



**MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE REPORT
PRELIMINARY DOCUMENTATION**

MARYS MOUNT BLUE METAL GRAVEL QUARRY

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Front cover photograph: Location shot of Marys Mount Blue Metal Gravel Quarry

EXECUTIVE SUMMARY

Context

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Gunnedah Quarry Products Pty Ltd to assess matters of national environmental significance (MNES) impacted by the proposed Marys Mount Blue Metal Quarry (the Project). This report represents the preliminary documentation requested by the Commonwealth Department of Environment (DoE) in the determination notice for the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral (ref: 2012/6603).

Aims

This report aims to provide additional information specified in items 2 and 3 of the DoE determination notice, dated 4/12/2012 for EPBC Act 2012/6603.

Methods

EPBC Act listed MNES impacted by the Project were assessed in accordance with the MNES Significant Impact Guidelines version 2 (DoE 2013). This assessment has relied on targeted surveys completed on 16-18 January 2013 and 4-8 March 2013, the associated inventory report (Niche 2013a), approved site specific Koala Plan of Management (KPoM) (Niche 2014a) and BioBanking assessment report for the proposed biodiversity offset site (Niche 2014b).

Key Results - flora

One Commonwealth listed threatened grass species (Lobed Bluegrass *Bothriochloa biloba* - delisted in December 2013) was observed outside the boundary of the development site. The Project would avoid this species and its habitat. No other threatened flora species considered likely to occur have been observed within the development site.

Key Results - ecological communities

Semi-evergreen Vine Thicket of the Brigalow (north and south) and Nandewar Bioregions endangered ecological community (SEVT EEC) was found within the site in moderate to good condition. An estimated 2.9 hectares of this vegetation occurs within the development site. The remaining native vegetation cover comprises shrubby White Box (*Eucalyptus albens*) - White Cypress Pine (*Callitris glaucophylla*) woodland (6.8 hectares), comprising two floristic and condition variants.

Key Results - fauna

The Koala (*Phascolarctos cinereus*), listed as vulnerable under the EPBC Act, was common within the study area. Approximately 6.81 hectares of primary and secondary Koala habitat occurs within the development site. Considerable mitigation is proposed including revegetation of preferred habitat. While unlikely, it is concluded in this assessment that the revised Project may have a significant impact on an important population of this species.

A second EPBC Act listed species, the Large-eared Pied Bat (*Chalinolobus dwyeri*), was possibly recorded within the study area (i.e. ultrasonic detection). However, as no caves

for roosting occur within the study area impacts are restricted to a loss of potential foraging habitat. The assessment concluded that the Project is unlikely to have a significant impact on an important population of this species.

The Rainbow Bee-eater (*Merops ornatus*) and Black-faced Monarch (*Monarcha melanopsis*), common migratory bird species listed under the EPBC Act, were also recorded. The assessments concluded that the Project is unlikely to have a significant impact on these species.

Target species identified in item 1 of DoE's letter, Superb Parrot (*Polytelis swainsonii*), Malleefowl (*Leipoa ocellata*) and Brush-tailed Rock Wallaby (*Petrogale penicillata*), were not recorded within the study area. These species are highly unlikely to occur as habitat suitability is considered very low to nil. The Project is therefore unlikely to have a significant impact on any of these species.

Impact avoidance and mitigation

The Project as originally proposed (ref: 2012/6603) would result in the loss of 39 hectares native vegetation without any specific sequencing or mitigation. Subsequent adjustments to the quarry footprint resulted in a reduction in native vegetation loss to an estimated 9.7 hectares. There are three stages proposed spanning 23 years, with vegetation loss to be proportioned over this period.

Koala habitat would be removed progressively in three stages over 23 years with most of the habitat removal being between years 7 to 23. Impact avoidance, mitigation and offsetting are proposed in an approved Koala Plan of Management (Niche 2014a), including extensive revegetation works in adjacent cleared lands to the east. The revegetation would ensure that suitable Koala feeding habitat would be replaced prior to the majority of clearing taking place.

Biodiversity offsets

Significant residual impacts on MNES require offsetting under the *EPBC Act Environmental Offsets Policy* (October 2012). Assuming this to be the case the proposed biodiversity offset, known as Black Jack Mountain BioBank site, contains 'like for like' habitat for MNES impacted by the Project (i.e. Koala and SEVT). The net present value of the proposed offset, as calculated in accordance with the *EPBC Act Environmental Offsets Policy* (October 2012), was found to far exceed the offsetting requirements for the Koala and SEVT.

Conclusions

A low potential for a significant residual impact on the Koala and SEVT was identified at the development site following incorporation of impact avoidance strategies and mitigation. Notwithstanding, it is considered that the Project impacts are acceptable on the basis of the following:

- Impact mitigation would reduce the Projects impact on residual habitat at the development site and is unlikely to result in a lasting irreversible impact on MNES;
- Proposed revegetation works would establish new Koala habitat adjacent to the development site, and this would be suitable for use by Koalas prior to the majority

of clearing taking place. The extent of the new habitat would far exceed the current area of habitat availability;

- ❑ Proposed progressive rehabilitation would aim to re-establish vegetation similar to SEVT through the life of the quarry; and
- ❑ The proposed Black Jack Mountain biodiversity offset is like for like, local and significantly exceeds the offsetting requirements calculated in accordance with the *EPBC Act environmental offsets policy* (October 2012) calculator.

It is concluded that the Project does not represent an unacceptable impact as it has been demonstrated that a 'maintain or improve' outcome is likely for the Koala and SEVT EEC through impact minimisation/avoidance, on site mitigation and local biodiversity offsetting.

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1 INTRODUCTION

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Gunnedah Quarry Products Pty Ltd (GQP) to assess matters of national environmental significance (MNES) impacted by the proposed Marys Mount Blue Metal Quarry (the Project). This report represents the preliminary documentation as requested by the Commonwealth Department of Environment (DoE) in their determination notice for *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral (ref: 2012/6603). This report is to be read in conjunction with the Biodiversity Inventory Report (Niche 2013a), approved site specific Koala Plan of Management (KPoM) (Niche 2014a) and BioBanking Assessment report prepared for the proposed biodiversity offset site (Niche 2014b).

1.1 The Project

The Project, as described in the Environmental Impact Statement (EIS) (Stewart Surveys 2012) and EPBC Act referral (ref: 2012/6603), was initially designed for an impact area comprising 39 hectares of native vegetation. The development site boundary has been since revised following an analysis of biodiversity survey findings (Niche, 2013a). The Project boundary, as originally proposed and revised through this assessment, is shown in Figure 1.

1.1.1 State approvals

Environmental Planning and Assessment Act 1979

Gunnedah Shire Council has approved the revised Project following the recommendation made by the Regional Planning and Assessment Panel. The revised development has yielded a 75% reduction in the area affected (i.e. reduced to clearing of 9.7 hectares of native vegetation). The approval is for a three stage extraction program (see Appendix 1) over a 23 year quarry life. Impacts are delineated as follows:

Stage 1 - Years 1 to 6

- Approximately 2.1 hectares of vegetation removal comprising:
 - Shrubby White Box White Cypress Pine Woodland (approx. 0.3 hectares);
 - Tumbledown Redgum Open Woodland (approx. 0.9 hectares); and
 - Semi-evergreen Vine Thicket (SEVT) (approx. 0.9 hectares).

Stage 2 - Years 7 to 13

- Approximately 1.9 hectares of vegetation removal comprising:
 - Shrubby White Box White Cypress Pine Woodland (approx. 0.5 hectares); and
 - Tumbledown Redgum Open Woodland (approx. 1.4 hectares).

Stage 3 - Years 14-23

- Approximately 5.7 hectares of vegetation removal comprising:
 - Shrubby White Box White Cypress Pine Woodland (3.3 hectares);
 - Tumbledown Redgum Open Woodland (approx. 0.4 hectares); and
 - SEVT (approx. 2.0 hectares).

BioBanking Statement

The NSW Office of Environment and Heritage (OEH) have approved a BioBanking Statement for the Project thereby giving approval for the disturbance and removal of native vegetation and habitat under a biodiversity offsetting arrangement. Approval required a detailed assessment of the Project by OEH under Section 7A of the *Threatened Species Conservation Act 1995*.

The BioBanking Statement provides for a 'like for like' offset of native vegetation and habitat impacted by the Project. An approved BioBanking Statement means that a 'maintain or improve' outcome is reached for the Project. The approved BioBanking statement for the revised Project can be viewed in the public register (<http://www.environment.nsw.gov.au/bimsprapp/biobankingpr.aspx>).

OEHs assessment of the BioBanking Statement application involved a full day site inspection as part of their thorough investigation of the Niche BioBanking report submission. Important matters validated by OEH include:

- The mapping of native vegetation cover including the extent and condition of SEVT;
- Agreement regarding the absence of any other threatened ecological community including White Box Yellow Box Blakely's Redgum Woodland. OEH were satisfied that onsite vegetation dominated by White Box (*Eucalyptus albens*) belongs to the shrubby vegetation class Regional Vegetation Class 44 White Box - pine - Silver-leaved Ironbark shrubby open forests, Brigalow Belt South and Nandewar (Namoi CMA 2014);
- Agreement that no threatened plant species would be impacted by the Project; and
- Agreement regarding the Projects impact on matters of high conservation value such as SEVT.

Through their assessment and approval of the BioBanking Statement OEH have agreed that the Project would achieve a maintain or improve outcome for biodiversity. The requirement to comply with the approved BioBanking Statement is linked the Project approval through its conditions of consent. This condition must be satisfied prior to commencement otherwise the Project is in breach of its approval (i.e. offset must be secured).

Site specific Koala Plan of Management (KPoM)

A site specific KPoM has been approved by Gunnedah Shire Council and the Department of Planning under State Environmental Planning Policy 44 - Koala Habitat Protection. Compliance with the KPoM is a requirement specified in the conditions of consent for the Project approval. It specifies how impacts on the Koala are to be minimised, managed and mitigated both within and adjacent to the Project including the revegetation of 45 hectares of preferred Koala habitat. The KPoM is subject to a monitoring program and is auditable to ensure the outcomes are delivered.

1.1.2 Proposed action

The proposed action is consistent with the revised Project as approved by Gunnedah Shire Council. As indicated the approved Project is for a reduced impact extent over three stages, representing a substantially reduced impact on listed threatened species, ecological communities and their habitats. Impact avoidance is discussed in detail in Section 2 of this

report. Assessments presented in Section 3 of this report are for the revised Project, which indicate an acceptable impact on MNES.

Equally there is a substantially reduced likelihood for a significant residual impact on affected MNES. Mitigation including progressive quarry rehabilitation and the revegetation of Koala habitat is proposed within and adjacent to the site to minimise impacts on MNES. Offsetting determined in accordance with the *EPBC Act environmental offsets policy* (October 2012) is also proposed at a site that is currently being assessed as a BioBank site (i.e. Black Jack Mountain). Further details of these commitments to the management of impacts on MNES are outlined below and in Sections 3 and 4 of this report.

Rehabilitation

The final landform would be progressively rehabilitated using native species consistent with the current character of native vegetation cover observed in the impact area. Efforts to re-establish vegetation similar to SEVT EEC and Tumbledown Redgum dominated vegetation would form the primary focus of this rehabilitation work. These outcomes would be delivered, in part, through the implementation of an approved site specific KPOM (Niche 2014a) and supporting Vegetation Management Plan (VMP) (Stewart Surveys 2014).

Koala management

Approximately 45 hectares of woodland revegetation is proposed on land adjacent to the Projects northern and eastern boundaries as described in the approved KPOM (Niche 2014a) and VMP (Stewart Surveys 2014). Revegetation would be initiated at Project commencement and completed early within Stage 1 in accordance with the Project VMP and KPOM. Ecological benefit is expected within seven years of the commencement of revegetation works (Kavanagh and Stanton 2012), this coinciding with Stage 1 impacts and before Stages 2 and 3.

Offsetting

Offsetting is proposed to specifically address residual impacts on SEVT EEC and the loss of Koala habitat. The proposed Black Jack Mountain offset site, which is located approximately 20 km east of the study area, is currently being assessed under the NSW Biodiversity Offsets Scheme (BioBanking) for its suitability as a like-for-like biodiversity offset. No barriers thwarting the approval of the proposed offset site have as yet been identified by the Office of Environment and Heritage (OEH), thereby indicating a very high likelihood for suitability as an offset for MNES impacted by the Project.

1.2 The development site and study area

1.2.1 Location

The Project is located approximately 28 km west-southwest of Gunnedah, NSW (Figure 2). The Project comprises areas referred to as the 'development site' and 'study area', as shown in Figure 3. These are described as follows:

- Development site - the operational area of the quarry, as originally proposed, comprises 39 hectares of native vegetation (note: comparison between original and revised development boundaries is shown in Figure 1); and

- Study area - the area including the development site and lands where mitigation is proposed and is approximately 367 hectares.

Also shown in Figure 2 is the location of a second site (i.e. the proposed Black Jack Mountain offset site) s.

1.2.2 Regional context

For the purposes of this assessment the region is defined as the Brigalow Belt South Bioregion where it occurs within the Namoi CMA. A regional context is presented in Table 1.

Table 1: Regional geographic context of the development site

Geographical Feature	Description
Bioregion	Brigalow Belt South
Catchment management authority	Namoi
Subregion	Liverpool Plains Part B
Mitchell Landscape	Nombi Plateau and Pinnacles
Local government area	Gunnedah local government area
Watercourses	n/a
Nearby conservation areas	Pilliga Nature Reserve (approximately 30 km to the west north west)

The Nombi Plateau and Pinnacles Mitchell Landscape (DECC 2003) is described as follows:

“Rounded and conical volcanic peaks and domes of Jurassic trachyte with low angle debris slopes standing above rolling plateau and low hills, general elevation 500 to 770m, local relief to 250m. Soils vary with slope position, relatively light textured and shallow on rubble to heavy brown to black clays on flats and valley floors. Open woodland and extensive grasslands, slender rat’s tail grass (*Sporobolus elongatus*) and early spring grass (*Eriochloapsuedo-acrotricha*) on rubble slopes, spear grasses (*Austrostipa* sp.) with *Bothriochloa* sp. at lower levels on heavier soils.”

According to OEH (2012) the Nombi Plateau and Pinnacles Mitchell Landscape is not classified as overcleared (i.e. greater than 70 % native vegetation cover loss), although is approaching this status (i.e. 67% cleared).

1.2.3 Existing land use

Current land uses within the study area include agriculture (i.e. grazing) and extractive industries (i.e. gravel quarry). It is bounded by open grazing land with light timber cover in all directions (Figure 3). Cropping is also prominent in adjacent properties where higher soil fertility occurs.

1.2.4 Biophysical character

The study area is characterised by woodlands and open eucalypt woodlands dominated primarily by white box with varying understorey structure and plant composition. The steeper rocky slopes of east and south-east, or other slopes with sheltered aspects, are characterised by closed shrublands grading to open shrublands comprising red gum mallee woodland on northern aspects of the exposed hilltops (Niche 2013a).

1.3 Legislative context

1.3.1 EPBC Act

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on MNES undergo appropriate assessment and approval processes. Under the EPBC Act, an action includes a project, undertaking, development or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Environment.

The EPBC Act identifies MNES as:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

The Project was determined to be a controlled action (ref: 2012/6603) under Section 75 and Section 87 of the EPBC Act (i.e. controlling provisions being *listed threatened species and communities* (sections 18 & 18A)). The former Department of Sustainability, Environment, Water, Population and Community (SEWPaC) (now Department of the Environment or DoE) determined preliminary documentation as the assessment pathway for the Project with this document fulfilling this assessment requirement.

1.3.2 Other legislation

State approvals are currently being sought through concurrent assessments under the following relevant NSW legalisation:

- NSW *Threatened Species Conservation Act* 1995 (TSC Act); and
- NSW State Environmental Planning Policy 44 - Koala Habitat Protection (SEPP 44).

The relevance of this legislation is outlined as follows:

TSC Act

The TSC Act provides legal status for biota of conservation significance in NSW. The Project's impacts were assessed and approved under Part 7A of the TSC Act (i.e. NSW Biodiversity Offsets Scheme or BioBanking). A BioBanking Statement was approved by the Director General of the NSW OEH in accordance with the NSW BioBanking and Offsets Scheme (BioBanking Scheme). This BioBanking Statement has defined the offsetting parameters for the Project. A suitable 'like for like' offset site is currently being assessed under the BioBanking Scheme at a site known as 'Black Jack Mountain'.

SEPP 44

SEPP 44 aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline'. A site

specific KPoM has been prepared for the study area as the development site is deemed to contain core Koala habitat.

The KPoM provides an appropriate enforceable regulatory mechanism for protecting and managing Koala habitat within the study area. The Director General of NSW Planning and Infrastructure and Gunnedah City Council is responsible for approving a site specific KPoM. An approved site specific KPoM has been issued for the Project (Niche 2014a).

The mitigation and habitat protection proposed in the KPoM has formed the basis for assessing the residual impacts of the Project on the Koala and its habitat, if any.

1.4 Purpose of this report

The purpose of this report is to specifically address items 2 and 3 of SEWPaC's letter dated 4/12/2012. These items are:

2. Following the results of surveys, analysis of the potential direct, indirect and facilitated impacts of the proposed action on threatened ecological communities and threatened species and their available and/or potential habitat, within or adjacent to the project area, including, but not limited to:

2.1 Clearing;

2.2 Top soil storage;

2.3 Water use;

2.4 Dust creation (including during project construction, operation, decommissioning and road use);

2.5 Noise disturbance (including during project construction, operation and decommissioning); and

2.6 Risks of failing mitigation measures such as dirty water catch drains and sediment control dams.

3. Proposed avoidance and mitigation measures, and proposed offsets for residual impacts, for all relevant matters of national environmental significance, following the results of recent surveys, including:

3.1 How any proposed offset is consistent with the new Commonwealth EPBC Act Environmental Offsets Policy (October 2012).

Directions listed in item 1 of this letter have been addressed in a Project specific Biodiversity Inventory Report (Niche 2013a) involving the completion of the following tasks:

- Review of relevant data and reports;
- Completion of targeted field surveys by experienced and recognised ecologists;
- Data analysis to examine the extent of habitat for listed threatened species, populations and ecological communities, if present;
- Description of the biodiversity characteristics of the study area; and
- Robust assessment of the likely presence of State and Commonwealth listed threatened species, populations and ecological communities.

Directions listed in items 2 and 3 above are addressed in Section 2 of this report. Significance assessments for MNES are provided in Sections 3 and Appendix 2. Offsetting is discussed in Section 4.

Furthermore, assessments presented in this report have, in part, referred to content provided in the following documents:

- Biodiversity Inventory Report: Marys Mount (Niche 2013a);
- BioBanking Assessment Report: Marys Mount (Niche 2013b);
- Koala Plan of Management: Marys Mount (Niche 2014a); and
- BioBanking Assessment Report: Black Jack Mountain BioBank site (Niche 2014b).

1.5 MNES requiring assessment

The following two sections identify EPBC Act controlling provisions relevant to the Project as distinct from MNES that are not considered relevant. Identifying the relevance of MNES has relied on the analysis of detailed field survey results as reported in the Biodiversity Inventory Report (Niche 2013a) and impact implications arising from the revised development footprint.

1.5.1 EPBC Act Controlling Provisions

Listed in Table 2 are the threatened species and ecological communities relevant to the assessment of the Project (Niche 2013a). The Projects impact on these MNES has been assessed in this report (se Sections 2 and 3 and Appendix 2).

Table 2: Relevant MNES (controlling provisions)

MNES Listing	Nature of occurrence
Threatened Ecological Communities (TECs)	
Semi-evergreen Vine Thicket of the Nandewar and Brigalow Belt (North and South) Bioregions endangered ecological community (SEVT)	Known occurrence.
Threatened Flora	
<i>Dichanthium setosum</i>	Suitable habitat. Not observed.
Threatened fauna	
Koala (<i>Phascolarctos cinereus</i>)	Known occurrence.
Greater Long-eared Bat (<i>Nyctophilus corbeni</i>)	Suitable habitat. Not detected.
Large-eared Pied Bat (<i>Chalinobilis dwyeri</i>)	Suitable foraging habitat. Possible detection.
Spotted-tail Quoll (<i>Dasyurus maculata</i>)	Suitable foraging habitat. Not detected.
Swift Parrot (<i>Lathamus discolor</i>)	Suitable foraging habitat. Not detected.
Migratory species	
Rainbow Bee-eater (<i>Merops ornatus</i>)	Known occurrence.
Black-faced Monarch (<i>Monarcha melanopsis</i>)	Known occurrence.

1.5.2 MNES not considered relevant

The following MNES and their habitats are not considered to be impacted by the Project (Niche 2013a) and are accordingly excluded from assessment in this report.

White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands Critically Endangered Ecological Community (CEEC)

The previously reported occurrence of White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grasslands critically endangered ecological community within the development site was not confirmed during recent biodiversity surveys (Niche 2013a). There are no occurrences of this threatened ecological community (TEC) or its habitat within the revised development footprint (Niche 2013a). This TEC and its habitat are unlikely to be impacted by the Project and thus it has not been assessed in this report.

Native grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland CEEC

There are no occurrences of native grasslands formed on cracking clays or self mulching soils within the development site (Niche 2013a). This TEC and its habitat are unlikely to be impacted by the Project and thus it has not been assessed in this report.

Weeping Myall Woodlands Endangered Ecological Community (EEC)

There is no occurrence of Weeping Myall Woodlands or any associated derived vegetation types within the development site (Niche 2013a). This TEC and its habitat are unlikely to be impacted by the Project and thus it has not been assessed in this report.

Brigalow EEC

There is no occurrence of Brigalow or any associated derived vegetation types within the development site (Niche 2013a). This TEC and its habitat are unlikely to be impacted by the Project and thus it has not been assessed in this report.

Threatened Flora

There is no recorded or observed incidence of ooline, finger panic and austral toadflax within the development footprint. Habitat for these species is also unlikely to be impacted by the development (Niche 2013a). Therefore, none of these threatened plant species have been assessed in this report.

Threatened Fauna

Surveys and habitat assessment identified three of the four nominated species (and their habitat) in item 1 of the EPBC Act referral decision notice as unlikely to occur within the development site, namely; the Superb Parrot (*Polytelis swainsonii*), Malleefowl (*Leipoa ocellata*) and Brush-tailed Rock Wallaby (*Petrogale penicillata*) (Niche 2013a). Accordingly, none of these threatened fauna species have been assessed in this report.

2 IMPACT AVOIDANCE AND ANALYSIS

Section 1 outlined the total proposed native vegetation loss (i.e. 39 hectares revised down to 9.7 hectares) over three stages spanning a quarry life of 23 years. Discussed in this section are the proposed impact avoidance measures and remaining Project impacts (i.e. direct, indirect and facilitated impacts).

Impact analysis adopted the principles of *avoid, mitigate and offset*. Impact avoidance considerations are provided in Section 2.1 followed by impact analysis for the revised Project design. Mitigation requirements for residual impacts are discussed in Section 3.5. A requirement for a biodiversity offset, if considered necessary (i.e. for significant impacts on MNES), is discussed in Section 4.

2.1 Proposed impact avoidance

The Project as originally referred (ref: 2012/6603) was for an impact footprint of 39 hectares (Stewart Surveys 2012). Following the completion of detailed field investigations and analysis, a revision to the quarry footprint was established with the purpose of reducing impacts on biodiversity, as shown in Figure 1. The impact avoidance outcomes and effect are described in the following sections.

2.1.1 Avoidance outcomes

A detailed biodiversity survey targeting MNES was completed to better define the biodiversity values within the development site (Niche 2013a) and hence the Project's impact on MNES. Project design was subsequently re-examined to identify potential to avoid impacts on MNES. The following impact avoidance outcomes have been achieved:

- ❑ A reduction in the total extent of the impact area to 9.7 hectares as indicated in Figure 1 or 75 per cent reduction of the original proposed quarry area (i.e. 39 hectares). A contraction in the quarry's surface area was achieved by deepening the quarry pit floor; and
- ❑ A staged development approach designed to spread the Projects impacts over a 23 year timeframe. Mitigation and management is proposed throughout this period to further minimise the Projects impact on MNES.

2.1.2 Avoidance effect

The revised Project design has reduced impact on MNES as follows:

- ❑ SEVT EEC - Impacts on this EEC have been reduced from 7.2 hectares to 2.9 hectares, constituting a 59 per cent reduction in the Projects impact on this TEC (i.e. avoidance of 4.3 hectares);
- ❑ Koala - Impacts on core Koala habitat have been reduced from an original estimated area of 32 hectares to 6.8 hectares, constituting a 79 per cent reduction; and

- ❑ Lobed Bluegrass (delisted December 2013) - All observed individuals and habitat for this species have been excluded from the development site. The Project would avoid having an impact on this species and its habitat.

Similar reduced impact outcomes can also be demonstrated for the following MNES:

- ❑ Foraging habitat for the Swift Parrot, Spotted-tailed Quoll, Large-eared Pied Bat and Rainbow Bee-eater; and
- ❑ Foraging and roosting habitat for the Greater Long-eared Bat and Black-faced Monarch.

Connectivity would remain relatively unaltered through the development period and following quarry closure. Impacts on patch and remnant size have also been reduced, thereby minimising the potential for any lasting impacts on local and regional biodiversity. Revegetation works proposed in the KPoM (Niche 2014a) aim to increase patch size, integrity and connectivity over the term of the Project with measurable ecological benefit expected within seven years of commencement.

2.2 Impact analysis

Unavoidable impacts assessed in this report are defined by the revised quarry footprint and associated management buffer as shown in Figure 1 and Appendix 1. Relevant direct, indirect and facilitated impacts are discussed as follows for this area.

2.2.1 Direct impacts

Vegetation and habitat loss

The Project comprises a 9.7 hectare impact on native vegetation, inclusive of a management buffer, which would be developed in two stages over a 23 year period. This includes the staged removal of preferred Koala habitat (i.e. White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (NA225)) throughout that period.

Two vegetation types impacted by the Project comprise preferred habitat of variable importance for the Koala as estimated below:

- ❑ 4.1 hectares of White Box shrubby woodland. Approximately four hectares of this habitat type is required to support the needs of an individual Koala; and
- ❑ 2.7 hectares of Tumbledown Red Gum open woodland. Approximately one hectare of this habitat type is required to support the needs of an individual Koala.

With respect to the Projects impacts on the Koala and its habitat it is estimated that preferred Koala habitat availability would be progressively reduced over the three Project stages with the greatest impact on preferred habitat experienced during Stages 2 and 3 (i.e. years 7-23). Based on observed habitat utilisation within the study area it is estimated that the Project would locally reduce Koala habitat for up to four individuals over the 23 year operational period as estimated below.

Stage 1 - Years 1 to 6

- Approximately 2.1 hectares of vegetation removal comprising
 - Shrubby White Box White Cypress Pine Woodland (approx. 0.3 hectares);
 - Tumbledown Redgum Open Woodland (approx. 0.9 hectares); and
 - Semi-evergreen Vine Thicket (SEVT) (approx. 0.9 hectares).
- This habitat loss approximately equivocates to the habitat requirement of one individual Koala.

Stage 2 - Years 7 to 13

- Approximately 1.9 hectares of vegetation removal comprising:
 - Shrubby White Box White Cypress Pine Woodland (approx. 0.5 hectares); and
 - Tumbledown Redgum Open Woodland (approx. 1.4 hectares).
- This habitat loss approximately equivocates to the habitat requirement of one and a half Koala individuals.

Stage 3 - Years 14-23

- Approximately 5.7 hectares of vegetation removal comprising:
 - Shrubby White Box White Cypress Pine Woodland (3.3 hectares);
 - Tumbledown Redgum Open Woodland (approx. 0.4 hectares); and
 - SEVT (approx. 2.0 hectares).
- This habitat loss approximately equivocates to the habitat requirement of one and a third Koala individuals.

The most intense impact period is Stages 2 and 3 (i.e. from year 7 to 23) where habitat for up to three individual Koalas would be lost. Temporally, these two stages represent the key target period for the delivery of effective mitigation outcomes. In this respect it is considered that opportunity exists for effective mitigation during Stage 1 to minimise the impacts of Stages 2 and 3 (i.e. revegetation works).

Vehicle strike (Koala)

Potential exists for interactions between quarry related vehicle traffic and Koala individuals on the haul road and within the quarry/product stockpile areas. Direct impacts such as injury or death are a potential consequence of such interactions.

Ardill Payne & Partners (2013) indicate a potential for up to 120 heavy vehicle movements occurring offsite from the quarry as a consequence of quarry activity. Additional related light vehicle traffic is also expected. Within the quarry, additional heavy vehicle movements are expected between the extraction area and product stockpiles. However, due to the haulage configuration it is considered that there would be limited cumulative vehicle traffic impacts for any particular section of the haulage pathway as most of the offsite heavy vehicle movements will terminate at the product stockpile area.

The potential for vehicle - Koala interaction is mostly avoided on the basis of typical Koala movement behaviour. The Koala is largely a nocturnal species generally moving through the

night and in dawn dusk periods. During the day, the Koala is generally sedentary in the tree it has selected during the preceding night. The quarry daylight operational hours are 7am to 5pm AEST and 7am to 6pm (AESST), which should have the affect of avoiding most vehicle interactions with the Koala.

However, Koala vehicle strike is possible as some Koala movements may be completed during daylight hours. The traditional approach to managing vehicle strike is to construct a barrier (i.e. fence) to prevent animals from venturing into the path of a vehicle. While merit exists in isolating the potential for vehicle strike, other unintended impacts (e.g. barrier to movement) should also be evaluated prior to using these mitigation methods. Speed limiting site vehicles and use of a code of conduct is viewed as an appropriate alternative method for managing the low likelihood of vehicle strike during daylight hours.

Outside the study area the Traffic Impact Study (Ardill Payne & Partners 2013) describes two proposed haul routes from the quarry to identified destinations where interactions with the Koala and its habitat may occur. An average of 88 heavy vehicle and 30 light vehicle movements are predicted daily, with up to 120 heavy vehicle movements per day potentially occurring during peak extraction periods.

From the quarry the two routes are in common until the Goolhi - Quia Road intersection. Only from that intersection does the heavy vehicle traffic load split to a 3:1 ratio, with the majority of vehicle traffic progressing north along Goolhi Road to Emerald Hill.

The quarry's hours of operation are between 7 am and 6 pm (AESST) and 7 am to 5pm (AEST). A short duration of elevated heavy and light vehicle movements is anticipated just prior to and after operational hours; this aligning with personnel movements at these times.

With respect to vehicle movements along Barker and Mary's Mount Roads it is considered unlikely that vehicle - animal interactions would occur along this road section. Koala movements across these roads are likely to be rare to uncommon due to the limited occurrence of adjacent suitable habitat and/or the road intersecting movement pathways between proximal habitat areas. Similarly, it is considered unlikely that vehicle movements through the Goolhi Road to Emerald Hill road section would directly impact Koala individuals.

Conversely, wildlife atlas data indicates that Koala movements are more common across the Goolhi Road between Mary's Mount Road and Quia Road. These records coincide with substantive areas of Koala habitat adjacent to this road section. Potential for vehicle strike exists along this section and would require management to minimise the likelihood of vehicle strike.

There is potential for Koala individuals to be impacted by vehicle strike and/or accidental entry into the quarry area from the high wall. It is considered that the restriction of quarry operations to diurnal periods would substantially limit the potential occurrence of vehicle strike as Koala movements generally occur outside the diurnal operational period (i.e. nocturnal movements).

High wall falls (Koala)

Protecting Koala individuals from accidental injury or death from falls into the quarry area from the high wall should be managed through the duration of the quarrying operation and thereafter. The installation of a suitable fence along the quarry high wall is recommended

for this purpose. This fence should be established prior to the high wall establishment. In part, fencing may also be used as a method to limit the potential for direct impacts on the Koala during pre-clearing activities (i.e. quarantine habitat areas prior to vegetation removal). The fence should be a floppy-topped fence with the overhanging wire facing away from the quarry.

Top soil storage

Topsoil will be stripped from the quarry footprint and stored in a number of mounds throughout the life of the quarry. These mounds will be located between the edge of the quarry and the project boundary and generally take a linear form. There is an existing stockpile located west of the site office infrastructure which will be added to in the first stages of the quarry expansion. Mounds are to be battered at 3:1 and have a maximum height of 3 metres. Cover crops will be planted on topsoil mounds to minimise the potential for wind erosion. Rehabilitation is proposed to occur progressively as the quarry operations are completed in each area. The topsoil would then be re-spread to allow for replanting. The planting of a cover crop and restrictions on batter slope grade and height have been adopted to mitigate the risk of mound failure. The potential hazards for Koalas relating to the topsoil stockpiles are associated with machinery movements in the placing of the soil for storage and potential for mound failure. Given that the proposed stockpile mounds will be located adjacent to the quarry footprint the potential for interaction with Koalas is anticipated to be minimal.

Water use

Water is used on site for dust suppression on haul roads, the quarry area and crushing machinery. New tree plantings will be watered using watercart facilities during their establishment period. There is also a small amount of water used for employee amenities.

Water will be supplied by a licenced bore located in the south-western section of the Burleith property. Water is to be pumped into a water storage tank located near the site office. The quarry expansion will include the installation of a 20,000 litre steel water tank, construction of a 1ML dam for water treatment, located between the quarry project boundary and the haul route, and upgrade of an existing dam to 8ML for collection of overland flow and water storage for dust suppression use. Water runoff would be managed by contour banks and drainage channels.

The quality of surface and dam water on the site may be diminished as a result of operations. To maintain acceptable water quality, the proposed 1ML dam, which collects run off and sediment from the quarry, will have the spillway lined with geo fabric and rip rap sized rocks to trap sediment and manage erosion in high flow areas.

The proposed drainage from the quarry is generally to the north-northeast, conveying any runoff away from the main areas of Koala habitat and other key flora and fauna values, and potential discharges from the site are unlikely to impact on Koalas. Discharge water will be stored and treated in dams, and is likely to have high suspended sediment loads. Koalas are not expected to use these dams as a water source, and subsequently consumption of this water by Koalas is not anticipated to present an impact to Koalas.

Noise disturbance

The impacts of noise and blasting were assessed by Spectrum Acoustics Pty Limited (2014) for potential impacts at human residential receivers. The closest residence is receiver “Berlieth” 1, which is approximately 250 metres from the development site, and is representative of the worst case noise and blasting levels that may be applicable to Koala’s inhabiting the woodland directly adjoining the project site. The surrounding area is described as rural in nature and a conservative approach has been adopted to establish a project specific noise level of 35 dB(A)_{Leq(15min)} for the residential receivers. The existing acoustic environment (including noise from the existing quarrying operations) has not been measured and subsequently default background noise levels have been adopted resulting in a conservative approach.

It should be noted that proposed quarrying operations will use the same equipment as existing quarrying operations and therefore the peak noise levels during operation will be similar to the existing quarry, however, the existing equipment will be operated more frequently to achieve the increased production from 30,000 m³ per annum (approved) to 120,000 BCM (proposed). Proposed quarrying operations may also require some drill and blast operations up to a maximum of 7 times per year.

Noise modelling undertaken for sensitive receivers such as “Berlieth” 1 and other nearby receivers (which are located 1650 m or more from the development site) indicates that there will be no exceedances in human health criteria. Similarly the calculated blast overpressure and ground vibration levels are also below the criteria for all receivers.

The impacts of blasting on the Koalas (i.e. overpressure and ground vibration levels), which are expected on seven occasions per year (Spectrum Acoustics Pty Ltd 2014), is unknown. Notwithstanding, it is unlikely that Koalas would avoid or reduce their usage of preferred Tumbledown Red Gum habitat near the quarry until additional, new planted habitat becomes available for use (approximately 7-10 years after planting; Kavanagh and Stanton 2012). In this respect it should be noted that no blasting is anticipated in stage 1 quarrying activity, with blasting most likely to start sometime during stage 2.

Animals remaining *in situ* near the quarry are unlikely to suffer mortality as a consequence of these blasting events, but it is anticipated the impacts of blasting would elevate stress levels, which may remain high for several days after each blast. By the time blasting activity is proposed (i.e. Stage 2) it is anticipated that the revegetation works located to the east and north of the quarry would be available as a suitable alternative area of preferred habitat that would offer sanctuary to individuals, should they be stressed.

The increase in volume and frequency of daily noise production from the quarry, may also affect Koalas adversely in similar ways. While stress levels of individual Koalas are likely to remain higher and for extended periods under the scenario of an increase in daily noise levels, the most likely response is that individual animals will move away from preferred habitat adjacent to the quarry while noise disturbances are being experienced (i.e. during operational hours). In this respect Koalas are expected to move in and out of preferred habitat during the night when background noise levels are reduced (i.e. no quarry operation). As such, significant conflict between quarrying activity and Koala usage of preferred habitat are not expected.

Dust creation

An Air Quality Assessment was prepared by Pacific Environmental Limited (2014) to assess potential impacts at human residential receivers. The closest residence is receiver “Berlieth” 1 which is approximately 250 metres from the development site, and is representative of the worst case air quality levels that may be applicable to Koala’s inhabiting the woodland directly adjoining the project site. The assessment compared predicted levels of airborne dust against health-based criteria for humans, and compared dust deposition against nuisance criteria from a human amenity perspective.

The modelling undertaken indicates that “Berlieth” 1 and other modelled receivers (which are located 1650 metres or more from the development site) are unlikely to experience exceedances in dust pollution for human health. A cumulative assessment, incorporating existing background levels, indicates that the Project is unlikely to result in any additional exceedances of impact assessment criteria for human health at identified sensitive receivers (Pacific Environment Limited 2014).

The impacts on Koalas due to the expected decrease in air quality, and in particular the increased dust deposition, are unknown. However, it is possible that increased dust deposition on tree foliage in the surrounding woodland environment may have adverse consequences for the digestive systems and water balances of Koalas. Koalas obtain all of their food and most of their water requirements from the foliage of preferred tree species (Tumbledown Red Gums in this case). If those leaves are continually coated with a layer of dust due to daily quarrying activities, the nutritional budget of Koalas living near the quarry may suffer, potentially creating additional stress for those animals.

The extent to which Koala respiratory function would be affected is unknown, although presumably the increase in daily dust levels would not persist into the evening when Koalas are most active. Survey data indicates that Koalas are not usually present near the quarry area during daylight hours, with movement into areas dominated by Tumbledown Red Gum undertaken through the evening and night period. As such, it is considered that the effects of dust on the respiratory system of the Koala is likely to be negligible and within health limits, as indicated by the modelling for human health.

2.2.2 Indirect

The Project may result in various indirect impacts on adjacent vegetation, species and their habitats. Indirect impacts considered relevant to this Project are discussed as follows.

Edge Effects

Edges can occur naturally within ecosystems and include situations such as the common boundary between two ecological communities (i.e. ecotone) or the boundary between burnt and unburnt vegetation. Biodiversity often adapt to the effects of an edge, with some species being partially or wholly reliant on edge effects.

The ‘edge effect’ describes a collection of factors and processes that influence the presence and abundance of species at a boundary such as natural boundaries (e.g. ecotones) or a disturbance (e.g. cleared lands). As a source of indirect impacts the edge effect can be defined by the following main factors and processes:

- Changes in microclimate (e.g. localised temperature, wind, light, humidity);
- Altered hydrology (i.e. localised changes in surface and subsurface water flows);

- Altered fire frequency and intensity;
- Invasion by exotic plant and animal species;
- Alteration of soil conditions (e.g. increased sedimentation and nutrient availability); and
- Alteration of vegetation structure (e.g. tree death and increased shrub densities).

On average these effects have been estimated to occur up to 50 metres from an edge, although much greater distances have been recorded for linear infrastructure (Forman et al. 2003).

Edge effects are particularly pronounced in patches where large edge to area ratios exist (i.e. small vegetation patches with a proportionally large perimeter). Such conditions often lead to diminished biodiversity where generalist or edge specialist species dominate. With respect to the existing landscape context it is considered that edge effects have already had influence on the biodiversity values of the development site and adjacent patch (e.g. presence of exotic flora).

The effect of the Project is to shift the existing edge effects where they currently reside (i.e. edge of existing quarry) into the remnant vegetation present on Melville Hill for the duration of the quarrying period. The condition of previously buffered native vegetation and habitat is likely to change and become similar to existing edge conditions found at the site. The increased incidence of exotic plant species and cover expected at the new edge would be actively managed through implementation of the VMP.

The management of existing edge effects and any associated exacerbation of these effects arising from the development would be managed during the construction and operational periods of the Project. A range of impact mitigation measures are proposed to minimise edge effects on adjacent native vegetation and habitat including the following:

- Clear demarcation of vegetation clearance boundaries to prevent inadvertent and/or premature habitat removal;
- Replanting and regeneration of local native plant species (e.g. herbs and overstorey species) in buffer areas that lie adjacent to retained native vegetation; and
- Implementation of a weed control and management program throughout the duration of the Project.

Habitat fragmentation

The clearance of native vegetation has the potential to result in the partial or complete severance of otherwise connected habitat. Such fragmentation has the potential to impact species sensitive to change in accessible habitat areas or home ranges, particularly when the severance results in the isolation of important habitat.

The proposed vegetation clearing for the Project is unlikely to result in any serious or irreversible habitat fragmentation. The extent of clearing would be restricted in such a manner to maintain woodland linkages of greater than 200 metres width. In combination with the proposed impact mitigation it is considered that the Project would not have a substantial impact on habitat connectivity within the study area.

Habitat degradation from over browsing

Habitat loss of the Koala has the potential to result in a concentrated use of remaining resources resulting in the potential for over-browsing. Over-browsing is recognised as a threat to the Koala in high density populations such as those in Victoria and South Australia, although is not well known in NSW.

The removal of native vegetation that constitutes core Koala habitat (Red Gum Woodland), with densities of up to approximately 1 individual per hectare, is expected to result in an increased utilisation of the retained habitat resources by an unchanged number of Koala individuals. Project staging sensitive to MNES and mitigation, including extensive revegetation works (i.e. 45 hectares) in adjacent cleared and partially cleared lands, is proposed to address this issue. The KPoM (Niche 2013b) demonstrates that a net increase in available Koala habitat would be achieved through the staged vegetation clearing and revegetation works. Additionally, clearing of primary Koala habitat (tumbledown red gum Open Woodland) would in the main not occur until Stage 2 (2.9 hectares) and Stage 3 (3.7 hectares), although 1.2 hectares would be cleared in Stage 1.

Spine stick from tiger pear (Koala)

Tiger pear (*Opuntia aurantiaca*) occurs within the study area and is known to cause injury to the Koala through spine stick injury and secondary infections (Kavanagh *et al.* 2007). The most appropriate and practicable harm minimisation method available to manage tiger pear spine stick injury is to routinely conduct weed management activities throughout the study area, which is to occur as part of the KPoM and VMP. Tiger pear occurrence should be routinely surveyed for and suppressed. Preventing the early spread of this noxious weed would substantially limit the incidence of Koala individuals being harmed by tiger pear spine stick injury.

2.2.3 Facilitated

The approved Project plans to supply blue metal to various existing approved coal mines in the Gunnedah - Boggabri area where it would be an important in the supply of building materials (e.g. concrete). The blue metal would also be used more widely for the maintenance of existing linear infrastructure such as roads and rail lines throughout the Gunnedah local government area (LGA) and adjacent LGAs.

With respect to the above it is considered that the Project's facilitated impacts would be mostly limited to nearby developments that are already approved under the EPBC Act. As such, it is not expected that there will be further impacts on MNES as a consequence of this Project.

2.3 Key Threatening Processes

Six Key Threatening Processes (KTPs) are considered relevant to the MNES assessed for this Project, as detailed in the sub-sections below.

2.3.1 Land clearance

The Project is expected to result in the clearance of approximately 9.7 hectares of native vegetation and, as such, is by definition consistent with operation of this KTP. The habitat loss for MNES identified in this report is as follows:

- ❑ SEVT (2.9 hectares);
- ❑ *Dichanthium setosum*, Koala and Swift Parrot (6.8 hectares);
- ❑ Spotted-tailed Quoll and Greater Long-eared Bat (9.7 hectares); and
- ❑ Migratory species - removal of potential foraging and breeding habitat.

The Mitchell Landscape that the Project occurs within is not currently classified as an overcleared landscape (i.e. >70% cleared), although without abatement is tracking towards this status as it is currently 67% cleared. The impact of the development is not, in its own right, capable of pushing the Nombi Plateau and Pinnacles Mitchell Landscape into an overcleared landscape. Conversely, proposed revegetation (Niche 2014a) is expected to deliver improvements in native vegetation cover within seven years of Project commencement.

2.3.2 Predation by European red fox *Vulpes vulpes*

The European Red Fox was recorded within the study area during field surveys (Niche 2013a). Predation by the Red Fox has the potential to affect the Spotted-tailed Quoll (competition for resources) and the Koala. However, the Project is unlikely to affect the abundance or distribution of the European Red Fox within the study area. Accordingly, the Project is unlikely to increase the influence of fox predation within the study area.

2.3.3 Predation by feral cats *Felis catus*

The Feral Cat *Felis catus* was recorded within the study area during field surveys (Niche 2013a). It is likely that feral cats occur throughout study area and could predate individuals of relevant threatened fauna, such as the Greater Long-eared Bat. However, the Project is unlikely to affect the abundance or distribution of the Feral Cat within the study area. Accordingly, the Project unlikely to increase the incidence of cat predation within the study area.

2.3.4 Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs *Sus scrofa*

The Feral Pig *Sus scrofa* was recorded within the study area during field surveys (Niche 2013a). The occurrence of the Feral Pig is not a consequence of existing quarrying activities, rather a function of agricultural activity (i.e. cereal cropping).

Feral pigs have the potential to affect the condition of SEVT and the habitat of Spotted-tailed Quoll, Koala and migratory species assessed in this report. However, the Project is unlikely to increase the activity of Feral Pigs within the habitat of threatened ecological communities and species habitats within the study area.

2.3.5 Competition and land degradation by rabbits *Oryctolagus cuniculis*

Land degradation caused by rabbit grazing and browsing could affect habitat quality for ground dwelling threatened species such as the Spotted-tailed Quoll and the recruitment of primary feed trees for the Koala. Notwithstanding, the Project is unlikely to affect the abundance or distribution of rabbits within the study area and as such is unlikely to cause increased land degradation by the rabbit.

2.3.6 Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)

There is a risk the Project may cause the introduction of root-rot (or cinnamon) fungus into the study area (e.g. machinery). This KTP has the potential to impact the recruitment of primary and secondary feed trees for the Koala. Any dieback of native vegetation caused by root rot fungus could lead to reduced habitat quality for this species.

3 IMPACT ASSESSMENT

3.1 Threatened Ecological communities

One TEC was identified within the development site and would be impacted by the Project (SEVT EEC) as shown in Figure 4. An assessment for this TEC is provided as follows.

3.1.1 Semi-evergreen Vine Thicket

SEVT is listed as an EEC on the EPBC Act.

Regional status

SEVT occurring within the development site corresponds to the Benson *et al* (2010) plant community: *Mock Olive - Wilga - Peach Bush - Carissa Semi-evergreen Vine Thicket (dry rainforest) mainly on basalt soils in the BBS bioregion*. ELA (2007) in Benson *et al* (2010) modelled a pre-1750 extent of 12,000 hectares (8,400 - 15,000 hectares) for this plant community within the Brigalow Belt South (30-70%) and Nandewar (<30%) bioregions. An estimated 1,800-2,200 hectares is now predicted to remain in the Brigalow Belt South Bioregion (ELA 2007 in Benson *et al* 2010).

According to Benson *et al* (2010), less than 30 per cent or 3,600 hectares of the pre-1750 cover estimate is predicted to occur within the Namoi CMA. Current estimates for SEVT cover within the Namoi CMA are 451-500 hectares or 12-15 per cent of the pre-1750 Namoi CMA modelled occurrence (ELA 2007; Benson *et al* 2010). However, as outlined in the following section, these are considered underestimates of actual regional SEVT occurrence.

Local occurrence

A greater occurrence of SEVT has been inferred from recent site-based biodiversity investigations for the study area (Niche 2013a), the locality (ELA 2010, Niche 2012, Curran *et al* 2008), proposed offset site at Black Jack Mountain (Niche 2013) and aerial photography interpretation than otherwise indicated (ELA 2007, Benson *et al* 2010). Previously unmapped SEVT occurrences in the Gunnedah area are likely to exceed 650 hectares as shown in Figure 4, which has been estimated as follows:

- ❑ Mt Somner - 55 hectares (Niche 2012);
- ❑ BioBanking Agreement #43 - 176 hectares (ELA 2010, OEH 2011);
- ❑ Nombi Plateau and Pinnacles (including the development site) - approximately 370 hectares (aerial photography interpretation; Figure 4); and
- ❑ Additional SEVT occurrences observed at Black Jack Mountain southwest of the Gunnedah township comprising at least 50 hectares of SEVT (Curran *et al* 2008, Niche 2013).

Alone these unmapped SEVT occurrences account for approximately 18 per cent of the Namoi CMA pre-1750 estimate (ELA 2007) and over 100 per cent of the current estimated extent (i.e. 451 hectares). As such it is considered that extant mapping for SEVT in the Namoi CMA, as reported in Benson *et al* (2010), is likely to represent a significant

underestimate for both pre-1750 and current SEVT cover. Such findings are not inconsistent with the difficulty of mapping SEVT occurrences, as reported by Curran et al (2008).

Status within the development site

Plot data analysis indicates the condition of SEVT within the development site is not within benchmark condition (Niche 2013a). Site attribute values are above and below benchmark condition for NA199 resulting in a condition estimate of 50% of benchmark. The effects of historical land clearing (e.g. reduced remnant size and connectivity) and adjacent farming land uses (e.g. edge effects and influence of feral fauna such as pigs and goats) are likely to be the main factors responsible for this lower condition state.

Land clearing

The development site is surrounded by a developed agricultural landscape that has been intensively used for cropping and grazing for over 150 years. Land clearing for the development of agricultural land uses has resulted in the partial fragmentation of woody vegetation, including local patches of SEVT.

The degradation of SEVT condition is linked to the reduced native plant species richness and altered vegetation structure. Reduced condition is likely to be linked to habitat simplification/alteration (e.g. fire frequency and recovery). The latter effect is common in isolated patches and is well described in the literature (i.e. island biogeography).

Farming

Agricultural practices in the area have introduced various factors that are likely to have had a pronounced effect on isolated patches of native vegetation, such as those occurring within the development site. Weeds, feral pigs, goats and red fox are present within the development site and would collectively have an adverse affect on the SEVT.

These adverse influences are currently uncontrolled and, when considering the site's current land use and isolated nature, would continue to simplify the biodiversity values of the SEVT. This is supported by site observations of feral pig activity and weed occurrence where impacts exerted by these existing threats are directly impacting groundcover conditions.

Impact analysis

The Project would result in the removal of 2.9 hectares of SEVT over three clearing stages spanning 23 years.

The revised Project has substantially reduced impacts on SEVT by an estimated 75% of the original proposed quarry (Stewart Surveys 2012). This was primarily achieved through deepening the quarry pit floor allowing a reduction in pit surface area. Approximately 4 hectares have been avoided through modifying the Project footprint.

Retained areas of SEVT would be managed for weeds and feral fauna (e.g. wild pigs). Edge effects would be minimised through proposed management of weeds and threats such as unplanned fire events (i.e. SEVT is fire sensitive). Progressive rehabilitation within the quarry area is also proposed and would focus on establishing vegetation similar to SEVT.

The maximum impact the Project would have on current mapped SEVT occurrences in the Namoi CMA is estimated to be 0.6% (ELA 2007), although this is considered an overestimate

of actual impacts (Curran et al 2008). After accounting for locally unmapped SEVT occurrences it is estimated that the Project's regional impact would be closer to 0.3%. In this respect it is considered that the proposed loss of SEVT would not substantially adjust the regional occurrence of SEVT.

Significance assessment

An EPBC Act significance assessment has been conducted for the SEVT EEC (Appendix 2), which has taken into consideration the above information. The significance assessment concludes that the proposed action may have a significant impact on SEVT.

In the absence of scientific certainty the precautionary principle has been applied in this impact assessment. On this basis it is assumed that potential exists for a significant residual impact on SEVT. Mitigation, monitoring and offsetting is proposed to address this potential for a significant impact on SEVT.

With respect to the benefits obtained from the proposed mitigation, offsetting and monitoring later discussed in the report, it is considered unlikely that the Project would have an unacceptable impact on SEVT. Moreover, it is predicted that the proposed mitigation and offset strategy (see Sections 3.5 and 4) would provide a 'maintain or improve' outcome at a local, regional and national level. Proposed monitoring, as outlined in Section 3.6, would permit establishment of an adaptive management framework having the purpose of reducing the risk of not achieving the predicted outcomes.

3.2 Threatened Flora

Suitable habitat for one threatened flora species, *Dichanthium setosum*, has been identified in the development footprint and as such may be impacted by the Project. Individuals of a second species, Lobed Bluegrass *Bothriochloa biloba* (delisted December 2013), has been identified adjacent to the development footprint and may as a consequence experience an indirect impact. An assessment for these vulnerable listed threatened species is provided in the following sections.

3.2.1 *Dichanthium setosum*

Dichanthium setosum is listed as a vulnerable species on the EPBC Act.

Regional status

Dichanthium setosum occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, as well as in Queensland and Western Australia. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. There are large populations in the Saumarez area, west of Armidale, east of Guyra and Somerton Road Travelling Stock Route.

The species is associated with heavy basaltic black soils and red-brown loams with clay subsoil and can be found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Specimens have regularly been collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched. It is open to question

whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. It can be locally common or found as scattered clumps in broader populations.

Associated species include *Eucalyptus albens*, *E. melanophloia*, *E. melliodora*, *E. viminalis*, *Myoporum debile*, *Aristida ramosa*, *Themeda triandra*, *Poa sieberiana*, *Bothriochloa ambigua*, *Medicago minima*, *Leptorhynchos squamatus*, *Lomandra* aff. *longifolia*, *Ajuga australis*, *Calotis hispidula*, *Austrodanthonia* spp., *Dichopogon* spp., *Brachyscome* spp., *Vittadinia* spp., *Wahlenbergia* spp. and *Psoralea* spp.

Local occurrence

Dichanthium setosum is known to occur within the Liverpool Plains (Part B) subregion of the Namoi CMA area (OEH 2013). There are no recorded occurrences of this species within 10 kilometres of the site.

Status within the development site

Suitable habitat for *Dichanthium setosum* has been identified within the development site. However, appropriately timed targeted surveys have not confirmed its presence (Niche 2013a).

Impact analysis

The Project would remove 6.8 hectares of suitable habitat for this species. This proposed habitat loss represents an estimated 0.005 per cent of similar habitat within the region (Namoi CMA 2013).

Significance assessment

An EPBC Act significance assessment has been conducted for *Dichanthium setosum* (Appendix 2), which has taken into consideration the above information. The significance assessment concluded that the proposed action is **unlikely** to have a significant impact on an important population of *Dichanthium setosum*.

3.2.2 Lobed Bluegrass *Bothriochloa biloba*

Lobed Bluegrass was listed as a vulnerable species on the EPBC Act. While delisted in December 2013 the assessment for this species has been retained as the Project was declared a controlled action prior to its delisting.

Regional status

Lobed Blue-grass is known from the Darling Downs district in Queensland, south along the western slopes of the Great Dividing Range to North Star, Warialda, Bingara and Merriwa in NSW (Quinn et al., 1995; NSW Scientific Committee, 2004). It also occurs west to Dubbo and around the Hunter Valley (Quinn et al., 1995). This species occurs within the Hunter-Central Rivers, Central West, Namoi, Northern Rivers and Border Rivers-Gwydir (NSW) and Border Rivers Maranoa-Balonne and Condamine (Queensland) Natural Resource Management Regions (TSSC 2008).

Local occurrence

Lobed Bluegrass is known to occur within the Liverpool Plains (Part B) subregion of the Namoi CMA area (OEH 2013). Bean (1999) has observed Lobed Bluegrass in the Marys Mount - Mullaley as follows:

“sections of the Oxley Highway east of Mullaley, and on the stock route running from ‘Lambrook’ (latitude 31°06’16”, longitude 149°56’20”) towards Curlewis, Bothriochloa biloba is a dominant species. These areas on heavier-textured soils are at the lower altitude of 300-340 m asl. In the parking area adjacent to the Mullaley Anglican church, an area which is regularly mown, Bothriochloa biloba is a significant species. Areas on properties that have been slashed to remove weeds also continue to contain the species.”

These observations are supported by recent roadside and farm paddock observations in the Nombi, Mullaley, Caroona and Spring Ridge localities (Mark Aitkens pers obs).

Locally, Lobed Bluegrass shows a distinct preference for the heavier-textured soils formed from the Garrawilla Volcanics (Bean 1999). More specifically, Bean (1999) characterises the habitat of Lobed Bluegrass in the locality as:

“The presence of a Bothriochloa biloba shows a strong preference for heavier-textured soils. On these soils the species, despite its known poor seed production, has been maintained under grazing over long periods of time. It is concluded that normal levels of grazing do not lead to elimination of Bothriochloa biloba, and in fact may enhance maintenance of the species. By contrast, at restricted levels of grazing, rank growth of Aristida ramosa causes reduction in total number of species and exclusion of Bothriochloa biloba. In grasslands grazed at an unrestricted level, stock selectively grazed other species of grass, giving Bothriochloa biloba a competitive advantage. Mowing and/or slashing also appeared to maintain the species.”

The Bean (1999) local observations indicate a sizeable and noteworthy population in the Mullaley area, which in its entirety can be regarded an important population. This is supported by opportunistic observations including roadside occurrences and paddocks comprising Lobed Bluegrass as the dominant species (Mark Aitkens pers obs.). While unknown, the total number of individuals contained within the road reserves, travelling stock routes and grazing paddocks of the Liverpool Plains is likely to number at least 100,000 individuals, albeit not in any areas of conservation.

Status within the development site

Suitable habitat for Lobed Bluegrass has been identified adjacent to and downslope of the development site (i.e. no habitat within the development site). Targeted surveys confirmed its presence in two locations as shown in Figure 5. Approximately 100 individuals are estimated to occur within the two observed locations.

Impact analysis

The Project would not directly impact the habitat of this species. However, the proximity of the Project to known occurrences of the Lobed Bluegrass means there is potential for indirect impacts. Indirect impacts on environmental factors/ gradients that contribute to

the formation and maintenance of Lobed Bluegrass habitat would be restricted to the following development related impacts:

- Increased dust generation and deposition;
- Waste water (negligible to none);
- Weed introductions and population growth; and
- Increased solar radiation on suitable habitat through the overstorey canopy removal within the development site.

Bean (1999) notes that Lobed Bluegrass is commonly found in roadside reserves and grazing paddocks throughout the locality; environments that are heavily exposed to all the above listed impacts. In this respect it is considered that local observations indicate that Lobed Bluegrass is a resilient species capable of co-existing with the altered environmental conditions arising from the development of the quarry.

An analogue for the effects of dust on Lobed Bluegrass can be observed along unsealed roads of the locality where dust is regularly cast on roadside vegetation containing populations of this species. Similarly, the surface hydrological regimes of roadside environments are also highly varied with Lobed Bluegrass seemingly resilient to these conditions. High levels of solar radiation are unlikely to deleteriously affect the species as Lobed Bluegrass is commonly found in native grasslands and grassy woodlands where ground level solar radiation is largely unabated. Even the impacts of grazing and slashing, which is not proposed as part of the development, do not appear to adversely impact the lifecycle of this species to an extent where the species would become locally extinct (Bean 1999).

Significance assessment

An EPBC Act significance assessment has been prepared for Lobed Bluegrass (Appendix 2), which has taken into consideration the above information. The significance assessment concluded that the proposed action is **unlikely** to have a significant impact on an important population of Lobed Bluegrass.

3.3 Threatened Fauna

Suitable habitat for five threatened fauna species has been identified as being impacted by the Project. The following three species are listed as vulnerable and have been assessed in terms of the Project's impact on important populations:

- Koala;
- Greater Long-eared Bat; and
- Large-eared Pied Bat.

The following two species are listed as endangered and have been assessed in terms of the Project's impact on individual populations:

- Spotted-tailed Quoll; and
- Swift Parrot.

The assessments are provided in the following sections and in Appendix 2.

3.3.1 Koala

The Koala *Phascolarctos cinereus* is listed as vulnerable on the EPBC Act.

Regional status

The Gunnedah LGA is well known as a ‘hot spot’ for Koalas in NSW (Smith 1992, Lunney *et al.* 2009, Kavanagh and Stanton 2012), as are the adjacent Pilliga forests (Kavanagh and Barrott 2001). This is supported by 798 location records for the Koala (many of which included multiple animals at the same location) within a 50 km radius of the study area (BioNet search, April 2013: OEH Atlas of NSW Wildlife) as shown in Figure 6. Most of these were recent records with 94.5% observed since 2000.

The native vegetation within a 10 km radius of the site, and the broader Liverpool Plains region, has been extensively cleared for cropping and grazing. This clearing has greatly reduced the amount of habitat available for the Koala in the local area and region. Koalas are now largely restricted to the remaining areas of native vegetation in the landscape, whether this occurs as strips of remnant trees along roadsides, remnant trees and sparse woodland in paddocks, or larger patches of remnant forest and woodland. Koalas are scattered throughout the local landscape but their continued viability is likely to depend on the protection of the remaining vegetated areas of preferred habitat, the creation of new or supplementary habitat and improved connectivity between areas of suitable habitat.

Lunney *et al.* (2012) and Smith (1992) identify the following tree species as important for feed and shelter on the Liverpool Plains; *Eucalyptus albens* (white box), *E. camaldulensis* (river red gum), *E. blakelyi* (Blakely’s red gum), *E. dealbata* (tumbledown red gum), *E. populnea* (poplar box), *E. crebra* (narrow-leaved ironbark), *E. pilligaensis* (narrow-leaved grey box), *E. melliodora* (yellow box), *Casuarina cristata* (belah) and *Callitris glaucophylla* (white cypress pine). All these species occur within the local area and are likely to be used by the Koala.

Koala habitat throughout the Gunnedah area is generally associated with the regional vegetation community “White Box - Pine - Silver-leaved Ironbark shrubby open forests, Brigalow Belt South and Nandewar” (Namoi CMA 2013). According to ELA (2007), this vegetation is widespread and common throughout the locality. Benson *et al* (2010) describe a tumbledown red gum plant community within the Mullaley area that is also likely to provide habitat suitable for the Koala. This was confirmed by surveys of the study area where numerous Koala observations were made in patches of tumbledown red gum (Niche 2013a).

An estimate of available preferred Koala habitat in the Gunnedah area has been defined for the draft Gunnedah LGA (part) Comprehensive Koala Plan of Management 2013 (Greenloaning Biostudies 2013). Koala habitat in the Gunnedah area includes:

- 1,508 hectares of primary habitat;
- 682 hectares of secondary habitat (class A);
- 15,006 hectares of secondary habitat (class A-B); and
- 25,296 hectares of secondary habitat (class B).

An estimated 42,492 hectares of preferred Koala habitat or *habitat critical to the survival of the species* (SEWPaC 2012a) is recorded to occur within the Gunnedah area.

Local occurrence

Vegetation mapping and recent satellite imagery show the development site and study area is associated with a larger area of variously connected native vegetation comprising Koala habitat bordered by intensively cropped lands of the Liverpool Plains. This area, hereafter referred to as the Gunnedah area, correlates with the area investigated by Greenloaning Biostudies (2013) and is defined by a line linking Mullaley, Boggabri, Gunnedah, Breeza and Lake Goran. The surrounding cropped lands are, for the purposes of this assessment, considered barriers that would substantially limit the movement of individual Koalas into adjacent parts of the region such as the Pilliga.

Koala individuals within the development site and study area are considered to be a subset of the Koala population that occupy the Gunnedah area (i.e. meta-population). This meta-population meets the definition of an important population and is hereafter referred to as the Gunnedah population. According to the listing advice (TSSC 2012), the Gunnedah population is estimated to number approximately 3,000 individuals. This compares with the draft Comprehensive Koala Plan of Management estimate of 12,700 individuals for the same area (Greenloaning Biostudies 2013). Based on an estimated 12,700 Koalas and 42,492 hectares of habitat (Greenloaning Biostudies 2013), the average density of Koalas in the Gunnedah area is 0.3 individuals per hectare.

Local connectivity for Koalas is principally limited to the vegetated hills to the northeast and east. Limited connectivity also occurs to the southeast to the vegetated hills south of the Oxley Highway. Connectivity to the north, south and west is highly limited or non-existent due to the presence of cleared grazing and cropping lands.

Some connectivity exists beyond the hills to the east of the study area along the road reserve of the Oxley Highway and through native grasslands with isolated trees. Koala records indicate that the Oxley Highway provides some level of connectivity between the study area and vegetated areas to the east near Gunnedah and, to a lesser extent, to the west near Mullaley.

Status within the development site

Greenloaning Biostudies (2013) identify the site as containing secondary habitat (class B).

Site observations are shown in Figure 7. Koala densities of approximately one animal per hectare occur within the Red Gum open woodlands of the study area. This exceeds the average reported density for Koalas in the Gunnedah area of 0.3 individuals per hectare. The habitat values of the Tumbledown Redgum open woodland conforms with the definition for secondary habitat (class A) as Tumbledown Redgum is a listed secondary food tree species exceeding 50% of the overstorey species (DECC 2008). SEWPaC (2012a) identify this as *habitat critical to the survival of the species*.

The density of Koala individuals within the White Box woodlands of the development site range from 0.25 to 0.69, which is largely consistent with the average density of Koala individuals found in the Gunnedah area (Greenloaning Biostudies 2013). As for Tumbledown Redgum, White Box woodlands also conforms to the definition of secondary habitat (class A) (DECC 2008) and *habitat critical to the survival of the species* (SEWPaC 2012a).

Impact analysis

The Project's impact on the Koala and its habitat has been assessed on the basis of the following assumptions:

- ❑ Koala individuals within the site form part of an important population numbering between 3,000 (TSSC 2012) and 12,700 (Greenloaning Biostudies 2013);
- ❑ Habitat critical for the survival of the Koala is defined as available preferred Koala habitat in the Gunnedah area (42,492 hectares; Greenloaning Biostudies 2013); and
- ❑ Project impacts would be minimised through time by staged habitat removal, pre-emptively matched, where possible, with habitat creation (Niche 2014a).

The Project would result in the loss of 6.8 hectares of Koala habitat over a 23 year period.

An estimated 2.70 hectares of Tumbledown Red Gum open woodland supports a high density of Koala individuals (i.e. 1.14 Koala individuals per hectare) would be removed during this period. This majority of this habitat would be removed in years 7-23 (i.e. 1.8 hectares identified for clearing during Stages 2 and 3). Initial impacts on this habitat include the loss of 0.9 hectares in Stage 1 (i.e. first seven years of quarrying activity).

An estimated 4.8 hectares of lower value shrubby White Box woodland would also be impacted by the Project. This vegetation supports 0.25 to 0.69 Koalas per hectare. An estimated 0.3 hectares would be removed in Stage 1 (years 1-7), 0.5 hectares in Stage 2 (years 7-14), 3.3 hectares in Stage 3 (i.e. years 15-23).

Project staging over 23 years would distribute the effect of direct impacts on Koalas utilising this habitat, and hence substantially reduce the potential for habitat over-browsing following rapid and extensive habitat loss. The staged rate of habitat clearance would coincide with an equivalent number of Koala generations (i.e. a generation is defined as 6-8 years), thereby introducing potential for successional adaptation to the changing conditions. Aiding this successional adaptation is the rehabilitation of 45 hectares of habitat within the study area during Stage 1, which would start at Project commencement and be completed in year 1 as specified in the site specific KPOM (Niche 2014a). These eucalypt plantings, which would be managed to reduce revegetation failure, are known to provide usable and valuable Koala habitat within seven years in the Liverpool Plains region (Kavanagh and Stanton 2012).

It is estimated that the Project would remove approximately 0.016 per cent of habitat available to the Gunnedah important population that is defined as *critical to the survival of the species* (i.e. 6.8 of 45,496 hectares). Conversely, it has been estimated that the habitat loss is equivalent to an area that would support approximately four Koala individuals (Niche 2014a). This equates to an estimated loss of between 0.04 and 0.1 per cent of the estimated number of Koala individuals that comprise the Gunnedah important population (TSSC 2102; Greenloaning Biostudies 2013).

Significance assessment

An EPBC Act significance assessment has been prepared for the Koala (Appendix 2) following the consideration of the above information. The significance assessment concludes that the proposed action may have a significant impact on habitat critical to the survival of an important population of the Koala.

In the absence of scientific certainty the precautionary principle has been applied in this impact assessment. On this basis it is concluded that potential exists for a significant residual impact on the Koala. Mitigation, monitoring and offsetting is proposed to address the potential for a significant impact on the Koala.

With respect to the benefits obtained from the proposed mitigation, offsetting and monitoring it is considered unlikely that the Project would result in an unacceptable impact on the Koala and its habitat. Moreover, it is predicted that the proposed mitigation and offset strategy (see Sections 3.5 and 4), as detailed in the site specific KPoM (Niche 2014a), would provide a 'maintain or improve' outcome. Proposed monitoring, as outlined in Section 3.6, would provide an adaptive management framework to reduce the risk of not achieving the intended outcomes.

3.3.2 Greater Long-eared Bat

The Greater Long-eared Bat is listed as a vulnerable species on the EPBC Act.

Regional status

Turbill and Ellis (2006) reviewed the records for *Nyctophilus timoriensis* before redescription by Parnaby (2009) as *N. corbeni*. Turbil and Ellis (2006) found a correlation of records with extensive patches of Box - Ironbark woodland. Bat trapping studies in fragmented woodland habitat had very low capture rates for this species.

Local occurrence

The Greater Long-eared Bat is known to occur within the Liverpool Plains (Part B) subregion of the Namoi CMA area (OEH 2013). There are no recorded occurrences of this species within 10 kilometres of the site.

Status within the development site

Harp traps were specifically used to survey for this species. Traps were successful in capturing two other *Nyctophilus* species (18 captures of *N. geoffroyi* and one capture of *N. gouldi*), along with 21 captures of seven other bat species. It is considered that the trapping effort was sufficient to detect this species, should it be present on site (Niche 2013a).

Notwithstanding the above findings, it is considered that suitable habitat for the Greater Long-eared Bat was present within the development site.

Impact analysis

The Project would remove 6.8 hectares of suitable habitat for this species. This habitat loss represents an estimated 0.015 per cent of similar habitat within the region (Namoi CMA 2013). Such impacts would be mitigated through the proposed woodland revegetation for an area of 45 hectares, initiated at Project commencement, as specified in the site specific KPoM (Niche 2014a).

Significance assessment

An EPBC Act significance assessment has been prepared for the Greater Long-eared Bat (Appendix 2) following consideration of the above information. The significance assessment

concluded that the proposed action is **unlikely** to have a significant impact on an important population of the Greater Long-eared Bat.

3.3.3 Large-eared Pied Bat

The Large-eared Pied Bat is listed as vulnerable species on the EPBC Act.

Regional status

The species' current distribution is poorly known. Records exist from Shoalwater Bay, north of Rockhampton, Queensland, through to the vicinity of Ulladulla, NSW in the south. Much of the known distribution is within NSW. Available records suggest that the largest concentrations of populations appear to be in the sandstone escarpments of the Sydney basin and the north-west slopes (Coolah Tops, Mt Kaputar, Warrumbungle National Park and Pilliga Nature Reserve). Although the species is widely distributed, it is uncommon and patchy within this area.

It has been located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range (Hoye and Dwyer 1995). It can also be found on the edges of rainforests and in wet sclerophyll forests (Churchill 2008). This species roosts in caves and mines in groups of between 3 and 37 individuals (Churchill 2008).

Local occurrence

The Large-eared Pied Bat is known to occur within the Liverpool Plains (Part B) subregion of the Namoi CMA area (OEH 2013). There are no recorded occurrences of this species within 10 kilometres of the site.

Status within the development site

The Large-eared Pied Bat was not positively detected during detailed field surveys (i.e. harp traps and ultrasonic bat detectors), although a single call sequence recorded in the study area had some of the characteristics of this species. That call sequence, was more likely to be a low call of the Southern Freetail Bat (*Mormopterus sp 4.*), a species that was commonly detected by its slightly higher frequency calls on site. Low calls can be generated from fast flying bat species such as *Mormopterus* because of the Doppler Effect. In this case the bat would have been flying away from the microphone and modifying its usual search pattern because of a cluttered flying environment (*pers. comm.* Brad Law).

For the purposes of this assessment it is assumed that only suitable foraging habitat is present within the development site as there is no occurrence of suitable roosts (caves or tunnels) required for rest, breeding and overwintering.

Impact analysis

The Project would remove 6.8 hectares of suitable habitat for this species. This habitat loss represents an estimated 0.015 per cent of similar habitat within the region (Namoi CMA 2013). Such impacts would be mitigated through the proposed woodland revegetation for an area of 45 hectares initiated at Project commencement as specified in the site specific KPOM (Niche 2014a).

Significance assessment

An EPBC Act significance assessment has been prepared for the Large-eared Pied Bat (Appendix 2) following consideration of the above information. The significance assessment concluded that the proposed action is **unlikely** to have a significant impact on an important population of the Large-eared Pied Bat.

3.3.4 Spotted-tailed Quoll

Spotted-tailed Quoll is listed as an Endangered species on the EPBC Act.

Habitat Requirements

The Spotted-tailed Quoll *Dasyurus maculatus* is mainly a forest dwelling species that occupies large home ranges (Andrews 2005, Belcher and Darrant 2004). Minimum reported home range size for females is around 88 hectares, but is usually larger and males occupy substantially larger home ranges. Typical environments where quolls prosper are those with higher productivity and subsequent abundant prey. The prey utilised by quolls is diverse and varies dramatically between sites.

The Spotted-tailed Quoll inhabits a variety of habitats, including dry to moist open forests or closed forests containing rock caves, hollow logs or trees for denning and foraging. Viable populations of the Spotted-tail Quoll occupy complex overlapping individual home ranges comprising numerous individuals. Females occupy smaller home ranges (mean 500 hectares) comprising an abundance of resources with males occupying larger home ranges that overlap those of the females (Belcher 2008). Ideal habitat for this species is generally contained in large undisturbed connected tracts of intact native vegetation, which are under threat throughout the range of this species.

Populations of the Spotted-tailed Quoll are very sensitive to changes in the predator-prey relationship of their chosen environment (Catling and Burt 1995). An area containing an abundant source of medium-sized mammals (500 - 5,000 grams) is an important feature of suitable foraging habitat for the Spotted-tail Quoll (Belcher 1995), with a low abundance of medium-sized mammals likely to increase habitat suitability for competitors such as the European fox (*Vulpes vulpes*) (Catling and Burt 1995). Competition from the European fox serves to inhibit Spotted-tail Quoll populations (Catling and Burt 1995), with the fox more adapted to fragmented landscapes comprising a mosaic of cleared and vegetated lands.

Regional status

The Spotted-tailed Quoll was previously widely distributed from south-east Queensland, eastern NSW, Victoria, south-east South Australia and Tasmania (Jones et al. 2001). The subspecies' mainland range has reduced by 50-90% (Jones et al. 2001). Detailed distribution records and abundance estimates are generally lacking due to the scale and intensity of surveying that is required to detect the species across its entire range (Long & Nelson 2004).

Figures since 2004 suggest that there are 44 known sites in NSW, 16 sites in the ACT, four to five sites in Victoria and possibly none in South Australia (TSSC 2004). Spotted-tailed Quoll records indicate that the species is now confined to within 200 km of the coast and range from the Queensland border to Kosciuszko National Park. Locations include:

- ❑ Hunter Valley, Taree, Port Macquarie and Coffs Harbour through to the gorges and escarpments of the New England Tableland;
- ❑ locally abundant populations occur in the south of the state (i.e. Kosciuszko NP and coastal national parks);
- ❑ isolated records near Hay; and
- ❑ several disjunct populations between the Border Ranges and the Blue Mountains/Illawarra area (Catling & Burt 1997).

Local occurrence

The Spotted-tailed Quoll is known to occur within the Liverpool Plains (Part B) subregion of the Namoi CMA area (OEH 2012).

Status within the development site

From a vegetation type and structure perspective it is considered that the habitat values of the study area are suitable for the Spotted-tailed Quoll. The fertile basaltic soils might provide the productivity required. The suitable prey species present are Common Brushtail Possum, hollow and communal roosting birds and any small mammals present. Other well known prey such as small macropods, rabbits and smaller arboreal mammals seem to be rare or absent from this site.

However, the habitat area within the study area and connected adjacent lands is not large enough to support a sustainable population of Spotted-tailed Quolls. Suitably high quality habitats is not located in close proximity to the study area with the surrounding open grassland and open grassy woodlands not documented or known to support Spotted-tailed Quoll populations. The density of preferred prey species within the woodlands of the study area is low and is unlikely to be sufficient to support a breeding population of this species. It is considered that the habitat present within the site and study area is suitable only for opportunistic foraging activity by dispersing or non-breeding individuals.

Impact analysis

The Project would result in the removal of 9.7 hectares of habitat for the Spotted-tailed Quoll. This habitat loss represents an estimated 0.015 per cent of similar habitat within the region (Namoi CMA 2013). Such impacts would be mitigated through the proposed woodland revegetation for an area of 45 hectares initiated at Project commencement as specified in the site specific KPoM (Niche 2014a).

Significance assessment

An EPBC Act significance assessment has been prepared for the Spotted-tailed Quoll (Appendix 2) following consideration of the above information. The significance assessment concluded that the proposed action is **unlikely** to have a significant impact on the Spotted-tailed Quoll.

3.3.5 Swift Parrot

Swift Parrot is listed as an Endangered species on the EPBC Act.

Habitat requirements

The Swift Parrot migrates from its Tasmanian breeding grounds to overwinter in the box-ironbark forests and woodlands of Victoria, New South Wales and southern Queensland. The principal wintering grounds are the inland slopes of the Great Dividing Range and along the eastern coastal plains. In Victoria, approximately 38% of the total box-ironbark habitat (including habitat on private and public land) occurs within reserves (Environment Conservation Council 2001). In New South Wales, only 5% of ironbark and woodland communities are reserved.

Regional status

Until recently it was considered that the NSW wintering range was mostly on the western slopes region along the inland slopes of the Great Dividing Range, and some areas along the northern and southern coasts, including the Sydney region. However, increasing evidence suggests that coastal plains forests from southern to northern NSW are also extremely important (Swift Parrot Recovery Team 2001). There have also been records from the ACT in the Canberra area and Namadgi National Park (Swift Parrot Recovery Team 2001).

Local status

Swift Parrot is known to occur within the Liverpool Plains (Part B) subregion of the Namoi CMA area (OEH 2013).

Status within the development site

As the Swift Parrot (*Lathamus discolor*) is a winter visitor to mainland Australia, the survey timing was not suitable for detecting this species. However, Swift Parrots are known to visit the Liverpool Plains in some years with apparent gaps between visits that may be many years (OEH 2013). The winter flowering white box in the study area is a known feed tree and would provide a foraging resource for Swift Parrots should they visit the region.

Impact analysis

The Project would remove 6.8 hectares of suitable foraging habitat for this species. No loss of breeding habitat would occur. This habitat loss represents an estimated 0.015 per cent of similar habitat within the region (Namoi CMA 2013). Such impacts would be mitigated through the proposed woodland revegetation for an area of 45 hectares initiated at Project commencement as specified in the site specific KPOM (Niche 2014a).

Significance assessment

An EPBC Act significance assessment has been prepared for the Swift Parrot (Appendix 2) following consideration of the above information. The significance assessment concluded that the proposed action is **unlikely** to have a significant impact on the Swift Parrot.

3.4 Migratory birds (international)

Two migratory birds listed under the EPBC Act were detected on site:

- (i) Rainbow Bee-eater (*Merops ornatus*); and
- (ii) Black-faced Monarch (*Monarcha melanopsis*).

It is probable that both these common species do not breed on site, but instead use it as a stop-over point as part of their migration (Niche 2013a).

3.4.1 Rainbow Bee-Eater

Habitat Requirements

The Rainbow Bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation (Higgins 1999). It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. It also occurs in inland and on coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in various other habitat types including heathland, sedgeland, vine forest and vine thicket, and on beaches.

Regional Status

The Rainbow Bee-eater is distributed across much of mainland Australia, and occurs on several near-shore islands. It is not found in Tasmania, and is sparsely distributed in the most arid regions of central and western Australia.

The extent of occurrence of the Rainbow Bee-eater in Australia has not been estimated.

Local Status

The Rainbow Bee-eater is known to occur within the Namoi CMA.

Status within the development site

The Rainbow Bee-eater (*Merops ornatus*) would not be able to breed within the development site as the soils are too rocky to allow nest burrow excavation.

Impact analysis

The Project would result in the removal of approximately 9.7 potential foraging habitat for the Rainbow Bee-eater. This habitat loss represents an estimated 0.015 per cent of similar habitat within the region (Namoi CMA 2013). Such impacts would be mitigated through the proposed woodland revegetation for an area of 45 hectares initiated at Project commencement as specified in the site specific KPOM (Niche 2014a).

Significance assessment

An EPBC Significance assessment has been prepared for the Rainbow Bee-eater (Appendix 2) following the consideration of the above information. The significance assessment concluded that the proposed action is **unlikely** to have a significant impact on the Rainbow Bee-eater.

3.4.2 Black-faced Monarch

Habitat Requirements

The Black-faced Monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical

(notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.

The species also occurs in selectively logged and 20–30 years old regrowth rainforest (Laurance et al. 1996). It is also sometimes found in nearby open eucalypt forests (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey. The species especially occurs in 'marginal' habitats during winter or during passage (migration).

Other areas in which the Black-faced Monarch may be found include: gullies in mountain areas or coastal foothills, softwood scrub dominated by Brigalow (*Acacia harpophylla*), coastal scrub dominated by Coast Banksia (*Banksia integrifolia*) and Southern Mahogany (*Eucalyptus botryiodes*), occasionally among mangroves and sometimes in suburban parks and gardens.

Regional Status

The Black-faced Monarch is widespread in eastern Australia. In New South Wales and the Australian Capital Territory, the species occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park, Wombeyan Caves and Canberra. It is rarely recorded farther inland (e.g. Munghorn Gap Nature Reserve, January 1995, and Maules Creek, 50 km south-east of Narrabri, December 1994).

Local Status

The Black-faced Monarch is known to occur within the Namoi CMA.

Status within the development site

The Black-faced Monarch (*Monarcha melanopsis*) detected during the survey was a juvenile. This species would most likely have been migrating northwards at the time of the survey and using the study area as a staging point. This record is unusually far west for this species.

Impact analysis

The Project would result in the removal of foraging and nesting habitat for the Black-faced Monarch. Such impacts would be mitigated through progressive rehabilitation of the quarry footprint through the re-establishment of native vegetation similar in character to SEVT.

Significance assessment

An EPBC Significance assessment has been prepared for the Black-faced Monarch (Appendix 2) following the consideration of the above information. The significance assessment concluded that the proposed action is **unlikely** to have a significant impact on the Black-faced Monarch and its habitat.

3.5 Residual impacts

The impacts assessments provided in Sections 3.1 and 3.3 concluded that the Project may have a significant impact on some MNES. On this basis potential exists for the Project's unavoidable impacts to have a significant residual impact on MNES. Such circumstances, if

shown to be true, would require an offset in addition to mitigation outcomes in accordance with *Commonwealth EPBC Act Environmental Offsets Policy* (October 2012).

With regard to the residual impacts, mitigation is recommended to minimise the Project's residual impacts on the Koala and SEVT EEC. A monitoring program is also proposed to provide an adaptive management framework that matches environmental outcomes as they occur. A separate discussion on the proposed biodiversity offsetting for the Project is provided in Section 4.

3.5.1 Mitigation

The implementation of a NSW agency approved VMP (Stewart Surveys 2014) and site specific KPoM (Niche 2014a) would be required as part of a conditional approval under Part 4 of the NSW EP&A Act. These plans would formalise the management actions required to mitigate unavoidable direct and indirect impacts on MNES.

Direct impacts

The approved KPoM is an enforceable statutory requirement (i.e. State Environmental Planning Policy 44). The approved KPoM prepared for the development site details the spatial and temporal revegetation specifications required to protect and enhance Koala habitat identified within the study area.

Key mitigation specified in the KPoM includes:

- Revegetation of existing cleared lands occurring in the study area prior to the majority of vegetation clearing works;
- Progressive rehabilitation of the quarry;
- Habitat maintenance activities to effect maintain and improve outcomes for retained habitat areas; and
- Adaptive management procedures to reduce impacts through the quarry's operational period.

Approximately 45 hectares of revegetation works using preferred feed tree species are proposed in addition to the progressive rehabilitation of the staged quarry operation. The maintenance requirements for revegetation works and residual vegetation cover (e.g. removal of grazing stock) are also defined. A net benefit to the Koala is expected as a consequence of the management works thereby limiting the likelihood of overbrowsing.

Much of the proposed mitigation (i.e. revegetation) is to occur in advance of vegetation clearing thereby minimising the effects of habitat loss. Revegetation works were guided by the following principles:

- Planting of locally occurring species, including plants representative of groundcover, understorey and canopy strata;
- Planting of preferred food trees for native fauna, including appropriate eucalypt species for the Koala;
- Monitoring and maintenance of plantings;
- Exclusion of stock; and

- Managing and controlling weeds.

The KPoM would also provide for the following actions that would be of benefit to the Koala:

- Completion of pre-clearance surveys. Koalas found in pre-clearance surveys would be relocated in accordance with protocols outlined in the KPoM; and
- Monitoring of Koala activity throughout the study area to measure the effectiveness of prescribed mitigation measures.

Monitoring and reporting procedures would enable the implementation of an adaptive management framework.

Indirect impacts

Indirect impacts on the Koala and SEVT are expected through the life of the Project. Through the implementation of proactive and adaptive management practices these impacts would be limited to the development site boundary (e.g. careful quarry staging and timely implementation of management actions). This expected outcome would be delivered through an agency approved site specific VMP (Stewart Surveys 2014), which would have sufficient scope to encompass the management of retained native vegetation and habitat in adjacent areas.

The VMP details actions designed to manage matters such as weeds. Management actions specified in the VMP would aim to prevent the occurrence of indirect impacts and/or intensity of existing threats such as those associated with feral animals (e.g. feral pigs) and inappropriate fire regimes.

Management actions proposed for inclusion in the VMP would include the following:

- Weed control, particularly *Zinnia peruviansis* and tiger pear;
- Feral animal control, particularly feral pigs, which were noted to be damaging SEVT; and
- Fire management by proactively excluding fire from areas of SEVT, whilst maintaining appropriate fire regimes to maintain and improve Koala habitat (i.e. stimulate the regeneration of overstorey feed tree species).

Retained areas of SEVT would be managed for weeds and feral fauna (i.e. wild pigs). Edge effects would be minimised through management practices contained within development site boundary. The propensity for threats posed by inappropriate fire regimes would be managed to minimise the potential for adverse impacts on SEVT and Koala habitat.

Progressive rehabilitation of the final landform would also be undertaken as part of a staged development. Details for establishing vegetation cover of similar structure and floristics to SEVT would be defined in the VMP. The establishment of suitable feed tree species for the Koala would also be considered.

Other tangible benefits expected from the implementation of the VMP would include:

- Establishment of alternative Koala habitat in Stage 1 that is adjacent to but sufficiently distant from the quarry's operational influence (i.e. noise and dust). In

addition to the increased availability of Koala habitat this mitigation would also serve as a sanctuary for animals during periods of stress (e.g. blasting);

- ❑ Provisions for the planting of winter-flowering trees to supplement seasonal foraging habitat for the Swift Parrot and prey species of the Spotted-tailed Quoll; and
- ❑ Placing logs removed from the development site into adjoining retained habitat to provide refuge and foraging substrates for native fauna.
- ❑ A 'Code of Conduct' for quarry operators as a mechanism for delivering harm minimisation. Such as code would provide opportunity to develop and establish a 'Koala aware' operational culture that would ultimately deliver benefits to this species, both within and outside the quarry area.

3.6 Risk of mitigation measures failing

Risks of mitigation measures failing such as dirty water catch drains and sediment control dams.

Sedimentation dams, contour banks and catch drains will be regularly monitored to ensure they are functioning as intended. Rip rap rock is to be placed in overflow and spillway areas to minimise the risks of erosion. If dirty water does overflow the pit and quarry sedimentation pond it will be contained by contour banks and directed into the upgraded 8ML Dam A. Should this dam fail or overtop an additional 1ML dam is proposed between Dam A and the property boundary.

Revegetation

Revegetation works are proposed to start at Project commencement and be established to a maintenance standard within a year of this commencement. On-going maintenance is proposed to ensure delivery of the proposed 45 hectare revegetation area prior to the commencement of Stages 2 and 3. Active management through the implementation of the VMP and KPoM is designed to address any unexpected shortfalls in performance. Performance would be measured through annual monitoring and reporting. It is considered that these arrangements offer a low risk model for the proposed revegetation works as a mitigation measure for impacts on the Koala.

3.7 Managing retained Koala habitat

In addition to the areas to be replanted, it would also be necessary to protect and enhance existing areas of woody vegetation in the eastern parts of the study area, including the White Box Woodland, White Box Open Woodland, Poplar Box Open Woodland and Red Gum Open Woodland, as described in the KPoM (Niche 2014a). Management actions, such as the exclusion of stock, use of appropriate fire regimes and weed management to assist the natural regeneration of adjacent Koala habitat are proposed.

3.7.1 Livestock grazing

All livestock grazing is to be removed from the Project area for the duration of the quarrying period. This is a critical management action designed to aid the establishment of replanted areas and to allow for the natural regeneration of overstorey tree species such as those that are important to the establishment of preferred Koala habitat.

3.7.2 Fire regimes

The selective use of low intensity fires is recommended to stimulate the natural regeneration of overstorey tree species, particularly throughout areas of grassy White Box woodland and open woodland. Low intensity fires may be used to assist plantings and weed suppression.

Fire is to be excluded from any areas that are classified as Semi-evergreen Vine Thicket, as this vegetation would be adversely impacted by the use of fire.

3.7.3 Pest management

Weed management to control the occurrence of tiger pear is required to limit the potential for Koala individuals suffering spine stick injury. The control of feral animals such as wild pigs is also considered important for the protection of replanting areas and minimizing surface disturbances, which can lead to increased weed occurrence and growth.

3.8 Protecting Koala habitat and SEVT

Project approval would commit the quarry operator to the implementation of the approved site specific KPOM for the term of the consent (an estimated 23 years). Conditions of consent are enforceable and in this respect represent an appropriate mechanism to protect retained and compensatory Koala habitat whilst the Project is in operation. Mitigation, management and monitoring linked to Koala habitat within the study area is provided in the KPOM (Niche 2014a), which includes timeframes for its implementation. These measures are auditable and, as such, provide an on going compliance mechanism which allows for the delivery of a 'maintain and improve' outcome for the Koala.

In addition to the proposed mitigation within the study area, the Project is also required to deliver a biodiversity offset in accordance with an approved BioBanking Statement issued by the Office of Environment and Heritage (OEH) under the NSW Biodiversity Offsets Scheme (i.e. BioBanking see Section 4). BioBanking is a government-endorsed biodiversity offsetting scheme that provides a fully funded, in-perpetuity biodiversity conservation outcome for native flora and fauna, including threatened biodiversity such as the Koala and SEVT.

In summary, it is considered that the dual outcomes proposed, which includes the implementation of the KPOM for the life of the Project and provision of an independent biodiversity offset at Black Jack Mountain, significantly exceed the Project's requirements to demonstrate a 'maintain and improve' outcome for the Koala and SEVT.

3.9 Monitoring

Proposed is a 'Before After Control Impact' (BACI) style monitoring program targeting the Koala. BACI is a rigorous audit style process that establishes quantifiable links between predicted impacts and actual outcomes.

This monitoring program is designed to examine the Project's direct and indirect impacts and the efficacy of mitigation. This monitoring would provide information necessary for identifying the need for adaptive management actions designed to remedy unforeseen or unexpected negative Project impacts. The main benefits of this monitoring approach include:

- The timely identification of unexpected environmental impacts (i.e. positive and negative);
- Increased temporal and spatial sensitivity enabling a more targeted and measured response to key environmental issues as they emerge; and
- Quantitative analysis of cause and affect, with the resultant scientific knowledge potentially leading to improved environmental stewardship.

The four principal elements of a BACI are:

- Before data - site data collected prior to development;
- After data - data is collected over areas where management works have occurred but are no longer reoccurring. The purpose of this data is to measure the extent of change (positive or negative) and hence guide on-going actions and activities;
- Control data - control sites are to be established within areas that are stable (i.e. representative of natural variation over time), are not influenced by the Project, have habitat values consistent with those of the site and are sites independent of the study area. Such data may be collected from nearby conservation areas, State Forest or private landholdings; and
- Impact data - this is data collected for areas subject to the effects of management. The purpose of this data is to examine the effects of management works while they are occurring against before and control plots. Such data is used to reduce, increase or cease management works.

BACI Monitoring Program and the Project

A BACI monitoring program developed for the Project would provide a clear scientifically objective analytical framework for demonstrating the achievement of the mitigation measures. The proposed monitoring program would focus primarily on measuring the following:

- The impact of Koala habitat loss on individuals within the study area and the effectiveness of the KPoM to remedy predicted residual impacts; and
- The success or otherwise of proposed progressive rehabilitation works, which would be designed to establish vegetation with floristic and structural similarity to that removed (SEVT and white box woodland).

Documentation outlining the monitoring methodology would include:

- The term of the monitoring period;
- The variables required to be measured for the evaluation of management actions and Project impacts;
- The methods and protocols for collecting this data;
- The collection of baseline and control datasets;
- The analysis techniques used to detect change; and
- The identification of ‘trigger’ levels prompting a management response.

The proposed monitoring program for the Koala is specified in detail in the approved site specific KPoM (Niche 2014a).

4 BIODIVERSITY OFFSETS

4.1 Requirement for an offset

Impacts are staged over a 23 year quarry life with residual impacts addressed by proposed mitigation as detailed in the site specific VMP and KPoM. The impact assessment presented in this report does not indicate with certainty that the Project would have a significant residual impact on MNES. Such circumstances require the adoption of the precautionary principle (i.e. scientific uncertainty) and on this basis offsets under the EPBC Act would be required (i.e. Koala and SEVT). The *EPBC Act environmental offsets policy* (October 2012) has been used to determine the extent of offsetting required for affected MNES. The NSW BioBanking Scheme is proposed as the conservation mechanism for implementing the proposed offset. The following sections discuss the calculations used to determine if the proposed Black Jack Mountain offset site would act as a suitable offset for the Project.

4.2 Proposed offset site

Located approximately 20 km east of the Project is the proposed Black Jack Mountain offset site, southwest of Gunnedah as shown in Figure 1. At a landscape and biodiversity level the offset is consistent with the *EPBC Act environmental offsets policy* (October 2012) as it:

- Shares the same bioregion, catchment and subregion values, as described in Table 1;
- Has 'like for like' geological, climatic and native vegetation cover (see Figure 8); and
- Is within close proximity to the impact site.

The offset site is approximately 113 hectares in area, of which approximately 50 per cent is required to satisfy the OEH approved BioBanking statement for the Project (i.e. retirement of 599 credits through the NSW Biodiversity Offsets Scheme or BioBanking). The proposed offset site has sufficient availability of both credit quantity and type (i.e. 1,093 ecosystem credits with like for like vegetation).

Other benefits offered by the Black Jack Mountain biodiversity offset site include:

- Contiguous with adjacent vegetation of remnant size exceeding 500 hectares;
- Harbours a substantial number of Koala individuals that comprise part of the Gunnedah important population near the epicentre of recorded Koala activity (see Figure 9); and
- The land is currently under private ownership and is zoned for rural purposes without any conservation agreements active on the land.

4.3 EPBC Act offset calculations

4.3.1 Offset site suitability

Offsetting information for the Koala and SEVT are provided in the following sections.

4.3.2 Data inputs and assumptions

The *EPBC Act environmental offsets policy* (October 2012) and associated offset calculator requires data inputs derived from the impact site and offset area. A semi qualitative estimate of vegetation/ habitat condition is required in addition to expected change in condition over time and assumptions relating to risk and time to ecological benefit. Table 3 lists the data inputs used in the offset calculations for this Project.

Table 3. EPBC Act Offset Calculations: data inputs and assumptions

Data input/ assumption	Koala Red Gum	Koala White Box	SEVT
Impact area (hectares)	2.7	4.1	2.9
Quality of impact area (0-10) ¹	5 (5.2)	8 (7.5)	5 (5.2)
Offset area (hectares)	41.7	42.4	17.9
Risk related time horizon (years)	6 ²	6	20
Time to ecological benefit (years)	15 ³	15	5
Start area (hectares)	41.7	42.4	17.9
Quality of offset area (0-10) ¹	8 (7.7)	8 (8.2)	6 (6.0)
Future area and quality without offset – risk of loss (%)	10	10	20
Future area and quality without offset – quality (0-10)	7	7	5
Future area and quality with offset – risk of loss (%)	2	2	2
Future area and quality with offset – quality (0-10)	9	9	7
Confidence in result – risk (%)	95	95	95
Confidence in result – time to ecological benefit (%)	80	80	80

Time to ecological benefit

¹ Derived from ‘Site value’ - See Section 4.4.3 and Section 4.4.4 for further details. Value in brackets represents the actual ‘site value’ score range standardised to between 0 and 10.

² Estimated length of a Koala generation is 6-8 years (Phillips 2000 in TSSC 2012).

³ Estimated longevity of a female Koala in the wild (Martin and Handasyde 1999 in TSSC 2012).

Management actions proposed at the offset site would substantially minimise the likelihood of a premature death for female Koala's (i.e. addressing prevailing unmanaged threats). Fire management and wild dog control are proposed as the main management themes for the Koala in the biodiversity offset site, both regarded as key threatening process for the Koala.

Fecundity benefits are expected from increased certainty of female Koala survival in the proposed offset site. The expected time to ecological benefit is likely to be defined by the length of longevity for a wild female Koala, which is estimated to be at least 15 years (Martin and Handasyde 1999 in TSSC 2012).

Similarly, it is considered that fire management and control of wild goats and pigs (e.g. baiting and shooting) and livestock grazing (e.g. fencing) would result in a marked improvement in vegetation structure and floristics. The expected time to ecological benefit is estimated to be five years and correspond with the time taken for understory plant species to respond to these management actions.

Future area and quality without offset

The proposed Black Jack Mountain offset site forms part of a very large vegetation remnant indicating that the vegetation and associated habitats are likely to be resilient to most identifiable threats. Notwithstanding, the offset site lies adjacent to agricultural lands and is currently grazed by livestock and feral goats. Wild pigs and dogs are also present, with evidence of the former species noted particularly in patches of SEVT.

The risk of loss for the Koala is considered low due to the overall remnant size lying adjacent to the Black Jack Mountain offset site. However, the Black Jack Mountain offset does contain a large proportion of the available high value Koala habitat located throughout the Black Jack Mountain area as such securing and managing this important habitat would be central to the protection of the Gunnedah Koala population.

Conversely, SEVT is restricted to small patches throughout the Black Jack Mountain vegetation remnant and as such is more vulnerable to degradation either through the affects of wild pig disturbance and weed invasions. The potential for unmanaged fire to significantly impact SEVT patches is also high. Accordingly, the risk of loss is higher than that estimated for the Koala.

Future area and quality with offset

Land management actions proposed at the Black Jack Mountain biodiversity offset site include the following:

- Supplementary plantings of white box and Tumbledown Redgum in a patch of disturbed white box woodland of approximately 10 hectares in area;
- Emplacement of fallen timber to improve groundlayer habitat condition in areas of proposed White Box revegetation;
- Weed management in the disturbed white box woodland patch;
- Establishment of fire management zones to protect the offset site from catastrophic wild fire events;
- Control of feral goats and pigs using methods such as baiting and shooting;

- Control of wild dogs; and
- Use of fencing to exclude domestic livestock.

These management activities would be fully funded and calculated at commercial rates; this being a mandatory requirement under the NSW BioBanking Scheme. OEH is responsible for approving the magnitude of the management fund as part of the application for the BioBank agreement. These provisions significantly increase the certainty of delivering a viable in perpetuity conservation agreement that is capable of achieving its predicted biodiversity gains.

With respect to the above it is assumed that the 'risk of loss' for 'future area and quality with offset' is low and reflects the conservative estimate of the predicted biodiversity gains expected within the proposed offset site.

Confidence in result

The proposed land management actions are a mandatory annual fully funded requirement for BioBank agreements, should one be approved for the proposed Black Jack Mountain offset site. The proposed management actions would directly benefit the Koala and SEVT by minimizing existing threats that otherwise are known to adversely impact the viability of these MNES. While not yet established, the detail of management actions proposed for the offset site must be sufficiently robust and achievable for OEH to approve the proposed BioBanking agreement. Within this context it is considered that the confidence of the result is very high and appropriately justify the 95 per cent confidence in result assumption used in the *EPBC Act environmental offsets policy* (October 2012) offset calculator.

4.3.3 Koala offset

The offset and impact calculations provided in this assessment have taken into account the importance of habitat contained within the proposed offset site for the Koala. Prior site inspections and detailed site investigations of the proposed Black Jack Mountain offset site have identified the Koala as present within the offset area exhibiting high activity within Tumbledown Redgum dominated vegetation. Observations obtained from within the proposed offset site are consistent with those of the development site, thereby further supporting the 'like for like character' of the proposed offset site for the Koala. Koala records for the area support these assertions (Figure 9).

The proposed offset outcome is in addition to the ecological benefits expected from the implementation of the site specific KPOM and VMP (see Section 3.5). These proposed development site management actions (i.e. mitigation) would address the Project's direct and indirect impacts on Koala individuals and associated retained habitat located at the development site. Mitigation would be implemented independent of any biodiversity offset provisions and as such would be additional to the proposed Black Jack Mountain biodiversity offset site.

4.3.4 SEVT

The proposed offset outcome is in addition to ecological benefits expected from the implementation of the site specific VMP (see Section 3.5). Proposed development site

management actions (i.e. mitigation) would address the Project's indirect impacts on SEVT retained at Marys Mount. Mitigation would be implemented independent of any biodiversity offset provisions.

4.4 Offset mechanism

The mechanism proposed to deliver the biodiversity offsets for the Project is the NSW *Biodiversity Banking and Offsets Scheme* (BioBanking Scheme); established under Part 7A of the NSW TSC Act. A requirement of this scheme is the delivery of in-perpetuity 'like for like' biodiversity offsets that are specific to the Project and are enforceable through State environmental approvals. This is further discussed in the following section.

4.4.1 NSW BioBanking Scheme

The BioBanking Scheme enables a streamlined method for biodiversity assessment (i.e. the BBAM) and rigorous credible framework for offsetting development impacts. It provides clear transparent methods for an independent rule based consideration of development impacts on listed threatened species, populations, ecological communities and their habitats and matching criteria for the offsetting of these impacts.

The BBAM incorporates a 'maintain and improve' test to determine whether or not there would be a net impact on threatened species or native vegetation. The assessment rules are designed to meet the objectives of the TSC Act. The results of a BioBanking assessment are expressed as the number biodiversity credits required to be retired by a development site and the number of credits generated and available for retirement at a BioBank site (offset site).

4.4.2 Functioning of the NSW BioBanking Scheme

Where a Project is assessed under the NSW BioBanking Scheme it is compulsory for the proponent of a project to acquire and retire ecosystem credits in the manner specified in the approved BioBanking Statement to comply with the Project's consent conditions. The credits retired must satisfy the following offsetting criteria:

- Must be an OEH approved BioBank site;
- Must be the same NSW Vegetation Type or OEH nominated similar NSW Vegetation Type within the same vegetation formation and class;
- Must occur within the nominated CMA;
- Must occur within the nominated CMA subregion or adjacent subregions; and
- Must have the same or greater patch and adjacent patch size class.

The provision of an offset compliant with the NSW BioBanking Scheme is designed to achieved a 'maintain or improve' outcome, with the underlying conservation principles being consistent with the *EPBC Act environmental offsets policy* (October 2012). The following sections provide details on calculations in accordance with the BBAM and *EPBC Act environmental offsets policy* (October 2012) for the development and proposed offset

site. The results of the two offset calculators have been equivocated in the following sections thereby demonstrating the adequacy of the proposed offset for MNES impacted by the Project.

4.4.3 Development site

An assessment pursuant to Part 7A of the NSW TSC Act was prepared to satisfy the Project’s impact assessment requirements under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* to apply for a BioBanking Statement compliant with the NSW BioBanking Scheme. The approved BioBanking Statement requires the retirement of 599 ecosystem credits as detailed in Table 4.

Table 4. Ecosystem credit calculation for the development site

NSW Vegetation Type	Site Value (0-10) ⁴	EEC	Area (ha)	Credits
Semi-evergreen vine thicket of basalt hills of the NSW north western slopes (Benson 147)	5.1	Yes	2.9	146
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	8.8	No	3.3	234
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	3.7	No	0.9	45
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (Red Gum)	5.2	No	2.7	174
Total			9.7	599

Retiring ecosystem credits through the NSW Biodiversity Offsets Scheme would have the effect of generating an in-perpetuity managed conservation outcome for native vegetation and habitat impacted by the Project. A matched offset site consistent with the NSW BioBanking offsetting rules is required to satisfy the Projects conditions of consent.

4.4.4 BioBank site

An assessment pursuant to Part 7A of the NSW TSC Act was prepared for the purpose of establishing a BioBank site as an offset for the Project. This assessment confirmed the presence of like for like vegetation types within the offset area, as shown in Figure 8. A brief description of the vegetation types observed within the BioBank site is provided below.

⁴ ‘Site value’ is equivalent to a range standardised ‘site value score’, which was calculated by the BBAM from plot data collected from the development/ offset sites.

White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [NA225] - nominate type

Woodlands almost solely dominated by white box comprising a 'shrubby' understory and scattered grassy herbaceous groundcover occur throughout the BioBank site. Vegetation with a shrubby understory was found on the steeper slopes of the BioBank site where exposed basalt and shallow weathered basalt soils prevail. The shrubby variant contains white cypress pine (*Callitris glaucophylla*) as a canopy associate and understory comprising sticky hopbush (*Dodonaea viscosa*), blackthorn (*Bursaria spinosa*) and mock olive (*Notelaea microcarpa*). Grassy tussocks characterise the groundcover stratum, including snow grass (*Poa sieberiana*), barbed wire grass (*Cymbopogon refractus*) and wallaby grass (*Rytidoperma* spp.).

White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions [NA225] - Tumbledown Red Gum variant

Scattered occurrences of white cypress pine and tumbledown red gum (*Eucalyptus dealbata*) form an open woodland structure on the upper slopes and crest of the site. This vegetation is predominantly grassy herbaceous although is variously covered by shrub species found in the nominate vegetation type. The occurrence of this vegetation is restricted to north and west facing slopes where these canopy species emerge above an open shrubland structure. Structural and floristic variation was observed throughout this vegetation indicating the presence of broad transition between adjacent white box woodlands and SEVT. Weeds were present throughout, particularly near disturbed edges, and included Cobblers Pegs (*Bidens pilosa*).

Semi-evergreen vine thicket of basalt hills of the NSW north western slopes (Benson 147) (SEVT) [NA199]

Shrublands dominated by mock olive and peach bush (*Ehretia membranifolia*) occur on the north and west facing rocky basalt scree slopes with skeletal red soils. The occurrence of dense vine growth of wonga vine (*Pandorea pandorea*) extending into the overstorey canopy is restricted to this vegetation. Grassiness varies in accordance with overstorey canopy shading, with vegetation on the gentler slopes, such as the areas in the southwest, generally being grassier than vegetation in the central and northern parts where canopy cover is comparatively greater. Groundcover species include poison rock fern (*Cheilanthes distans*), *Cyperus gunnii* and *Cymbopogon refractus*.

As detailed in Table 5 an approved BioBank site established at the proposed offset location would generate an estimated 1,093 ecosystem credits.

Table 5. Ecosystem credit calculation for the proposed offset site

NSW Vegetation Type	Site Value (0-10) ⁴	EEC	Area (ha)	Credits	Credits/ha
Semi-evergreen vine thicket of basalt hills of the NSW north western slopes (Benson 147)	6.0	Yes	17.85	223	12.49
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	8.3	No	42.36	397	9.37
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	4.2	No	11.23	126	11.22
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions (Red Gum)	7.7	No	41.66	349	8.38
Total			113.10	1,093	

4.5 Comparison of offset calculations

The proportion of the Black Jack Mountain biodiversity offset site that is attributed to offsetting the Projects impact on MNES is approximately 45.4 hectares (determined by credit to hectare calculation). A comparison with results produced using the *EPBC Act environmental offsets policy* (October 2012) and calculator is provided in Table 6.

Table 6. Offsetting calculator comparison: NSW BBAM and EPBC Act (2012)

MNES	Impact area (ha)	Adjusted Impact (ha)	BioBank Offset (ha)	Adjusted Offset (ha)	Per cent of Impact
SEVT	2.9	1.45	11.7	2.51	173
Koala (Tumbledown Redgum Woodland)	2.7	1.35	9.3	1.93	143
Koala (White Box Woodland)	4.1	3.28	24.4	5.06	154
Total	9.7	6.08	45.4	9.5	156

A favourable comparison is shown in Table 6 with offset calculations produced by the NSW BBAM exceeding those produced by the *EPBC Act environmental offsets policy* (October 2012).

4.6 Conclusions

Offsetting proposed in accordance with the NSW BioBanking Scheme would deliver a ‘like for like’ conservation outcome that is consistent with and greater than that required under the *EPBC Act environmental offsets policy* (October 2012). Further, without quantifying the expected benefits of the site VMP and site specific KPOM it is considered that the proposed Black Jack Mountain biodiversity offset would, on its own merit, adequately demonstrate a

maintain or improve outcome for any residual significant impacts on SEVT and the Koala within the local area.

The proposed Black Jack Mountain biodiversity offset site would deliver a maintain or improve conservation outcome for the Koala and SEVT consistent with the *EPBC Act environmental offsets policy* (October 2012) for the following reasons:

- Funded management actions in perpetuity under a conservation agreement established under Section 7A of the TSC Act. Conservation management under a BioBanking agreement for the offset site is mandatory and is an enforceable requirement. Management actions will specifically address the conservation needs of the Koala and SEVT;
- The proposed offset site currently has no formal or informal protection measures. The site is potentially at risk of degradation from permissible land use activities such as grazing (e.g. goats and sheep) and/or unregulated fire regimes; and
- BioBanking offers the highest available conservation mechanism for MNES that occur on private lands within NSW.

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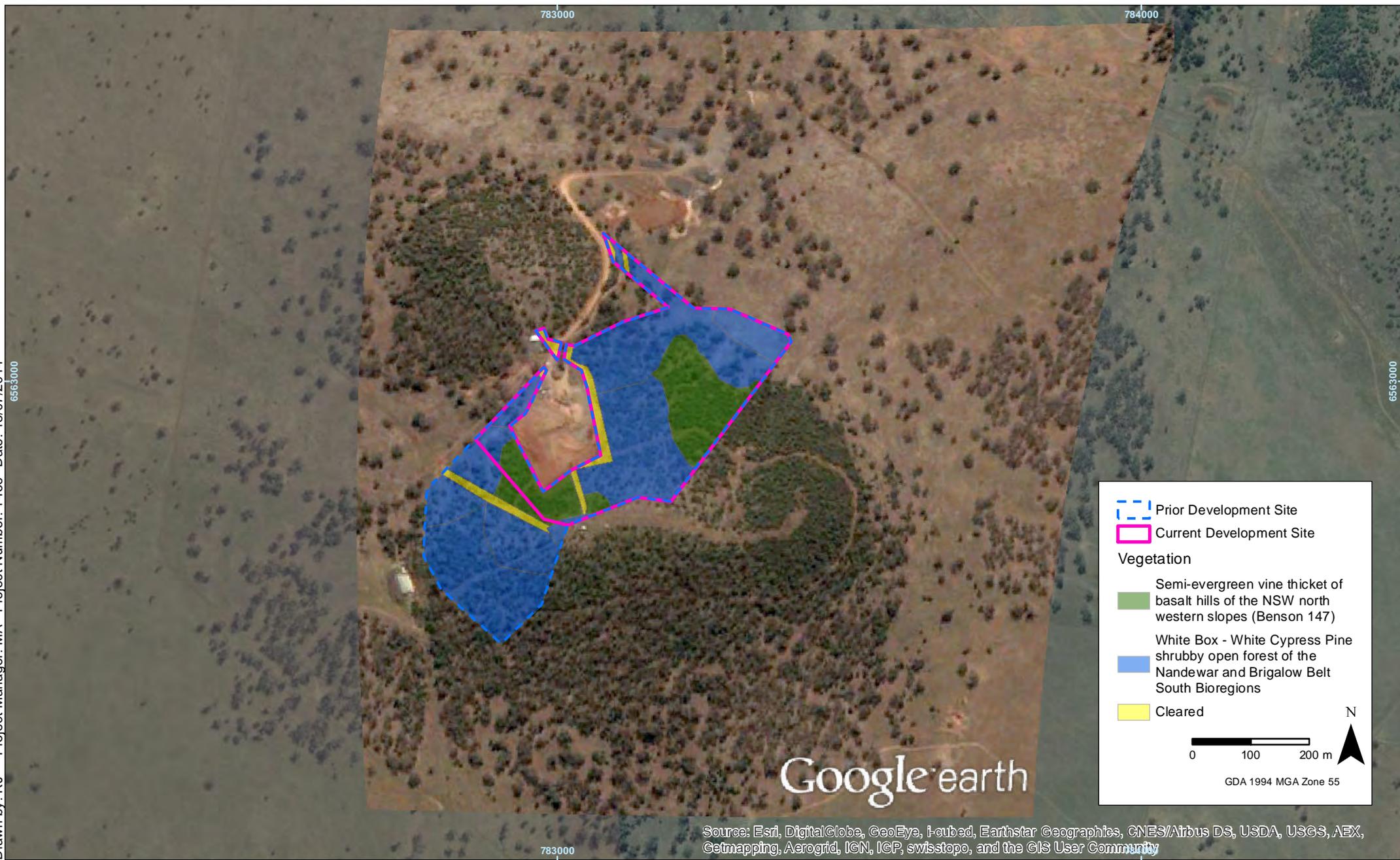
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FIGURES

Drawn by: RJ Project Manager: MA Project Number: 1466 Date: 18/07/2014

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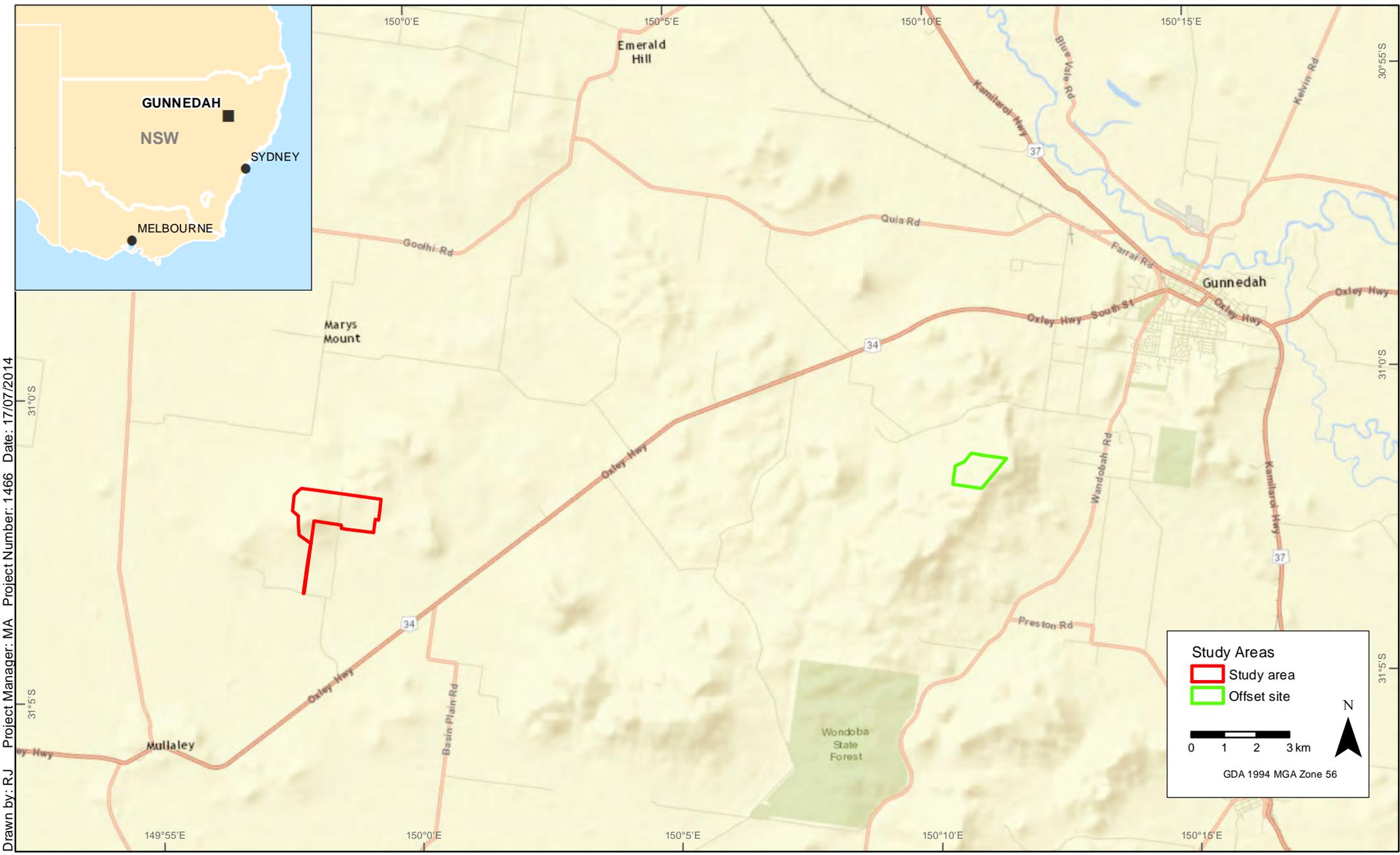


Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Proposed development (original and revised)
Marys Mount Gravel Quarry

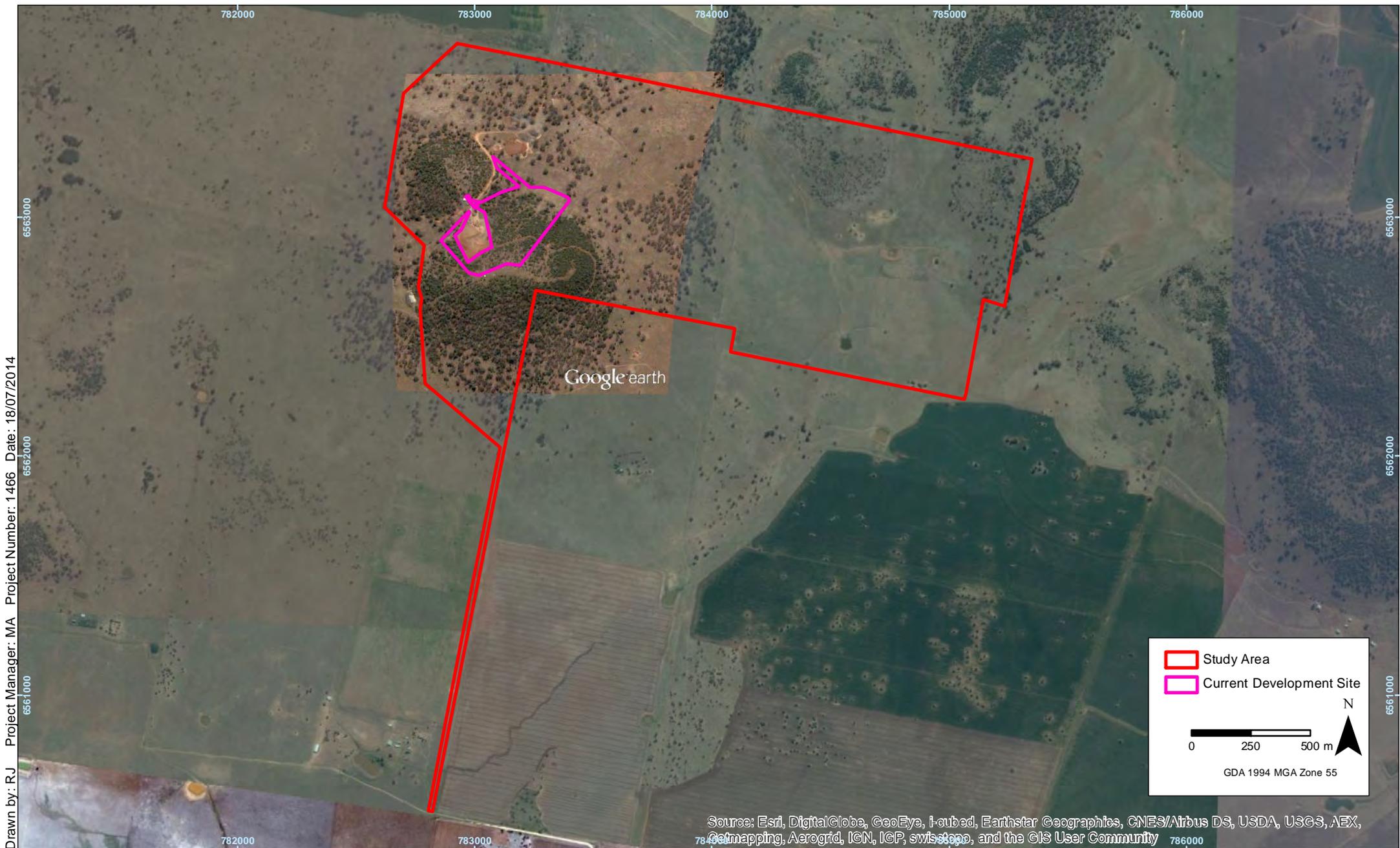
FIGURE 1

Imagery: (c) 2012-10-09 Google Earth



Project location and proposed offset site
 Marys Mount Gravel Quarry

FIGURE 2



Drawn by: RJ Project Manager: MA Project Number: 1466 Date: 18/07/2014

The site and study area
Marys Mount Gravel Quarry

FIGURE 3

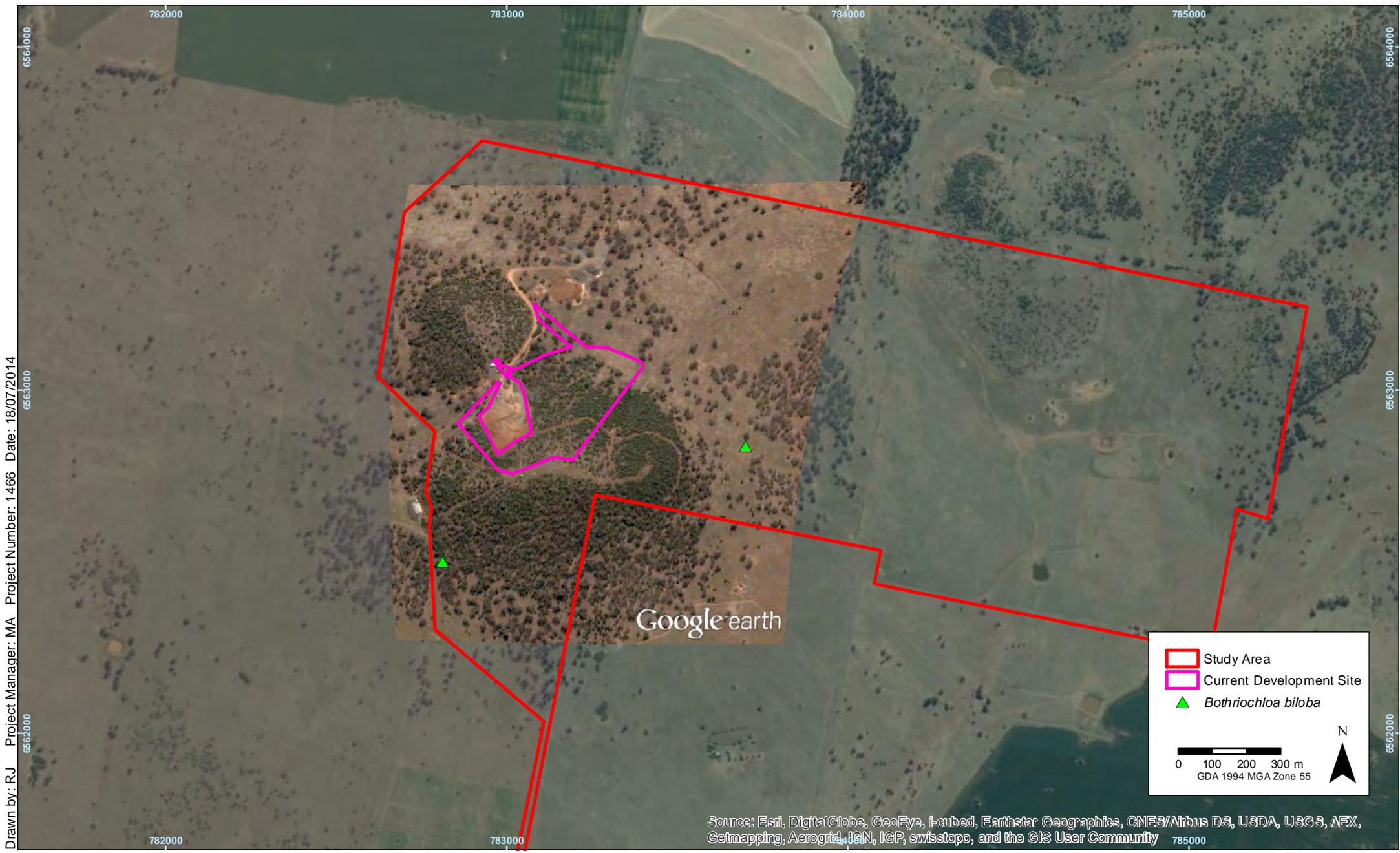


Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Endangered Ecological Communities
Marys Mount Gravel Quarry

FIGURE 4

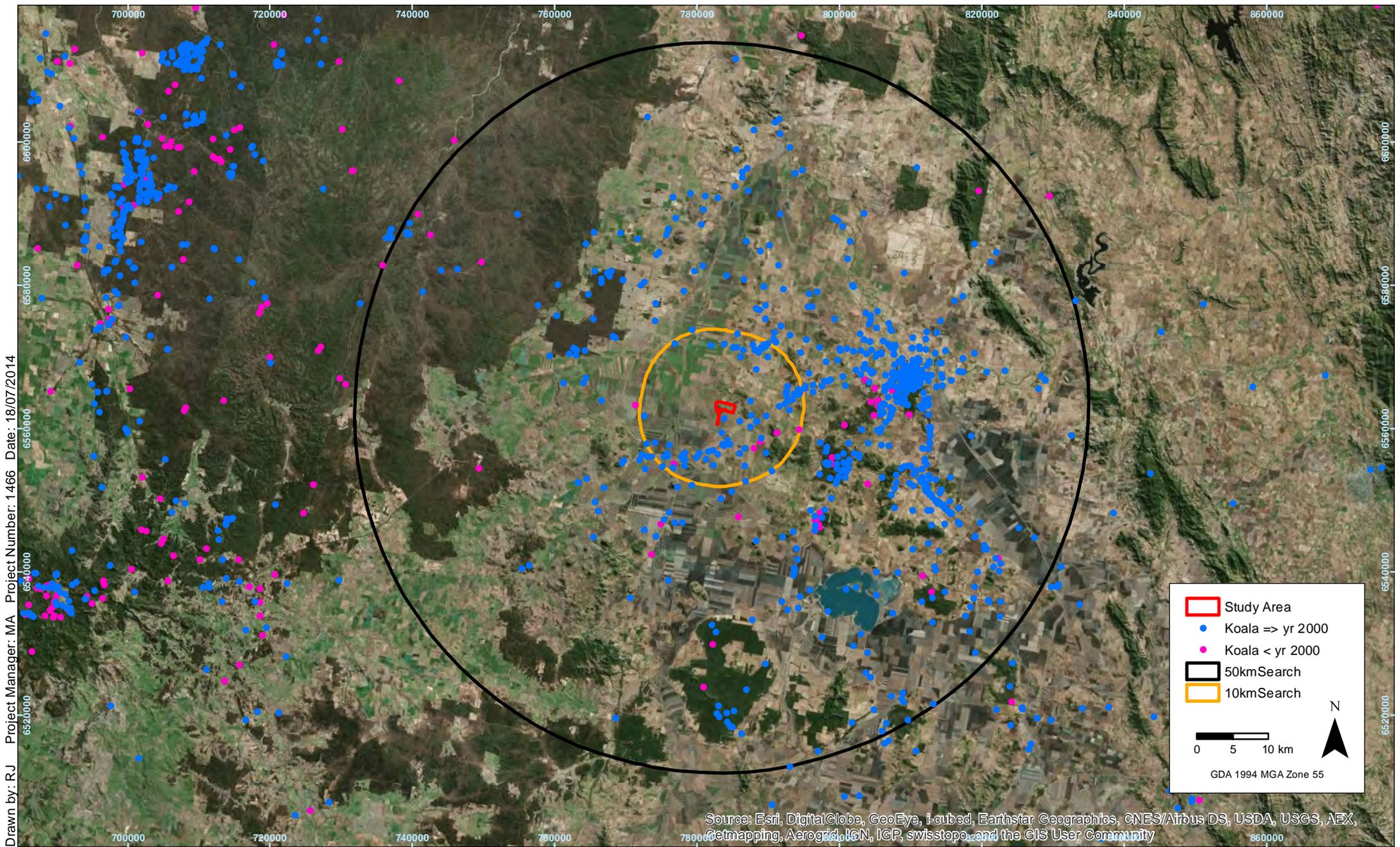
Inset imagery: (c) 2012-10-09 Google Earth



Lobed Bluegrass observations
Marys Mount Gravel Quarry

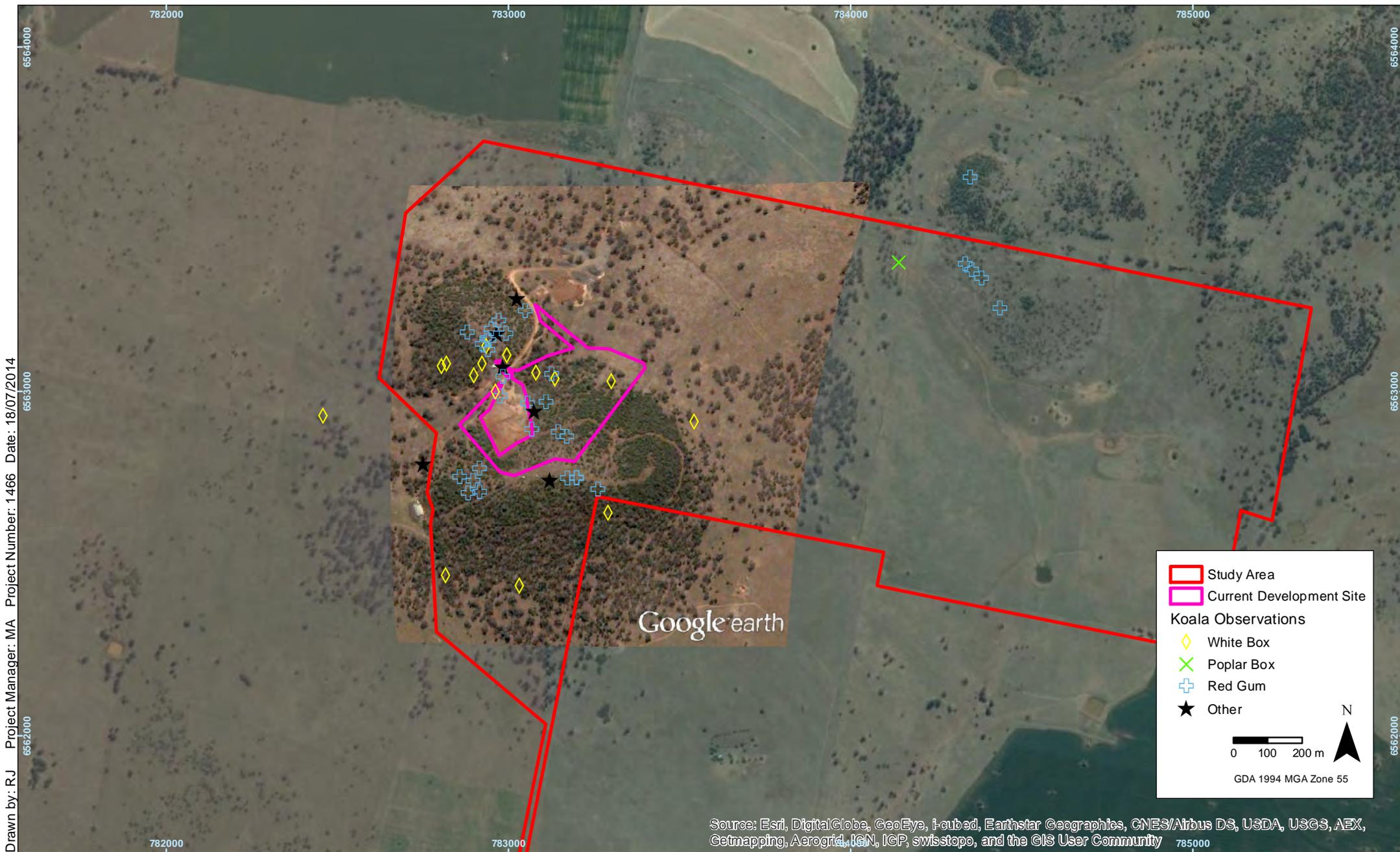
FIGURE 5

Imagery: (c) 2012-10-09 Google Earth



Koala observations: Region
 Marys Mount Gravel Quarry

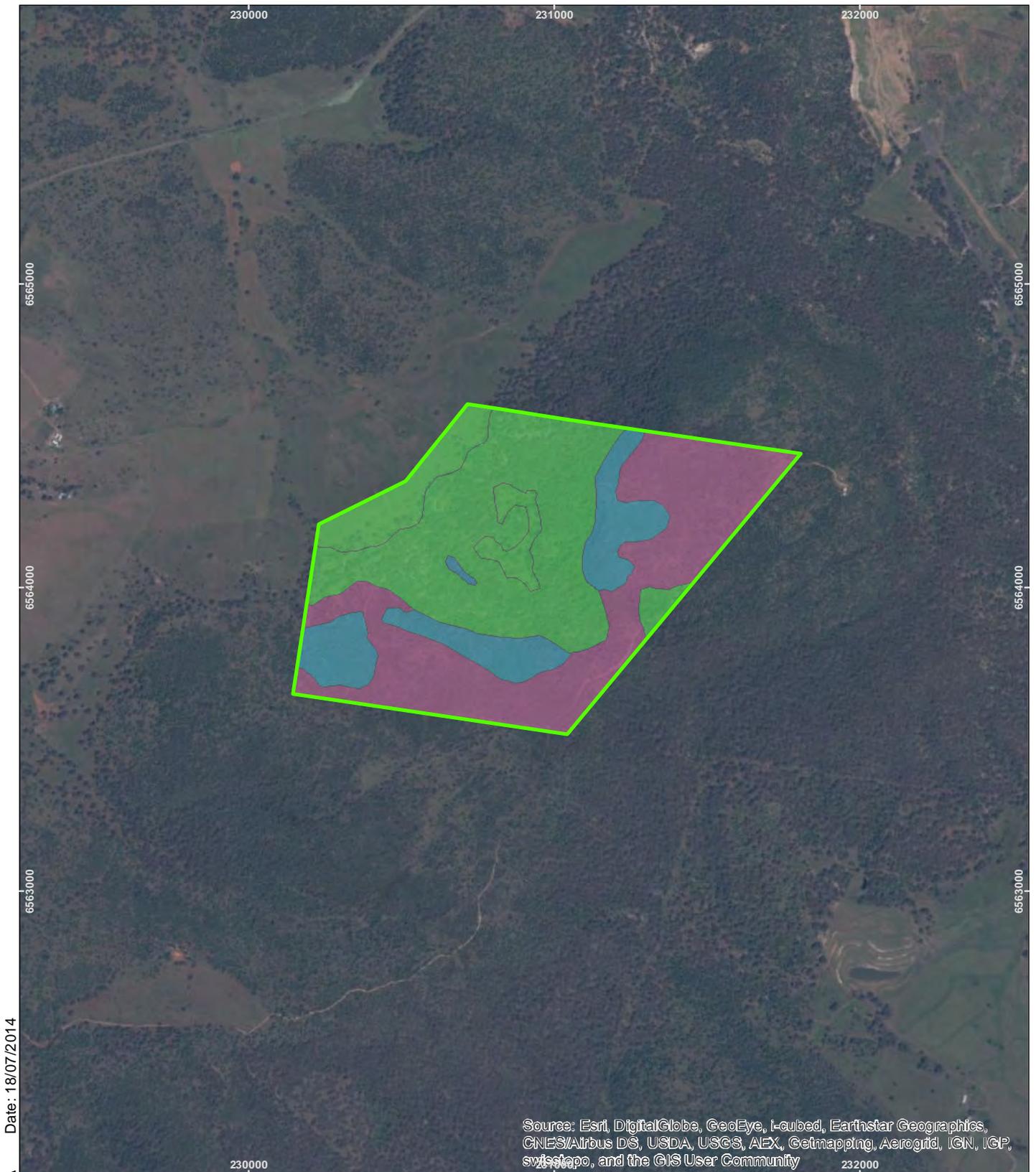
FIGURE 6



Koala observations
Marys Mount Gravel Quarry

FIGURE 7

Imagery: (c) 2012-10-09 Google Earth



Project Manager: MA
 Drawn by: RJ
 Date: 18/07/2014

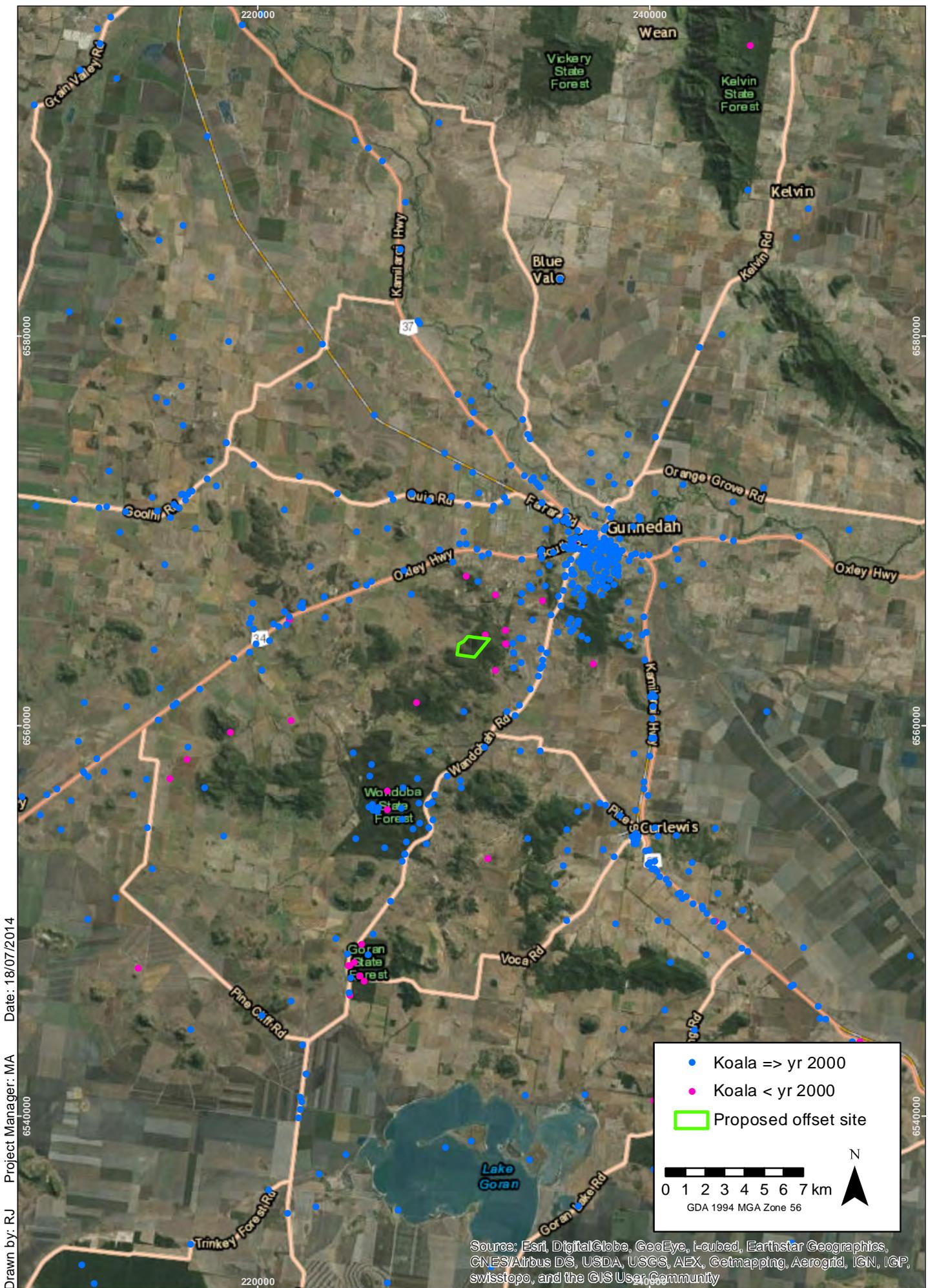
 Proposed offset site

Native Vegetation

-  Semi Evergreen Vine Thicket of Basalt Hills of the NSW North-western Slope (Benson 147)
-  White Box - White Cypress Pine Shrubby Open Forest of the Nandewar and Brigalow Belt south region
-  White Box - White Cypress Pine Shrubby Open Forest of the Nandewar and Brigalow Belt south region (Red Gum variant)



Native vegetation of the proposed offset site
 Marys Mount gravel quarry: Black Jack BioBank site



Drawn by: RJ Project Manager: MA Date: 18/07/2014

Koala observations: Black Jack Mountain BioBank site and surrounds
 Marys Mount gravel quarry: Black Jack BioBank site

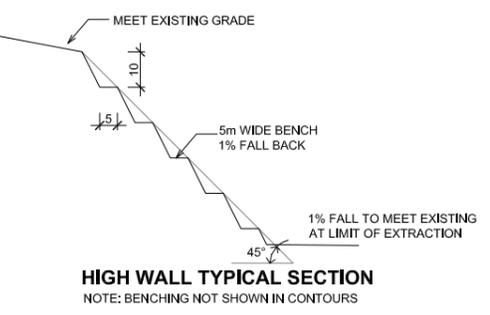
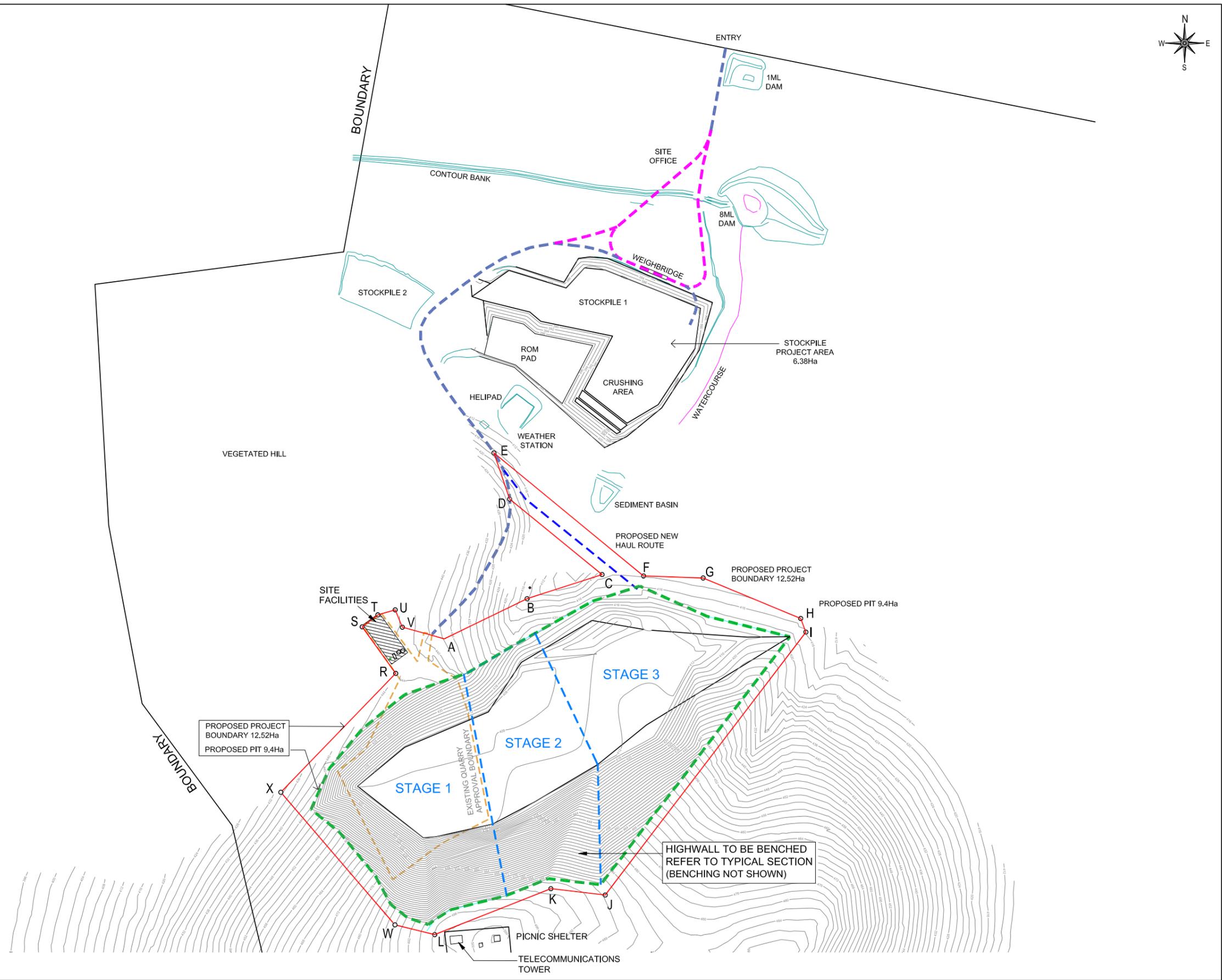
APPENDICES

Appendix 1: Quarry Staging Plan



LEGEND

- Proposed Project Site Boundary
- - - Existing Quarry Approved Limit
- - - Limit of Extraction
- Site Facilities
- Contours (2m Interval)
- Bank
- Lot 161 DP 755508 Boundary
- - - Haul Road
- - - One Way Haul Road
- - - Proposed Quarry Stage



	COPYRIGHT © This drawing is the copyright of Stewart Surveys Pty Ltd. and is protected under the Copyright Act 1968. It may not be altered, reproduced or transmitted in any form, or by any means without the express permission of Stewart Surveys Pty Ltd.		<p>STEWART SURVEYS Pty Ltd Inc in NSW ABN 65 002 886 508 109 Conadilly Street P.O. Box 592 GUNNEDAH NSW 2380 T 02 67422966 F 02 67420684 E office@stewartsurveys.com</p>	Client GUNNEDAH QUARRY PRODUCTS PTY LTD	Project MARY'S MOUNT BLUE METAL QUARRY Title PROPOSED QUARRY SITE PLAN	Date 11 April 2014	Sheet No. 2 of 3
Issue	Date	Description	Drawing number 4122_quarry design		Issue H DRAWING SHEET SIZE = A1		

Appendix 2: EPBC Act Significance Impact Criteria

Significant Impact Criteria assessments have been conducted below for the following items of threatened biodiversity under the EPBC Act:

- Semi-evergreen Vine Thicket EEC;
- Dichanthium setosum* - Vulnerable;
- Lobed Bluegrass - Vulnerable;
- Koala - Vulnerable;
- Greater Long-eared Bat- Vulnerable;
- Large-eared Pied Bat- Vulnerable;
- Spotted-tailed Quoll - Endangered;
- Swift Parrot - Endangered;
- Rainbow Bee-eater - Migratory; and
- Black-faced Monach - Migratory.

Note: Unless otherwise stated, the habitat and general ecological information contained in these assessments has been taken from the NSW Office of Environment and Heritage (OEH) Threatened Species Profiles database (DECC 2008) and/or the Commonwealth SPRAT database (SEWPaC 2012b):

- <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/>
- <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

Definitions

‘Habitat critical to the survival of a species or ecological community’ refers to areas that are necessary:

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

Such habitat may be, but is not limited to; habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community, and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

An ‘important population’ is one that is necessary for a species’ long-term survival and recovery. This may include populations identified in recovery plans, and/or that are:

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

Critically Endangered and Endangered Ecological Communities

<i>Semi-evergreen Vine Thicket</i>		
Criteria (Critically Endangered and Endangered Ecological Communities)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> reduce the extent of an ecological community 	The proposal would remove approximately 2.9 hectares of degraded SEVT. This equates to a loss of between 0.3 and 0.6 percent of SEVT in the region. The proposal would not substantially reduce the extent of the EEC.	Low
<ul style="list-style-type: none"> fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines 	SEVT naturally occurs in a fragmented pattern irrespective of human land use. The proposal is unlikely to result in the further isolation of currently interconnecting or proximate areas of habitat for SEVT in the long-term.	None
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of an ecological community 	The habitat of SEVT that will be impacted within the study area is small and moderately degraded. No recovery plan exists for the EEC under the EPBC Act and no critical habitat has been declared under the Act that is relevant to the study area. Retained occurrences onsite would be managed with nearby occurrence remaining affected by the Project.	None
<ul style="list-style-type: none"> modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns 	The proposal would not modify or destroy abiotic factors necessary for SEVT survival. Hydrological regimes are not expected to be altered or removed to an extent that would adversely impact SEVT. Post quarrying rehabilitation would aim to re-establish vegetation of similar character to SEVT that currently occurs within the study area.	Low
<ul style="list-style-type: none"> cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting 	Whilst the proposal would impact part of a small degraded patch of SEVT, the plant species composition of this patch is already diminished and its composition is unlikely to substantially change following the staged development and progressive rehabilitation works. Previous land management practices have lead to substantial and on-going disturbance and alteration through weed invasion and feral animal activity. Furthermore, it is likely, through the implementation of the site VMP, that an improvement in condition would be achieved throughout the avoided areas of SEVT.	Unlikely
<ul style="list-style-type: none"> cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to; <ul style="list-style-type: none"> assisting invasive species, that are harmful to the listed ecological community, to become established, or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or 	The proposed loss of SEVT is not considered substantive at a local or regional level. This impact would be excluded from adjacent areas of similar condition SEVT and would not exacerbate pre-existing detrimental land uses and threats (i.e. weeds and feral animals). Existing land uses (agriculture), feral animal (feral pig) and weeds are the main causal factors in prior and on-going disturbance and alteration in the SEVT occurring within the study area. Through the removal of agricultural practices, SEVT progressive rehabilitation and implementation of a site VMP to control weeds and feral pigs, it is expected that there would be an improvement in the condition of residual SEVT within the study area such that the Project would not cause a substantial reduction in the quality or integrity of remaining SEVT occurrences.	Low
<ul style="list-style-type: none"> interfere with the recovery of an ecological community. 	As has previously been stated, it is likely that through the implementation of the site VMP and	Unlikely

<i>Semi-evergreen Vine Thicket</i>		
Criteria (Critically Endangered and Endangered Ecological Communities)	Address of Criteria	Likelihood
	progressive rehabilitation an improvement in condition would be achieved throughout the residual patch of SEVT in the study area. The recovery of the EEC is unlikely to be threatened by the project.	
Conclusion: The proposed action is unlikely to have a significant impact on the SEVT EEC.		

Vulnerable Species

<i>Dichanthium setosum</i>		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> lead to a long-term decrease in the size of an important population of a species 	No impacts are expected to occur on known occurrences of this species. Approximately 6.8 hectares of unoccupied habitat would be removed by the Project. The Project would not significantly decrease the availability of habitat for an important population within the region.	None
<ul style="list-style-type: none"> reduce the area of occupancy of an important population 	No impacts are expected to occur on known occurrences of this species or its habitat. The Project would not result in a reduced area of occupancy of an important population.	None
<ul style="list-style-type: none"> fragment an existing important population into two or more populations 	The Project would not result in an impact of magnitude that would otherwise result in the fragmentation of an important population into two or more populations.	None
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	Suitable habitat identified for this species within the development site is not occupied by this species and is not regarded as habitat crucial to the survival of this species.	Low
<ul style="list-style-type: none"> disrupt the breeding cycle of an important population 	The Project would not remove any known occurrences of this species. It is considered that the Project is unlikely to disrupt breeding cycles of an important population.	Unlikely
<ul style="list-style-type: none"> modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	The removal of suitable habitat identified within the site would not decrease the availability or quality of habitat to the extent that the species is likely to decline.	Low
<ul style="list-style-type: none"> result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat 	The Project would, through its operational period, implement a site VMP that would detail the management requirements for weeds and feral animals. The Project is likely to result in the reduction of these threats.	Unlikely
<ul style="list-style-type: none"> introduce disease that may cause the species to decline, or 	The Project would, through its operational period, implement a site VMP that would detail the management requirements for dust and soil management. The Project is unlikely to result in the introduction of a disease that would cause the species to decline.	Unlikely
<ul style="list-style-type: none"> interfere substantially with the recovery of the species. 	The loss of suitable unoccupied habitat from the development site would be small and isolated within a large area of occurrence for this species. There would be no reduction in the area of occupancy for this species. Accordingly, it is concluded that the Project would not interfere substantially with the recovery of the species.	Unlikely
Conclusion: The proposed action is unlikely to have a significant impact on <i>Dichanthium setosum</i> .		

<i>Bothriochloa biloba</i>		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Indirect impacts	
<ul style="list-style-type: none"> lead to a long-term decrease in the size of an important population of a species 	<p>The Liverpool Plain contains substantial number of individuals of the Lobed Bluegrass (likely to exceed 100,000 individuals). These occurrences mostly occur in road reserves, footslope woodlands, grazing lands and undisturbed woodlands and native grasslands on heavier textured soils (Bean 1999). In this respect the entire population of the Liverpool Plains would be regarded an important population.</p> <p><i>Bothriochloa biloba</i> is known to respond favourably to grazing, mowing and slashing. It is unlikely to be adversely impacted by changes in dust levels or a varied hydrological regime. The Project would not remove any individuals of this species, with indirect impacts being the only possible effect on this species. Given the avoidance of direct impacts and limited, if any, effect of indirect impacts it is considered that the Project is unlikely to lead to the long-term decrease in the size of an important population.</p>	Unlikely
<ul style="list-style-type: none"> reduce the area of occupancy of an important population 	The Project would not reduce the area of occupancy of an important population.	None
<ul style="list-style-type: none"> fragment an existing important population into two or more populations 	The Project would not fragment an important population into two or more populations.	None
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	The Project would not adversely affect habitat critical to the survival of the species.	None
<ul style="list-style-type: none"> disrupt the breeding cycle of an important population 	The Project would not result in the removal of any breeding individuals, associated soil seed bank. The Project would not indirectly impact the breeding cycle of an important population of this species.	Unlikely
<ul style="list-style-type: none"> modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	The Project would not remove, destroy, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. Indirect impacts may modify habitat, although it appears that these impacts are within the tolerance limits of this species and as such no adverse impact are expected on this species..	Low
<ul style="list-style-type: none"> result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat 	Weed management is proposed and would limit the likelihood of any indirect impacts on Lobed Bluegrass. Notwithstanding, Bean (1999) indicates that Lobed Bluegrass is capable of persisting in weedy environments and as such this species is likely to be tolerant of weeds.	Unlikely
<ul style="list-style-type: none"> introduce disease that may cause the species to decline, or 	The Project is unlikely to result in the introduction of disease that would cause the species to decline.	Unlikely
<ul style="list-style-type: none"> interfere substantially with the recovery of the species. 	The Project is unlikely to substantially interfere with the recovery of the species.	Unlikely
Conclusion: The proposed action is unlikely to have a significant impact on the Lobed Bluegrass.		

Koala		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> lead to a long-term decrease in the size of an important population of a species 	<p>The Project would result in the loss of 2.7 hectares of high value and 4.1 hectares of supplementary Koala habitat (total 6.8 hectares) over three stages for a period of 23 years. This amounts to an estimated habitat loss for up to four Koala individuals. Mitigation through the implementation of a site specific KPoM would result in early/ pre-emptive habitat establishment by planting suitable feed tree species within 45 hectares of currently cleared lands that adjoin the development site (four times the total impact on Koala habitat). This habitat establishment is likely to result in the generation of alternative preferred habitat for at least 10 individual Koalas. The associated ecological benefit by the end of Stage 1 is anticipated to match the Project's total impacts on the Koala, with much of the remaining ecological benefit expected through Stage 2. The proposed staged habitat loss and early habitat establishment is unlikely to lead to a long term decrease in the size of an important population. Rather it is considered that a maintain or improve outcome would be generated for the Koala in the Gunnedah area through the proposed mitigation. The negative impacts arising from habitat loss are countered by habitat establishment, management and conservation.</p>	Very low
<ul style="list-style-type: none"> reduce the area of occupancy of an important population 	<p>Project development represents an action that would reduce the area of occupancy of an important population. Proposed measures including the establishment of alternate habitat adjacent the impact area by planting 45 hectares with preferred feed tree species.. In this respect the Project is likely to result in an increase in the area of occupancy for the Koala in the Gunnedah area.</p>	Very low
<ul style="list-style-type: none"> fragment an existing important population into two or more populations 	<p>The Project is unlikely to result in the fragmentation of an important population into two or more populations. Free ranging Koala's are capable of moving around the development site without being adversely impacted. Conversely, the establishment of feed tree species is likely to result in enhanced habitat connectivity.</p>	Unlikely
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	<p>The Project involves the removal of habitat relied on by the Koala. This habitat type is regarded as critical to the survival of the Koala in the Gunnedah area. Early, pre-emptive habitat establishment is a proposed compensatory measure that appropriately responds to this key impact. Habitat patch size, connectivity and protection is proposed within the study area through the implementation of the site specific KPoM. Offsetting at the nearby Black Jack mountain offset site provides long term habitat conservation for the Koala. Combined it is considered that the Projects impacts have been appropriately managed through compensatory habitat establishment, protection and conservation to an extent that would not compromise the survival of the species.</p>	Medium in the short term (stage 1) Low in the long term
<ul style="list-style-type: none"> disrupt the breeding cycle of an important population 	<p>The habitat to be removed by the Project is relied on by the Koala. Females have been observed within the impact area as have their young. As such it is considered that the Project would result</p>	Medium in the short term

	<p>in a disruption in the breeding cycle.</p> <p>Early and pre-emptive habitat establishment is proposed to minimise the effects of any disruption to the breeding cycle. Significant adverse disruption to the breeding cycle is likely to be minimised to a period approximating two generations (i.e. six to seven years). By year 7 (end of Stage 1) it is anticipated that the habitat establishment works would provide ecological benefit equivalent to the total impact expected over the 23 year Project period. The ecological benefit expected by the end of Stage 2 is likely to substantially exceed the Project's total impact, thereby potentially having a positive affect on the breeding cycle of the Koala.</p>	Unlikely in the long term
<ul style="list-style-type: none"> modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	<p>The Project would remove habitat currently and routinely utilised by the Koala. In the short term population decline may occur as a consequence of habitat loss should a temporary imbalance in births and deaths eventuate. In this respect the main period where the Koala would be vulnerable to this outcome is within the first seven years of the Project where sufficient ecological benefit from compensatory measures has yet to be realised. Minimising this risk is the delayed removal of habitat through a carefully designed staged development. Following year seven it is anticipated that ecological benefit derived from the compensatory measures would equal or exceed the impacts arising from the Project, thereby minimising the likelihood of species decline.</p> <p>Habitat modification designed to increase and enhance Koala habitat is also proposed as part of the Project. Mitigation measures described in the site specific KPOM are focused on an early and pre-emptive delivery of compensatory Koala habitat throughout lands currently cleared of suitable feed trees. The extent and nature of the proposed habitat establishment would substantially exceed the Project's impacts and as a consequence, is likely to result in a positive impact on Koala habitat suitability, availability and use throughout the duration of the Project.</p>	Low
<ul style="list-style-type: none"> result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat 	<p>The Koala may be harmed by Tiger Pear, a cactus species that is known to cause injury to koalas, should the development not adequately manage the occurrence and spread of this invasive species. Weed management is proposed as part of the Project where invasive species such as Tiger Pear would be actively managed to minimise any effects.</p>	Unlikely
<ul style="list-style-type: none"> introduce disease that may cause the species to decline, or 	<p>The Project occurs within an area where Chlamydia, a disease threat to the Koala, already occurs. The Project would not result in the introduction of this or any other disease that would cause the species to decline.</p>	Unlikely
<ul style="list-style-type: none"> interfere substantially with the recovery of the species. 	<p>While the Project proposes the removal of Koala habitat, it would also result in the establishment of compensatory habitat and conservation outcomes (i.e. offsets). It is anticipated that a positive outcome for the Koala would eventuate as a consequence of the Project, albeit at the expense of some existing Koala habitat. It is considered unlikely that the Project would substantially interfere with the recovery of the Koala.</p>	Unlikely
<p>Conclusion: Following the application of the precautionary principle it is considered that the proposed action may have a significant impact on the Koala. Notwithstanding, the proposed staged approach to habitat loss and provision of early, pre-emptive targeted compensatory measures such as habitat establishment in cleared lands and provision of habitat offsets is likely to have a positive influence on the species. To that extent it is considered unlikely that the Project would result in an unacceptable impact on the Koala where long-term decline of an important population would occur.</p>		

Greater Long-eared Bat		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> lead to a long-term decrease in the size of an important population of a species 	No impacts are expected to occur on known occurrences of this species or its habitat. The Project would not significantly decrease the availability of habitat for an important population within the region.	None
<ul style="list-style-type: none"> reduce the area of occupancy of an important population 	No impacts are expected to occur on known occurrences of occupied habitat. The Project would not result in a reduced area of occupancy of an important population.	None
<ul style="list-style-type: none"> fragment an existing important population into two or more populations 	The Project would not result in an impact of magnitude that would otherwise result in the fragmentation of an important population into two or more populations.	None
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	Suitable habitat identified for this species within the development site is not known to be occupied by this species and is not regarded as habitat crucial to the survival of this species.	Low
<ul style="list-style-type: none"> disrupt the breeding cycle of an important population 	The Project would not remove any known occurrences of this species. It is considered that the Project is unlikely to disrupt breeding cycles of an important population.	Unlikely
<ul style="list-style-type: none"> modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	The removal of suitable unoccupied habitat identified within the site would not decrease the availability or quality of habitat to the extent that the species is likely to decline.	Low
<ul style="list-style-type: none"> result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat 	The Project would, through its operational period, implement a site VMP that would detail the management requirements for weeds and feral animals. The management of residual lands under the VMP would improve the regeneration of midstorey and over story species thereby improving habitat conditions for this species. The Project is likely to result in the reduction of threats to habitat for this species.	Unlikely
<ul style="list-style-type: none"> introduce disease that may cause the species to decline, or 	The Project would, through its operational period, implement a site VMP that would detail the management requirements for dust and soil management. The Project would be unlikely to result in the introduction of a disease that would cause the species to decline.	Unlikely
<ul style="list-style-type: none"> interfere substantially with the recovery of the species. 	The loss of suitable unoccupied habitat from the development site is small and isolated within a large area of occurrence for this species. There would be no reduction in the area of occupancy for this species. Accordingly, it is concluded that the Project would not interfere substantially with the recovery of the species.	Unlikely
Conclusion: The proposed action is unlikely to have a significant impact on the Greater Long-eared Bat .		

Large-eared Pied Bat		
Criteria (Vulnerable Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> lead to a long-term decrease in the size of an important population of a species 	No impacts are expected to occur on known occurrences of this species or its habitat. The Project would not significantly decrease the availability of habitat for an important population within the region.	None
<ul style="list-style-type: none"> reduce the area of occupancy of an important population 	No impacts are expected to occur on known occurrences of occupied habitat. No caves or suitable roosts would be removed by the Project. The Project would not result in a reduced area of occupancy of an important population.	None
<ul style="list-style-type: none"> fragment an existing important population into two or more populations 	The Project would not result in an impact of magnitude that would otherwise result in the fragmentation of an important population into two or more populations.	None
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	No caves or like roosts that would be suitable for this species would be removed by the Project. Suitable foraging habitat identified for this species within the development site is widespread throughout the region and is not regarded as habitat crucial to the survival of this species.	Low
<ul style="list-style-type: none"> disrupt the breeding cycle of an important population 	The Project would not remove any known occurrences of this species or its breeding sites. It is considered that the Project is unlikely to disrupt breeding cycles of an important population.	Unlikely
<ul style="list-style-type: none"> modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	The removal of suitable unoccupied habitat identified within the site would not decrease habitat availability or quality to the extent that the species is likely to decline.	Low
<ul style="list-style-type: none"> result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat 	No invasive species harmful to this species would become established as a consequence of the Project.	Unlikely
<ul style="list-style-type: none"> introduce disease that may cause the species to decline, or 	The Project would, through its operational period, implement a site VMP that would detail the management requirements for dust and soil management. The Project would be unlikely to result in the introduction of a disease that would cause the species to decline.	Unlikely
<ul style="list-style-type: none"> interfere substantially with the recovery of the species. 	The loss of suitable unoccupied habitat from the development site is small and isolated within a large area of occurrence for this species. There would be no reduction in the area of occupancy for this species. Accordingly it is concluded that the Project would not interfere substantially with the recovery of the species.	Unlikely
Conclusion: The proposed action is unlikely to have a significant impact on the Large-eared Pied Bat .		

Critically Endangered and Endangered Species

<i>Spotted-tailed Quoll</i>		
Criteria (Critically Endangered and Endangered Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> lead to a long-term decrease in the size of a population 	It is highly unlikely that the study area supports Spotted-tailed Quolls and certainly not as a breeding population. Therefore, it is highly unlikely that the proposed action will lead to a long-term decrease in the size of a population.	Unlikely
<ul style="list-style-type: none"> reduce the area of occupancy of the species 	There is no high quality habitat in close proximity to the study area and the open grassland and open grassy woodlands surrounding the study area have not been documented to support Spotted-tailed Quoll populations. Therefore, it is highly unlikely that the proposed action will reduce the area of occupancy of the species.	Unlikely
<ul style="list-style-type: none"> fragment an existing population into two or more populations 	It is highly unlikely that the study area supports Spotted-tailed Quolls and certainly not as a breeding population. Therefore, it is highly unlikely that the proposed action will fragment an existing population into two or more populations.	Unlikely
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	9.7 ha of potential foraging habitat for Spotted-tailed Quoll would be cleared as part of the proposed action. However, it is highly unlikely that the study area supports Spotted-tailed Quolls and certainly not as a breeding population and therefore the proposed action is unlikely to adversely affect habitat critical to the survival of the species.	Unlikely
<ul style="list-style-type: none"> disrupt the breeding cycle of a population 	It is highly unlikely that the study area supports Spotted-tailed Quolls and certainly not as a breeding population. Therefore, it is highly unlikely that the proposed action will disrupt the breeding cycle of a population.	Unlikely
<ul style="list-style-type: none"> modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	9.7 ha of potential foraging habitat for Spotted-tailed Quoll would be cleared as part of the proposed action. However, it is highly unlikely that the study area supports Spotted-tailed Quolls and certainly not as a breeding population and therefore the proposed action is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely
<ul style="list-style-type: none"> result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat 	The proposed action would not result in invasive species becoming established in potential foraging habitat for Spotted-tailed Quoll. Measures for control of invasive species would be included in the VMP.	Unlikely
<ul style="list-style-type: none"> introduce disease that may cause the species to decline, or 	The proposed action would not result in introduced disease that may cause the decline of the Spotted-tailed Quoll. Measures for control of invasive species would be included in the VMP.	Unlikely
<ul style="list-style-type: none"> interfere substantially with the recovery of the species. 	The proposed action would remove 9.7 ha of potential foraging habitat only, and Spotted-tailed Quoll have not been previously documented as occurring within or in close proximity to the study area. Therefore, the proposed action would not interfere with recovery of the species.	Unlikely
Conclusion: The proposed action is unlikely to have a significant impact on the Spotted-tailed Quoll .		

Swift Parrot		
Criteria (Critically Endangered and Endangered Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> lead to a long-term decrease in the size of a population 	It is possible that Swift Parrot may access the study area in winter should they visit the region again. However, the species is highly mobile and there is availability of high quality habitat within the region. Therefore, the proposed action is unlikely to lead to a long-term decrease in the size of a population.	Unlikely
<ul style="list-style-type: none"> reduce the area of occupancy of the species 	The exact area of occupancy of the Swift Parrot is unknown, however the species has been recorded as visiting the region in the past. It is unlikely that the proposed action would reduce the area of occupancy of the species due to the availability of other suitable habitat within the region and because this species is highly mobile.	Unlikely
<ul style="list-style-type: none"> fragment an existing population into two or more populations 	The Swift Parrot is highly mobile and there is other suitable habitat available within the region. Therefore, the removal of 6.8 ha of potential habitat is unlikely to fragment an existing population into two or more populations.	Unlikely
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species 	6.8 ha of potential habitat for the Swift Parrot would be cleared as part of the proposed action. However, it is highly unlikely that the proposed action would adversely affect habitat critical to the survival of the species because this species is highly mobile and there is abundant other suitable habitat available in the region.	Unlikely
<ul style="list-style-type: none"> disrupt the breeding cycle of a population 	While it is possible that the Swift Parrot may access the study area should they visit the region again in the future, they breed in Tasmania and the proposed action would not disrupt the breeding cycle of a population.	Unlikely
<ul style="list-style-type: none"> modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	6.8 ha of potential foraging habitat for Swift Parrot would be cleared as part of the proposed action. However, it is highly unlikely that the proposed action would modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. The species is highly mobile and has access to other abundant other suitable habitat in the region, should it visit again in the future.	Unlikely
<ul style="list-style-type: none"> result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat 	The proposed action would not result in invasive species becoming established in potential foraging habitat for the Swift Parrot. Measures for control of invasive species are included in the VMP.	Unlikely
<ul style="list-style-type: none"> introduce disease that may cause the species to decline, or 	The proposed action will not result in introduced disease that may cause decline of the Swift Parrot. Measures for control of invasive species would be included in an VMP.	Unlikely
<ul style="list-style-type: none"> interfere substantially with the recovery of the species. 	The proposed action would remove 6.8 ha of potential habitat. However, the species is highly mobile, and there is other suitable habitat within the region. It is highly unlikely the proposed action would interfere with recovery of the species.	Unlikely
Conclusion: The proposed action is unlikely to have a significant impact on the Swift Parrot .		

Migratory Species

Two migratory birds listed under the EPBC Act were detected on site. It is probable that both these common species do not breed on site, but use it as a stop over point as part of their migration. The Rainbow Bee-eater (*Merops ornatus*) would not be able to breed on the site as the soils are too rocky to allow nest burrow excavation. The Black-faced Monarch (*Monarcha melanopsis*) detected during the survey was a juvenile. This individual would most likely have been migrating northwards at the time of the survey and using the study area as a staging point. This record is unusually far west for this species.

<i>Rainbow Bee-eater</i>		
Criteria (Migratory Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species 	<p>The proposed action would remove potential foraging habitat for the Rainbow Bee-eater. However, this is not considered important habitat for this species because:</p> <ul style="list-style-type: none"> the habitat does not support an ecologically significant proportion of the population of the species; the habitat is not of critical importance to the species at particular life-cycle stages; the habitat is not at the limit of the species range; and the habitat is not significantly declining within the region. 	Unlikely
<ul style="list-style-type: none"> result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species 	<p>The proposed action would not result in invasive species becoming established in potential foraging habitat for the Rainbow Bee-eater. Measures for control of invasive species would be included in an VMP.</p>	Unlikely
<ul style="list-style-type: none"> seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. 	<p>The Rainbow Bee-eater is a common species that is widely dispersed throughout Australia and eastern Indonesia. It is not known if the total population of the Rainbow Bee-eater is divided into a series of discrete subpopulations. However, the mobility of the species suggests that it is unlikely that any local or regional population would be genetically isolated from the remainder of the Australian population and therefore the proposed action would not seriously disrupt the lifecycle of an ecologically significant proportion of the population.</p>	Unlikely
<p>Conclusion: The proposed action is unlikely to have a significant impact on the Rainbow Bee-eater</p>		

Black-faced Monarch		
Criteria (Migratory Species)	Address of Criteria	Likelihood
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:		
<ul style="list-style-type: none"> substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species 	<p>The proposed action would remove potential foraging habitat for the Black-faced Monarch. However this is not considered important habitat for this species because:</p> <ul style="list-style-type: none"> - the habitat does not support an ecologically significant proportion of the population of the species; - the habitat is not of critical importance to the species at particular life-cycle stages; - the habitat is not at the limit of the species range; and - the habitat is not significantly declining within the region. 	Unlikely
<ul style="list-style-type: none"> result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species 	<p>The proposed action would not result in invasive species becoming established in potential foraging habitat for the Black-faced Monarch. Measures for control of invasive species would be included in a VMP.</p>	Unlikely
<ul style="list-style-type: none"> seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. 	<p>The Black-faced Monarch is widely dispersed throughout eastern Australia and there are no known ecologically significant proportions of the population of the species. Therefore, the proposed action will not seriously disrupt the lifecycle of an ecologically significant proportion of the population.</p>	Unlikely
<p>Conclusion: The proposed action is unlikely to have a significant impact on the Black-faced Monarch.</p>		

GLOSSARY AND SHORTENED FORMS

GLOSSARY

Direct impacts	Impacts that directly affect the habitat and/or individual plants and animals and cannot be avoided or mitigated. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat (DEC 2007).
Indirect impacts	Impacts that affect species, populations or ecological communities in a manner other than through direct loss or disturbance. These can usually be avoided or mitigated. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas (DECC 2007).
Local occurrence	The distribution of an ecological community within the study area and continuous with it.
Local population	The population that occurs in the study area and contiguous with it.
Locality	The area within 10 km of the study area.
Study area	The site and any additional areas which may potentially be affected by the proposal either directly or indirectly.
Site	The area directly affected by the proposal.
Subject species	List of threatened species considered in the assessment
Threatened biodiversity	Threatened species, populations, ecological communities or their habitats listed on the EPBC Act.

SHORTENED FORMS

CMA	Catchment management authority
EEC	Endangered ecological community
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</i>
EPI	Environmental planning instrument
LGA	Local government area
MNES	matters of national environmental significance.
OEH	NSW Office of Environment and Heritage
RDP	Rapid data point
SEPP	State environmental planning policy
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
TEC	Threatened ecological community as listed on the TSC and or EPBC Acts. Includes vulnerable, endangered and critically endangered ecological communities.
TSC Act	<i>NSW Threatened Species Conservation Act 1995</i>