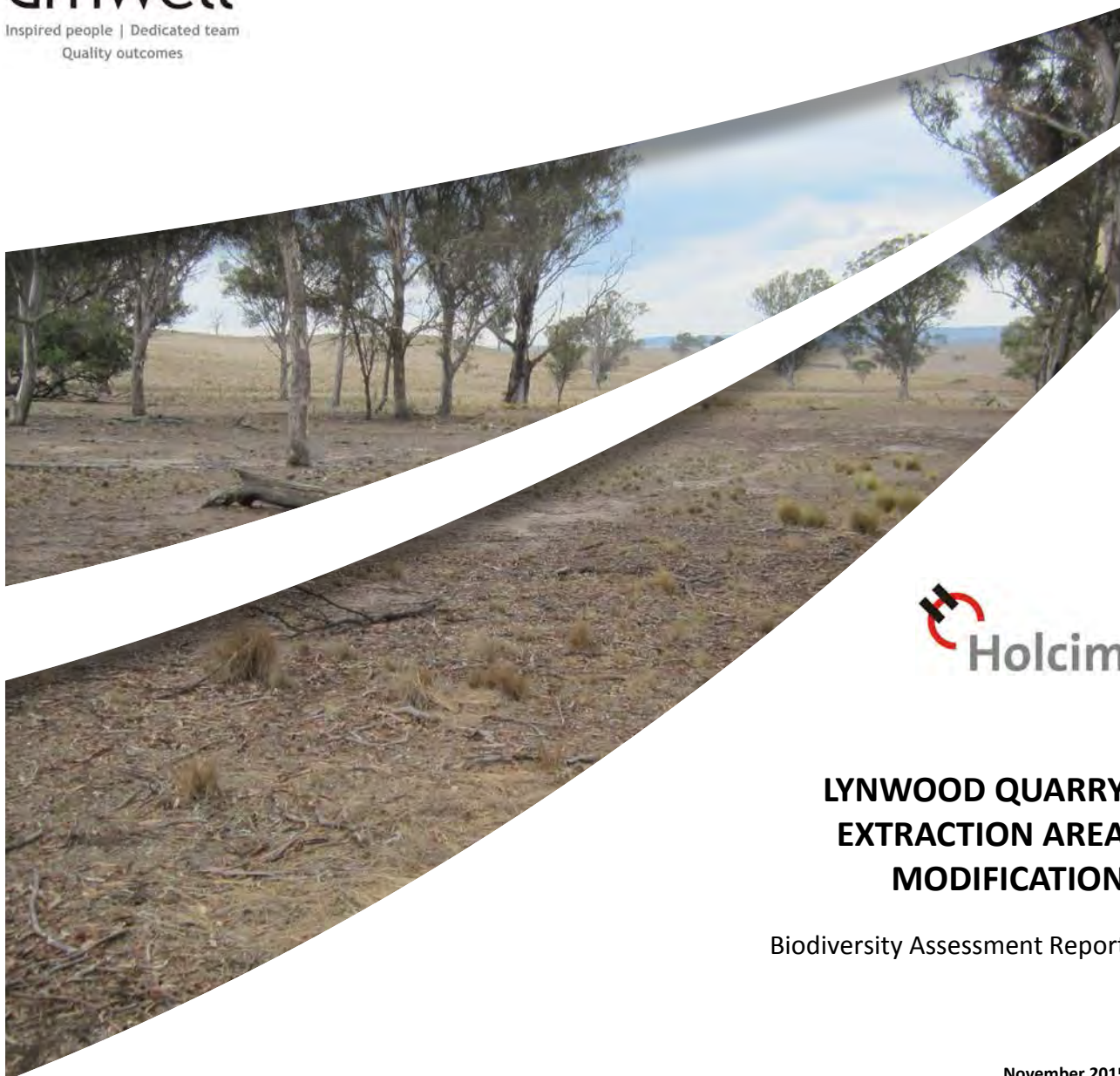




APPENDIX 7

Ecology



LYNWOOD QUARRY EXTRACTION AREA MODIFICATION

Biodiversity Assessment Report

November 2015



LYNWOOD QUARRY EXTRACTION AREA MODIFICATION

Biodiversity Assessment Report

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Holcim (Australia) Pty Ltd

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Report No. 3330/R07/V2
Date: November 2015



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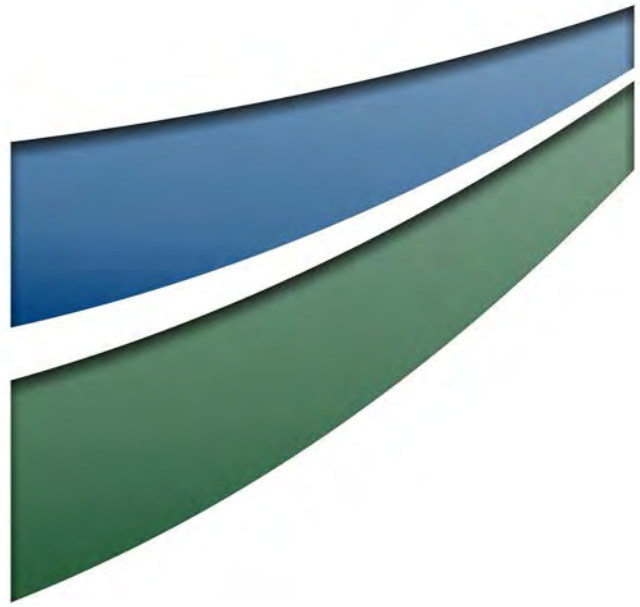
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This report was prepared using
Umwelt's ISO 9001 certified
Quality Management System.

Executive Summary



Lynwood Quarry is a hard rock quarry operated by Holcim Australia, located west of Marulan, NSW. In December 2005 Holcim (Australia) Pty Ltd (Holcim Australia) was granted development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (DA 128-5-2005) by the [then] NSW Minister for Infrastructure and Planning to construct and operate Lynwood Quarry until 1 January 2038.

During the operational readiness works, further drilling and material testing revealed that the resource in the approved pit at Lynwood Quarry is more variable and substantial areas are characterised by more significant concentrations of either intense fracturing, alteration, clay, or a combination of these characteristics, than was detected during the earlier resource assessment investigations. Holcim Australia is therefore seeking approval to modify the original development consent to extract quarry resources on Holcim Australia-owned land, to the west of the Approved Pit (the Development Site).

Umwelt (Australia) Pty Limited (Umwelt) has prepared this Biodiversity Assessment Report (BAR) on behalf of Holcim Australia to assess the potential ecological impacts of the proposed Extraction Area Modification Project (Modification Project) at Lynwood Quarry using the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (FBA)*.

The BioBanking Credit Calculator (BBCC) Version 4.1 (Major Project Assessment Type) was applied following extensive literature reviews, the

identification of relevant landscape features and detailed flora and fauna field surveys undertaken in February, August and October 2014 of the Development Site, in accordance with BioBanking Assessment Methodology (BBAM) (DECC 2008).

Following the application of appropriate avoidance and mitigation measures, the BioBanking Assessment identified the following biodiversity features and subsequent credits required for offsetting as a result of the Modification Project:

- 2124 ecosystem credits for Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (HN614);
- 881 ecosystem credits for Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (HN570);
- 33 ecosystem credits for Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (HN515);
- 1011 species credits for large-eared pied bat (*Chalinolobus dwyeri*); and
- 1725 species credits for squirrel glider (*Petaurus norfolcensis*).

An offset strategy is being developed for the Modification Project in accordance with the FBA to satisfy these credit requirements.

Glossary

Approved Operations	Lynwood Quarry Project as approved under DA 128-5-2005 (as modified).
Approved Pit	The currently approved (under DA 128-5-2005, as modified) ignimbrite pit.
Approved Project Area	Lynwood Quarry project area as approved under DA 128-5-2005 (as modified) as shown on Figure 1.2 .
BAR	Biodiversity Assessment Report
BBAM	BioBanking Assessment Methodology
BBCC	BioBanking Credit Calculator
BVT	Biometric Vegetation Type
CEEC	Critically Endangered Ecological Community
CMA Subregion	Catchment Management Authority Subregion
DA	Development Application
DECC	NSW Department of Environment and Climate Change (now OEH)
Development Footprint	The area of impact within the Development Site that has not been previously approved for disturbance. This includes disturbances associated with the construction and operation of the proposed Granite Pit, overburden emplacement, amenity bund, water management infrastructure and associated development.
Development Site	The area within the Modification Project Area that is not covered by previous development consents (i.e. outside the Approved Project Area boundary).
DoE	Commonwealth Department of the Environment
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (now DoE)
EEC	Endangered Ecological Community
EP	Endangered Population
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
ESCP	Erosion and Sediment Control Plan
FBA	Framework for Biodiversity Assessment
FM Act	Fisheries Management Act
GIS	Geographical Information System
Granite Pit	The proposed modified extraction area to the west of the Approved Pit as shown on Figure 1.3 quarrying a granite resource.
Granite Pit Area	The proposed modified extraction area (the Granite Pit) plus the area required for associated haul roads, emplacement areas, amenity bund and water management structures on Lot 2 DP 1107232 (and an enclosed Crown road reserve) located to the west of the existing Approved Lynwood Quarry as shown on Figure 1.3 .
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
LGA	Local Government Area
LPI	Land and Property Information

MGA	Map Grid of Australia
MNES	Matters of national environmental significance
Modification Project	The subject of this Biodiversity Assessment Report, the Proposed Extraction Area Modification, which includes the proposed development of an additional quarry resource to the west of the currently approved quarry area and associated components.
Modification Project Area	The Approved Project Area plus the area required for the proposed Granite Pit, associated haul roads, emplacement areas, amenity bund and water management structures as shown on Figure 1.3 .
Mtpa	Million tonnes per annum
NSW	New South Wales
OEHS	Office of Environment and Heritage (NSW)
PCT	Plant Community Type
PMST	Protected Matters Search Tool
SAT	Spot Assessment Technique
SIX	Spatial Information eXchange
TEC	Threatened Ecological Community
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW)
VIS	Vegetation Information System

Table of Contents

Executive Summary	i
Glossary	i
1.0 Introduction	1
1.1 Background	1
1.1.1 Proposed Modification	3
1.2 Development Site Information	8
1.2.1 Location	8
1.2.2 Size	11
1.2.3 Topography and Natural Features	11
1.3 Key Resources, Policies and Documents	11
1.4 Report Preparation	12
2.0 Methods	13
2.1 Landscape Features	13
2.1.1 Identifying Landscape Features	13
2.1.2 Determining Landscape Value	13
2.2 Native Vegetation Assessment	14
2.2.1 Literature and Database Review	14
2.2.2 Digital Aerial Photograph Interpretation	15
2.2.3 Systematic Plot/Transect Surveys	15
2.2.4 Semi-quantitative Rapid Sampling	20
2.2.5 Meandering Transects	20
2.2.6 Plant Identification and Nomenclature Standards	20
2.2.7 Vegetation Mapping	20
2.2.8 Threatened Ecological Community Delineation Techniques	21
2.3 Threatened Species	22
2.3.1 Literature and Database Review	22
2.3.2 Species-credit Flora Surveys	22
2.3.3 Species-credit Fauna Surveys	24
3.0 Results	30
3.1 Landscape Value	30
3.1.1 Landscape Features	30
3.1.2 Landscape Value Scores	30
3.2 Native Vegetation within the Development Site	33
3.2.1 Biometric Vegetation Types and Vegetation Zones	33
3.2.2 Current Site Value	45
3.2.3 Threatened Ecological Communities	46

3.3	Threatened Species within the Development Site	53
3.3.1	Ecosystem-credit Species	53
3.3.2	Species-credit Species	62
4.0	Avoidance and Mitigation Measures	75
4.1	Site Selection and Planning Phase Avoidance	75
4.1.1	Site Selection	75
4.1.2	Planning Phase	75
4.2	Construction Phase	78
4.2.1	Management of Arboreal Species and Habitat	78
4.2.2	Weed Control	79
4.2.3	Sediment and Erosion Control	80
4.2.4	General Mitigation Measures	81
4.3	Operational Phase	81
4.3.1	Nest Box Establishment	81
4.3.2	Ongoing Weed Management	82
4.3.3	Feral Animal Management	82
4.3.4	Ongoing Sediment and Erosion Control	83
4.3.5	Rehabilitation	83
4.3.6	General Mitigation Measures	83
4.4	Direct Impacts	83
4.5	Indirect Impacts	84
4.5.1	Fugitive Light Emissions	84
4.5.2	Noise Impacts	85
4.5.3	Dust Impacts	85
4.5.4	Weed and Feral Animal Encroachment	86
5.0	Impact Assessment	87
5.1	Impacts Not Requiring Further Assessment	87
5.2	Impacts Not Requiring Offset	87
5.3	BVTs and Threatened Species Requiring Offset	89
5.3.1	Ecosystem Credits	89
5.3.2	Species Credits	91
5.4	Impacts that Require Further Consideration	91
5.5	Impacts on Aquatic Species	91
5.6	Seven Part Tests of Significance	92
5.7	Impacts on Matters of National Environmental Significance	95
6.0	Offsetting Requirements	96
6.1	Biodiversity Credit Report	96
6.2	Offsetting Options for Ecosystem Credits	96
6.2.1	Offset Location	96

6.2.2	HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	97
6.2.3	HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	97
6.2.4	HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	97
6.3	Holcim Australia Offsetting Strategy	98
7.0	References	99

Figures

Figure 1.1	Site Map	2
Figure 1.2	Approved Conceptual Quarry Plan (Year 30)	6
Figure 1.3	Proposed Extraction Area Modification Project Stage 6 (Life of Project)	7
Figure 1.4	Location Map – IBRA V7 Regions	9
Figure 1.5	Location Map – Landscape Features	10
Figure 2.1	Flora Survey Locations	19
Figure 2.2	Fauna Survey Locations	26
Figure 3.1	Connectivity Value	32
Figure 3.2	Vegetation Zones in the Development Site	34
Figure 3.3	Threatened Ecological Communities within the Development Site	47
Figure 3.4	Ecosystem-credit Species Recorded in the Development Site	60
Figure 3.5	Species-credit Polygons	74
Figure 4.1	Final Development Footprint	76
Figure 5.1	Offset Summary of the Development Site	88

Tables

Table 1.1	Comparison of Approved Project and the Modification Project	3
Table 1.2	Development Site Location in the Landscape	8
Table 2.1	Minimum Number of Plots/Transects Required per Zone Area (OEH 2012)	16
Table 2.2	Adequacy of Vegetation Survey in the Development Footprint	16
Table 2.3	Modified Bran-Blanquet Crown Cover-Abundance Scale	17
Table 2.4	Species-credit Flora Species Requiring Targeted Survey	23
Table 2.5	Species-credit Fauna Species Requiring Targeted Survey	24
Table 3.1	Landscape Features in the Development Site	30
Table 3.2	Native Vegetation Cover in Assessment Circles	31
Table 3.3	Connectivity Value Scores	31
Table 3.4	Patch Size Score Parameters	33
Table 3.5	Zone 1: HN614 – Yellow Box – Blakely’s Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion – Moderate to Good Condition	35
Table 3.6	Zone 2: HN614 – Yellow Box – Blakely’s Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion – Moderate to Good_Poor Condition	36
Table 3.7	Zone 3: HN570 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion – Moderate to Good Condition	38
Table 3.8	Zone 4: HN570 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion – Moderate to Good_Poor Condition	40
Table 3.9	Zone 5: HN515 – Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion – Moderate to Good Condition	41
Table 3.10	Zone 6: HN572 – Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion – Moderate to Good Condition	43
Table 3.11	Vegetation Zone Site Value Scores	45
Table 3.12	Predicted Ecosystem-credit Species	54
Table 3.13	Geographic and Habitat Features in the Development Site	62
Table 3.14	Predicted Species-credit Species	63
Table 4.1	Vegetation Community and Habitat Avoidance	77
Table 4.2	Direct Impacts of the Modification Project	84
Table 5.1	Ecosystem-credit species requiring offset as a result of the Modification Project	89
Table 5.2	Biometric Vegetation Types Requiring Offset and the Ecosystem Credits Required	90
Table 5.3	Species-credit Species Requiring Offset and the Species Credits Required	91
Table 5.4	Seven Part Tests of Significance and the FBA	92
Table 6.1	Ecosystem and Species Credits Generated at the Development Footprint	96

Appendices

Appendix A	Flora Species List
Appendix B	Plot and Transect Data
Appendix C	Fauna Species List
Appendix D	Biodiversity Credit Report

1.0 Introduction

1.1 Background

Holcim (Australia) Pty Ltd (Holcim Australia) was granted development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) in December 2005 (DA 128-5-2005) by the [then] NSW Minister for Infrastructure and Planning to construct and operate Lynwood Quarry west of Marulan, NSW (refer to **Figure 1.1**). Lynwood Quarry is approved to operate until 1 January 2038. The Lynwood Quarry consent has an approved production rate of up to 5 Mtpa, includes a processing facility, road and rail loading facility and is approved to transport up to 1.5 Mtpa of product by truck and up to 5 Mtpa by rail.

Holcim Australia commenced operational readiness works in the approved quarry pit or extraction area (an ignimbrite resource) in 2012 as part of the construction works and commenced operations in late 2015. Material extracted from the approved Lynwood Quarry pit (the Approved Pit) was used in the onsite civil works and to prepare the quarry pit ready for operation (e.g. removing overburden to expose the ignimbrite resource).

During the operational readiness works, further drilling and material testing has revealed that the resource in the Approved Pit is more variable and substantial areas are characterised by more significant concentrations of either intense fracturing, alteration, clay, or a combination of these characteristics, than was detected during the earlier resource assessment investigations. The variability and complexity of the approved Lynwood Quarry resource will challenge Holcim Australia's ability to consistently supply in-specification products from Lynwood Quarry to the market.

Holcim Australia is therefore seeking approval to extract quarry resources on Holcim Australia-owned land, which adjoins the existing Lynwood Quarry Project Area to the west of the Approved Pit. The proposed additional extraction area (the Granite Pit) is a granite resource and has different properties and mineralogy to the currently approved ignimbrite resource. Extensive drilling and testing of the granite resource has revealed that it is homogeneous, relatively unaltered and unfractured. The proposed granite resource will enable Holcim Australia to consistently produce in-specification products required to be delivered by Lynwood Quarry to supply the local, regional and Sydney markets.

The planning approach for the Project is to modify the existing consent under Section 75W of the EP&A Act. Umwelt (Australia) Pty Limited (Umwelt) has prepared this Biodiversity Assessment Report (BAR) on behalf of Holcim Australia to assess the potential ecological impacts of the proposed modification at Lynwood Quarry using the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (September 2014).

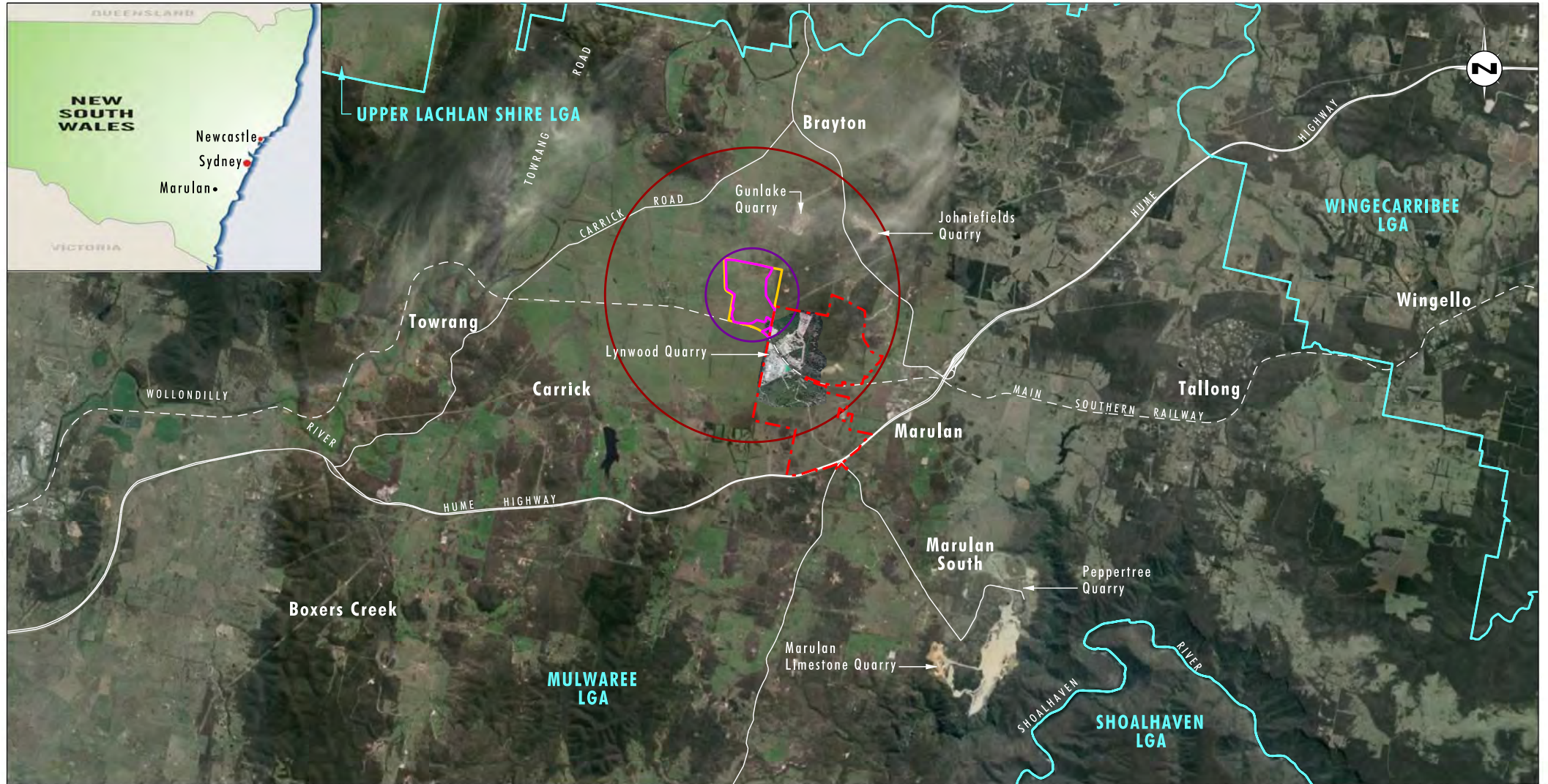


Image Source: Google Earth (2012), Holcim (2014)
Data Source: Holcim (2014)

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Legend

- Approved Project Area
- Development Site
- Development Footprint
- Local Government Area (LGA)
- 500Ha Assessment Circle
- 5000Ha Assessment Circle

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FIGURE 1.1

Site Map

1.1.1 Proposed Modification

The Development, being the proposed Extraction Area Modification (hereafter referred to as the Modification Project) comprises development of the following key features:

- A Granite Pit extraction area (the Granite Pit) to the west of the existing Approved Pit.
- Reduction in the extent of the Approved Pit to reflect limitations within the ignimbrite resource.
- Revised overburden emplacement areas.
- Additional haul roads and water management system structures.
- Additional amenity bund and vegetative screen.

These features are shown in **Figure 1.3**. Other than the proposed changes to the layout or footprint of the development, Lynwood Quarry from an operational perspective will be largely unchanged from the currently approved operations. **Table 1.1** compares the proposed modified development to the existing approved operations.

Table 1.1 Comparison of Approved Project and the Modification Project

Major Project Components/Aspects	Approved Project	Proposed Modification Project
Quarry Life	Quarry operations to cease on 1 January 2038	No change.
Limits on Production	5 Mtpa saleable product	No change.
Maximum Transportation of Product by Rail	5 Mtpa	No change.
Maximum Transportation of Product by Road	1.5 Mtpa	No change.
Rail Facilities	Rail spur and loading facility as shown on Figure 1.2	No change.
Infrastructure (e.g. processing plant, rail infrastructure, truck loading infrastructure, workshop, offices etc.)	As shown on Figure 1.2	No change to approved infrastructure. Additional haul road to connect to new Granite Pit (refer to Figure 1.3) and water management structures.

Major Project Components/Aspects	Approved Project	Proposed Modification Project
Hours of Operation	Topsoil / overburden removal / emplacement; drilling: • 7am to 6pm Blasting • Mon to Sat - 9am to 5pm • Sunday and public holidays – none Extraction • 7am to 10pm Processing, loading, delivery and distribution; maintenance • 24 hours per day	No change.
Employment	Employment at maximum production of approximately 115 people (including road transport drivers).	No change.
Quarry Footprint	As shown on Figure 1.2	Development of new Granite Pit to the west of the existing Approved Pit (refer to Figure 1.3). Reduction of the Approved Pit footprint by approximately 55 hectares.
Overburden and Excess Product Emplacement Areas	As shown on Figure 1.2	The approved Western and Eastern Overburden Emplacement Areas will no longer be required. The Rail Overburden Emplacement area is already constructed. Instead, emplacement areas to handle overburden from the Granite Pit will include backfilling the Approved Pit (refer to Figure 1.3), emplacement within part of the currently approved quarry limit, and a proposed emplacement area adjacent to the Granite Pit. An amenity bund will also be developed to west and northwest of the Granite Pit (refer to Figure 1.3).

Major Project Components/Aspects	Approved Project	Proposed Modification Project
Total Disturbance Footprint	As shown on Figure 1.2 (approximately 383 hectares)	The disturbance footprint will extend to the west to provide for the proposed Granite Pit and associated infrastructure and decrease in the east through a reduction in the Approved Pit disturbance footprint and associated overburden storage and haul roads to the east. Total disturbance footprint approximately 499 hectares.
Construction Phase	Largely completed, quarry currently in commissioning phase.	Construction limited to construction of haul road to proposed extraction area, amenity bund and water management infrastructure.

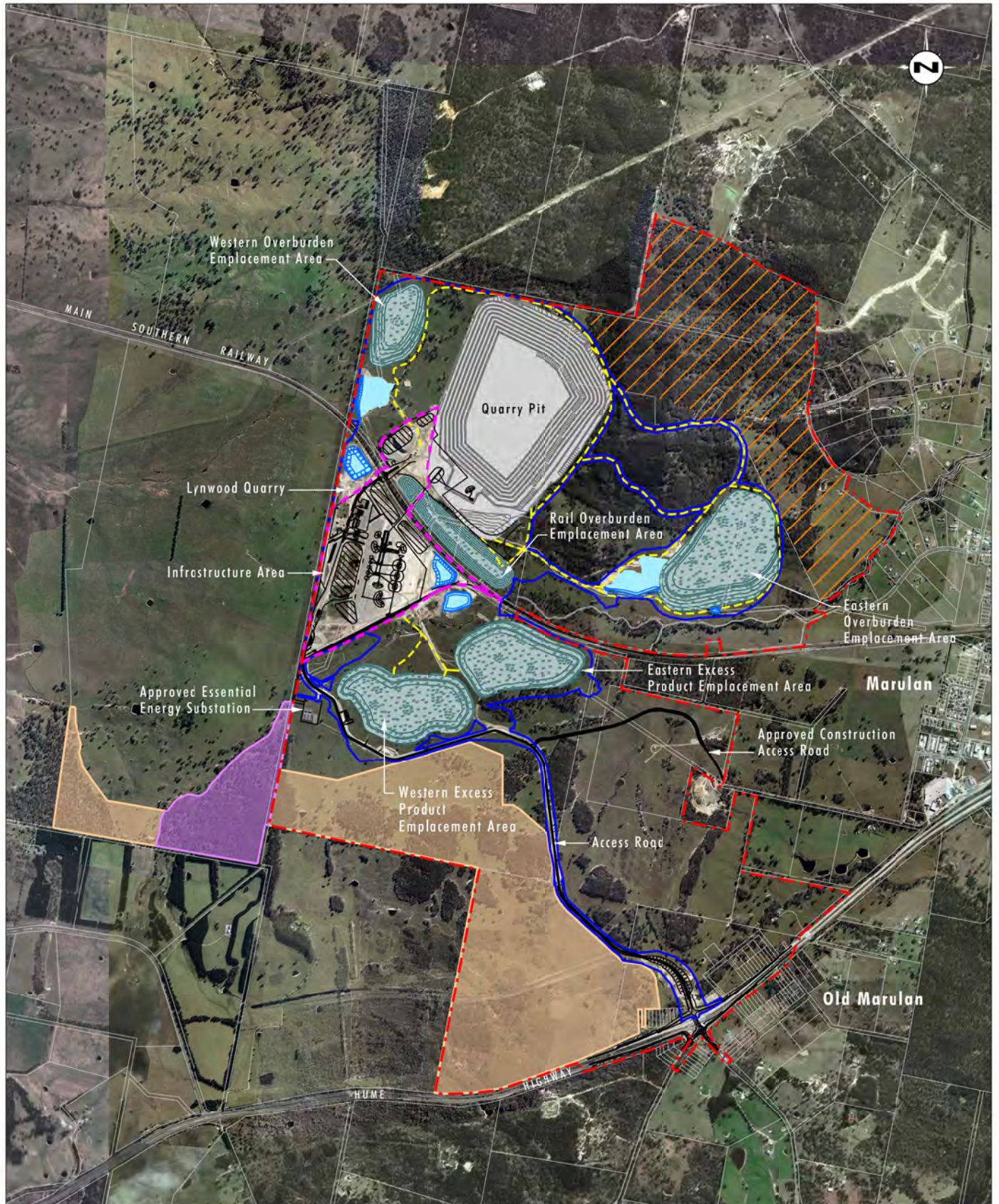


Image Source: Holcim Australia (Aerial Photo March 2012)
Data Source: LPI 2014

0 0.5 1.0 1.5 km
1:30 000

Legend

- Approved Project Area
- Lynwood Infrastructure Facilities
- Haul Road
- Approved Disturbance Footprint
- Quarry Pit
- Rehabilitated Area
- Dam
- Existing Biodiversity Offset Area (EPBC)
- Existing Habitat Management Area (EPBC)
- Existing Habitat Management Area

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FIGURE 1.2

Approved Conceptual
Quarry Plan
(Year 30)

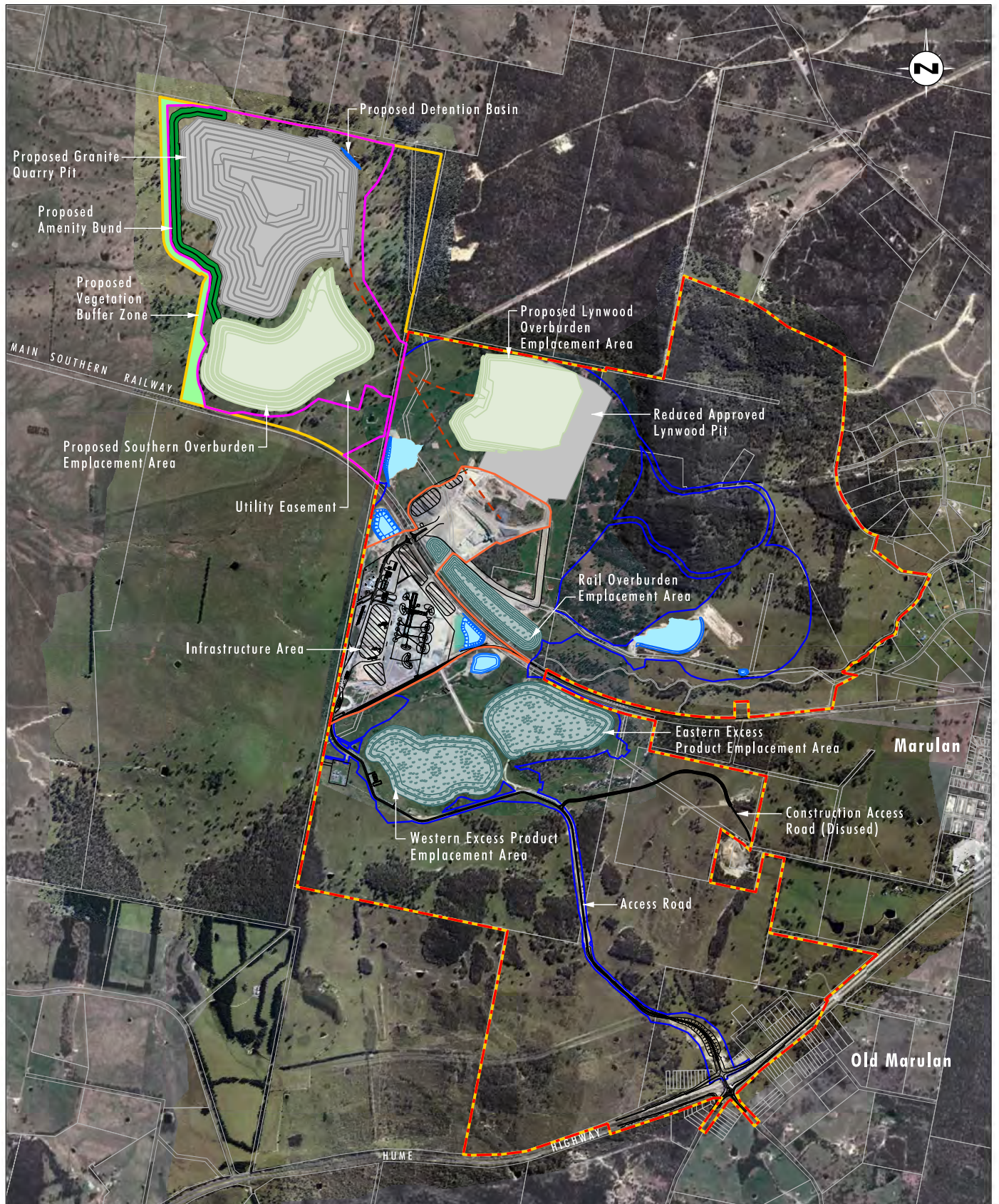


Image Source: Google Earth (2012), Holcim (2012, 2014)
Data Source: LPI (2014), Holcim Australia (2015)

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1:30 000

Legend

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|--|--------------------------------------|--------------------|
| Approved Project Area | Quarry Pit | Proposed Haul Road |
| Modification Project Area | Emplacement Area | |
| Lynwood Infrastructure Area | Dam | |
| Approved Disturbance Footprint | Proposed Overburden Emplacement Area | |
| Proposed Granite Pit Disturbance Footprint | Proposed Vegetation Buffer Zone | |
| Lynwood Infrastructure Layout | Proposed Amenity Bund | |

FIGURE 1.3

Proposed Extraction Area
Modification Project
Conceptual Stage 6 (Life of Project)

1.2 Development Site Information

For the purposes of this Biodiversity Assessment Report (BAR), the Development Site for the Modification Project represents the area within the Modification Project Area that is not covered by the existing Lynwood Quarry development consent (i.e. outside the Approved Project Area boundary). The Development Footprint is the area of impact within the Development Site. This includes areas associated with the proposed Granite Pit, overburden emplacement areas, haul roads, water management infrastructure and associated development. The Development Footprint is shown on **Figure 1.3**.

1.2.1 Location

Lynwood Quarry is a hard rock quarry operated by Holcim Australia, located west of Marulan, NSW (refer to **Figure 1.1**). The Development Site is located in the northwest of Holcim Australia's land holdings. The Development Site is located within the South Eastern Highlands IBRA bioregion and the Bungonia IBRA subregion. Refer to **Figure 1.4** and **Figure 1.5** for the location of the Development Site and other relevant landscape features.

Table 1.2 Development Site Location in the Landscape

Lynwood Quarry Modification Development Site	
IBRA Bioregion	South Eastern Highlands
IBRA Subregion	Bungonia
Major Catchment Area	Hawksbury/Nepean
Mitchell Landscape	Oberon – Kialla Granites (majority)
LGA	Goulburn Mulwaree
Address	Hume Highway, Marulan NSW, 2579

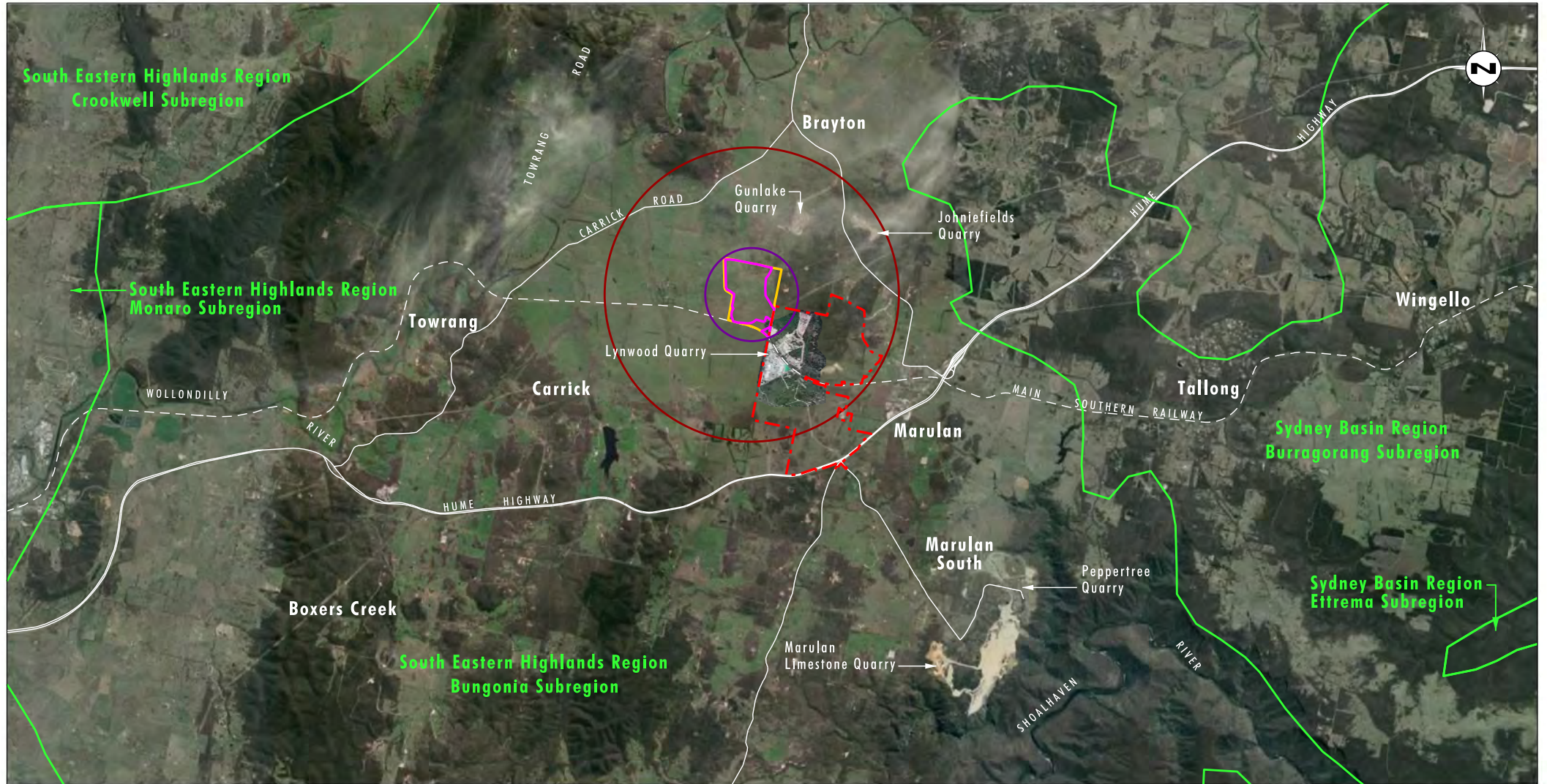


Image Source: Google Earth (2012), Holcim (2014)
Data Source: IBRA V7 - Australian Government Department of the Environment (2012)

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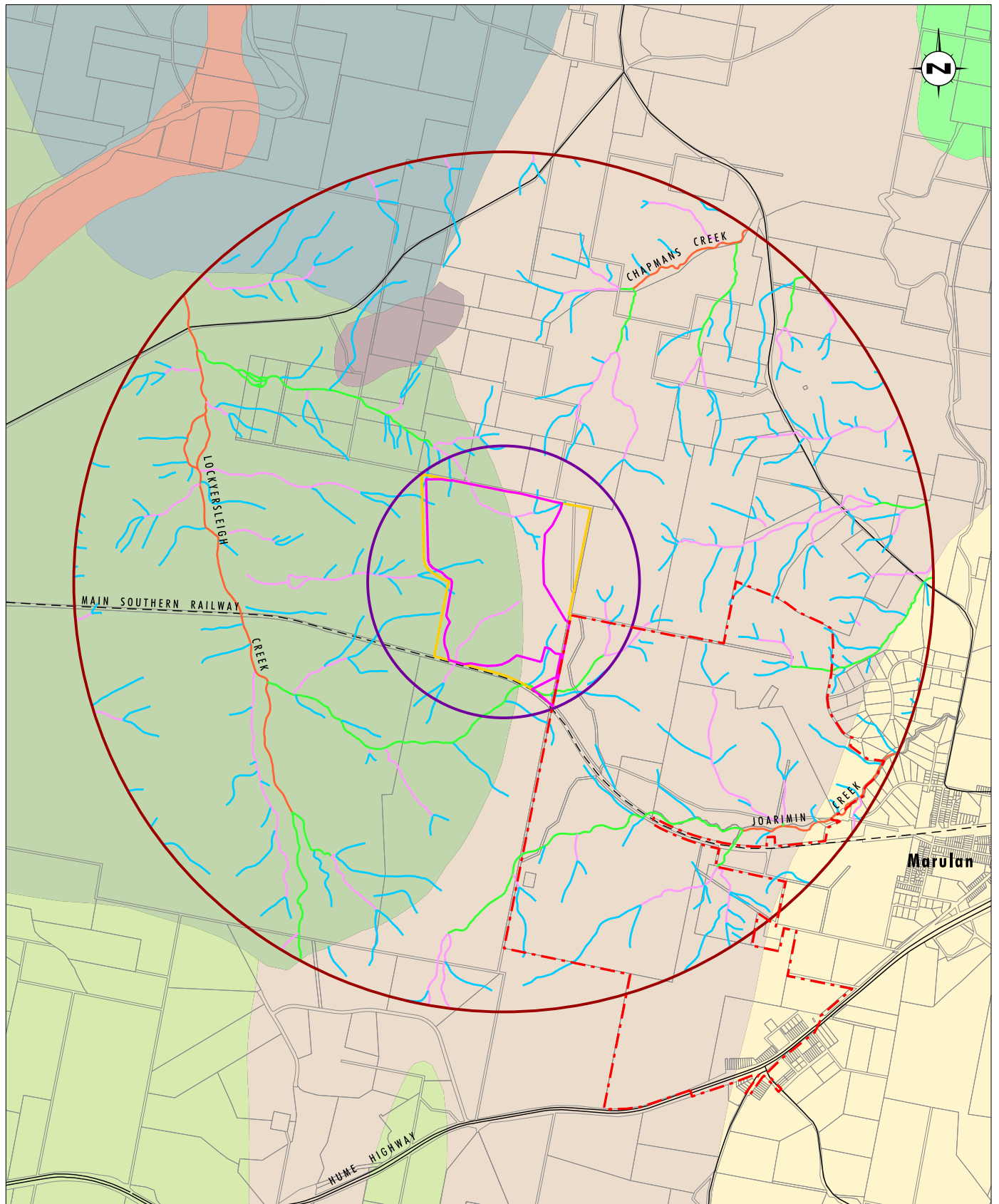
Legend

- Approved Project Area
- Development Site
- Development Footprint
- IBRA V7 Region/Subregion
- 500Ha Assessment Circle
- 5000Ha Assessment Circle

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20151027 13.58

FIGURE 1.4

Location Map - IBRA V7 Regions



Data Source: LPI (2009), Holcim Australia (2015), DECC (2008)

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1:50 000

Legend

- | | |
|---|--|
| - - - Approved Project Area | Mitchell Landscapes: |
| — Development Site | — Breadalbane Swamps and Lagoons |
| — Development Footprint | — Crookwell Basalts and Sands |
| — 500ha Assessment Circle | — Moss Vale Highlands |
| — 5000ha Assessment Circle | — Oberon - Kialla Granites |
| — 1st Order Stream | — Rockley Plains |
| — 2nd Order Stream | — Towrang Ranges |
| — 3rd Order Stream | — Wollondilly - Bindook Tablelands and Gorges |
| — 4th Order Stream | |

FIGURE 1.5

Location Map - Landscape Features

1.2.2 Size

The Development Site covers approximately 227 hectares.

The Development Footprint covers approximately 175 hectares.

1.2.3 Topography and Natural Features

The Development Site is typical of the Southern Tablelands region, which is characterised by ridges, crests, hillsides, undulating plains, valleys and lower slopes. The Development Site lies near the divide of the volcanics that underlie the majority of the Southern Tablelands and the sedimentary formations to the east of this region in the upper reaches of both the Sydney Basin and the Shoalhaven catchment. The topography of the Development Site generally consists of undulating ridges separated by drainage valleys, with elevations ranging from 710 metres Australian Height Datum (mAHD) in the north, to approximately 630 mAHD near Joarimin Creek. The majority of the topography of the Development Site slopes gently to the south or west towards Lockyersleigh Creek, with a small ridge separating the Development Site and the Approved Pit.

The Development Site is located entirely within the Lockyersleigh Creek catchment. Lockyersleigh Creek has a catchment area of approximately 2630 hectares and is a fourth order stream. A second order stream (tributary) to the Lockyersleigh Creek occurs in the northern portion of the Development Site (refer to **Figure 1.5**).

The majority of the Development Site has been heavily modified by past and ongoing agricultural activities and contains scattered trees occurring in predominately exotic understoreys. Grazing, which has been widespread across the Development Site, has resulted in the fragmentation and subsequent high disturbance and degradation of vegetation communities.

1.3 Key Resources, Policies and Documents

The following key resources, policies and documents were used to prepare the Biodiversity Assessment Report for the Modification Project:

- Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects (OEH September 2014)
- BioBanking Assessment Methodology 2008 (DECC July 2008)
- BioBanking Assessment Methodology 2014 (OEH September 2014)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities –Working Draft (DEC 2004)
- BioBanking Credit Calculator (Major Project Assessment Type) Version 4.1, accessed in August 2015
- Vegetation Information System (VIS) Classification Database (OEH 2015), accessed in August 2015
- OEH Atlas of NSW Wildlife database and mapping tool (OEH 2015), accessed in August 2015
- Department of the Environment (DoE) Protected Matters Database (DoE 2015), accessed in August 2015

- Ecological Assessment for the Proposed Lynwood Quarry (original project) (Umwelt 2005), and
- Ecological Assessment for the Proposed Modifications to Lynwood Quarry (Umwelt 2010).

1.4 Report Preparation

This Biodiversity Assessment Report (BAR) was prepared by Kate Connolly (Senior Ecologist) and Allison Riley (Principal Ecologist). Kate is accredited under the NSW *Threatened Species Conservation Act 1995* as a BioBanking and BioCertification Assessor while Allison has successfully completed the BioBanking and BioCertification training and is in the process of gaining accreditation. The report was also reviewed by Travis Peake (Practice Leader Ecology) who is also an accredited BioBanking and BioCertification Assessor.

2.0 Methods

2.1 Landscape Features

2.1.1 Identifying Landscape Features

Landscape features within the Development Site and the inner and outer assessment circles were determined through reviewing aerial photography and relevant GIS layers. Landscape features that were reviewed included:

- IBRA bioregions and IBRA subregions
- Mitchell landscapes
- Rivers, streams and estuaries (using the Strahler (1952) ordering system)
- Wetlands
- Native vegetation extent, and
- State and/or Regional Biodiversity Links.

2.1.2 Determining Landscape Value

Determining the 'Landscape Value' of the Development Site is calculated by assessing the following landscape attributes:

- Percent Native Vegetation Cover
- Connectivity Value, and
- Patch Size.

2.1.2.1 Percent Native Vegetation Cover

'Percent Native Vegetation Cover' is determined by the current percent native vegetation cover and the future percent native vegetation cover within the inner and outer assessment circles. This was determined using digital aerial photography interpretation using the Manifold GIS software package. Aerial photographs captured during 2012 and 2014 were used to digitise all native vegetation within the assessment circles. Further refinement of these areas was undertaken following field surveys of the Development Site.

The inner and outer assessment circles must be at a 1:10 ratio and one of the combinations from Table 8 of Appendix 4 of the FBA (OEH 2014). Due to the size and configuration of the Development Site, it was determined that a 500 hectare inner assessment circle and 5000 hectare outer assessment circle was the most appropriate combination. These circles were then centred on the Development Site which represents the area of native vegetation most impacted by the Modification Project.

2.1.2.2 Connectivity Value

To determine the connectivity value, the Development Site was assessed for the presence of native vegetation connecting links, state, regional or local biodiversity links as required by the FBA (OEH 2014).

Connecting links are present when an area of native vegetation in a Development Site is adjoined to and it is:

- in moderate to good condition; and
- has a patch size of > 1 hectare; and
- is separated by a distance of < 100 metres (or ≤ 30 metres for non-woody ecosystems); and
- is not separated by a large waterbody, dual carriageway, wider highway or similar.

State biodiversity links are defined as links which have been identified as important on a state scale. State biodiversity links are identified in a plan approved by the Chief Executive of OEH or are a riparian buffer either side of a 6th order stream (using the Strahler (1952) ordering system), or greater or either side of an important wetland or estuarine area.

Regional biodiversity links are recognised as important links at a regional scale. Regional biodiversity links are identified in a plan approved by the Chief Executive of OEH or are a riparian buffer either side of a 4th or 5th order stream.

2.1.2.3 Patch Size

A 'Patch' is an area of native vegetation that:

- occurs on the Development Site; and
- is in moderate to good condition; and
- includes native vegetation that has a gap of less than 100 metres from the next area of moderate to good condition native vegetation (or ≤ 30 metres for non-woody vegetation).

The patch may extend onto adjoining land that is not part of the Development Site. An assessment of the patch size class and the patch size score was then determined using Table 15 of the FBA (OEH 2014).

2.2 Native Vegetation Assessment

2.2.1 Literature and Database Review

A review of previous documents and reports relevant to the Modification Project was undertaken. This included regional and sub-regional vegetation mapping reports, site-specific monitoring surveys, ecological surveys undertaken in the vicinity of the Development Site and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species, EPs and TECs. Relevant documents included:

- South Coast Illawarra Vegetation Inventory (Tozer *et al.* 2010)
- Upper Murrumbidgee Plant Community Classification (Armstrong *et al.* 2013)

- VIS Classification Database (OEH 2015), accessed August 2015
- Ecological Assessment for the Proposed Lynwood Quarry (Umwelt 2005)
- OEH Threatened Species Website for known/predicted Threatened Ecological Communities (TECs) in the Bungonia subregion, accessed August 2015, and
- DoE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed August 2015.

2.2.2 Digital Aerial Photograph Interpretation

Digital imagery (aerial photographs) of the Development Site was viewed prior to and after vegetation survey to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design and implementation, ecological assessment and vegetation community mapping in the Development Site.

The QGIS 2.6 Brighton Edition (64-bit mode) geographical information system (GIS) was used to view digital imagery on-screen. Additionally, Google Earth was used to examine topographic variation across the landscape. Use of GIS and Google Earth allowed for zooming to a relatively large scale. Using this method, mapping was carried out at a scale of approximately 1:4,000; at times observations were made at a larger resolution of approximately 1:1,000. A 1:4,000 zoom was considered appropriate for plant community delineation, with larger zoom used to make fine-scale observations.

In addition to contemporary aerial imagery of the Development Site, digital imagery from 2002, 2006 and 2009 was also viewed in Google Earth to inform the assessment, particularly in relation to the changes in vegetation patterns and land use over this period. High resolution imagery was viewed in SIX Maps (LPI 2014) to provide an additional image resource. The Manifold System 8.0 Enterprise Edition GIS was used to prepare the figures for this report.

2.2.3 Systematic Plot/Transect Surveys

A total of 19 systematic plots/transect surveys were conducted across the Development Site during the surveys undertaken for this assessment (refer to **Figure 2.1**). These surveys were undertaken over six days and two survey periods:

- 11 to 14 February 2014, and
- 16 to 17 October 2014.

2.2.3.1 Plot/Transect Selection and Stratification of the Development Site

Designing an appropriate survey requires consideration of both survey methods and effort. Reference was made to the VIS Classification Database to identify Plant Community Types (PCTs), as well as reviews of other regional and local vegetation mapping and reporting (refer to **Section 2.2.1**) when designing the field survey. The Development Site PCTs were further stratified into Vegetation Zones (condition states) following the initial field survey of the site to determine the appropriate number of transect/plots required in accordance with the BioBanking Assessment Methodology (DECC 2008) as outlined in **Table 2.1**. (Note: at the time of survey, the updated BioBanking and FBA Methodology (OEH 2014) had not been released). Broad condition states include vegetation in 'Moderate/Good' condition and 'Moderate/Good_Poor' condition.

Table 2.1 Minimum Number of Plots/Transects Required per Zone Area (OEH 2012)

Vegetation Zone Area (ha)	Minimum Number of Plot/Transect
0-4	1 transect/plot per 2 ha (or part thereof) or 1 transect/plot if vegetation is in low condition
>4-20	3 transects/plots or 2 transects/plots if vegetation is in low condition
>20-50	4 transects/plots or 3 transects/plots if vegetation is in low condition
>50-100	5 transects/plots or 3 transects/plots if vegetation is in low condition
>100-250	6 transects/plots or 4 transects/plots if vegetation is in low condition
>250-1000	7 transects/plots or 5 transects/plots if vegetation is in low condition (More transects/plots may be needed if the condition of the vegetation is variable across the zone)
>1000	8 transects/plots or 5 transects/plots if vegetation is in low condition or in a homogenous landscape in the Western Division (More transects/plots may be needed if the condition of the vegetation is variable across the zone)

Table 2.2 below outlines the adequacy of the plot-based flora survey with respect to the BioBanking Methodology (DECC 2008) pertinent to the Development Site. Vegetation Zones 1 and 6 occur outside the Development Footprint, but within the Development Site and were therefore also sampled during the surveys undertaken for this assessment.

Table 2.2 Adequacy of Vegetation Survey in the Development Footprint

Vegetation Zone	BVT and Condition Class	Area in the Development Footprint (ha)	No. Plots and Transects Sampled (No. Required in parentheses)		
			Plot	Transect	Rapid Sampling
1	HN614_Moderate/Good	0.0^	1 (0)	1 (0)	0
2	HN614_Moderate/Good_Poor	58.1	7 (5)	7 (5)	0
3	HN570_Moderate/Good	5.3	3 (3)	3 (3)	0
4	HN570_Moderate/Good_Poor	13.1	5 (3)	5 (3)	0
5	HN515_Moderate/Good	1.2	2 (1)	2 (1)	0
6	HN572_Moderate/Good	0.0^	1 (0)	1 (0)	0
	Exotic Pastures	97.5	0 (0)	0 (0)	4

Vegetation Zone	BVT and Condition Class	Area in the Development Footprint (ha)	No. Plots and Transects Sampled (No. Required in parentheses)		
			Plot	Transect	Rapid Sampling
Total			19 (12)	19 (12)	4

^ These vegetation zones occur outside the Development Footprint, but within the Development Site and were also sampled during the surveys undertaken for this assessment prior to the refinement of the Development Footprint.

2.2.3.2 Plot/Transect Data Collected

At each plot/transect data was recorded according to Appendix 2 of the BioBanking Assessment Methodology (BBAM) and Credit Calculator Operational Manual (DECC 2008) (note: at the time of survey, the updated BioBanking and FBA Methodology (OEH 2014) had not been released). This involved setting out 20 x 50 metre and 20 x 20 metre plots and a 50 metre transect. The location of each quadrat was recorded using a hand-held GPS with accuracy of ± 5 metres. The Map Grid of Australia (MGA) coordinate system was used. The location of the 19 plots/transects undertaken within the Development Site is shown on **Figure 3.1**.

At each plot/transect, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 metre plot. Searches of each 20 x 20 metre plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of the shrub, mid-storey, canopy and emergent layers were also thoroughly examined. Effort was made to search the tree canopy and tree trunks for mistletoes, vines and epiphytes.

Species within the plot were also assigned a cover-abundance value to reflect their relative cover and abundance in the plot. Species located outside the plot (recorded to assist in vegetation community identifications and mapping) were marked as present but were not assigned a cover-abundance value. A modified Braun-Blanquet 6-point scale was used to estimate cover-abundances of all plant species within each quadrat (Braun-Blanquet 1927), with selected modifications sourced from Poore (1955) and Austin *et al.* (2000). **Table 2.2** shows the cover-abundance categories used. Voucher specimens were collected of species that could not be identified in the field for later identification. No specimens were required to be sent to the NSW Royal Botanic Gardens for further identification.

Table 2.3 Modified Bran-Blanquet Crown Cover-Abundance Scale

Class	Cover-abundance^	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: <5 individuals Shrubs and small trees: <5 individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Shrubs and small trees: 5 or more individuals Medium-large overhanging tree
3	5 – less than 20% cover	Applies to all species.
4	20 – less than 50% cover	

Class	Cover-abundance [^]	Notes
5	50 – less than 75% cover	
6	75 – 100% cover	

Note: at the time of survey, the updated BioBanking and FBA Methodology (OEH 2014) had not been released including the new requirements for abundance ratings and therefore the modified Braun-Blanquet 6-point scale was used for Cover-Abundance measures.

At each standard flora quadrat, 10 points along a 50 metre transect were assessed for:

- percentage native overstorey cover, and
- percentage native mid-storey cover.

In addition, 50 points along a 50 metre transect were assessed for:

- percentage native groundcover (grass)
- percentage native groundcover (shrubs)
- percentage native ground cover (other), and
- percentage exotic plant cover.

Additional details were also recorded in each quadrat, including soil texture, drainage and depth; site disturbances; physiography (position in the landscape); and vegetation structure (strata percentage covers, heights and dominant species). Photographic records were also taken at each site.

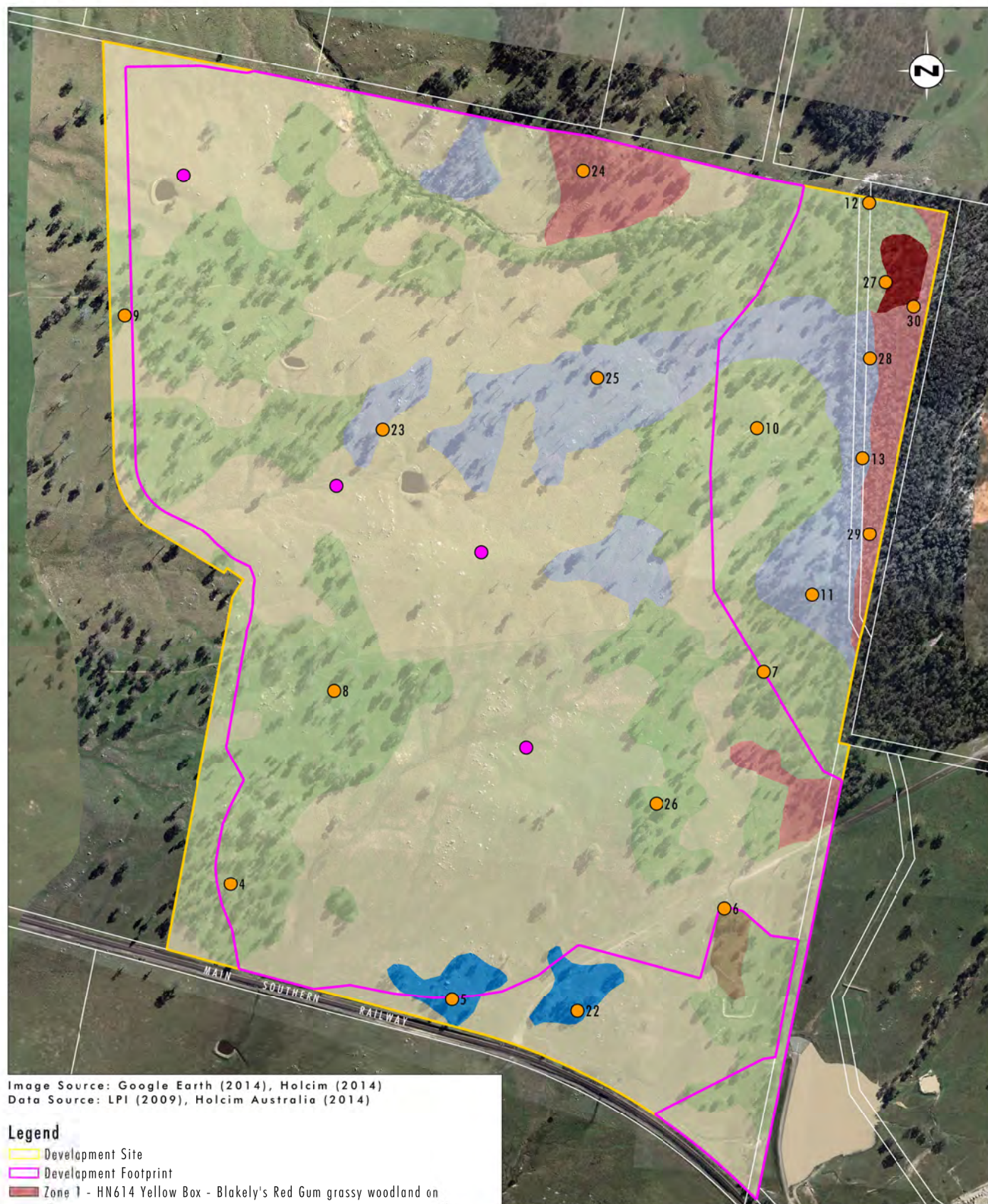


Image Source: Google Earth (2014), Holcim (2014)
Data Source: LPI (2009), Holcim Australia (2014)

Legend

- Development Site
- Development Footprint
- Zone 1 - HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate to Good)
- Zone 2 - HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor)
- Zone 3 - HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good)
- Zone 4 - HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor)
- Zone 5 - HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (Moderate to Good)
- Zone 6 - HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion (Moderate to Good)
- Exotic Pastures

- Flora Plot/Transect Location
- Rapid Sampling Location

0 100 250 500m
1:10 000

FIGURE 2.1

Flora Survey Locations

2.2.4 Semi-quantitative Rapid Sampling

Four rapid vegetation assessments were completed in exotic pastures within the Development Site (refer to **Figure 2.1**) during the February 2014 survey. Assessment areas were not fixed area-based, but were generally confined to an area similar to that of a 20 x 20 metre quadrat.

Rapid sampling was used in combination with rapid reconnaissance and meandering transects primarily to assist in the delineation and refinement of vegetation mapping with respect to the distribution of native and exotic pasture areas. Rapid vegetation assessment points were located within distinct vegetation community units (rather than within ecotones) to allow data collection for each community without confounding effects from adjacent communities. Dominant, common and some uncommon plant taxa were recorded within each rapid vegetation assessment points, along with cover abundance scores as per **Table 2.3**. The vegetation structure at each rapid vegetation assessment point was documented, including the dominant species in each stratum.

2.2.5 Meandering Transects

Meandering transects were undertaken through vegetation units across much of the Development Site, particularly for the delineation and refinement of vegetation mapping and searching for threatened and otherwise significant species, endangered populations and TECs. Meandering transects enabled floristic sampling across a much larger area than systematic quadrats, allowing the survey to achieve a combination of detailed observation and broader appreciation. Records along transects supplemented floristic sampling carried out as part of quadrat survey, however, the data collected was in the form of presence records, rather than semi-quantitative cover abundance scores (note that the cover and abundance of additional species was generally low). Where meandering transects revealed significant variation within a vegetation unit, or a potential new vegetation community, additional quadrat survey was undertaken.

Meandering transects provided invaluable information on spatial patterns of vegetation that informed vegetation community mapping of the Development Site.

2.2.6 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within quadrats and on meandering transects were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Jacobs *et al.* (2008). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from the Australian Plant Census (CHAH 2011), an Australian Government sponsored database which provides a list of currently accepted names for Australian vascular flora.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

2.2.7 Vegetation Mapping

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Site. Vegetation mapping involved the following key steps:

- preliminary review of digital airborne imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography
- preliminary review of the modelled distribution of vegetation communities as part of the South Coast – Illawarra Vegetation Inventory (Tozer *et al.* 2010)

- predicting the distribution of particular vegetation communities based on understanding the distribution of Biometric vegetation types (OEH 2014b) and plant communities described by Armstrong *et al.* (2013) and Tozer *et al.* (2010)
- preparation of draft vegetation community map based on interpretation of digital airborne imagery and preliminary delineation of vegetation community floristics
- ground-truthing of vegetation map based on survey effort documented in **Section 2.2**
- revision of vegetation community floristic delineations based on plot data, and
- revision of the vegetation map based on ground-truthing.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata. Communities were named in accordance with their site character, with consideration of the naming conventions of those vegetation communities identified by Armstrong *et al.* (2013) and the NSW Biometric vegetation types database (version updated June 2008; OEH 2014b).

2.2.8 Threatened Ecological Community Delineation Techniques

Vegetation communities identified in the Development Site were compared to TECs listed under the Commonwealth EPBC Act and NSW TSC Act and an assessment of similarity with the NSW Scientific Committee Final Determinations and the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice.

For the EPBC Act these included comparison between on-ground floristic and landscape information and descriptive information for *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC and *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory* EEC.

For the TSC Act, the same comparison was made with the *White Box Yellow Box Blakely's Red Gum Woodland* EEC and *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions* EEC. The following approach was used:

- Full-floristic quadrat assessment, and meandering survey to determine floristic composition and structure of each ecological community
- comparison with published species lists, including lists of 'important species' as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee
- comparison with habitat descriptions and distributions for listed TECs
- assessment using guidelines and recovery plans published by the Commonwealth DoE and the NSW OEH, and
- comparison with other assessments of TECs in the region.

2.3 Threatened Species

2.3.1 Literature and Database Review

A review of previous documents and reports relevant to the Modification Project was undertaken. This included reports, previous ecological surveys undertaken in the vicinity of the Development Site and also relevant ecological database searches. The information obtained was used to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species and endangered populations. Relevant documents included:

- Ecological Assessment for the Proposed Lynwood Quarry (Umwelt 2005);
- Ecological Assessment for the Proposed Modifications to Lynwood Quarry (Umwelt 2010);
- Hoary Sunray Assessment (Umwelt 2011);
- OEH Threatened Species Website for known/predicted Threatened Ecological Communities (TECs) in the Bungonia subregion, accessed August 2015;
- PlantNET (Royal Botanic Gardens Sydney) database search for Rare or Threatened Australian Plant species within the Goulburn Mulwaree LGA, accessed August 2015; and
- DoE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed August 2015.

A preliminary assessment using the BioBanking Credit Calculator was undertaken which provided a list of species credit species that might require survey and the suitable survey periods for each species. The results of the database searches, literature review and preliminary assessment using the BioBanking Credit Calculator were used to design the survey requirements for species credit species to ensure that adequate surveys were undertaken.

The Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC 2004) was considered when undertaking the threatened species surveys in the Development Site.

2.3.2 Species-credit Flora Surveys

Species-credit flora surveys were undertaken over six days and two survey periods:

- 11 to 14 February 2014, and
- 16 to 17 October 2014.

The February 2014 field survey was undertaken at a time which was unsuitable for detection of most targeted species and therefore an additional survey was undertaken in October 2014 surveys to provide an optimal period for targeting these species. It should be noted that all threatened flora species are species-credit species under the BioBanking Assessment Methodology (OEH 2014).

A preliminary list of species-credit flora species with potential to occur in the Development Site was generated during the literature review, completion of database searches and preliminary assessment using the BioBanking Credit Calculator. The preliminary list of potentially occurring species credit species was reviewed to remove species that are not known to occur in the local area or species for which there was a

lack of suitable habitat in the Development Site. **Table 2.4** identifies the species-credit flora species that may occur in the Development Site and that required targeted and seasonal surveys.

Table 2.4 Species-credit Flora Species Requiring Targeted Survey

Common Name	Scientific Name	TSC Status	EPBC Status	Required Survey Period [^]	Source
hoary sunray	<i>Leucochrysum albicans</i> var. <i>tricolor</i>	-	E	All year	Umwelt (2011) DoE PMST
Bynoes wattle	<i>Acacia bynoeana</i>	E	V	September-March	BioBanking Credit Calculator
few-seeded bossiaea	<i>Bossiaea oligosperma</i>	V	V	All year	OEHS Atlas of NSW Wildlife
Flockton wattle	<i>Acacia flocktoniae</i>	V	V	All year	BioBanking Credit Calculator
buttercup doubletail	<i>Diuris aequalis</i>	E	V	October - December	BioBanking Credit Calculator
pine donkey orchid	<i>Diuris tricolor</i>	V	-	September - October	OEHS Atlas of NSW Wildlife
black gum	<i>Eucalyptus aggregata</i>	V	-	February - December	OEHS Atlas of NSW Wildlife
Camden woollybutt	<i>Eucalyptus macarthurii</i>	V	-	All year	BioBanking Credit Calculator Umwelt (2005)
<i>Solanum armourense</i>	<i>Solanum armourense</i>	E	-	All year	BioBanking Credit Calculator
silky Swainson-pea	<i>Swainsona sericea</i>	V	-	September - March	BioBanking Credit Calculator

[^] Months that surveys are required according to the Threatened Species Profile Database for the Hawkesbury Nepean CMA.

Throughout flora surveys of the Development Site, targeted searches were carried out for threatened flora species that are known to occur in the vicinity of the Development Site or were considered likely to occur based on the species' known distribution and the presence of suitable habitat. Searches for these species were undertaken in suitable habitat along numerous walking meandering transects and within the plot and transect surveys. The seasonal requirements of all species-credit flora species with potential to occur within the Development Site were met by the February and October 2014 survey periods.

2.3.3 Species-credit Fauna Surveys

Species-credit fauna surveys were undertaken over seven days and three survey periods:

- 24 to 28 February 2014
- 27 to 28 August 2014, and
- 16 to 17 October 2015.

A preliminary list of species-credit fauna species with potential to occur in the Development Site was generated during the literature review, completion of database searches and preliminary assessment using the BioBanking Credit Calculator (BBCC). The preliminary list of potentially occurring species-credit fauna species was reviewed to remove species that are not known to occur in the local area or species for which there was a lack of suitable habitat in the Development Site. **Table 2.5** identifies the species-credit fauna species that may occur in the Development Site and that required targeted survey.

Table 2.5 Species-credit Fauna Species Requiring Targeted Survey

Common Name	Scientific Name	TSC Status	EPBC Status	Required Survey Period [^]	Source
pink-tailed legless lizard	<i>Aprasia parapulchella</i>	V	V	September – February	BBCC DoE PMST
regent honeyeater	<i>Anthochaera phrygia</i>	CE	CE	All year	BBCC
swift parrot	<i>Lathamus discolor</i>	E	E	Not specified	DoE PMST
Boooroorlong frog	<i>Litoria booroolongensis</i>	E	E	November – February	BBCC
giant burrowing frog	<i>Heleioporus australiacus</i>	V	V	September – May	BBCC
eastern pygmy possum	<i>Cercartetus nanus</i>	V	-	September – April	BBCC
squirrel glider	<i>Petaurus norfolcensis</i>	V	-	All year	BBCC
koala	<i>Phascolarctos cinereus</i>	V	V	All year	BBCC

Common Name	Scientific Name	TSC Status	EPBC Status	Required Survey Period [^]	Source
eastern bentwing bat (breeding habitat)	<i>Miniopterus schreibersii oceanensis</i>	V	-	October - March	OEH Atlas of NSW Wildlife
large-eared pied bat	<i>Chalinolobus dwyeri</i>	V	V	September - April	OEH Atlas of NSW Wildlife

[^] Months that surveys are required according to the Threatened Species Profile Database for the Hawkesbury Nepean CMA.

Targeted surveys were undertaken for the species listed in **Table 2.5** that included a range of survey techniques including targeted searches, trapping, call playback, spotlighting and remote detection surveys. Throughout surveys of the Development Site, opportunistic surveys for these species were undertaken in suitable habitat along numerous walking meandering transects. The seasonal requirements of all species-credit fauna species with potential to occur within the Development Site were met by the February and August, and October 2014 survey periods. The details of these surveys are discussed in the sections below and specific survey locations are shown on **Figure 2.2**.

2.3.3.1 Pink-tailed Legless-lizard Surveys

Targeted searches for pink-tailed legless lizard were undertaken in February 2014 at four locations (refer to **Figure 2.2**) within the Development Site. The searches targeted areas of potential rocky habitat, with each survey comprising one person hour for a total of four person hours of pink-tailed legless lizard searches. The searches involved traversing rocky outcrops and looking in cracks, crevices and under rocks in the warmest parts of the day as recommended in the *Survey Guidelines for Australia's Threatened Reptiles* (DSEWPC 2011). Although it is acknowledged that the survey effort of turning 150-200 stones was not achieved, it is noted that the Development Site contains very few areas where the groundcover is predominately native that contains rocks 15-60cm diameter, a key indicator of suitable habitat for the species (DoE 2015).

In addition, diurnal herpetological searches were undertaken in 8 locations across the Development Site. During the search likely micro-habitats were examined including around waterbodies, beneath rocks and logs, in tree bark and in ground litter. Each survey consisted approximately 1 person hour of survey, totalling 8 hours of diurnal herpetological surveys.

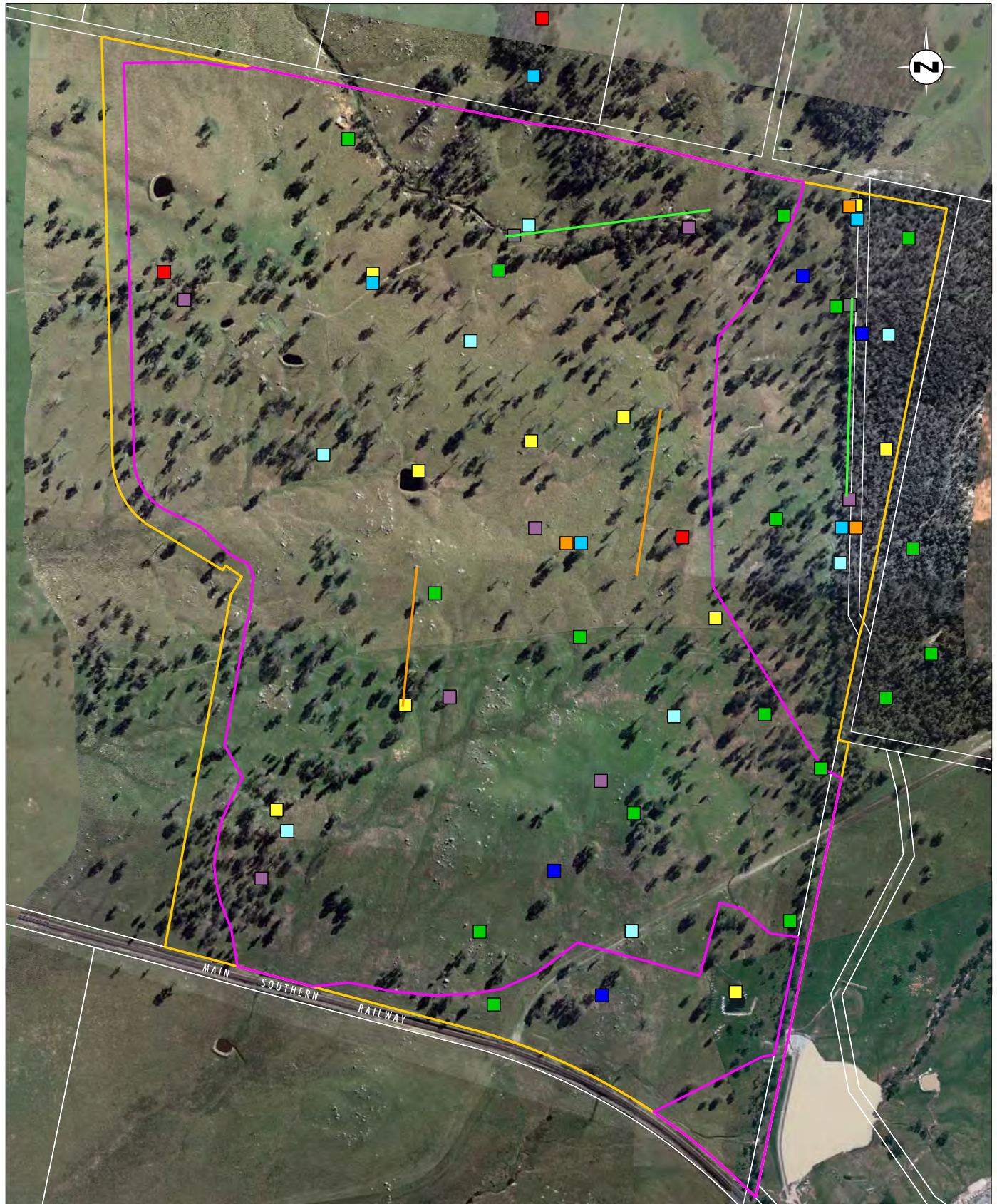


Image Source: Google Earth (2014), Holcim (2014)
Data Source: LPI (2009), Holcim Australia (2014)

Legend

- Development Site
- Development Footprint
- Booroolong Frog and Giant Burrowing Frog Surveys:
 - Diurnal Herpetological Survey
 - Spotlighting
- Micro-bats Surveys:
 - Anabat
 - Habitat Assessment

- Pink-tailed Legless Lizard Surveys:
 - Targeted Rock Searches
 - Diurnal Herpetological Survey
- Eastern Pygmy Possum and Squirrel Glider Surveys:
 - Arboreal Elliot Trapping
 - Hair Funnel
 - Call Playback
 - Remote Camera Survey
 - Spotlighting

- Regent Honeyeater and Swift Parrot Surveys:
 - Summer Diurnal Bird Survey
 - Winter Diurnal Bird Survey
- Koala Surveys:
 - Call Playback
 - Remote Camera Survey
 - Spotlighting

0 100 250 500m
1:10 000

FIGURE 2.2

Fauna Survey Locations

2.3.3.2 Regent Honeyeater and Swift Parrot Surveys

Diurnal bird surveys, each of one person-hour and repeated over two days, were undertaken in two locations within the Development Site in February 2014. An additional location was surveyed immediately north of the Development Site for context. Bird surveys were undertaken at various times of the day, primarily in early to mid morning and mid to late afternoon. Each survey consisted of a slow walking transect within a two hectare area of the survey site.

Targeted regent honeyeater and swift parrot surveys were undertaken across two days in August 2014. The bird surveys targeted areas of box-gum woodlands containing other nectarivorous species such as lorikeets and honeyeaters. A total of 14 targeted surveys were undertaken within the Development Site, as well as an additional three sites in adjacent lands to the east for increased survey context. Each survey consisting of a 5 minute period of call playback for both species followed by 15 minutes of searching which consisted of a slow walking transect within a two hectare area.

Bird species were identified from characteristic calls and by observation using binoculars with magnification up to 10 x. Opportunistic observations were recorded during all other aspects of the field survey.

2.3.3.3 Eastern Pygmy Possum and Squirrel Glider Surveys

Eastern pygmy possum and squirrel glider were targeted by conducting arboreal Elliot trapping, arboreal hair funnels, spotlighting and remote cameras. Additionally, nocturnal call playback surveys were undertaken for squirrel glider.

Arboreal Elliott B traps were set approximately 30 metres apart on tree trunks, and were baited with a mixture of rolled oats, peanut butter and honey. Traps were positioned on platforms attached to the trunks of large trees, 3 to 4 metres above the ground. The trunk of the tree and entrance to the trap were sprayed with a honey and water mixture to attract arboreal mammals. Trap lines were targeted in areas of higher habitat value including along riparian corridors and dense canopied vegetation. A total of 13 arboreal Elliott B traps were set over 4 nights in the Development Site with a total of 52 arboreal Elliott B trap nights undertaken in February 2014.

Arboreal hair funnels were mounted to trees and were baited with a rolled oats, peanut butter and honey mixture. Arboreal hair funnels were positioned 1.5 to 2.0 metres above the ground on tree trunks or branches. The entrance to the hair funnel and the tree trunk were sprayed with a honey and water emulsion as an attractant. A total of 10 arboreal hair funnels were set over 4 nights in the Development Site with a total of 40 arboreal hair funnel sampling nights undertaken in February 2014. All collected hair samples were identified by Barbara Triggs of 'Dead Finish'.

Nocturnal spotlighting surveys, each of one person-hour repeated over two nights, were undertaken in three locations within the Development Site. Spotlighting was conducted on foot within a two hectare area of each survey location using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 8.00 pm and 12.00 am, commencing one hour after dusk. In addition, opportunistic spotlighting was undertaken from a slow-moving vehicle while travelling between fauna survey locations at night.

Bushnell Trophy Cam HDs (remote cameras) were mounted approximately 1 metre above the ground on a tree trunk and positioned towards a bait station containing oats and honey to increase the likelihood of detecting the eastern pygmy possum. One camera was also mounted between 2 and 3 metres up a tree, positioned towards the bait station. This camera was mounted in such a way due to the presence of multiple claw scratches along the trunk of the tree. The cameras were set to take three photos in quick succession when movement was detected. The remote cameras were programmed to record movement on

an ongoing basis until removed from the site. The cameras were installed for four nights in 10 locations, totalling 40 nights of remote camera survey.

Nocturnal call-playback sessions targeting squirrel glider were undertaken at four locations within the Development Site. An additional location was surveyed immediately north of the Development Site for context. Call-playback sessions commenced with a quiet listening period of approximately five minutes. The squirrel glider call was played on a 15 watt directional loud hailer for a minimum of 4 minutes followed by a listening period of 2 minutes.

2.3.3.4 Koala Surveys

Koalas were targeted by conducting nocturnal call playback and walking and driving spotlighting surveys.

Nocturnal spotlighting surveys, each of one person-hour repeated over two nights, were undertaken in three locations within the Development Site. Spotlighting was conducted on foot within a two hectare area of each survey location using 30 watt Lightforce hand-held spotlights and head torch as well as opportunistic spotlighting from a slow-moving vehicle while travelling between fauna survey locations at night. Spotlighting was undertaken generally between 8.00 pm and 12.00 am, commencing one hour after dusk.

Nocturnal call-playback sessions targeting koala were undertaken at four locations within the Development Site. An additional location was surveyed immediately north of the Development Site for context. Call-playback sessions commenced with a quiet listening period of approximately five minutes. The squirrel koala call was played on a 15 watt directional loud hailer for a minimum of 4 minutes followed by a listening period of 2 minutes.

Opportunistic notes on potential koala presence around known koala feed trees, including signs of scats and scratches on trees, was taken throughout the surveys undertaken in the Development Site.

2.3.3.5 Amphibian Surveys

The BioBanking Calculator predicted the occurrence of Booroolong frog (*Litoria booroolongensis*) and giant burrowing frog (*Heleioporus australiacus*) due to the geographic habitat feature of land within 100 metres of a stream or a creek and land within 40 metres of woodland within the Hawkesbury/Nepean catchment area, respectively. Despite these features being within the Development Site, potential habitat for these species is marginal as the site is highly disturbed and in low condition due to extensive sheep grazing pressures. A small area of riparian vegetation occurs in the north of the Development Site and farm dams are scattered throughout the site, however no permanent streams with substantial fringing vegetation occur in the Development Site.

Despite this, diurnal herpetological searches were undertaken in 8 locations across the Development Site. During the search likely micro-habitats were examined including around waterbodies, beneath rocks and logs, in tree bark and in ground litter. Each survey consisted of approximately one person hour of survey, totalling 10 hours of diurnal herpetological surveys.

Nocturnal spotlighting surveys, each of one person-hour repeated over two nights, were also undertaken in three locations within the Development Site. Spotlighting was conducted on foot within a two hectare area of each survey location using 30 watt Lightforce hand-held spotlights and head torch. Spotlighting was undertaken generally between 8.00 pm and 12.00 am, commencing one hour after dusk and targeted relevant habitat features such as farm dams and riparian zones.

2.3.3.6 Micro-bat Habitat Surveys

The eastern bentwing-bat is a species-credit species for breeding habitat only. For the eastern bentwing-bat this includes areas containing caves or similar structures. The large-eared pied bat is a species-credit species with roosting habitat containing escarpments, cliffs, caves, deep crevices and mine shafts and foraging habitat occurring in proximity to these features. Habitat searches for these features were conducted throughout the Development Site. If these features were identified, notes on the sizes, structure and suitability of the habitat for these species were taken.

The presence of threatened micro-bat species was also surveyed using Anabat SD1 recorders at two locations within the Development Site. At each site, the Anabat was positioned at an approximate 30 degree angle one metre above the ground in waterproof housing. Each detector was positioned towards potential micro-bat flight paths or over waterbodies to increase the likelihood of detecting micro-bat species. The Anabat detector was programmed to start recording from one hour before sunset to one hour after sunrise.

Recordings of bat calls were analysed by Glenn Hoyer of Fly By Night Bat Surveys Pty Ltd (a recognised expert in the identification of micro-bat calls). The echolocation calls of species were identified to one of three levels of confidence:

- confident
- probable, and
- possible.

3.0 Results

3.1 Landscape Value

3.1.1 Landscape Features

The outer assessment circle contains some prominent landscape features including sections of 4th order streams, Lockyersleigh Creek and Joarimin Creek. The outer assessment circle also covers multiple Mitchell landscapes and an extensive area of native vegetation in the north and east of the circle. These landscape features are shown in **Figures 1.4** and **1.5**.

Landscape features that were considered in the connectivity value scores for the Development Site are outlined in **Table 3.1** below.

Table 3.1 Landscape Features in the Development Site

Landscape Features	
IBRA Bioregion	South Eastern Highlands
IBRA Subregion	Bungonia
Mitchell Landscape	Oberon – Kialla Granites
Rivers, Streams, Estuaries	1 st , 2 nd and 3 rd order streams from Lockyersleigh Creek
Wetlands	None identified
Native Vegetation	235 hectares in the inner assessment circle 1854 hectares in the outer assessment circle
State or Regional Biodiversity Links	None identified

3.1.2 Landscape Value Scores

3.1.2.1 Percent Native Vegetation Cover

Table 3.2 details the percent native vegetation cover before and after the proposed disturbance in the Development Footprint and the native vegetation per cent class entered into the BioBanking Calculator as per Table 9 of Appendix 4 of the FBA (OEH 2014).

Table 3.2 Native Vegetation Cover in Assessment Circles

Assessment Circle	Before Development			After Development		
	Area of Native Vegetation (ha)	Native Vegetation Cover (%)	Native Vegetation Percent Class	Area of Native Vegetation (ha)	Native Vegetation Cover (%)	Native Vegetation Percent Class
Outer (5,000 ha)	1854	37	36-40	1776	36	36-40
Inner (500 ha)	235	47	46-50	157	31	31-35

3.1.2.2 Connectivity Value

No state or regional significant biodiversity links were identified within a plan approved by the Chief Executive of OEH in the South Eastern Highlands. Although a number of tributaries run through the Development Site, including first, second and third order streams from Lockyersleigh Creek, these are not defined as state or regional significant biodiversity links under the FBA (OEH 2014) (refer to **Figure 3.1**).

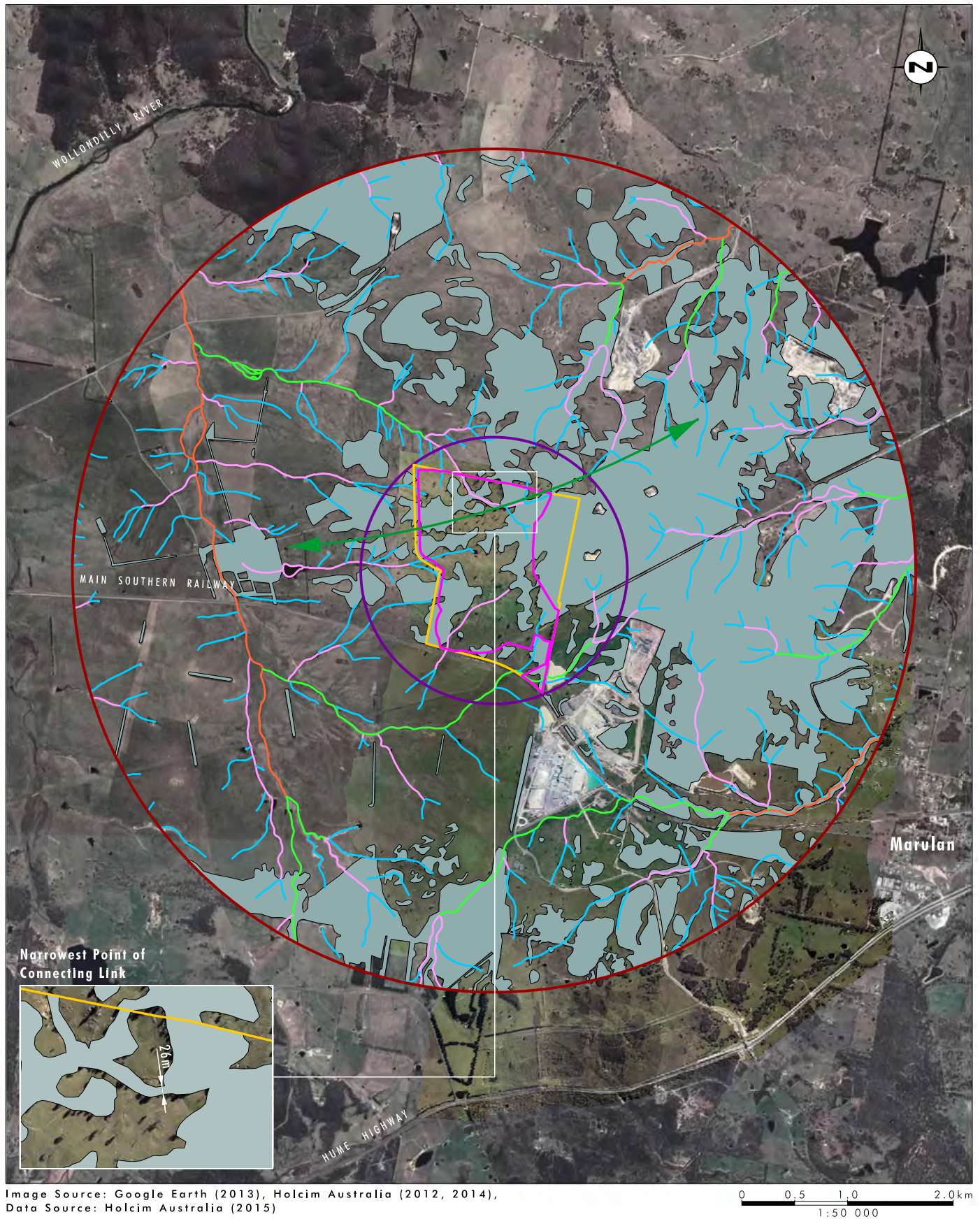
Connecting links using moderate to good condition native vegetation were found on the site to occur in all woodland communities in the Development Site. The current narrowest point of these links occurs in the north of the Development Site along a strip of riparian vegetation along a second order stream and is estimated to be approximately 26 metres wide (refer to **Figure 3.1**). After the development of the Modification Project, this link would be removed and the development will sever the connecting links in the Development Footprint. Therefore it is considered that the connectivity width class after the development of the Modification Project would be zero (refer to **Table 3.3**).

Woody PCTs within the outer assessment circle were estimated for their current average condition for overstorey foliage cover and midstorey foliage cover. This was estimated based on previous surveys and the collection of BioMetric data (Umwelt 2015, unpublished) in vegetation within the outer assessment circle. The overstorey per cent foliage cover in the woody vegetation in the outer assessment circle was estimated, on the whole, to be $\geq 25\%$ of the lower benchmark. The midstorey per cent foliage cover in the woody vegetation in the outer assessment circle was estimated, on the whole, to be within benchmark. These are likely to remain the same after the Modification Project.

Details of the connectivity value scores entered into the BioBanking Credit Calculator are shown in **Table 3.3** below.

Table 3.3 Connectivity Value Scores

Attribute	Before Development	After Development
Connectivity Width Class	>5-30	0-5
Connectivity Overstorey Condition	PFC $\geq 25\%$ of lower benchmark	PFC $\geq 25\%$ of lower benchmark
Connectivity Midstorey Condition	PFC within benchmark	PFC within benchmark



Legend

- Development Site
- Development Footprint
- 500ha Assessment Circle
- 5000ha Assessment Circle
- Native Vegetation
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- Connecting link

FIGURE 3.1
Connectivity Value

3.1.2.3 Patch Size

Table 3.4 below details the parameters that determined the Patch Size score as per Table 15 of Appendix 4 of the FBA (OEH 2014).

Table 3.4 Patch Size Score Parameters

Mitchell Landscape	Oberon – Kialla Granites
Percent Native Vegetation Cleared	89%
Patch Size Class	> 100 hectares
Patch Size Score	12

3.1.2.4 Landscape Value Score

The landscape value score for the Development Site is 15.80.

3.2 Native Vegetation within the Development Site

3.2.1 Biometric Vegetation Types and Vegetation Zones

Surveys of the Development Site identified four Biometric Vegetation Types (BVTs) (excluding exotic pastures) being:

- HN614 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
- HN570 - Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
- HN515 - Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion, and
- HN572 - Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion.

These BVTs were aligned with types described as part of the NSW Biometric vegetation types database (OEH 2014b), Upper Murrumbidgee plant community classification (Armstrong *et al.* 2013) and South Coast Illawarra Vegetation Inventory (Tozer *et al.* 2010). The BVTs were then categorised into six vegetation condition zones (refer to **Figure 3.2**). The composition of these vegetation zones are outlined in **Tables 3.5** to **3.10** below.

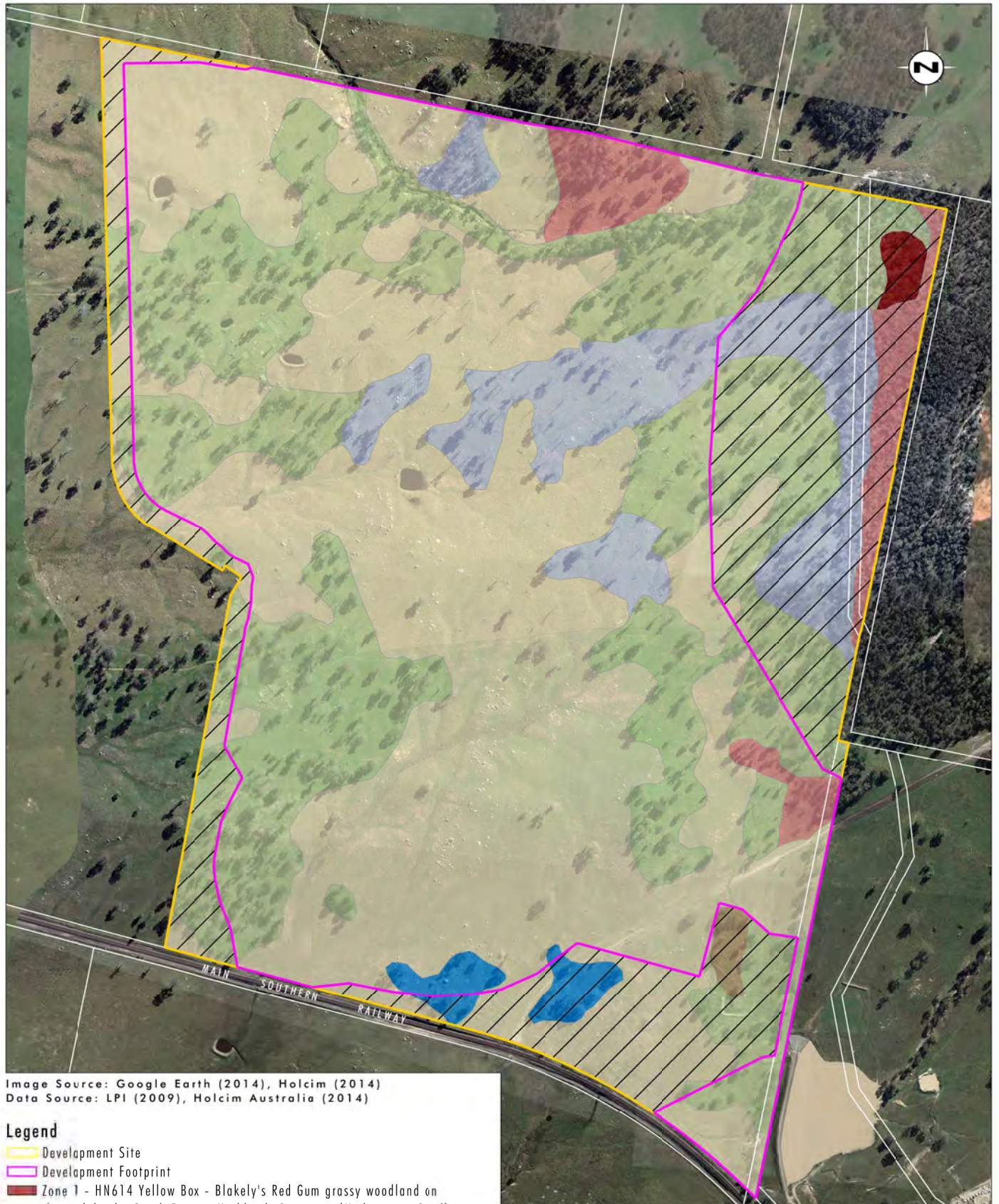


Image Source: Google Earth (2014), Holcim (2014)
Data Source: LPI (2009), Holcim Australia (2014)

Legend

- Development Site
- Development Footprint
- Zone 1 - HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate to Good)
- Zone 2 - HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor)
- Zone 3 - HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good)
- Zone 4 - HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor)
- Zone 5 - HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (Moderate to Good)
- Zone 6 - HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion (Moderate to Good)
- Exotic Pastures

Areas not Impacted

0 100 250 500m
1:10 000

FIGURE 3.2

Vegetation Zones in
the Development Site

Table 3.5 Zone 1: HN614 – Yellow Box – Blakely’s Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion – Moderate to Good Condition

Feature	Description
Name	Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
Condition	Moderate to Good
BVT ID	HN614
PCT ID	1330
Vegetation Formation	Grassy Woodlands
Vegetation Class	Southern Tableland Grassy Woodlands
Hectares in Development Site	0.98
Hectares in Development Footprint	0.0
Tozer <i>et al.</i> (2010) Equivalent	Tableland Grassy Box-Gum Woodland
Armstrong <i>et al.</i> (2013) Equivalent	p24 Yellow Box – Blakely’s Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands Bioregion
Plots/Transects Undertaken	One (P27)
Floristic Description	This community is a tall woodland that occupies more fertile lower parts of the landscape where resources such as water and nutrients are more available. The majority of the woodland area is dominated by yellow box (<i>Eucalyptus melliodora</i>) and Blakely’s red gum (<i>E. blakelyi</i>) with an understorey dominated by rough speargrass (<i>Austrostipa scabra</i> subsp. <i>falcata</i>), snowgrass (<i>Poa sieberiana</i>), weeping grass (<i>Microlaena stipoides</i> var. <i>stipoides</i>), numerous wallaby grasses (<i>Rytidosperma</i> spp.) and blown grass (<i>Lachnagrostis filiformis</i>); and forbs including wattle mat-rush (<i>Lomandra filiformis</i> subsp. <i>coriacea</i>) and climbing saltbush (<i>Einadia nutans</i> subsp. <i>nutans</i>). This vegetation zone also contains a range of native non-grass understorey species including six ‘important’ species under the EPBC Act including <i>Bulbine bulbosa</i>, <i>Chrysocephalum apiculatum</i>, <i>Diuris sulphurea</i>, <i>Hypericum gramineum</i>, <i>Sebaea ovata</i> and <i>Triptilodiscus pygmaeus</i>. Approximately 10% cover of the highly invasive serrated tussock (<i>Nassella trichotoma</i>) occurs in this patch. Flora species recorded in this zone are included in Appendix A.
TSC Status	White Box Yellow Box Blakely’s Red Gum Woodland EEC
EPBC Status	White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland CEEC

Feature	Description
Habitat Value	Moderate – hollow-bearing trees and fallen logs provide moderate habitat for local fauna species.
Photo	

Table 3.6 Zone 2: HN614 – Yellow Box – Blakely’s Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion – Moderate to Good_Poor Condition

Feature	Description
Name	Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
Condition	Moderate to Good_Poor
BVT ID	HN614
PCT ID	1330
Vegetation Formation	Grassy Woodlands
Vegetation Class	Southern Tableland Grassy Woodland
Hectares in Development Site	81.2
Hectares in Development Footprint	58.1
Tozer <i>et al.</i> (2010) Equivalent	Tableland Grassy Box-Gum Woodland

Feature	Description
Armstrong <i>et al.</i> (2013) Equivalent	p24 Yellow Box – Blakely’s Red Gum tall grassy woodland on undulating sedimentary and acid-volcanic substrates in the Goulburn area of the South Eastern Highlands Bioregion
Plots/Transects Undertaken	Seven (P04, P07, P08, P09, P10, P12, P26)
Floristic Description	This community is a tall woodland that occupies more fertile lower parts of the landscape where resources such as water and nutrients are more available. While the overstorey is intact, this community is considered highly disturbed due to a dominance of annual and perennial exotic grasses and a lack of native herbaceous groundcover or recruitment of overstorey species. These conditions indicate that the area has been subjected to a high level of historic grazing resulting in a loss of native understorey diversity and partial loss of A-horizon soils. The majority of the woodland area is dominated by yellow box (<i>Eucalyptus melliodora</i>) and Blakely’s red gum (<i>E. blakelyi</i>) with isolated occurrences of snow gum (<i>E. pauciflora</i> subsp. <i>pauciflora</i>), and an understorey dominated by exotic annual pasture species including soft brome (<i>Bromus hordeaceus</i>), prairie grass (<i>Bromus catharticus</i>), <i>Bromus brevis</i>, rats-tail fescue (<i>Vulpia myuros</i>) and exotic perennials including cocksfoot (<i>Dactylis glomerata</i>) and serrated tussock (<i>Nassella trichotoma</i>). Common exotic forbs include spear thistle (<i>Cirsium vulgare</i>), flatweed (<i>Hypochaeris radicata</i>) and Chilean whitlow wort (<i>Paronychia brasiliensis</i>). Native understorey species are scattered throughout the exotic pastures, with grasses including rough speargrass (<i>Austrostipa scabra</i> subsp. <i>falcata</i>), snowgrass (<i>Poa sieberiana</i>), weeping grass (<i>Microlaena stipoides</i> var. <i>stipoides</i>), numerous wallaby grasses (<i>Rytidosperma</i> spp.) and blown grass (<i>Lachnagrostis filiformis</i>), and forbs including wattle mat-rush (<i>Lomandra filiformis</i> subsp. <i>coriacea</i>) and climbing saltbush (<i>Einadia nutans</i> subsp. <i>nutans</i>). Flora species recorded in this zone are included in Appendix A.
TSC Status	<i>White Box Yellow Box Blakely’s Red Gum Woodland</i> EEC
EPBC Status	None. This community does not conform to <i>White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland</i> CEEC due to the primarily exotic understorey (refer to Section 3.2.2.3 for clarification).
Habitat Value	Low – some hollow-bearing trees and fallen logs provide minimal habitat for local fauna species.

Feature	Description
Photo	

Table 3.7 Zone 3: HN570 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion – Moderate to Good Condition

Feature	Description
Name	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
Condition	Moderate to Good
BVT ID	HN570
PCT ID	1093
Vegetation Formation	Dry Sclerophyll Forests (shrubby)
Vegetation Class	Southern Tableland Dry Sclerophyll Forests
Hectares in Development Site	8.9
Hectares in Development Footprint	5.3
Tozer <i>et al.</i> (2010) Equivalent	Western Tablelands Dry Forest
Armstrong <i>et al.</i> (2013) Equivalent	p14 Red Stringybark – Scribbly Gum – <i>Rytidosperma pallidum</i> tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion.

Feature	Description
Plots/Transects Undertaken	Three (P24, P29, P30)
Floristic Description	This community occupies loamy low ridges and rises. The overstorey is generally intact and is dominated by red stringybark (<i>Eucalyptus macrorhyncha</i>), with infrequent yellow box (<i>E. melliodora</i>) and Blakely's red gum (<i>E. blakelyi</i>). A sparse midstorey contains species such as Parramatta wattle (<i>Acacia parramattensis</i>) while the understorey is dominated by serrated tussock, there are native elements including sub-shrubs such as urn-heath (<i>Melichrus urceolatus</i>) and honeypots (<i>Acrotriche serrulata</i>), grasses including foxtail speargrass (<i>Austrostipa densiflora</i>), rough speargrass (<i>Austrostipa scabra</i> subsp. <i>falcata</i>) and ringed wallaby grass (<i>Rytidosperma caespitosa</i>), and forbs including wattle mat-rush (<i>Lomandra filiformis</i> subsp. <i>coriacea</i>) and climbing saltbush (<i>Einadia nutans</i> subsp. <i>nutans</i>). Other forbs include <i>Gonocarpus tetragynus</i>, <i>Poranthera microphylla</i>, <i>Cymbonotus</i> spp., <i>Hydrocotyle laxiflora</i> and <i>Stypandra glauca</i> as well as the fern <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>. Serrated tussock is also present within this area. Flora species recorded in this zone are included in Appendix A.
TSC Status	None.
EPBC Status	None.
Habitat Value	Moderate – hollow-bearing trees and fallen logs provide moderate habitat for local fauna species.
Photo	

Table 3.8 Zone 4: HN570 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion – Moderate to Good_Poor Condition

Feature	Description
Name	Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion
Condition	Moderate to Good_Poor
BVT ID	HN570
PCT ID	1093
Vegetation Formation	Dry Sclerophyll Forests (shrubby)
Vegetation Class	Southern Tableland Dry Sclerophyll Forests
Hectares in Development Site	21.5
Hectares in Development Footprint	13.1
Tozer <i>et al.</i> (2010) Equivalent	Western Tablelands Dry Forest
Armstrong <i>et al.</i> (2013) Equivalent	p14 Red Stringybark – Scribbly Gum – <i>Rytidosperma pallidum</i> tall grass-shrub dry sclerophyll open forest on loamy ridges of the central South Eastern Highlands bioregion.
Plots/Transects Undertaken	Five (P11, P13, P23, P25, P28)
Floristic Description	This community occupies loamy low ridges and rises. The overstorey is generally intact; however, similar to Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (HN614 Moderate to Good_Poor) much of the understorey is highly degraded due to a dominance of annual and perennial exotic grasses and a lack of native herbaceous groundcover. The tall open forest is dominated by red stringybark (<i>Eucalyptus macrorhyncha</i>), with infrequent yellow box (<i>E. melliodora</i>) and Blakely's red gum (<i>E. blakelyi</i>), and an understorey dominated by perennial exotic grasses including serrated tussock (<i>Nassella trichotoma</i>). A sparse midstorey contains species such as Parramatta wattle (<i>Acacia parramattensis</i>) while the understorey is dominated by serrated tussock, there are scattered native elements including sub-shrubs such as urn-heath (<i>Melichrus urceolatus</i>) and honeypots (<i>Acrotriche serrulata</i>), grasses including foxtail speargrass (<i>Austrostipa densiflora</i>), rough speargrass (<i>Austrostipa scabra</i> subsp. <i>falcata</i>) and ringed wallaby grass (<i>Rytidosperma caespitosa</i>), and forbs including wattle mat-rush (<i>Lomandra filiformis</i> subsp. <i>coriacea</i>) and climbing saltbush (<i>Einadia nutans</i> subsp. <i>nutans</i>). Flora species recorded in this zone are included in Appendix A.
TSC Status	None.

Feature	Description
EPBC Status	None.
Habitat Value	Low – some young trees and fallen logs provide minimal habitat for local fauna species.
Photo	

Table 3.9 Zone 5: HN515 – Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion – Moderate to Good Condition

Feature	Description
Name	Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion
Condition	Moderate to Good
BVT ID	HN515^
PCT ID	732
Vegetation Formation	Grassy Woodlands
Vegetation Class	Southern Tablelands Grassy Woodlands
Hectares in Development Site	2.9
Hectares in Development Footprint	1.2
Tozer <i>et al.</i> (2010) Equivalent	Southern Tableland Flats Forest

Feature	Description
Armstrong <i>et al.</i> (2013) Equivalent	p220 Ribbon Gum – Snow Gum tableland flats tall grassy woodland primarily on granitoids in the Kybean – Gourrock and Monaro subregions of the South Eastern Highlands bioregion.
Plots/Transects Undertaken	Two (P05, P22)
Floristic Description	This community occurs on low rises associated with granite outcrops. The overstorey is sparse due to reduced natural recruitment adjacent to a frost hollow and grazing disturbance, or potentially due to historic partial clearing. The understorey is highly degraded due to a dominance of annual and perennial exotic grasses, although patches of native groundcover are evident. The sparse tree layer is dominated by ribbon gum (<i>Eucalypts viminalis</i>), with isolated occurrences of snow gum (<i>E. pauciflora</i> subsp. <i>pauciflora</i>), apple box (<i>E. bridgesiana</i>) and Blakely's red gum (<i>E. blakelyi</i>). The midstorey layer is absent, with the understorey dominated by exotic grasses including barley grass (<i>Hordeum leporinum</i>), serrated tussock (<i>Nassella trichotoma</i>), rats-tail fescue (<i>Vulpia myuros</i>) and brome (<i>Bromus</i> spp.) and exotic forbs such as Chilean whitlow wort (<i>Paronychia brasiliensis</i>), sheep sorrel (<i>Acetosella vulgaris</i>) and catsear (<i>Hypochaeris radicata</i>). Native elements include rough speargrass (<i>Austrostipa scabra</i> subsp. <i>falcata</i>), weeping grass (<i>Microlaena stipoides</i> var. <i>stipoides</i>), snow grass (<i>Poa sieberiana</i>), wallaby grass (<i>Rytidosperma laeve</i>), climbing saltbush (<i>Einadia nutans</i> subsp. <i>nutans</i>), common woodruff (<i>Asperula conferta</i>) and variable glycine (<i>Glycine tabacina</i>). Flora species recorded in this zone are included in Appendix A.
TSC Status	Possible <i>Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions</i> EEC (refer to Section 3.2.3.2 for clarification).
EPBC Status	None.
Habitat Value	Low – some trees and fallen logs provide minimal habitat for local fauna species.

Feature	Description
Photo	

Table 3.10 Zone 6: HN572 – Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion – Moderate to Good Condition

Feature	Description
Name	Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion
Condition	Moderate to Good
BVT ID	HN572
PCT ID	1100
Vegetation Formation	Grassy Woodlands
Vegetation Class	Tableland Clay Grassy Woodlands
Hectares in Development Site	0.9
Hectares in Development Footprint	0.0
Tozer <i>et al.</i> (2010) Equivalent	Tableland Swamp Flats Forest
Armstrong <i>et al.</i> (2013) Equivalent	p520 Ribbon Gum very tall woodland on alluvial soils along drainage lines of the eastern South Eastern Highlands bioregion.
Plots/Transects Undertaken	One (P06)

Feature	Description
Floristic Description	This community occurs within a damp drainage depression in the south east of the Development Site. While small in extent, based on landform features this community was likely to be uncommon within the Development Site prior to clearing. The overstorey is dominated by Ribbon Gum (<i>Eucalyptus viminalis</i>), with infrequent Blakely's Red Gum (<i>E. blakelyi</i>) to a height of 20 metres. The midstorey is absent, and the understorey is dominated by exotic grasses and forbs. Exotic grasses include soft brome (<i>Bromus molliformis</i>), rats tail fescue (<i>Vulpia myuros</i>), serrated tussock (<i>Nassella trichotoma</i>) and barley grass (<i>Hordeum leporinum</i>) as well as exotic forbs such as spear thistle (<i>Cirsium vulgare</i>), variegated thistle (<i>Silybum maritimum</i>), Chilean whitlow wort (<i>Paronychia brasiliensis</i>), sheep sorrel (<i>Acetosella vulgaris</i>) and catsear (<i>Hypochaeris radicata</i>). Native elements include rough speargrass (<i>Austrostipa scabra</i> subsp. <i>falcata</i>), common wheatgrass (<i>Elymus scaber</i>), climbing saltbush (<i>Einadia nutans</i> subsp. <i>nutans</i>) and <i>Geranium solanderi</i> var. <i>solanderi</i>. Flora species recorded in this zone are included in Appendix A.
TSC Status	None. This community does not conform to <i>Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions</i> EEC due to the high dominance of annual exotic grasses and short-lived perennial exotic forbs (refer to Section 3.2.3.2 for clarification).
EPBC Status	None.
Habitat Value	Low to moderate – some trees and fallen logs provide minimal habitat for local fauna species.
Photo	

3.2.1.1 Exotic Pastures

Exotic pastures occupies a large portion of the Development Site (refer to **Figure 3.2**). It is highly degraded due to extensive sheep grazing, with a high dominance of exotic flora species. Within this community, exotic pasture grasses such as rats-tail fescue (*Vulpia myuros*), soft brome (*Bromus hordeaceus*), *Bromus brevis* and serrated tussock (*Nassella trichotoma*) are dominant, along with exotic forbs such as saffron thistle (*Carthamus lanatus*), spear thistle (*Cirsium vulgare*), buchan weed (*Hirschfeldia incana*), catsear (*Hypochaeris radicata*), Chilean whitlow wort (*Paronychia brasiliiana*), sheep sorrel (*Acetosella vulgaris*) and red-flowered mallow (*Modiola caroliniana*).

Exotic pastures on the site do not meet the definition of 'native vegetation' under the *Native Vegetation Act 2003* and therefore could not be aligned with a BVT or vegetation zone and is excluded from further assessment as per Section 9.5 of the FBA (OEH 2014).

3.2.2 Current Site Value

Table 3.11 below details the current site value scores for each of the vegetation zones in the Development Footprint. Vegetation Zones 1 and 6 have been excluded as these occur outside the Development Footprint. The raw site condition attribute data for each of the vegetation zones is provided in **Appendix B**.

Table 3.11 Vegetation Zone Site Value Scores

Vegetation Zone No.	Vegetation Zone	Current Site Value Score
2	HN614 – Yellow Box – Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor Condition)	43.48
3	HN570 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good Condition)	63.02
4	HN570 – Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor Condition)	56.77
5	HN515 – Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (Moderate to Good Condition)	43.48

3.2.3 Threatened Ecological Communities

Three TECs, listed under the TSC or EPBC Act, were recorded in the Development Site (refer to **Figure 3.3**) being:

- *White Box Yellow Box – Blakely’s Red Gum Woodland EEC* under the TSC Act (refer to **Section 3.2.3.1**)
- *Possible Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland EEC* under the TSC Act (refer to **Section 3.2.3.2**), and
- *White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland CEEC* under the EPBC Act (refer to **Section 3.2.3.3**).

Analysis of consistency to the scientific determinations for each TEC was undertaken, with consideration of the advice provided by the NSW Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee guidelines for interpreting listings for species, populations and ecological communities under the TSC Act and EPBC Act respectively.

White Box – Yellow Box – Blakely’s Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act occurs outside the Development Footprint and therefore only one TEC and one possible TEC will be subject to disturbance as a result of the Modification Project. One other potential TEC, *Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT EEC* under the EPBC Act, was also assessed for its presence within the Development Site, however the recorded BVTs do not conform to this TEC. An assessment of the potential occurrence of this TEC is provided in **Section 3.2.3.4**.

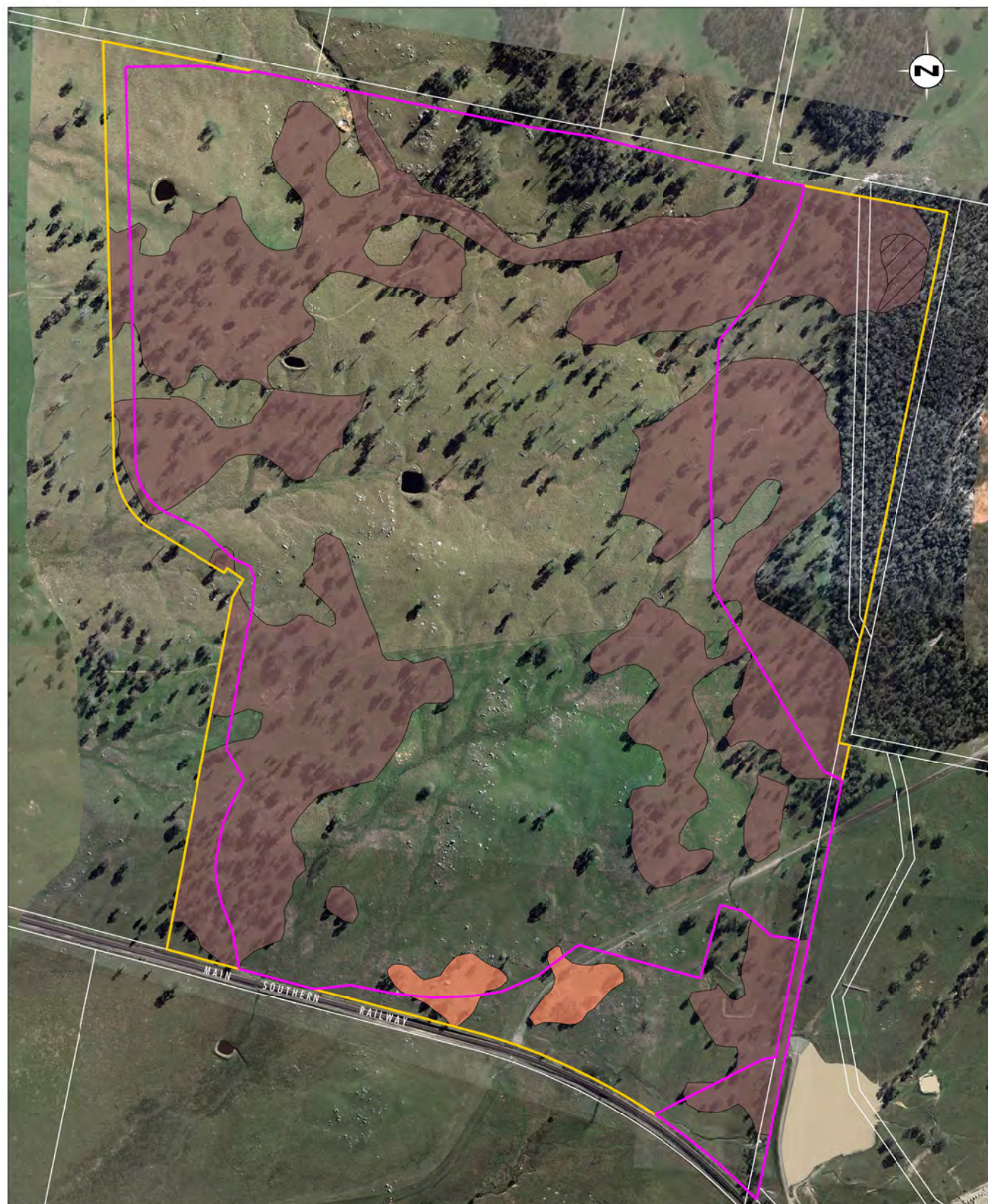


Image Source: Google Earth (2014)
Data Source: LPI (2009), Holcim Australia (2014)

0 100 250 500m
1:10 000

Legend

- Development Site
- Development Footprint
- White Box - Yellow Box - Blakelys Red Gum Woodland EEC under TSC Act
- White Box - Yellow Box - Blakelys Red Gum Woodland and Derived Native Grassland CEEC under the EPBC Act
- Possible Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland EEC under the TSC Act

FIGURE 3.3

Threatened Ecological Communities
within the Development Site

3.2.3.1 *White Box Yellow Box Blakely's Red Gum Woodland* EEC under the TSC Act

White Box Yellow Box – Blakely's Red Gum Woodland is listed as an endangered ecological community under the TSC Act. The community is known to occur from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW and is characterised by the presence or prior occurrence of white box (*Eucalyptus albens*), yellow box (*Eucalyptus melliodora*) and/or Blakely's red gum (*Eucalyptus blakelyi*).

The Development Site supports a total of 82.1 hectares of *White Box Yellow Box Blakely's Red Gum Woodland* EEC under the TSC Act within HN615 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good condition and Moderate/Good_Poor condition). A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to the Final Determination for this community (NSW Scientific Committee 2002).

Constituent Species

The species recorded within White Box Yellow Box Blakely's Red Gum Woodland EEC in the Development Site comprise species, and/or taxa below species rank, as required by the Act.

This included the canopy species of yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*E. blakelyi*), but not white box (*E. albens*) which naturally occurs west and north of the Development Site. However, it is worth noting that the understorey is almost entirely exotic across the vast majority of community within the Development Site, with greater than 50 percent of groundcover species being non-native vegetation (HN615 Moderate/Good_Poor condition).

Assemblage of Species

Due to the broad geographic range of this EEC, the NSW Scientific Committee (2002) lists 95 species as characterising the assemblage of species for *White Box Yellow Box Blakely's Red Gum Woodland* EEC. As part of ecological investigations for the Project, eight systematic 20 metre x 20 metre quadrats were sampled in *White Box Yellow Box Blakely's Red Gum Woodland* EEC across the Development Site.

Within the Development Site, either yellow box (*Eucalyptus melliodora*) or Blakely's red gum (*E. blakelyi*) were recorded in all quadrats. A total of 16 species (17 per cent) of the species listed in the Final Determination were present within this community across the Development Site.

Particular Area

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Woodland* EEC, the NSW Scientific Committee (2002) states that the community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions.

The Development Site is situated within the South Eastern Highlands Bioregion.

Supplementary Descriptors

In relation to supplementary descriptors, the NSW Scientific Committee (2002) includes the following key information pertaining to the *White Box Yellow Box Blakely's Red Gum Woodland* EEC:

- occurs on relatively fertile soils, generally between 400 and 800 millimetre isohyets, and at an altitude of circa 170 metres to circa 1200 metres

- the shrub layer is generally sparse or absent, though it may be locally common, and
- condition states may range from relatively good to highly degraded, such as paddock remnants with a weedy understorey and only a few hardy natives left. The tree layer may be absent as a result of past clearing or thinning.

Of the above supplementary descriptors, the *White Box Yellow Box Blakely's Red Gum Woodland* EEC present in the Development Site occurs on relatively fertile soil in comparison to adjacent remnant vegetation. The altitude is circa 700 metres above sea level. The shrub layer is non-existent, and while some of this may have been as a result of past clearing and grazing management, shrubs were most likely sparse. While the overstorey is relatively intact, the understorey is highly degraded, and dominated by perennial and annual exotic grasses.

3.2.3.2 Possible *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland* EEC under the TSC Act

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland is listed as an endangered ecological community under the TSC Act. The community is known to occur in the South Eastern Highlands of NSW and is characterised by the presence of apple box (*Eucalyptus bridgesiana*), swamp gum (*E. ovata*), black gum (*E. aggregata*), mountain gum (*E. dalrympleana*), broad-leaved peppermint (*E. dives*) and narrow-leaved peppermint (*E. radiata*).

The Development Site is considered to possibly support 2.9 hectares of *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland* EEC within HN515 - Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion. A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to the listing advice provided in the Final Determination for the EEC by the NSW Scientific Committee (2011) and consideration of supplementary advice on the NSW Threatened Species website (OEH 2014a).

Constituent Species

The species recorded within HN515 - Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion in the Development Site comprise species, and/or taxa below species rank, as required by the Act for *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland* EEC.

However, it is worth noting that the understorey was considered exotic across the entire community within the Development Site, with greater than 50 percent of perennial groundcover species being non-native vegetation.

Assemblage of Species

The NSW Scientific Committee (2011) lists 58 species as characterising the assemblage of species *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland* EEC. As part of ecological investigations for the Project, two systematic 20 metre x 20 metre quadrats were sampled in this potential EEC within the Development Site. Of these, ribbon gum (*E. viminalis*) was recorded as the dominant tree in all plots. While 12 species (21 per cent) of the species listed in the Final Determination were present within this community across the Development Site, no plots were considered to have a native understorey as defined under the NSW *Native Vegetation Act 2003*. This was also the case for all areas observed in this community.

The Final Determination provided by the NSW Scientific Committee (2011) does not indicate that remnants dominated by an annual exotic understorey are part of the EEC, however it suggests the following:

- The groundlayer is dominated by grasses and other herbaceous species including *Themeda triandra*, *Poa* spp., *Austrostipa* spp., *Austrodanthonia* (syn. *Rytidosperma* spp.), *Leptorhynchos squamatus*, *Chrysocephalum apiculatum* and *Asperula conferta*
- It may also occur as a secondary grassland where the dominant trees have been removed but the ground stratum remains, and
- At any one time, above ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers.

While the diversity of the native seedbank was not able to be determined as part of this Project, it is likely to be largely restricted to the species which were recorded during the survey. This assumption is drawn on the basis of a long vegetation and soil disturbance history (grazing commenced on the property over 180 years ago). A low yet present diversity of native understorey species were present in areas where this community occurs on granitoids, suggesting that the community may respond to assisted natural regeneration as described on the NSW Threatened Species Website (OEH 2014). Understorey species present in low abundance that are mentioned in the Final Determination include *Acaena ovina*, *Asperula conferta*, *Austrostipa scabra* subsp. *falcata*, *Dichelachne crinita*, *Elymus scaber*, *Hydrocotyle laxiflora*, *Juncus australis*, *Microlaena stipoides* and *Poa sieberiana*. *Austrostipa scabra* subsp. *falcata* was common in patches; however the entire native understorey was assessed as containing 34 per cent native cover, with 60 per cent being annual exotic grasses.

While consideration of the Final Determination on its own is not conclusive as it gives no solid guidance on the eligibility of remnants with a dominance of annual or perennial exotic understorey species, when coupled with the following advice on the habitat and ecology of this ecological community from the NSW Threatened Species Website (OEH 2014), areas with the potential to recover with assisted natural regeneration may be considered part of the EEC where:

- disturbed remnants are considered to form part of the community, including where the vegetation would respond to assisted natural regeneration.

The Development Site has been subject to a range of historic disturbances including grazing, clearing and logging for more than 180 years. In particular, historic grazing has removed topsoil and redistributed nutrients across the site, resulting in a highly exotic understorey. However, the potential for HN515 - Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion community to respond to assisted natural regeneration cannot be discounted, and as such, for the purposes of this assessment, the precautionary principle has been applied and the possible occurrence of *Tablelands Snow Gum*, *Black Sallee*, *Candlebark* and *Ribbon Gum Grassy Woodland* EEC in the Development Site has been assumed as present.

The 0.9 hectares of HN572 - Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion within the Development Site does not conform to *Tablelands Snow Gum*, *Black Sallee*, *Candlebark* and *Ribbon Gum Grassy Woodland* EEC due to the high dominance of annual exotic grasses and short-lived perennial exotic forbs. While a minor native component is present, the soil profile and nutrient balance is disturbed to a point where assisted natural regeneration is highly unlikely and therefore is considered too disturbed to conform to the EEC. This area does not occur within the Development Footprint.

Particular Area

In relation to the particular area of the *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland* EEC, the NSW Scientific Committee (2011) states that the community occurs within the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions.

The Development Site is situated within the South Eastern Highlands Bioregion.

Supplementary Descriptors

In relation to supplementary descriptors the NSW Scientific Committee (2011) and includes the following key information pertaining to the *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland* EEC:

- may also occur as secondary grassland where the dominant trees have been removed but the ground stratum remains
- mainly occurs on valley floors, margins of frost hollows, footslopes and undulating hills between approximately 600 and 1400 m in altitude, and
- occurs on a variety of substrates including granite, basalt, metasediments and Quaternary alluvium.

Of the above supplementary descriptors, the possible *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland* EEC present in the Development Site does not contain a groundlayer dominated by any native grasses or herbaceous species (i.e. the groundlayer is dominated by annual exotic grasses; noting that under favourable management and seasons native grasses may dominate), and it does not occur as a secondary grassland. It does comply with other descriptors related to landform (undulating hills) and substrate (granite and Quaternary alluvium).

3.2.3.3 *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is listed as a critically endangered ecological community under the EPBC Act. This community occurs in an along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria. It is characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of white box, yellow box or Blakely's red gum trees.

The Development Site is considered to support 0.98 hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC within HN615 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good condition). A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to Listing Advice provided by the Department of the Environment under the EPBC Act (TSSC 2006).

Particular Area

In relation to the particular area of the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC, the TSSC (2006) states that the community occurs within the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions

The Development Site is situated within the South Eastern Highlands Bioregion.

Additional Criteria

There are a number of additional criteria which a patch needs to satisfy to be considered part of the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act. The following requirements must be satisfied sequentially, with each point requiring being satisfied prior to proceeding to the next:

1. Containing, or previously containing at least one of the most common overstorey species white box, yellow box or Blakely's red gum (or western grey box or coastal grey box in the Nandewar Bioregion)
2. Having a predominantly native groundcover
3. Being of a patch size of greater than or equal to 0.1 hectares (1000m²), and
4. Containing 12 or more native understorey species present within the patch (excluding grasses). At least one of these species must be an 'important species' as defined by a list maintained on the DoE website.

If the ecological community satisfies all of the above criteria it is considered to be part of the CEEC.

5. Additionally, if the ecological community satisfied criteria's 1 and 2 above but does not contain 12 or more native species (criteria 4), it may also be considered part of the CEEC if the patch is of greater than or equal to 2 hectare patch size *and* has an average of 20 or more mature trees per hectare or natural regeneration of the dominant overstorey eucalypts.

Of the above supplementary descriptors, the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC present in the Development Site within HN615 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good condition) contains the appropriate overstorey species and is of a patch size of greater than 0.1 hectares. The patch of this CEEC occurring in the northeast of the Development Site contained 20 non-grass understorey species, and six important species including *Bulbine bulbosa*, *Chrysocephalum apiculatum*, *Diuris sulphurea*, *Hypericum gramineum*, *Sebaea ovata* and *Triptilodiscus pygmaeus*. Approximately 10% cover of the highly invasive serrated tussock (*Nassella trichotoma*) occurs in this patch.

HN615 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good_Poor condition) within the Development Site does not contain a predominately native groundcover or 12 or more native understorey species. As the criteria are assessed sequentially, HN615 (Moderate/Good_Poor condition) is not eligible to be part of the CEEC. Where there may be small patches (generally of less than 0.5 hectares) with a predominantly native groundcover, these are excluded as they do not contain 12 or more native understorey species including one important species.

3.2.3.4 *Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT* EEC under the EPBC Act

The Development Site does not support any areas of *Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT* EEC. A comprehensive analysis of this vegetation community was undertaken to determine if it conformed to Listing Advice provided by the DoE under the EPBC Act (ESSS 2000).

Particular Area

In relation to the particular area of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT* EEC, the ESSS (2000) states that the community occurs within the Southern Tablelands of NSW and the ACT, which extends southwards from the Abercrombie River to the Victorian border, from Boorowa and Jindabyne in the west and Goulburn to Braidwood and Bombala to the east.

The Development Site is located approximately 15 kilometres east-north-east of Goulburn and approximately 50 kilometres south of the Abercrombie River, and as such is considered to be within the area broadly described as the Southern Tablelands.

Additional Criteria

ESSS (2000) has been subject to ongoing refinement as further information is gathered on this ecological community. The national recovery plan (Environment ACT 2005) provides a number of criteria to assess whether an ecological community should be considered part of the *Natural Temperate Grassland of the Southern Tablelands of NSW and the ACT* EEC. These are:

1. Occurrence within the temperate lowland zone of the Southern Tablelands where tree growth is climatically limited (elevation up to approximately 600 m in the central and northern areas and up to 1200 m in the south)
2. Treeless, or containing up to 10% opaque canopy cover of trees, shrubs or sedges
3. Dominated by native grasses and/or native forbs (more than 50 per cent total vegetative cover, excluding introduced annuals), and
4. A diversity of native forbs present, or if disturbed, having components of the indigenous native species (including both existing plants and reproductive propagules in the soil e.g. soil seed banks) sufficient to re-establish the characteristic native groundcover.

One small area within the Development Site at approximately 680 metres above sea level is considered to have potentially historically contained Natural Temperate Grassland based on landform elements suggesting they were part of a cold air drainage area, and the isolated presence of mature ribbon gum (*Eucalyptus viminalis*) which often occurs adjacent to such areas. However, this area is dominated by exotic pasture grasses and as such is no longer recognisable as a Natural Temperate Grassland community.

3.3 Threatened Species within the Development Site

3.3.1 Ecosystem-credit Species

3.3.1.1 Predicted Species

Table 3.13 below outlines the predicted ecosystem-credit species predicted to occur by the BioBanking Calculator and whether they are considered to occur on site.

Table 3.12 Predicted Ecosystem-credit Species

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	On Site?^	Justification
barking owl <i>Ninox connivens</i>	V	-	3.0	No	The barking owl has not been recorded in the Development Site or in the immediate locality. The closest record of this species occurs approximately 20 km to the north-east of the site from 1986 (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
black-chinned honeyeater (eastern subspecies) <i>Melithreptus gularis</i> subsp. <i>gularis</i>	V	-	1.3	Yes	Species has not been recorded in the Development Site. The closest record occurs approximately 4 km to the south-east of the site from 1985 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
brown treecreeper (eastern subspecies) <i>Climacteris picumnus</i> subsp. <i>victoriae</i>	V	-	2.0	Yes	Species has not been recorded in the Development Site. The closest record occurs approximately 5 km to the south-east of the site from 2006 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	On Site?^	Justification
diamond firetail <i>Stagonopleura guttata</i>	V	-	1.3	Yes	Species has not been recorded in the Development Site. The closest record occurs approximately 5 km to the south-east of the site from 2008 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
eastern false pipistrelle <i>Falsistrellus tasmaniensis</i>	V	-	2.2	Yes	Species has not been recorded in the Development Site. The closest record occurs approximately 3 km to the east of the site from 2007 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
flame robin <i>Petroica phoenicea</i>	V	-	1.3	Yes	Species as not been recorded in the Development Site. The closest record occurs approximately 4 km to the south-east of the site from 2008 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
gang-gang cockatoo <i>Callocephalon fimbriatum</i>	V	-	2.0	Yes	Species was recorded in the Development Site during the surveys undertaken for this assessment (refer to Figure 3.4 and Section 3.3.1.2). The Development Footprint contains marginal foraging habitat for the species.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	On Site?^	Justification
glossy black-cockatoo <i>Calyptorhynchus lathami</i>	V	-	1.8	Yes	Species was recorded in the Development Site during the surveys undertaken for this assessment (refer to Figure 3.4 and Section 3.3.1.2). The Development Footprint contains marginal foraging habitat for the species.
greater broad-nosed bat <i>Scoteanax rueppellii</i>	V	-	2.2	Yes	Species has not been recorded in the Development Site. The closest record occurs approximately 10 km to the north-east of the site from 2005 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
little eagle <i>Hieraaetus morphnoides</i>	V	-	1.4	Yes	Species as not been recorded in the Development Site. The closest record occurs approximately 4 km to the east of the site from 2007 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
little lorikeet <i>Glossopsitta pusilla</i>	V	-	1.8	Yes	Species has not been recorded in the Development Site. The closest record occurs approximately 3 km to the east of the site from 2007 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	On Site?^	Justification
masked owl <i>Tyto novaehollandiae</i>	V	-	3.0	Yes	Species has not been recorded in the Development Site or in the immediate locality. The closest record occurs approximately 10 km to the south of the site from 2003 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
powerful owl <i>Ninox strenua</i>	V	-	3.0	Yes	Species has not been recorded in the Development Site. The closest record occurs approximately 5 km to the north-east of the site from 2007 (OEH 2015). The Development Footprint may contain marginal foraging habitat for the species.
scarlet robin <i>Petroica boodang</i>	V	-	1.3	Yes	Species was recorded in the Development Site during the surveys undertaken for this assessment (refer to Figure 3.4 and Section 3.3.1.2). The Development Footprint contains marginal foraging habitat for the species.
speckled warbler <i>Chthonicola sagittata</i>	V	-	2.6	Yes	Species was recorded in the Development Site during the surveys undertaken for this assessment (refer to Figure 3.4 and Section 3.3.1.2). The Development Footprint contains marginal foraging habitat for the species.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	On Site?^	Justification
spotted-tailed quoll <i>Dasyurus maculatus</i>	V	E	2.6	No	Species has not been recorded in the Development Site. The closest record occurs approximately 10 km to the east of the site from 2004 (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
swift parrot <i>Lathamus discolor</i>	E	E	1.3	No	Species has not been recorded in the Development Site. The closest record occurs approximately 50 km to the north of the site from 2002 (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
turquoise parrot <i>Neophema pulchella</i>	V	-	1.8	No	Species has not been recorded in the Development Site. The closest record occurs approximately 30 km to the east of the site from 1983 (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
varied sittella <i>Daphoenositta chrysoptera</i>	V	-	1.3	Yes	Species has not been recorded in the Development Site, however the species was recorded 100 m to the east of the Development Site in 2014 (refer to Figure 3.4). The Development Footprint may contain marginal foraging habitat for the species.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	On Site?^	Justification
yellow-bellied glider <i>Petaurus australis</i>	V	-	2.3	No	Species as not been recorded in the Development Site. The closest record occurs approximately 10 km to the north of the site from 1997 (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.

^ As entered into the 'Site Survey Details' tab in the BBCC.

3.3.1.2 Survey Results

Five ecosystem credit species were recorded in the Development Site during the surveys undertaken for this assessment (refer to **Figure 3.4**). These were:

- gang-gang cockatoo (*Callocephalon fimbriatum*);
- glossy black-cockatoo (*Calyptorhynchus lathami*);
- speckled warbler (*Chthonicola sagittata*);
- scarlet robin (*Petroica boodang*); and
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

No other records of ecosystem-credit species are known to occur within the Development Site. A discussion on these records is provided below and a full fauna species list from the surveys undertaken by Umwelt in 2014 is included in **Appendix C**.



Image Source: Google Earth (2014), Holcim (2014)
Data Source: LPI (2009), Holcim Australia (2014)

0 100 250 500m
1:10 000

Legend

- ▬ Development Site
- ▬ Development Footprint
- ◆ Eastern Bentwing-bat
- Varied Sittella
- Gang-gang Cockatoo
- ▲ Glossy Black-cockatoo
- Scarlet Robin
- Speckled Warbler

FIGURE 3.4

Ecosystem-credit Species
Recorded in the Development Site

Gang-gang Cockatoo – *Callocephalon fimbriatum*

The gang-gang cockatoo is listed as vulnerable under the TSC Act. The species occurs from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the gang-gang cockatoo is distributed from the Southern Coast to the Hunter region, and inland to the Central Tablelands and South-west Slopes.

Gang-gang cockatoos were recorded in three locations within the Development Site during the surveys undertaken for this assessment. Six individuals were observed in the northern woodland areas of the Development Site on 25 February 2014. One further individual was recorded in similar habitat on 27 February 2014. A further three individuals were recorded opportunistically approximately 3 kilometres south of the Development Site on 28 February 2014 feeding in a red stringybark (*Eucalyptus macrorhyncha*). The species has also been previously recorded in the Marulan locality (OEH 2015). The Development Site is considered to comprise marginal foraging habitat for this species as part of a wider foraging range in the locality. A moderate density of tree hollows greater than 10 cm in diameter occurs within the woodland habitats in the Development Site. No nesting behaviour was recorded by the species during the surveys undertaken for this assessment.

Glossy Black-cockatoo – *Calyptorhynchus lathami*

The glossy black-cockatoo is listed as vulnerable under the TSC Act. The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the Southern Tablelands and Central-western Plains of NSW.

The glossy black-cockatoo was recorded on one occasion within the Development Site during the surveys undertaken for this assessment. Three individuals were observed in the northern woodland areas of the Development Site on 26 February 2014. The species has also been previously recorded in the Marulan locality (OEH 2015). The Development Site is considered to comprise marginal foraging habitat for this species as part of a wider foraging range in the locality. A moderate density of hollows greater than 15 cm in diameter occurs within the woodland habitats in the Development Site. No nesting behaviour was recorded by the species during the surveys undertaken for this assessment.

Speckled Warbler – *Chthonicola sagittata*

The speckled warbler is listed as vulnerable under the TSC Act. In NSW, this species occupies eucalypt and cypress woodlands, generally on the Western Slopes of the Great Dividing Range.

Speckled warblers were recorded on one occasion within the Development Site and on one occasion in the adjacent habitats to the east of the Development Site during the surveys undertaken for this assessment. Three individuals were observed in the eastern portion of the Development Site on 25 February 2014. One further individual was recorded in adjacent woodland habitat outside the Development Site on 28 August 2014. The species has also been previously recorded in the wider Lynwood Quarry Project Area as part of previous project surveys (Umwelt 2005) and in the Marulan locality (OEH 2015). The Development Site is considered to comprise foraging habitat and potential breeding habitat for this species as part of a wider range in the locality.

Scarlet Robin – *Petroica boodang*

The scarlet robin is listed as vulnerable under the TSC Act. The species is found from south-east Queensland to south-east South Australia and also in Tasmania and south-west Western Australia. In NSW, it occurs from the coast to the inland slopes.

The scarlet robin was recorded on one occasion within the Development Site during the surveys undertaken for this assessment. One individual was observed in the north-eastern portion of the Development Site on 28 August 2014. The species has also been previously recorded in the Approved Project Area as part of previous project surveys (Umwelt 2005) and in the Marulan locality (OEH 2015). The Development Site is considered to comprise of a small area of quality woodland foraging habitat on the north-eastern boundary for this species.

Eastern Bentwing-bat - *Miniopterus schreibersii oceanensis*

The eastern bentwing-bat is listed as vulnerable under the TSC Act. The species is found along the east and north-west coasts of Australia and roosts in caves, tunnels, buildings and other man-made structures.

The eastern bentwing-bat was recorded in one location within the Development Site and two locations north of the Development Site during the surveys undertaken for this assessment. A probable identification through an echolocation recording was obtained in the northern portion of the Development Site within riparian habitat on 27 February 2014. One probable and one possible identification through an echolocation recording was made north of the Development Site between 25 and 27 February 2014. The species has also been previously recorded in the wider Lynwood Quarry Project Area as part of previous project surveys (Umwelt 2005) and in the Marulan locality (OEH 2015). The Development Site is considered to comprise of a small area of quality woodland foraging habitat on the north-eastern boundary for this species and marginal foraging habitat along the riparian vegetation associated with the 2nd order stream in the north of the Development Site. The Development Site does not contain any areas, such as caves or man-made structures that would provide suitable roosting or breeding habitat for the species.

3.3.2 Species-credit Species

3.3.2.1 Geographic and Habitat Features

Three geographic and habitat features (refer to **Table 3.13**) were chosen in the BioBanking Credit Calculator as having broad features that match site habitats at the Development Site. Other geographic and habitat features were considered as not having broad features that match the Development Site habitats and were therefore not relevant to the Development Site and were filtered out of the subsequent steps of the assessment.

Table 3.13 Geographic and Habitat Features in the Development Site

Geographic/Habitat Feature	Relevant Species-credit Species
Land within 40 metres of heath, woodland and forest	giant burrowing frog (<i>Heleioporus australiacus</i>)
Land within 100 metres of stream or creek beds	Booroolong frog (<i>Litoria booroolongensis</i>)
Land containing surface rocks (embedded or loose)	pink-tailed legless lizard (<i>Aprasia parapulchella</i>)

3.3.2.2 Predicted Species

Table 3.14 below outlines the predicted species-credit species predicted to occur by the BioBanking Credit Calculator (Major Project Assessment Type) and whether they are considered to occur on site.

Table 3.14 Predicted Species-credit Species

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
black gum <i>Eucalyptus aggregata</i>	V	-	7.7	No	Black gum was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The closest record of the species occurs approximately 10 km to the south-east of the Development Site within Bungonia National Park (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
Booroolong frog <i>Litoria booroolongensis</i>	E	E	1.3	No	The Booroolong frog was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. Although a small area of riparian vegetation occurs within the Development Site, this area does not contain a permanent stream with substantial fringing vegetation as required for this species. The habitats within the Development Footprint are highly disturbed and in low condition due to extensive sheep grazing pressures. The closest record of the species occurs approximately 50 km to the north of the Development Site along the Abercrombie River (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
buttercup doubletail <i>Diuris aequalis</i>	E	V	1.2	No	The buttercup doubletail was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Footprint are highly disturbed and in low condition due to extensive sheep grazing pressures. The closest most recent record of the species occurs approximately 40 km to the north-west of the Development Site near Mount Rae (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
Bynoes wattle <i>Acacia bynoeana</i>	E	V	7.7	No	Bynoes wattle was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Footprint are highly disturbed and in low condition due to extensive sheep grazing pressures. The closest most recent record of the species occurs approximately 20 km to the east of the Development Site within Penrose State Forest (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
eastern pygmy-possum <i>Cercartetus nanus</i>	V	-	2	No	The eastern pygmy possum was not recorded within the Development Site despite thorough fauna surveys (including targeted spotlighting, hair funnel and remote camera surveys)

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
					undertaken in accordance with the seasonal requirements for this species. Although tree hollows occur within the Development Footprint, the habitats within the Development Footprint are highly disturbed and in low condition due to extensive sheep grazing pressures with little or no midstorey or native understorey. The closest record of the species occurs approximately 25 km to the east of the Development Site within Morton National Park (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
Flockton wattle <i>Acacia flocktoniae</i>	V	V	1.8	No	Flockton wattle was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. The habitats within the Development Footprint are highly disturbed and in low condition due to extensive sheep grazing pressures and do not occur on sandstone as required by the species. No confirmed records in the last 50 years occur within 100 km of the Development Site (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
giant burrowing frog <i>Heleioporus australiacus</i>	V	V	1.3	No	The giant burrowing frog was not recorded within the Development Site despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. Although a small area of riparian vegetation occurs within the Development Site, this area is highly disturbed and with high exotic groundcovers due to extensive sheep grazing pressures. The closest record of the species occurs approximately 35 km to the south-east of the Development Site on the eastern side of Morton National Park (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
hoary sunray <i>Leucochrysum albicans</i> var. <i>tricolor</i>	-	E	1.7*	No	The hoary sunray was not recorded within the Development Footprint despite thorough vegetation surveys (including targeted threatened flora searches) undertaken in accordance with the seasonal requirements for this species and when other nearby populations were in flower. Three individuals were recorded in October 2014 immediately adjacent the Development Site in higher quality native vegetation. The habitats within the Development Footprint are highly disturbed and in low condition due to extensive sheep grazing pressures. Although the species is known to occur in disturbed habitats, the predominantly exotic understoreys in the

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
					Development Footprint mean this species is unlikely to occur. Extensive survey work in the locality has been undertaken and no populations have been found in the Development Site. This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
koala <i>Phascolarctos cinereus</i>	V	V	2.6	No	The koala was not recorded within the Development Site despite thorough fauna surveys (including spotlighting, call playback, remote camera and SAT searches) undertaken in accordance with the seasonal requirements for this species. Although the Development Footprint contains six known food tree species for this species (according to Appendix 2 of the Approved Recovery Plan (DECC 2008)), this area is highly disturbed with most canopy species suffering from severe dieback. One record from 2006 occurs approximately 5 km north of the Development Site near the Wollondilly River, two records from 2000 and 1995 occur around the Marulan township approximately 5 km south-east of the Development Site and one road mortality record exists from 2010 on the Hume Highway 4 km south of the Development Site (OEH 2015). No evidence of the koala (sightings, scats, scratchings) were recorded in the Development Site during the surveys undertaken for this assessment or during previous ecological surveys of Holcim land-holdings at Marulan (Umwelt 2005; 2011; 2013). It is acknowledged that the

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
					Development Site could be occasionally used as movement habitat for the species noting the sporadic local records, however this has not been recorded and it is considered highly unlikely the species would utilise the Development Site on any more permanent basis given the higher quality habitats in the wider locality. This species is unlikely to occur regularly in the Development Footprint and will not be impacted by the Modification Project.
large-eared pied bat <i>Chalinolobus dwyeri</i>	V	V	1.3	Yes	The large-eared pied bat was recorded through an echolocation recording as a 'confident' record in one location within the Development Site in the February 2014 surveys undertaken for this assessment. The species has also been previously recorded within quarry infrastructure in the eastern portions of the Lynwood Quarry outside the Development Site (Heath, R. pers comm.). The Development will not impact any cliffline or escarpment habitat (or quarry infrastructure) that could be used as roosting or breeding habitat or adjacent fertile woodland valley foraging habitat. The record of the species occurred within higher quality dense canopied habitats. The Modification Project will result in the loss of approximately 78 hectares of canopied woodland potential foraging habitat for the species. No breeding or shelter/refuge habitat will be impacted.

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
Camden woollybutt <i>Eucalyptus macarthurii</i>	E	-	1.4	No	The Camden woollybutt was not recorded within the Development Site despite thorough vegetation surveys undertaken in accordance with the seasonal requirements for this species. This species has been previously recorded in an isolated 0.2 hectare stand approximately two km south of the Development Site (Umwelt 2005). It was determined in consultation with OEH as part of the assessment process for Lynwood Quarry in 2005 that this species was planted on Lynwood Quarry site. This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
pink-tailed legless lizard <i>Aprasia parapulchella</i>	V	V	2.9 [#]	No	The pink-tailed legless lizard was not recorded within the Development Site despite thorough fauna surveys (including targeted rock searches) undertaken in accordance with the seasonal requirements for this species. Although the Development Site contains some areas of loose rock, it contains very few areas where the groundcover is predominately native and contains rocks 15-60 cm diameter as required by the species. Records of the species are not known to occur within 100 km of the Development Site (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
regent honeyeater <i>Anthochaera phrygia</i>	CE	CE	7.7	No	The regent honeyeater was not recorded within the Development Site despite thorough fauna surveys

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
					(including targeted winter bird surveys in 2014) undertaken in accordance with the seasonal requirements for this species. Although the Development Site contains two known foraging tree species for this species (yellow box (<i>Eucalyptus melliodora</i>) and Blakelys red gum (<i>Eucalyptus blakelyi</i>)) the vegetation in the Development Footprint is highly disturbed with most canopy trees suffering from severe dieback and unlikely to provide substantial foraging resources. The closest record of the species occurs approximately 10 km to the south of the Development Site in intact vegetation within Bungonia National Park (OEH 2015). No breeding habitat will be impacted by the Modification Project. This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
silky Swainson-pea <i>Swainsona sericea</i>	V	-	1.8	No	The silky Swainson-pea was not recorded within the Development Site despite thorough vegetation surveys (including targeted threatened flora searches) undertaken in accordance with the seasonal requirements for this species. Although the Development Footprint contains box-gum woodland habitat, this area is highly disturbed and in low condition due to extensive sheep grazing pressures. The closest recent confirmed record of the species occurs approximately 60 km to the south-west of the Development Site near Lake George (OEH 2015). This species is not likely to occur in

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
					the Development Footprint and will not be impacted by the Modification Project.
<i>Solanum amourense</i>	E	-	1.3	No	<i>Solanum amourense</i> was not recorded within the Development Site despite thorough vegetation surveys (including targeted threatened flora searches) undertaken in accordance with the seasonal requirements for this species. The Development Footprint does not include steep rocky hillside that this species requires. Additionally, this area is highly disturbed and in low condition due to extensive sheep grazing pressures. The closest recent record of the species occurs approximately 60 km to the north-east of the Development Site within Nattai National Park (OEH 2015). This species is not likely to occur in the Development Footprint and will not be impacted by the Modification Project.
squirrel glider <i>Petaurus norfolcensis</i>	V	-	2.2	Yes	The squirrel glider was recorded on two occasions within the Development Site during the surveys undertaken for this assessment. One individual responded to call playback in the north-eastern portion of the Development Site on 24 February 2014. One juvenile squirrel glider was recorded in woodland habitat during spotlighting surveys on the eastern boundary of the Development Site on 25 February 2014. The species has also been previously recorded in the wider Lynwood Quarry area as part of previous project surveys (Umwelt 2005) and in the Marulan locality (OEH 2015).

Species Name	TSC Status	EPBC Status	Threatened Species Offset Multiplier	Impacted by the Modification Project?^	Justification
					Both records occurred outside the Development Footprint within higher quality native woodland habitat. The habitats in the Development Footprint is highly disturbed with most canopy trees suffering from severe dieback and are unlikely to provide substantial resources for the species. Despite this, the Modification Project will result in the loss of approximately 78 hectares of low-quality woodland foraging, breeding, and/or roosting habitat for the species.

^ As entered into the 'Threatened Species Survey Results' tab in the BBCC.

* A 0.6 TS Offset Multiplier was quoted in the BBCC. This was manually changed to 1.7 as per the Tg score to TS Offset Multiplier equation in Equation 5 in Appendix 1 of the FBA (OEH 2014). Tg scores were derived from the TSPD on 29/7/2015.

A 0.0 TS Offset Multiplier was quoted in the BBCC. This was manually changed to 2.9 as per the Tg score to TS Offset Multiplier equation in Equation 5 in Appendix 1 of the FBA (OEH 2014). Tg scores were derived from the TSPD on 29/7/2015.

3.3.2.3 Survey Results

Two species-credit species were recorded in the Development Site during the surveys undertaken for this assessment (refer to **Figure 3.5**). These were:

- large-eared pied bat (*Chalinolobus dwyeri*), and
- squirrel glider (*Petaurus norfolcensis*).

The hoary sunray (*Leucochrysum albicans* var. *tricolor*) was also recorded during these surveys outside the Development Site. A discussion on these records is provided below and a full fauna species list from the surveys undertaken in 2014 is included in **Appendix C**.

Large-eared Pied Bat – *Chalinolobus dwyeri*

The large-eared pied bat is listed as vulnerable under the TSC and EPBC Acts. The species is mainly found in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. The species mainly roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the fairy martin (*Petrochelidon ariel*).

The large-eared pied bat was recorded in one location within the Development Site during the surveys undertaken for this assessment. A 'confident' identification from an echolocation recording was obtained in the north-eastern portion of the Development Site on 28 August 2014. The species has also been previously

recorded in the Marulan locality (OEH 2015). The Development Site is considered to contain a small area of low quality woodland foraging habitat on the north-eastern boundary for this species.

Squirrel Glider – *Petaurus norfolcensis*

The squirrel glider is listed as vulnerable under the TSC Act. The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.

Squirrel gliders were recorded on two occasions within the Development Site during the surveys undertaken for this assessment. One individual responded to call playback in the north-eastern portion of the Development Site on 24 February 2014. One juvenile squirrel glider was recorded in woodland habitat during spotlighting surveys on the eastern boundary of the Development Site on 25 February 2014. The species has also been previously recorded in the wider Lynwood Quarry Project Area as part of previous project surveys (Umwelt 2005) and in the Marulan locality (OEH 2015). The Development Site is considered to comprise only marginal foraging habitat for the species due to the lack of shrub and mid-storey layers in the disturbed woodland vegetation.

Hoary Sunray - *Leucochrysum albicans* var. *tricolor*

The hoary sunray is listed as endangered under the EPBC Act. The species occurs primarily in the South Eastern Highlands in woodland and open forest communities. The species is known to occur in previously disturbed sites as bare ground is required for germination.

Three hoary sunray individuals were recorded immediately to the east of the Development Site in disturbed land surrounded by Blakely's red gum (*Eucalyptus blakelyi*) and red stringybark (*Eucalyptus macrorhyncha*). In previous survey periods, large populations of hoary sunray were recorded south of the Development Site in grassy habitat near the South Marulan Road and Hume Highway intersection (Umwelt 2011). No hoary sunrays were recorded within the Development Site despite surveys undertaken in the appropriate detection season and with other sites in the locality experiencing a prolific flowering event. It is unlikely that this species will be impacted as a result of the Modification Project.

It should be noted that hoary sunray is currently under consideration for delisting under the EPBC Act. *Leucochrysum albicans* var. *tricolor* is conventionally accepted as a variety. Varieties are not considered to be a species for the purpose of the EPBC Act and are therefore not eligible to be listed under Section 178 of the EPBC Act. At the time of writing, the Threatened Species Scientific Committee is reviewing the status of listed varieties and their higher taxon for eligibility under the Act.

3.3.2.4 Species Habitat Polygons

Species habitat polygons have been prepared for all the species recorded and assumed present at the site as per **Table 3.14** above. The species polygons were prepared:

- using satellite imagery dated 2009 (LPI 2014)
- using the unit of measurement identified for those species in the Threatened Species Profile Database
- including the location of the species or areas likely occupied by the species
- containing the specific habitat feature associated with the species at the Development Site, and
- using GPS to confirm the location of the species polygon on the best available aerial image of the Development Site.

Species polygons are shown on **Figure 3.5**.

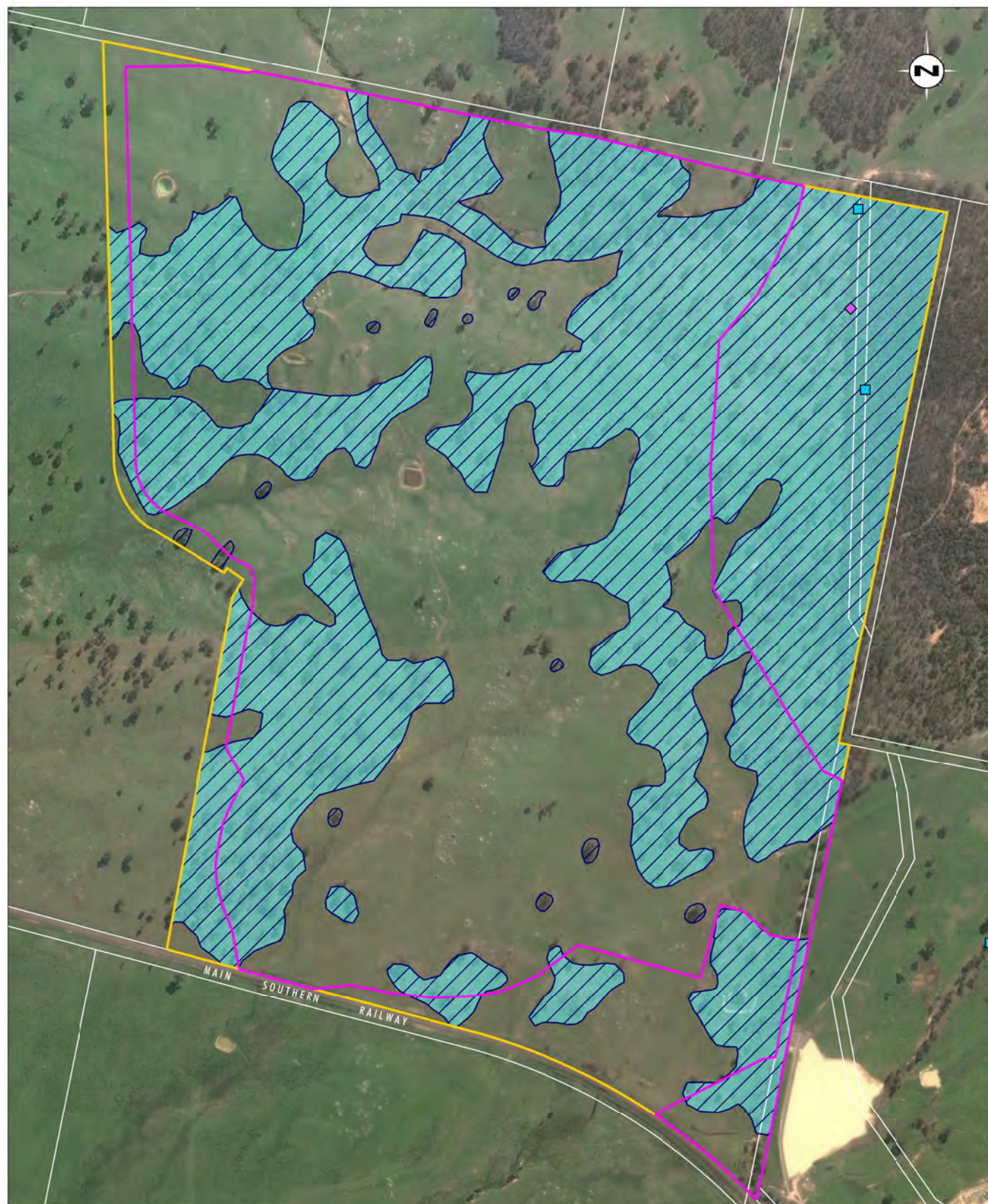


Image Source: Google Earth (2014), Holcim (2014)
Data Source: LPI (2009), Holcim Australia (2014)

0 100 250 500m
1:10 000

Legend

- Development Site
- Development Footprint
- Large-eared Pied Bat Habitat
- Squirrel Glider Habitat
- ◆ Large-eared Pied Bat
- Squirrel Glider

FIGURE 3.5

Species-credit Polygons

4.0 Avoidance and Mitigation Measures

4.1 Site Selection and Planning Phase Avoidance

4.1.1 Site Selection

Holcim Australia undertook a detailed constraints study to guide the site selection for the Modification Project. Through this process, different quarry locations were considered and Holcim Australia has sought to minimise the biodiversity impacts associated with the Modification Project whilst providing an economic resource. Key factors in selecting the location of the quarry included the likely impacts on significant ecological features, including threatened species, TECs and/or their habitats.

Ecological field surveys were undertaken in 2014 within the current Development Site and within lands surrounding the Development Site provide information on the early site selection process for the quarry. The final location of the proposed Granite Pit was determined with consideration of the biodiversity values of the potential development sites. It was found that the area north of the final Development Site contained higher value vegetation and fauna habitat in structured woodland areas than the lower quality scattered woodland trees and exotic groundcovers dominating the Development Site.

4.1.2 Planning Phase

Once the quarry location was selected, Holcim Australia then assessed the biodiversity values in the Development Site (as identified in the 2014 surveys) to guide the detailed design of the Modification Project. Alternative quarry design and overburden emplacement options were considered and Holcim Australia has sought to minimise the biodiversity impacts associated with the Modification Project whilst also maximising resource efficiency. Key factors in project design have been amended to ameliorate the impacts on significant ecological features, including higher quality threatened species habitat and the occurrence of a Commonwealth-listed TEC. Changes were made to the overburden emplacement area design to the south of the Granite Pit to reduce the extent of impact on TECs. The approach taken by Holcim Australia has been to avoid ecological impacts where possible and maximise the use of existing disturbed areas as much as possible.

The specific location and size of the quarry pit, emplacement areas and associated developments such as water management structures were determined with consideration of avoiding higher quality woodland habitats to the east of the Development Footprint. This included a specific reduction in the size of the Development Footprint to avoid the identified high quality woodland habitat and presence of White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland CEEC to the east of the current Development Footprint. As a result, this CEEC will not be impacted by the Modification Project.

Other predominately native woodland communities have been largely avoided by this design and in doing so the Modification Project will retain the higher quality threatened species habitats and structurally diverse vegetation communities that have not been subject to ongoing disturbances as a result of extensive sheep grazing. This has resulted in approximately half of the moderate quality woodlands in the Development Site being entirely avoided by the Modification Project and the majority of the impacts occurring on poorer condition vegetation and exotic pastures. This has effectively reduced habitat loss, connectivity loss and minimised the amount of clearing required for the Modification Project. **Table 4.1** below outlines the impacts and retained BVTs within the Development Site in relation to condition classes.

Figure 4.1 shows the final Development Footprint in relation to the BVTs mapped within the Development Site and the areas of avoidance.

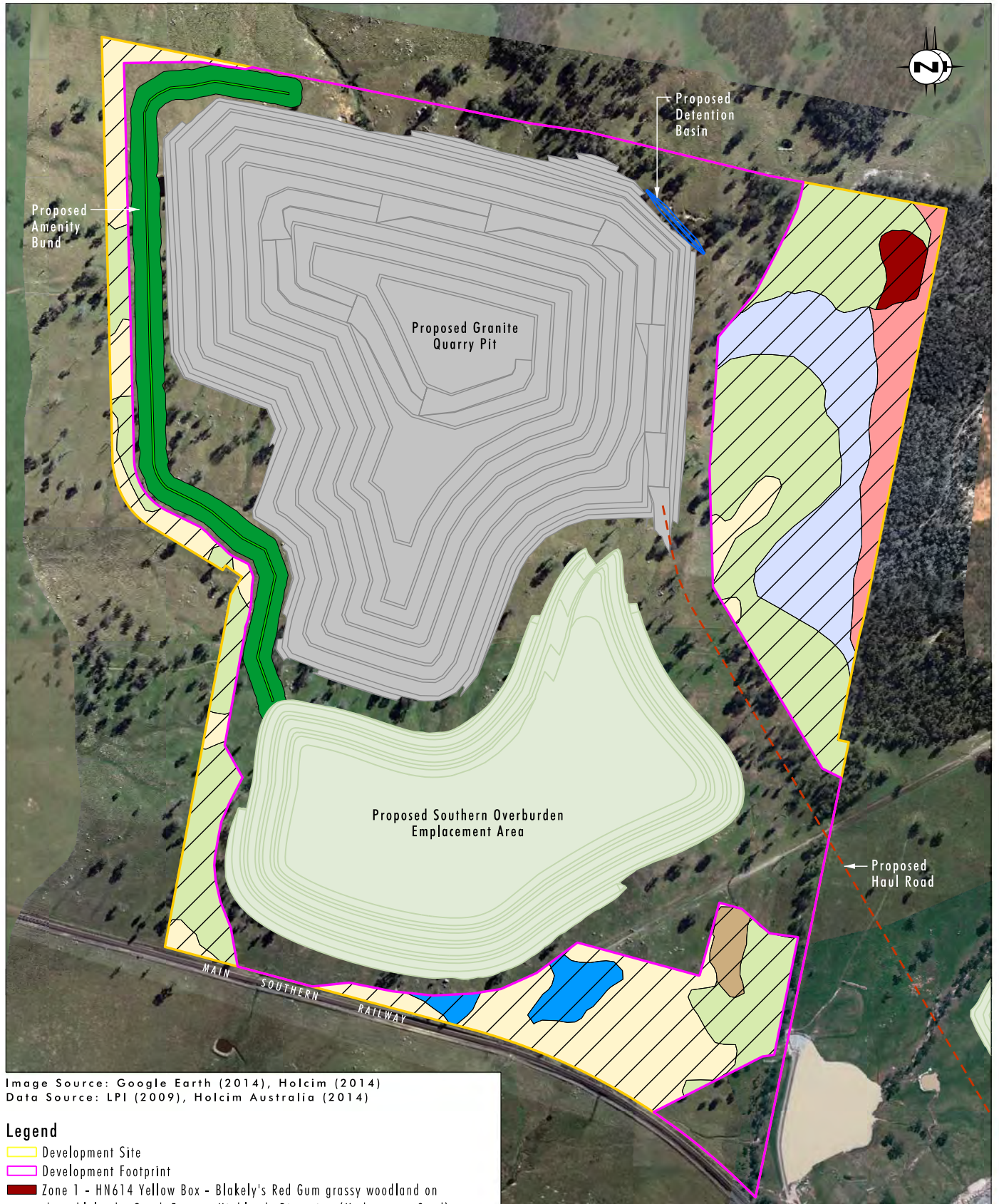


Image Source: Google Earth (2014), Holcim (2014)
Data Source: LPI (2009), Holcim Australia (2014)

Legend

- Development Site
- Development Footprint
- Zone 1 - HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate to Good)
- Zone 2 - HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor)
- Zone 3 - HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good)
- Zone 4 - HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate to Good_Poor)
- Zone 5 - HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (Moderate to Good)
- Zone 6 - HN572 Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion (Moderate to Good)
- Exotic Pastures

Areas not Impacted

0 100 250 500 m
1:10 000

FIGURE 4.1

Final Development Footprint

Table 4.1 Vegetation Community and Habitat Avoidance

Vegetation Community	Area in the Development Site (ha)	Area to be Impacted in the Development Footprint (ha)	Area to be Retained (Avoided) in the Development Site (ha)
Moderate Quality Woodlands			
HN614 Moderate/Good (<i>White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland CEEC and White Box Yellow Box Blakely's Red Gum Woodland EEC</i>)	0.98	0.0	0.98
HN570 Moderate/Good	9.0	5.3	3.7
Total	10.0	5.3	4.7
Low Quality Degraded Woodlands			
HN614 Moderate/Good_Poor (<i>White Box Yellow Box Blakely's Red Gum Woodland EEC</i>)	80.9	58.1	22.8
HN570 Moderate/Good_Poor	21.5	13.1	8.4
HN515 Moderate/Good (<i>Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland EEC</i>)	2.9	1.2	1.7
HN572 Moderate/Good	0.9	0.0	0.9
Total	106.2	72.4	33.8
Exotic Pastures			
Exotic Pastures	110.3	97.5	12.8
All Vegetation			
Total	226.5	175.2	51.3

In addition to the above, in applying for the modification, impacts to some of the vegetation and habitats that were approved for disturbance under DA128-5-2005 will now no longer occur. This includes approximately 27 hectares of native woodland vegetation originally planned to be disturbed by the Approved Pit, emplacement areas and subsequent haul roads within the Holcim land holdings. This change is discussed further in the EA main text.

4.2 Construction Phase

Holcim Australia has committed to the design and implementation of a comprehensive strategy to mitigate adverse impacts during the construction phase of the Modification Project. This includes specific measures to manage potential impacts on fauna species in the Development Footprint during vegetation clearing and construction of the quarry.

Holcim Australia has an existing ecological management regime in place for Lynwood Quarry, including management plans approved under both NSW and Commonwealth approvals. This existing management regime will be updated and applied to the Modification Project as part of the implementation of the project. Further discussion of the proposed management and mitigation measures to be implemented is included in the following sections.

4.2.1 Management of Arboreal Species and Habitat

A robust tree felling procedure will be implemented to minimise the potential for impacts on native fauna species (focusing on threatened species) as a result of the clearing of hollow-bearing trees. The tree felling procedure is designed to minimise impacts to hollow-dependent fauna, particularly the threatened squirrel glider and hollow-dependent micro-bats.

4.2.1.1 Pre-clearance Surveys

Pre-clearance surveys will be required within areas of woody native vegetation (including scattered trees within grassland) that are to be cleared. Pre-clearance surveys will be undertaken by suitably qualified and experienced person and involve the following:

- the demarcation of areas approved for clearing to reduce risk of accidental clearing
- habitat resources and habitat trees should be identified and marked (Note: habitat trees are those containing hollows, cracks or fissures and spouts, active nests, dreys or other signs of recent fauna usage. Other habitat features to be identified include fallen timber/hollow logs, burrows and boulder piles)
- the potential presence of threatened flora and fauna species, endangered populations and TECs should be identified
- the identification of species or habitat features that are suitable for translocation or salvage
- the presence of weed species and vertebrate pest species should be assessed, if relevant, and
- disturbance activities should be targeted for specific times of the year to minimise impacts to target species usage of habitat features for breeding and roosting, where practicable.

4.2.1.2 Tree-felling Supervision

Tree clearing will be completed as close to the completion of pre-clearance surveys as practicable to limit the potential for new issues to arise (such as new active nests being built). Tree felling supervision will be undertaken by an appropriately qualified and experienced person after pre-clearance surveys have identified potential threatened species habitat. The supervising person will be licensed by the relevant field survey and ethics authorities to allow for capture, housing, transport and possibly ethical euthanizing of injured fauna. The tree-felling procedure will include the following:

- Prior to clearing identified habitat trees, the felling of non-habitat trees will be completed as close to the felling of habitat trees as possible, with all surrounding habitat trees to be vigorously shaken with heavy machinery.
- On the day of habitat tree felling, the following is to be undertaken:
 - o all habitat trees will be subject to a visual inspection to survey for threatened species
 - o trees previously identified as containing fauna will be shaken and then felled, providing no threatened species are identified
 - o all reasonable attempts will be made to reduce the impact of felling on all fauna species. This may include delaying felling trees with fauna present or felling in sections to reduce potential for injury
 - o the lowering of hollow-bearing trees will be done as gently as possible with heavy machinery
 - o if a threatened species is identified in a habitat tree on the day of felling, the supervising person is to advise the most appropriate method to minimise potential harm. This may include leaving the tree overnight, further shaking to encourage the animal to vacate the tree, gradual removal of branches to discourage ongoing use, soft-felling of the tree with the animal in the tree, or measures to capture and relocate the animal to secure habitats
 - o uninjured animals should be released on the day of capture into nearby suitable secure habitat and should not be held for extended periods of time, and
 - o injured animals will be taken to the nearest veterinary clinic or wildlife carer as soon as possible for assessment and treatment. If required, the supervising person may ethically euthanize fauna
- Following felling, habitat trees will be inspected for remaining or injured fauna species and to ensure that no hollows are blocked against the ground. This may require the tree to be rolled to ensure adequate access
- All felled habitat trees should remain in place for a least one night to allow any fauna still present to move on
- Habitat features identified for translocation or salvage operations should be extracted and stored appropriately, and
- Detailed records should be maintained regarding the type and number of habitat features cleared, the type and number of fauna encountered and their fate. This will assist in informing mitigation programs such as nest boxes and habitat augmentation programs.

4.2.2 Weed Control

Weed species could be inadvertently brought into the Development Site with imported materials, or could invade naturally through removal of native vegetation. The increased presence of weed species within the Development Site has the potential to decrease the value of extant vegetation to native species, particularly threatened species.

The following management measures will be undertaken to minimise the potential impacts and spread of weeds during the construction of the Modification Project:

- Any vehicles or equipment being brought onto the Lynwood Quarry site to be involved in ground disturbance activities and/or travelling around the site must be inspected and cleaned prior to commencing work to limit the spread of seeds and plant material between sites.
- The limits of ground disturbance will be clearly demarcated and no unnecessary disturbance will be undertaken outside of these areas.
- Rehabilitation will be undertaken on disturbed areas as soon as practical following disturbance. This may include resspreading of topsoil, seeding and/or planting of natives.
- Regular inspections will be undertaken in the Development Site to monitor the spread of weed species.
- Training of environmental personnel on the identification of target weed species.

Any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Weed control and eradication techniques may include:

- spraying with herbicides
- physical removal e.g. chipping, or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

4.2.3 Sediment and Erosion Control

Surface water management procedures similar to those currently used within the Lynwood Quarry are proposed for the Modification Project. This will involve ensuring the direction of clean water flows around the quarry site where practicable and the containment of dirty water within the quarry water management system for treatment.

Erosion and sediment control will be undertaken in accordance with the *Lynwood Erosion and Sediment Plan (ESCP)* (Holcim, 2013), which will be updated as part of the implementation of the Modification Project. The ESCP provides a framework for the management of erosion and sedimentation at Lynwood Quarry.

As part of construction works, the specific inspection, maintenance and revegetation requirements for each works area will be determined and implemented. These control measures will be in accordance with relevant guidelines for erosion and sediment control, including the relevant volumes of the Blue Book, including:

- Landcom (2004) *Managing Urban Stormwater – Soils and Construction*, Volume 1, 4th Edition.
- Department of Environment and Climate Change (DECC) (2008) *Managing Urban Stormwater – Soils and Construction*, Volume 2A – Installation of Services.
- Department of Environment and Climate Change (DECC) (2008) *Managing Urban Stormwater – Soils and Construction*, 2C – Unsealed Roads.
- Department of Environment and Climate Change (DECC) (2008) *Managing Urban Stormwater – Soils and Construction*, 2D – Main Road Construction.

- Department of Environment and Climate Change (DECC) (2008) Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries.

When work is required within or adjacent to watercourses, work will be in accordance with guidelines from *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and *Volumes 2A, 2C, 2D and 2E* (DECC 2008) (the Blue Book), including:

- works within the riparian zone will maximise, where possible the preservation of any existing vegetation and minimise disturbance
- designs for works within or near water bodies will provide for the retention of natural functions and maintenance of fish passage in accordance with NSW Fisheries Guidelines (2004) *Fish Friendly Waterway Crossings*, and
- planned works will, where possible, be scheduled for forecasted dry weather periods.

4.2.4 General Mitigation Measures

A range of general mitigation measures will be employed across the site during the construction phase to minimise impacts to biodiversity values, including:

- Employee education and training including inductions for staff, contractors and visitors to the site will be conducted to inform personnel of the biodiversity issues present at the site and so they know their role and responsibilities in relation to the protection and/or minimisation of impacts to native biodiversity.
- Areas of biodiversity value outside the Development Footprint will be fenced or signposted, where appropriate, to prevent the unnecessary disturbance during the construction phase.
- Traffic control measures/speed limits/signage will be enforced on haul roads and access roads to minimise fauna injury/road kills, as much as possible.
- Where sensitive biodiversity receivers are identified, appropriate lighting controls to minimise impacts will be implemented (providing that these actions do not compromise site safety issues).

4.3 Operational Phase

Holcim Australia has committed to the implementation of a comprehensive strategy to mitigate the adverse impacts during the operational phase of the Modification Project. This includes specific measures to minimise the potential impacts on the biodiversity of the Development Site and the locality. As discussed in **Section 4.2**, an existing ecological management regime is in place for Lynwood Quarry and it will be updated and implemented for the Modification Project.

4.3.1 Nest Box Establishment

Nest boxes will be established in retained vegetation in proximity to the Development Footprint to mitigate the loss of hollow-bearing trees. An assessment of the number of tree hollows lost during clearing will be made as part of the tree felling activities and nest boxes will be established to compensate for this loss, with consideration of the carrying capacity of the surrounding vegetation. Suitably designed nest boxes will be established for the range of hollow-dependent species that are known to occur in the Development Site such as squirrel glider (*Petaurus norfolcensis*), glossy black-cockatoo (*Calyptorhynchus lathami*) and gang-gang cockatoo (*Callocephalon fimbriatum*).

4.3.2 Ongoing Weed Management

Holcim Australia will update its existing site Landscape Management Plan to incorporate details of the design and implementation of a robust weed management program for the Development Site.

Regular inspections of the Development Site will be undertaken for weed infestations and to assess the need for control measures. Areas not impacted by quarrying activities will be subject to six monthly weed assessments, to be undertaken by the Environmental Officer. These inspections will identify any weed infestations, the need for any control measures and the effectiveness of past weed control activities. Rehabilitated areas will also be regularly inspected to reduce the potential for weed infestations in these areas.

As outlined in **Section 4.2.2**, any outbreak of noxious weeds will be controlled and eradicated as required under the *Noxious Weeds Act 1993*, and as required by the Local Land Services and other relevant authorities. Noxious and other undesirable weed species within the Development Site, such as serrated tussock (*Nassella trichotoma*) and blackberry (*Rubus fruticosus* agg. species), will be controlled to an acceptable level, and where possible eliminated. Weed control and eradication techniques may include:

- spraying with herbicides
- physical removal e.g. chipping, or
- minimisation of area available for weed infestation, through prompt revegetation of bare areas.

4.3.3 Feral Animal Management

Holcim Australia will update its existing site Landscape Management Plan to incorporate details of the design and implementation of a robust feral animal management program for the Development Site. The feral cat (*Felis catus*), European red fox (*Vulpes vulpes*) and European rabbit (*Oryctolagus cuniculus*) were identified in the Development Site during fauna surveys undertaken for this assessment. Measures to control feral species will be undertaken in consultation with the Local Land Services, and will include:

- identification of pest species
- determination of appropriate control practices (this may include baiting, trapping or other methods as appropriate)
- implementing control practices, and
- undertaking monitoring and follow up control as required.

Inspections of the occurrence of feral animals will be undertaken by the Environmental Officer. Additionally, regular monitoring of revegetation and regeneration areas will be undertaken to determine the impact of feral animals, particularly on vegetation establishment. Feral animal control works will be undertaken periodically to provide for the suppression of feral animals, and will consider ecological impacts.

4.3.4 Ongoing Sediment and Erosion Control

During the operational phase, additional water management system components will be constructed as work progresses. The operational phase will involve the ongoing management of the water management system, and be consistent with the relevant requirements of:

- Landcom (2004) Managing Urban Stormwater – *Soils and Construction, Volume 1, 4th Edition*, and
- Department of Environment and Climate Change (DECC) (2008) Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries.

Specific erosion and sediment control measures proposed to be implemented for the Modification Project will also include those measures outlined the Environmental Assessment report.

4.3.5 Rehabilitation

The aim of the rehabilitation of the Development Footprint will be to re-establish those vegetation communities and fauna habitats currently recorded and reconnect, as far as practicable, the habitat areas to the north and south of the Development Footprint with a vegetated corridor. A range of criteria relating to biodiversity issues has been developed to direct the rehabilitation activities. Rehabilitation biodiversity objectives will be used in rehabilitation planning, and will:

- comprise a sustainable final landform and land use that can co-exist with surrounding land uses, and
- utilise flora species consistent with the composition of extant vegetation communities of the Development Footprint within the post-mining landform.

Rehabilitation of overburden emplacement areas will be conducted progressively over the life of the quarry, as an integral component of quarry operations. All rehabilitation works will be scheduled to commence as soon as practicable after disturbance and reformation of the landscape. This approach will minimise the disturbed area at any point in time and hence reduce the ecological impact of the Modification Project.

4.3.6 General Mitigation Measures

The general mitigation measures outlined in **Section 4.2.4**, are also applicable during the operational phase of the Modification Project.

4.4 Direct Impacts

The construction and operation of the Modification Project will result in a range of direct impacts on biodiversity values within the Disturbance Footprint. Direct impact includes loss of native vegetation and fauna habitats as a result of direct clearance works and construction of the quarry.

Table 4.2 below outlines these impacts as they were entered into the BioBanking Credit Calculator (Major Project Assessment Type). Avoidance and mitigation measures associated with minimising the impacts of these direct impacts are discussed in **Sections 4.1, 4.2 and 4.3** above.

Table 4.2 Direct Impacts of the Modification Project

Ecological Feature	Area within the Development Footprint Impact (ha)
Biometric Vegetation Types	
HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good_Poor)	58.1
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate/Good)	5.3
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate/Good_Poor)	13.1
HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (Moderate/Good)	1.2
Threatened Fauna Habitats	
Dense woodland and riparian vegetation for large-eared pied bat	77.8
Native woodland vegetation within 75 metres of high quality woodlands for squirrel glider	78.4

4.5 Indirect Impacts

The Modification Project is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands during the construction or operational phases of the Modification Project. However, some minor indirect impacts associated with fugitive light emissions, dust, noise, weeds and feral animals may occur during the construction and operational phase of the Modification Project. This is further discussed in the sections below.

4.5.1 Fugitive Light Emissions

Fugitive light emissions resulting from the construction and operation of the quarry may result in adverse impacts on adjacent habitats and fauna species such as nocturnal fauna species, particularly birds and bats. Potential impacts may include:

- a reduction in the navigational signal ability for some nocturnal animals, and
- delaying bats from emerging from roost access points and shortening the amount of time available to them for foraging.

As outlined in **Section 4.2.4**, where sensitive biodiversity receivers are identified, appropriate lighting controls to minimise impacts will be implemented (providing that these actions do not compromise site safety issues). It is noted that the only lighting proposed as part of the Modification Project is mobile lighting plant and equipment headlights which may be used in the Granite Pit up to 10pm. No fixed lighting is proposed in the Granite Pit Area.

4.5.2 Noise Impacts

Construction and operational noise and dust impacts have the potential to adversely impact native species. Potential impacts include:

- dust covering vegetation thereby reducing vegetation health and growth
- noise disturbing the roosting and foraging behaviour of fauna species, and
- noise reducing the occupancy of areas of suitable habitat.

The design of the Modification Project will include inherent measures to minimise the potential for adverse noise impacts. These include:

- the use of physical barriers adjacent to operational quarry areas, where practical such as earthen bunds and noise walls
- quarry design to minimise adverse noise impacts by operating deeper in the quarry pit in noise sensitive periods, and
- equipment selection and maintenance to minimise noise generation.

Further details of the noise controls that will be implemented as part of the Modification Project are outlined in the Environmental Assessment report.

4.5.3 Dust Impacts

Construction and operational dust impacts have the potential to adversely impact native species during ground disturbance including blasting. Potential impacts include:

- dust covering vegetation thereby reducing vegetation health and growth.

The design of the Modification Project will include inherent measures to minimise the potential for adverse dust impacts. These may include:

- the minimisation of vegetation clearance where it is not required
- progressive rehabilitation and stabilisation of disturbed land
- planting groundcover species for stabilisation purposes as soon as is feasible, and
- dust suppression on haul roads and other operational areas to reduce vehicle generated dust emissions.

Further details of the dust controls that will be implemented as part of the Modification Project are outlined in the Environmental Assessment report.

4.5.4 Weed and Feral Animal Encroachment

Weed species could be inadvertently brought into the Development Site with imported materials, or could invade naturally through removal of native vegetation. The presence of weed species within the Development Site has the potential to decrease the value of extant vegetation to native species, particularly threatened species. Mitigation measures outlined in **Sections 4.2.2** and **4.3.2** will minimise the potential for weed encroachment into surrounding areas around the Development Site.

Feral fauna species pose serious threats to local biodiversity. Populations of feral fauna species such as foxes, rabbits, pigs, dogs and cats can increase and quickly populate new areas as a result of disturbance. Clearing, thinning of vegetation and the creation of tracks have the ability to assist the establishment and spread of feral fauna species. Mitigation measures outlined in **Section 4.3.3** will minimise the potential for feral animal spread and impacts into surrounding areas around the Development Site.

5.0 Impact Assessment

5.1 Impacts Not Requiring Further Assessment

Impacts not requiring further assessment under the FBA include areas of land without native vegetation. The Development Footprint contains approximately 97.5 hectares of exotic pastures that will be removed as a result of the Modification Project that does not meet the definition of 'native vegetation' under the *Native Vegetation Act 2003* (refer to **Figure 5.1**). This impact does not require further assessment under the FBA.

5.2 Impacts Not Requiring Offset

Impacts on native vegetation not requiring offsets under the FBA include native vegetation that has a site value score of less than 17, including native vegetation that is an endangered or critically endangered ecological community, and/or vegetation that is associated with threatened species habitat (as represented by ecosystem credits).

Impacts on species and populations not requiring offsets under the FBA include threatened species habitat associated with a PCT that has a site value score of less than 17 or species or populations that are not threatened and do not form part of a EEC or CEEC.

A range of non-threatened flora and fauna species were recorded within the Development Site during the surveys undertaken for this assessment. These species do not require offsets under the FBA. Additionally, as no BVTs within the Development Footprint have a site value score of less than 17 and are predicted to be habitat for threatened ecosystem species, all will require offsetting as discussed in **Section 5.3**.

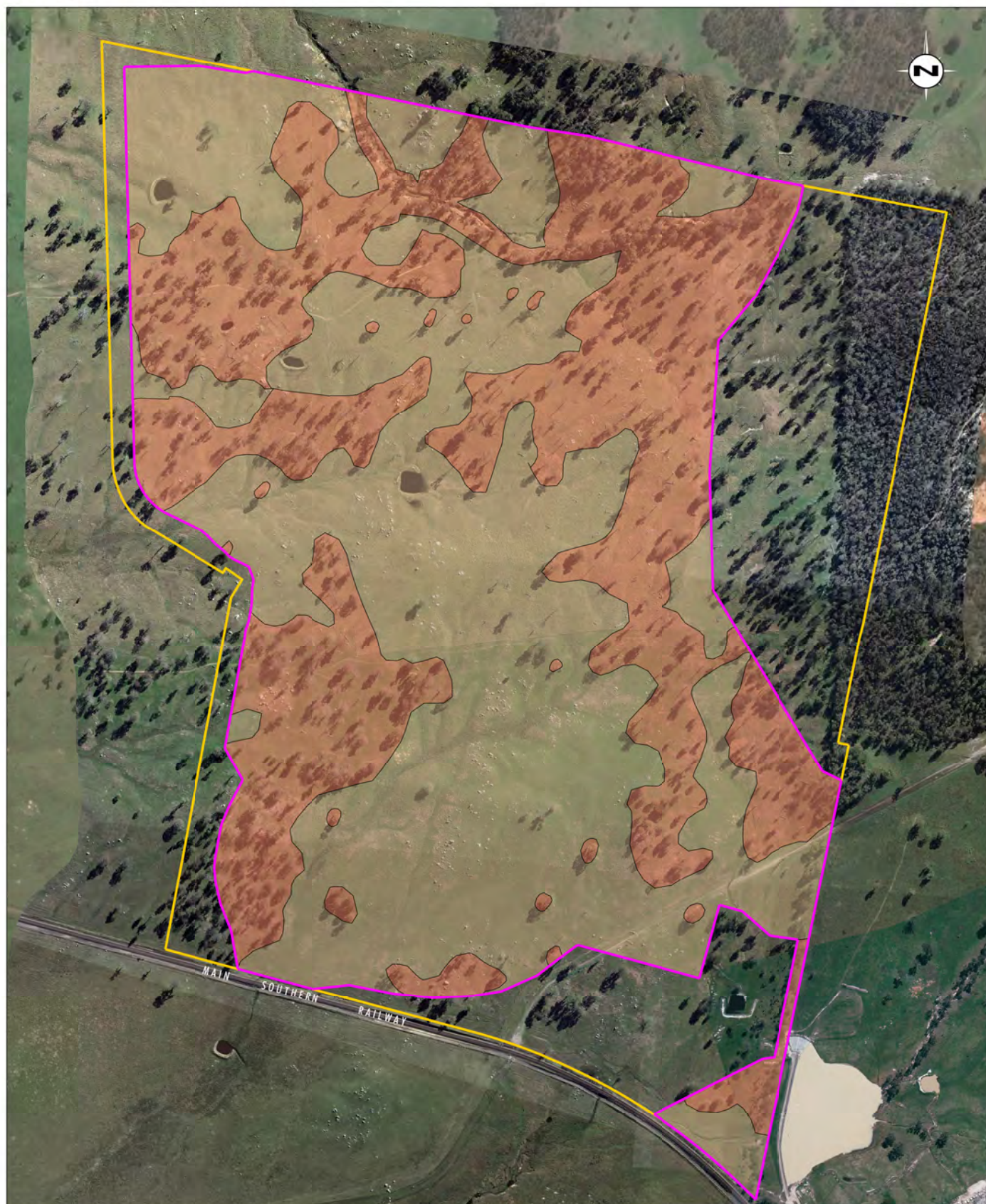


Image Source: Google Earth (2014), Holdim (2014)
Data Source: LPI (2009), Holcim Australia (2014)

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Legend

- Development Site
- Development Footprint
- Areas not Requiring Further Assessment
- Areas Requiring Offset

FIGURE 5.1

Offset Summary of
the Development Site

5.3 BVTs and Threatened Species Requiring Offset

A range of BVTs, ecosystem-credit species and species-credit species were found to require offsetting as discussed in the sections below.

5.3.1 Ecosystem Credits

Table 5.1 outlines the ecosystem-credit species requiring offset as a result of the Modification Project. The highest threatened species offset multiplier will determine the credit requirements for the BVTs these species are predicted to occur in.

Table 5.1 Ecosystem-credit species requiring offset as a result of the Modification Project

Common Name	Species Name	Threatened Species Offset Multiplier
black-chinned honeyeater (eastern subspecies)	<i>Melithreptus gularis</i> subsp. <i>gularis</i>	1.3
brown treecreeper (eastern subspecies)	<i>Climacteris picumnus</i> subsp. <i>victoriae</i>	2.0
diamond firetail	<i>Stagonopleura guttata</i>	1.3
eastern false pipistrelle	<i>Falsistrellus tasmaniensis</i>	2.2
flame robin	<i>Petroica phoenicea</i>	1.3
gang-gang cockatoo	<i>Callocephalon fimbriatum</i>	2.0
glossy black-cockatoo	<i>Calyptorhynchus lathami</i>	1.8
greater broad-nosed bat	<i>Scoteanax rueppellii</i>	2.2
little eagle	<i>Hieraetus morphnoides</i>	1.4
little lorikeet	<i>Glossopsitta pusilla</i>	1.8
masked owl	<i>Tyto novaehollandiae</i>	3.0
powerful owl	<i>Ninox strenua</i>	3.0
scarlet robin	<i>Petroica boodang</i>	1.3
speckled warbler	<i>Chthonicola sagittata</i>	2.6
varied sittella	<i>Daphoenositta chrysoptera</i>	1.3

Table 5.2 below outlines the BVTs to be impacted as a result of the Modification Project and the ecosystem credits required to offset those impacts. A full Credit Calculator report is included in **Appendix D**.

Table 5.2 Biometric Vegetation Types Requiring Offset and the Ecosystem Credits Required

Biometric Vegetation Type	Vegetation Zone	Area to be Impacted (ha)	Loss in Landscape Value	Current Site Value Score	Future Site Value Score	Threatened Species Offset Multiplier	Ecosystem Credits Required
HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good_Poor)	2	54.9	15.8	43.48	0.0	3.0	2124
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate/Good)	3	5.2	15.8	63.02	0.0	3.0	271
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate/Good_Poor)	4	13.1	15.8	56.77	0.0	3.0	610
HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (Moderate/Good)	5	1.2	15.8	43.48	0.0	2.2	33

5.3.2 Species Credits

Table 5.3 below outlines the species-credit species to be impacted as a result of the Modification Project and the species credits required to offset those impacts. A full Credit Calculator report is included in **Appendix D**.

Table 5.3 Species-credit Species Requiring Offset and the Species Credits Required

Common Name	Species Name	Threatened Species Offset Multiplier	Species Credits Required
large-eared pied bat	<i>Chalinolobus dwyeri</i>	1.3	1011
squirrel glider	<i>Petaurus norfolcensis</i>	2.2	1725

5.4 Impacts that Require Further Consideration

Under the FBA, certain impacts on biodiversity values may require further consideration by the consent authority. These are impacts that are considered to be complicated or severe and include:

- impacts on landscape features, being:
 - o impacts that will reduce the width of vegetation in the riparian buffer zone bordering significant streams and rivers, important wetlands or estuarine areas, or
 - o impacts that will prevent species movement along corridors that have been identified as providing significant biodiversity linkages across the state, and
- impacts on native vegetation that are likely to cause the extinction of an EEC/CEEC from an IBRA subregion or significantly reduce its viability, and
- impacts on critical habitat or on threatened species or populations that are likely to cause the extinction of a species or population from an IBRA subregion or significantly reduce its viability.

The Modification Project will not have an impact on any biodiversity features that would result in one or more of the above severe impacts. Therefore there are no impacts that require further consideration by the consent authority.

5.5 Impacts on Aquatic Species

No *Fisheries Management Act 1994* (FM Act) listed threatened aquatic flora or fauna species has been recorded within the Development Site. The Development Site contains minimal aquatic habitats being a small section of a 2nd order stream (tributary) to the Lockyersleigh Creek occurring in the northern portion of the Development Site. No FM Act-listed threatened flora and fauna are known to occur in the Lockyersleigh Creek catchment area.

5.6 Seven Part Tests of Significance

Threatened species impact assessment is an integral part of environmental impact assessment. The objective of s. 5A of the EP&A Act, the *assessment of significance*, is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure that the consideration is transparent.

Although it is understood that the preparation of a BioBanking Assessment under the FBA supersedes the requirement to prepare Seven Part Tests, this assessment has been prepared during the 18-month transitional period for the Policy since its release in October 2014. The preparation of a BAR under the FBA addresses the components of the Seven Part Tests by use of the BBCC. A summary of the requirements of the Seven Part Tests of Significance and where they are addressed in the FBA Assessment is outlined in **Table 5.4** below.

Table 5.4 Seven Part Tests of Significance and the FBA

Seven Part Test of Significance	Where Addressed in the FBA Process
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;	Threatened species (ecosystem-credit and species-credit) are predicted in the BBCC by the landscape features of the Development Footprint (native vegetation cover, IBRA regions, patch sizes, condition and plant community types) and assessed by the impact on these features. Impacts requiring further consideration (Section 9.2 of the FBA (OEI 2014)) identify impacts on critically endangered threatened species, impacts that may cause the extinction of a species in a IBRA subregion and impacts that significantly reduce the viability of a species.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction	Endangered populations are predicted in the BBCC by the landscape features of the Development Footprint (native vegetation cover, IBRA regions, patch sizes, condition and plant community types) and assessed by the impact on these features. Impacts requiring further consideration (Section 9.2 of the FBA (OEI 2014)) identify impacts that may cause the extinction of an endangered population in a IBRA subregion and impacts that significantly reduce the viability of a population.

Seven Part Test of Significance	Where Addressed in the FBA Process
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed; i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; and ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;	Endangered ecological communities are predicted in the BBCC by the plant community types and biometric community types identified from the field surveys and entered into the BBCC. Impacts requiring further consideration (Section 9.2 of the FBA (OEH 2014) are identified as impacts on any critically endangered or endangered ecological community that may cause the extinction of the EEC/CEEC in a IBRA subregion or significantly reduce the viability of an EEC/CEEC.
d) in relation to the habitat of a threatened species, population or ecological community; i. the extent to which habitat is likely to be removed or modified as a result of the action proposed; ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;	Habitat loss is assessed in the BBCC via the 'Site Values' tab and the loss in site value score entered for each vegetation zone. Fragmentation of habitat is addressed as part of the 'Landscape Value' score including consideration of features before and after the development including per cent native vegetation cover, connectivity value and vegetation condition. The per cent cleared scores for the dominant Mitchell Landscape is also calculated in the 'Landscape Value' score. Important habitat features are identified through determining geographic and habitat features relevant for particular species-credit species and the assessment of landscape features (such as riparian buffers, important wetlands and state or regionally significant biodiversity links). The extent of habitat loss is ultimately determined by the measure of ecosystem credits and species credits calculated in the BBCC.

Seven Part Test of Significance	Where Addressed in the FBA Process
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);	Critical habitat is addressed under impacts that require further consideration by the consent authority (refer to Section 9.2 of the FBA (OEH 2014)).
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and	Recovery plans are not directly addressed in the FBA. National recovery plans have been prepared for large-eared pied bat (<i>Chalinolobus dwyeri</i>) (DERM 2011) and White Box – Yellow Box – Blakelys Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2011). It is likely that the Modification Project would be inconsistent with any recovery plans prepared for the threatened species and/or communities impacted by the Project as it relates to impacts on the CEEC and habitat for the species. However the Modification Project will not impede the implementation of these recovery plans. If supplementary offsetting measures are used (as per Appendix B of the NSW Biodiversity Offset Policy for Major Projects) to offset species or communities impacted by projects, reference can be made to the key objectives and actions in the relevant recovery plans.

Seven Part Test of Significance	Where Addressed in the FBA Process
g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	Key threatening processes are not directly assessed under the FBA. In the case of the Modification Project, the Project may contribute to the following key threatening processes: • Aggressive exclusion of birds by noisy miners (<i>Manorina melanocephala</i>); • Clearing of native vegetation; • Competition and grazing by the feral European rabbit (<i>Oryctolagus cuniculus</i>); • Invasion of native plant communities by exotic perennial grasses; • Predation by the European red fox (<i>Vulpes vulpes</i>); • Removal of dead wood and dead trees.

5.7 Impacts on Matters of National Environmental Significance

Under the Commonwealth EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (MNES). These matters are:

- listed threatened species and communities
- migratory species protected under international agreements
- Ramsar wetlands of international importance
- the Commonwealth marine environment
- the Great Barrier Reef Marine Park
- World Heritage properties
- National Heritage places
- nuclear actions, and
- a water resource, in relation to coal seam gas development and large coal mining development.

A Referral to the Commonwealth Environment Minister was submitted in November 2015. The Referral indicates that the Modification Project is unlikely to be deemed to comprise a 'Controlled Action'.

6.0 Offsetting Requirements

6.1 Biodiversity Credit Report

A full Credit Calculator report is included in **Appendix D**.

Table 6.1 below provides a summary of the ecosystem and species credits that require offsetting as a result of this Project.

Table 6.1 Ecosystem and Species Credits Generated at the Development Footprint

Name	Credits Required
Ecosystem Credits	
HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	2124
HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	881
HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	33
Total	3038
Species Credits	
large-eared pied bat (<i>Chalinolobus dwyeri</i>)	1011
squirrel glider (<i>Petaurus norfolcensis</i>)	1725
Total	2736

6.2 Offsetting Options for Ecosystem Credits

6.2.1 Offset Location

Ecosystem credits for any of the PCTs in the Development Footprint can be located in any IBRA subregion that adjoins the IBRA subregion in which the Modification Project occurs. The Modification Project occurs in the Bungonia IBRA subregion and therefore, ecosystem credits can be sourced from the following IBRA subregions:

South Eastern Highlands Bioregion

- Bungonia
- Crookwell
- Monaro
- Kybeyan-Gourock

South East Corner Bioregion

- South East Coast Ranges
- Bateman

Sydney Basin Bioregion

- Ettrema
- Burragorang
- Kanangra

6.2.2 HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion

Only HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion can be used to offset this community under the FBA.

6.2.3 HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion

The following PCTs could be used to offset HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion under the FBA:

- HN570 Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, or
- HN543 Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion.

6.2.4 HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion

The following PCTs could be used to offset HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion under the FBA:

- HN515 Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion
- HN506 Blakely's Red Gum - Yellow Box - Rough-barked Apple grassy woodland of the Capertee Valley, Sydney Basin Bioregion
- HN514 Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion
- HN614 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, or
- HN573 Ribbon Gum - Yellow Box grassy woodland on undulating terrain of the eastern tablelands, South Eastern Highlands Bioregion.

6.3 Holcim Australia Offsetting Strategy

Holcim Australia is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Modification Project under the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014). Firstly, Holcim Australia has, where possible, altered the Modification Project to substantially avoid and minimise ecological impacts in the project planning stage, and a range of impact mitigation strategies have been included in the Modification Project to mitigate the impact on ecological values (refer to **Section 4.0**) prior to the consideration of offsetting requirements.

The NSW *Biodiversity Offset Policy for Major Projects* commenced on 1 October 2014 and is now in an 18 month transitional implementation. Fulfilling offset requirements under the Policy will be undertaken using one or a combination of the following offset strategies:

- On-site in-perpetuity conservation of applicable credits.
- Securing required credits through the open credit market, off site.
- Offsetting through a site secured by a BioBanking Agreement.
- If suitable offsets are unavailable, contributing money to supplementary measures in accordance with relevant conservation or recovery actions.
- Contributing to the Offsets Fund.

As a priority, Holcim Australia is investigating the available lands within and surrounding the Holcim Australia landholdings around the Development Site for potential BioBanking Agreement offsetting opportunities. Holcim Australia will also investigate a range of available properties in the locality that contain the appropriate biodiversity features to offset the impacts of the Modification Project (as summarised in **Table 6.1** above). The application of the FBA Variation Rules may be required if it is demonstrated that the appropriate ecosystem or credit-species credits are unavailable for use in the Holcim Biodiversity Offset Strategy.

Further to this, Holcim will investigate, in consultation with OEH, the application of the Offsets Fund (when available) and the monetary contribution required in lieu of or in addition to the proposed offset sites through the use of a BioBanking Agreement.

7.0 References

- Anstis, M, (2002) *Tadpoles of South-eastern Australia*. Reed New Holland, Sydney.
- Armstrong, R.C., Turner, K.D., McDougall, K.L., Rehwinkel, R. and Crooks, J.I. (2013) *Plant Communities of the Upper Murrumbidgee Catchment in New South Wales and the Australian Capital Territory*, *Cunninghamia* 13(1), 125-266.
- Austin, M, P, Cawsey, E, M, Baker, B, L, Yialeloglou, M, M, Grice, D, J, and Briggs, S, V, (2000) *Predicted Vegetation Cover in the Central Lachlan Region*. Final report of the Natural Heritage Trust Project AA 1368.97. CSIRO Wildlife and Ecology, Canberra
- Barker, J, Grigg, G, C, & Tyler, M, J, (1995) *A Field Guide to Australian Frogs*. Surrey Beatty & Sons, Sydney.
- Birdlife International (2013) *Taxonomic Checklist*, Version 6.0, November 2013.
- Botanic Gardens Trust, (2015) *PlantNET* – The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). <<http://plantnet.rbgsyd.nsw.gov.au>> accessed February 2015.
- Braun-Blanquet, J, (1927) *Pflanzensoziologie*. Springer, Vienna.
- Churchill, S. (1998) *Australian Bats*. First Edition, Reed New Holland, Sydney.
- Churchill, S. (2008) *Australian Bats*. Second Edition, Allen & Unwin, Sydney.
- Cogger, H, G. (2000) *Reptiles and Amphibians of Australia*. Reed Books, Chatswood.
- Council of Heads of Australian Barbaria (CHAH) (2011) *Australian Plant Census (APC)*, accessed August 2015.
- Cronquist, A, (1981) *An Integrated System of Classification of Flowering Plants*. Columbia University Press, New York.
- Department of the Environment (2013) *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance*.
- Department of Environment and Climate Change (DECC) (2008) *Approved Recovery Plan for the Koala (Phascolarctos cinereus)*, November 2008.
- Department of Environment and Climate Change (DECC) (2008) *Managing Urban Stormwater – Soils and Construction*, Volume 2A, 2C, 2D and 2E (the Blue Book).
- Department of Environment and Conservation (DEC) (2004) *Threatened Species Survey and Assessment: Guidelines for development and activities (working draft)*, November 2004.
- Department of Environment and Climate Change (OEH) (2008) *BioBanking Assessment Methodology*, July 2008.
- Department of Environment and Resource Management (DERM) (2011) *National recovery plan for the large-eared pied bat Chalinolobus dwyeri*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Department of Environment, Climate Change and Water NSW (DECCW) (2011) *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*. Department of Environment, Climate Change and Water NSW, Sydney

Department of Infrastructure, Planning and Natural Resources (DIPNR) (2003) *Soil Landscapes of the Goulburn Region 1:100 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Department of Sustainability, Environment, Water, Population and Communities (DSWEPC) (2011) Survey Guidelines for Australia's Threatened Reptiles.

Department of the Environment (DoE) (2015) *Aprasia parapulchella* in Species Profile and Threats Database, Department of the Environment, Canberra.

Department of the Environment (DoE) (2015) Protected Matters Search Tool
<http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf> accessed February 2015.

Department of Primary Industries (DPI) (2004) Policy and Guidelines for Fish Friendly Waterway Crossings

Endangered Species Scientific Subcommittee (ESSS) (2000) Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory, advice to the Minister for the Environment and Heritage on a proposal to add an ecological community to Schedule 2 of the Endangered Species Protection Act 1992 (ESP Act).

Harden, G, J, editor, (1992) *Flora of New South Wales. Volume 3*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (1993) *Flora of New South Wales. Volume 4*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (2000) *Flora of New South Wales. Volume 1*. 2nd edition. New South Wales University Press and Royal Botanic Gardens, Sydney.

Harden, G, J, editor, (2002) *Flora of New South Wales. Volume 2*. Revised edition. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Holcim (Australia) Pty Ltd (2013) Lynwood Quarry Erosion and Sediment Plan.

Land and Property Information (LPI) (2014) SIX Maps < <https://maps.six.nsw.gov.au/>>

Landcom (2004) Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition.

Menkhorst, P, and Knight, F, (2004) *A Field Guide to the Mammals of Australia*, Oxford University Press, South Melbourne.

NSW National Parks and Wildlife Services (NPWS) (2003) *The Bioregions of New South Wales: their biodiversity, conservation and history, Chapter 16: The South Eastern Highlands Bioregion*.

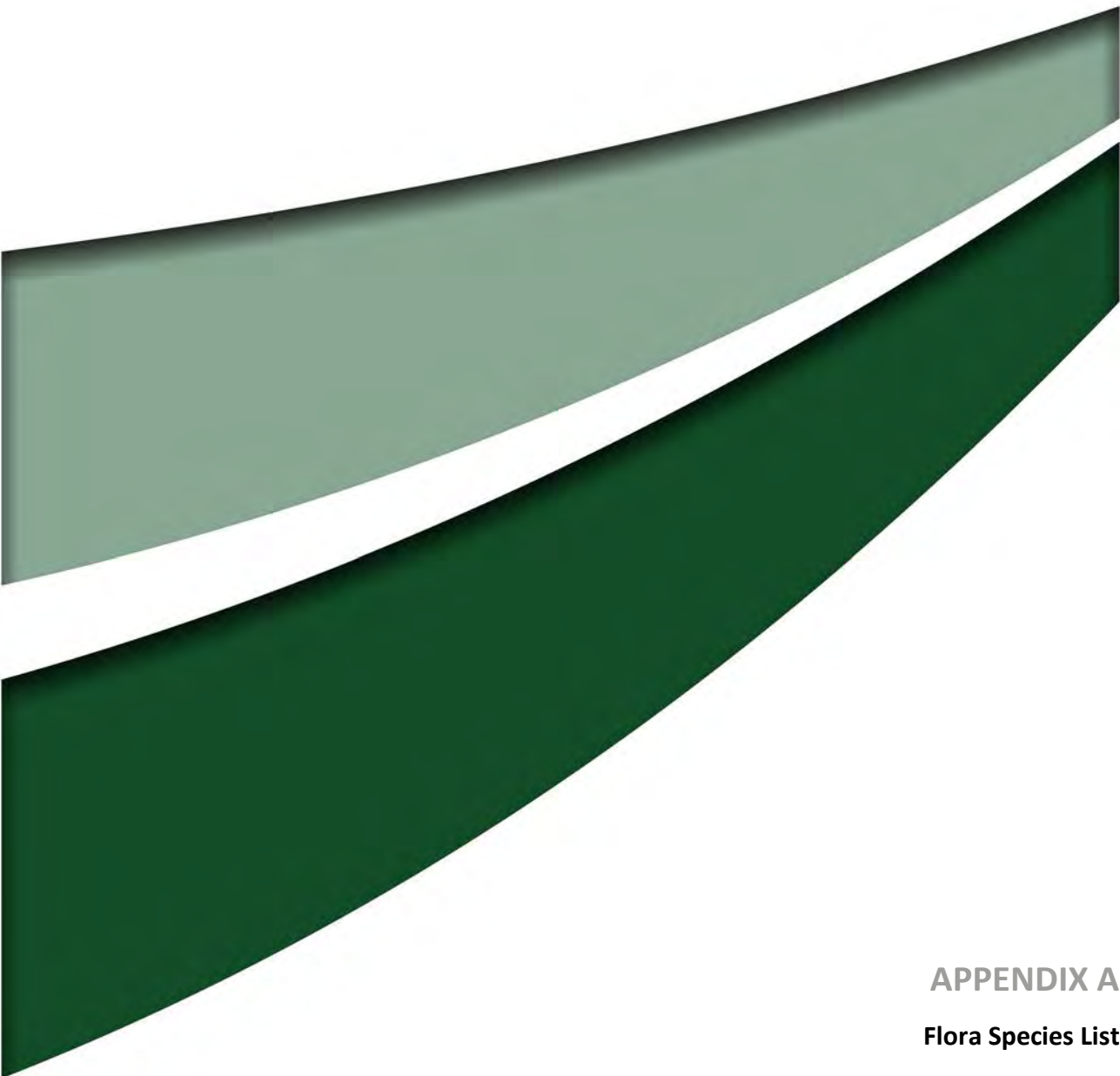
NSW Scientific Committee (2002) White Box Yellow Box Blakely's Red Gum Woodland – endangered ecological community final determination, gazetted 15 March 2002.

NSW Scientific Committee (2011) Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands – endangered ecological community final determination, gazetted 15 April 2011.

Office of Environment and Heritage (OEH) (2014) BioBanking Assessment Methodology, September 2014.

Office of Environment and Heritage (OEH) (2014) Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects, September 2014

- Office of Environment and Heritage (OEH) (2015) BioNet Atlas of NSW Wildlife, accessed July 2015.
- Office of Environment and Heritage (OEH) (2015) Vegetation Information System (VIS).
- Poore, M. E. D. (1955) The use of phytosociological methods in ecological investigations. I. The Braun-Blanquet system. *Journal of Ecology* 42: 216-224.
- Robinson, M, (1998) *A Field Guide to Frogs of Australia*. Australian Museum/Reed New Holland, Sydney
- Slater, P, Slater, P, and Slater, R, (2003) *The Slater Field Guide to Australian Birds*. Reed New Holland, Sydney.
- Strahan, R, (ed) (2002) *The Mammals of Australia* Revised Edition. Reed New Holland, Sydney.
- Strahler, A. N., (1952) Hypsometric (area-altitude) analysis of erosional topography, *Geological Society of America Bulletin* 63 (11): 1117-1142.
- Swan, G, Shea, G, and Sadler, R, (2004) *A Field Guide to Reptiles of New South Wales*. Reed New Holland, Sydney.
- Threatened Species Scientific Committee (TSSC) (2006) White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands Listing Advice, registered 17 May 2006.
- Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., Mackenzie, B., Beukers, P. and Cox, S. (2010) Native Vegetation of Southeast NSW: a revised classification and map for the coast and eastern tablelands, *Cunninghamia* 11(3) 359-406.
- Umwelt (Australia) Pty Limited (2011) Lynwood Quarry Project Inspection and Assessment of Hoary Sunray, report prepared on behalf of Minter Ellison Lawyers, November 2011
- Umwelt (Australia) Pty Limited (2010) Environmental Assessment for the Proposed Modifications to Lynwood Quarry, Marulan, Report prepared for Holcim (Australia) Pty Ltd, October 2010.
- Umwelt (Australia) Pty Limited (2005) Ecological Assessment for the Proposed Lynwood Quarry, Marulan, Report prepared for Readymix Holdings Pty Limited.
- Weigel, J, (1990) *Australian Reptile Park's Guide to Snakes of South-East Australia*. Weigel Postscript.
- Wheeler D, J, B, Jacobs S, W, L, and Whalley R, D, B, (2002) *Grasses of New South Wales*, 3rd Edition. The University of New England, Armidale.
- Wilson, S, and Swan, G, (2008) *A Complete Guide to Reptiles of Australia*. Reed New Holland, Sydney.



APPENDIX A

Flora Species List

Appendix A - Flora Species List

The following list was developed from surveys of the Development Site by Umwelt in February and October 2014. It includes all species of vascular plants observed during these surveys. It is acknowledged that the list is not comprehensive, as not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp. specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

1 to 6	modified Braun-Blanquet cover-abundance score;
X	species recorded in proximity to, but outside of, quantitative floristic quadrat;
✓	species recorded opportunistically during surveys;
asterisk (*)	denotes species not native to the Marulan area;
subsp.	subspecies; and
var.	variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler *et al.* (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2015), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Filicopsida																										
Adiantaceae	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	poison rock fern								2	2				1			2	2							X
Magnoliopsida (Flowering Plants) - Lillidae																										
Anthericaceae	<i>Tricoryne elatior</i>	yellow autumn-lily										X														
Asphodelaceae	<i>Bulbine bulbosa</i>	bulbine lily																1								
Cyperaceae	<i>Carex incomitata</i>																									X
Cyperaceae	<i>Carex inversa</i>	knob sedge	X																	2						X
Cyperaceae	<i>Cyperus difformis</i>	dirty dora																								X
Cyperaceae	<i>Cyperus lhotskyanus</i>																									X
Cyperaceae	<i>Cyperus</i> sp.																									X
Cyperaceae	<i>Eleocharis acuta</i>																									X
Cyperaceae	<i>Eleocharis plana</i>	flat spike-sedge																								X
Cyperaceae	<i>Fimbristylis dichotoma</i>	common fringe-sedge																		1	1					X
Cyperaceae	<i>Schoenoplectus validus</i>																									X
Cyperaceae	<i>Schoenus apogon</i>	fluke bogrush																								X
Cyperaceae	<i>Schoenus latelaminatus</i>	medusa bog sedge																								X
Juncaceae	* <i>Juncus articulatus</i>	a rush																								X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Juncaceae	<i>Juncus australis</i>	rush											1													
Juncaceae	<i>Juncus filicaulis</i>										1															X
Juncaceae	<i>Juncus</i> sp.	a rush	X																							X
Juncaceae	<i>Juncus subsecundus</i>	finger rush	1					1	1																	
Juncaceae	<i>Juncus vaginatus</i>																									X
Lomandraceae	<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	wattle mat-rush	X							2	2	2			2	1		2	2	3	2					X
Lomandraceae	<i>Lomandra longifolia</i>	spiny-headed mat-rush										X			X											X
Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	many-flowered mat-rush																	1							
Orchidaceae	<i>Diuris sulphurea</i>	hornet orchid																1								
Phormiaceae	<i>Dianella longifolia</i>	blueberry lily	1	1																						
Phormiaceae	<i>Dianella revoluta</i> var. <i>revoluta</i>	a blue flax lily																								X
Phormiaceae	<i>Stypantra glauca</i>	nodding blue lily																		X						X
Poaceae	* <i>Aira caryophyllea</i>	silvery hairgrass	1	1						1					1			2	2							X
Poaceae	* <i>Aira</i> sp.	a hairgrass									2			2												X
Poaceae	<i>Amphibromus nervosus</i>	swamp wallaby grass																								X
Poaceae	<i>Aristida</i> sp.	a wiregrass																								X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Poaceae	<i>Aristida vagans</i>	threeawn speargrass									2															X
Poaceae	<i>Austrostipa bigeniculata</i>	yanganbil																								X
Poaceae	<i>Austrostipa densiflora</i>	foxtail speargrass									2															X
Poaceae	<i>Austrostipa scabra</i> subsp. <i>falcata</i>	rough speargrass	3	3	2	2	1	2	1	2	2	2		2	2	1				2		3	2	2		X
Poaceae	<i>Austrostipa setacea</i>	corkscrew grass					1																			
Poaceae	<i>Austrostipa</i> sp.	a speargrass																								X
Poaceae	* <i>Avena</i> sp.	oats																								X
Poaceae	<i>Bothriochloa macra</i>	red grass																								X
Poaceae	<i>Brachiaria miliiformis</i>																									X
Poaceae	* <i>Bromus brevis</i>		2				2	3								2										X
Poaceae	* <i>Bromus catharticus</i>	prairie grass					4						3	2		3	1			1		3	2	2	2	X
Poaceae	* <i>Bromus diandrus</i>	great brome																								X
Poaceae	* <i>Bromus hordeaceus</i>	soft brome	4																							X
Poaceae	* <i>Bromus molliformis</i>	soft brome			4				2	3																

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Poaceae	<i>*Bromus sp.</i>	a brome		2		3																				
Poaceae	<i>Cynodon dactylon</i>	common couch						2																		X
Poaceae	<i>*Dactylis glomerata</i>	cocksfoot						4																		
Poaceae	<i>Dactyloctenium radulans</i>	button grass	1				1																			
Poaceae	<i>Dichelachne crinita</i>	longhair plumegrass		1							2															X
Poaceae	<i>*Eleusine tristachya</i>	goose grass						1																		
Poaceae	<i>Elymus scaber</i>	common wheatgrass		2	2							1											2			X
Poaceae	<i>*Holcus lanatus</i>	yorkshire fog											1	1											5	X
Poaceae	<i>*Hordeum leporinum</i>	barley grass		1	2	3	2	2	2	2			4	3		2	1									X
Poaceae	<i>Lachnagrostis filiformis</i>		1																							X
Poaceae	<i>*Lolium perenne</i>	perennial ryegrass											2													X
Poaceae	<i>*Lolium sp.</i>	a ryegrass																								X
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	weeping grass	1	2	2		1	1					2		1	2		2		2						X
Poaceae	<i>*Nassella trichotoma</i>	serrated tussock	2	2	2	2	1	1	4	3	5	5	2	2	2	3		3	4	2	1	4	3	2		X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Poaceae	<i>*Paspalum dilatatum</i>	paspalum																								X
Poaceae	<i>Pennisetum alopecuroides</i>	swamp foxtail																								X
Poaceae	<i>*Phalaris aquatica</i>	phalaris					1																			X
Poaceae	<i>*Phalaris</i> sp.																									X
Poaceae	<i>*Poa bulbosa</i>	bulbous poa											2													
Poaceae	<i>Poa labillardierei</i>	tussock grass																						2		X
Poaceae	<i>Poa sieberiana</i>	snowgrass	2	2											2											X
Poaceae	<i>Poa sieberiana</i> var. <i>sieberiana</i>	snowgrass						1																		X
Poaceae	<i>Poa</i> sp.										2														3	
Poaceae	<i>*Polypogon monspeliensis</i>	annual beardgrass																								X
Poaceae	<i>Rytidosperma auriculatum</i>	lobed wallaby grass																								X
Poaceae	<i>Rytidosperma caespitosum</i>	ringed wallaby grass					2	2		2	2	1														X
Poaceae	<i>Rytidosperma carphoides</i>	short wallaby grass																								X
Poaceae	<i>Rytidosperma erianthum</i>	wallaby grass	2																							
Poaceae	<i>Rytidosperma laeve</i>	wallaby grass																								X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Poaceae	<i>Rytidosperma monticola</i>	mountain wallaby grass	2																							
Poaceae	<i>Rytidosperma racemosum</i> var. <i>racemosum</i>	a wallaby grass										2														X
Poaceae	<i>Rytidosperma</i> sp.			3														3	2	2	2		1			X
Poaceae	<i>Themeda australis</i>	kangaroo grass																								X
Poaceae	* <i>Vulpia myuros</i>	rat's tail fescue	4	2	3	3	4	3	2	2			4	3		4						2	5	5		X
Typhaceae	<i>Typha domingensis</i>	narrow-leaved cumbungi																								X
Magnoliopsida (Flowering Plants) - Magnoliidae																										
Amaranthaceae	<i>Alternanthera denticulata</i>	lesser joyweed			1	1				1																X
Amaranthaceae	<i>Alternanthera</i> sp.	joyweed																							1	X
Amaranthaceae	* <i>Amaranthus hybridus</i>	slim amaranth				1		1																		X
Amaranthaceae	<i>Amaranthus</i> sp.	amaranth							1																	
Apiaceae	<i>Hydrocotyle laxiflora</i>	stinking pennywort		1							1				2			3	2	3	2					X
Asteraceae	* <i>Aster subulatus</i>	wild aster																								X
Asteraceae	* <i>Carthamus lanatus</i>	saffron thistle																								X
Asteraceae	<i>Cassinia arcuata</i>	sifton bush									1															X
Asteraceae	* <i>Chondrilla juncea</i>	skeleton weed	1																							X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Asteraceae	<i>Chrysocephalum apiculatum</i>	common everlasting									1							1								X
Asteraceae	* <i>Cirsium vulgare</i>	spear thistle	2	2	2	2		2	2	1	1	1	2	3	1					1			2			X
Asteraceae	* <i>Conyza bonariensis</i>	flaxleaf fleabane	1																							
Asteraceae	* <i>Conyza</i> sp.	a fleabane			1	1			2																	
Asteraceae	<i>Cotula australis</i>	common cotula											2	2												
Asteraceae	<i>Cymbonotus lawsonianus</i>	bears ear													1			1	2	2						
Asteraceae	<i>Euchiton gymnocephalus</i>	creeping cudweed																1			1					
Asteraceae	<i>Euchiton involucratus</i>	star cudweed																1	2	2						
Asteraceae	* <i>Gamochaeta americana</i>	cudweed	2			1			2		1															
Asteraceae	* <i>Gamochaeta</i> sp.																			2						
Asteraceae	* <i>Hypochaeris radicata</i>	catsear	1	2	2	2		2	2		1	1	2	2	2	2		2	2	2	2		2	2		X
Asteraceae	* <i>Lactuca serriola</i>	prickly lettuce						1																		X
Asteraceae	<i>Olearia megalophylla</i>	large-leaf daisy-bush										2														
Asteraceae	<i>Olearia viscidula</i>	wallaby weed																2	3		1					
Asteraceae	<i>Senecio quadridentatus</i>	cotton fireweed									1															
Asteraceae	* <i>Silybum marianum</i>	variegated thistle			2	X	2	2	1				2	2		2	1						3			X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Asteraceae	<i>*Sonchus oleraceus</i>	common sowthistle													1											
Asteraceae	<i>*Tolpis barbata</i>	yellow hawkweed							1																	X
Asteraceae	<i>*Tragopogon porrifolius</i>	salsify	1																							
Asteraceae	<i>Triptilodiscus pygmaeus</i>	common sunray																1								
Asteraceae	<i>Vittadinia cuneata</i> var. <i>cuneata</i>	fuzzweed									2															
Asteraceae	<i>Vittadinia gracilis</i>	woolly new holland daisy									X															
Boraginaceae	<i>Cynoglossum suaveolens</i>	sweet hounds-tongue		1																						
Brassicaceae	<i>*Capsella bursa-pastoris</i>	shepherds purse											1	1		1	1									
Brassicaceae	<i>*Hirschfeldia incana</i>	Buchan weed						1																		X
Brassicaceae	<i>*Lepidium africanum</i>	common peppergrass	1		2	1	1	1	1																	X
Campanulaceae	<i>Wahlenbergia communis</i>	tufted bluebell																2		2						X
Campanulaceae	<i>Wahlenbergia luteola</i>	bluebell																		2						X
Campanulaceae	<i>Wahlenbergia</i> sp.	bluebell		1							1								2							X
Campanulaceae	<i>Wahlenbergia stricta</i>	tall bluebell																			2					

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Caryophyllaceae	<i>Cerastium fontanum</i>													2												
Caryophyllaceae	<i>*Paronychia brasiliensis</i>	chilean whitlow wort	2	2	2	2	2	2	3	2			3	4	2	3	1			2			2	2		X
Caryophyllaceae	<i>*Petrohragia nanteuillii</i>	proliferous pink								2	2	1			2											X
Caryophyllaceae	<i>Stellaria pungens</i>	prickly starwort													X											
Chenopodiaceae	<i>*Chenopodium album</i>	fat hen						1																		
Chenopodiaceae	<i>Einadia hastata</i>	berry saltbush			1																					
Chenopodiaceae	<i>Einadia nutans</i> subsp. <i>nutans</i>	climbing saltbush	2	2	2	2	1	2	2	2		2		1	1			1	1							X
Clusiaceae	<i>Hypericum gramineum</i>	small St Johns wort								1	1				1			2		2	2					X
Clusiaceae	<i>*Hypericum perforatum</i>	St. Johns wort																	2							
Convolvulaceae	<i>Convolvulus angustissimus</i>																	1								X
Convolvulaceae	<i>Dichondra repens</i>	kidney weed													1			1	2							
Convolvulaceae	<i>Dichondra</i> sp. A	kidney weed										X														X
Crassulaceae	<i>Crassula sieberiana</i>	Australian stonecrop								2		X		2	2			2		2						X
Crassulaceae	<i>Crassula</i> sp.	stonecrop																								X
Ericaceae	<i>Acrotriche serrulata</i>	honeypots								2		1														X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Ericaceae	<i>Lissanthe strigosa</i>	peach heath													1			2	2	2	2					X
Ericaceae	<i>Melichrus erubescens</i>	ruby urn heath								1	2	2														X
Ericaceae	<i>Melichrus urceolatus</i>	urn heath																								X
Fabaceae (Faboideae)	<i>Bossiaea buxifolia</i>										1				1											X
Fabaceae (Faboideae)	<i>Bossiaea prostrata</i>																				1					
Fabaceae (Faboideae)	<i>Cullen tenax</i>	emu-foot																								X
Fabaceae (Faboideae)	<i>Desmodium varians</i>	slender tick-trefoil																								X
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	twining glycine																	2							X
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	variable glycine		2						1					1											X
Fabaceae (Faboideae)	<i>Indigofera australis</i>	Australian indigo													1											
Fabaceae (Faboideae)	<i>Jacksonia scoparia</i>	dogwood																								X
Fabaceae (Faboideae)	<i>*Medicago polymorpha</i> var. <i>vulgaris</i>																									X
Fabaceae (Faboideae)	<i>*Trifolium arvense</i>	haresfoot clover					1									2										

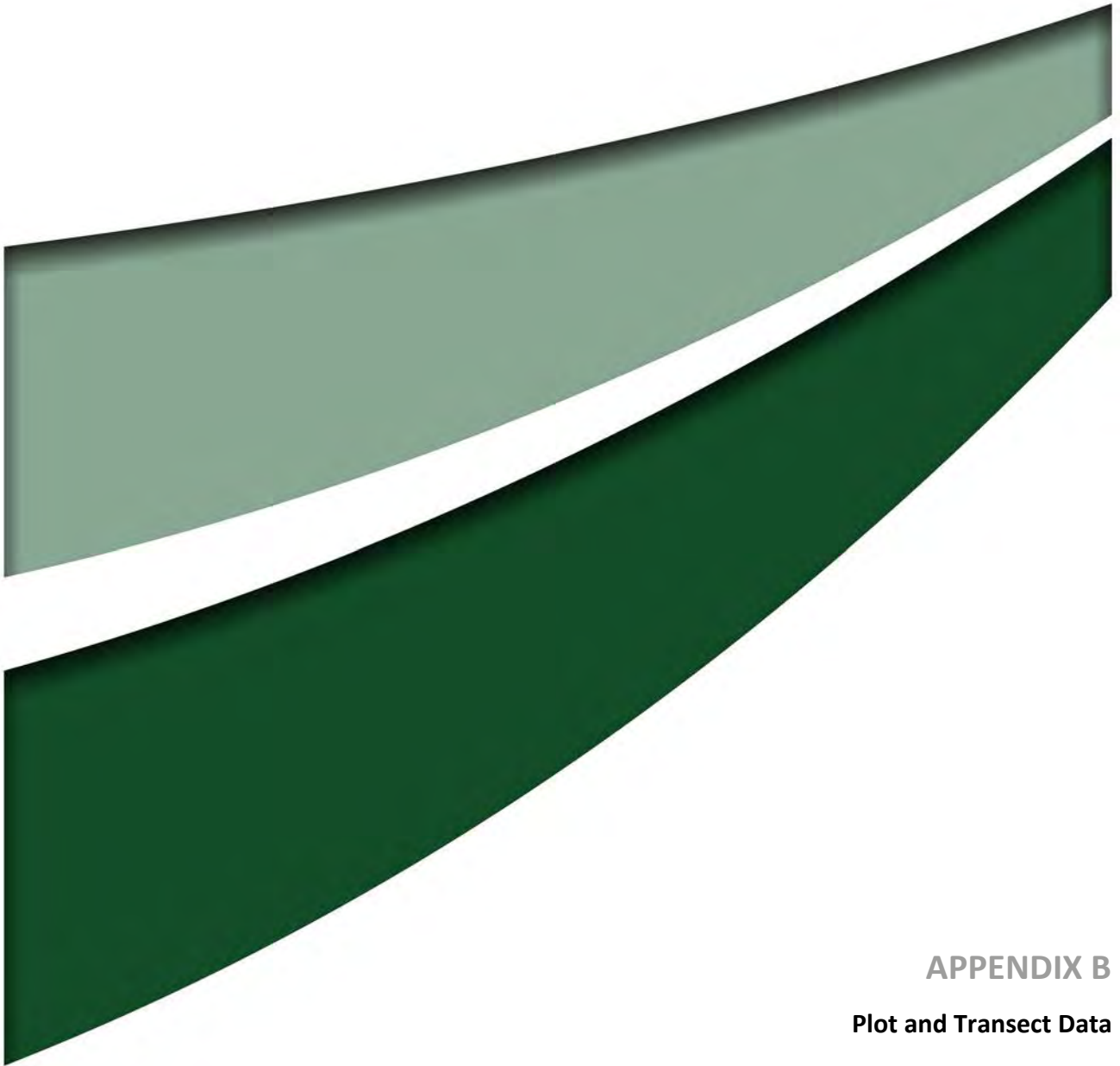
			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Fabaceae (Faboideae)	<i>*Trifolium fragiferum</i>	strawberry clover																								X
Fabaceae (Faboideae)	<i>*Trifolium glomeratum</i>	clustered clover					1		1	1			2			3										
Fabaceae (Faboideae)	<i>*Trifolium repens</i>	white clover											2													X
Fabaceae (Faboideae)	<i>*Trifolium subterraneum</i>	subterranean clover												3		2										
Fabaceae (Faboideae)	<i>*Trifolium tomentosum</i>	woolly clover																								X
Fabaceae (Mimosoideae)	<i>Acacia parramattensis</i>	Parramatta wattle									1	2						2		2						X
Gentianaceae	<i>Sebaea ovata</i>	yellow centaury																2								
Geraniaceae	<i>*Erodium botrys</i>	long storksbill					1									2										X
Geraniaceae	<i>*Erodium moschatum</i>	musky crowfoot											1	1			1									
Geraniaceae	<i>*Geranium molle</i>	doves foot cranesbill														1										
Geraniaceae	<i>Geranium solanderi</i> var. <i>solanderi</i>				1		1	1	1				1											1		X
Geraniaceae	<i>Geranium</i> sp.													1											2	
Goodeniaceae	<i>Goodenia hederacea</i>	ivy goodenia													2											
Goodeniaceae	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	ivy goodenia								1								2			2					

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Haloragaceae	<i>Gonocarpus tetragynus</i>	poverty raspwort									1				3			2	2	2	2					
Lamiaceae	<i>Ajuga australis</i>	austral bugle													2											
Lamiaceae	* <i>Marrubium vulgare</i>	white horehound				1	1																			X
Lamiaceae	<i>Mentha satureioides</i>	native pennyroyal																								X
Lamiaceae	* <i>Prunella vulgaris</i>	self-heal													2											
Lamiaceae	<i>Scutellaria humilis</i>	dwarf skullcap																	2							
Loranthaceae	<i>Muellerina eucalyptoides</i>								1																	
Malaceae	* <i>Crataegus monogyna</i>	hawthorn																								X
Malvaceae	* <i>Malva parviflora</i>	small-flowered mallow			1	2	1	2						1		1	1									X
Malvaceae	* <i>Modiola caroliniana</i>	red-flowered mallow	1		1	2	2	2					2	2										1		X
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakely's red gum	2			3	X	2	3	X	2	4						4		2	2					X
Myrtaceae	<i>Eucalyptus bridgesiana</i>	apple box		X			X						X													
Myrtaceae	<i>Eucalyptus macrorhyncha</i>	red stringybark								4	3			3	4	3		3	4	4	4					X
Myrtaceae	<i>Eucalyptus melliodora</i>	yellow box	X				2	3		X	2						1	2	X	2	2					X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Myrtaceae	<i>Eucalyptus pauciflora</i>	white sally	X	X									X													
Myrtaceae	<i>Eucalyptus viminalis</i>	ribbon gum		3	3								3												1	X
Myrtaceae	<i>Melaleuca erubescens</i>	pink honeymyrtle																								
Onagraceae	<i>Epilobium billardiereum</i> subsp. <i>cinereum</i>																									X
Oxalidaceae	<i>Oxalis perennans</i>										1		2		2				2	2						
Oxalidaceae	<i>Oxalis</i> sp.													2				1								
Phyllanthaceae	<i>Poranthera microphylla</i>	small poranthera																	2		2					
Phytolaccaceae	* <i>Phytolacca americana</i>	poke root								X																
Plantaginaceae	* <i>Plantago lanceolata</i>	lambs tongues											1													X
Plantaginaceae	<i>Plantago</i> sp.	plantain									2															X
Plantaginaceae	<i>Plantago varia</i>														2											
Plantaginaceae	<i>Veronica plebeia</i>	trailing speedwell									X															
Polygonaceae	* <i>Acetosella vulgaris</i>	sheep sorrel	1	2	3	2	2	2	2	2			3	4	3	2	1						2	2		X
Polygonaceae	<i>Persicaria prostrata</i>	creeping knotweed																								X
Polygonaceae	* <i>Polygonum aviculare</i>	wireweed																								X
Polygonaceae	<i>Rumex brownii</i>	swamp dock	X				1																			X

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Polygonaceae	<i>*Rumex crispus</i>	curled dock																								X
Polygonaceae	<i>Rumex</i> sp.	dock											1	1		1	1					1		2		X
Polygonaceae	<i>Rumex tenax</i>	shiny dock										1														X
Portulacaceae	<i>Portulaca oleracea</i>	pigweed						1																		
Primulaceae	<i>Samolus valerandi</i>	common brookweed																								X
Ranunculaceae	<i>Ranunculus lappaceus</i>	common buttercup																								X
Rosaceae	<i>Acaena ovina</i>	acaena		1		1																				X
Rosaceae	<i>*Rosa rubiginosa</i>	sweet briar																								X
Rosaceae	<i>*Rubus fruticosus</i> sp. agg.	blackberry complex																								X
Rubiaceae	<i>Asperula conferta</i>	common woodruff								1			2													X
Rubiaceae	<i>Opercularia diphylla</i>	stinkweed									1															
Rubiaceae	<i>Opercularia hispida</i>	hairy stinkweed										1														
Salicaceae	<i>*Salix babylonica</i>	weeping willow																								X
Santalaceae	<i>Exocarpos cupressiformis</i>	cherry ballart													X											X
Scrophulariaceae	<i>*Parentucellia latifolia</i>	red bartsia				1																				
Solanaceae	<i>*Lycium ferocissimum</i>	African boxthorn																								X
Solanaceae	<i>*Solanum chenopodioides</i>	whitetip nightshade			1	1																				

			P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P22	P23	P24	P25	P26	P27	P28	P29	P30	R07	R08	R09	R10	Opps
Solanaceae	<i>Solanum cinereum</i>	Narrawa burr									1	1														X
Solanaceae	* <i>Solanum linnaeanum</i>	apple of Sodom								X																
Solanaceae	* <i>Solanum nigrum</i>	black-berry nightshade	X		1	1												1	1	1	1					X
Urticaceae	* <i>Urtica urens</i>	small nettle											1													



APPENDIX B

Plot and Transect Data

Appendix B - Plot and Transect Data

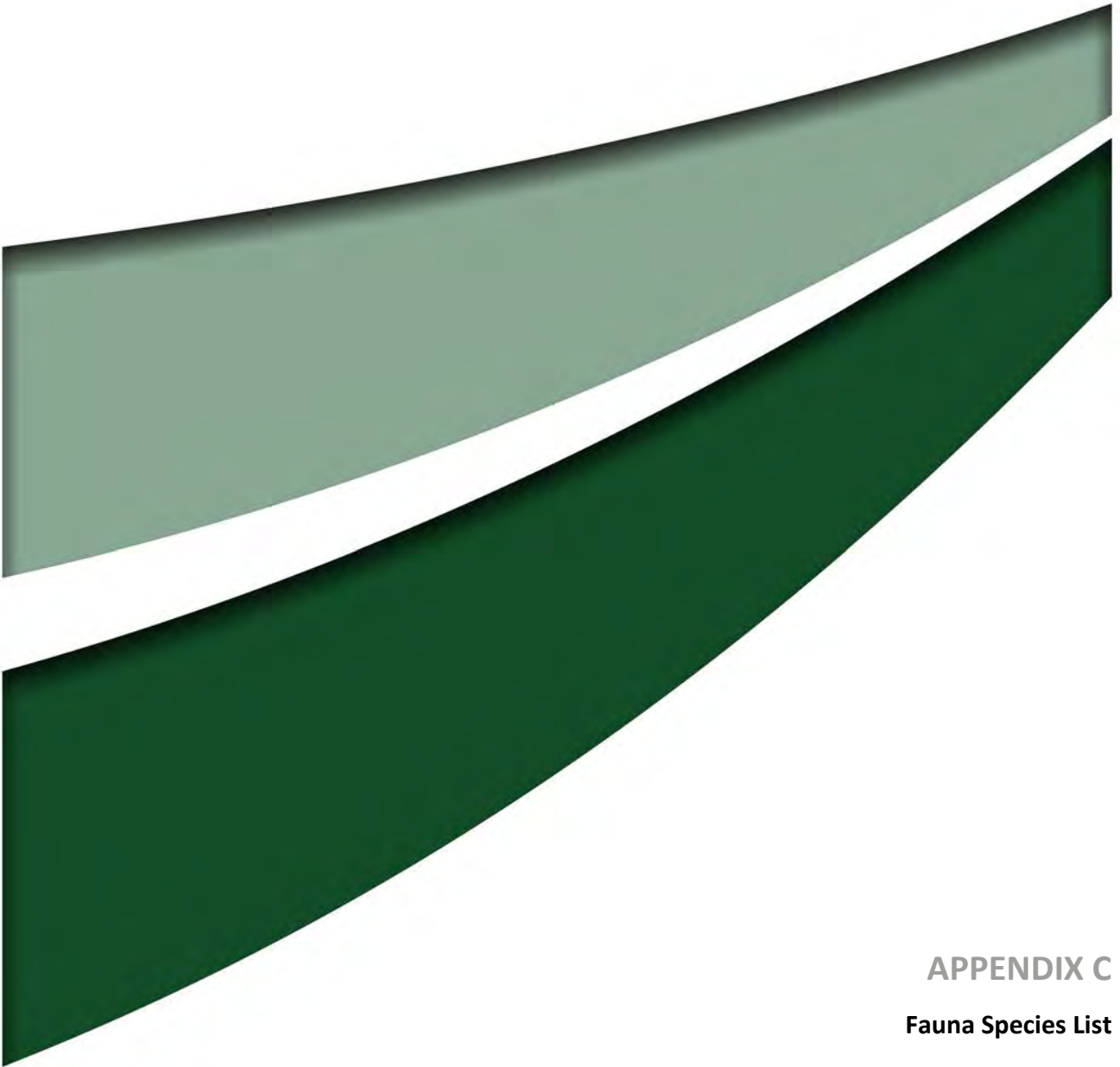
The following plot and transect data was collected from surveys of the Development Site in February and October 2014. It includes the ten site attributes that are recorded in each Biometric plot and transect as per Table 2 of the FBA (OEH 2014). This data is assessed against benchmark data for PCTs and then entered into the BioBanking Calculator to assess the site value of each PCT in the Development Site.

The following abbreviations or symbols are used in the list:

NPS	native plant species
NOC	native overstorey cover
NMC	native midstorey cover
NGCG	native ground cover (grasses)
NGCS	native ground cover (shrubs)
NGCO	native ground cover (other)
EPC	exotic plant cover
NTH	number of trees with hollows
OR	overstorey regeneration, and
FL	total length of fallen logs.

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
Zone 1: HN614 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good)													
P27	28	25	0	22	2	28	12	0	0	31	771276	6157843	55
Zone 2: HN614 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (Moderate/Good_Poor)													
P04	17	8	0	14	8	0	62	3	1	6	770059	6156723	55
P07	5	13	0	0	2	0	76	1	1	3	771049	6157117	55
P08	11	6	0	0	2	0	80	1	1	0	770251	6157082	55
P09	11	7	0	4	2	0	94	1	1	12	768962	6157780	55
P10	7	7	0	2	0	0	84	0	1	13	771037	6157570	55
P12	27	15	0	18	14	24	56	7	1	13	771245	6157989	55
P26	1	14	0	0	0	0	84	0	1	0	770850	6156872	55
Zone 3: HN570 - Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate/Good)													
P24	21	24	0	18	0	14	16	0	0.3	26	770715	6158050	55
P29	16	30	2	8	0	10	2	3	0.3	14	771246	6157373	55
P30	24	15	0	10	2	14	8	1	0.3	19	771329	6157796	55
Zone 4: HN570 - Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (Moderate/Good_Poor)													
P11	16	6	0	0	4	0	60	1	0.7	11	771140	6157261	55
P13	19	11	1	6	16	0	62	2	0.7	61	771233	6157514	55
P23	7	12	0	0	0	6	88	2	0.7	36	770342	6157567	55
P25	4	6	0	2	0	0	88	1	0.7	4	770741	6157664	55
P28	19	25	10	8	0	12	34	0	0.7	18	771247	6157700	55

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
Zone 5: HN515 - Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion (Moderate/Good)													
P05	16	8	0	28	0	6	60	1	0	22	770471	6156509	55
P22	9	11	0	8	0	6	84	3	0	13	770704	6156487	55
Zone 6: HN572 - Ribbon Gum - Snow Gum grassy forest on damp flats, eastern South Eastern Highlands Bioregion (Moderate/Good)													
P06	8	8	0	16	0	0	54	4	0.3	66	770977	6156677	55



APPENDIX C

Fauna Species List

Appendix C - Fauna Species List

The following fauna list was developed from surveys of the Development Site by Umwelt in February and August 2014.

The following abbreviations or symbols are used in the list:

asterisk (*)	Denotes species not indigenous to the Development Site;
subsp.	Subspecies;
MAR	Listed marine species under the EPBC Act;
MIG	Listed migratory species under the EPBC Act;
V	Vulnerable under the TSC and/or EPBC Acts; and
E	Endangered under the TSC and/or EPBC Acts;

Birds recorded were identified using descriptions in Slater *et al.* (2003) and the scientific and common name nomenclature of BirdLife International Taxonomic Checklist (2013) (formerly Birds Australia). Reptiles recorded were identified using keys and descriptions in Cogger (2000), Swan *et al.* (2004), Weigel (1990) and Wilson and Swan (2008) and the scientific and common name nomenclature of Cogger (2000).

Amphibians recorded were identified using keys and descriptions in Cogger (2000), Robinson (1998), Anstis (2002) and Barker *et al.* (1995) and the scientific and common name nomenclature of Cogger (2000). Mammals recorded were identified using keys and descriptions in Strahan (2002) and Menkhorst and Knight (2004) and the scientific and common name nomenclature of Strahan (2002) for non bat species. Bat species recorded were identified using keys and descriptions in Churchill (1998) and ecological information was obtained from Churchill (2008).

Scientific Name	Common Name	TSC Status	EPBC Status
AMPHIBIANS			
Myobatrachidae			
<i>Limnodynastes peronii</i>	striped marsh frog		
<i>Limnodynastes tasmaniensis</i>	spotted marsh frog		
REPTILES			
Scincidae			
<i>Egernia cunninghami</i>	Cunninghams skink		
<i>Lampropholis delicata</i>	dark-flecked garden sunskink		
<i>Saiphos equalis</i>	three-toed skink		
<i>Tiliqua scincoides</i>	eastern blue-tongue		
Elapidae			
<i>Pseudechis porphyriacus</i>	red-bellied black snake		

Scientific Name	Common Name	TSC Status	EPBC Status
BIRDS			
Apodidae			
<i>Hirundapus caudacutus</i>	white-throated needletail		MIG
Podargidae			
<i>Podargus strigoides</i>	tawny frogmouth		
Ardeidae			
<i>Egretta novaehollandiae</i>	white-faced heron		
Columbidae			
<i>Ocyphaps lophotes</i>	crested pigeon		
<i>Phaps chalcoptera</i>	common bronzewing		
Alcedinidae			
<i>Dacelo novaeguineae</i>	laughing kookaburra		
<i>Todiramphus sanctus</i>	sacred kingfisher		
Maluridae			
<i>Malurus cyaneus</i>	superb fairy-wren		
Cacatuidae			
<i>Cacatua galerita</i>	sulphur-crested cockatoo		
<i>Callocephalon fimbriatum</i>	gang-gang cockatoo	V	
<i>Eolophus roseicapillus</i>	galah		
<i>Cacatua sanguinea</i>	little corella		
<i>Calyptorhynchus lathami</i>	glossy black-cockatoo	V	
Psittacidae			
<i>Platycercus elegans</i>	crimson rosella		
<i>Platycercus eximius</i>	eastern rosella		
<i>Psephotus haematonotus</i>	red-rumped parrot		
Anatidae			
<i>Anas superciliosa</i>	pacific black duck		
<i>Anas gracilis</i>	grey teal		
<i>Chenonetta jubata</i>	wood duck		
Podicipedidae			
<i>Tachybaptus novaehollandiae</i>	Australasian grebe		
Accipitridae			
<i>Aquila audax</i>	wedge-tailed eagle		

Scientific Name	Common Name	TSC Status	EPBC Status
<i>Elanus axillaris</i>	black-shouldered kite		
<i>Haliastur sphenurus</i>	whistling kite		
Falconidae			
<i>Falco cenchroides</i>	nankeen kestrel		
<i>Falco berigora</i>	brown falcon		
Charadriidae			
<i>Elseyornis melanops</i>	black-fronted dotterel		
Climacteridae			
<i>Cormobates leucophaea</i>	white-throated treecreeper		
Pardalotidae			
<i>Pardalotus striatus</i>	striated pardalote		
<i>Pardalotus punctatus</i>	spotted pardalote		
Meliphagidae			
<i>Acanthorhynchus tenuirostris</i>	eastern spinebill		
<i>Lichenostomus chrysops</i>	yellow-faced honeyeater		
<i>Manorina melanocephala</i>	noisy miner		
<i>Philemon corniculatus</i>	noisy friarbird		
Acanthizidae			
<i>Acanthiza pusilla</i>	brown thornbill		
<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill		
<i>Acanthiza lineata</i>	striated thornbill		
<i>Acanthiza nana</i>	yellow thornbill		
<i>Acanthiza reguloides</i>	buff-rumped thornbill		
<i>Chthonicola sagittata</i>	speckled warbler	V	
Neosittidae			
<i>Daphoenositta chrysoptera</i>	varied sittella	V	
Pachycephalidae			
<i>Pachycephala pectoralis</i>	golden whistler		
<i>Colluricincla harmonica</i>	grey shrike-thrush		
Artamidae			
<i>Cracticus nigrogularis</i>	pied butcherbird		
<i>Cracticus tibicen</i>	Australian magpie		
<i>Cracticus torquatus</i>	grey butcherbird		

Scientific Name	Common Name	TSC Status	EPBC Status
<i>Strepera graculina</i>	pied currawong		
Campephagidae			
<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike		
Corcoracidae			
<i>Corcorax melanorhamphos</i>	white-winged chough		
Corvidae			
<i>Corvus coronoides</i>	Australian raven		
Rhipiduridae			
<i>Rhipidura albiscapa</i>	grey fantail		
<i>Rhipidura leucophrys</i>	willie wagtail		
Monarchidae			
<i>Grallina cyanoleuca</i>	magpie-lark		
Hirundinidae			
<i>Hirundo neoxena</i>	welcome swallow		
Petroicidae			
<i>Petroica boodang</i>	scarlet robin	V	
Sturnidae			
* <i>Sturnus vulgaris</i>	common starling		
MAMMALS			
Macropodidae			
<i>Macropus giganteus</i>	eastern grey kangaroo		
<i>Macropus robustus</i>	common wallaroo		
Petauridae			
<i>Petaurus breviceps ariel</i>	sugar glider		
<i>Petaurus norfolcensis</i>	squirrel glider	V	
Phalangeridae			
<i>Trichosurus vulpecula</i>	common brushtail possum		
<i>Pseudocheirus peregrinus</i>	common ringtail possum		
Vombatidae			
<i>Vombatus ursinus</i>	common wombat		
Molossidae			
<i>Tadarida australis</i>	white-striped freetail-bat		

Scientific Name	Common Name	TSC Status	EPBC Status
Vespertilionidae			
<i>Chalinolobus dwyeri</i>	large-eared pied bat	V	V
<i>Chalinolobus gouldii</i>	Goulds wattled bat		
<i>Chalinolobus morio</i>	chocolate wattled bat		
<i>Miniopterus schreibersii oceanensis</i>	eastern bentwing-bat	V	
<i>Vespadelus darlingtoni</i>	large forest bat		
<i>Vespadelus regulus</i>	southern forest bat		
<i>Vespadelus vulturnus</i>	little forest bat		
Canidae			
<i>Vulpes vulpes</i>	red fox		
Felidae			
* <i>Felis catus</i>	cat		
Leporidae			
* <i>Oryctolagus cuniculus</i>	rabbit		
Muridae			
* <i>Mus musculus</i>	house mouse		
Bovidae			
* <i>Ovis aries</i>	sheep		



APPENDIX D

Biodiversity Credit Report

Biodiversity credit report



This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 22/10/2015

Time: 3:43:03PM

Calculator version: v4.0

Major Project details

Proposal ID:	0020/2015/2026MP
Proposal name:	Lynwood Quarry Extraction Area Modification
Proposal address:	Hume Highway Marulan NSW 2579
Proponent name:	Holcim
Proponent address:	Tower B, Level 8 799 Pacific Highway Chatswood NSW 2067
Proponent phone:	(02) 94146615
Assessor name:	Travis Peake
Assessor address:	75 York Street Teralba NSW 2284
Assessor phone:	4950 5322
Assessor accreditation:	0020

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion	1.20	33.00
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	18.40	881.00
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion	58.10	2,124.14
Total	77.70	3,038

Credit profiles

1. Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion, (HN515)

Number of ecosystem credits created

33

IBRA sub-region

Bungonia - Hawkesbury/Nepean

Offset options - Plant Community types	Offset options - IBRA sub-regions
Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion, (HN515) Blakely's Red Gum - Yellow Box - Rough-barked Apple grassy woodland of the Capertee Valley, Sydney Basin Bioregion, (HN506) Broad-leaved Peppermint - Red Stringybark grassy open forest on undulating hills, South Eastern Highlands Bioregion, (HN514) Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, (HN614) Ribbon Gum - Yellow Box grassy woodland on undulating terrain of the eastern tablelands, South Eastern Highlands Bioregion, (HN573)	Bungonia - Hawkesbury/Nepean and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, (HN614)

Number of ecosystem credits created	2,124
IBRA sub-region	Bungonia - Hawkesbury/Nepean

Offset options - Plant Community types	Offset options - IBRA sub-regions
Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion, (HN614)	Bungonia - Hawkesbury/Nepean and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (HN570)

Number of ecosystem credits created	881
IBRA sub-region	Bungonia - Hawkesbury/Nepean

Offset options - Plant Community types	Offset options - IBRA sub-regions
Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion, (HN570) Inland Scribbly Gum - Brittle Gum low woodland of the eastern tablelands, South Eastern Highlands Bioregion, (HN543)	Bungonia - Hawkesbury/Nepean and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Large-eared Pied Bat	Chalinolobus dwyeri	77.80	1,011
Squirrel Glider	Petaurus norfolcensis	78.40	1,725

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