).
- Department of the Environment's (DoE) Species Profile and Threats Database (SPRAT).

Koala SAT and point survey locations were selected using a systematic grid-based approach. A 200m interval grid was placed over a map of the Project and study areas and the intercept points of the grid were used as potential survey sites. Figure 1 shows the location of potential Koala SAT survey points.

From the potential points, final survey sites were selected based on:

- The proximity of each potential survey site to Koala habitat (i.e. sites in cleared land or the operating quarry area were not selected).

- The location of the points within or immediately adjacent to the Project area.
- The total number of sites that could be adequately sampled during field surveys.

At each site surveyed a combination of two survey methods were employed. These were the SAT methodology and Koala point searches. Methods for each are described below.

3.2.2 SAT surveys

The SAT methodology employed was as described by Phillips and Callaghan (2011). At each point surveyed, a central tree was chosen (usually a preferred Koala feed tree if present). The base of this and the nearest 29 trees (> or = 100mm diameter at breast height) were searched for Koala scats by one observer for up to 2 minutes per tree. Searches were conducted within 1 metre from the base of the tree, and were conducted on the surface as well as beneath leaf litter (using a small hand-held rake). If Koala scats were detected the tree was scored as a "1". If no scats were detected within 2 minutes the tree was scored as a "0". The total score was then added for 30 trees to determine the activity value of the site.

In accordance with the methodology described by Phillips and Callaghan (2011) the Project area was mapped as "East Coast – low abundance". This was primarily based on Koala density estimates obtained during previous and current surveys, indicating that the Project area is likely to support less than 0.1 Koalas per hectare. The activity scores for East Coast – low abundance are as follows:

- 0 – 2 scats recorded – "Low" activity.
- 3 scats recorded – "Medium" activity.
- 4 – 30 scats recorded – "High" activity.

For the purposes of the assessment, "Low" activity areas (including areas where no scats were recorded) are considered to be used only infrequently by Koalas. Areas of "Medium" and "High" activity are considered to represent preferred Koala habitat within the Project area and the study area.

3.2.3 Koala point surveys and population density estimate

At each of the survey points selected, a total of 5 minutes was spent searching all vegetation (from ground to canopy) within a 25 metre radius of the central tree for any Koalas present. Any Koalas recorded within the 25 metre radial search were used in calculations of population density for the Project area. Any Koalas recorded outside of the 25 metre radial search area were counted as incidental records only, and were not used in population density estimates.

Each 25 metre radial search equated to a total of 0.125 hectares. The total search area for Koala population density estimates was therefore 0.125 hectares multiplied by the total number of sites surveyed. Thus the Koala population density for the study area was calculated using the total number of Koalas recorded within the 25 metre radial searches divided by the total area searched, and an estimate of the number of Koalas per hectare derived.

3.3 Survey limitations

General fauna surveys and targeted Koala surveys were conducted over three seasons in varying weather conditions. It is considered that this range of conditions was appropriate for detecting Koalas or signs of Koala activity throughout the study area.

The systematic grid based assessment provides a randomised approach to surveys. This method has the potential to over or under-estimate Koala activity if sites selected are co-incidentally over or under-utilised

compared to remaining parts of the study area. A relatively large number of sites were sampled to ensure the study area was adequately sampled.

4 Results

4.1 Desktop assessment and previous surveys

Figure 2 shows Koala records are known from the wider locality. Anecdotal reports from Brandy Hill Quarry staff indicate low abundance of Koalas over many years of operations.

Results of previous surveys indicate presence of one individual in winter and one individual in spring surveys (see Figure 3).

No breeding female Koalas were recorded during previous surveys. Under SEPP 44 the Project would therefore be defined as "potential" Koala habitat. The Port Stephens CKPoM maps the Project as supporting areas of "Preferred" and "Marginal" Koala habitat.

4.2 SAT surveys

Figure 1 and Figure 3 shows the locations of SAT survey points surveyed and the activity levels recorded at each SAT survey point. A total of 29 SAT points were surveyed. The data collected during the SAT surveys is included in Appendix 1.

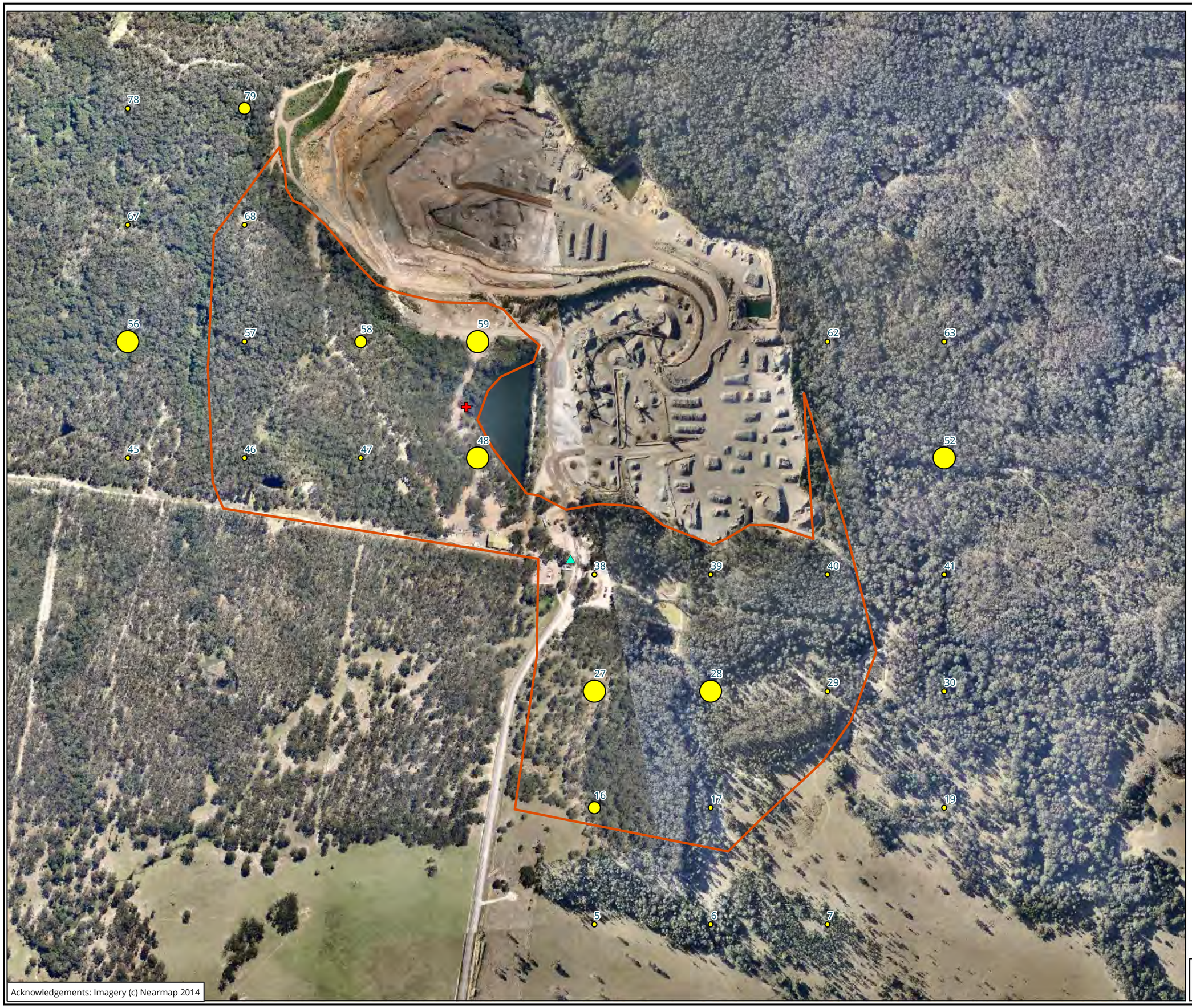
The East Coast low abundance category chosen based on the population density estimate calculated in Section 4.3 below as well as previous survey records.

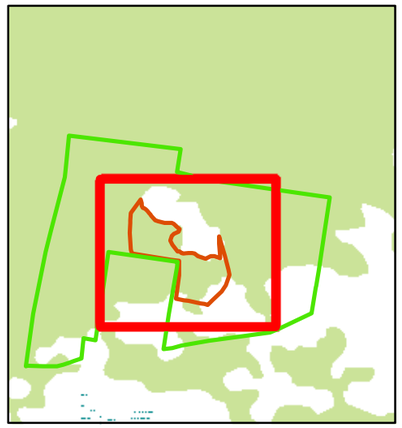
Mapping shows 6 High (between 4 and 30 trees with scats) and 3 Medium (3 trees with scats) activity sites within the study area, with the remaining 20 sites surveyed within the study area showing low (0 to 2 trees with scats) activity levels. With the exception of two outlying "High" sites to the east and west of the Project area, the SAT data indicates that the major areas of Koala activity occur within the Project vegetation clearing area. A band of High and Medium activity occurs from northwest to southeast, indicating a potential Koala activity corridor through the Project area (see Figure 3).

4.3 Koala point surveys and population density estimate

At each SAT point surveyed (see Figure 3) searches were conducted for individual Koalas within a 25m radius of the central tree chosen for the SAT surveys. No Koalas were recorded at any of the 29 survey points searched during the SAT surveys.

During the surveys a total of 3.6 hectares (29 x 0.125 hectares) of Koala habitat were searched for Koalas. This includes a search of 1.9 hectares (15 x 0.125 hectares) within the Project area. Although it is not possible to estimate actual Koala population density based on the Koala point surveys it can be assumed that the population within the Project area would be <0.1 Koalas per hectare of habitat present.





Legend

- Vegetation clearing area

Koala records

- August 2014
- November 2014

Koala Activity

- Low
- Medium
- High

Figure 3: Koala activity and records

0 60 120 180 240 300

Metres

Scale: 1:6,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Location:P:\19300s\19323\Mapping
19323_F4_KoalaActivity_20141219

5 Discussion and recommendations

No Koalas were recorded during the current Koala point surveys. Combined with the low numbers of Koala records from previous surveys and anecdotal observations of long-term staff at the Brandy Hill Quarry this indicates that, despite activity levels shown in the SAT data, the Project area currently supports only a low density of Koalas. The relatively high activity levels in parts of the Project may therefore indicate frequent use by a small number of individuals.

The Project area supports 48.65 hectares of Koala habitat, all of which would be removed for the Project. The total area of the site owned by Hanson is 561 hectares, much of which supports Koala habitat. It is therefore unlikely that removal Koala habitat for the Project will result in a significant reduction in the area of occupancy of Koalas in the locality, given the area of suitable habitat that will remain in adjacent land. To date, no areas of Commonwealth identified "critical habitat" have been listed for the Koala. However, in accordance with the *EPBC Act Referral Guidelines for the vulnerable listed Koala* (Commonwealth of Australia 2014) removal of Koala habitat resulting from the Project has potential to adversely affect "habitat critical to the survival of the species".

As recommended in the Referral Guidelines, a Koala habitat appraisal has been completed to assess impacts of the Project on Koalas (see Appendix 2). The Koala habitat appraisal determined that the Project achieved a total habitat assessment score of 9. In accordance with Referral Guidelines, the Project is therefore likely to result in adverse effects on habitat critical to the survival of the Koala given the Project will:

- *Impact on an area supporting habitat critical to the survival of the Koala (a habitat score of > or = 5).*
- *Require clearing of > or = 20 hectares of habitat containing known Koala food trees in an area with a habitat score > or =8.*

Based on the results of previous surveys (Biosis 2015) as well as the current SAT and Koala point surveys, combined with the results of the Koala habitat appraisal and the Significant Impact Criteria assessment of which a significant impact to Koala was determined to be likely (Biosis 2015), it is therefore recommended that a Referral under the Commonwealth EPBC Act for impacts on Matters of NES (Koalas) be submitted for the Project. This document has therefore been prepared to supplement the EPBC Act referral for Koalas.

Should the Project proceed, the following recommendations are made to minimise potential impacts on Koalas, resulting from the Project:

- A Biodiversity Management Plan (incorporating management measures for Koalas) should be prepared to outline the clearance procedure (including protection measures for adjacent vegetation), protocols for Koala finds and incidents and include an educational brochure for all workers to review prior to working on the Project.
- An ecologist should undertake pre-clearance surveys within the Project area immediately prior to the removal of any vegetation to give the clearance go ahead.
- An ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on Koalas displaced or injured during clearing.
- An ecologist or regional Koala care group should be contacted if any Koalas are injured and/or distressed during the construction and operation phases of the Project.

- Low site speed limits should be established on site to reduce the potential for vehicle impacts on Koalas. All drivers working on the Project should be made aware of Koalas and instructed to take precautions when driving on site.

6 References

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Port Stephens Council 2002. *Port Stephens Comprehensive Koala Plan of Management* (CKPoM). Port Stephens Council with the Australian Koala Foundation.

7 Appendices

7.1 Appendix 1 – SAT data sheets

Spot: Spotted Gum Creb: E. crebra Fib: E. fibrosa RG: E. tereticornis

Koala SAT Survey Data Sheet

Mel: Melaleuca sp.

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 38	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0945		WP: 1077	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	E-creb	Creb	Creb	Fibrosa	Fib	Creb	Creb	Fib	Creb	Creb	Fib	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Spot	Creb	Creb	Creb	Fib	Spot	Creb	Creb	Creb	Creb	Creb	Spot	Fib	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 39	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1015		WP: 1078	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Spot	Creb	Creb	Creb	Creb	Creb	Creb	RG	Creb	Spot	RG	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Creb	Spot	Spot	Spot	RG	Creb	RG	Creb	RG	Creb	Spot	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 40	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1045		WP: 1079	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Spot	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Mel	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

GB: E. moluccana Fib: E. fibrosa Mel: Melaleuca sp. Stri – Stringbark sp.

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 29	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1115		WP: 1090	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	GB	GB	GB	GB	Fib	Fib	Fib	GB	GB	GB	Mel	Spot	Fib	Spot	Fib
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	GB	Fib	GB	RG	Spot	Fib	Creb	Fib	Creb	Fib	Fib	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 27	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1230		WP: 1081	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	RG	RG	RG	RG	RG	RG	RG	RG	Creb	GB	GB	Spot	RG
No. scats:	Ø	Ø	Ø	1	Ø	Ø	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	RG	GB	GB	Creb	RG	RG	RG	RG	RG	RG	RG	RG	RG
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

7

SAT ID: 28	Date: 9-12-14	Staff: CAC + 2 Henson	GPS:	East:
	Time: 1300		WP: 1082	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Creb	Spot	Spot	GB	Creb	GB	Spot	GB	Creb	Spot	GB	Spot	GB
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	1	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Spot	GB	Spot	Spot	GB	GB	Mel	GB	Creb	Spot	GB	GB	GB	Creb
No. scats:	1	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

6

Cas- Casuarina glauca Ang- Angophora floribunda

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 17	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1320		WP: 1083	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	RG	Spot	Fib	Spot	Cieb	Spot	Spot	Cieb	Spot	Spot	Spot	Fib	Spot	Spot
No. scats:	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cieb	Spot	Spot	Fib	Cieb	Spot	Fib	Spot	Spot	RG	Cieb	Spot	Spot	Spot	Cieb
No. scats:	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

2

SAT ID: 6	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1345		WP: 1084	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Ang	RG	RG	RG	Ang	RG	RG	Cas	Ang	RG	Ang	Ang	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Ang	Ang	Cas	Cas	Cas	Ang	Ang	Ang	RG	Ang	RG	RG	Ang	RG	RG
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

SAT ID: 5	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1405		WP: 1085	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

GG: Grey Gum

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 16	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1425		WP: —	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Mel	Mel	Mel	Creb	Spot	Mel	Mel	Mel	Spot	RG	RG	Mel	Mel	RG	Mel
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Mel	Mel	Mel	GB	Creb	Spot	Spot	Creb	Mel	Mel	Mel	Mel	Creb	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

3

SAT ID: 48	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1520		WP: 1086	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Spot	Creb	Creb	RG	RG	Creb	Creb	GG	GB	Spot	Creb	Mel	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	RG	Spot	Creb	Creb	GG	Creb	Creb	GB	Spot	RG	Stri	GB	GB	Spot
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø

No. Koalas recorded within 25m radial search (5 minutes):

4

SAT ID: 59	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1540		WP: 1087	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Stri	RG	Mel	RG	Creb	Stri	RG	Creb	GG	GG	Stri	RG	Creb	GG
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Stri	Creb	GG	GG	Creb	Creb	Aeg	Aeg	GG	GG	Stri	Stri
No. scats:	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

5

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 47	Date: 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: ~~0800~~		WP: 1088	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Stri	Stri	Stri	Spot	Stri	Spot	Stri	Spot	Creb	Spot	Spot	Acac.	Stri	Acac.
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Stri	Stri	Spot	Spot	GG	Spot	Creb	Spot	Spot	Stri	Stri	Stri	Spot	Spot
No. scats:	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 1

SAT ID: 58	Date: ~~0815~~ 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0815		WP: 1089	North:

Tree no.:	1	2	3	4	RG	6	7	8	9	10	11	12	RG	14	15
Sp:	Creb	Creb	Stri	Stri	~~RG~~	Creb	Spot	Creb	Creb	Creb	Stri	Creb	~~RG~~	Creb	Stri
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	1	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	0	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Creb	Stri	Stri	Creb	~~RG~~	Kurrajong	~~RG~~	Kurra	Kurra	Stri	Creb	Creb	Spot	Stri
No. scats:	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 3

SAT ID: 57	Date: 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0840		WP: 1090	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	GG	Stri	Spot	Spot	Stri	Stri	Stri	Kurra.	Stri	GG	Spot	Spot	Stri	GG
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Spot	Spot	Stri	Creb	Stri	GG	Stri	Stri	Stri	GG	Stri	Stri	Stri	Stri
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 0

Page: 5

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 68	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0855		WP: 1091	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cleb	Spot	Creb	RG	Stri	RG	Cleb	Spot	Spot	RG	Stri	Spot	Stri	Stri	Cleb
No. scats:	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Stri	Kurra	RG	Cleb	Kurra	Spot	Stri	Stri	Spot	Cleb	Stri	Cleb	Cleb	Spot
No. scats:	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

2

SAT ID: 79	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0920		WP: 1092	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	Creb	Stri	Kurra	RG	RG	Spot	RG	Stri	RG	Cleb	Creb	RG	RG
No. scats:	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Fib	RG	Cleb	Stri	RG	RG	Stri	Creb	Creb	Stri	RG	RG	Stri	Stri
No. scats:	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

3

SAT ID: 78	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0940		WP: 1093	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Kurra	RG	RG	Cleb	Stri	Stri	Stri	RG	Spot	Stri	RG	Stri
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cleb	Stri	Stri	Spot	Stri	Spot	RG	Stri	Creb	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 46	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1110		WP: 1094	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Stri	Spot	Spot	Stri	GG	GG	Spot	Spot	Spot	Stri	Spot	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	GG	Stri	Stri	GG	GG	Spot	GG	GG	Spot	GG	Spot	GG	Stri	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 45	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1130		WP: 1095	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Mel	Stri	Stri	RG	RG	Fib	Fibe	RG	Fib	Fib	Fib	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Fib	Fib	Fib	RG	Mel	Stri	RG	Fib	Fib	Fib	Mel	Fib	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 56	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1145		WP: 1096	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	RG	Stri	Creb	Stri	Stri	Spot
No. scats:	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Creb	Creb	Stri	Spot	Kurra	Stri	Creb	Stri	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	Ø	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 67	Date: 10-12-14	Staff: CAC +2 Hanson	GPS:	East:
	Time: 1200		WP: 1097	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	RG	Spot	Stri	RG	RG	Spot	Creb	RG	Mel	Stri	Kuri
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	RG	RG	Stri	Creb	Stri	Stri	RG	Stri	RG	Stri	RG	Stri	RG	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 62	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1345		WP: 1098	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Mel	Stri	Mel	Stri	Creb	Creb	Mel	Mel	Stri	Mel	Creb	Creb	Mel	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	Creb	Stri	Stri	Mel	RG	Stri	Mel	Creb	Stri	RG	RG	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 63	Date: 10-12-14	Staff: CAC +2 Hanson	GPS:	East:
	Time: 1405		WP: 1099	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	RG	GG	GG	GG	Creb	Stri	Creb	Spot	GG	Stri	GG	RG	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	GG	GG	Creb	GG	Spot	Spot	GG	Spot	GG	GG	Spot	Spot	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Coach - Coachwood

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID:	52		Date:	10-12-14		Staff:	CAC + 2 Hanson		GPS:		East:				
			Time:	1420					WP:	1100	North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Fib	Creb	Fib	Fib	Creb	Fib	Creb	Fib	Mel	Stri	RG	Creb	Fib	Creb
No. scats:	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	RG	Mel	GG	Creb	Creb	RG	Creb	Spot	Creb	Creb	RG	Creb	Creb
No. scats:	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
No. Koalas recorded within 25m radial search (5 minutes):															

4

SAT ID:			Date:			Staff:			GPS:		East:				
			Time:						WP:		North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:															
No. scats:															
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:															
No. scats:															
No. Koalas recorded within 25m radial search (5 minutes):															

SAT ID:	41		Date:	10-12-14		Staff:	CAC + 2 Hanson		GPS:		East:				
			Time:	1500					WP:	1101	North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Coach	Kulla	Spot	GG	Stri	Stri	Stri	Coach	Spot	Stri	Spot	Stri	Stri	Creb	Mel
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	Spot	GG	Stri	Mel	Mel	Mel	Mel	Spot	Creb	Creb	Mel	Mel	Spot	Creb
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. Koalas recorded within 25m radial search (5 minutes):															

0

Alph: Alphitonia excelsa (Red Ash)

Ang: Angophora floribunda

Koala SAT Survey Data Sheet

biosis

Project: Brandy Hill Quarry **Matter No.:** 19323

SAT ID: 30	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 0940		WP: 1102	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Creb	Stri	Creb	Creb	Creb	Stri	RG	Spot	Spot	Creb	Creb	Alph.	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Alph.	RG	Alph.	Creb	RG	Creb	GG	Creb	Creb	Stri	RG	Cas.	Spot	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

+ Black-faced Monarch + Leaden F-catcher seen

1

SAT ID: 19	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1005		WP: 1103	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	RG	Creb	Creb	RG	Creb	Stri	RG	Stri	Stri	Stri	Stri	RG	Creb	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	RG	RG	Fib	RG	Fib	RG	Creb	Creb	RG	RG	RG	RG	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

1

SAT ID: 7	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1035		WP: 1104	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Ang	Cas	Cas	Cas	Ang	Cas	Ang	Cas	Cas	Cas	Creb	Mel	Mel	RG	Ang
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Mel	Cas	Cas	Creb	Cas	Ang	Mel	Cas	Ang	Cas	Mel	Cas	Mel
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

7.2 Appendix 2 – Koala habitat appraisal

Koala habitat appraisal - Brandy Hill Quarry expansion		
Action: Quarry expansion in the Lower Hunter, NSW Context: Coastal (East Coast - low abundance)		
Associated infrastructure: Additional quarry areas		
Primary impacts: Vegetation clearing, vehicle strike		
Impact area size: 97 hectares		
Attribute	**Score**	**Habitat appraisal**
Koala occurrence	2	Koala records known from the locality for the study area
		Biosis conducted targeted Koala surveys in winter and spring 2014 using diurnal and nocturnal searches and call playback. A total of 2 Koalas was recorded within the Project area.
		Biosis conducted targeted SAT and Koala point surveys in summer 2014 to determine Koala population density estimate. No Koalas were recorded during this period.
Vegetation structure and composition	2	Comprehensive vegetation mapping undertaken by Biosis in winter and spring 2014 mapping all vegetation within the study area. All forest and woodland communities present support 2 or more Koala food tree species.
Habitat connectivity	2	Koala habitat present is a component of an area of suitable habitat > 1,000 hectares
Key existing threats	2	No evidence of recent or regular Koala fatalities from vehicle strikes or dog attacks
Recovery value	1	Uncertain whether the habitat present is important for achieving the interim recovery objectives for Koalas.
Total	9	Based on the area of habitat to be cleared and total habitat score a Commonwealth referral under the EPBC Act is recommended.

Appendix 7B

Biodiversity

EPBC Act Referral

Brandy Hill Expansion Project

Environmental Impact Statement

EPBC Assessment Document

Hanson has prepared this section to address the requirements under the Environmental Protection and Biodiversity Conservation Act, 1999 for matters of national environmental significance identified by the Department of Environment. This document has engaged the following references to ensure adequate assessment of these species;

- *Environment Protect and Biodiversity Conservation Act 1999* - section 51-55, section 96A(3)(a)(b), 101A(3)(a)(b), section 136, section 527E;
- Environment Protect and Biodiversity Conservation Regulations 2000 - Division 3.2, 3.02(a)(b)(ii)(iii), Division 5.2, Schedule 4;
- Bilateral Agreements - Item 18.1, Item 18.5, Schedule 1; and
- Policy - *Environment Protect and Biodiversity Conservation Act 1999* Environmental Offsets Policy October 2012

The Department of Environment (delegate to the Minister for the Environment) has considered the that project is likely to have a significant impact on the following matters protected by the EPBC Act;

- Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable)
- Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable)
- Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered)
- Regent Honeyeater *Anthochaera Phrygia* (Endangered)
- Swift Parrot *Lathamus discolour* (Endangered)

The Project will be assessed as a bilateral agreement between the New South Wales and Commonwealth, in which the Department of Planning and Environment has prepared additional guidelines for preparing Assessment Documentation. Much of this information has been included in the Environmental Impact Statement and supporting documentation including the Biodiversity Assessment Report prepared by Biosis Pty Ltd and a supplementary Koala Assessment Report also prepared by Biosis Pty Ltd.

Of the five species identified in the referral notification, the koala has a confirmed presence in the project area, and the grey-headed flying fox (no roosting or breeding camps). Notwithstanding this, Biosis has prepared a species impact statement for all five species to ensure adequate assessment of identified MNES. It is considered that the level of detail of information provided in the BAR and supplementary koala report provides adequate assessment of any MNES with the potential to occur on site. This document is intended to be reviewed in conjunction with the BAR and Environmental Impact Statement.

EPBC Requirement	Addressed in report
Background and Description of the Action	
Provide background to the action	Section 1: Introduction Section 2: Proposed description
Describe in detail all components of the action - Construction - Operation - Decommissioning	Section 2: Proposal Description Section 2: Proposal Description Appendix 18: Rehabilitation
Precise Location	Section 1: Introduction Section 2: Description of the Proposal
Offsite works	No offsite works or infrastructure
Structures to be built	Section 2: Proposal Description
How the works are to be undertaken (stages of the development and their timing).	Section 2: Proposal Description Section 2.6 Project Staging
Design parameters for those aspects of the structures or elements of the action that may have relevant impacts	Section 2: Proposal Description.
How the action relates to any other action (of which the proponent should be reasonably aware) that have been, or are being, taken or that have been approved in the region affected by the action.	Section 6: Key Environmental Issues Section 6.3.3 EPBC Act Referral Appendix 4: Cumulative effects discussed in CCC meetings Appendix 8: Traffic Impact Assessment addressed cumulative impacts. Appendix 15: Visual Impact Assessment addressed the proposed Wallalong development. Appendix 17: Social and Economic Impact Assessment – identifies the Daracon development.
Details on the; - current status of the action; - alternatives to the action; as well as - the consequences of not proceeding with the action	Section 1: Introduction & Section 2: Description (1.3.1 Current Operations) Section 2: Description, 2.12 Alternatives to the Final Proposal Section 2: Proposal Description – 2.12 Alternative of not proceeding with the development, 6.3.3 – EPBC Assessment
The Environment Including MNES	
Description of the Environment	Section 2.4: Vegetation and natural environment Appendix 7: Biodiversity Assessment Report (BAR), 1.1 Project Background, Stage 2 – Impact Assessment (biodiversity values).
Management practices of the proposal site	Section 1 and Section 2

Management practices of the surrounding area	Section 2.4
Description of the World Heritage values of the World Heritage property relevant to the action	n/a. There is no World Heritage property relevant to the proposal
A description of the National Heritage values of the National Heritage Place relevant to the action.	n/a. There is no National Heritage Place relevant to the proposal
A description of the ecological character of the Ramsar Wetland relevant to the action	n/a. There is no Ramsar Wetland relevant to the proposal
Listed threatened species and communities (including suitable habitat) that are or are likely to be present in the vicinity of the site, including the following details of: - best practice survey guidelines are applied; and - how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements. Any relevant plans/agreements.	Appendix 7: BAR (Summary), Section 6.3.3 EPBC Act Referral. Appendix 7: BAR (Section 4/5 Methods) Appendix 7: BAR (Section 2. Legislative Context, Section 4/5. Methods) Section 6.3.3 EPBC Act Referral
Listed migratory species (including suitable habitat) that are or are likely to be present in the vicinity of the site, including the following details: - Details of the scope, timing/effort (survey season/s) and methodology for studies or surveys used to provide information on the listed species/habitat at the site (and in areas that may be impacted by the project. Include details of: - Best practice survey guidelines are applied - How these are consistent with (or a justification for divergence from) published Australian Government guidelines and policy statements. - Include any relevant plans/agreements	Appendix 7: Referral/BAR, Section 9 EPBC Act Referral Appendix 7: BAR (Section 4/53. Methods) Appendix 7: BAR (Section 4/53. Methods) Appendix 7: BAR (2 Section 2. Legislative Context) Note: The controlling provision for the project is listed threatened species and communities (sections 18 & 18A), and therefore migratory species are not considered beyond the scope of what is presented in the BAR.
A description of the environmental relevant to the nuclear action	n/a. There is no nuclear action relevant to the proposal.
A description of the Great Barrier Reef Marine Park environment relevant to the action	n/a the project does not involve activity in the GBR Marine Park.
A description of the water resource environment relevant to the coal seam gas development of large coal mining development.	n/a the project does not involve coal seam gas development or the development of a large coal mining development.
A description of the environment relevant for part of the Commonwealth Marine (for actions outside the Commonwealth marine area that may impact in the Commonwealth marine area)	n/a the project doesn't involve a Commonwealth Marine.
A description of the environment relevant for the commonwealth Land (for actions outside Commonwealth Land that may impact on the environment of Commonwealth land.	n/a the project doesn't involve commonwealth land.

Impacts	
Description of the relevant impacts of the actions;	Section 2: Proposal Description
Detailed analysis of the nature and extent of the likely direct, indirect and consequence impacts relevant to MNES, including likely short-term and long-term impacts – refer to Appendix 7: BAR, Section 6.4 – Indirect Impacts. for guidance on the various types of impact that need to be considered.	Appendix 7: BAR, Appendix 6, Significant Impact Criteria for; - Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable) - Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable) - Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered) - Regent Honeyeater *Anthochaera Phrygia* (Endangered) - Swift Parrot *Lathamus discolour* (Endangered) Appendix 7: Additional Koala Report Appendix 7: BAR, Appendix 6 Significant Impact Criteria. Section 6.3.3 (EIS)
Statement whether any relevant impacts are likely to be unknown, unpredicted or irreversible;	Appendix 7: BAR, Appendix 6, Significant Impact Criteria for; - Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable) - Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable) - Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered) - Regent Honeyeater *Anthochaera Phrygia* (Endangered) - Swift Parrot *Lathamus discolour* (Endangered) Appendix 7: Additional Koala Report Section 6.3.3 (EIS)
Any technical data and other information used or needed to make detailed assessment of the relevant impacts;	Appendix 7: BAR
An explanation of how indigenous stakeholders' views of the action's impacts to biodiversity and cultural heritage have been sort and considered in the assessment. Including where relevant, how guidelines published by the Commonwealth in relation to the consulting with indigenous peoples for proposed actions that are under assessment have been considered and applied	Appendix 12: Heritage Impact Assessment
Where the proposal is a coal seam gas development or large coal mining development and likely to significantly impact on a water resource	Not applicable
The Assessment Documentation should identify and address cumulative impacts, where potential project impacts are in addition to existing impacts of other activities (including known potential future	Section 5.2: Interaction Section 6: Key Environmental Issues Section 6.3.3 EPBC Act Referral

expansions or developments by the proponent and other proponents in the region and vicinity).	Appendix 4: Cumulative effects discussed in CCC meetings Appendix 8: Traffic Impact Assessment addressed cumulative impacts. Appendix 15: Visual Impact Assessment addressed the proposed Wallalong development. Appendix 17: Social and Economic Impact Assessment – identifies the Daracon development.
The Assessment Documentation should also provide a detailed assessment of any likely impact that this proposed action may facilitate on the relevant MNES at the local, regional, state and national scale.	Appendix 7: BAR, Appendix 6, Significant Impact Criteria for; - Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable) - Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable) - Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered) - Regent Honeyeater *Anthochaera Phrygia* (Endangered) - Swift Parrot *Lathamus discolour* (Endangered) Appendix 7: Additional Koala Report
Avoidance and Mitigation Measures/Alternatives	
The Assessment Documentation also must take into account relevant agreements and plans that cover impacts on MNES including but not limited to:	See below
Any recovery plan, conservation advice for the species or community; Any threat abatement plan for a process that threatens the species; Any wildlife conservation plan for the species;	Appendix 7: BAR, Appendix 6, Significant Impact Criteria for; - Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable) - Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable) - Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered) - Regent Honeyeater *Anthochaera Phrygia* (Endangered) - Swift Parrot *Lathamus discolour* (Endangered) Section 6.3.3 Appendix 7: Additional Koala Report
The Assessment Documentation must include, and substantiate, specific and detailed descriptions of the proposed avoidance and mitigation measures, based on best available practices and must include the following elements:	See below
A consolidated list of avoidance and mitigation measures proposed to be undertaken to prevent or minimise for the relevant impacts of the action on MNES, including:	See below
A description of proposed avoidance and mitigation measures to deal	Appendix 7: BAR – Section 6.1

with relevant impacts of the action, including mitigation measures proposed to be taken by State/Territory governments, local governments or the proponent;	EIS: Section 2.11 & 2.12
Assessment of the expected or predicted effectiveness of the mitigation measures, including the scale and intensity of impacts of the proposed action and the on-ground benefits to be gained through each of these measures;	Appendix 7: BAR – Section 5.2 Section 6.3.3 – EPBC Act Referral
a description of the outcomes that the avoidance and mitigation measures will achieve;	Appendix 7: BAR – Section 5.2 Section 6.3.3 – EPBC Act Referral
any statutory or policy basis for the mitigation measures; and	Section 4 – Planning Context Section 6.3.3 – EPBC Act Referral
The cost of the mitigation measures.	Section 6.3.3 – EPBC Act Referral
A detailed outline of a plan for the continuing management, mitigation and monitoring of relevant MNES impacts of the action, including a description of the outcomes that will be achieved and any provisions for independent environmental auditing. Where appropriate, each project phase (construction, operation, decommission) must be addressed separately. It must state the environmental outcomes, performance criteria, monitoring, reporting, corrective action, contingencies, responsibility and timing for each environmental issue.	Section 6.3.3 – EPBC Act Referral It is recommended that a Biodiversity Management Plan is prepared post approval which will outline environmental outcomes, performance criteria, monitoring, reporting, corrective action, contingencies, responsibility and timing for each environmental issue. This has not been prepared for submission to avoid duplication of documentation.
c) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Section 6.3.3– EPBC Act Referral
Alternatives	
The Assessment Documentation must include any feasible alternatives to the action to the extent reasonably practicable, including:	See below
if relevant, the alternative of taking no action;	Section 2.12, Section 6.3.3
a comparative description of the impacts of each alternative on the	Section 6.3.3 – EPBC Act Referral

triggered MNES protected by controlling provisions of Part 3 of the EPBC Act for the action; and	
Sufficient detail to make clear why any alternative is preferred to another.	Section 2.12 Section 6.3.3
Short, medium and long-term advantages and disadvantages of the options must be discussed.	Section 6.3.3– EPBC Act Referral
Residual Impacts / Offsets	
The likely residual impacts on MNES that are likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account.	Appendix 7: BAR, Appendix 3, Significant Impact Criteria for; - Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable) - Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable) - Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered) - Regent Honeyeater *Anthochaera Phrygia* (Endangered) - Swift Parrot *Lathamus discolour* (Endangered) Appendix 7: Additional Koala Report
Include the reasons why avoidance or mitigation of impacts is not reasonably achieved; and	Section 6.3.3 – EPBC Act Referral
Identify the significant residual impacts on MNES.	Appendix 7: BAR, Appendix 3, Significant Impact Criteria for; - Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable) - Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable) - Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered) - Regent Honeyeater *Anthochaera Phrygia* (Endangered) - Swift Parrot *Lathamus discolour* (Endangered) Appendix 7: Additional Koala Report
Environmental Record of Persons (s) Proposing to Take the Action	
The information provided must include details of any	

proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: (a) the person proposing to take the action; and (b) for an action for which a person has applied for a permit, the person making the application.	Hanson has operated in Australia for over 50 years and currently operates approximately 300 sites. In accordance with reasonable knowledge over the past 5 years, Hanson has/is subject to the following proceeding under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources; • At the time of writing, Hanson Construction Materials Pty Ltd is being prosecuted for an alleged breach of *the Planning & Environment Act 1987 (Vic)* in connection with clearing of vegetation. Approximately 100 of Hanson's sites have third party certification to 14001 and the remainder operate to 14001 but are yet to be certified. Brandy Hill Quarry is certified under ISO 9001:2008 Quality Management System, ISO 14001:2004 Environmental Management System, and AS/NZS 4801:2001 Occupational Health and Safety Management System.
If the person proposing to take the action is a corporation, details of the corporation's environmental policy and planning framework must also be included.	Hanson's environmental policy and corporate chain of responsibility is included in this document. The corporation (Hanson) does not have a specific planning framework, but applies the Company's internal environmental policy and external management systems to maintain adequate conservation of the environment and sustainable use of resources.
Economic and Social Matters	
The economic and social impacts of the action, both positive and negative, must be analysed. Matters of interest include:	See Below
details of any public consultation activities undertaken, and their outcomes;	Section 3
details of any consultation with Indigenous stakeholders.	Section 3 Section 6.8 Appendix 12
projected economic costs and benefits of the project, including the basis for their estimation through cost/benefit analysis or similar studies;	Appendix 17 CIV included in EIS: est. $22.5M

employment opportunities expected to be generated by the project (including construction and operational phases).	Appendix 17
Economic and social impacts should be considered at the local, regional and national levels. Details of the relevant cost and benefits of alternative options to the proposed action, as identified in Section 4 above, should also be included.	Appendix 17 Section 2.11/2.12, Section 3 Section 6.1
Identification of affected parties is required, including a statement mentioning any communities that may be affected and describing their views.	Communities potentially affected: Section 3 of the EIS Consultation is further outlined in Appendix 4. Community views are highlighted in the CCC meeting minutes (**Appendix 4**) and in the Socio-Economic Impact Statement (**Appendix 17**). Further viewpoints will be expressed during the public exhibition period.
Information Sources Provided in the Assessment Documentation	
For information given in the Assessment Documentation, state: (a) the source of the information; (b) how recent the information is; (c) how the reliability of the information was tested; (d) what uncertainties (if any) are in the information; and (e) what guidelines, plans and/or policies did you consider.	Addressed in the EIS report and each specialist study.
Conclusion	
An overall conclusion as to the environmental acceptability of the proposal on each MNES, including:	Appendix 7: BAR, Appendix 6, Significant Impact Criteria for; - Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT) (Vulnerable) - Grey-headed Flying-Fox *Pteropus poliocephalus* (Vulnerable) - Spotted-tailed Quoll *Dasyurus maculatus maculatus* (SE mainland population) (Endangered) - Regent Honeyeater *Anthochaera Phrygia* (Endangered) - Swift Parrot *Lathamus discolour* (Endangered) Appendix 7: Additional Koala Report
a discussion on the consideration with the requirements of the EPBC	Section 6.3.3

Act, including the objects of the EPBC Act, the principles of ecologically sustainable development and the precautionary principle;	Section 9 of EIS
reasons justifying undertaking the proposal in the manner proposed, including the acceptability of the avoidance and mitigation measures; and	Section 2.11/2.12 Section 9 of EIS
if relevant, a discussion of residual impacts and any offsets and compensatory measures proposed or required for significant residual impacts on MNES, and the relative degree of compensation and acceptability.	Appendix 7 (BAR)

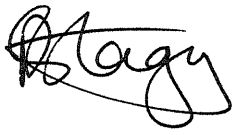
Figure 1: Corporate Chain of Responsibility

Australian Government
Department of the Environment

Notification of
REFERRAL DECISION AND DESIGNATED PROPONENT – controlled action
BILATERAL ASSESSMENT

Referral Decision – Brandy Hill rock quarry extension, Seaham, Port Stephens, NSW
EPBC 2015/7453

This decision is made under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

proposed action	To expand a hard rock quarry and construct and operate additional infrastructure on Brandy Hill, approximately 3.5 kilometres west of Seaham and 175 kilometres north of Sydney [See EPBC Act referral 2014/7453].
decision on proposed action	The proposed action is a controlled action. The project will require assessment and approval under the EPBC Act before it can proceed.
relevant controlling provisions	Listed threatened species and communities (sections 18 & 18A)
designated proponent	Hanson Construction Materials Pty Ltd ACN: 009 679 734
assessment approach	not applicable – the action will be assessed under the Bilateral Agreement with NSW (NSW assessment approach: Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979*)
Decision-maker	
Name and position	Paula Stagg Acting Assistant Secretary Environment Assessment Branch
Signature	
date of decision	3 June 2015

Australian Government
Department of the Environment

Referral of proposed action

What is a referral?

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (NES). Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any of the matters of NES without approval from the Australian Government Environment Minister or the Minister's delegate. (Further references to 'the Minister' in this form include references to the Minister's delegate.) To obtain approval from the Environment Minister, a proposed action should be referred. The purpose of a referral is to obtain a decision on whether your proposed action will need formal assessment and approval under the EPBC Act.

Your referral will be the principal basis for the Minister's decision as to whether approval is necessary and, if so, the type of assessment that will be undertaken. These decisions are made within 20 business days, provided sufficient information is provided in the referral.

Who can make a referral?

Referrals may be made by or on behalf of a person proposing to take an action, the Commonwealth or a Commonwealth agency, a state or territory government, or agency, provided that the relevant government or agency has administrative responsibilities relating to the action.

When do I need to make a referral?

A referral must be made for actions that are likely to have a significant impact on the following matters protected by Part 3 of the EPBC Act:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- Wetlands of international importance (sections 16 and 17B)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Protection of the environment from nuclear actions (sections 21 and 22A)
- Commonwealth marine environment (sections 23 and 24A)
- Great Barrier Reef Marine Park (sections 24B and 24C)
- A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)
- The environment, if the action involves Commonwealth land (sections 26 and 27A), including:
    - actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land);
    - actions taken on Commonwealth land that may have a significant impact on the environment generally;
- The environment, if the action is taken by the Commonwealth (section 28)
- Commonwealth Heritage places outside the Australian jurisdiction (sections 27B and 27C)

You may still make a referral if you believe your action is not going to have a significant impact, or if you are unsure. This will provide a greater level of certainty that Commonwealth assessment requirements have been met.

To help you decide whether or not your proposed action requires approval (and therefore, if you should make a referral), the following guidance is available from the Department's website:

- the Policy Statement titled Significant Impact Guidelines 1.1 – Matters of National Environmental Significance. Additional sectoral guidelines are also available.

- the Policy Statement titled Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies.
- the Policy Statement titled Significant Impact Guidelines: Coal seam gas and large coal mining developments—Impacts on water resources.
- the interactive map tool (enter a location to obtain a report on what matters of NES may occur in that location).

Can I refer part of a larger action?

In certain circumstances, **the Minister may not accept a referral for an action that is a component of a larger action and may request the person proposing to take the action to refer the larger action for consideration under the EPBC Act (Section 74A, EPBC Act).** If you wish to make a referral for a staged or component referral, read 'Fact Sheet 6 Staged Developments/Split Referrals' and contact the Referrals Gateway (1800 803 772).

Do I need a permit?

Some activities may also require a permit under other sections of the EPBC Act or another law of the Commonwealth. Information is available on the Department's web site.

Is your action in the Great Barrier Reef Marine Park?

If your action is in the Great Barrier Reef Marine Park it may require permission under the *Great Barrier Reef Marine Park Act 1975* (GBRMP Act). If a permission is required, referral of the action under the EPBC Act is deemed to be an application under the GBRMP Act (see section 37AB, GBRMP Act). This referral will be forwarded to the Great Barrier Reef Marine Park Authority (the Authority) for the Authority to commence its permit processes as required under the Great Barrier Reef Marine Park Regulations 1983. If a permission is not required under the GBRMP Act, no approval under the EPBC Act is required (see section 43, EPBC Act). The Authority can provide advice on relevant permission requirements applying to activities in the Marine Park.

The Authority is responsible for assessing applications for permissions under the GBRMP Act, GBRMP Regulations and Zoning Plan. Where assessment and approval is also required under the EPBC Act, a single integrated assessment for the purposes of both Acts will apply in most cases. Further information on environmental approval requirements applying to actions in the Great Barrier Reef Marine Park is available from http://www.gbrmpa.gov.au/ or by contacting GBRMPA's Environmental Assessment and Management Section on (07) 4750 0700.

The Authority may require a permit application assessment fee to be paid in relation to the assessment of applications for permissions required under the GBRMP Act, even if the permission is made as a referral under the EPBC Act. Further information on this is available from the Authority:

Great Barrier Reef Marine Park Authority

2-68 Flinders Street PO Box 1379
Townsville QLD 4810
AUSTRALIA

Phone: + 61 7 4750 0700
Fax: + 61 7 4772 6093

www.gbrmpa.gov.au

What information do I need to provide?

Completing all parts of this form will ensure that you submit the required information and will also assist the Department to process your referral efficiently. If a section of the referral document is not applicable to your proposal enter N/A.

You can complete your referral by entering your information into this Word file.

Instructions

Instructions are provided in blue text throughout the form.

Attachments/supporting information

The referral form should contain sufficient information to provide an adequate basis for a decision on the likely impacts of the proposed action. You should also provide supporting documentation, such as environmental reports or surveys, as attachments.

Coloured maps, figures or photographs to help explain the project and its location should also be submitted with your referral. Aerial photographs, in particular, can provide a useful perspective and context. Figures should be good quality as they may be scanned and viewed electronically as black and white documents. Maps should be of a scale that clearly shows the location of the proposed action and any environmental aspects of interest.

Please ensure any attachments are below three megabytes (3mb) as they will be published on the Department's website for public comment. To minimise file size, enclose maps and figures as separate files if necessary. If unsure, contact the Referrals Gateway (email address below) for advice. Attachments larger than three megabytes (3mb) may delay processing of your referral.

Note: the Minister may decide not to publish information that the Minister is satisfied is commercial-in-confidence.

How do I pay for my referral?

From 1 October 2014 the Australian Government commenced cost recovery arrangements for environmental assessments and some strategic assessments under the EPBC Act. If an action is referred on or after 1 October 2014, then cost recovery will apply to both the referral and any assessment activities undertaken. Further information regarding cost recovery can be found on the Department's website.

Payment of the referral fee can be made using one of the following methods:

- **EFT Payments can be made to:**

  BSB: 092-009
  Bank Account No. 115859
  Amount: $7352
  Account Name: Department of the Environment.
  Bank: Reserve Bank of Australia
  Bank Address: 20-22 London Circuit Canberra ACT 2601
  Description: The reference number provided (see note below)

- **Cheque** - Payable to "Department of the Environment". Include the reference number provided (see note below), and if posted, address:

  The Referrals Gateway
  Environment Assessment Branch
  Department of the Environment
  GPO Box 787
  Canberra ACT 2601

- **Credit Card**

  Please contact the Collector of Public Money (CPM) directly (call (02) 6274 2930 or 6274 20260 and provide the reference number (see note below).

Note: in order to receive a reference number, submit your referral and the Referrals Gateway will email you the reference number.

How do I submit a referral?

Referrals may be submitted by mail or email.

Mail to:

Referrals Gateway
Environment Assessment Branch
Department of Environment
GPO Box 787
CANBERRA ACT 2601

- If submitting via mail, electronic copies of documentation (on CD/DVD or by email) are required.

Email to: epbc.referrals@environment.gov.au

- Clearly mark the email as a 'Referral under the EPBC Act'.
- Attach the referral as a Microsoft Word file and, if possible, a PDF file.
- **Follow up with a mailed hardcopy including copies of any attachments or supporting reports.**

What happens next?

Following receipt of a valid referral (containing all required information) you will be advised of the next steps in the process, and the referral and attachments will be published on the Department's web site for public comment.

The Department will write to you within 20 business days to advise you of the outcome of your referral and whether or not formal assessment and approval under the EPBC Act is required. There are a number of possible decisions regarding your referral:

The proposed action is NOT LIKELY to have a significant impact and does NOT NEED approval

No further consideration is required under the environmental assessment provisions of the EPBC Act and the action can proceed (subject to any other Commonwealth, state or local government requirements).

The proposed action is NOT LIKELY to have a significant impact IF undertaken in a particular manner

The action can proceed if undertaken in a particular manner (subject to any other Commonwealth, state or local government requirements). The particular manner in which you must carry out the action will be identified as part of the final decision. You must report your compliance with the particular manner to the Department.

The proposed action is LIKELY to have a significant impact and does NEED approval

If the action is likely to have a significant impact a decision will be made that it is a *controlled action*. The particular matters upon which the action may have a significant impact (such as World Heritage values or threatened species) are known as the *controlling provisions*.

The controlled action is subject to a public assessment process before a final decision can be made about whether to approve it. The assessment approach will usually be decided at the same time as the controlled action decision. (Further information about the levels of assessment and basis for deciding the approach are available on the Department's web site.)

The proposed action would have UNACCEPTABLE impacts and CANNOT proceed

The Minister may decide, on the basis of the information in the referral, that a referred action would have clearly unacceptable impacts on a protected matter and cannot proceed.

Compliance audits

If a decision is made to approve a project, the Department may audit it at any time to ensure that it is completed in accordance with the approval decision or the information provided in the referral. If the project changes, such that the likelihood of significant impacts could vary, you should write to the Department to advise of the changes. If your project is in the Great Barrier Reef Marine Park and a decision is made to approve it, the Authority may also audit it. (See "*Is your action in the Great Barrier Reef Marine Park,"* p.2, for more details).

For more information

- call the Department of the Environment Community Information Unit on 1800 803 772 or
- visit the web site http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999

All the information you need to make a referral, including documents referenced in this form, can be accessed from the above web site.

Referral of proposed action

Project title:

1 Summary of proposed action

1.1 Short description

Hanson Construction Materials Pty Ltd owns and operates a hard rock quarry located in the Port Stephens Shire Council area about 30 kilometres (km) north of Newcastle. Hanson proposes to increase the rate of production to 1.5 million tonnes per annum and to increase the quarry footprint, equating to a project life of 30 years (the Project).

The Brandy Hill Quarry is located at 979 Clarence Town Rd, Seaham (refer to Attachment A; Figure 1 – Locality). Attachment A; Figure 2 illustrates the current extraction limit, proposed extraction area, proposed processing plant location, property boundary and proposed disturbance area (Project area).

1.2 Latitude and longitude

The following geographic points detail the Project site (Depicted by the pink and orange line - Attachment A; Figure 2) including the current approved extraction area (yellow line – Attachment A, Figure 1).

Table 1: Project site geographic points

Location point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
A	32	39	23.30	151	41	2.15
B	32	39	28.73	151	40	57.34
C	32	39	33.95	151	40	56.78
D	32	39	42.32	151	40	56.93
E	32	39	44.05	151	40	58.01
F	32	39	46.20	151	41	15.62
G	32	39	47.36	151	41	18.71
H	32	39	49.83	151	41	18.86
I	32	39	53.52	151	41	18.51
J	32	40	1.29	151	41	17.10
K	32	40	3.85	151	41	31.27
L	32	39	59.15	151	41	37.09
M	32	39	56.38	151	41	39.44
N	32	39	52.59	151	41	41.06
O	32	39	45.17	151	41	38.80
P	32	39	36.75	151	41	36.09
Q	32	39	36.04	151	41	36.67
R	32	39	34.36	151	41	35.54
S	32	39	30.78	151	41	35.10
T	32	39	28.85	151	41	32.65
U	32	39	28.35	151	41	31.09
V	32	39	26.01	151	41	28.20
W	32	39	24.25	151	41	25.63
X	32	39	24.76	151	41	23.51
Y	32	39	23.36	151	41	21.53
Z	32	39	20.42	151	41	18.28
AA	32	39	18.43	151	41	13.58
AB	32	39	18.40	151	41	11.54
AC	32	39	19.29	151	41	8.58
AD	32	39	23.18	151	41	2.24

1.3 Locality and property description

Brandy Hill Quarry (BHQ) is located in the Port Stephens Shire Council, approximately 3.5km east of Seaham, 15km northeast of Maitland, 30km North of Newcastle and 175 kilometres north of Sydney (Attachment A; Figure 1). BHQ is a hard rock quarry which has been in operation since 1983.

The property is dominated by Brandy Hill which rises to 180m above sea level. To the north of the quarry extraction area runs Deadmans Creek. The creek is ephemeral and runs east through a steep valley to the north of Brandy Hill, along the northern edge of the quarry before following the quarry in a southern direction and turning southeast through the south eastern end of the property until it passes under Clarence Town Road. Deadmans Creek marks the northern and eastern edge of the quarry. The surrounding landscape consists of farmland, primarily used for cattle, that lies on a large floodplain. Tributaries flow from the surrounding area into the Hunter River which lies 7km south of the quarry.

The Project area is located within the Upper Hunter subregion of the North Coast Bioregion in NSW. The development site is situated on a low ridge on the eastern flank of Brandy Hill. Brandy Hill is an elevated suburb of the Port Stephens Local Government Area (LGA) and primarily consists of large, semi rural/rural blocks overlooking the lower Hunter River floodplain. The Hunter River forms a prominent feature to the south of the Project area and is a major river system in NSW joined by ten tributaries upstream and an additional thirty-one tributaries downstream providing significant flora and fauna habitat for the region.

The property consists predominately of native vegetation communities forming Hunter-Macleay Dry Sclerophyll Forests, Coastal Floodplain Woodlands and Coastal Swamp Forest formations. The property also includes some prior cleared grazing land located at the southeast of the property. Threatened ecological communities, listed under the *Threatened Species Conservation Act 1995* (TSC Act) present on the Project area include:

- *Lower Hunter Spotted Gum –Ironbark Forest in the Sydney Basin Bioregion*
- *Hunter lowland redgum forest in the Sydney Basin and NSW North Coast bioregions*
- *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*

The Project area is considered to provide suitable habitat and presence was identified for Vulnerable listed Koala *Phascolarctos cinereus* (48.65 hectares of native vegetation forming Hunter-Macleay Dry Sclerophyll Forests, Coastal Floodplain Woodlands and Coastal Swamp Forest).

1.4	**Size of the development footprint or work area (hectares)**	Currently, the site encompasses 561 hectares of which 18.6 hectares are occupied by the existing quarry, 11.1 hectares by the plant and 5.3 hectares by the stockpile area. In total 12 lots (Refer to Section 1.6) of land is privately owned by Hanson. The proposed expansion will seek to extend the currently approved extraction boundary to extend the life of the quarry and allow for the extraction of additional resources of up to 1.5 Million tonnes per annum across a total of 78.5 ha (pink boundary Attachment A; Figure 2) and 18.5 ha (orange boundary Attachment A; Figure 2). The disturbance area is 48.65 ha.
1.5	**Street address of the site**	979 Clarence Town Rd, Seaham

1.6 Lot description

Land allotments owned by Hanson include:

Table 2: Land allotments owned by Hanson

Lot Number	Classification
Current extraction area (yellow line **Fig. 1**)	
1 DP 47313	Rural Landscape
101 DP 712886	Rural Landscape
56 DP 752487	Environmental Management/Rural Landscape Extraction boundary is within rural landscape land use zoning, however the lot is duel zoned. The proposed expansion site will remain within the Rural Landscape zoned land.
Proposed extraction boundary (pink line **Fig. 1**)	
12 DP 264033	Rural Landscape
19 DP 752487	Rural Landscape
2 DP 752487	Rural Landscape
36 DP 752467	Rural Landscape
Proposed location for fixed plant and stockpile area (orange line **Fig. 1**)	
1 DP 737844	Rural Landscape
19 DP 752487	Rural Landscape
20 DP 752487	Rural Landscape
21 DP 752487	Rural Landscape
236 DP 752487	Rural Landscape

1.7 Local Government Area and Council contact (if known)

Local Government Area: Port Stephens

The existing Brandy Hill Quarry was approved by Port Stephens Shire Council of the Development Application No 1920 on the 22 December 1983.

1.8 Time frame

Project life: 30 years.

Start date of operation/construction: An Environmental Impact Statement (EIS) will be submitted to the NSW Department of Planning and Environment early 2015. Subject to Project Approval, the Project will commence works immediately. Project staging identified in section 2.1 provides a more detailed time line for the proposed works.

Project time frame: The Project will develop over 5 broad stages (30 years) which will involve progressive vegetation clearance and will be accompanied with a progressive rehabilitation effort.

1.9	**Alternatives to proposed action** Were any feasible alternatives to		No

	taking the proposed action (including not taking the action) considered but are not proposed?	X	Yes, you must also complete section 2.2
1.10	**Alternative time frames etc** Does the proposed action include alternative time frames, locations or activities?	X	No
		-	Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3.3 (where relevant).
1.11	**State assessment** Is the action subject to a state or territory environmental impact assessment?	-	No
		X	Yes, you must also complete Section 2.5
1.12	**Component of larger action** Is the proposed action a component of a larger action?	X	No
		-	Yes, you must also complete Section 2.7
1.13	**Related actions/proposals** Is the proposed action related to other actions or proposals in the region (if known)?	-	No
		X	Yes, Daracon's Martens Creek Quarry which is located 20km (by road) to the NNW of Brandy Hill Quarry is also in the process of compiling an EIS. As per Daracon's preliminary environmental statement, the Company will be proposing a 1.5 mtpa extraction limit. This PEA can be found by searching on the NSW Department of Planning and Environment's website (http://majorprojects.planning.nsw.gov.au/page/development-categories/mining--petroleum---extractive-industries/extractive-industries/?action=view_job&job_id=6612)
1.14	**Australian Government funding** Has the person proposing to take the action received any Australian Government grant funding to undertake this project?	X	No
		-	Yes, provide details
1.15	**Great Barrier Reef Marine Park** Is the proposed action inside the Great Barrier Reef Marine Park?	X	No
		-	Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

NOTE: It is important that the description is complete and includes all components and activities associated with the action. If certain related components are not intended to be included within the scope of the referral, this should be clearly explained in section 2.7.

2.1 Description of proposed action

Hanson Construction Materials Pty Ltd (the Proponent), currently operates Brandy Hill Quarry (BHQ), located in the Port Stephens Shire Council (PSSC) area. The site lies on Clarence Town Drive and is 3.5 km East of Seaham, 15km Northeast of Maitland and 30km North of Newcastle (Attachment A; Figure 1). BHQ is a hard rock quarry which has been in operation since 1983. The quarry produces a range of building materials including concrete aggregates, road base material and sealing aggregates.

The Proponent is currently compiling an EIS, to support a Development Application (DA) (Application Number 5899) for Brandy Hill Quarry. The Proponent is proposing to expand the allowable extraction area and increase the rate of production to 1.5 million tonnes per annum (tpa) from currently approved 700, 000 tpa and continue operations for a further 30 years. This is a significant change to the current consent and the Department of Planning and Environment has identified the proposal as being a State Significant Development (SSD). This will require a new development application to be lodged.

A detailed assessment of the available resource has been conducted and a geological investigation has identified over 76 million tonnes of available material within the proposed new extraction area. The existing extraction area of 19.45 hectares to RL 30 metres is nearing exhaustion and to continue operations the quarry needs to expand. The proposed extraction limit will be 78.5 hectares to RL -78 metres. This will provide access to enough resource to sufficiently cover the 30 year life span of the quarry.

Additionally the Proponent is seeking consent to install a concrete batching plant, capable of producing 15,000m^3 per annum and to receive up to 20,000 tonnes per annum of waste concrete from Hanson concrete plants for recycling. Attachment A; Figure 2 illustrates the current extraction area, the proposed extraction area, and the proposed processing plant relocation and concrete batching plant location.

Concrete recycling will occur on site with up to 20,000 tonnes annually recycled. The concrete will be primarily brought by trucks returning from concrete plants, post-delivery of quarry products. Due to utilising truck back-load, the numbers of truck movements will not be heavily impacted by having recycling occur on site. It is anticipated that the recycling process will utilise the existing fixed plant, no new infrastructure will be needed to facilitate the recycling at BHQ.

The quarry processing plant infrastructure will be moved to a new location of 18.5ha (within the orange boundary shown in Attachment A; Figure 2) to allow for the quarry pit form to access the resource. This wouldn't occur until necessary, around 20 years from consent. The concrete batching plant is planned to be installed within 10 years dependent upon growth in the area.

Proposed Project staging has been detailed (Attachment A; Figure 3 and Table 1) and shows the approximate proposed quarry pit plans which are designed to maximise extraction of available ignimbrite.

Table 3: Project staging

Stage	Details of staging plan
1	The initial stage expands the western end of the quarry towards the south and creates 4 broad benches running southwest to northeast and a large quarry pit floor at RL (Relative Level i.e. height above or below sea level) 22 metres. Overburden from this area will be used to create a bund wall at the southern end of the final plant location. This will allow sufficient time to rehabilitate the area to act as a visual shield from residences and traffic along Clarence Town Road when the plant is moved during stage 4.
2	Stage 2 further expands the existing western end of the quarry southwards to the proposed expansion boundary and the quarry pit floor at RL -8 metres. Overburden from this area will again be used to build the bund wall at the southern end of the final plant location. Topsoil will also be used to rehabilitate the upper benches above RL 30m as these benches will remain exposed upon completion of the quarry rehabilitation. Rehabilitation will be continual from stage 2 onwards and all final form areas will be planted with self-sustaining native vegetation communities and derived native grasslands. These communities will be selected based on the adjoining undisturbed areas and will be described in full in the EIS and associated Biodiversity Assessment Report (Biosis 2015a).
3	Stage 3 expands the quarry along the southern extraction boundary towards the existing plant infrastructure. The western dam is removed and broad benches are created with the pit floor at RL -38 metres. Overburden will be used for finalising the bund wall and for rehabilitation of benches that have reached their final form.
4	Stage 4 entails widening the benches towards the eastern extraction boundary. This stage will involve moving the existing fixed plant and stockpiles to the area allocated as the final plant location. The weighbridge, amenities and maintenance building will be relocated to suit the pit form. At this stage the quarry pit floor at RL -58 metres. This stage is the last stage where previously undisturbed land will be stripped to allow access to the resource material to make room for the fixed plant and stockpile area.
5	The final stage of the planned pit realises the final form of the quarry. This stage expands the quarry to the proposed extraction boundary at the eastern and southern end. The final pit will consist of 14 broad benches and the quarry pit floor at RL -78m. Full rehabilitation can begin with the quarry being allowed to begin being filled through groundwater seepage and rain events up to RL 30m. This Project rehabilitation plan outlines in more detail the rehabilitation objectives for the site. A completed copy of this document will be included as part of the Project EIS.

The proposed development has been thoroughly assessed to identify any environmental impacts and allow for the management or mitigation of these impacts. Through the EIS process, a Biodiversity Assessment was conducted by Biosis Pty Ltd which involved a search of potential matters of National Environmental Significance (NES) within the Project area using the Commonwealth Government's Protected Matters Search Tool with a pre-set 10km radius encompassing the Project area. This search identified Koala's, amongst other species as a possessing a potential presence in the Project area. Koala presence was confirmed during the spring/summer sampling effort. . This triggered the requirement to submit a referral to the Department of the Environment for further assessment under the *Environmental Protection and Biodiversity Conservation Act 1979* (this document).

2.2 Alternatives to taking the proposed action

The Proponent has analysed any feasible alternatives to the proposed development. This is in regards to the objectives of the proposal and includes the consequences of not carrying out the development. The following alternatives were considered in the planning process as these variables are the primary drivers behind the need to implement this development.

Alternative material

BHQ is the only Hanson owned quarry in the Hunter Region. By road the nearest Hanson owned hard rock quarries from Brandy Hill are at Kulnura (130km) and at Sancrox (220km). Delivering products to the region from either of the two aforementioned quarries would be unviable due to the expenses incurred by the excessive distance needing to be travelled. Increasing prices to mitigate this would mean the Proponent would become less competitive within the region.

Purchasing materials from external companies would mean paying higher costs for aggregates and therefore making less profit. The Proponent would become reliant upon external companies and a loss of control in the production of aggregates increases the risk of being unable to attain the desired quantities of aggregates.

There are currently no viable alternate materials for aggregates within New South Wales. Roads are predominately sealed with aggregate and this material makes up a large percentage of Brandy Hill sales. As a building product concrete is still the cheapest and most widely used building material available. Concrete has very low embodied energy which makes it a more sustainable product than other building materials.

Alternative site

BHQ sits at the top end of a sloping ignimbrite resource as identified in the geological assessment. The quarry is positioned between two faults which caused this resource to be shallow enough to be financially viable to extract. Finding other

resources of this nature within close proximity to Newcastle is a difficult prospect. Suitable lands with enough area to open a new quarry are expensive and aren't often available. Relocating infrastructure and developing a new site would undoubtedly cause more environmental impact than expanding the existing quarry site.

The existing quarry has operated for 30 years without adversely affecting the surrounding natural ecosystems. Given the resource on site being readily accessible with functioning extraction and processing infrastructure, expanding the existing site was identified as the most feasible and most sustainable option.

Alternative offset sites

There are a range of 'like for like' vegetation communities comprising 48.65 hectares of native vegetation forming Hunter-Macleay Dry Sclerophyll Forests, Coastal Floodplain Woodlands and Coastal Swamp Forest. Such potential offset sites are shown through vegetation mapping within the Biodiversity Assessment Report (Biosis 2015a), an addendum to the Project EIS currently being finalised. The final offset area will form part of a Biodiversity Offset Strategy, to be prepared once the EIS has been finalised, submitted and approved.

Alternative to 24 hours 7 days a week sales and production

Community concern regarding BHQ maintaining the right to operate 24 hours a day 7 days a week was noted through the community consultation committee. The quarry hasn't often needed to have sales or production occur outside regular hours of operation so restricting operating and sales hours was identified as an alternate option. However, given the requirements of certain night jobs, including road works which often occur at night and the potential to deliver aggregates to concrete plants, the Proponent needs to maintain the right to have production and sales occur 24 hours a day 7 days a week to remain competitive in the future.

Alternative of continuing with existing production limit

Current operations at BHQ extract up to 700,000 tonnes of material annually. The option of continuing with this level of production was proposed when establishing a proposed extraction limit for the Project. However, increasing production will allow BHQ to remain competitive in the future and allow for the provision of materials in line with increasing levels of demand due to growth in the region.

Being able to tender for large jobs means Hanson can provide competition, within the Hunter region, and reduce prices for large scale infrastructure works. This has a flow on effect by allowing cost effective investment opportunities to come to fruition.

Increasing production often has an added benefit of increasing tonnes produced per unit of energy. Electricity used to power the crushing and screening is the same regardless of tonnes put through the plant. It is therefore beneficial to have higher quantities entering the crushing and screening process.

Alternative of not proceeding with the development

If the development of BHQ does not proceed, construction within the lower Hunter region will suffer. Increased costs of supplying aggregates to the area will have a flow on effect to concrete prices. Increased prices of concrete could lead to a potential reduction in new construction taking place within the region.

Employment opportunities, for 30 years of employment for up to 30 direct employment positions will be lost if the proposal is rejected. It would mean the current 20 employees of BHQ would be laid off and Proponent would incur much greater costs within the Hunter region. Economic reasons for carrying out the development are drafted in the Project's EIS within the socio-economic impact assessment. The overall effects of not proceeding are detrimental to the local, regional and state communities.

2.3 Alternative locations, time frames or activities that form part of the referred action

The EIS scoping stage did not involve detailed assessment of alternate sites, timeframes or activities as the Proponent deemed pursuing a site expansion the most financial and ecologically beneficial outcome. Therefore section 2.3 is not applicable to the Brandy Hill Quarry Expansion Project.

2.4 Context, planning framework and state/local government requirements

Due to the proposed development extracting more than 500,000t of material per year and accessing greater than 5Mt of reserves, the development meets the criteria listed within schedule 1, clause 7 (1)(a) and (b) of the State Environmental Planning Policy (State and Regional Development) 2011 for assessment as a 'state significant development' under section 89C (2) of the EP&A Act. The minister for planning or a delegate will be the determining authority for this development.

Planning Process

The planning process until the submission of the EIS under Section 89C of the EP&A Act is outlined below;

1. Hanson has submitted a Project Application and Preliminary Environmental Assessment (PEA) to the Department of Planning and Environment (previously the Department of Planning and Infrastructure) under Part 4 of the *Environmental Planning & Assessment (EP&A) Act 1979.* The PEA requested the extension of the currently approved quarry footprint along with an increase in annual sales/production volume with an estimated capital

value of $15 million (M). It also provided a preliminary Project proposal and identified potential environmental issues during the life of the Project.

2. Director General's Environmental Assessment Requirements (now SEARs) were subsequently issued under an application number SSD 5899 under Section 78A (8A) of the EP&A Act 1979 on the 26 April 2013 and revised on 11th November 2014 under the same application number.
3. Hanson is preparing an EIS to meet the requirement of Section 78a, Clause (8A) of the EP&A Act, and the accompanying SEARs. This will be submitted to the Department of Planning and Environment early 2015. Assuming the Project is approved, the Company will endeavour to meet all Project Approval Conditions during the life of the Project wherever feasible and reasonable.

The approval process post submission of the EIS under Section 89C of the EP&A Act is outlined below;

1. The EIS is placed online for public review for a minimum period of 30 days. The public and Director-General consultants are invited to provide comment of any issues (if any), which are reviewed and considered by the Department of Planning and Environment (DP&E) and relevant government agencies.
2. The DP&E will provide the Proponent with recommendations; identify further issues and community issues raised. This will be responded to by the Proponent and may include modifying the proposal or statement of commitments and responding to any issues raised by the community in a Submissions Report.
3. If changes to the proposal are necessary due to the recommendations a Preferred Project Report will be prepared. This would be publicly displayed for 30 days.
4. The DP&E will then release the Secretary's Environmental Assessment Report which would be publicly available.
5. The minister for planning or delegate either approves the development (with or without conditions) or refuses the Project.

Further detailed legislative application is detailed in section 2.5.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

Environmental assessment of the relevant impacts of the Project

The Proponent is in the process of compiling a comprehensive EIS to address all relevant criteria set out in the Director General's Requirements. This process has included involved assessments of;

- Land Resources
- Biodiversity
- Traffic and Transport
- Noise
- Blasting
- Air Quality
- Heritage
- Water Resources
- Waste Greenhouse Gas
- Visual
- Hazards
- Social and Economic
- Rehabilitation

Status of Assessment Approvals

All environmental assessment reports have been drafted or are in the process of being drafted for inclusion in the Project's EIS. The Proponent aims to submit the pertinent EIS in early 2015.

Relevant Legislation

Brandy Hill EIS is accountable under federal, State and local legislative controls. These are identified below;

Table 4: Relevant Legislative Controls.

Government Tier	Legislation
Federal	*Environment Protection and Biodiversity Conservation Act 1999 (*EPBC Ac)
	Native Title Act 1993
State	*Environmental Planning and Assessment Act 1979*

	State environmental Planning policies - State Environmental Planning Policy No.33 – Hazardous and Offensive Development - State Environmental Planning Policy No. 44 – Koala Habitat Protection - State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.
	Fisheries Management Act 1994
	Heritage Act 1977
	National Parks and Wildlife Act 1974
	Native Vegetation Act 2003
	Protection of the Environment and Operations Act 1997
	Roads Act 1993
	Noxious Weeds Act 1993
	Threatened Species Conservation Act 1995 (TSC Act)
	Water Management Act 2000
Local and Regional Planning Instruments	Port Stephens Local Environment Plan 2013
	Lower Hunter Regional Strategy
	Port Stephens Futures Strategy 2009
	Port Stephens Planning Strategy 2011
	Port Stephens Development Control Plan 2013
	Water Sharing Plan for the Hunter Unregulated & Alluvial Water Sources 2009
	Aquifer Interference Policy

2.6 Public consultation (including with Indigenous stakeholders)
To undertake a comprehensive environmental assessment of the development proposal, identification of significant issues is a priority. This occurred through consultation with State and Local government agencies and the local community. The 1983 EIS was consulted to ensure issues brought to light in that EIS were either resolved or needed to be addressed again. The current operation was assessed and risks identified included in this document and all relevant policies and guidelines were used.

Government consultation

Government agencies and Community Groups contacted by Hanson or the specialist consultants either directly or through other government agencies prior to or during the preparation of the EIS includes:

- The Commonwealth Department of Environment
- The Department of Planning and Infrastructure
- Environment Protection Authority
- The Office of Environment and Heritage
- N.S.W Office of Water
- Fisheries N.S.W
- N.S.W Department of Trade and Investment, Regional Infrastructure and Services.
    - Resource and Energy Division.
    - Primary Industries Division.
- Hunter Water Corporation
- Transport for NSW (RMS);
- Department of Primary Industries (Crown Lands)Hunter-Central Rivers Catchment Management Authority.
- Port Stephens Council

- Dungog Shire Council
- Maitland City Council
- Hunter Local Land Services
- Bolwarra Heights Community Group
- Brandy Hill and Seaham Action Committee
- Clarence Town and District Progress Association
- Seaham Scouts

Community consultation

Historic Community Involvement

BHQ has been actively involved within the local community for a long period through sponsorships and the donation of construction material for community.

Initial Project Community Meeting

The first community meeting was held on the 18th of July 2013 at Seaham School. This public meeting was attended by a member from the Department of planning, EPA and PSSC. The development process was described by the member from the Department of Planning as well as the EPA's role in the process. Hanson management spoke on the development and BHQ operations and the member from PSSC described their role in the development process.

Informal Community Consultative Committee

The community expressed an interest in being informed of the progress of the proposed Project. To enable active dialogue between the Proponent and the local community, an informal Community Consultation Committee (CCC) has been established with the primary goal of informing the local community of the EIS process and progress.
This committee is primarily composed of Hanson representatives and community members, however the committee now has an independent chairperson and a representative of Port Stephens Shire Council attended the 4th meeting. A copy of agenda and minutes for these meetings can be provided upon request.

Community Concerns

Primary concerns have been identified in a community run survey by Brandy Hill and Seaham Action Committee. The findings of this survey were presented to the Proponent in the CCC meetings.

- Increased traffic levels
- 24 hour production and sales
- Road surface deterioration
- Safety (pedestrian/cycle path along Brandy Hill Drive)
- Noise associated with increase in truck movements

Aboriginal consultation

The aboriginal people, as one of the oldest continuous living cultures in human history, need to have their cultural heritage recognised and valued. This cultural heritage lives through memories, stories and associations to their traditional land as well as important evidence present throughout the landscape. Due to this a comprehensive consultation process is employed to protect this invaluable link between past and present by seeking to identify and protect this cultural heritage.

Biosis undertook the Aboriginal Heritage consultation on behalf of the Proponent using the Department of Climate Change and Water (DECCW) guideline *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* as required under the National Parks and Wildlife Act 1974. The Proponent recognises that Aboriginal people are the primary determinants of the cultural significance of their heritage.

The Heritage Impact Assessment involves notifying relevant Aboriginal stakeholders of the Project proposal. Such stakeholders include;

- NSW Office of Environment and Heritage (OEH)
- Mindaribba Local Aboriginal Land Council (MLALC)
- Worimi Local Aboriginal Land Council (WLALC)
- Office of the Registrar, *Aboriginal Land Rights Act 1983* (NSW)
- National Native Title Tribunal
- NSW Native Title Services Corporation Limited (NTSCORP Limited)
- Port Stephens City Council (PSCC)
- Hunter Local Land Services

The consultation process involved placing a public notification in the *Newcastle Herald* on Friday 18 July 2014 calling for registration of interest in the project by Aboriginal groups. An invitation was then sent to all interested groups to register. The following Aboriginal parties registered for consultation;

- Worimi LALC
- Gomeroi Namoi
- Lower Hunter Aboriginal Incorporated
- Maaiangal Aboriginal Heritage
- Mur-roo-ma Inc
- Nur-Run-Gee Pty Ltd

The following Aboriginal parties provided comment on the methodology by the closing date, and were sent invitations to participate in the field survey conducted 9 October 2014;

- Worimi LALC
- Nur-Run-Gee Pty Ltd
- Mur-roo-ma Inc

A field survey of the Project Area was conducted on 9 October 2014 attended by;

- Worimi LALC
- Nur-Run-Gee Pty Ltd
- Mur-roo-ma Inc

A detailed Aboriginal Cultural Heritage Assessment has been completed and will be included in the EIS. This can be provided upon request

2.7 A staged development or component of a larger project

This Project is not part of a larger project and should be assessed based on the information provided in this report.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

Describe the affected area and the likely impacts of the proposal, emphasising the relevant matters protected by the EPBC Act. Refer to relevant maps as appropriate. The interactive map tool can help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in your area of interest.

Your assessment of likely impacts should refer to the following resources (available from the Department's web site):

- specific values of individual World Heritage properties and National Heritage places and the ecological character of Ramsar wetlands;
- profiles of relevant species/communities (where available), that will assist in the identification of whether there is likely to be a significant impact on them if the proposal proceeds;
- *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance*; and
- associated sectoral and species policy statements available on the web site, as relevant.

Your assessment of likely impacts should consider whether a bioregional plan is relevant to your proposal. The Minister has prepared four marine bioregional plans (MBP) in accordance with section 176. It is likely that the MBP's will be more commonly relevant where listed threatened species, listed migratory species or a Commonwealth marine area is considered.

Note that even if your proposal will not be taken in a World Heritage area, Ramsar wetland, Commonwealth marine area, the Great Barrier Reef Marine Park or on Commonwealth land, it could still impact upon these areas (for example, through downstream impacts). Consideration of likely impacts should include both direct and indirect impacts.

3.1 (a) World Heritage Properties

Description

N/A

Nature and extent of likely impact

None.

3.1 (b) National Heritage Places

Description

N/A

Nature and extent of likely impact

None.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

N/A

Nature and extent of likely impact

None.

3.1 (d) Listed threatened species and ecological communities

Description
Koala *Phascolarctos cinereus* – species and habitat present within the Project area.

Nature and extent of likely impact

The Project will remove up to 48.65 ha of Koala habitat. As assessed under the Commonwealth EPBC Draft Referral Guidelines for the (Commonwealth of Australia 2014; DoE 2013) Koala these impacts are likely to result in an adverse impact on Koalas and a Referral is required.

3.1 (e) Listed migratory species

Description
White-bellied Sea-eagle *Haliaeetus leucogaster* – species and habitat present within the Project area
Black-faced Monarch *Monarcha melanopsis* – species and habitat present within the Project area
Rainbow Bee-eater *Merops ornatus* – species and habitat present within the Project area

Nature and extent of likely impact

White-bellied Sea-eagle – no breeding habitat present and similar suitable forage habitat present in the wider locality. No adverse impacts on this species are likely as a result of the Project.
Black-faced Monarch – similar suitable forage and breeding habitat present in the wider locality. No adverse impacts on this species are likely as a result of the Project.
Rainbow Bee-eater – similar suitable forage and breeding habitat present in the wider locality. No adverse impacts on this species are likely as a result of the Project.

3.1 (f) Commonwealth marine area
(If the action is in the Commonwealth marine area, complete 3.2(c) instead. This section is for actions taken outside the Commonwealth marine area that may have impacts on that area.)

Description
N/A

Nature and extent of likely impact

None.

3.1 (g) Commonwealth land
Not on Commonwealth Land.

3.1 (h) The Great Barrier Reef Marine Park
Not on within the Great Barrier Reef Marine Park.

3.1 (i) A water resource, in relation to coal seam gas development and large coal mining development
Not on a water resource relating to coal seam gas development.

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	**Is the proposed action a nuclear action?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))		

3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))		

3.2 (e)	**Is the proposed action to be taken in the Great Barrier Reef Marine Park?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))		

3.3 Other important features of the environment

Provide a description of the project area and the affected area, including information about the following features (where relevant to the project area and/or affected area, and to the extent not otherwise addressed above). If at Section 2.3 you identified any alternative locations, time frames or activities for your proposed action, you must complete each of the details below (where relevant) for each alternative identified.

3.3 (a) Flora and fauna

The winter flora assessment was undertaken from 11 to 15 August 2014 and the spring flora assessment was completed on 13 and 14 November 2014. The survey methodology used a combination of plots and transects in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014; Biosis 2015a), spot locations for incidental observations and random meanders (Cropper 1992) to determine the vegetation types present within the study area (defined as the area of vegetation to be cleared within the Project area). General classification of native vegetation in NSW used was based on the Vegetation Information System (VIS) classification. Vegetation communities are separated into Plant Community Types (PCTs) based on the form, floristic composition landscape position, soils and geographical location. The general condition of native vegetation was observed as well as the effects of current seasonal conditions. A list of flora species was compiled for each vegetation type. A total of six PCTs were identified, which formed the six vegetation zones of the study area. A descriptive summary of identified PCTS and vegetation zones within the study area are provided below.

Table 5: PCT's and vegetation zones within the study area

PCT	Description	Condition for FBA	Vegetation Zone	Extent and survey effort
PCT 1602: *Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter.*	PCT 1602 extended across the elevated ridges in both the northern and southern section of the study area, grading into other Spotted Gum – Ironbark variants on the lower slopes. The community was dominated by Spotted Gum *Corymbia maculata* and Narrow-leaved Ironbark *Eucalyptus crebra* with White Mahogany *Eucalyptus acmenoides* also dominant in a number of locations. The understorey was open consisting of shrubs, native herbs, grasses and graminoids.	Moderate-High	VZ2	30.5 ha(9 plots)
PCT 1600: *Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.* (Endangered under the NSW TSC Act)	PCT 1600 was recorded predominantly in the south western portion of the study area. The community is characterized by a canopy of Spotted Gum, Narrow Leaved Ironbark, Grey Box *Eucalyptus moluccana* and, to a lesser extent, Red Ironbark *Eucalyptus fibrosa* and Forest Red Gum *Eucalyptus tereticornis*. Grey Box was more abundant in the eastern portion with Forest Red Gum more prevalent to the west. The shrub strata largely consisted of prickly shrubs with native grasses and herbs in the understorey.	Moderate-High	VZ1	12.5 ha(5 plots)
PCT 1584: *White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley*.	PCT 1584 was recorded predominantly in the north western portion of the study area and within moist gullies between ridgelines, adjacent to ephemeral drainage lines and seepage points. The community is characterized by a dense canopy of Grey Myrtle *Backhousia myrtifolia* with an understory of mesic shrubs, vines and epiphytes. Emergent sclerophyllous canopy species included White Mahogany, Grey Gum and Spotted Gum. Dominant shrubs included Creek Sandpaper Fig *Ficus coronata*, Cheese Tree *Glochidion ferdinandi*, White Supplejack *Ripogonum album*, Willow Bottlebrush *Callistemon salignus*, Rough Fruit Pittosporum *Pittosporum revolutum* and *Myrsine variabilis*. Vines and scramblers as well as ferns and their allies were common throughout the understory.	Moderate-High	VZ6	2.16 ha(2 plots)
PCT 1064: *Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.* (Endangered under the NSW TSC Act)	PCT1064 was recorded upstream of the three settlement dams in the southwestern portion of the study area. The community is characterized by a canopy of Swamp Oak *Casuarina glauca* and Forest Red Gum with scattered Narrow-leaved Ironbark and White Stringybark on the outer fringes. Prickly-leaved Tea Tree *Melaleuca styphelioides* was characteristic of the midstorey along with Cheese Tree, Acacia falcata and *Acacia longifolia*. The understory typically comprised of native grasses, forbs and vines.	Moderate-High	VZ3	0.67 ha (1 plot)
PCT 1592: *Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter*. (Endangered under the NSW TSC Act)	PCT 1592 was recorded along the northern boundary of the southeastern portion of the study area. The community is characterized by an overstorey of Red Ironbark with scattered Spotted Gum. Common shrub and understory species included Prickly Beard-heath, Downy Dodder-laurel *Cassytha pubescens*, Narrow-leaved Geebung and	Moderate-High	VZ4	1.12 ha (1 plot)

	Sandfly Zieria.			
PCT 1598: *Forest Red Gum grassy open forest on floodplains of the Lower Hunter*. (Endangered under the NSW TSC Act)	PCT 1598 was recorded fringing the bank of the large dam in the centre of the study area. The community is characterized by a tall canopy of Forest Red Gum, Rough-barked Apple and Grey Ironbark with scattered Grey Gum intergrade *Eucalyptus punctata X canaliculata* and Broad-leaved White Mahogany *Eucalyptus u*mbra. Some common shrub species included; Prickly Beard-heath *Leucopogon juniperinus*, Dolly Bush *Cassinia aculeata*, Swamp Wattle *Acacia elongata* and Narrow-leaved Geebung *Persoonia linearis*. Native grasses, forbs, vines and graminoids were common in the understorey.	Moderate-High	VZ5	1.67 ha (1 plot)

Fauna assessment was undertaken from 11 to 15 August 2014 and 13 and 14 November 2014. A total of 55 fauna species were recorded within the study area including; 47 birds, 6 mammals, 1 reptile and 1 amphibian. Four birds listed as Vulnerable under the NSW TSC Act were identified namely; Varied Sittella *Daphoenositta chrysoptera*, Black Falcon *Falco subniger*, Little Lorikeet *Glossopsitta pusilla* and Square-tailed Kite *Lophoictinia isura*.

3.3 (b) Hydrology, including water flows

A large manmade storage dam is located in the centre of the study area. It is bound on all sides by vehicle access roads, with a narrow strip of riparian vegetation. Three smaller settlement dams are located to the east of this larger dam. Deadmans Creek, a third order (Strahler 1952) ephemeral stream flows from north to south, to the east of the study area. The southern portion of Deadmans Creek was flowing during the winter survey, however to the north it was dry. During the spring survey, the entire creekline was dry, highlighting the ephemeral nature of this minor creek.

3.3 (c) Soil and Vegetation characteristics

The Northern portion of the study area is located within the Scone-Gloucester Foothills Mitchell Landscape and the larger southern portion of the study area is located within the Newcastle Coastal Ramp landscape. This is reflected in the composition and structure of the existing vegetation communities.

3.3 (d) Outstanding natural features

The Hunter River forms a prominent feature to the south of the study area and is a major river system in NSW joined by ten tributaries upstream and an additional thirty-one tributaries downstream providing significant flora and fauna habitat for the region.

Deadmans Creek, an ephemeral stream, flows from north to south, to the east of the study area. Deadmans Creek is a tributary of Williams Creek which flows south to its confluence with the Hunter River approximately 10 kilometres south of the study area.

Vegetation communities in the study area are considered to have a moderate level of groundwater dependence based on the presence of Deadmans Creek to the east of the study area, and several manmade storage and settlement dams. The Sydney Coastal Councils Group defines six categories of Groundwater Dependent Ecosystems (GDE) within Australia (SCCG 2006), those observed within the study area include;

- Terrestrial vegetation - Forests and woodlands often have a permanent or seasonal dependence on groundwater. This can be accomplished by extending deep tap roots well below the land surface to reach the water table.
- Base flow in streams – ephemeral creek lines can maintain groundwater flow and supply of water even after the channel has dried.
- Wetlands - These include lowland and upland wetlands and hanging swamps in addition to more typical aquatic environs.
- Terrestrial fauna - The species assemblage reliant on groundwater dependent vegetation communities.

Two of the vegetation communities recorded within the study area appears more reliant on groundwater based on their location within riparian corridors and on coastal floodplains. These include:

- PCT 1064 - *Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion* (0.67 ha).
- PCT 1598 - *Forest Red Gum grassy open forest on floodplains of the lower Hunter* (1.67 ha).

3.3 (e) Remnant native vegetation

The property consists predominately of native vegetation forming Hunter-Macleay Dry Sclerophyll Forests, Coastal Floodplain Woodlands and Coastal Swamp Forest vegetation communities. The property also includes some prior cleared grazing land located at the southeast of the property. Threatened ecological communities present on the Project area include:

- *Lower Hunter Spotted Gum –Ironbark Forest in the Sydney Basin Bioregion*
- *Hunter lowland redgum forest in the Sydney Basin and NSW North Coast bioregions*
- *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

N/A

3.3 (g) Current state of the environment

The broader area around BHQ primarily consists of large, semi rural/rural blocks overlooking the lower Hunter River floodplain. The study area is situated on a low ridge on the eastern flank of Brandy Hill, 180 metres above sea level and is surrounded by relatively intact native vegetation with little weed ingress and good connective diversity. Deadmans Creek, which runs through a steep valley to the north of Brandy Hill, is ephemeral and runs east along the northern edge of the quarry before following the quarry in a southern direction and turning southeast through the southeastern end of the property until it passes under Clarence Town Road. Deadmans Creek was found to be in good condition acting as a key landscape feature, connecting other landscape features and providing flora and fauna resources. Deadmans Creek falls outside of the Project disturbance area.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

N/A

3.3 (i) Indigenous heritage values

A detailed assessment and report has been completed and will be included in the EIS. This can be provided upon request

3.3 (j) Other important or unique values of the environment

Nearby to the BHQ, significant features include; to the east approximately 12 km away is the Grahamtown lake system and Wallaroo National Park and to the south-east the Tilligerry State Conservation Area. To the North approximately 7 km is the Columrey National Park and Liffington State Forest.

3.3 (k) Tenure of the action area (e.g. freehold, leasehold)

Refer to Section 1.6.

3.3 (l) Existing land/marine uses of area

N/A

3.3 (m) Any proposed land/marine uses of area

N/A

4 Measures to avoid or reduce impacts

Note: If you have identified alternatives in relation to location, time frames or activities for the proposed action at Section 2.3 you will need to complete this section in relation to each of the alternatives identified.

Provide a description of measures that will be implemented to avoid, reduce, manage or offset any relevant impacts of the action. Include, if appropriate, any relevant reports or technical advice relating to the feasibility and effectiveness of the proposed measures.

For any measures intended to avoid or mitigate significant impacts on matters protected under the EPBC Act, specify:
- what the measure is,
- how the measure is expected to be effective, and
- the time frame or workplan for the measure.

Examples of relevant measures to avoid or reduce impacts may include the timing of works, avoidance of important habitat, specific design measures, or adoption of specific work practices.

Provide information about the level of commitment by the person proposing to take the action to implement the proposed mitigation measures. For example, if the measures are preliminary suggestions only that have not been fully researched, or are dependent on a third party's agreement (e.g. council or landowner), you should state that, that is the case.

Note, the Australian Government Environment Minister may decide that a proposed action is not likely to have significant impacts on a protected matter, as long as the action is taken in a particular manner (section 77A of the EPBC Act). The particular manner of taking the action may avoid or reduce certain impacts, in such a way that those impacts will not be 'significant'. More detail is provided on the Department's web site.

For the Minister to make such a decision (under section 77A), the proposed measures to avoid or reduce impacts must:
- clearly form part of the referred action (eg be identified in the referral and fall within the responsibility of the person proposing to take the action),
- be must be clear, unambiguous, and provide certainty in relation to reducing or avoiding impacts on the matters protected, and
- must be realistic and practical in terms of reporting, auditing and enforcement.

More general commitments (eg preparation of management plans or monitoring) and measures aimed at providing environmental offsets, compensation or off-site benefits CANNOT be taken into account in making the initial decision about whether the proposal is likely to have a significant impact on a matter protected under the EPBC Act. (But those commitments may be relevant at the later assessment and approval stages, including the appropriate level of assessment, if your proposal proceeds to these stages).

Hanson has endeavoured to avoid and minimise ecological impacts associated with the proposed Project. Hanson has assessed the feasibility of using alternative quarry material, sites, extraction boundaries, operating hours and operation, and has endeavoured to avoid or minimise Project impacts, whilst maximising the economic recovery associated with material extraction. The following outline the measures Hanson has taken or will take if Project Approval is granted.

Extraction boundary

a. Avoid and minimise disturbance of key vegetation communities including;
    i. Disturbance/extraction boundary excludes Deadmans Creek thereby reducing Project imposed impact on this environment.
b. Much of the expansion area is over regenerated area which was previously cleared and mapped as closed grassland and open forest (see 1983 EIS).
c. Reduction in the impact area upon isolation of the resource. The PEA initially identified an area of 42 hectares due to the geological mapping identifying the potential resource underlying the BHQ position. This was reassessed prior to the drilling campaign occurring and a 121 hectare extraction area was identified. Due to the findings of the comprehensive geological and geotechnical assessment a final extraction area of 97 hectares has been included for consent. This area was refined based on geological and ecological constraints, and in particular the need to provide for an on-site biodiversity offset.
d. The impact area was refined to occupying the most concise area to minimise net impacts on flora/fauna.

Expansion

a. The company has chosen to expand the existing quarry thereby maximising the operating capacity at the current site avoiding the need to develop in a greenfield site.

Offset

a. Prepare a comprehensive biodiversity offset strategy to address impacts of the Project that cannot be adequately minimised or mitigated.

Proposed Mitigation Measure to Minimise Impact

- Pre clearance surveys will be conducted prior to any vegetation clearance in areas of identified threatened species habitat to ensure that threatened species are not present.
- Progressive vegetative rehabilitation will be completed using indigenous species.
- Weed, sediment and erosion control will be undertaken.
- Environmental Management Plans/Strategies will be developed and implemented.

5 Conclusion on the likelihood of significant impacts

Identify whether or not you believe the action is a controlled action (i.e. whether you think that significant impacts on the matters protected under Part 3 of the EPBC Act are likely) and the reasons why.

5.1 Do you THINK your proposed action is a controlled action?

	No, complete section 5.2
X	Yes, complete section 5.3

5.2 Proposed action IS NOT a controlled action.

Specify the key reasons why you think the proposed action is NOT LIKELY to have significant impacts on a matter protected under the EPBC Act.

5.3 Proposed action IS a controlled action

Type 'x' in the box for the matter(s) protected under the EPBC Act that you think are likely to be significantly impacted. (The 'sections' identified below are the relevant sections of the EPBC Act.)

	Matters likely to be impacted
	World Heritage values (sections 12 and 15A)
	National Heritage places (sections 15B and 15C)
	Wetlands of international importance (sections 16 and 17B)
X	Listed threatened species and communities (sections 18 and 18A)
	Listed migratory species (sections 20 and 20A)
	Protection of the environment from nuclear actions (sections 21 and 22A)
	Commonwealth marine environment (sections 23 and 24A)
	Great Barrier Reef Marine Park (sections 24B and 24C)
	A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)
	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
	Protection of the environment from Commonwealth actions (section 28)
	Commonwealth Heritage places overseas (sections 27B and 27C)

Specify the key reasons why you think the proposed action is likely to have a significant adverse impact on the matters identified above.

As per recommendations of the Draft Referral Guidelines for Koalas, the Project will adversely affect habitat critical to the survival of the Koala. Refer to Attachment B for the Targeted Koala Survey Report (Biosis 2015b).

6 Environmental record of the responsible party

NOTE: If a decision is made that a proposal needs approval under the EPBC Act, the Environment Minister will also decide the assessment approach. The EPBC Regulations provide for the environmental history of the party proposing to take the action to be taken into account when deciding the assessment approach.

		Yes	No
6.1	**Does the party taking the action have a satisfactory record of responsible environmental management?** **Provide details** Environmental Protection Licence: Brandy Hill Quarry operates under Environmental Protection Licence number 1879 which was issues on 25 July 2000, with several variations on 3 September 2002, 7 October 2010, 1 September 2011, 31 October 2011, 29 April 2013. Additionally Brandy Hill Quarry has submitted applications for a licence transfer on 1 May 2001 and 2 August 2004 which have been approved and 8 August 2011 which has been approved. Brandy Hill Quarry have released annual returns from 2001 – 2013 which have all been compliant with relevant criteria. Development Application Approval: The site operates in accordance with Development Application Approval granted by Port Stephens Shire Council on 21st December 1983.	✓	
6.2	**Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?** **If yes, provide details** n/a		✓
6.3	**Is the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?** **If yes, provide details of environmental policy and planning framework** Hanson Construction Materials Pty. Ltd. have developed a sound general environmental management policy. The policy outlines Hanson's commitment to the environmental management including; - Operating practices - Compliance - Management Review - Waste management - Product development - Environmental assessment - Environmental Incident Response - Rehabilitation - Communication - Community expectations - Water management Additionally Brandy Hill Quarry has a site specific Environmental Management Plan, which has been updated in 2014 to reflect the sites environmental progress and requirements. Note: These policies can be provided on request.	✓	
6.4	**Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?**		✓

Provide name of proposal and EPBC reference number (if known) The Proponent has not previously referred an action under the EPBC Act or been responsible for undertaking an action under the EPBC Act.		

7 Information sources and attachments

(For the information provided above)

7.1 References

Biosis (2015a). *Brandy Hill Quarry Expansion Biodiversity Assessment Report*. Report for Hanson. Authors: J.Murray, C.Corden, E.Cooper, S.Rose, A.Steelcable & A.Nelson. Biosis Pty Ltd, Sydney. Project no. 18371

Biosis (2015b) *Targeted threatened species survey for Koala*. Report for Hanson. Author: Corden, C. Biosis Pty Ltd, Sydney Office. Project no. 19323.

Commonwealth of Australia 2014. *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capitol Territory)*. Commonwealth of Australia.

DoE 2013 *Matters of National Environmental Significance, Significant Impact Criteria Guidelines 1.1 Environmental Protection and Biodiversity Conservation Act 1999*. Department of the Environment, Canberra.

OEH 2014. *Framework for Biodiversity Assessment*. *NSW Offset Policy for Major Projects* Office of Environment and Heritage.

SCCG 2006. *Groundwater Management Information Fact Sheet 3: Groundwater Dependent Ecosystems*. Sydney Coastal Councils Group.

7.2 Reliability and date of information

For information in section 3 specify:

- source of the information;
- how recent the information is;
- how the reliability of the information was tested; and
- any uncertainties in the information.

7.3 Attachments

Attachment A: Figures 1 to 5
Attachment B: Targets Koala Survey Report
Attachment C: Legislative Controls Applicable to the Project
Attachment D: Biodiversity Assessment Report

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Attachment A Zip file with metadata.
	GIS file delineating the boundary of the referral area (section 1)		
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Attachment A
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)		
	copies of any completed assessments to	✓	Attachment D

meet state or local government approvals and outcomes of public consultations, if available (section 2.6)		
copies of any flora and fauna investigations and surveys (section 3)	✓	Attachment B
technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	✓	Attachment B Attachment C
report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		can be provided upon request

8 Contacts, signatures and declarations

NOTE: Providing false or misleading information is an offence punishable on conviction by imprisonment and fine (s 489, EPBC Act).

Under the EPBC Act a referral can only be made by:

- the person proposing to take the action (which can include a person acting on their behalf); or
- a Commonwealth, state or territory government, or agency that is aware of a proposal by a person to take an action, and that has administrative responsibilities relating to the action[1].

Project title: Brandy Hill Quarry Expansion

8.1 Person proposing to take action

Hanson Construction Materials Pty Ltd

1. Name and Title:	Pip Cox Graduate Environmental Manager
2. Organisation (if applicable):	Hanson Construction Materials Pty Ltd
3. EPBC Referral Number (if known):	
4: ACN / ABN (if applicable):	ABN: 90 009 679 734
5. Postal address	Level 5, 75 George Street Parramatta, NSW, 2150
6. Telephone:	(M) 0439 131 941 (W) (02) 9354 2638
7. Email:	pip.cox@hanson.com.au
8. Name of designated proponent (if not the same person at item 1 above and if applicable): 9. ACN/ABN of designated proponent (if not the same person named at item 1 above):	

COMPLETE THIS SECTION ONLY IF YOU QUALIFY FOR EXEMPTION FROM THE FEE(S) THAT WOULD OTHERWISE BE PAYABLE

I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

□ an individual; OR

□ a small business entity (within the meaning given by section 328-110 (other than subsection 328-119(4)) of the *Income Tax Assessment Act 1997*).

If you are small business entity you must provide the Date/Income Year that you became a small business entity:

Note: You must advise the Department within 10 business days if you cease to

[1] *If the proposed action is to be taken by a Commonwealth, state or territory government or agency, section 8.1 of this form should be completed. However, if the government or agency is aware of, and has administrative responsibilities relating to, a proposed action that is to be taken by another person which has not otherwise been referred, please contact the Referrals Gateway (1800 803 772) to obtain an alternative contacts, signatures and declarations page.*

be a small business entity. Failure to notify the Secretary of this is an offence punishable on conviction by a fine (regulation 5.23B(3) *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth)).

COMPLETE THIS SECTION ONLY IF YOU WOULD LIKE TO APPLY FOR A WAIVER

I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations. Under sub regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made:	
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence. I agree to be the proponent for this action. I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.
Signature	Date

8.2 Person preparing the referral information (if different from 8.1)

Individual or organisation who has prepared the information contained in this referral form.

Name	Carl Corden
Title	Consultant Zoologist
Organisation	Biosis Pty Ltd
ACN / ABN (if applicable)	ACN 006 175 097 - ABN 65 006 175 097
Postal address	14, 17-27 Power Ave, Alexandria NSW 2015
Telephone	(02) 9690 2777
Email	ccorden@biosis.com.au
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence.
Signature	Date

REFERRAL CHECKLIST

NOTE: This checklist is to help ensure that all the relevant referral information has been provided. It is not a part of the referral form and does not need to be sent to the Department.

HAVE YOU:

- ❑ Completed all required sections of the referral form?
- ❑ Included accurate coordinates (to allow the location of the proposed action to be mapped)?
- ❑ Provided a map showing the location and approximate boundaries of the project area?
- ❑ Provided a map/plan showing the location of the action in relation to any matters of NES?
- ❑ Provided a digital file (preferably ArcGIS shapefile, refer to guidelines at Attachment A) delineating the boundaries of the referral area?
- ❑ Provided complete contact details and signed the form?
- ❑ Provided copies of any documents referenced in the referral form?
- ❑ Ensured that all attachments are less than three megabytes (3mb)?
- ❑ Sent the referral to the Department (electronic and hard copy preferred)?

Attachment A

Figure 1, Figure 2, Figure 3, Figure 4, Figure 5

Figure 1 Brandy Hill Quarry Project Locality

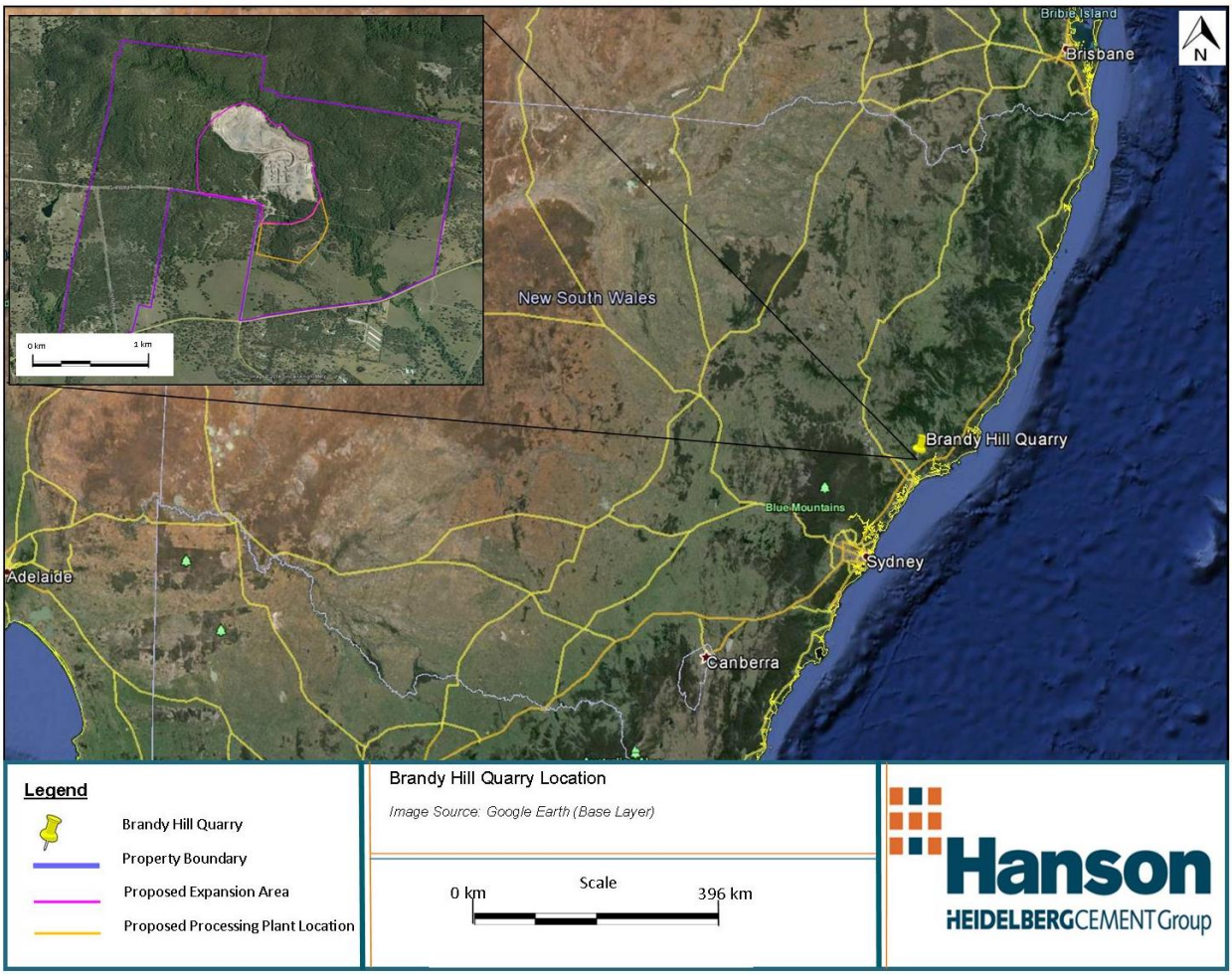


Figure 2: Current extraction limit, proposed extraction limit and proposed plant location

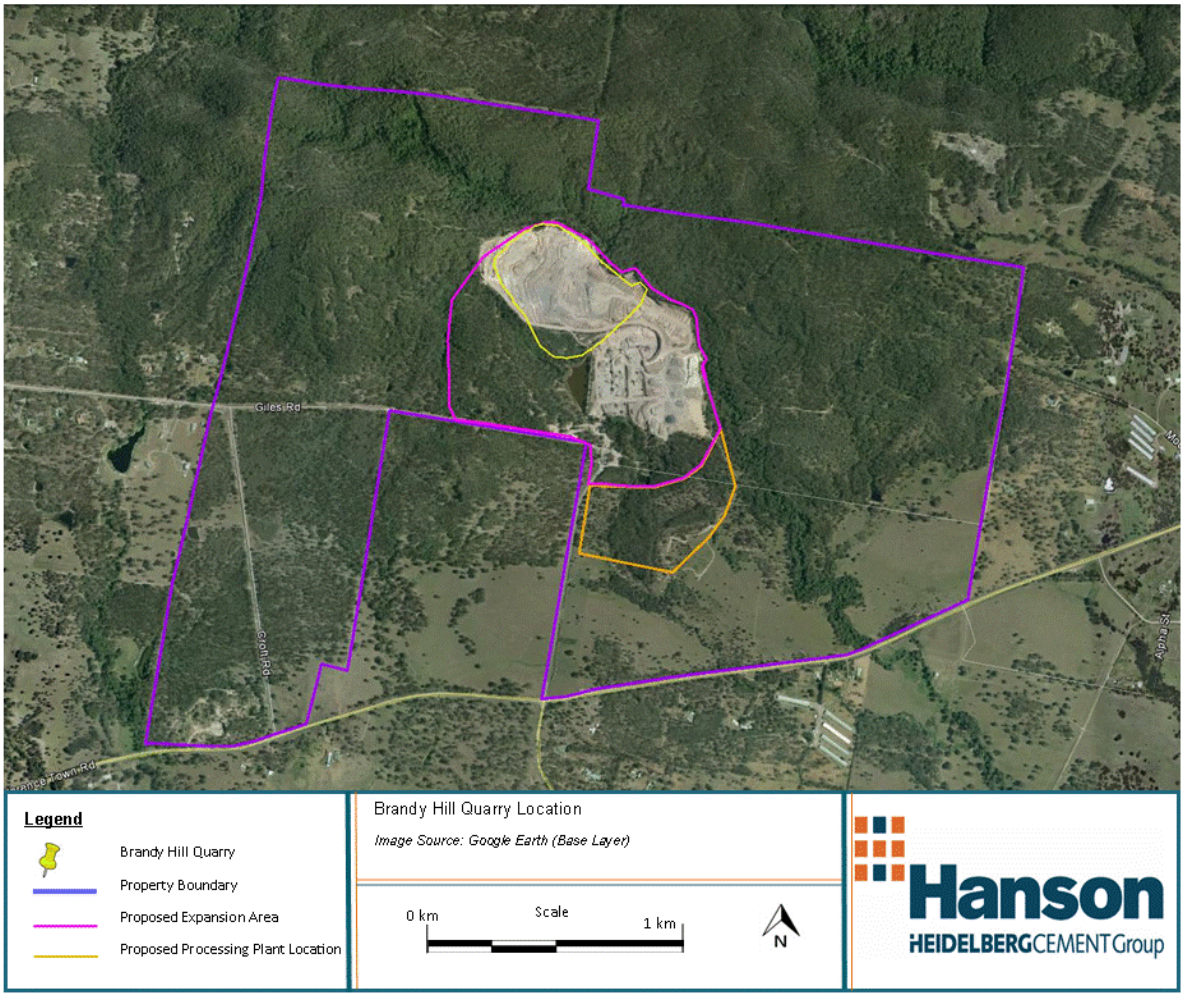


Figure 3: Project staging

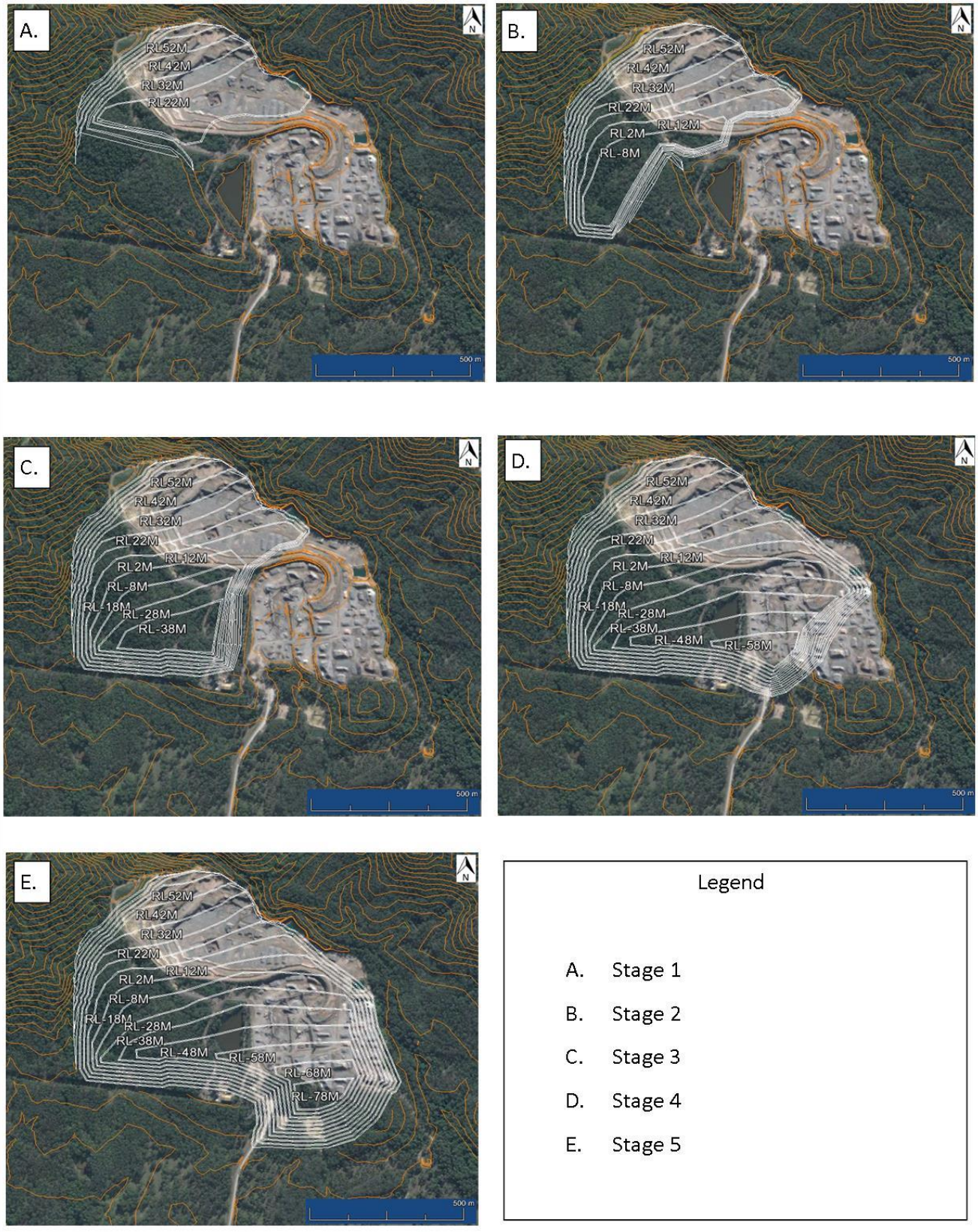


Figure 4: Property Ownership

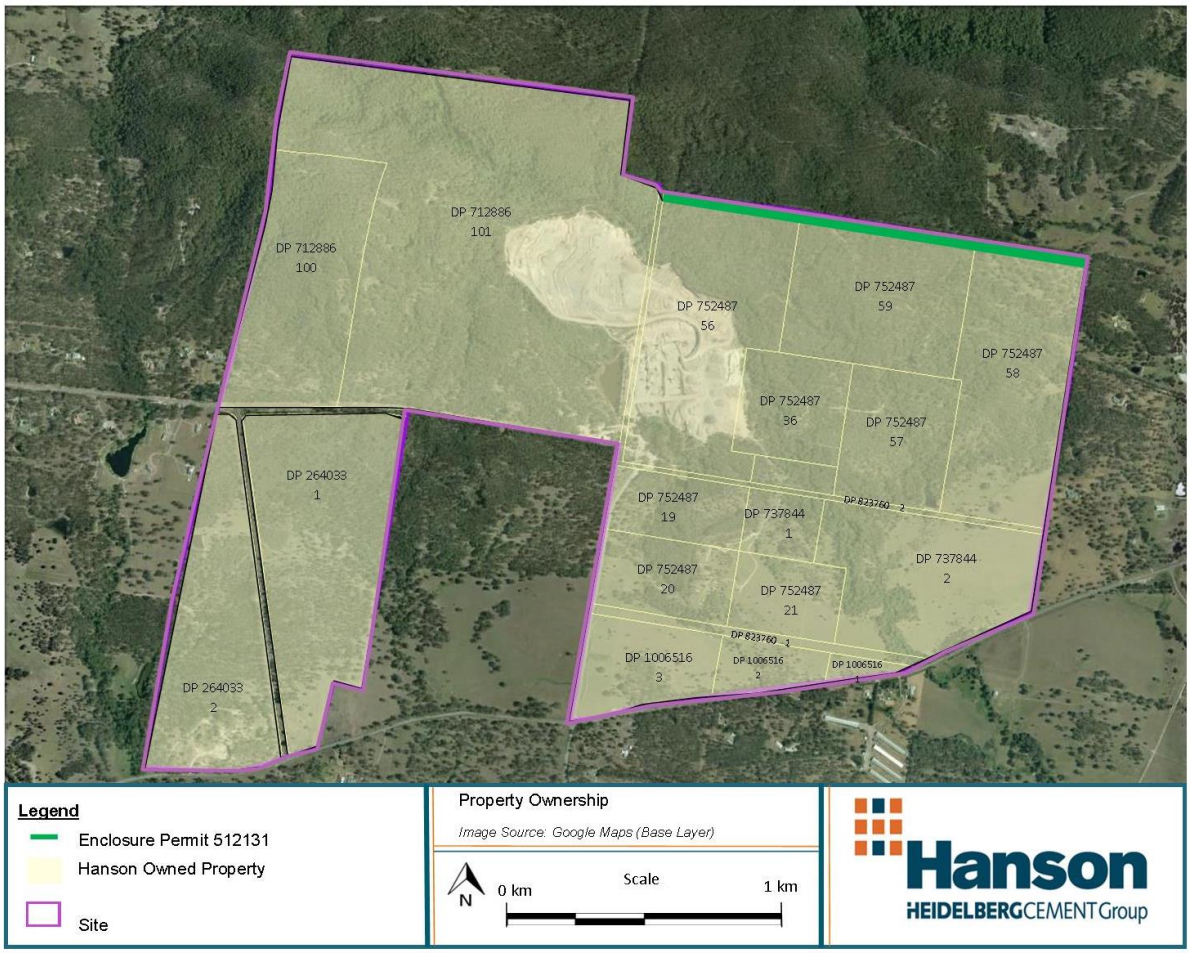
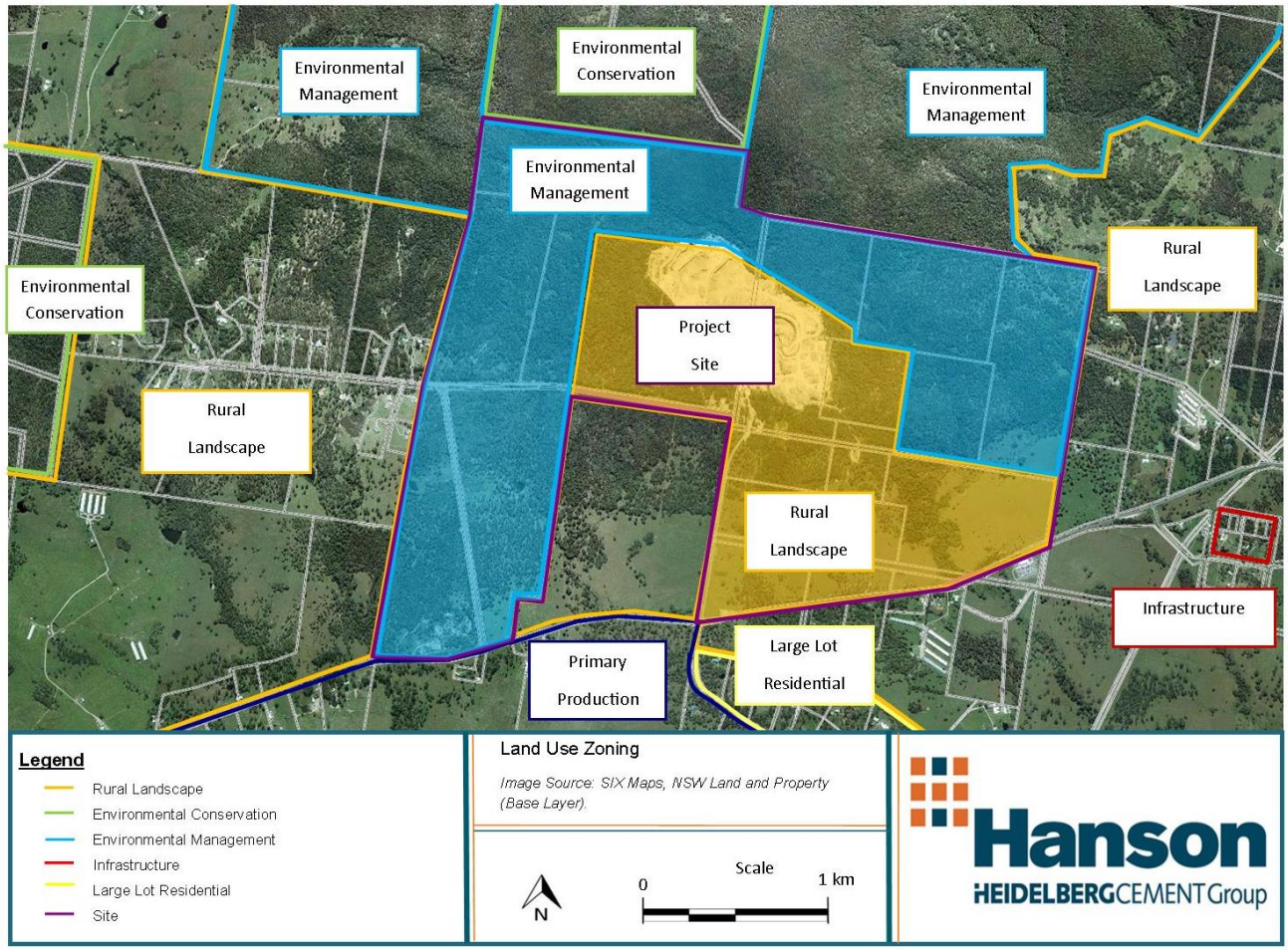


Figure 5: Project and Surrounding Land Use Zoning



Refer to attached Zip file containing metadata in accordance with Commonwealth Guidelines.

Attachment B

Targeted Koala Survey Report

Brandy Hill Quarry Expansion

Targeted Threatened Species Survey –

Koala *Phascolarctos cinereus*

Prepared for Hanson Construction Materials Pty Ltd

17 March 2015

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Document information

Report to:	Pip Cox of Hanson
Prepared by:	Carl Corden
Biosis project no.:	19323

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Document control

Version	Internal reviewer	Date issued
Draft version 01	Brian Wilson	09.01.2014
Draft version 02	Carl Corden	20.01.2015
Final version 01	Jane Murray	24.02.2015

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Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- Pip Cox and Simon Jones of Hanson

The following Biosis staff were involved in this project:

- Carl Corden for field surveys and reporting
- James Shepherd for mapping
- Jane Murray and Brian Wilson for quality assurance

Contents

1 Introduction

1.1 Background

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry located at 979 Clarence Town Rd, Seaham (the Project). The Project will be assessed against Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as a State Significant Development (SSD). To support the design and approval of the Project, Hanson is preparing an Environmental Impact Statement (EIS).

While undertaking the flora and fauna assessments to support the EIS, Biosis identified the presence of the Koala *Phascolarctos cinereus* within the Project area. The Koala is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). The presence of Koalas within the Project area was deemed likely to trigger the requirement to submit a referral for impacts on Commonwealth Matters of National Environmental Significance (NES). A Significant Impact Criteria assessment was therefore undertaken for the Koala, and the results of the assessment confirmed that the Project was likely to result in a significant impact on Koalas.

Targeted Koala and Koala habitat utilisation surveys were recommended to provide additional information for inclusion with the Commonwealth EPBC Act referral for the Project. The need for additional targeted surveys is stipulated by the *EPBC Act referral guidelines for the vulnerable Koala* (Commonwealth of Australia 2014). Biosis Pty Ltd was commissioned by Hanson to undertake targeted Koala surveys to provide additional information to support the Commonwealth EPBC Act referral for the Project.

The following definitions apply to the Project and are used throughout this document:

The **Project area** includes the area that forms the SSD application as per Attachment 1 (Figure 1 and Figure 2) of the EPBC Referral.

The **study area** encompasses the area within the Project area comprising vegetation to be removed, as well as adjacent areas supporting potential Koala habitat (Figure 1 below).

The **Koala** refers to the combined populations of the Koala in Queensland, New South Wales and the Australian Capital Territory, which were determined to be a single population for the purposes of the Vulnerable listing for this species under the Commonwealth EPBC Act.

1.2 Scope of works

The scope of works for this study involved targeted surveys for the Koala using the Spot Assessment Technique (SAT) in conjunction with point searches for Koalas, in line with relevant species survey guidelines (DoE 2013). Surveys were undertaken in December to meet the optimal survey period for this species, and were conducted by an ecologist experienced in Koala survey methods. Following the field survey, the following tasks were completed:

- Identified and mapped koala habitat, activity and recorded the number and location of any Koalas observed.
- Prepared and analysed data in accordance with the SAT to determine habitat utilisation by Koalas within the study area.
- Prepared an EPBC Act referral for the Minister of the Environment.

This report was prepared to provide an addendum to the Biodiversity Assessment Report (Biosis 2015) prepared to support the EIS.

1.3 Objectives of the report

The occurrence of Koalas at the proposed quarry expansion at Brandy Hill was confirmed from sightings of Koalas in addition to detection of scats during both the winter and spring fauna assessments of the Project area. To provide DoE with adequate information to support the determination of whether Project, a state significant development (SSD) under the *Environmental Planning and Assessment Act 1979* (EP&A Act), may potentially become a 'controlled action', Biosis completed targeted Koala surveys using the SAT developed by the Australian Koala Foundation (Phillips and Callaghan 2011) in conjunction with point searches for Koalas.

The objectives of the survey were to establish population density and habitat utilisation within the Project area and the adjacent study area (vegetation to be cleared as part of the proposed SSD and surrounding suitable habitat).

The tasks of the project are identified as follows:

- Undertake a targeted Koala surveys and Koala activity surveys within the Project area and suitable adjoining habitat (study area).
- Determine the potential for the Project area to provide habitat for the Koala.

Given the scope of works outlined above, and relevant species survey guidelines and requirements for the Koala, this report documents the following:

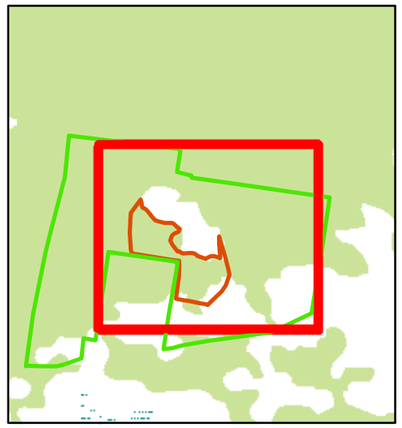
- Background information.
- Survey methodology.
- Survey limitations.
- Results of the field survey.
- Survey conclusion.

Following the survey an EPBC Act referral to the Minister has been prepared, of which this report forms Attachment B, including the details of the proposed SDD works and findings of the targeted Koala surveys and relevant components of the flora and fauna assessment.

1.4 Literature and database review

The following policies, documents and databases were reviewed to provide background information for this report:

- *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capitol Territory)* (Commonwealth of Australia 2014).
- NSW BioNet - the database for the Atlas of NSW Wildlife (OEH 2015).
- State Environmental Planning Policy (SEPP) No. 44 – Koala Habitat Protection.
- *Port Stephens Comprehensive Koala Plan of Management* (CKPoM) (Port Stephens Council 2002).



Legend

- Koala Survey Grid 200m
- Koala Survey Grid Extent
- Vegetation clearing area

Figure 1: Study area and SAT survey points

0 75 150 225 300 375

Metres
Scale: 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 19323
Date: 05 January 2015,
Checked by: CAC, Drawn by: LDM, Last edited by: jshepherd
Location:P:\19300s\19323\Mapping
19323_F3_KoalaSatSurvey

2 Background

2.1 Habitat and ecology

Koalas are generally solitary animals inhabiting eucalypt woodlands and forests. They have been known to feed on the foliage of more that 100 eucalypt and non-eucalypt species, though they prefer only a few browse species in any one location. Koalas are inactive for most of the day, spending most of their time in trees and feeding and moving between trees at night. They display complex social hierarchies and territories, with their home range varying between less than two hectares to several hundred hectares, depending on habitat quality (DoE SPRAT 2014).

SEPP 44 defines potential Koala habitat as *"areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component"*. Core Koala habitat is defined as *"land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population"*.

SEPP 44 does not apply to Major Projects that are being assessed as SSD. However, SEPP 44 Koala habitat definitions have been used to determine potential and core Koala habitat areas for the study area. The Port Stephens CKPoM mapping was also used to identify Koala habitat within the study area.

2.2 Species distribution

The Koala has a sparse and fragmented distribution throughout the central and north coasts of NSW, and throughout eastern Australia from Queensland to the Eyre Peninsula in South Australia, with some populations occurring west of the Great Dividing Range (DoE SPRAT 2014).

NSW OEH Bionet data indicates a total of 6,749 Koala records from within the Port Stephens LGA, as at 20 January 2015 (OEH 2015). Figure 2 shows the locality of historical records of the species in the immediate locality of the study area (NSW OEH Bionet 2015).

Legend

- Koala records (OEH Bionet)
- Search area
- Study area

Figure 2: Koala records within 10km of the study area

0 860 1,720 2,580 3,440 4,300

Metres

Scale: 1:86,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

N

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Matter: 15743
Date: 20 January 2015,
Checked by: , Drawn by: SMV, Last edited by: jshepherd
Location:P:\19300s\19323\Mapping
19323_F2_KoalaRecords

3 Methodology

All Biosis field surveys were conducted by a qualified and competent zoologist under the authority of a current NSW *National Parks and Wildlife Act, 1974* Scientific Licence (SL100758) to harm/trap/pick/hold/study protected fauna and native flora, and a current Animal Research Authority (ARA) (TRIM 14/271#4) issued under the NSW *Animal Research Act, 1985* Certificate of Approval by the Animal Ethics Committee (AEC) of the Director-General of NSW Agriculture to conduct fauna survey work carried out as part of Environmental Impact Statements, Species Impact Statements and general wildlife research.

3.1 Previous Surveys

Comprehensive flora and fauna surveys were conducted within the study area in winter and spring. These surveys included vegetation mapping (identifying the occurrence of Koala feed trees) and targeted threatened fauna searches, including diurnal and nocturnal searches for Koalas. Methods used to search for Koalas included:

- Diurnal searches of trees for Koalas within bird census and BioBanking plots.
- Diurnal incidental searches beneath Koala feed trees within bird census and vegetation survey plots for signs of Koalas (scats and scratches).
- Diurnal incidental searches of trees for Koalas and signs of Koala activity while traversing the Project area and the study area.
- Nocturnal spotlighting and call playback for Koalas throughout the Project area and study area.

3.2 Current SAT and point surveys

Targeted Koala and Koala activity surveys were conducted 9 to 11 December 2014. Surveys were conducted by 3 or 4 staff for a maximum of 8 hours on each day. The timing of the surveys was considered appropriate for detecting both Koalas and signs of Koala activity as stipulated in the Draft Koala Referral Guidelines (DoE 2013). The targeted survey was guided by key documents:

- *Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DoE 2013).
- The *Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus* (Phillips and Callaghan 2011).
- DRAFT NSW *Threatened Biodiversity Survey and Assessment Guidelines* (DEC 2004).
- Department of the Environment's (DoE) Species Profile and Threats Database (SPRAT).

Koala SAT and point survey locations were selected using a systematic grid-based approach. A 200m interval grid was placed over a map of the Project and study areas and the intercept points of the grid were used as potential survey sites. Figure 1 shows the location of potential Koala SAT survey points.

From the potential points, final survey sites were selected based on:

- The proximity of each potential survey site to Koala habitat (i.e. sites in cleared land or the operating quarry area were not selected).

- The location of the points within or immediately adjacent to the Project area.
- The total number of sites that could be adequately sampled during field surveys.

At each site surveyed a combination of two survey methods were employed. These were the SAT methodology and Koala point searches. Methods for each are described below.

3.2.2 SAT surveys

The SAT methodology employed was as described by Phillips and Callaghan (2011). At each point surveyed, a central tree was chosen (usually a preferred Koala feed tree if present). The base of this and the nearest 29 trees (> or = 100mm diameter at breast height) were searched for Koala scats by one observer for up to 2 minutes per tree. Searches were conducted within 1 metre from the base of the tree, and were conducted on the surface as well as beneath leaf litter (using a small hand-held rake). If Koala scats were detected the tree was scored as a "1". If no scats were detected within 2 minutes the tree was scored as a "0". The total score was then added for 30 trees to determine the activity value of the site.

In accordance with the methodology described by Phillips and Callaghan (2011) the Project area was mapped as "East Coast – low abundance". This was primarily based on Koala density estimates obtained during previous and current surveys, indicating that the Project area is likely to support less than 0.1 Koalas per hectare. The activity scores for East Coast – low abundance are as follows:

- 0 – 2 scats recorded – "Low" activity.
- 3 scats recorded – "Medium" activity.
- 4 – 30 scats recorded – "High" activity.

For the purposes of the assessment, "Low" activity areas (including areas where no scats were recorded) are considered to be used only infrequently by Koalas. Areas of "Medium" and "High" activity are considered to represent preferred Koala habitat within the Project area and the study area.

3.2.3 Koala point surveys and population density estimate

At each of the survey points selected, a total of 5 minutes was spent searching all vegetation (from ground to canopy) within a 25 metre radius of the central tree for any Koalas present. Any Koalas recorded within the 25 metre radial search were used in calculations of population density for the Project area. Any Koalas recorded outside of the 25 metre radial search area were counted as incidental records only, and were not used in population density estimates.

Each 25 metre radial search equated to a total of 0.125 hectares. The total search area for Koala population density estimates was therefore 0.125 hectares multiplied by the total number of sites surveyed. Thus the Koala population density for the study area was calculated using the total number of Koalas recorded within the 25 metre radial searches divided by the total area searched, and an estimate of the number of Koalas per hectare derived.

3.3 Survey limitations

General fauna surveys and targeted Koala surveys were conducted over three seasons in varying weather conditions. It is considered that this range of conditions was appropriate for detecting Koalas or signs of Koala activity throughout the study area.

The systematic grid based assessment provides a randomised approach to surveys. This method has the potential to over or under-estimate Koala activity if sites selected are co-incidentally over or under-utilised

compared to remaining parts of the study area. A relatively large number of sites were sampled to ensure the study area was adequately sampled.

4 Results

4.1 Desktop assessment and previous surveys

Figure 2 shows Koala records are known from the wider locality. Anecdotal reports from Brandy Hill Quarry staff indicate low abundance of Koalas over many years of operations.

Results of previous surveys indicate presence of one individual in winter and one individual in spring surveys (see Figure 3).

No breeding female Koalas were recorded during previous surveys. Under SEPP 44 the Project would therefore be defined as "potential" Koala habitat. The Port Stephens CKPoM maps the Project as supporting areas of "Preferred" and "Marginal" Koala habitat.

4.2 SAT surveys

Figure 1 and Figure 3 shows the locations of SAT survey points surveyed and the activity levels recorded at each SAT survey point. A total of 29 SAT points were surveyed. The data collected during the SAT surveys is included in Appendix 1.

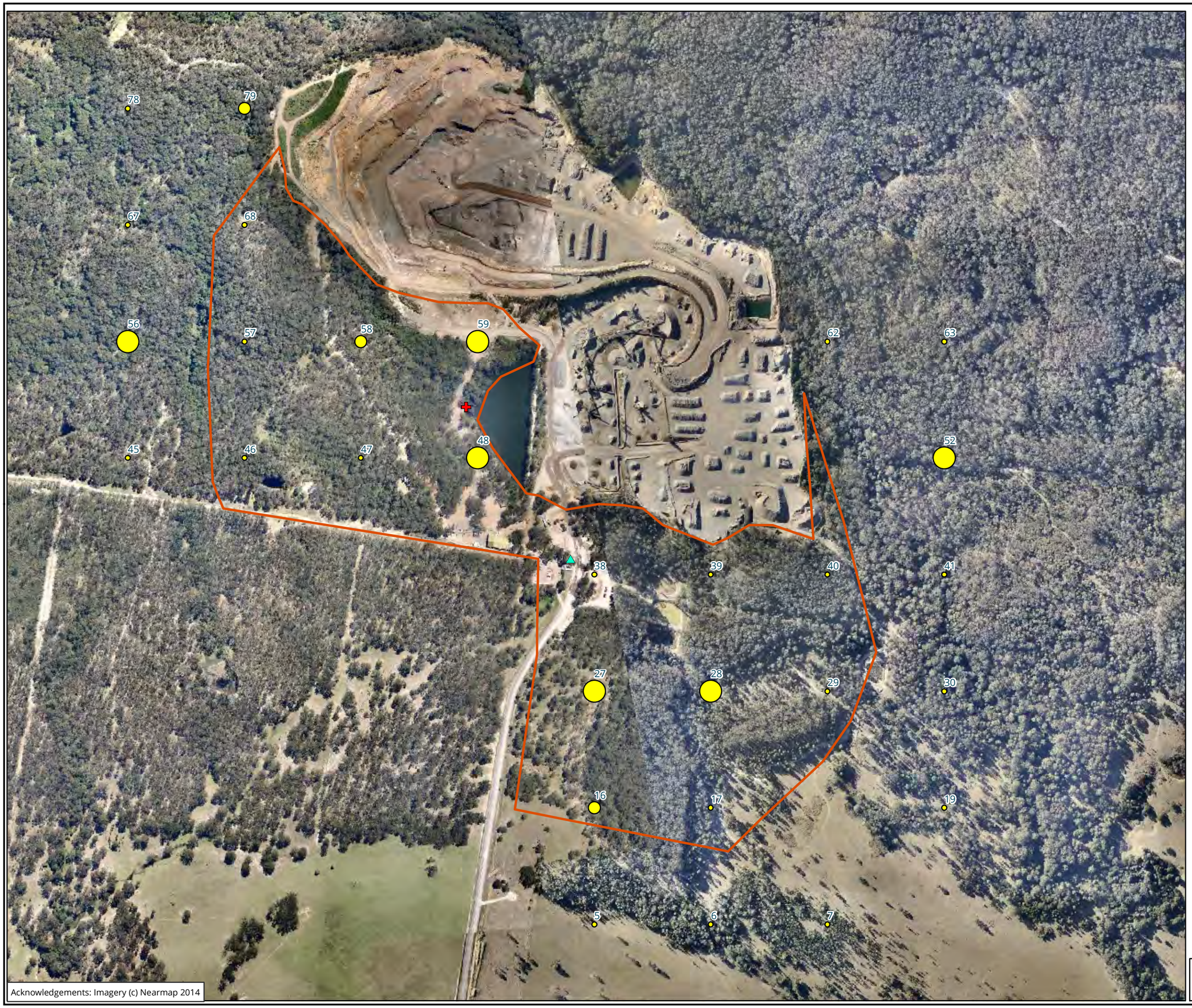
The East Coast low abundance category chosen based on the population density estimate calculated in Section 4.3 below as well as previous survey records.

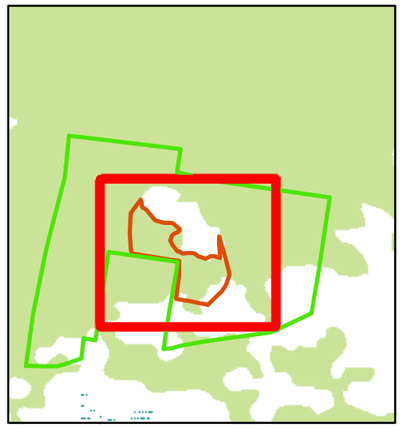
Mapping shows 6 High (between 4 and 30 trees with scats) and 3 Medium (3 trees with scats) activity sites within the study area, with the remaining 20 sites surveyed within the study area showing low (0 to 2 trees with scats) activity levels. With the exception of two outlying "High" sites to the east and west of the Project area, the SAT data indicates that the major areas of Koala activity occur within the Project vegetation clearing area. A band of High and Medium activity occurs from northwest to southeast, indicating a potential Koala activity corridor through the Project area (see Figure 3).

4.3 Koala point surveys and population density estimate

At each SAT point surveyed (see Figure 3) searches were conducted for individual Koalas within a 25m radius of the central tree chosen for the SAT surveys. No Koalas were recorded at any of the 29 survey points searched during the SAT surveys.

During the surveys a total of 3.6 hectares (29 x 0.125 hectares) of Koala habitat were searched for Koalas. This includes a search of 1.9 hectares (15 x 0.125 hectares) within the Project area. Although it is not possible to estimate actual Koala population density based on the Koala point surveys it can be assumed that the population within the Project area would be <0.1 Koalas per hectare of habitat present.





Legend

- Vegetation clearing area

Koala records

- August 2014
- November 2014

Koala Activity

- Low
- Medium
- High

Figure 3: Koala activity and records

0 60 120 180 240 300

Metres

Scale: 1:6,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 19323
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Checked by: CAC, Drawn by: LDM, Last edited by: jshepherd
Location:P:\19300s\19323\Mapping
19323_F4_KoalaActivity_20141219

5 Discussion and recommendations

No Koalas were recorded during the current Koala point surveys. Combined with the low numbers of Koala records from previous surveys and anecdotal observations of long-term staff at the Brandy Hill Quarry this indicates that, despite activity levels shown in the SAT data, the Project area currently supports only a low density of Koalas. The relatively high activity levels in parts of the Project may therefore indicate frequent use by a small number of individuals.

The Project area supports 48.65 hectares of Koala habitat, all of which would be removed for the Project. The total area of the site owned by Hanson is 561 hectares, much of which supports Koala habitat. It is therefore unlikely that removal Koala habitat for the Project will result in a significant reduction in the area of occupancy of Koalas in the locality, given the area of suitable habitat that will remain in adjacent land. To date, no areas of Commonwealth identified "critical habitat" have been listed for the Koala. However, in accordance with the *EPBC Act Referral Guidelines for the vulnerable listed Koala* (Commonwealth of Australia 2014) removal of Koala habitat resulting from the Project has potential to adversely affect "habitat critical to the survival of the species".

As recommended in the Referral Guidelines, a Koala habitat appraisal has been completed to assess impacts of the Project on Koalas (see Appendix 2). The Koala habitat appraisal determined that the Project achieved a total habitat assessment score of 9. In accordance with Referral Guidelines, the Project is therefore likely to result in adverse effects on habitat critical to the survival of the Koala given the Project will:

- *Impact on an area supporting habitat critical to the survival of the Koala (a habitat score of > or = 5).*
- *Require clearing of > or = 20 hectares of habitat containing known Koala food trees in an area with a habitat score > or =8.*

Based on the results of previous surveys (Biosis 2015) as well as the current SAT and Koala point surveys, combined with the results of the Koala habitat appraisal and the Significant Impact Criteria assessment of which a significant impact to Koala was determined to be likely (Biosis 2015), it is therefore recommended that a Referral under the Commonwealth EPBC Act for impacts on Matters of NES (Koalas) be submitted for the Project. This document has therefore been prepared to supplement the EPBC Act referral for Koalas.

Should the Project proceed, the following recommendations are made to minimise potential impacts on Koalas, resulting from the Project:

- A Biodiversity Management Plan (incorporating management measures for Koalas) should be prepared to outline the clearance procedure (including protection measures for adjacent vegetation), protocols for Koala finds and incidents and include an educational brochure for all workers to review prior to working on the Project.
- An ecologist should undertake pre-clearance surveys within the Project area immediately prior to the removal of any vegetation to give the clearance go ahead.
- An ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on Koalas displaced or injured during clearing.
- An ecologist or regional Koala care group should be contacted if any Koalas are injured and/or distressed during the construction and operation phases of the Project.

- Low site speed limits should be established on site to reduce the potential for vehicle impacts on Koalas. All drivers working on the Project should be made aware of Koalas and instructed to take precautions when driving on site.

6 References

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Phillips, S. & Callaghan, J. (2014) What faecal pellet surveys can and can't reveal about the ecology of koalas *Phascolarctos cinereus* II: an interim response to Woosnam - Merchez *et al.* (2013). *Biolink technical report No. 1.*

Phillips, S. & Callaghan, J. (2011) The *Spot Assessment Technique*: a tool for determining localised levels of habitat use by Koalas *Phascolarctos cinereus*. *Australian Zoologist*, 35 (3), p. 774-780.

Port Stephens Council 2002. *Port Stephens Comprehensive Koala Plan of Management* (CKPoM). Port Stephens Council with the Australian Koala Foundation.

7 Appendices

7.1 Appendix 1 – SAT data sheets

Spot: Spotted Gum Creb: E. crebra Fib: E. fibrosa RG: E. tereticornis

Koala SAT Survey Data Sheet

Mel: Melaleuca sp.

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 38	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0945		WP: 1077	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	E-creb	Creb	Creb	Fibrosa	Fib	Creb	Creb	Fib	Creb	Creb	Fib	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Spot	Creb	Creb	Creb	Fib	Spot	Creb	Creb	Creb	Creb	Creb	Spot	Fib	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 39	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1015		WP: 1078	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Spot	Creb	Creb	Creb	Creb	Creb	Creb	RG	Creb	Spot	RG	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Creb	Spot	Spot	Spot	RG	Creb	RG	Creb	RG	Creb	Spot	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 40	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1045		WP: 1079	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Spot	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Mel	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

GB: E. moluccana Fib: E. fibrosa Mel: Melaleuca sp. Stri – Stringbark sp.

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 29	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1115		WP: 1090	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	GB	GB	GB	GB	Fib	Fib	Fib	GB	GB	GB	Mel	Spot	Fib	Spot	Fib
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	GB	Fib	GB	RG	Spot	Fib	Creb	Fib	Creb	Fib	Fib	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 27	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1230		WP: 1081	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	RG	RG	RG	RG	RG	RG	RG	RG	Creb	GB	GB	Spot	RG
No. scats:	Ø	Ø	Ø	1	Ø	Ø	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	RG	GB	GB	Creb	RG	RG	RG	RG	RG	RG	RG	RG	RG
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

7

SAT ID: 28	Date: 9-12-14	Staff: CAC + 2 Henson	GPS:	East:
	Time: 1300		WP: 1082	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Creb	Spot	Spot	GB	Creb	GB	Spot	GB	Creb	Spot	GB	Spot	GB
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	1	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Spot	GB	Spot	Spot	GB	GB	Mel	GB	Creb	Spot	GB	GB	GB	Creb
No. scats:	1	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

6

Cas- Casuarina glauca Ang- Angophora floribunda

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 17	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1320		WP: 1083	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	RG	Spot	Fib	Spot	Cieb	Spot	Spot	Cieb	Spot	Spot	Spot	Fib	Spot	Spot
No. scats:	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cieb	Spot	Spot	Fib	Cieb	Spot	Fib	Spot	Spot	RG	Cieb	Spot	Spot	Spot	Cieb
No. scats:	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

2

SAT ID: 6	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1345		WP: 1084	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Ang	RG	RG	RG	Ang	RG	RG	Cas	Ang	RG	Ang	Ang	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Ang	Ang	Cas	Cas	Cas	Ang	Ang	Ang	RG	Ang	RG	RG	Ang	RG	RG
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

SAT ID: 5	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1405		WP: 1085	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

GG: Grey Gum

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 16	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1425		WP: —	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Mel	Mel	Mel	Creb	Spot	Mel	Mel	Mel	Spot	RG	RG	Mel	Mel	RG	Mel
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Mel	Mel	Mel	GB	Creb	Spot	Spot	Creb	Mel	Mel	Mel	Mel	Creb	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

3

SAT ID: 48	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1520		WP: 1086	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Spot	Creb	Creb	RG	RG	Creb	Creb	GG	GB	Spot	Creb	Mel	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	RG	Spot	Creb	Creb	GG	Creb	Creb	GB	Spot	RG	Stri	GB	GB	Spot
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø

No. Koalas recorded within 25m radial search (5 minutes):

4

SAT ID: 59	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1540		WP: 1087	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Stri	RG	Mel	RG	Creb	Stri	RG	Creb	GG	GG	Stri	RG	Creb	GG
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Stri	Creb	GG	GG	Creb	Creb	Aeg	Aeg	GG	GG	Stri	Stri
No. scats:	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

5

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 47	Date: 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: ~~0800~~		WP: 1088	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Stri	Stri	Stri	Spot	Stri	Spot	Stri	Spot	Creb	Spot	Spot	Acac.	Stri	Acac.
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Stri	Stri	Spot	Spot	GG	Spot	Creb	Spot	Spot	Stri	Stri	Stri	Spot	Spot
No. scats:	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 1

SAT ID: 58	Date: ~~0815~~ 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0815		WP: 1089	North:

Tree no.:	1	2	3	4	RG	6	7	8	9	10	11	12	RG	14	15
Sp:	Creb	Creb	Stri	Stri	~~RG~~	Creb	Spot	Creb	Creb	Creb	Stri	Creb	~~RG~~	Creb	Stri
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	1	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	0	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Creb	Stri	Stri	Creb	~~RG~~	Kurrajong	~~RG~~	Kurra	Kurra	Stri	Creb	Creb	Spot	Stri
No. scats:	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 3

SAT ID: 57	Date: 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0840		WP: 1090	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	GG	Stri	Spot	Spot	Stri	Stri	Stri	Kurra.	Stri	GG	Spot	Spot	Stri	GG
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Spot	Spot	Stri	Creb	Stri	GG	Stri	Stri	Stri	GG	Stri	Stri	Stri	Stri
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 0

Page: 5

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 68	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0855		WP: 1091	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cleb	Spot	Creb	RG	Stri	RG	Cleb	Spot	Spot	RG	Stri	Spot	Stri	Stri	Cleb
No. scats:	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Stri	Kurra	RG	Cleb	Kurra	Spot	Stri	Stri	Spot	Cleb	Stri	Cleb	Cleb	Spot
No. scats:	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

2

SAT ID: 79	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0920		WP: 1092	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	Creb	Stri	Kurra	RG	RG	Spot	RG	Stri	RG	Cleb	Creb	RG	RG
No. scats:	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Fib	RG	Cleb	Stri	RG	RG	Stri	Creb	Creb	Stri	RG	RG	Stri	Stri
No. scats:	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

3

SAT ID: 78	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0940		WP: 1093	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Kurra	RG	RG	Cleb	Stri	Stri	Stri	RG	Spot	Stri	RG	Stri
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cleb	Stri	Stri	Spot	Stri	Spot	RG	Stri	Creb	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 46	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1110		WP: 1094	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Stri	Spot	Spot	Stri	GG	GG	Spot	Spot	Spot	Stri	Spot	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	GG	Stri	Stri	GG	GG	Spot	GG	GG	Spot	GG	Spot	GG	Stri	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 45	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1130		WP: 1095	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Mel	Stri	Stri	RG	RG	Fib	Fibe	RG	Fib	Fib	Fib	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Fib	Fib	Fib	RG	Mel	Stri	RG	Fib	Fib	Fib	Mel	Fib	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 56	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1145		WP: 1096	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	RG	Stri	Creb	Stri	Stri	Spot
No. scats:	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Creb	Creb	Stri	Spot	Kurra	Stri	Creb	Stri	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	Ø	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 67	Date: 10-12-14	Staff: CAC +2 Hanson	GPS:	East:
	Time: 1200		WP: 1097	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	RG	Spot	Stri	RG	RG	Spot	Creb	RG	Mel	Stri	Kuri
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	RG	RG	Stri	Creb	Stri	Stri	RG	Stri	RG	Stri	RG	Stri	RG	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 62	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1345		WP: 1098	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Mel	Stri	Mel	Stri	Creb	Creb	Mel	Mel	Stri	Mel	Creb	Creb	Mel	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	Creb	Stri	Stri	Mel	RG	Stri	Mel	Creb	Stri	RG	RG	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 63	Date: 10-12-14	Staff: CAC +2 Hanson	GPS:	East:
	Time: 1405		WP: 1099	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	RG	GG	GG	GG	Creb	Stri	Creb	Spot	GG	Stri	GG	RG	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	GG	GG	Creb	GG	Spot	Spot	GG	Spot	GG	GG	Spot	Spot	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Coach - Coachwood

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID:	52		Date:	10-12-14		Staff:	CAC + 2 Hanson		GPS:		East:				
			Time:	1420					WP:	1100	North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Fib	Creb	Fib	Fib	Creb	Fib	Creb	Fib	Mel	Stri	RG	Creb	Fib	Creb
No. scats:	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	RG	Mel	GG	Creb	Creb	RG	Creb	Spot	Creb	Creb	RG	Creb	Creb
No. scats:	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
No. Koalas recorded within 25m radial search (5 minutes):															

4

SAT ID:			Date:			Staff:			GPS:		East:				
			Time:						WP:		North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:															
No. scats:															
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:															
No. scats:															
No. Koalas recorded within 25m radial search (5 minutes):															

SAT ID:	41		Date:	10-12-14		Staff:	CAC + 2 Hanson		GPS:		East:				
			Time:	1500					WP:	1101	North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Coach	Kulla	Spot	GG	Stri	Stri	Stri	Coach	Spot	Stri	Spot	Stri	Stri	Creb	Mel
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	Spot	GG	Stri	Mel	Mel	Mel	Mel	Spot	Creb	Creb	Mel	Mel	Spot	Creb
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. Koalas recorded within 25m radial search (5 minutes):															

0

Alph: Alphitonia excelsa (Red Ash)

Ang: Angophora floribunda

Koala SAT Survey Data Sheet

biosis

Project: Brandy Hill Quarry **Matter No.:** 19323

SAT ID: 30	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 0940		WP: 1102	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Creb	Stri	Creb	Creb	Creb	Stri	RG	Spot	Spot	Creb	Creb	Alph.	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Alph.	RG	Alph.	Creb	RG	Creb	GG	Creb	Creb	Stri	RG	Cas.	Spot	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

+ Black-faced Monarch + Leaden F-catcher seen

1

SAT ID: 19	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1005		WP: 1103	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	RG	Creb	Creb	RG	Creb	Stri	RG	Stri	Stri	Stri	Stri	RG	Creb	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	RG	RG	Fib	RG	Fib	RG	Creb	Creb	RG	RG	RG	RG	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

1

SAT ID: 7	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1035		WP: 1104	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Ang	Cas	Cas	Cas	Ang	Cas	Ang	Cas	Cas	Cas	Creb	Mel	Mel	RG	Ang
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Mel	Cas	Cas	Creb	Cas	Ang	Mel	Cas	Ang	Cas	Mel	Cas	Mel
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

7.2 Appendix 2 – Koala habitat appraisal

Koala habitat appraisal - Brandy Hill Quarry expansion		
Action: Quarry expansion in the Lower Hunter, NSW Context: Coastal (East Coast - low abundance)		
Associated infrastructure: Additional quarry areas		
Primary impacts: Vegetation clearing, vehicle strike		
Impact area size: 97 hectares		
Attribute	**Score**	**Habitat appraisal**
Koala occurrence	2	Koala records known from the locality for the study area
		Biosis conducted targeted Koala surveys in winter and spring 2014 using diurnal and nocturnal searches and call playback. A total of 2 Koalas was recorded within the Project area.
		Biosis conducted targeted SAT and Koala point surveys in summer 2014 to determine Koala population density estimate. No Koalas were recorded during this period.
Vegetation structure and composition	2	Comprehensive vegetation mapping undertaken by Biosis in winter and spring 2014 mapping all vegetation within the study area. All forest and woodland communities present support 2 or more Koala food tree species.
Habitat connectivity	2	Koala habitat present is a component of an area of suitable habitat > 1,000 hectares
Key existing threats	2	No evidence of recent or regular Koala fatalities from vehicle strikes or dog attacks
Recovery value	1	Uncertain whether the habitat present is important for achieving the interim recovery objectives for Koalas.
Total	9	Based on the area of habitat to be cleared and total habitat score a Commonwealth referral under the EPBC Act is recommended.

Attachment C

Legislative Controls Applicable to the Project

Environmental assessment of the relevant impacts of the project

The Proponent is in the process of compiling a comprehensive EIS to address all relevant criteria set out in the Director General's Requirements. This process has included involved assessments of;

- Land Resources
- Biodiversity
- Traffic and Transport
- Noise
- Blasting
- Air Quality
- Heritage
- Water Resources
- Waste Greenhouse Gas
- Visual
- Hazards
- Social and Economic
- Rehabilitation

Status of Assessment Approvals

All environmental assessment reports have been drafted or are in the process of being drafted for inclusion in the project's EIS. The Proponent aims to submit the pertinent EIS in early 2015.

Relevant Legislation

Brandy Hill EIS is accountable under federal, State and local legislative controls. These are identified below in Table 2;

Table 2: Legislative Controls

Government Tier	Legislation
Federal	*Environment Protection and Biodiversity Conservation Act 1999*
	Native Title Act 1993
State	*Environmental Planning and Assessment Act 1979*
	State environmental Planning policies: • State Environmental Planning Policy No.33 – Hazardous and Offensive Development • State Environmental Planning Policy No. 44 – Koala Habitat Protection • State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.
	Fisheries Management Act 1994
	Heritage Act 1977
	National Parks and Wildlife Act 1974
	Native Vegetation Act 2003
	Protection of the Environment and Operations Act 1997
	Roads Act 1993
	Noxious Weeds Act 1993
	Threatened Species Conservation Act 1995
	Water Management Act 2000
Local and Regional Planning Instruments	*Port Stephens Local Environment Plan 2013*
	Lower Hunter Regional Strategy
	Port Stephens Futures Strategy 2009
	Port Stephens Planning Strategy 2011
	Port Stephens Development Control Plan 2013
	Water Sharing Plan for the Hunter Unregulated & Alluvial Water Sources 2009

The legislation has been analysed in respect to its application to the Project and is summarised below.

Federal Legislation

Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires approval of the Commonwealth Minister for the Environment pertaining to any action that has, or is likely to have, a significant impact on matters of NES.

A search of potential matters of NES within the project area was performed using the Commonwealth Government's Protected Matters Search Tool on 14 October 2014. The search identifies the potential presence of matters of NES within the site area and within a pre-determined 10km buffer around the project area using EPBC Act Online Database search. This search identified the potential presence of a range of matters of NES, however following winter and spring survey efforts (Biosis 2015a) it was determines that likely 48.65 hectares of habitat exists and presence was identified for Vulnerable listed Koala *Phascolarctos cinereus*.

Native Title Act 1993

The commonwealth Native Title Act 1993 is applied in Australia to provide determinations of native title, which are investigated by the National Native Title Tribunal and determined by the Federal Court of Australia. The Act aims to;

- *"Provide for the recognition and protection of native title; and*
- *To establish ways in which future dealings affecting native title may process and to set standards for those dealings; and*
- *To establish a mechanism for determining claims to native title; and*
- *To provide for, or permit, the validation of past act, and intermediate period acts, invalidated because of the existence of native title." (Native Title Act 1993)".*

Section 1.6 of the Project referral identifies property ownership of the Project area. All lots, bar one, are free help land. Native Title does not apply under the Native Title Act 1993 for these free hold land lots.

Additionally, Hanson possesses an Enclosure Permit 512131 for the Crown land parcel shown in Attachment A; Figure 4. A search using the National Native Title Register managed under the National Native Title Tribunal revealed that there have been no claims on said land parcel. Therefore, at the time of submission, Native Title Act 1993 does not apply to any of the land lots on site.

State Legislation

Environmental Planning and Assessment Act 1979

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

Under Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011, the Project will require approval under Section 89C of the EP&A Act due to the annual and total project extraction quantities. The Minister for Planning has confirmed that Section 89C of the EP&A Act will be the governing Act under which the project will be assessed. Pursuant to Section 89C, the Minister or their delegate will be the determining authority for the proposal. Additionally the Project will be assessed under the Environment Planning and Assessment Regulation 2000 which is made under the EP&A Act.

In relation to the natural environment, Section 5A of the EP&A Act requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and FM Act. Section 5A (and Section 9A of the TSC Act) outlines seven factors that must be taken into account in an Assessment of Significance (formally known as the "7-part test"). Where any Assessment of Significance (AoS) determines that a development will result in a significant effect to a threatened species, population

or community a Species Impact Statement (SIS) is required. However, under Clause 89I of Division 4.1 dictates that the Minister can grant consent to a State Significant Development (SSD) subject to a clause to acquire and retire biodiversity credits generated in accordance with Part 7A of the TSC Act. The NSW Biodiversity Offsets Policy for Major Projects and underlying tool, the FBA, seek to standardise the assessment and offset procedures for Major Projects. Section 5A does not refer to Division 4.1 and therefore does not apply to Major Projects that are being assessed as SSD.

Under Section 117(2) of the EP&A Act, direction 1.3 aims to ensure (amongst other things) 'that the supply of regionally significant extractive materials is not compromised by inappropriate development'. Under this direction local councils are required to consult with the Minister for the Department of Primary Industries during the preparation of a draft Local Environmental Plan (LEP) to identify existing extractive industries in the area.

State Environmental Planning Policies

The following State Environmental Planning Policies (SEPPs) may be triggered by the proposed development and are considered below.

State Environmental Planning Policy No.33 – Hazardous and Offensive Development

SEPP 33 – Hazardous and Offensive Development (SEPP 33) assess the potential hazard associated with a proposed development by providing definitions for 'hazardous industry', 'hazardous storage establishment', 'offensive industry' and 'offensive storage establishment'. Under SEPP 33 a preliminary hazard analysis (PHA) may be required based on the outcome of a preliminary risk screening of the proposed development based on its potential hazard potential. This process involves the identification and assessment of the storage of specific dangerous goods classes that may produce off site effects. A full hazard assessment in association with SEPP 33 has been drafted for inclusion in the project's EIS.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

SEPP 44 - Koala Habitat Protection (SEPP 44) aims to conserve and manage areas of natural vegetation that provide habitat for koala to promote a permanent free-living population of koalas over their present range, and also reverse the current trend of koala population decline. This process requires the preparation of a management plan/s prior to development consent in areas of core koala habitat, the identification of core koala habitat and the protection of said habitat in environment protection zones.

SEPP 44 is triggered in areas where koala trees constitute at least 15% of the total number of trees in the upper or lower vegetative strata. The identification of a Koala and Koala feed trees and scats within the Project area triggered the requirement to assess whether the site possesses 'core koala habitat'. Detailed flora and fauna investigations were undertaken as part of the EIS as well as a targeted Koala Survey Report (Biosis 2015b) presented in Attachment B of this report.

State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.

Mining, Petroleum Production and Extractive Industries SEPP provides guidance on the consent requirements for various activities. This SEPP defines developments as prohibited, exempt or complying based on their proposed works. Under Clause 7(3)(a) of this SEPP, the proposed project is permissible with consent as it is zoned RU2, rural landscape.

Threatened Species Conservation Act 1995

The TSC Act provides for the protection and conservation of biodiversity in NSW through the listing of threatened biota; key threatening processes; and critical habitat for threatened biota. Under this Act, approval is required to:

- *Harm any animal that is of, or is part of, a threatened species, population or ecological community;*
- *Pick any plant that is of, or is part of a threatened species, population or ecological community;*
- *Damage critical habitat; or*
- *Damage habitat of a threatened species, population or ecological community.*

An ecological impact assessment is being drafted and will identify the presence of any threatened species potentially occurring within the proposed project boundary.

Fisheries Management Act 1994

This Act aims to conserve threatened species, populations and ecological communities of fish and marine vegetation, and to promote ecologically sustainable development and biological diversity. Impacts to threatened species, populations and communities listed under the FM Act must be assessed through the AoS process under Section 5A of the EP&A Act.
An assessment of the aquatic life in Dead Man's creek did not identify any threatened aquatic biota within the project, and therefore further consideration under this Act is not required.

Native Vegetation Act 2003
This Act aims to protect native vegetation possessing high conservation value, to improve the condition of existing native vegetation, and to encourage the revegetation of land with appropriate native vegetation.
Approval is required under this Act from appropriate Catchment Authority to clear native vegetation in particular circumstances. In relation to the current development, no approval is required under this legislation for projects assessed as a SSD under the EP&A Act.

Noxious Weeds Act 1993
This Act was enacted to provide for the identification, classification and control of noxious weeds. Plants declared as noxious weeds are currently listed under Weed Control Order No. 28 Declaring Certain Plants to be Noxious Weeds published in the New South Wales Government Gazette No. 97 (Department of Premier and Cabinet 2011). As declared noxious weeds were identified within the study area, the occupier (other than a public authority or a local control authority) must take all reasonable steps to eradicate state prohibited weeds and comply with the requirements in the NW Act for a notifiable weed for restricted plants. As an area within Port Stephens LGA, the occupier must also take all reasonable steps to eradicate regionally prohibited weeds; fully and continuously suppress and destroy regionally controlled weeds; and prevent the growth and spread of locally controlled weeds. Noxious weeds present within the Project area are outlined within the Biodiversity assessment being prepared.

National Parks and Wildlife Act 1974
This Act promotes the conservation of the State's natural environments, objects, places or features, whilst fostering public appreciation, understanding and enjoyment of nature. The Act also aims to conserve areas which hold cultural significance to Aboriginal people, places of historic, architectural or scientific significance. No areas included in the project are declared under this Act. In this case there is no requirement to seek approval for projects assessed as a State Significant Development under the EP&A Act.
Heritage Act 1977
This Act aims to develop an understanding of and encourage conservation of State heritage by enabling the identification and registration of items of State heritage significance. An Aboriginal and European Heritage site Assessment was undertaken on 9 October 2014 which revealed there were no areas of cultural significance or cultural artefacts.

Protection of the Environment and Operations Act 1997
This Act aims to protect, restore and enhance the quality of the environment in NSW through ecologically sustainable development. Under this Act Environmental Protection Licences are required to be administered from the Environmental Protection Authority for 'scheduled activities' and 'scheduled development work'. Any 'scheduled development work' during the life of the project will obtain all required licenses under Part 3.2 (47) of this Act. The project will be assessed as a scheduled activity under Schedule 1, Clause 19 of this Act as it involves the extraction of more than 30, 000tpa of extractive materials. The project will apply for a variation to the current EPA licence (number: 1879), as the proposed extraction limit (1.5Mtpa) will exceed the current approved limit of 700 000tpa.

Roads Act 1993
Under this Act approval is required from NSW Roads and Maritime Services (Roads and Maritime) or local Council. There is no anticipated impact on any State road infrastructure pertinent to the proposed project. A traffic impact assessment has been drafted in accordance with this Act.

Water Management Act 2000
This Act manages State water including the provision of licences and management plans. In particular Part 3, division 6 provides the regulatory framework for controlled activities and aquifer interference activities. The Project is managed under the Water Sharing Plan for the Hunter Unregulated & Alluvial Water Sources 2009. A comprehensive water assessment is being drafted in accordance with this Act. A comprehensive water assessment is being drafted in accordance with this Act.

Local and Regional Planning Instruments

Key Plans, Strategies and documents have been elaborated upon in the subsequent section. Additional Plans, Strategies and important documents have been identified, with specific regard to their relevance to the project and are outline below.

Port Stephens Local Environment Plan 2013

The project is assessed in accordance with the provisions of the Port Stephens Local Environment Plan (LEP) 2013. This Plan makes local environmental planning provisions for land in Port Stephens in relation to applicable standard environment planning instruments under section 33A of the EP&A Act. Specifically provides the guidance for the application of the community's Port Stephens Futures Strategy 2009 and Port Stephens Planning Strategy 2011. The proposed operations are located within Zone RU2 – Rural Landscape.

Specifically the aims of the Port Stephens LEP are as follows;

- *to implement the community's Port Stephens Futures Strategy 2009 and Port Stephens Planning Strategy 2011;*
- *to cultivate a sense of place that promotes community wellbeing and quality of life;*
- *to provide for a diverse and compatible mix of land uses supported by sound planning policy to deliver high quality development and urban design outcomes;*
- *to protect and enhance the natural environmental assets of Port Stephens;*
- *to continue to facilitate economic growth that contributes to long-term and self-sufficient employment locally;*
- *to provide opportunity for housing choice and support services tailored to the needs of the community;*
- *to conserve and respect the heritage and cultural values of the natural and built environments;*
- *to promote an integrated approach for the provision of infrastructure and transport services;*
- *to continue to implement the legislative framework that supports openness, transparency and accountability of assessment and decision making; and*
- *to achieve intergenerational equity by managing the integration of environmental, social and economic goals in a sustainable and accountable manner.*

Extractive industries are permitted to operate with consent in RU2 zoned land – Rural Landscape. Additionally, in accordance with part 7 of SEPP (Mining, Petroleum Production and Extractive Industries) 2007, extractive industries are able to develop on agricultural or industrial zoned land.

The proposed project is consistent with the objectives of the Port Stephens LEP, specifically;

- The Project will provide construction materials to facilitate regional development consistent with Port Stephens Futures Strategy 2009 and Port Stephens Planning Strategy 2011,
- The Project will facilitate economic growth through the provision of direct and flow on employment opportunities,
- The Project has assessed any cultural or heritage values on site with not identified sites/items that hold significant value,
- Clearing of vegetation will only occur in the expansion area, with mitigation measures in place to minimise ecological impact. Offset measures are will be implemented in accordance with findings from the Biodiversity Assessment Report (Biosis 2015a),
- The expansion will minimise visual impact through the construction of an earth bund, consistent with the existing regional character (rural landscape),
- The Project will not place additional demand on existing amenities/services or create demand for the extension of these amenities/services.

Attachment A; Figure 5 found in the Project referral illustrates the land use zoning applicable to the project site and the immediate surrounding locality under the Port Stephens LEP 2013. The property is divided into two categories of land use zoning, these being Rural Landscape (RU2) and Environmental Management (E3). The Project impact area is entirely situated within "Rural Landscape (RU2)" zoned land.

Lower Hunter Regional Strategy

The Lower Hunter Regional Strategy is a pre-eminent document detailing the State government's development intentions for the Lower Hunter Region, NSW. The primary purpose of this plan is to ensure sustainable development through the provision of adequate land to ensure projected regional population growth is accommodated for by the provision of housing and services. The Strategy draws upon the following;

State Infrastructure Strategy 2006/2007 to 2015/2016
Regional Conservation Plan
The Plan also provides guidance for Local Environmental Plan development in accordance with the broader regional setting. The project will provide road and construction materials integral to the provision of services and infrastructure required to meet the demands of increasing population outlined in the Lower Hunter Regional Strategy.

Port Stephens Futures Strategy 2009
Port Stephens Futures Strategy provides a statement of the strategic directions of the region in accordance with the Port Stephens Local Environmental Plan. Specifically the plan addresses;

- Regional context
- Future trends and issues
- Community Engagement
- Over-arching Strategic Directions
- Social Futures
- Cultural Futures
- Economic Futures
- Environmental Futures
- Primary Industries
- Achieving Sustainable Development and Infrastructure
- Governance

The plan provides regional guidance, facilitating compliance with overarching parental framework including local, State and federal legislation.

Port Stephens Planning Strategy 2011
The Port Stephens Planning Strategy 2011 provides a comprehensive planning strategy for the Port Stephens LGA building upon the 2007 Community Settlement and Infrastructure Strategy. This plan addresses the regional objectives outlined in the State Governments Lower Hunter Regional Conservation Plan and Lower Hunter Regional Strategy at a local scale.
The Plan also provides a review of the Port Stephens Development Control Plan, rational for the land use planning policies and also incorporates;

- Port Stephens Commercial and Industrial Land Study; and
- Rural Lands Study.

On the whole, the project supports the outcomes contained within this plan through the provision of construction materials required to facilitate planned local and regional development as well as the provision of direct and subsequent employment opportunities required to extract, transport and process the construction materials for infrastructure development.

Port Stephens Development Control Plan 2013
The Port Stephens Development control plan provides guidelines for local development which enhances natural and cultural heritage values consistent with the local amenity. This Plan applies to all land zones under the Port Stephens Local Environmental Plan 2013. It is applies in conjunction with the Environmental Planning and Assessment (EPA) Act, 1979 and other State Planning Policies which may apply to the land to which the DCP applies. Issues that are relevant to the project include;

- Environmental and Construction Management;
- Parking, Traffic and Transport; and
- Industrial Development.

Lower Hunter Regional Conservation Plan, 2009
This Plan develops the framework to guide conservation efforts in the Lower Hunter in relation to conservation planning efforts in areas of anticipated growth. The project has reduced the impact area to decrease the amount of required clearing sites and to promote the maintenance of biodiversity on site. This Plan provides guidelines for environmental impact assessment of biodiversity in areas identified for development.

Port Stephens Economic Development Strategy, 2007

This Strategy documents the development strategy for the Port Stephens LGA. The plan is sustainability focused, accounting for economic, social and environmental factors in the development of services and provisions required to support population growth. The Project will provide integral road and construction resources to enable this Strategy to meet it's objectives and the objectives of interrelated plans.

Australia to 2050: Future Challenges - the 2010 Intergenerational Report, 2010

This report documents Australia's demographic composition and also the factors influences demographic changes on a national scale and the challenges associated with providing services to meet these challenges. The Project will facilitate the provision of road and construction materials required to develop infrastructure to meet some of the planning challenges outlined in this report.

Water Sharing Plan for the Hunter Unregulated & Alluvial Water Sources 2009

Under section 50 of the Water Management Act 2000 the Water Sharing Plan for the Hunter Unregulated & Alluvial Water Sources 2009 provides a vision of sustainability and integrated management of water sources which cover an area of more than two (2) million hectares. The Water Sharing Plan for the Hunter Unregulated & Alluvial Water Sources 2009 provides guidance on the planning, implementation, and monitoring and evaluation of water sharing for the Hunter Region NSW.

Aquifer Interference Policy

This Policy assists in the administration of the Water Management Act 2000 in relation to licencing and assessment of aquifer interference activities. Under the Aquifer Interference Policy (AIP) an aquifer is defined as;
"a groundwater system that is sufficiently permeable to allow water to move within in and which can yield productive volumes of groundwater".
This Policy applies to all activities which penetrate, interfere, obstruct, take or dispose with/of water in an aquifer. Under this Policy aquifer has the same meaning as groundwater system and hence Brandy Hill Expansion Project must consider the potential Project interference with its related ground water system under the AIP. This will be considered in the Project EIS.

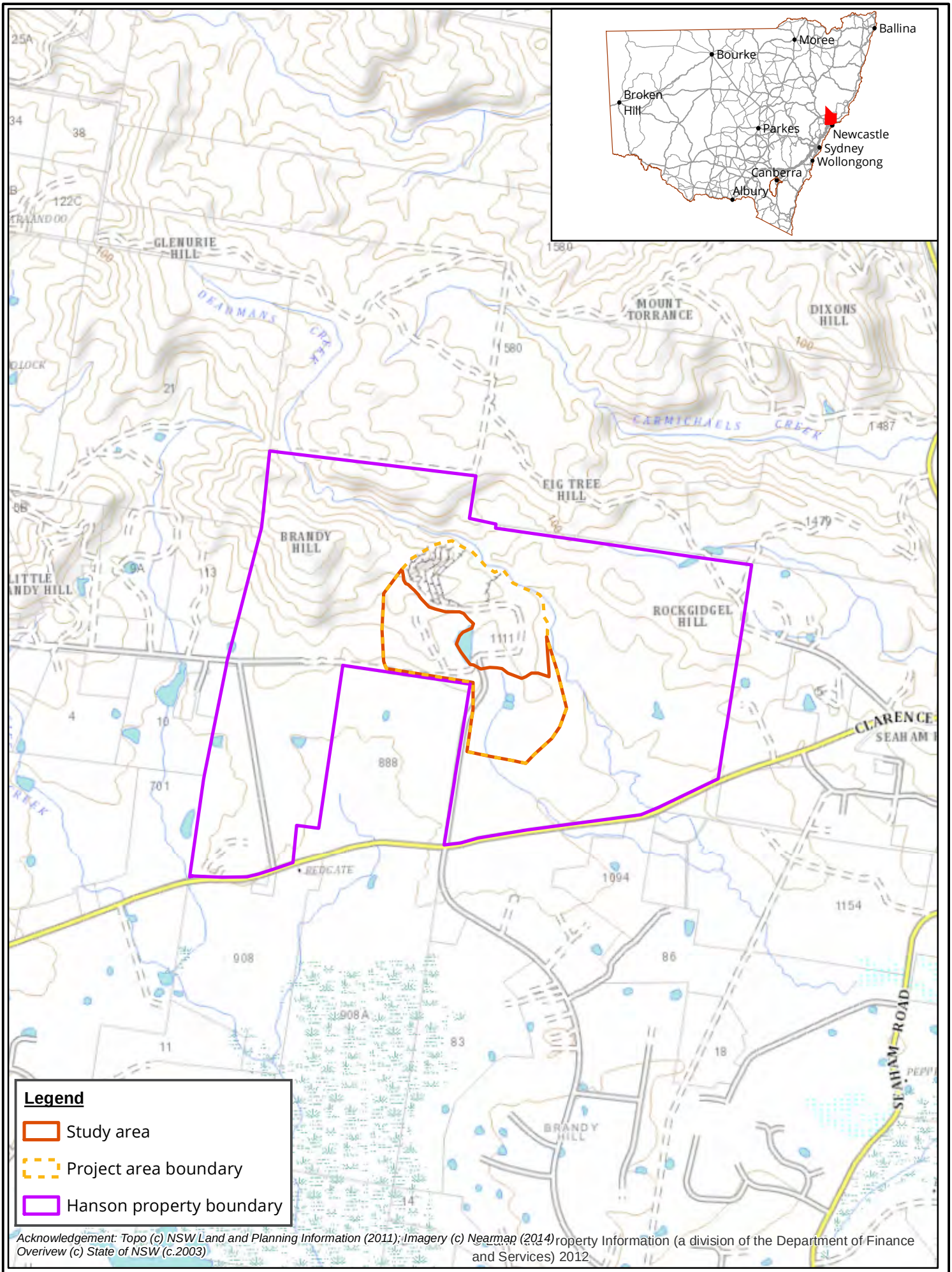

Figure 1: Location of the study area, NSW

Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 18371
Date: 15 January 2015,
Checked by: JMM, Drawn by: JMS, Last edited by: jshepherd
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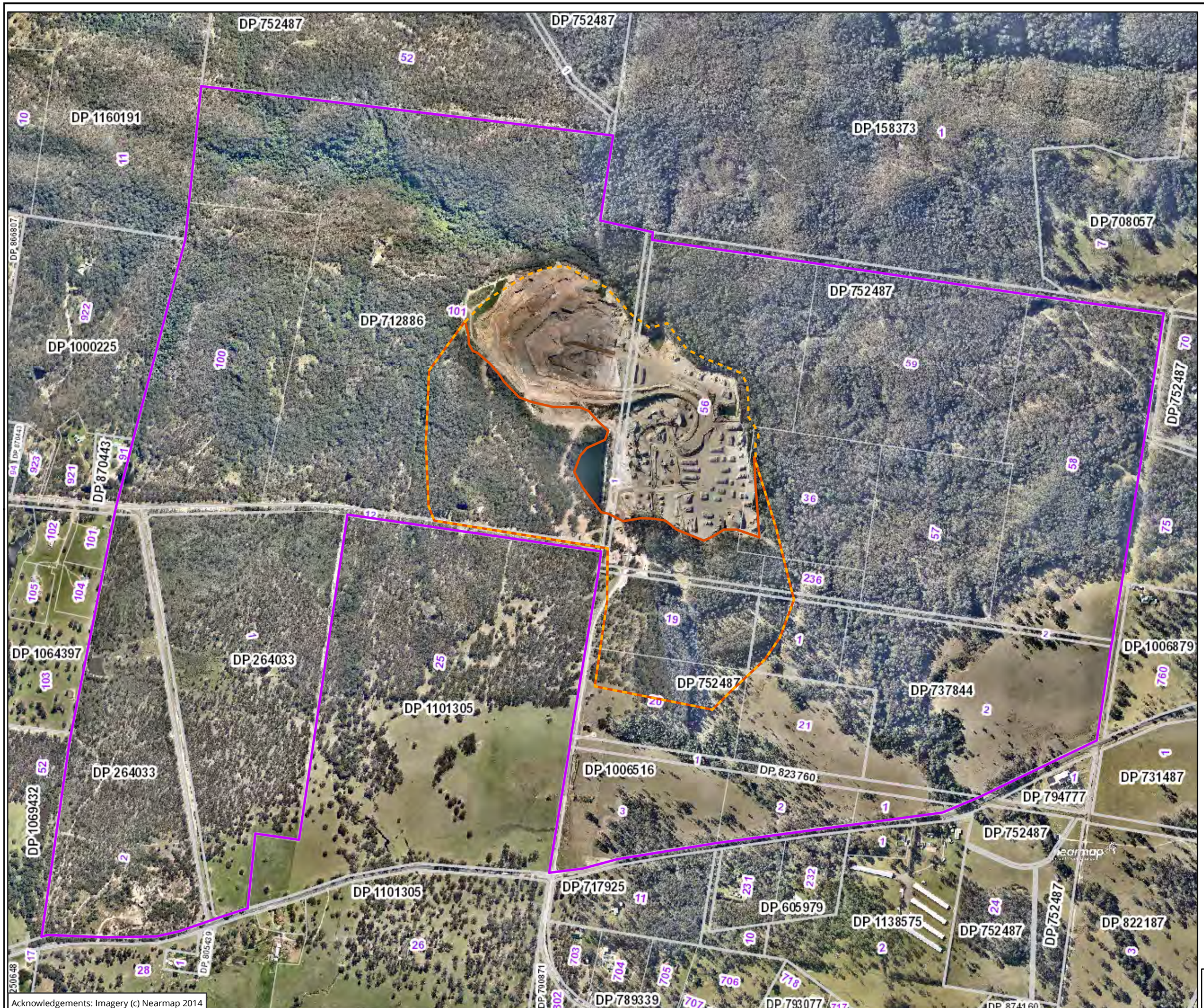
Metres
N
Scale 1:30,000 @ A4, GDA 1994 MGA Zone 56



Legend

- Hanson property boundary
- Project area
- Study area
- Cadastre

Figure 2: Site Map

0 110 220 330 440 550

Metres

Scale: 1:11,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 18371
Date: 16 January 2015,
Checked by: EC, Drawn by: JMS, Last edited by: jshepherd
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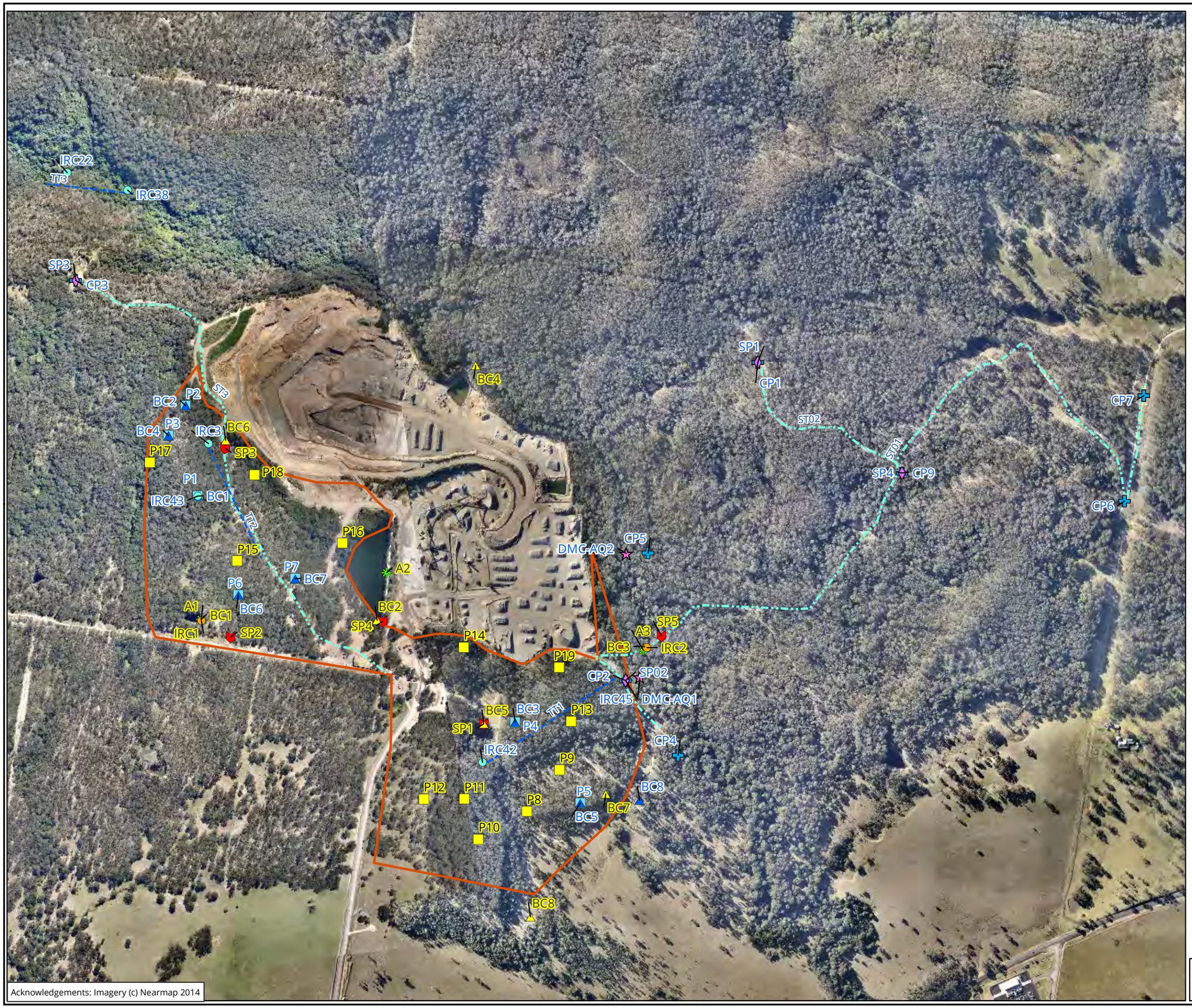

Acknowledgements: Imagery (c) Nearmap 2014

Legend

- Study area

Winter Survey effort

- Flora plot and transect
- Aquatic Sampling locations
- Bird Census
- Call Playback
- IR Camera
- Spotlight Point
- Spotlight Transect
- Trapline Transect

Spring Survey effort

- Flora plot and transect
- Anabat
- Bird Census
- IR Camera
- Spotlight Point

Figure 3: Survey Effort

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 18371
Date: 16 January 2015,
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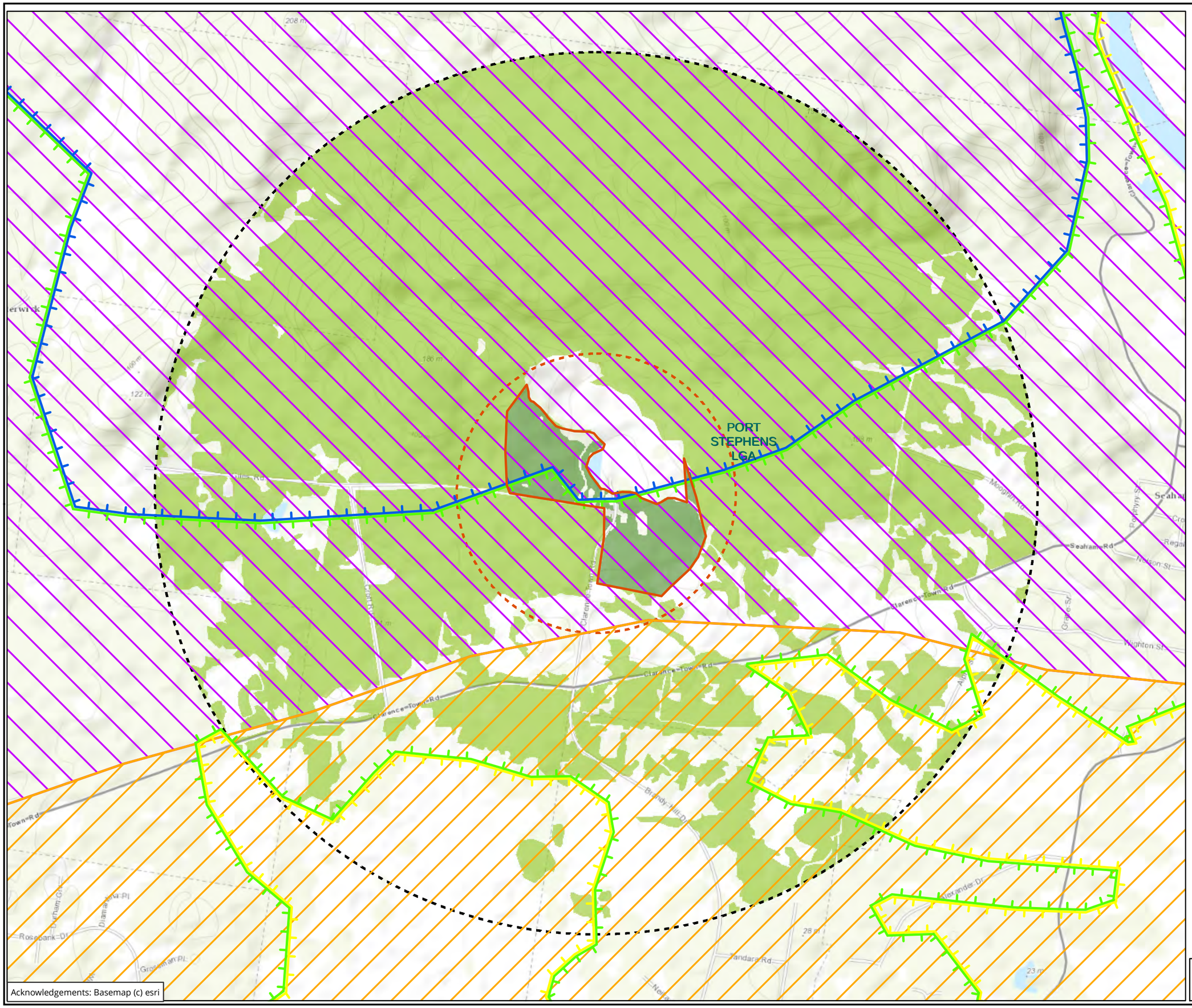

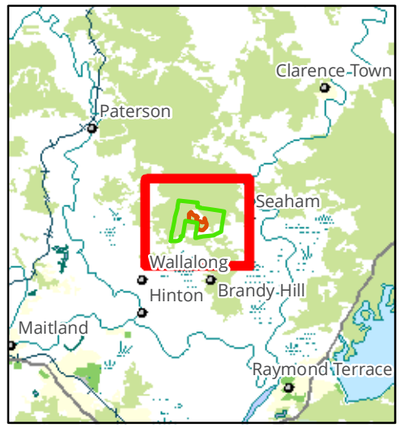

Legend

- Study area

Assessment circles

- Inner
- Outer

Native vegetation

- Native vegetation - LHCCREMS
- Native vegetation - Biosis (2014)

Mitchell Landscaes (V3)

- Lower Hunter Channels and Floodplains
- Newcastle Coastal Ramp
- Scone - Gloucester Foothills

IBRA Bioregion, Sub-region

- Hunter, Sydney Basin
- Upper Hunter, NSW North Coast

Figure 4: Location map and landscape features

0 200 400 600 800 1,000

Metres

Scale: 1:20,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 18371
Date: 16 January 2015,
Checked by: EC, Drawn by: JMS, Last edited by: jshepherd
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18371_F4_LocationMap

Acknowledgements: Imagery (c) Nearmap 2014

Legend

- Study area
- Project area
- Flora plot and transect

Vegetation PCT codes

- PCT 1584: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and Lower Hunter Valley
- PCT 1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
- PCT 1598: Forest Red Gum grassy open forest on floodplains of the Lower Hunter
- PCT 1600: Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the Lower Hunter
- PCT 1602: Spotted Gum - Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
- PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion.
- Cleared
- Water

Figure 5: Vegetation communities

0 50 100 150 200 250

Metres
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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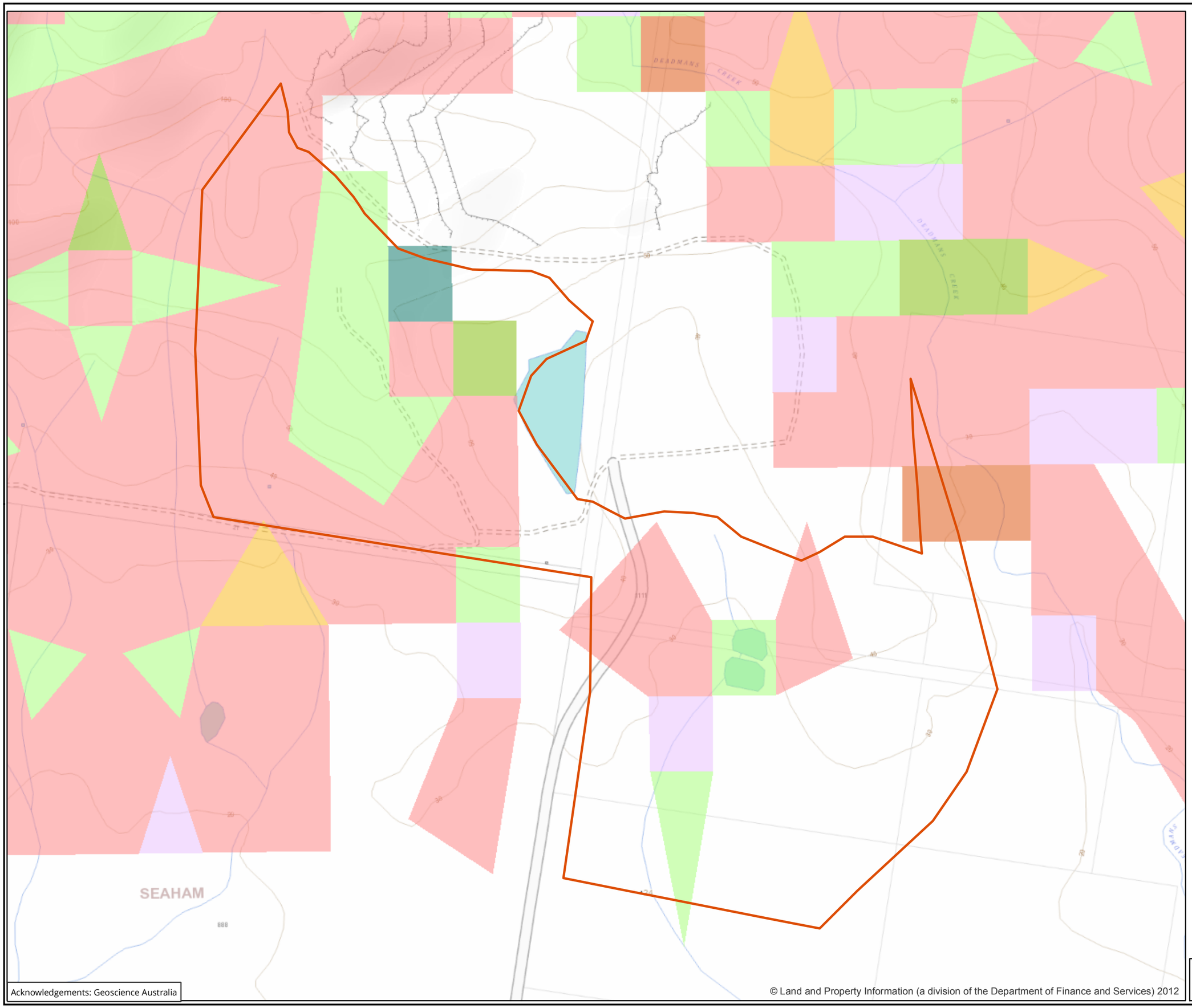

Legend

Study area

Groundwater Dependent Ecosystems

- Escarpment Redgum
- Ironbark
- Moist Foothills Spotted Gum
- Rough-barked Apples
- Smoothbarked Apple-Sydney Peppermint-Stringybark
- South Coast Shrubby Grey Gum
- Stringybark-Apple

Figure 6: Groundwater Dependent Ecosystems

0 50 100 150 200 250

Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

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Matter: 18371
Date: 16 January 2015,
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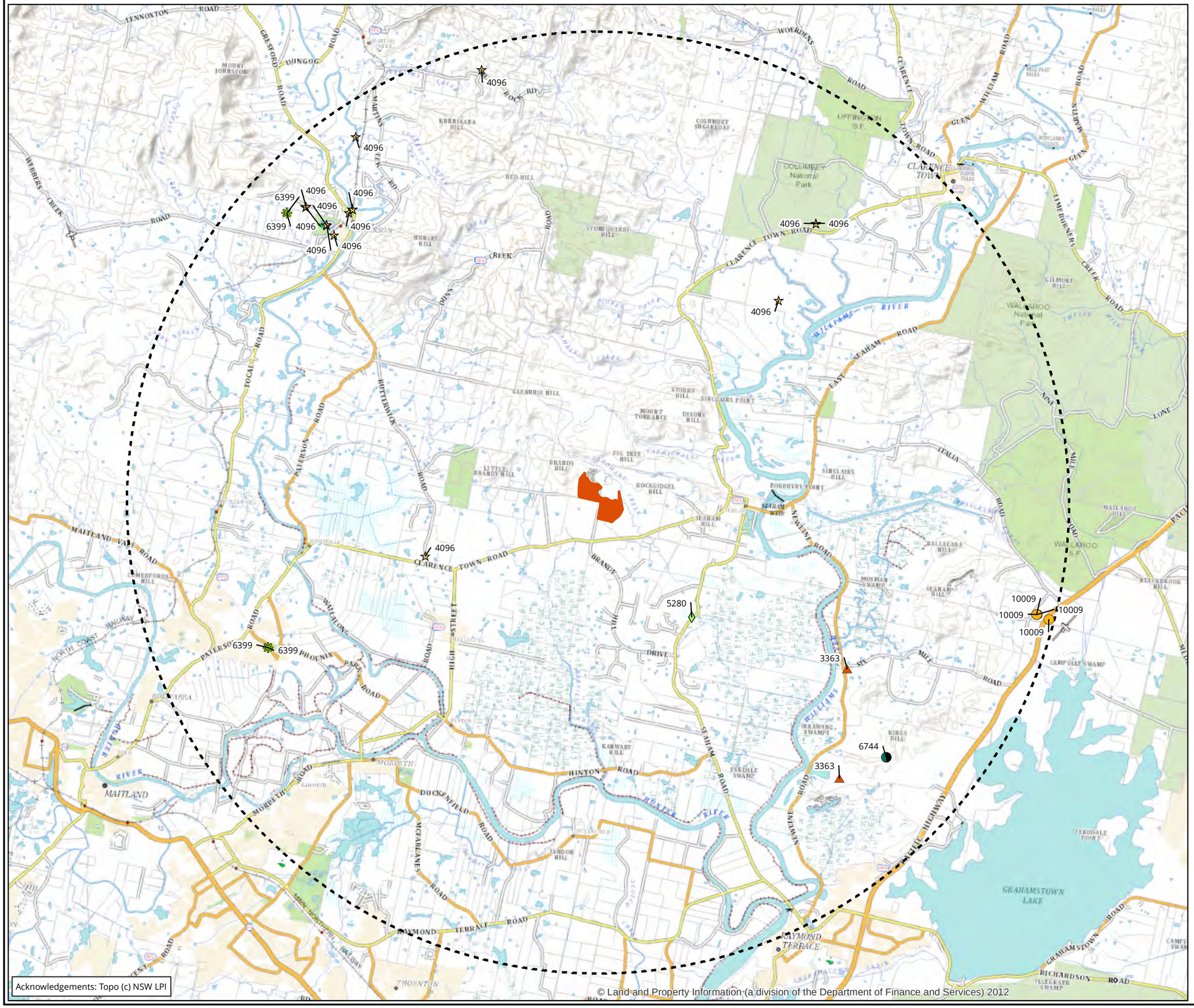
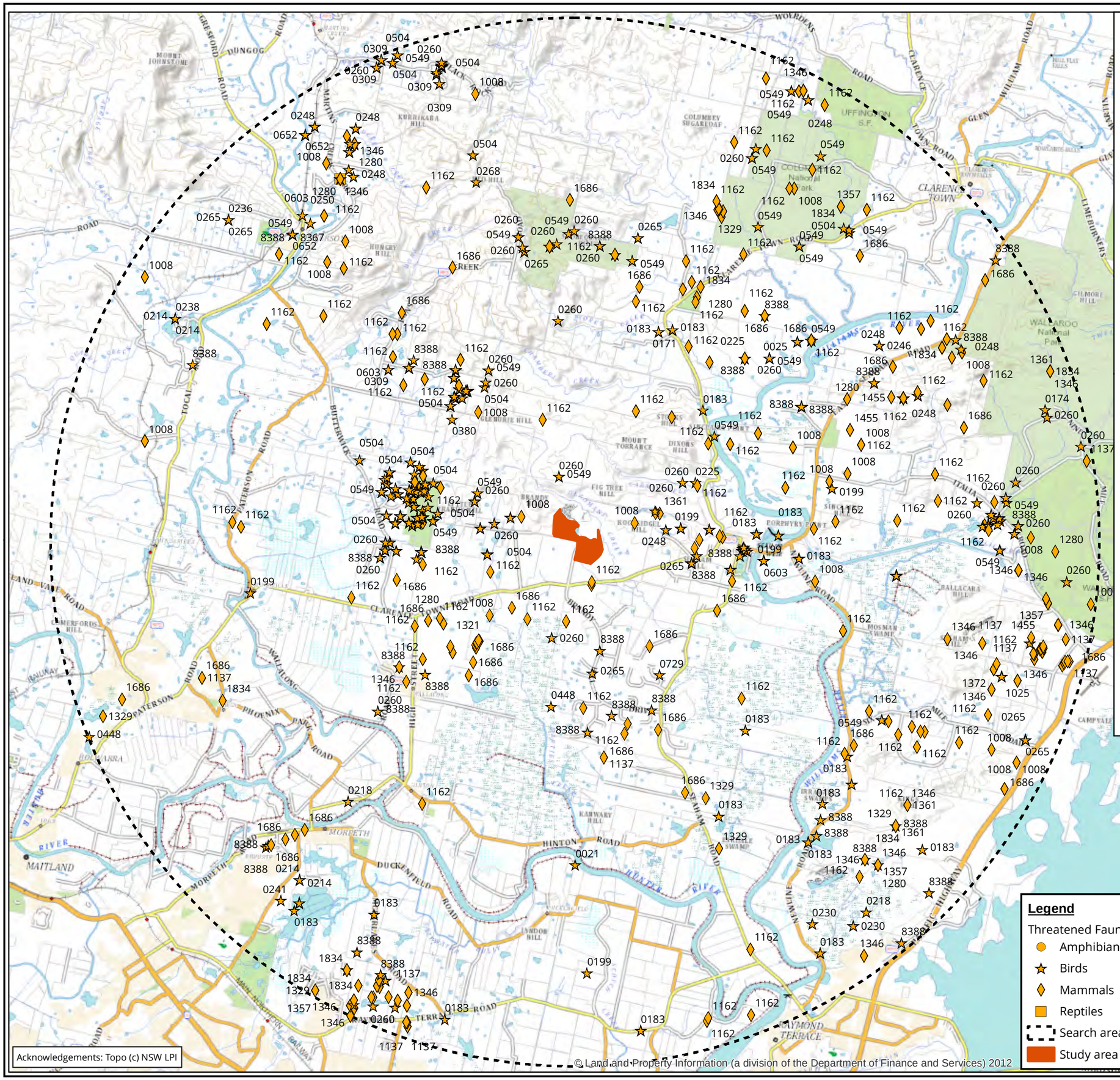
Acknowledgements: Geoscience Australia





Amphibians

3166 - Green and Golden Bell Frog

Birds

0013 - Red-backed Button-quail
0021 - Rose-crowned Fruit-Dove
0025 - Wompoo Fruit-Dove
0152 - Black-tailed Godwit
0161 - Curlew Sandpiper
0171 - Comb-crested Jacana
0174 - Bush Stone-curlew
0183 - Black-necked Stork
0196 - Black Bittern
0197 - Australasian Bittern
0199 - Magpie Goose
0214 - Freckled Duck
0216 - Blue-billed Duck
0218 - Spotted Harrier
0225 - Little Eagle
0230 - Square-tailed Kite
0236 - Grey Falcon
0238 - Black Falcon
0241 - Osprey
0246 - Barking Owl
0248 - Powerful Owl
0250 - Masked Owl
0260 - Little Lorikeet
0265 - Glossy Black-Cockatoo
0268 - Gang-gang Cockatoo
0302 - Turquoise Parrot
0309 - Swift Parrot
0380 - Scarlet Robin
0382 - Flame Robin
0405 - Olive Whistler
0448 - White-fronted Chat
0504 - Speckled Warbler
0549 - Varied Sittella
0603 - Regent Honeyeater
0652 - Diamond Firetail
0729 - Eastern Grass Owl
8127 - Brown Treecreeper (eastern subspecies)
8303 - Black-chinned Honeyeater (eastern subspecies)
8367 - Hooded Robin (south-eastern form)
8388 - Grey-crowned Babbler (eastern subspecies)

Mammals

1008 - Spotted-tailed Quoll
1025 - Eastern Cave Bat
1136 - Yellow-bellied Glider
1137 - Squirrel Glider
1150 - Eastern Pygmy-possum
1162 - Koala
1280 - Grey-headed Flying-fox
1321 - Yellow-bellied Sheathtail-bat
1329 - Eastern Freetail-bat
1346 - Little Bentwing-bat
1353 - Large-eared Pied Bat
1357 - Southern Myotis
1361 - Greater Broad-nosed Bat
1369 - Golden-tipped Bat
1372 - Eastern False Pipistrelle
1455 - New Holland Mouse
1686 - Brush-tailed Phascogale
1834 - Eastern Bentwing-bat

Reptiles

2675 - Pale-headed Snake

Figure 8: Threatened Fauna within 10km of the study area

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Date: 20 January 2015,
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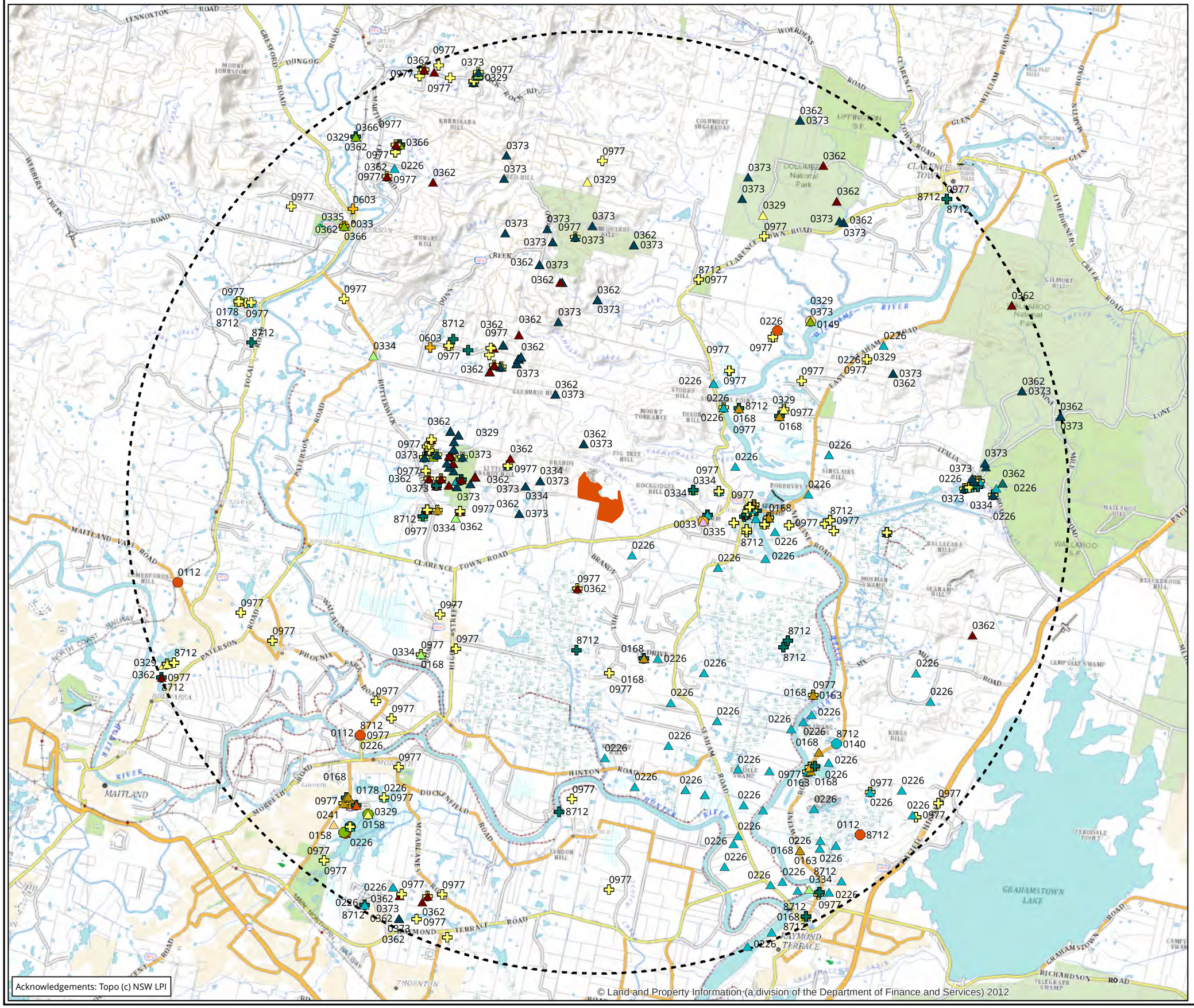

Figure 9: Migratory Fauna within 10km of the study area

0 900 1,800 2,700 3,600 4,500

Metres
Scale: 1:90,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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18371_F9_MigFauna

Brandy Hill Quarry Expansion

Targeted Threatened Species Survey –

Koala *Phascolarctos cinereus*

Prepared for Hanson Construction Materials Pty Ltd

17 March 2015

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Prepared by:	Carl Corden
Biosis project no.:	19323

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Draft version 02	Carl Corden	20.01.2015
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- Carl Corden for field surveys and reporting
- James Shepherd for mapping
- Jane Murray and Brian Wilson for quality assurance

Contents

1 Introduction

1.1 Background

Hanson Construction Materials Pty Ltd (Hanson) is seeking approval to expand the existing Brandy Hill Quarry located at 979 Clarence Town Rd, Seaham (the Project). The Project will be assessed against Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as a State Significant Development (SSD). To support the design and approval of the Project, Hanson is preparing an Environmental Impact Statement (EIS).

While undertaking the flora and fauna assessments to support the EIS, Biosis identified the presence of the Koala *Phascolarctos cinereus* within the Project area. The Koala is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). The presence of Koalas within the Project area was deemed likely to trigger the requirement to submit a referral for impacts on Commonwealth Matters of National Environmental Significance (NES). A Significant Impact Criteria assessment was therefore undertaken for the Koala, and the results of the assessment confirmed that the Project was likely to result in a significant impact on Koalas.

Targeted Koala and Koala habitat utilisation surveys were recommended to provide additional information for inclusion with the Commonwealth EPBC Act referral for the Project. The need for additional targeted surveys is stipulated by the *EPBC Act referral guidelines for the vulnerable Koala* (Commonwealth of Australia 2014). Biosis Pty Ltd was commissioned by Hanson to undertake targeted Koala surveys to provide additional information to support the Commonwealth EPBC Act referral for the Project.

The following definitions apply to the Project and are used throughout this document:

The **Project area** includes the area that forms the SSD application as per Attachment 1 (Figure 1 and Figure 2) of the EPBC Referral.

The **study area** encompasses the area within the Project area comprising vegetation to be removed, as well as adjacent areas supporting potential Koala habitat (Figure 1 below).

The **Koala** refers to the combined populations of the Koala in Queensland, New South Wales and the Australian Capital Territory, which were determined to be a single population for the purposes of the Vulnerable listing for this species under the Commonwealth EPBC Act.

1.2 Scope of works

The scope of works for this study involved targeted surveys for the Koala using the Spot Assessment Technique (SAT) in conjunction with point searches for Koalas, in line with relevant species survey guidelines (DoE 2013). Surveys were undertaken in December to meet the optimal survey period for this species, and were conducted by an ecologist experienced in Koala survey methods. Following the field survey, the following tasks were completed:

- Identified and mapped koala habitat, activity and recorded the number and location of any Koalas observed.
- Prepared and analysed data in accordance with the SAT to determine habitat utilisation by Koalas within the study area.
- Prepared an EPBC Act referral for the Minister of the Environment.

This report was prepared to provide an addendum to the Biodiversity Assessment Report (Biosis 2015) prepared to support the EIS.

1.3 Objectives of the report

The occurrence of Koalas at the proposed quarry expansion at Brandy Hill was confirmed from sightings of Koalas in addition to detection of scats during both the winter and spring fauna assessments of the Project area. To provide DoE with adequate information to support the determination of whether Project, a state significant development (SSD) under the *Environmental Planning and Assessment Act 1979* (EP&A Act), may potentially become a 'controlled action', Biosis completed targeted Koala surveys using the SAT developed by the Australian Koala Foundation (Phillips and Callaghan 2011) in conjunction with point searches for Koalas.

The objectives of the survey were to establish population density and habitat utilisation within the Project area and the adjacent study area (vegetation to be cleared as part of the proposed SSD and surrounding suitable habitat).

The tasks of the project are identified as follows:

- Undertake a targeted Koala surveys and Koala activity surveys within the Project area and suitable adjoining habitat (study area).
- Determine the potential for the Project area to provide habitat for the Koala.

Given the scope of works outlined above, and relevant species survey guidelines and requirements for the Koala, this report documents the following:

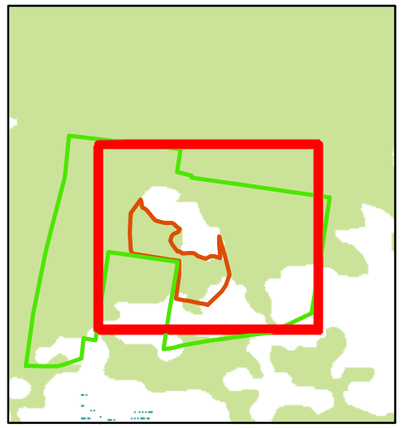
- Background information.
- Survey methodology.
- Survey limitations.
- Results of the field survey.
- Survey conclusion.

Following the survey an EPBC Act referral to the Minister has been prepared, of which this report forms Attachment B, including the details of the proposed SDD works and findings of the targeted Koala surveys and relevant components of the flora and fauna assessment.

1.4 Literature and database review

The following policies, documents and databases were reviewed to provide background information for this report:

- *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capitol Territory)* (Commonwealth of Australia 2014).
- NSW BioNet - the database for the Atlas of NSW Wildlife (OEH 2015).
- State Environmental Planning Policy (SEPP) No. 44 – Koala Habitat Protection.
- *Port Stephens Comprehensive Koala Plan of Management* (CKPoM) (Port Stephens Council 2002).



Legend

- Koala Survey Grid 200m
- Koala Survey Grid Extent
- Vegetation clearing area

Figure 1: Study area and SAT survey points

0 75 150 225 300 375

Metres
Scale: 1:7,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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19323_F3_KoalaSatSurvey

2 Background

2.1 Habitat and ecology

Koalas are generally solitary animals inhabiting eucalypt woodlands and forests. They have been known to feed on the foliage of more that 100 eucalypt and non-eucalypt species, though they prefer only a few browse species in any one location. Koalas are inactive for most of the day, spending most of their time in trees and feeding and moving between trees at night. They display complex social hierarchies and territories, with their home range varying between less than two hectares to several hundred hectares, depending on habitat quality (DoE SPRAT 2014).

SEPP 44 defines potential Koala habitat as *"areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component"*. Core Koala habitat is defined as *"land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population"*.

SEPP 44 does not apply to Major Projects that are being assessed as SSD. However, SEPP 44 Koala habitat definitions have been used to determine potential and core Koala habitat areas for the study area. The Port Stephens CKPoM mapping was also used to identify Koala habitat within the study area.

2.2 Species distribution

The Koala has a sparse and fragmented distribution throughout the central and north coasts of NSW, and throughout eastern Australia from Queensland to the Eyre Peninsula in South Australia, with some populations occurring west of the Great Dividing Range (DoE SPRAT 2014).

NSW OEH Bionet data indicates a total of 6,749 Koala records from within the Port Stephens LGA, as at 20 January 2015 (OEH 2015). Figure 2 shows the locality of historical records of the species in the immediate locality of the study area (NSW OEH Bionet 2015).

Legend

- Koala records (OEH Bionet)
- Search area
- Study area

Figure 2: Koala records within 10km of the study area

0 860 1,720 2,580 3,440 4,300

Metres

Scale: 1:86,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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19323_F2_KoalaRecords

3 Methodology

All Biosis field surveys were conducted by a qualified and competent zoologist under the authority of a current NSW *National Parks and Wildlife Act, 1974* Scientific Licence (SL100758) to harm/trap/pick/hold/study protected fauna and native flora, and a current Animal Research Authority (ARA) (TRIM 14/271#4) issued under the NSW *Animal Research Act, 1985* Certificate of Approval by the Animal Ethics Committee (AEC) of the Director-General of NSW Agriculture to conduct fauna survey work carried out as part of Environmental Impact Statements, Species Impact Statements and general wildlife research.

3.1 Previous Surveys

Comprehensive flora and fauna surveys were conducted within the study area in winter and spring. These surveys included vegetation mapping (identifying the occurrence of Koala feed trees) and targeted threatened fauna searches, including diurnal and nocturnal searches for Koalas. Methods used to search for Koalas included:

- Diurnal searches of trees for Koalas within bird census and BioBanking plots.
- Diurnal incidental searches beneath Koala feed trees within bird census and vegetation survey plots for signs of Koalas (scats and scratches).
- Diurnal incidental searches of trees for Koalas and signs of Koala activity while traversing the Project area and the study area.
- Nocturnal spotlighting and call playback for Koalas throughout the Project area and study area.

3.2 Current SAT and point surveys

Targeted Koala and Koala activity surveys were conducted 9 to 11 December 2014. Surveys were conducted by 3 or 4 staff for a maximum of 8 hours on each day. The timing of the surveys was considered appropriate for detecting both Koalas and signs of Koala activity as stipulated in the Draft Koala Referral Guidelines (DoE 2013). The targeted survey was guided by key documents:

- *Draft EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DoE 2013).
- The *Spot Assessment Technique: a tool for determining localised levels of habitat use by Koalas Phascolarctos cinereus* (Phillips and Callaghan 2011).
- DRAFT NSW *Threatened Biodiversity Survey and Assessment Guidelines* (DEC 2004).
- Department of the Environment's (DoE) Species Profile and Threats Database (SPRAT).

Koala SAT and point survey locations were selected using a systematic grid-based approach. A 200m interval grid was placed over a map of the Project and study areas and the intercept points of the grid were used as potential survey sites. Figure 1 shows the location of potential Koala SAT survey points.

From the potential points, final survey sites were selected based on:

- The proximity of each potential survey site to Koala habitat (i.e. sites in cleared land or the operating quarry area were not selected).

- The location of the points within or immediately adjacent to the Project area.
- The total number of sites that could be adequately sampled during field surveys.

At each site surveyed a combination of two survey methods were employed. These were the SAT methodology and Koala point searches. Methods for each are described below.

3.2.2 SAT surveys

The SAT methodology employed was as described by Phillips and Callaghan (2011). At each point surveyed, a central tree was chosen (usually a preferred Koala feed tree if present). The base of this and the nearest 29 trees (> or = 100mm diameter at breast height) were searched for Koala scats by one observer for up to 2 minutes per tree. Searches were conducted within 1 metre from the base of the tree, and were conducted on the surface as well as beneath leaf litter (using a small hand-held rake). If Koala scats were detected the tree was scored as a "1". If no scats were detected within 2 minutes the tree was scored as a "0". The total score was then added for 30 trees to determine the activity value of the site.

In accordance with the methodology described by Phillips and Callaghan (2011) the Project area was mapped as "East Coast – low abundance". This was primarily based on Koala density estimates obtained during previous and current surveys, indicating that the Project area is likely to support less than 0.1 Koalas per hectare. The activity scores for East Coast – low abundance are as follows:

- 0 – 2 scats recorded – "Low" activity.
- 3 scats recorded – "Medium" activity.
- 4 – 30 scats recorded – "High" activity.

For the purposes of the assessment, "Low" activity areas (including areas where no scats were recorded) are considered to be used only infrequently by Koalas. Areas of "Medium" and "High" activity are considered to represent preferred Koala habitat within the Project area and the study area.

3.2.3 Koala point surveys and population density estimate

At each of the survey points selected, a total of 5 minutes was spent searching all vegetation (from ground to canopy) within a 25 metre radius of the central tree for any Koalas present. Any Koalas recorded within the 25 metre radial search were used in calculations of population density for the Project area. Any Koalas recorded outside of the 25 metre radial search area were counted as incidental records only, and were not used in population density estimates.

Each 25 metre radial search equated to a total of 0.125 hectares. The total search area for Koala population density estimates was therefore 0.125 hectares multiplied by the total number of sites surveyed. Thus the Koala population density for the study area was calculated using the total number of Koalas recorded within the 25 metre radial searches divided by the total area searched, and an estimate of the number of Koalas per hectare derived.

3.3 Survey limitations

General fauna surveys and targeted Koala surveys were conducted over three seasons in varying weather conditions. It is considered that this range of conditions was appropriate for detecting Koalas or signs of Koala activity throughout the study area.

The systematic grid based assessment provides a randomised approach to surveys. This method has the potential to over or under-estimate Koala activity if sites selected are co-incidentally over or under-utilised

compared to remaining parts of the study area. A relatively large number of sites were sampled to ensure the study area was adequately sampled.

4 Results

4.1 Desktop assessment and previous surveys

Figure 2 shows Koala records are known from the wider locality. Anecdotal reports from Brandy Hill Quarry staff indicate low abundance of Koalas over many years of operations.

Results of previous surveys indicate presence of one individual in winter and one individual in spring surveys (see Figure 3).

No breeding female Koalas were recorded during previous surveys. Under SEPP 44 the Project would therefore be defined as "potential" Koala habitat. The Port Stephens CKPoM maps the Project as supporting areas of "Preferred" and "Marginal" Koala habitat.

4.2 SAT surveys

Figure 1 and Figure 3 shows the locations of SAT survey points surveyed and the activity levels recorded at each SAT survey point. A total of 29 SAT points were surveyed. The data collected during the SAT surveys is included in Appendix 1.

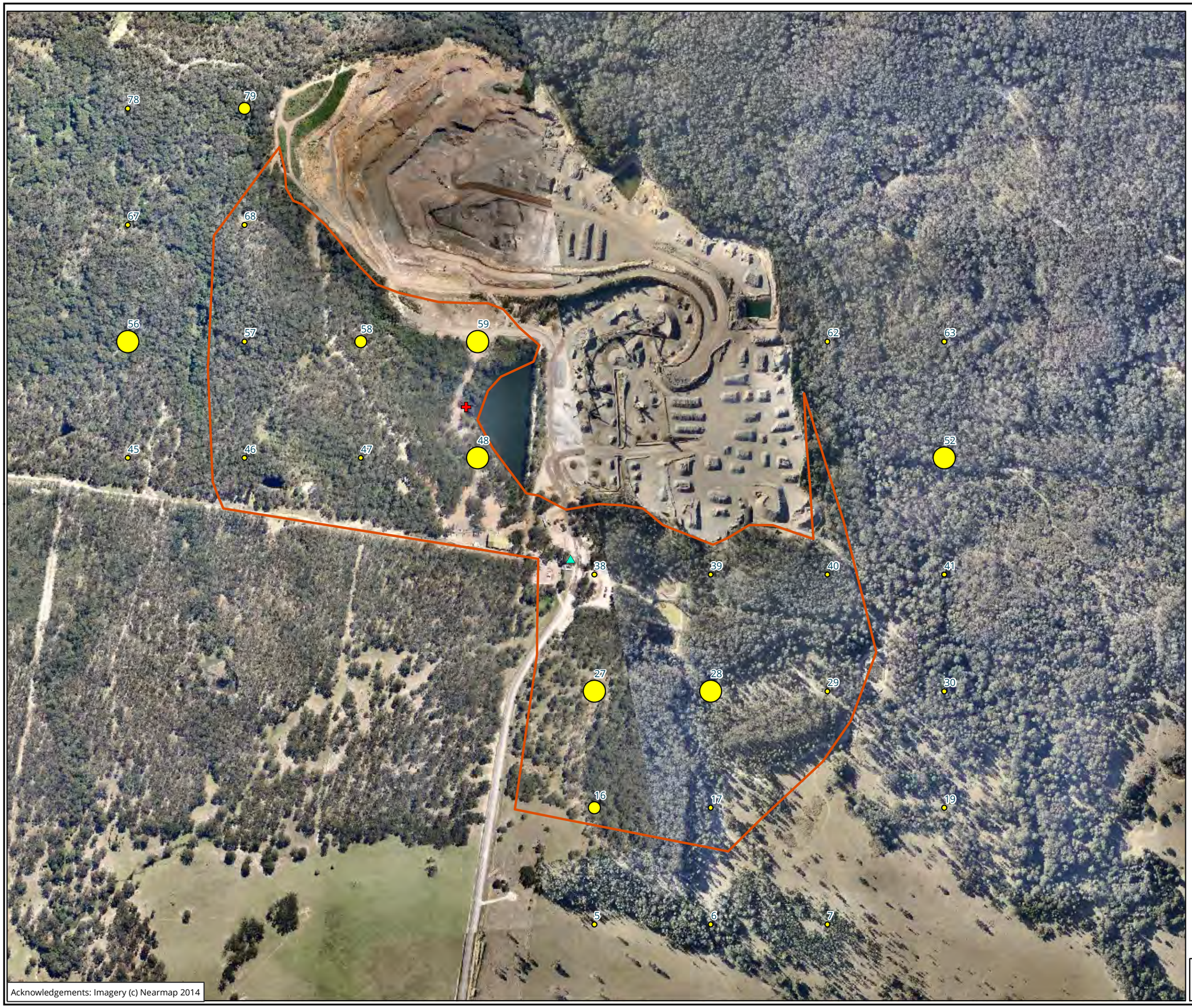
The East Coast low abundance category chosen based on the population density estimate calculated in Section 4.3 below as well as previous survey records.

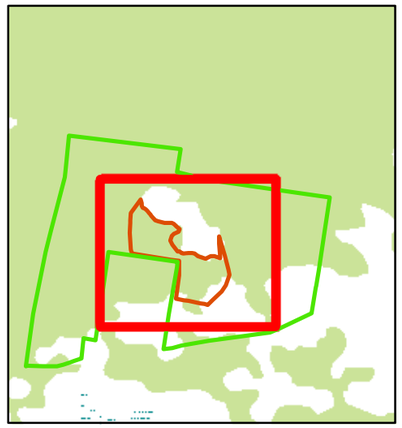
Mapping shows 6 High (between 4 and 30 trees with scats) and 3 Medium (3 trees with scats) activity sites within the study area, with the remaining 20 sites surveyed within the study area showing low (0 to 2 trees with scats) activity levels. With the exception of two outlying "High" sites to the east and west of the Project area, the SAT data indicates that the major areas of Koala activity occur within the Project vegetation clearing area. A band of High and Medium activity occurs from northwest to southeast, indicating a potential Koala activity corridor through the Project area (see Figure 3).

4.3 Koala point surveys and population density estimate

At each SAT point surveyed (see Figure 3) searches were conducted for individual Koalas within a 25m radius of the central tree chosen for the SAT surveys. No Koalas were recorded at any of the 29 survey points searched during the SAT surveys.

During the surveys a total of 3.6 hectares (29 x 0.125 hectares) of Koala habitat were searched for Koalas. This includes a search of 1.9 hectares (15 x 0.125 hectares) within the Project area. Although it is not possible to estimate actual Koala population density based on the Koala point surveys it can be assumed that the population within the Project area would be <0.1 Koalas per hectare of habitat present.





Legend

- Vegetation clearing area

Koala records

- August 2014
- November 2014

Koala Activity

- Low
- Medium
- High

Figure 3: Koala activity and records

0 60 120 180 240 300

Metres

Scale: 1:6,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Location:P:\19300s\19323\Mapping
19323_F4_KoalaActivity_20141219

5 Discussion and recommendations

No Koalas were recorded during the current Koala point surveys. Combined with the low numbers of Koala records from previous surveys and anecdotal observations of long-term staff at the Brandy Hill Quarry this indicates that, despite activity levels shown in the SAT data, the Project area currently supports only a low density of Koalas. The relatively high activity levels in parts of the Project may therefore indicate frequent use by a small number of individuals.

The Project area supports 48.65 hectares of Koala habitat, all of which would be removed for the Project. The total area of the site owned by Hanson is 561 hectares, much of which supports Koala habitat. It is therefore unlikely that removal Koala habitat for the Project will result in a significant reduction in the area of occupancy of Koalas in the locality, given the area of suitable habitat that will remain in adjacent land. To date, no areas of Commonwealth identified "critical habitat" have been listed for the Koala. However, in accordance with the *EPBC Act Referral Guidelines for the vulnerable listed Koala* (Commonwealth of Australia 2014) removal of Koala habitat resulting from the Project has potential to adversely affect "habitat critical to the survival of the species".

As recommended in the Referral Guidelines, a Koala habitat appraisal has been completed to assess impacts of the Project on Koalas (see Appendix 2). The Koala habitat appraisal determined that the Project achieved a total habitat assessment score of 9. In accordance with Referral Guidelines, the Project is therefore likely to result in adverse effects on habitat critical to the survival of the Koala given the Project will:

- *Impact on an area supporting habitat critical to the survival of the Koala (a habitat score of > or = 5).*
- *Require clearing of > or = 20 hectares of habitat containing known Koala food trees in an area with a habitat score > or =8.*

Based on the results of previous surveys (Biosis 2015) as well as the current SAT and Koala point surveys, combined with the results of the Koala habitat appraisal and the Significant Impact Criteria assessment of which a significant impact to Koala was determined to be likely (Biosis 2015), it is therefore recommended that a Referral under the Commonwealth EPBC Act for impacts on Matters of NES (Koalas) be submitted for the Project. This document has therefore been prepared to supplement the EPBC Act referral for Koalas.

Should the Project proceed, the following recommendations are made to minimise potential impacts on Koalas, resulting from the Project:

- A Biodiversity Management Plan (incorporating management measures for Koalas) should be prepared to outline the clearance procedure (including protection measures for adjacent vegetation), protocols for Koala finds and incidents and include an educational brochure for all workers to review prior to working on the Project.
- An ecologist should undertake pre-clearance surveys within the Project area immediately prior to the removal of any vegetation to give the clearance go ahead.
- An ecologist or fauna rescuer to be present during vegetation clearing to minimise impacts on Koalas displaced or injured during clearing.
- An ecologist or regional Koala care group should be contacted if any Koalas are injured and/or distressed during the construction and operation phases of the Project.

- Low site speed limits should be established on site to reduce the potential for vehicle impacts on Koalas. All drivers working on the Project should be made aware of Koalas and instructed to take precautions when driving on site.

6 References

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7 Appendices

7.1 Appendix 1 – SAT data sheets

Spot: Spotted Gum Creb: E. crebra Fib: E. fibrosa RG: E. tereticornis

Koala SAT Survey Data Sheet

Mel: Melaleuca sp.

Project: Brandy Hill Quarry **Matter No.:** 19323

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SAT ID: 38	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0945		WP: 1077	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	E-creb	Creb	Creb	Fibrosa	Fib	Creb	Creb	Fib	Creb	Creb	Fib	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Spot	Creb	Creb	Creb	Fib	Spot	Creb	Creb	Creb	Creb	Creb	Spot	Fib	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 39	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1015		WP: 1078	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Spot	Creb	Creb	Creb	Creb	Creb	Creb	RG	Creb	Spot	RG	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Creb	Spot	Spot	Spot	RG	Creb	RG	Creb	RG	Creb	Spot	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 40	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1045		WP: 1079	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Spot	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Mel	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

GB: E. moluccana Fib: E. fibrosa Mel: Melaleuca sp. Stri – Stringbark sp.

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 29	Date: 9-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 1115		WP: 1090	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	GB	GB	GB	GB	Fib	Fib	Fib	GB	GB	GB	Mel	Spot	Fib	Spot	Fib
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	GB	Fib	GB	RG	Spot	Fib	Creb	Fib	Creb	Fib	Fib	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

SAT ID: 27	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1230		WP: 1081	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	RG	RG	RG	RG	RG	RG	RG	RG	Creb	GB	GB	Spot	RG
No. scats:	Ø	Ø	Ø	1	Ø	Ø	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	GB	RG	GB	GB	Creb	RG	RG	RG	RG	RG	RG	RG	RG	RG
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

7

SAT ID: 28	Date: 9-12-14	Staff: CAC + 2 Henson	GPS:	East:
	Time: 1300		WP: 1082	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Creb	Spot	Spot	GB	Creb	GB	Spot	GB	Creb	Spot	GB	Spot	GB
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	1	1	Ø	1	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Spot	GB	Spot	Spot	GB	GB	Mel	GB	Creb	Spot	GB	GB	GB	Creb
No. scats:	1	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1

No. Koalas recorded within 25m radial search (5 minutes): Ø

6

Cas- Casuarina glauca Ang- Angophora floribunda

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 17	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1320		WP: 1083	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	RG	Spot	Fib	Spot	Cieb	Spot	Spot	Cieb	Spot	Spot	Spot	Fib	Spot	Spot
No. scats:	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cieb	Spot	Spot	Fib	Cieb	Spot	Fib	Spot	Spot	RG	Cieb	Spot	Spot	Spot	Cieb
No. scats:	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

2

SAT ID: 6	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1345		WP: 1084	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Ang	RG	RG	RG	Ang	RG	RG	Cas	Ang	RG	Ang	Ang	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Ang	Ang	Cas	Cas	Cas	Ang	Ang	Ang	RG	Ang	RG	RG	Ang	RG	RG
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

SAT ID: 5	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1405		WP: 1085	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas	Cas
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

GG: Grey Gum

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 16	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1425		WP: —	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Mel	Mel	Mel	Creb	Spot	Mel	Mel	Mel	Spot	RG	RG	Mel	Mel	RG	Mel
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Mel	Mel	Mel	Mel	GB	Creb	Spot	Spot	Creb	Mel	Mel	Mel	Mel	Creb	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

3

SAT ID: 48	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1520		WP: 1086	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Spot	Creb	Creb	RG	RG	Creb	Creb	GG	GB	Spot	Creb	Mel	Stri	Stri
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GB	RG	Spot	Creb	Creb	GG	Creb	Creb	GB	Spot	RG	Stri	GB	GB	Spot
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø

No. Koalas recorded within 25m radial search (5 minutes):

4

SAT ID: 59	Date: 9-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1540		WP: 1087	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	Stri	RG	Mel	RG	Creb	Stri	RG	Creb	GG	GG	Stri	RG	Creb	GG
No. scats:	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Creb	Creb	Stri	Creb	GG	GG	Creb	Creb	Aeg	Aeg	GG	GG	Stri	Stri
No. scats:	1	1	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

5

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 47	Date: 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: ~~0800~~		WP: 1088	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Stri	Stri	Stri	Spot	Stri	Spot	Stri	Spot	Creb	Spot	Spot	Acac.	Stri	Acac.
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Stri	Stri	Spot	Spot	GG	Spot	Creb	Spot	Spot	Stri	Stri	Stri	Spot	Spot
No. scats:	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 1

SAT ID: 58	Date: ~~0815~~ 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0815		WP: 1089	North:

Tree no.:	1	2	3	4	RG	6	7	8	9	10	11	12	RG	14	15
Sp:	Creb	Creb	Stri	Stri	~~RG~~	Creb	Spot	Creb	Creb	Creb	Stri	Creb	~~RG~~	Creb	Stri
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	1	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	0	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Creb	Stri	Stri	Creb	~~RG~~	Kurrajong	~~RG~~	Kurra	Kurra	Stri	Creb	Creb	Spot	Stri
No. scats:	1	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 3

SAT ID: 57	Date: 10-12-12	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0840		WP: 1090	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	GG	Stri	Spot	Spot	Stri	Stri	Stri	Kurra.	Stri	GG	Spot	Spot	Stri	GG
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Spot	Spot	Stri	Creb	Stri	GG	Stri	Stri	Stri	GG	Stri	Stri	Stri	Stri
No. scats:	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

No. Koalas recorded within 25m radial search (5 minutes): ~~0~~ 0

Page: 5

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 68	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0855		WP: 1091	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Cleb	Spot	Creb	RG	Stri	RG	Cleb	Spot	Spot	RG	Stri	Spot	Stri	Stri	Cleb
No. scats:	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Stri	Kurra	RG	Cleb	Kurra	Spot	Stri	Stri	Spot	Cleb	Stri	Cleb	Cleb	Spot
No. scats:	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

2

SAT ID: 79	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0920		WP: 1092	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	RG	RG	Creb	Stri	Kurra	RG	RG	Spot	RG	Stri	RG	Cleb	Creb	RG	RG
No. scats:	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Stri	Fib	RG	Cleb	Stri	RG	RG	Stri	Creb	Creb	Stri	RG	RG	Stri	Stri
No. scats:	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

3

SAT ID: 78	Date: 10-12-14	Staff: CAC + 3 Hanson	GPS:	East:
	Time: 0940		WP: 1093	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Kurra	RG	RG	Cleb	Stri	Stri	Stri	RG	Spot	Stri	RG	Stri
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cleb	Stri	Stri	Spot	Stri	Spot	RG	Stri	Creb	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

No. Koalas recorded within 25m radial search (5 minutes): 0

0

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 46	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1110		WP: 1094	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Spot	Stri	Spot	Spot	Stri	GG	GG	Spot	Spot	Spot	Stri	Spot	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	GG	Stri	Stri	GG	GG	Spot	GG	GG	Spot	GG	Spot	GG	Stri	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 45	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1130		WP: 1095	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Mel	Stri	Stri	RG	RG	Fib	Fibe	RG	Fib	Fib	Fib	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Fib	Fib	Fib	RG	Mel	Stri	RG	Fib	Fib	Fib	Mel	Fib	Stri	Spot
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 56	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1145		WP: 1096	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	Stri	RG	Stri	Creb	Stri	Stri	Spot
No. scats:	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	Creb	Creb	Stri	Spot	Kurra	Stri	Creb	Stri	Stri	Stri	Creb	Stri	Stri	Stri
No. scats:	Ø	Ø	Ø	1	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID: 67	Date: 10-12-14	Staff: CAC +2 Hanson	GPS:	East:
	Time: 1200		WP: 1097	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Creb	Creb	Creb	RG	Spot	Stri	RG	RG	Spot	Creb	RG	Mel	Stri	Kuri
No. scats:	1	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Spot	RG	RG	Stri	Creb	Stri	Stri	RG	Stri	RG	Stri	RG	Stri	RG	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 62	Date: 10-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1345		WP: 1098	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	Mel	Stri	Mel	Stri	Creb	Creb	Mel	Mel	Stri	Mel	Creb	Creb	Mel	Stri
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	Creb	Stri	Stri	Mel	RG	Stri	Mel	Creb	Stri	RG	RG	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

SAT ID: 63	Date: 10-12-14	Staff: CAC +2 Hanson	GPS:	East:
	Time: 1405		WP: 1099	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	RG	GG	GG	GG	Creb	Stri	Creb	Spot	GG	Stri	GG	RG	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	GG	GG	Creb	GG	Spot	Spot	GG	Spot	GG	GG	Spot	Spot	GG	GG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Coach - Coachwood

Koala SAT Survey Data Sheet

Project: Brandy Hill Quarry **Matter No.:** 19323

biosis

SAT ID:	52		Date:	10-12-14		Staff:	CAC + 2 Hanson		GPS:		East:				
			Time:	1420					WP:	1100	North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Fib	Fib	Creb	Fib	Fib	Creb	Fib	Creb	Fib	Mel	Stri	RG	Creb	Fib	Creb
No. scats:	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Creb	Mel	RG	Mel	GG	Creb	Creb	RG	Creb	Spot	Creb	Creb	RG	Creb	Creb
No. scats:	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
No. Koalas recorded within 25m radial search (5 minutes):															

4

SAT ID:			Date:			Staff:			GPS:		East:				
			Time:						WP:		North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:															
No. scats:															
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:															
No. scats:															
No. Koalas recorded within 25m radial search (5 minutes):															

SAT ID:	41		Date:	10-12-14		Staff:	CAC + 2 Hanson		GPS:		East:				
			Time:	1500					WP:	1101	North:				
Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Coach	Kulla	Spot	GG	Stri	Stri	Stri	Coach	Spot	Stri	Spot	Stri	Stri	Creb	Mel
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	GG	Spot	GG	Stri	Mel	Mel	Mel	Mel	Spot	Creb	Creb	Mel	Mel	Spot	Creb
No. scats:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. Koalas recorded within 25m radial search (5 minutes):															

0

Alph: Alphitonia excelsa (Red Ash)

Ang: Angophora floribunda

Koala SAT Survey Data Sheet

biosis

Project: Brandy Hill Quarry **Matter No.:** 19323

SAT ID: 30	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 0940		WP: 1102	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Spot	Creb	Stri	Creb	Creb	Creb	Stri	RG	Spot	Spot	Creb	Creb	Alph.	Stri	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Alph.	RG	Alph.	Creb	RG	Creb	GG	Creb	Creb	Stri	RG	Cas.	Spot	Creb	Creb
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

+ Black-faced Monarch + Leaden F-catcher seen

1

SAT ID: 19	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1005		WP: 1103	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Creb	RG	Creb	Creb	RG	Creb	Stri	RG	Stri	Stri	Stri	Stri	RG	Creb	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	1	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	RG	RG	Fib	RG	Fib	RG	Creb	Creb	RG	RG	RG	RG	RG	RG	RG
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

1

SAT ID: 7	Date: 11-12-14	Staff: CAC + 2 Hanson	GPS:	East:
	Time: 1035		WP: 1104	North:

Tree no.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sp:	Ang	Cas	Cas	Cas	Ang	Cas	Ang	Cas	Cas	Cas	Creb	Mel	Mel	RG	Ang
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Tree no.:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sp:	Cas	Cas	Mel	Cas	Cas	Creb	Cas	Ang	Mel	Cas	Ang	Cas	Mel	Cas	Mel
No. scats:	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø

No. Koalas recorded within 25m radial search (5 minutes): Ø

Ø

7.2 Appendix 2 – Koala habitat appraisal

Koala habitat appraisal - Brandy Hill Quarry expansion		
Action: Quarry expansion in the Lower Hunter, NSW Context: Coastal (East Coast - low abundance)		
Associated infrastructure: Additional quarry areas		
Primary impacts: Vegetation clearing, vehicle strike		
Impact area size: 97 hectares		
Attribute	**Score**	**Habitat appraisal**
Koala occurrence	2	Koala records known from the locality for the study area
		Biosis conducted targeted Koala surveys in winter and spring 2014 using diurnal and nocturnal searches and call playback. A total of 2 Koalas was recorded within the Project area.
		Biosis conducted targeted SAT and Koala point surveys in summer 2014 to determine Koala population density estimate. No Koalas were recorded during this period.
Vegetation structure and composition	2	Comprehensive vegetation mapping undertaken by Biosis in winter and spring 2014 mapping all vegetation within the study area. All forest and woodland communities present support 2 or more Koala food tree species.
Habitat connectivity	2	Koala habitat present is a component of an area of suitable habitat > 1,000 hectares
Key existing threats	2	No evidence of recent or regular Koala fatalities from vehicle strikes or dog attacks
Recovery value	1	Uncertain whether the habitat present is important for achieving the interim recovery objectives for Koalas.
Total	9	Based on the area of habitat to be cleared and total habitat score a Commonwealth referral under the EPBC Act is recommended.

Appendix 7C

Biodiversity

MNES Search

Brandy Hill Expansion Project

Environmental Impact Statement

Australian Government

Department of the Environment

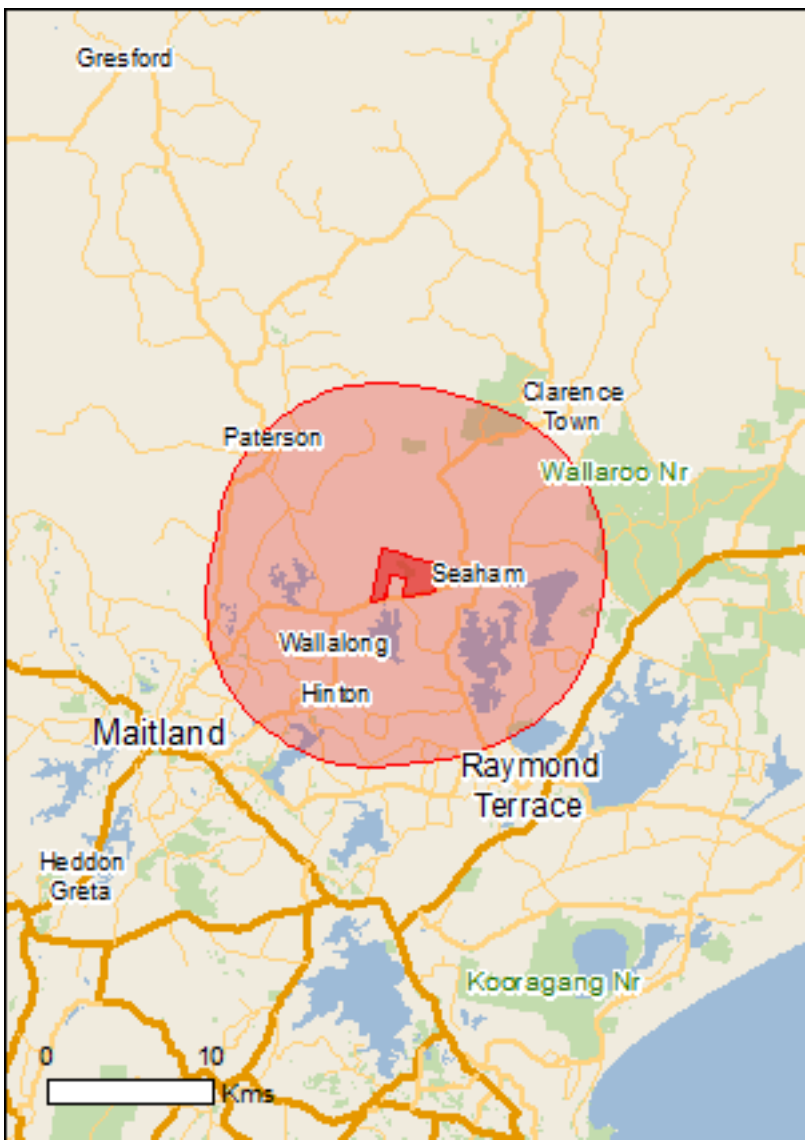
EPBC Act Protected Matters Report

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

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

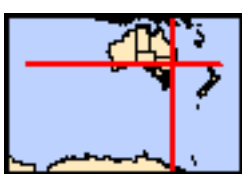
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/10/14 14:07:06



Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	33
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

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

Place on the RNE:	26
State and Territory Reserves:	5
Regional Forest Agreements:	1
Invasive Species:	46
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (RAMSAR) [Resource Information]

Name	Proximity
Hunter estuary wetlands	Within 10km of Ramsar

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
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Frogs		

Name	Status	Type of Presence
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to 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 known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pseudomys oralis		
Hastings River Mouse, Koontoo [98]	Endangered	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat may occur within area
Angophora inopina		
Charmhaven Apple [64832]	Vulnerable	Species or species habitat likely to occur within area
Asperula asthenes		
Trailing Woodruff [14004]	Vulnerable	Species or species habitat likely to occur within area
Asterolasia elegans		
[56780]	Endangered	Species or species habitat may occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus glaucina		
Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens		
Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat may occur within area
Euphrasia arguta		
[4325]	Critically Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Grevillea parviflora subsp. parviflora		
Small-flower Grevillea [64910]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca biconvexa		
Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior		
Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis		
Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Pterostylis gibbosa		
Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Streblus pendulinus		
Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Tetratheca juncea		
Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Hoplocephalus bungaroides		
Broad-headed Snake [1182]	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
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
[Rhipidura rufifrons](#)		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
[Ardea alba](#)		
Great Egret, White Egret [59541]		Breeding known to occur within area
[Ardea ibis](#)		
Cattle Egret [59542]		Breeding likely to occur within area
[Gallinago hardwickii](#)		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
[Rostratula benghalensis (sensu lato)](#)		
Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Commission

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		
[Apus pacificus](#)		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Ardea alba](#)		
Great Egret, White Egret [59541]		Breeding known to occur within area
[Ardea ibis](#)		
Cattle Egret [59542]		Breeding 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 known to occur within area
[Hirundapus caudacutus](#)		
White-throated Needletail [682]		Species or species habitat known to occur within area
[Lathamus discolor](#)		
Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
[Merops ornatus](#)		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Monarcha melanopsis](#)		
Black-faced Monarch [609]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Largs Raised Beach Geological Site	NSW	Registered
Seaham Swamp Nature Reserve	NSW	Registered
Historic		
Berry House	NSW	Indicative Place
Cemetery	NSW	Indicative Place
Bond Stores Group (former)	NSW	Registered
Closebourne House	NSW	Registered
Corn Staddle	NSW	Registered
Duninald	NSW	Registered
Dunmore Bridge	NSW	Registered
Dunmore House	NSW	Registered
Frys Coach Company Site	NSW	Registered
Hearse Shed	NSW	Registered
Hinton Bridge	NSW	Registered
Morpeth Museum & Library, former Courthouse	NSW	Registered
Morpeth Road Bridge	NSW	Registered
Morpeth Township	NSW	Registered
Paterson Courthouse (former)	NSW	Registered
Paterson River Road Bridge	NSW	Registered
Police Station	NSW	Registered
Police Station (former)	NSW	Registered
Primitive Methodist Church (former)	NSW	Registered
Railway Station (former)	NSW	Registered
St Pauls Anglican Church and Graveyard	NSW	Registered
Stradbroke House and Outbuildings	NSW	Registered
Tocal Homestead	NSW	Registered
Victoria Hotel	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
Columbey	NSW
Columbey	NSW
Seaham Swamp	NSW

Name	State
Unnamed FMZ2	NSW
Wallaroo	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

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
Alauda arvensis Skylark [656]		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 within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		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
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
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
Feral deer Feral deer species in Australia [85733]		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 norvegicus Brown Rat, Norway Rat [83]		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
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
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
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species 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
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		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
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Coordinates

-32.65005 151.67523,-32.65176 151.68896,-32.654 151.68868,-32.65702 151.70708,
-32.66893 151.70468,-32.67079 151.69939,-32.67202 151.68645,-32.66286 151.6885,
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-32.67402 151.66943,-32.65008 151.67545,-32.65005 151.67523

Caveat

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

- migratory and
- marine

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

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

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

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

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

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

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

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

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Appendix 7 D

Biodiversity

Referral Decision

Brandy Hill Expansion Project

Environmental Impact Statement

EPBC Ref: 2014/7453

Ms Pip Cox
Graduate Environmental Manager
Hanson Construction Materials Pty Ltd
Level 5, 75 George Street
PARRAMATTA NSW 2150

Dear Ms Cox

Decision on referral
Brandy Hill rock quarry extension, Seaham, Port Stephens, New South Wales

Thank you for submitting a referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).This is to advise you of my decision about the referral of the proposed action, to expand a hard rock quarry and construct and operate additional infrastructure on Brandy Hill, approximately 3.5 kilometres west of Seaham and 30 kilometres north of Newcastle.

As a delegate of the Minister for the Environment, I have decided under section 75 of the EPBC Act that the proposed action is a controlled action and, as such, it requires assessment and a decision about whether approval for it should be given under the EPBC Act.

The information that I have considered indicates that the proposed action is likely to have a significant impact on the following matters protected by the EPBC Act:

- Listed threatened species and communities (sections 18 & 18A)

Based on the information available in the referral, the proposed action is likely to have a significant impact on the following matters of national environmental significance, but not limited to:

- Koala (*Phascolarctos cinereus*) – vulnerable and Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable: The proposed action will result in the clearance of habitat critical to the survival of these species.
- Spot-tailed Quoll (*Dasyurus maculatus* subsp. *maculatus* [SE mainland population]) – endangered: The proposed action will result in the clearance of suitable foraging and breeding habitat for the Spotted-tail Quoll.
- Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) – endangered: The proposed action will result in the clearance of foraging habitat for the Swift Parrot, including key foraging and drought refuge habitat.

Please note that this decision only relates to the potential for significant impacts on matters protected by the Australian Government under Chapter 2 of the EPBC Act.

The New South Wales Government has advised the Department that your project will be assessed under Part 4, Division 4.1 of the *Environmental Planning and Assessment Act 1979* (NSW), which is listed as Item 2 (a)(i) of Schedule 1 to the bilateral agreement between New South Wales and the Commonwealth in relation to environmental assessment. This process will therefore be taken as the assessment of the controlled action for the purposes of the EPBC Act. This assessment includes a public consultation phase, *in which any third parties can comment on the proposed action*.

Please note, under subsection 520(4A) of the EPBC Act and the *Environment Protection and Biodiversity Conservation Regulations 2000*, your assessment is subject to cost recovery. Please find attached, a copy of the fee schedule for your proposal and an invoice for Stage 1. Fees will be payable prior to each stage of the assessment proceeding. Further details on cost recovery are available on the Department's website at: www.environment.gov.au/epbc/cost-recovery.

If you disagree with the fee schedule provided, you may apply under section 514Y of the EPBC Act for reconsideration of the method used to work out the fee. The application for reconsideration must be made within 30 business days of the date of the fee schedule and can only be made once in respect of a fee. Further details regarding the reconsideration process and an application form for reconsideration can be found on the Department's website at: www.environment.gov.au/epbc/cost-recovery. I have also written to the following party to advise them of this decision:

NSW Department of Planning and Environment Mrs Felicity Greenway

You may elect under section 132B of the EPBC Act to submit a management plan to be considered during the assessment at any time before an approval decision is made. If a management plan is submitted or revised after approval it may incur additional fees under cost recovery. Please refer to Attachment A for more details.

Please also note that once a proposal to take an action has been referred under the EPBC Act, it is an offence under section 74AA to take the action while the decision making process is on-going (unless that action is specifically excluded from the referral or other exemptions apply). Persons convicted of an offence under this provision of the EPBC Act may be liable for a penalty of up to 500 penalty units. The EPBC Act is available on line at: www.environment.gov.au/epbc/about/index.html

The Department has recently published an *Environmental Impact Assessment Client Service Charter* (the Charter) which outlines the Department's commitments when undertaking environmental impact assessments under the EPBC Act. A copy of the Charter can be found at: www.environment.gov.au/epbc/publications/index.html.

If you have any questions about the referral process or this decision, please contact the project manager, Caitlin Ellis, by email to caitlin.ellis@environment.gov.au, or telephone 02 6275 9927 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Paula Stagg
Acting Assistant Secretary
South-Eastern Australia Assessment Branch

3 June 2015

Cc: Carl Corden, Biosis Pty Ltd

Appendix 7 E

Addendum to Biodiversity Assessment Report, aquatic ecological impacts and mitigation advice

Brandy Hill Expansion Project

Environmental Impact Statement

04 January 2016

Pip Cox
Graduate Environmental Manager
Hanson
Level 10, 35 Clarence Street
Sydney, NSW 2000

Dear Pip

Re: Brandy Hill Quarry Expansion – Addendum to Biodiversity Assessment Report, aquatic ecological impacts and mitigation advice

Project no. 21334

This letter advice has been prepared to further address the potential impacts to aquatic ecology as a result of the proposed expansion of the Brandy Hill Quarry. This advice is based on new information made available following the submission of the Brandy Hill Quarry Expansion - Biodiversity Assessment Report (Biosis 2015) on 18 March 2015.

Biosis was commissioned by Hanson to prepare a Biodiversity Assessment Report (BAR) for the proposed expansion of the Brandy Hill Quarry (the Project), to address the Director General's Environmental Assessment requirements (DGRs). The Project was determined as a State Significant Development (SSD) under Section 78A (8A) of the *Environmental Planning and Assessment Act 1979* (EP&A Act); SSD 5899.

The Department of Planning and Environment (DP&E) has undertaken an adequacy review of the Project BAR and identified a lack of information regarding impacts of the Project on aquatic ecological values. Specifically, DP&E have made the following comment:

"The EIS does not adequately assess the potential impacts of the project on aquatic ecology as a result of surface water discharges (estimated in the water impact assessments in Appendix 13 of the EIS to be up to 1063 ML/ year). This assessment should take into account both water quality and flow regime impacts".

To address this comment, Biosis has reviewed the (now available) report titled *Surface Water Assessment: Hanson's Brandy Hill Quarry Expansion* (Martens 2015) to determine the implications of the Project on aquatic ecological values and develop appropriate mitigation measures.

Supplementary assessment

The primary factor that may result in impacts to aquatic ecological values is in relation to water discharge arising from the increased extent of extraction associated with Stage 5, as this would result in the highest volume of surplus water (1441 Mega litres per year). Increased discharge events will occur following rainfall and current site requirements. Water is currently discharged from the site at a maximum rate of 100 Litres per second (8.6 Megalitres/day) for a five day period. However, this maximum rate rarely occurs with discharge volumes and rates substantially lower than the maximum (pers comms Pip Cox). The proposed rate of discharge will not change from the current maximum; however the overall volume discharged, annually, would increase.

There are currently three approved discharge points that discharge water directly or indirectly into Deadman's Creek, in accordance with the site Environment Protection Licence (EPL) #1879. Discharge of water from the site currently occurs primarily from Discharge Point 1 (DP1) when the water quality approaches 50 mg/L for total suspended solids (TSS). This is in line with the EPL limit.

The Surface Water Management Plan for the Project states that water will only be discharged when all storages are at capacity and the water quality criteria specified in the EPL are met. This is expected to typically occur during high rainfall events or prolonged periods of rainfall. As such Deadman's Creek, an ephemeral waterway, would be flowing periodically. The water balance assessment has been updated in the Surface Water Assessment Report (Martens 2014), which identifies that the additional flows represent less than 5 % of the channel capacity of Deadman's Creek. It is considered unlikely that deleterious ecological impacts would occur as a result of the additional surface water flows, beyond alterations in water chemistry particularly electrical conductivity (EC), pH, turbidity and nutrient loads (Total Nitrogen and Total Phosphorous)..

Impact avoidance, minimisation and mitigation

Measures to avoid, minimise and mitigate potential impacts to aquatic ecological values as a result of the aforementioned potential impacts are recommended below:

- Include ongoing monitoring of EC and nutrient levels within the water storages in the Surface Water Management Plan and develop appropriate management measures for high nutrient loads to reduce the occurrence or severity of algal blooms.
- Monitor the effects of increased surface flows in relation to bank erosion and stream bed composition of Deadman's Creek as part of the Surface Water Management Plan. This would inform the adaptive management of surface water flows/discharge and identify the need for remediation if adaptations to management do not yield beneficial results.

Conclusion

This advice outlines the low level of potential impacts arising from the Project on aquatic ecological values and recommends suitable mitigation measures to avoid and minimise the effects of these impacts. The current maximum rate of discharge will not be increased as a result of the proposal, therefore not increasing the level of impact to Deadman's Creek beyond the current conditions.

In summary, the primary means of further reducing impacts would be associated with monitoring of the effect of discharge on Deadman's Creek and the implementation of an adaptive management plan will ensure that long-term impacts are minimised or modelled flow conditions are occurring as predicted..

Yours sincerely

Tony Steelcable
Consultant Aquatic Ecologist

References

Biosis 2015. Brandy Hill Quarry Expansion Biodiversity Assessment Report. Report for Hanson. Authors: J.Murray, C.Corden, E.Cooper, S.Rose, A.Steelcable & A.Nelson. Biosis Pty Ltd, Sydney. Project no. 18371.

Martens 2015. Surface Water Assessment Hanson's Brandy Hill Quarry Expansion. Martens & Associates Pty Ltd, Hornsby.