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Peppertree Quarry Modification 5

ENVIRONMENTAL ASSESSMENT

RESPONSE TO SUBMISSIONS

Prepared for Boral Quarries | March 2019

Peppertree Quarry

MODIFICATION 5 ENVIRONMENTAL ASSESSMENT | RESPONSE TO SUBMISSIONS REPORT

Prepared for Boral Resources (NSW) Pty Limited
March 2019

PR25

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1 INTRODUCTION

1.1 Overview

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Peppertree Quarry (the Quarry), a hard rock quarry in Marulan South, New South Wales.

Boral is seeking to modify the current Project Approval (PA 06_0074) (the project approval) under Section 75W of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to provide for the following (hereafter referred to as the Project):

- develop a new overburden area (South-west Overburden Emplacement – SWOE);
- extend the consent boundary to the south to encompass the SWOE;
- construct a new haul road from the pit to the SWOE;
- construct a new intersection at Marulan South Road to link the new haul road with the SWOE;
- amend the design of the Western Overburden Emplacement (WOE);
- remove the Western Earth Bund (which has not been constructed); and
- relocate a powerline which runs through the proposed SWOE site.

The modifications constitute Modification 5 to the Project Approval. The Minister for Planning is the consent authority for the Project.

Element Environment prepared an environmental assessment (EA) report on behalf of Boral to assess the potential environmental and community impacts from the modification.

The Department of Planning and Environment (DPE) placed the EA report on public exhibition, which ended on 6 December 2018. In a letter dated 10 December 2018, DPE requested a response to submissions (RTS) received from various government agencies and the community.

1.2 Submission summary

At the close of public exhibition of the EA report on 6 December 2018, there were 11 agency submissions, two submissions from members of the public and a consolidated submission/request for a RTS from DPE. One member of the public's submission opposed the proposal and the other submissions made comment on the proposal (refer to Appendix A of the preliminary RtS).

In agreement with the DPE, the proponent lodged a preliminary response to submission (RtS) report on 1 February 2019. This report was referred to relevant agencies for further consideration and comment. A total of five submissions were made in response to the preliminary RtS (refer to Appendix A). All agency responses received in relation to the preliminary RtS were comment only.

1.3 Response to submissions

The following report is an addendum to the preliminary RtS submitted on 1 February 2019. In principal, the addendum report addresses the following matters:

- The submission of the Office of Environment and Heritage (OEH) seeking further and additional information in relation to the Biodiversity Assessment Report (BDAR);
- The draft conditions of the Environmental Protection Authority (EPA);
- The DPE suggestion to formalise transport volumes for scalp donations.

Following the submission of the preliminary RtS, the report was referred back commenting agencies for consideration of additional information provided. Where a further submission has been made in response to matters addressed in the preliminary RtS, Boral has provided further response.

This report should be read in conjunction with the preliminary RtS and unless explicitly stated the comments included in this report are intended to supplement not derogate or amend those made in the previous report.

2 RESPONSE TO SUBMISSIONS

The following section includes details of submissions grouped by subject area and agency. As set out in section 1.3 this report is intended as an addendum to the preliminary RtS and addressing either matters deferred pending completion of further technical studies or further comments received in relation to the preliminary RtS.

2.1 Noise

Three respondents provided noise related submissions. As set out in the preliminary RtS, matters relating to the proposed conditions were deferred to allow Boral time to review the conditions and liaise with the EPA directly.

The following section, where relevant, has amended those submission responses that raised matters relating to noise conditions associated with the modification.

2.1.1 Goulburn Mulwaree Council

Potential noise impact from construction and operation of the proposal on nearby sensitive residential, commercial and industrial receivers was assessed in accordance with the EPA's guidelines. It is recommended that Boral and the EPA review the current environment protection licence prior to a determination of the application.

The EPA recommended noise related conditions of consent in its submission, including revised noise limits. A teleconference between Boral and the EPA was held on Thursday, 21 February 2019 to discuss possible amendments to the proposed conditions. A summary of this discussion and the outcomes is provided in Appendix B.

2.1.2 Environment Protection Authority

The EPA has reviewed the noise impact assessment contained within the EA, titled 'Noise Impact Assessment – Peppertree Quarry Mod 5' (NIA), prepared by Wilkinson Murray and dated September 2018.

The EPA considers that the NIA is adequate for the purposes of providing recommended noise conditions which are detailed in Attachment B. The recommended noise conditions include Lot and DP numbers for receiver identification, and in order to provide these are fully correct these details need to be confirmed by the proponent. It is recommended that this occur as part of any response to submissions by the proponent or prior to any approval of Modification 5 by the Department of Planning and Environment (DPE).

As set out in section 2.1.1, Boral has reviewed the proposed conditions and met with the EPA via teleconference on Thursday 21, February 2019 to address matters relating to:

- identification of adjacent receivers by Lot and DP;
- monitoring and reporting hours – afternoon to evening periods, establishing alignment between the existing consent and EPL conditions;
- noise criteria conditions based on meteorological conditions;
- location of monitoring at adjacent receivers due to restrictions of adjacent landowners; and
- compliance monitoring locations and interpretation/application of condition M8.1.

It was agreed during this meeting that minor modification to conditions L6.2 and L6.3. All other conditions were agreed.

A summary of the matters discussed is provided in Appendix B. It is understood that the EPA will submit comments direct to the DPE. However, advice received by email from the EPA following the teleconference is also provided as part of Appendix B.

The recommended conditions also nominate monitoring points for meteorological parameters, and it is understood that the proponent operates a weather station on the premises. The addition of this point to Environment Protection Licence 13088 (EPL) will need to be negotiated between the proponent and the EPA and is relevant to recommended conditions L6.4, M7.1 and M7.2 as detailed in Attachment B.

Boral met with the EPA via teleconference on Thursday, 21 February 2019 to discuss the draft conditions. Boral acknowledges that a monitoring point will need to be established in liaison with the EPA.

The EPA considers that the proposal as presented in the NIA will most likely be able to comply with the recommended conditions in Attachment B under any applicable prevailing winds and has recommended noise-enhancing meteorological conditions in Condition L6.3, which is also consistent with the existing EPL for the premises. However, for completeness DPE may wish to consider whether it requires the proponent amend the NIA to include an analysis of wind data in accordance with Fact Sheet D2 of the Noise Policy for Industry and assess impacts under any applicable prevailing winds.

The NIA has been amended to set out the detailed wind analysis that was undertaken to inform the assessment and initial environmental impact assessment (Appendix C). This analysis determined the frequency of winds did not trigger the 30% NPfI requirement to consider wind effects for any assessment periods.

Section 6 of the amended NIA demonstrates consistency with Fact Sheet D2 of the NPfI. Condition L6.3 should be amended to remove references to “stability Category F with wind speeds” as the noise impact assessment shows that temperature inversions are technically not a feature of the environment. MP06_0074 Modification 4 specifically excluded these criteria.

This was discussed and agreed with the EPA on Thursday 21 February 2019. A summary of the matters discussed is included in Appendix B, including an email from EPA acknowledging the outcomes refer to Appendix B.1. It was agreed during this meeting that references to “stability category F” conditions would be removed from condition L6.3.

2.2 Biodiversity

Five respondents provided biodiversity related submissions. While some matters were addressed in the preliminary RtS, comprehensive consideration of the matters raised in relation to the BDAR were deferred, these are now considered in more detail in the following sections.

2.2.1 Goulburn Mulwaree Council

The proposal has not satisfactorily met the requirements of the Biodiversity Conservation Act. The following direct impacts would result from the proposal:

- **clearing of vegetation conservatively estimated to be 39.69ha including 27.68 ha of endangered ecological community**
- **clearing of associate threatened species habitat**
- **clearing of Koala habitat estimated to be 27.1ha; and**
- **clearing of Large-eared Pied Bat habitat estimated to be 27.1ha**

Boral have acquired 1000ha which helps to offset Koala, Large-eared Pied Bat and the Coastal Grey Box habitat. They are currently negotiating another 360ha to help offset the

impacts on the Yellow Box-Blakely's Red Gum grassy woodland endangered ecological community. We are asking they finalise all of the land purchases and satisfy biodiversity requirements before a determination is made.

Council's comments on the adequacy of the BDAR are noted. Boral has considered alternative overburden emplacement options as described in Section 2.2.4 to avoid and minimise biodiversity impacts. This exercise demonstrated the alternative locations would be worse than the SWOE from amenity, economic and safety aspects, and the SWOE remains Boral's preferred emplacement option.

Negotiations to purchase the 360 ha of land for the purpose of establishing a stewardship site to offset impacts on the Box Gum Woodland were completed in December 2018.

Boral requests Schedule 3 Condition 34 of the project approval be amended to require implementation of the biodiversity offset strategy within 12 months of commencement of construction of the SWOE.

2.2.2 Division of Resources and Geoscience

GSNSW acknowledge the proponent's response to early consultation in relation to biodiversity offset areas. GSNSW will review the proposed Biodiversity Offset areas when referred under the appropriate legislative mechanisms and note the proponent's due diligence regarding mining leases.

The Division will review the RTS – Part B, regarding the alternative South-west Overburden Emplacement options.

The Division notes condition 46 of PA 06_0074 requires the provision of annual production data to the DPI using the standard form for that purpose. The Division requests this condition be updated to reference the NSW Division of Resources and Geoscience

Boral acknowledges the comment from DRG that the addendum RtS and associated amendments biodiversity assessment report will be reviewed on submission.

The requirement to modify condition 46 to the update of the Division's reference is also noted. No objection is raised.

2.2.3 Department of Planning and Environment

The Department notes that Boral has been liaising with OEH over the adequacy of the Biodiversity Assessment report (BDAR) provided in the EA. The Department requests that Boral provides a revised BDAR, prepared in consultation with OEH.

Comments of the DPE are noted. Matters raised by OEH have been addressed by Niche Environment and Heritage and the revised BDAR is in Appendix C.

Provide a detailed discussion regarding impacts on Koala habitat, having regard to State Environmental Planning Policy No. 44 - Koala Habitat Protection, in particular how it was determined that the site does not contain "core Koala habitat"

The listing of the former Mulwaree Local Government Area under Schedule 1 of State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) is noted.

Niche Environment and Heritage have provided advice that the site does contain potential Koala habitat as at least 15% of the trees in the study area are feed trees. However, the study area does not contain 'core Koala habitat' due to the absence of a resident Koala population on the site. Refer to Section 4.8 of the BDAR for further information.

2.2.4 Office of Environment and Heritage

As I mentioned to you last week, there are a number of matters in the environmental assessment that require clarification. As I proposed in our discussion, we contacted the Proponent, Boral Resources NSW and their consultants Element and Niche, in relation to improving how they fulfil the impact assessment requirements of the State and Commonwealth legislation under the bilateral.

We identified that the following key issues require addressing in Biodiversity Development Assessment Report (BDAR):

- **Demonstration of the avoidance and minimising principle as it relates to Site Selection;**
- **Survey methodology as it relates to vegetation integrity assessment and the application of the Biodiversity Assessment Method (BAM)**
- **Survey methodology as it relates to threatened species of EPBC listed fauna requirements; and**
- **Confirmation of suitable offsets to satisfy both the Commonwealth and State requirements.**

We also recommended that the options to avoid serious impacts to vegetation and fauna through seeking an alternative site should be more thoroughly investigated and considered during the assessment phase to provide confidence for decision makers as to the preferred site.

The above items are discussed below including references to the relevant sections of the BDAR.

Demonstration of the avoidance and minimisation principle as it relates to site selection

The below text has been added to Section 5.1 of the BDAR.

In accordance with the BAM, proponents must demonstrate the measures employed to avoid, mitigate and offset impacts of a project on biodiversity values. This section of the report outlines the avoidance, management and mitigation measures that Boral has incorporated into the project design or will employ during construction, operation or completion of the project to reduce impacts on biodiversity values.

Throughout the process of site planning Boral had identified three alternative overburden locations as shown on **Figure 2.1**. The alternative options were:

- Option 1 north-west– west of the rail loop and near receiver labelled R4, Tangarang Dam and a dam upstream of Tangarang Dam;
- Option 2 north – north of the quarry pit and between Marulan and Tangarang creeks; and
- Option 3 far north – north of the Quarry, Option 2 and Marulan Creek.

The alternative options would all be further from the Quarry pit than the proposed SWOE (the preferred SWOE option). The alternative options would be closer to sensitive receivers (when measured from a potential emplacement area to a residence) than the preferred SWOE option, as shown in Table 2.1 and Figure 2.1. The only exception occurs in relation to Option 3 and R13, where the emplacement would be adjacent to the property boundary but approximately 1,500 m from buildings on the property.

Table 2.1 Distances of overburden emplacements to nearest receivers (m)

Receiver	Emplacement option			
	SWOE	1	2	3
R3	-	1,150m	1,000m	1,300m
R4	-	1,140m	1,130m	-
R8	1,450m	-	-	-
R13	-	3,800m	2,900m	1,500m

Of the alternative options identified, one of these, Option 1, was discussed in the Environmental Assessment, and is discussed further in the table below and expanded to included two additional onsite options. The options are compared to the SWOE in Table 2.2.

The comparison includes an evaluation on whether each of the three alternative options are better, worse or neutral in their potential impacts on the key environmental, social and economic matters assessed in the Modification 5 Environmental Assessment, when compared to the preferred SWOE.

The better, worse or neutral impacts were determined for the environmental aspects assessed in the EA using the following methods:

- Noise and air quality: the distance of receivers to the proposed options were compared to the distances of the SWOE to its nearest receivers, in combination with local wind trends.
- It was assumed the impact would be worse if the option is closer to a receiver than the SWOE is to its nearest receivers.
- Visual amenity – like noise and air, distances from the options to nearest receivers were compared and the impact of intervening terrain and vegetation on sight lines was considered.
- Surface water – the requirements for new water management structures were considered against the use of existing structures by the SWOE. As the options would be near watercourses currently largely unaffected by the Quarry it was assumed this would result in additional impact over the SWOE associated with surface disturbance, changes to catchment areas and potential discharges from water management structures.
- Aboriginal heritage – the alternative locations were considered in their landscape context and compared to known Aboriginal heritage sensitivities in similar previously assessed landscapes, for example, the assessment of the proposed Marulan South Dam site for the Marulan South Limestone Mine environmental impact statement (not yet publicly available).
- Historic heritage – the proximity of the alternative locations to known heritage items was determined and compared to that for the SWOE.
- Traffic – the need for the proposed intersection was considered as the alternative options would be north of Marulan South Road, whereas the SWOE would be south of the road.
- Biodiversity – the area of impact to native vegetation and threatened biodiversity habitat has been assessed for each option using desktop analysis and results of field surveys completed within the locality by Niche. Each of the options were assessed in terms of likely impacts and indicative biodiversity offsetting credits in comparison to the proposed SWOE.
- Greenhouse gas – haulage distances for the alternative options were compared to the SWOE haulage distance, it was assumed there would be more emissions if the options are further from the Quarry pit than the SWOE.

The following other aspects were considered in addition to the environmental aspects assessed in the Environmental Assessment:

- Resource sterilisation – the locations of the alternative options were considered in relation to known resource deposits and compared to the SWOE in relation to deposits it may overlie.
- Economic viability – changes to infrastructure, new infrastructure requirements and potential haulage distances were compared to those for the SWOE to determine which would be the most cost-effective option.
- Safety – preferred SWOE and alternative option haul route locations were considered with reference to the potential for haul vehicles to interact with light vehicles and pedestrians. It was assumed options resulting in less interaction would be safer than those resulting in more interaction.

The alternative options were considered using the above method and it was concluded the alternative options would:

- be closer to receivers and would have increased noise, air quality and visual impacts compared to the preferred SWOE option;
- require expensive changes to the quarry's processing/infrastructure area and Dam 1 dam wall to accommodate haul routes;
- have increased surface water impacts as they would be adjacent to Tangarang Creek and Marulan Creek;
- have increased water requirements for dust suppression;
- impact land with moderate to high archaeological sensitivity;
- result in increased greenhouse gas emissions due to the longer haul distances;
- sterilise granodiorite resource under options 2 and 3; and
- increase safety risks around the processing/infrastructure area as haul vehicles may have to cross areas used by other vehicles and pedestrians.

As demonstrated through the assessment included in Table 1.2 Boral has completed reasonable steps to avoid direct impacts on biodiversity through the consideration of alternative locations within the existing land holding as well as the potential to transport material off site. However, as discussed in the Environmental Assessment, on the balance of all factors, Boral determined the preferred SWOE option would be the most appropriate location for overburden emplacement. The preferred location is regarded by Boral to represent either an equal or better overall outcome across the majority key assessment criteria, as it will result have fewer amenity impacts associated with noise, air quality and views; fewer impacts on sensitive aquatic environments; fewer impacts on Aboriginal and historic heritage; will result in fewer greenhouse gases being generated; will not sterilise granodiorite resource; and will have fewer potential safety impacts whilst also being financially viable.

Table 2.2 Analysis of alternative emplacement locations

Environmental aspect	Option			Description
	1. North-west	2. North	3. Far north	
Noise	Worse	Worse	Worse	Options 1, 2 and 3 would extend haulage and emplacement activities further north and closer to Boral's boundaries and adjacent sensitive receivers (R3, R4 and R13). As there would be long haulage routes to Options 2 and 3, there is a risk haulage and emplacement noise emissions enhanced by the autumn, spring and summer easterly winds would impact receivers to the west (R3 and R4). There is also a risk that R3 and R13 could be impacted by emplacement noise emissions during winter southerlies and south-south-easterlies. The noise impacts, shown by the noise contours (representing noise levels in decibels emanating from the project area) in Appendix B of the noise impact assessment report, may be extended further north and towards additional receivers (R3, R4 and R13) contributing to noise impacts at receivers that would be avoided by the preferred SWOE location.
Air quality	Worse	Worse	Worse	Similar to noise, alternative options would locate the overburden emplacement closer to sensitive receivers. The $PM_{2.5}$, PM_{10}, deposited dust and total suspended solids impacts, shown by the isopleths (representing pollutant concentrations emanating from the project area) in Appendix D of the air quality impact assessment report (attached to the Modification 5 EA), would extend towards R3, R4 and R13. There is a risk haulage and emplacement dust emissions enhanced by the autumn, spring and summer easterly winds would impact receivers to the west (R3 and R4). There is a risk that R3 and R13 could be impacted by emplacement dust emissions during winter southerlies and south-south-easterlies. Also, there would be much longer haul distances of between 1,700 m and 3,000 m on unsealed roads to Options 1, 2 and 3, while the haul distance to the SWOE would only be approximately 420 m. Therefore, the alternative options would generate significantly greater dust emissions from overburden hauling.
Surface water	Worse	Worse	Worse	All alternative options would require extensive new and extended water infrastructure and management devices, increasing the potential area of disturbance combined with construction of new and more extensive haulage routes, in turn increasing water demand associated with dust control. The options would contribute flows and potentially sediment to adjacent waterways. Option 1 would drain into an existing dam upstream of Dam 1, which is on Tangarang Creek. Option 2 would drain into Marulan Creek and Marulan Creek Dam, which is proposed in the limestone mine SSD application. Option 3 would be adjacent to Marulan Creek and a tributary to the creek. Marulan Creek and its tributaries are not currently impacted by flows and sediment from the quarry. The preferred SWOE site will drain to the mine pit via sediment basins (existing and proposed) and avoid direct drainage into

Environmental aspect	Option			Description
				water courses
Aboriginal heritage	Worse	Worse	Worse	Previous investigations of landscapes like Option 1 (relatively flat and broad spurs near a water course) showed such areas have medium archaeological sensitivity. Option 1 would be between two major waterways for the area; Marulan Creek and Tangarang Creek, suggesting Aboriginal heritage items would be encountered as the landform is similar to those determined in the Marulan South Limestone Mine environmental impact statement (not yet publicly available) as having Aboriginal heritage sensitivity. Options 2 and 3 would be near Marulan Creek. Aboriginal investigations around Marulan Creek for the Marulan Creek Dam proposed in the Limestone Mine SSD application showed areas within 200 m of the creek and a spur crest have moderate archaeological sensitivity, and the broad prominent crests surrounding the creek have high archaeological sensitivity. Therefore, all three options are likely to support areas of both moderate and/or high archaeological sensitivity, and it is highly likely Aboriginal items would be impacted during emplacement activities at these alternative locations. There is one site of moderate significance in the proposed SWOE area, which comprises a subsurface artefact deposit (refer to EA). The alternative emplacements would be in landscapes of higher archaeological significance than the SWOE. On balance, the preferred SWOE site was considered to be that with least disturbance and impact potential.
Historic heritage	Neutral	Neutral	Worse	Similar to the preferred SWOE site, Options 1 and 2 are not located within proximity to any known or registered items (local or state) of historic significance. Option 3 would be within 1,500 metres of the boundary to the adjacent property containing Glenrock homestead and outbuildings, listed as an item of local heritage significance (I314) under Schedule 5 of Goulburn-Mulwaree Local Environmental Plan 2009 (LEP). Glenrock, is listed for its “built” heritage due to the style and form of the residence and associated agricultural structures along with its associative and historic themes (i.e. developing local, regional and national economies) (OEH. The statement of significance does not mention vistas and views to the buildings as important, so the impacts of potential views of the alternative emplacements on the item’s heritage significance cannot be determined. Notwithstanding the above, the item falls under the ‘farming and grazing’ group/collection, and Option 3 would be in proximity to the southern boundary of the property containing the item and has the potential to disrupt the context and setting of the item throughout construction of the emplacement.
Visual amenity	Worse	Worse	Worse	The heights of the completed emplacement options were measured and compared to the heights of the nearest receivers to predict if the emplacements would be visible from residences. It was assumed the emplacement would be visible if it was higher than the receiver. The presence of intervening topography and vegetation was considered in each case to determine if it would provide visual screening. For all alternative options, a total of three (3) potential receivers were identified (R3, R4 and R13) refer to Figure 1.1. The alternative emplacement options would all be visible from nearby receivers. The SWOE would be partially visible from a public

Environmental aspect	Option			Description
				viewpoint (at the end of Long Point Road) and four residences would have minor views to the SWOE. For Option 1, the top of the emplacement would be 660 m when complete, which would be approximately 45 m higher than the residence at R4 and therefore be visible from R4 given there is no significant intervening topography. However, it is noted that trees could provide some screening. R3 (elevation 645 m) and R4 (elevation 614 m) are on top of the Marulan Creek valley slopes, to the north of the creek. Options 2 and 3 would be east of the identified receivers on the southern (Option 2) and northern (Option 3) slopes of the valley. They would be on the other side of the valley from the receivers, and there is no significant topography between the receivers and emplacement options. Options 2 and 3 would have maximum elevations of approximately 643 m prior to rehabilitation and up to 663 m after trees are established. Option 2 would be approximately the same height as R3 and R4 when complete, and vegetation on the rehabilitated emplacement would be up to 20 m higher than these receivers. There is minimal existing vegetation between R4 and Option 2, and some vegetation (downslope of the residence) between R3 and Option 2. However this vegetation could provide some screening of views to the emplacement options. Option 3 would be approximately the same height as R3 when complete, and vegetation on the rehabilitated emplacement would be up to 20 m higher than this receiver. There is minimal vegetation between R3 and Option 3. However this vegetation could provide some screening of views to the emplacement options. According to the visual impact assessment report prepared for the Environmental Assessment, the Eastern Overburden Emplacement (650m in elevation) is partially visible from R13. Therefore, the alternative emplacement locations (Option 3 would be 653 m in elevation) would each likely be visible from R13 as they are closer to this receiver than the Eastern Overburden Emplacement.
Traffic	Neutral	Neutral	Neutral	The alternative emplacement options and Quarry would be on the northern side of Marulan South Road. Therefore, haul trucks would no longer need to cross the road as they would under the proposal (as the SWOE will be south of the road). However, the SWOE is proposed to be shared with Marulan South Limestone Mine, which requires approximately 2 million tonnes of overburden space within the SWOE. Therefore, haulage trucks from Marulan South Limestone Mine would still need to cross Marulan South Road to access the alternative emplacements and the proposed intersection will still be required.
Biodiversity	Better	Better	Better	All three options would have a better biodiversity outcome compared to the proposed SWOE as detailed below: Option 1: would be in a grazed paddock which contains scattered eucalypts consisting of *Eucalyptus blakelyi X, E. melliodora* and *E. bosistiana*, with a predominantly non-native understorey. The vegetation would align to PCT1334 Yellow Box - Blakely's Red Gum grassy woodland, which would meet the definition of White Box Yellow Box Blakely's Red Gum Grassy Woodland Threatened Ecological Community (TEC) under both the Biodiversity Conservation Act 2016 (BC Act) and Environment

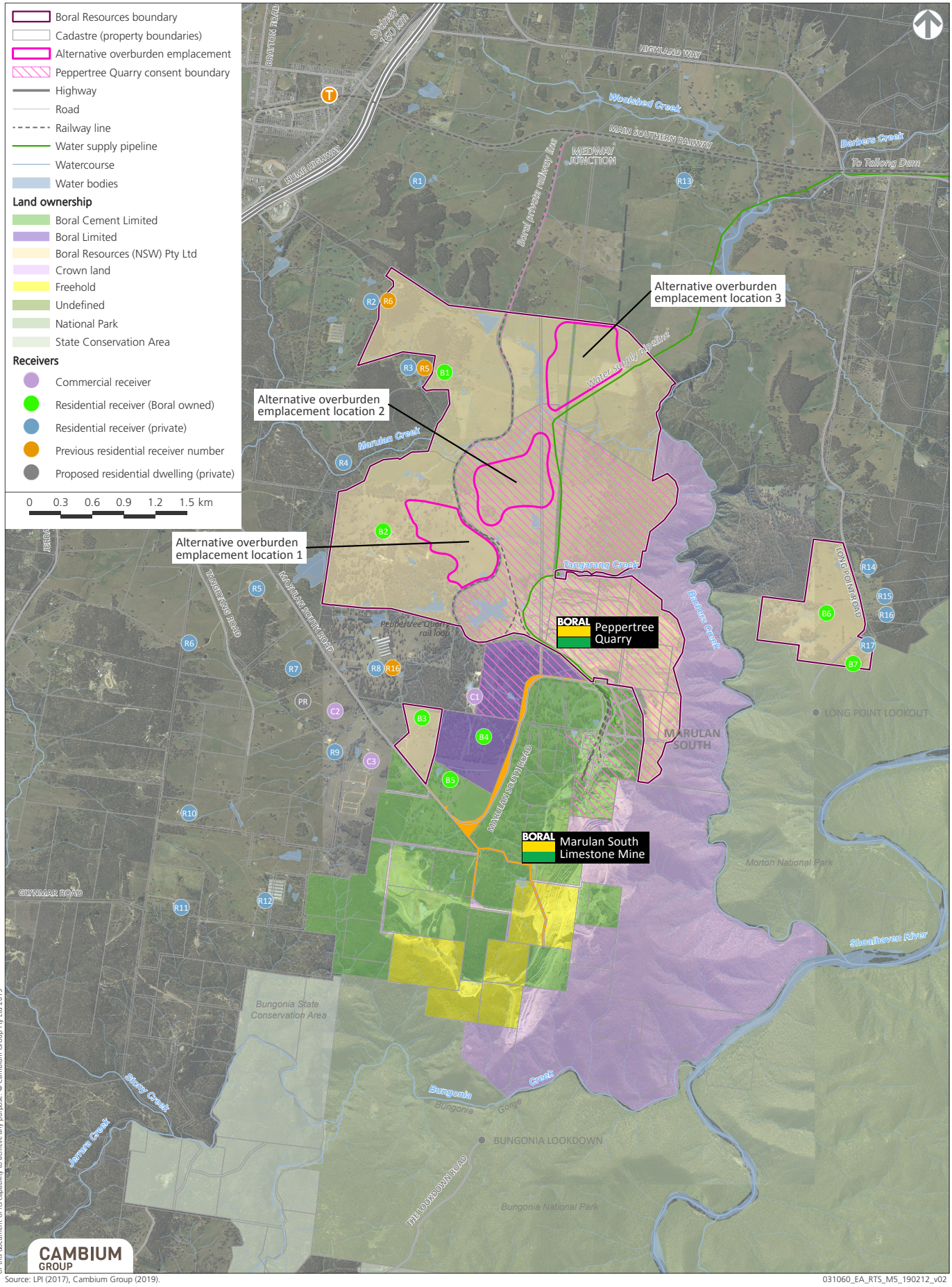
Environmental aspect	Option	Description
		Protection Biodiveristy Conservation Act 1999 (EPBC Act) given the presence of canopy species, and patch size. It is likely given the condition of the TEC (scattered trees, with no midstorey and shrub layer, with predominantly introduced ground cover) it would equate to low vegetation integrity scores. In total, approximately 17.8 ha of the TEC would be impacted if this option were to proceed. This would require approximately 320 ecosystem credits based on an average of 18 credits per hectare. In regards to the potential for threatened flora to occur at the optional site, given the relatively degraded condition of the understorey and the existing grazing pressures, it is unlikely that any threatened flora would be impacted. Fauna habitat is limited to the scattered eucalypts throughout the optional area, which is likely to provide some habitat to more mobile species such as birds, microbats, and some mammals. Microhabitat features such as logs and hollows are likely to be sparse. In regards to threatened fauna, Option 1 would likely be regarded as moderate Koala habitat and Large-eared Pied Bat habitat, given both species have been recorded during the field investigations completed by Niche, or recorded previously within relatively close proximity to the option area. As such, biodiversity offsets for both species would be required under the BAM. It is estimated the following species credits would be required: Koala: approximately 320 species credits based on 17.8 ha of habitat impact (average of 18 credits per ha). Large-eared Pied Bat: approximately 463 species credited based on 17.8 hectares of habitat impact (average 26 credits per ha). In summary, Option 1 would provide a lesser impact and offsetting requirement to the TEC, Koala habitat and Large-eared Pied Bat habitat when compared to the proposed SWOE. <u>Option 2</u>: would be in an open paddock with a patch of native vegetation toward the southern portion of the optional area. This option would result in impacts to approximately 36 hectares of non-native vegetation, and 1.7 hectares of vegetation likely aligned to PCT778. This PCT is not listed as a TEC under the BC Act or EPBC Acts. In total, it is estimated that the option would require 31 ecosystem credits based on an average of 18 credits per hectare. In regards to the potential for threatened flora to occur at the optional site, given the relatively degraded condition of the understorey and the existing open pasture grass areas, it is unlikely that any threatened flora would be impacted. This is supported by Niche surveys within the general area which did not record any threatened flora. Fauna habitat is limited largely to the open grassland areas, and the patch of eucalypts to the south. The patch may offer 'island habitat' to mobile birds and microbats. It is unlikely that threatened mammals, such as the Koala would utilise the area given the patch of vegetation is already fragmented by the existing rail loop, and open paddocks. However, it is likely that the patch would be regarded as foraging habitat for the Large-eared Pied Bat, given the species have been recorded during the field investigations completed by Niche, or recorded previously within relatively close proximity to the option area.

Environmental aspect	Option			Description
				As such, biodiversity offsets for the Large-eared Pied Bat would be required under the BAM. It is estimated that approximately 44 species credits would be required for the Large-eared Pied Bat based on 1.7 hectares of foraging habitat impact. The option would be relatively close to Marulan Creek and therefore would require a number of mitigation measures to ensure indirect impacts are prevented from entering the creek system. In summary, Option 2 would provide a lesser impact and offsetting requirement to native vegetation and Large-eared Pied Bat habitat when compared to the proposed SWOE. Option 3: would be in an open paddock to the north of Marulan Creek, with thin strips of native vegetation along sections of an access track. This option would result in impacts to approximately 40 hectares of non-native vegetation, and 0.5 hectares to native vegetation. It is highly unlikely the native vegetation present would align to a TEC under the BC Act or EPBC Acts. It is likely that the vegetation would align to PCT778. In total, it is estimated that the option would require 9 ecosystem credits based on an average of 18 credits per hectare. In regards to the potential for threatened flora to occur at the optional site, given the relatively degraded condition of the understorey and the existing open pasture grass areas, it is unlikely that any threatened flora would be impacted. Fauna habitat is limited largely to the open grassland areas, and the thin strip of trees located along the paddock boundary. The thin strip of trees is unlikely to contain any important habitat for threatened fauna, however, given the Large-eared Pied Bat has been recorded within the general area, and is within 3 kilometres of cliff line habitat, the trees would be regarded as foraging habitat and would need to be offset. As such, biodiversity offsets for the Large-eared Pied Bat would be required under the BAM. It is estimated that approximately 13 species credits would be required for the Large-eared Pied Bat based on 0.5 hectares of foraging habitat impact. This option would likely require a number of mitigation measures in relation to noise, dust and air quality controls compared to the other options given the distance for haulage. In summary, Option 3 would provide a lesser impact and offsetting requirement to native vegetation and Large-eared Pied Bat habitat when compared to the proposed SWOE.
Greenhouse gas	Worse	Worse	Worse	The proposed haul route to the SWOE will be approximately 420 m from the closest extent of the emplacement to the pit. The haul routes to the alternative locations would be at least 1,000 m, 1,300 m and 2,600 m longer for Options 1, 2 and 3 respectively. The haul truck trips on these routes would result in increased consumption of diesel and more greenhouse gas emissions compared to the SWOE.
Resource sterilisation	Neutral	Worse	Worse	Clause 13 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 applies to an application for consent for development on land that is identified by an Environmental Planning Instrument as being the

Environmental aspect	Option			Description
				location of significant resources of minerals, petroleum or extractive materials. Before determining an application to which clause 13 applies, the consent authority must consider whether the development is likely to have a significant impact on current or future extraction or recovery of extractive materials (including by limiting access to, or impeding assessment of, those resources). Map Sheet MRA-003 (Mineral Resource Area Map) adopted under the Goulburn Mulwaree Local Environmental Plan (LEP) 2009 shows that land identified for Options 2 and 3 would be on mineral resources (the northern section of the granodiorite reserve). Options 2 and 3 would limit access to, and impede assessment of, the granodiorite resource, thus impacting future extraction of this resource. There is no granodiorite resource under the proposed SWOE or Option 1.
Economic viability	Worse	Worse	Worse	The alternative emplacement options would be north-west (Options 1 and 2) and north (Option 3) of the Quarry pit, Dam 1 and processing/infrastructure areas. Each option would need to be accessed via the processing/infrastructure area and Dam 1 dam wall. This would require the formation of new roads, movement of overhead impediments such as conveyors, and widening of the dam wall to accommodate a two-way haul route specification road. Additionally, a new crossing would need to be installed over the rail line to enable access to Option 1. These works would be expensive and may not be able to be carried out prior to the need for the new emplacement area due to the construction timeframes involved and the need to start emplacement activities. Alternatively, a bridge could be constructed north of the pit and downstream of Dam 1 along Tangarang Creek. However, this area is vegetated and it would have high archaeological sensitivity given its proximity to the creek. A two-way bridge built to haul road specifications would be expensive. The haul routes to the alternative emplacement options would each be longer than the SWOE haul route and would have associated increased construction and on-going dust management and significantly higher fuel costs.
Safety	Worse	Worse	Worse	The alternative emplacement options would be less safe than the SWOE because their haul routes would need to pass through the Quarry's processing and infrastructure area. This would either require interaction with non-haul traffic and pedestrians, or require the construction of expensive over/underpasses. Additionally, the haul routes would need to cross the Dam 1 dam wall, which would need to be widened to two-way haul road specifications. The risk of dangerous interactions with other vehicles and pedestrians in the highly trafficked processing and infrastructure area makes haulage for the alternative options a safety risk. Additionally, it is Boral policy to separate vehicle and pedestrian routes to ensure pedestrian safety.

Figure 1
Alternative overburden emplacement locations

PEPPERTREE QUARRY MODIFICATION 5
ENVIRONMENTAL ASSESSMENT - RESPONSE TO SUBMISSIONS



Source: LPI (2017), Cambium Group (2019).

Survey method as it relates to vegetation integrity assessment and the application of the BAM

As described in Section 1.6 and Section 1.7 of the BDAR (Appendix C), the Biodiversity Assessment Method (BAM) has been used to assess potential impacts of the modification biodiversity, and determine resulting offset requirements under the NSW Biodiversity Offsets Scheme. Version 1.2.1.00 was used for the assessment.

As the BAM requires the proponent to identify and assess the impacts on nationally listed threatened species and ecological communities that may be present in a project area, it was partly used for the assessment of impacts under the EPBC Act also. Potential impacts under the EPBC Act were also assessed using 'assessments of significance' as described in Appendix 8 of the BDAR.

As described in Section 3.2 of the BDAR, flora was surveyed in February 2015 and February/July/August/December 2018. Methods in the Framework for Biodiversity Assessment and BAM were applied, including 35 BAM plots and transects in the wider Marulan South Limestone Mine area and 13 in the study area. the BAM plot requirements are summarised in Table 6 of the BDAR.

The vegetation integrity classes described in Section 3.2.7 and in Appendix 2 of the BDAR were determined from the observations made during the flora surveys.

Survey method as it relates to threatened species of EPBC listed fauna requirements

As described in Section 4.2 of the BDAR, the survey method comprised the targeted surveys summarised in Table 8 and Table 9 of the BDAR, and a habitat-based assessment. The fauna survey was focussed on species credit fauna and EPBC Act listed fauna where habitat was present for such species. The results of fauna surveys of the Marulan South Limestone SSD application area were also considered in the BDAR.

Confirmation of suitable offsets to satisfy both the Commonwealth and State requirements

The proposed offset strategy is described in Section 6.2 of the BDAR (Appendix C). The biodiversity assessment determined the ecosystem and species credits in Table 2.3 will need to be retired.

Table 2.3 Offset requirements

Plant community type	Condition	Area (ha)	Credits
Ecosystems			
PCT 1334 Yellow Box – Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670)	Medium	18.64	339
	Poor	9.04	89
PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges – Southern Sydney Basin (SR534)	Medium	8.46	134
	Poor	3.55	23
Species			
Koala (*Phascolarctos cinereus*)	–	27.1	487
Large-eared Pied Bat (*Chalinolobus dwyeri*)	–	27.1	731

Boral has bought a 1,000 ha property in the Bungonia subregion which surveys have demonstrated will be able to offset 100% of the State and Commonwealth liabilities for PCT 778, Koala and Large-eared Pied Bat.

Boral has also bought an approximately 360 ha property which will be able to offset 100% of the State and Commonwealth liabilities for PCT 1334.

2.3 Traffic

Following the submission of the preliminary RtS, one additional comment has been made in relation to road and traffic matters. Since the lodgement of the preliminary RtS Boral has had further meetings with GMC in relation to the proposed road closure arrangements for Marulan South Road and an updated in relation to these matters is also provided.

2.3.1 Goulburn Mulwaree Council

Council notes Boral's response to its submission in relation to the required road closures on Marulan South Road. At its meeting held 4 December 2018, Council resolved that "Boral is to finalise all road closure permits prior to commencement of work". Boral's response in which it has committed to finalising the Marulan South Road closure process prior to the start of haulage along the proposed haulage route is considered inconsistent with the resolution made by Council. It is asked that further consideration be made in this regard prior to a determination being made.

Council does wish to reinforce that the applicant would be required to obtain an approval under Section 138 of the Roads Act 1993 to ensure that all traffic management measures as well as road design specifications align with the requirements of Council in its capacity as the road authority of Marulan South Road should consent be granted.

Council's comments in response are noted. Boral raises no objection to the resolution of Council or the timing of road works to be delivered. Boral met with Council on Friday, 22 February in relation to the delivery and progression of the road closure process.

At this meeting it was confirmed that a survey by compilation would be acceptable. It is noted that the realignment of Marulan South Road forms part of the State Significant Development Application for Marulan Limestone and not the Modification 5 of Peppertree Quarry.

Discussion with Council in relation to these matters is ongoing and Boral notes their obligations under the *Roads Act 1993* in this regard.

2.3.2 Department of Planning and Environment

Condition 7 of schedule 2 of the project approval states that quarry products must not be transported from the site by road, except with the written approval of the Secretary. The Department routinely grants approval for the donation of quarried material to neighbours and for use in local community projects. The Department recommends that you consider establishing a weekly or daily cap for such vehicle movements, to avoid the need to seek written approval for each donation. However, the Department notes that these vehicle movements would need to be included in the TIA.

Schedule 2, condition 7 currently reads as follows:

All quarry products must normally be transported from the site by rail. However, with the written approval of the Secretary, the Proponent may transport quarry products by road in an emergency or in other limited and exceptional circumstances.

Boral has utilised this condition on a limited basis to facilitate the collection of materials

- by employees/staff for personal use. This occurs no more than 12 occasions in a calendar year and typically involves employees or staff utilising a light rigid vehicle,
- by local residents along Marulan South Road, on an as need basis for their personal use. This can involve collections of up to 1,000 tonnes, and
- for use in local projects, such as Bungonia Creek restoration project.

Boral agrees there is a benefit to formalising arrangements, in limited circumstances, to support donations to adjoining residents, employees and local projects. There is also a need to retain flexibility in these conditions to ensure that in emergencies, where rail is not an option, Boral has capacity to maintain transportations operations.

Accordingly, it is proposed to retain condition 7 with a minor modification and seek the adoption of condition 7A that sets out circumstances, in which Boral may permit road transportation without obtaining consent. The proposed conditions are set out below with modifications identified by **bold and underlined text.**

7. *All quarry products must normally be transported from the site by rail. However, with the written approval of the Secretary, the Proponent may transport quarry products by road in an emergency or in other limited, and exceptional circumstances, **as set out in condition 7A.***

7A. The proponent shall not permit more than 4 vehicle movements on any given day to transport quarry material from the site by road without the prior approval of the Secretary as set out in Condition 7.

2.3.3 Roads and Maritime Service

RMS has no further comment.

RMS further response is noted. It is anticipated that DPE will impose the conditions recommended by RMS in their initial submission as set out in the preliminary RtS.

2.4 Surface water

Two submissions were made in relation to surface water, one from WaterNSW and the other from the DPE. Following submission of the preliminary RtS, WaterNSW has reviewed the response prepared by Adivisan and provided further comment. These comments are considered further in the section below.

2.4.1 WaterNSW

WaterNSW has reviewed the RTS and notes that while our comments on the long term stability of the landform of the South West Overburden Emplacement (SWOE) have been considered, the project has not been amended to address these comments. We note that the RTS acknowledges that the material would be very erosive.

To address the long term stability issue of the SWOE, WaterNSW recommends that the department require the revised Water Management Plan include:

- **regular monitoring of the stability of the SWOE;**
- **updates to the proposed management measures depending upon the outcome of the monitoring**
- **the monitoring reports and any changes to management measures be provided to WaterNSW,**

- **and provision for monitoring to continue (and appropriate response measures) until such time as an independent expert confirms the SWOE is geomorphological stable.**

WaterNSW considers that the revision to the Water Management Plan should also consider erosion and sediment control measures specified in Appendix B, Table B.1 of Soils and Construction Volume 2C – Unsealed Roads DECC NSW (2008) including nearly flat slope of the berms and the dedicated drainage channels armoured in some way.

WaterNSW recommends that above matters be addressed in the Department's assessment of the modification application and approval conditions. It is requested that WaterNSW continue be included as a stakeholder for the project. Further, WaterNSW would appreciate being notified when the application has been determined.

Boral acknowledges of the request WaterNSW. Boral would like the opportunity to discuss these matters directly with WaterNSW to understand to determine the full extent and implication of their request. Boral will undertake to arrange a meeting with WaterNSW in the coming weeks and provide a formal response to the DPE shortly thereafter.

In relation to the matters of sediment and erosion control, Boral has developed, adopted and implemented a water management plan for the operation of Peppertree Quarry. This plan was prepared in accordance with Condition 26 of the existing project approval and incorporates erosion and sediment control practices including Table B.1 of Soils and Construction Volume 2C – Unsealed Roads DECC NSW (2008).

2.5 Powerline easement

Following the submission of the Preliminary RtS, Essential Energy (EE) provided further comment in response to ongoing discussion regarding the experience EE with the implications of project approvals impacting asset management and planning process.

As per the Peppertree Quarry Modification 5 Environmental Assessment, the relocation of the powerline has been defined as being the 'project'.

According to your latest consolidated approval for Mod 4, project is defined as meaning:

"Development to which the Project Approval applies"

If that current wording of the EA and/or the consolidated conditions were to remain, then the relocated powerline would be required to meet the conditions whenever it applies to the "project". Whilst I have no doubt this is not intended to apply to the powerline, unfortunately with the current wording means it would. Normally for significant developments, like this, that require amendments to our electricity infrastructure or where a new connecting powerline is required, Essential Energy prefers that part to be excluded from the project definition in the EA/EIS and/or assessed under Part 5 to avoid this potential problem.

The option recommended by EE to remove the power lines from the modification is still not considered desirable or practical.

In the event that conditions are imposed by the DPE in relation to the re-alignment of the powerlines. It is requested that the DPE consider the inclusion of a note that clarifies the limitations of the project approval in relation to subsequent works to transmission or distribution networks.

It is considered suitable that the draft conditions be referred to EE for comment to ensure there is no ongoing obligation for further consent following completion of the project works.

2.6 Resources Regulator

The Resources Regulator within DPE made the following further submission.

Environment and Rehabilitation:

The Resources Regulator advises the Department of Planning and Environment – resource Assessment that the information provided in "Peppertree Quarry Modification 5, Environmental Assessment, Preliminary Response to Submissions, February 2019", dated 1 February 2019, adequately addresses the issues raised in the Response to Request for Advice submission from the Resource Regulator dated 26 November 2019.

The resource regulator has determined that sustainable rehabilitation outcomes can be achieved as a result of the project and that any identified risks or opportunities can be effectively regulated through the conditions of mining authorities issued under the Mining Act 1992.

Mine Safety:

The resource regulator mine safety operations is responsible for ensuring mine operators manage the risk to worker health and safety through compliance with the Work Health and Safety (Mines and Petroleum Sites) Act 2013 and the subordinate mining legislation. In particular the effective management of risk associated with the principal hazards bas specified in the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014.

The resource regulator min safety operations have not identified any risk that would require comment in relation to this matter.

The further comments of the Resource Regulator are noted. No action is required.

APPENDIX A

SUBMISSIONS

Goulburn Mulwaree Council
Locked Bag 22
Goulburn NSW 2580

Civic Centre
184 - 194 Bourke Street
Goulburn NSW 2580
t (02) 4823 4444
e council@goulburn.nsw.gov.au
www.goulburn.nsw.gov.au

18 February 2019

Contact: Planning & Environment

Jack Murphy
Environmental Assessment Officer
Resource Assessments - Planning Services
GPO Box 39
Sydney NSW 2001

Dear Jack

Re: Peppertree Quarry - Modification 5 (PA 06_0074 MOD 5)

Council would like to thank Boral Resources Pty Ltd for taking its submission into account.

Council acknowledge that the majority of its submission has been satisfactorily addressed, particularly in relation to noise, air quality, visual amenity and biodiversity. Council acknowledges that the EPA and OEH are the appropriate regulatory authorities, and are both currently working towards a resolution to the issues of noise and biodiversity respectively.

Council notes Boral's response to its submission in relation to the required road closures on Marulan South Road. At its meeting held 4 December 2018, Council resolved that "Boral is to finalise all road closure permits prior to commencement of work". Boral's response in which it has committed to finalising the Marulan South Road closure process prior to the start of haulage along the proposed haulage route is considered inconsistent with the resolution made by Council. It is asked that further consideration be made in this regard prior to a determination being made.

Council does wish to reinforce that the applicant would be required to obtain an approval under Section 138 of the Roads Act 1993 to ensure that all traffic management measures as well as road design specifications align with the requirements of Council in its capacity as the road authority of Marulan South Road should consent be granted.

Should you require any further information please do not hesitate to contact me on (02) 48 234 480.

Yours faithfully

Scott Martin
Director Planning & Environment

6 February 2019

Jack Murphy
Environmental Assessment Officer – Planning Services
Department of Planning & Environment
GPO Box 39
Sydney NSW 2001

Emailed: jack.murphy@planning.nsw.gov.au

Your Reference: PA 06_0074 MOD 5 – Part A
Our Reference: DOC19/93104

Dear Mr Murphy,

Re: Peppertree Quarry (PA 06_0074) Modification 5 – Response To Submissions - Part A

Thank you for the opportunity to provide advice on the above matter. This is a response from the NSW Department of Planning & Environment – Division of Resources & Geoscience, Geological Survey of New South Wales (GSNSW).

GSNSW acknowledge the proponent's response to early consultation in relation to biodiversity offset areas. GSNSW will review the proposed Biodiversity Offset areas when referred under the appropriate legislative mechanisms and note the proponent's due diligence regarding mining leases.

The Division will review the RTS – Part B, regarding the alternative South-west Overburden Emplacement options.

The Division notes condition 46 of PA 06_0074 requires the provision of annual production data to the DPI using the standard form for that purpose. The Division requests this condition be updated to reference the NSW Division of Resources and Geoscience.

Geoscience Information Services

The Division has a range of online data related to mineral exploration, land use and general geoscience topics:

http://www.resources.nsw.gov.au/geological/online-services

The location of current exploration and mining titles in NSW, explanations of mining and production titles and the roles of community and government in the decision making process for mining/resource projects may be accessed by the general public using the following online utilities:

NSW Department of Planning and Environment
DIVISION of RESOURCES & GEOSCIENCE
PO Box 344 Hunter Region Mail Centre NSW 2310
E: landuse.minerals@geoscience.nsw.gov.au
Tel: 02 4063 6500
ABN 38 755 709 681

http://commonground.nsw.gov.au

https://resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/services/online-services/minview

Queries regarding the above information, and future requests for advice in relation to this matter, should be directed to the GSNSW Land Use team at landuse.minerals@geoscience.nsw.gov.au.

Yours sincerely

Andrew Helman
A/Manager - Land Use

for Paul Dale
Director – Land Use & Titles Advice

From:	REEDMAN Rebecca
To:	Jack Murphy
Subject:	RE: Peppertree Quarry - Modification 5 Response to Submissions
Date:	Tuesday, 5 February 2019 12:52:26 PM

Dear Jack,

RMS refers to your correspondence below regarding the subject modification application and the applicants response to submissions.

RMS has no further comments.

Regards,

Rebecca Reedman
Land Use Support Officer
Land Use Development **| Customer Services Southern Region**
www.rms.nsw.gov.au
Roads and Maritime Services
Level 4 90 Crown Street Wollongong NSW 2500

Planning & Environment
Resources Regulator

Our Ref: DOC19/113590
SF19/12422

Jack Murphy
Environmental Assessment Officer
Resource Assessments
Planning Services
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

By email: jack.murphy@planning.nsw.gov.au

Peppertree Quarry – Modification 5 (PA 06_0074 MOD 5): Preliminary Response to Submissions (RTS)

Dear Jack,

I refer to the Department of Planning and Environment – Resources Assessments (DPE – Resources & Assessment) email dated 4 February 2019 inviting the Resources Regulator to provide advice on the Preliminary Response to Submissions for the Peppertree Quarry Development Consent (PA 06_0074 MOD 5).

Development Details

The Peppertree Quarry is an open cut operation located at Marulan South, NSW. The Peppertree Quarry – Modification 5 ((PA 06_0074 MOD 5) proposes to:

- clear approximately 28 ha of endangered ecological community;
- develop a new overburden area (South-west Overburden Emplacement – SWOE);
- extend the approval boundary to the south to encompass the SWOE;
- construct a new haul road from the existing pit to the SWOE;
- construct a new intersection at Marulan South Road to link the new haul road with the SWOE;
- amend the design of the Western Overburden Emplacement;
- remove the Western Earth Bund from the approval; and
- relocate a powerline which runs through the proposed SWOE site.

The Resources Regulator has previously provided the following advice:

- *Response to Request for Advice (Our Reference: DOC18/891819), dated 26 November 2018.*

Environment and Rehabilitation

The Compliance Operations unit within the Resources Regulator has responsibility for providing strategic advice for environmental issues pertaining to the proposed project in so far as they relate to or affect rehabilitation.

The Resources Regulator provided the following advice in our Response to Request for Advice:

> *"The Resources Regulator has no specific comments to provide regarding environmental and rehabilitation aspects of the Peppertree Quarry- Modification 5 application.*
>
> *A detailed review of the forthcoming Marulan South Limestone Mine Development Consent application (SSD 7709) will be undertaken when received.*
>
> *In the event the Peppertree Quarry SWOE construction is approved and proposed to commence in areas covered by CML 16 prior to approval of the Marulan South Limestone Mine Development Consent, the Marulan South Limestone Mine Mining Operations Plan (MOP), required as a Condition of CML16, would need to be amended to incorporate activities in the areas covered by the Mining Lease".*

The Resources Regulator advises the Department of Planning and Environment – Resource Assessments that the information provided in the *"Peppertree Quarry Modification 5, Environmental Assessment, Preliminary Response to Submissions, February 2019"*, dated 1 February 2019, adequately addresses the issues raised in the 'Response to Request for Advice' submission from the Resources Regulator dated 26 November 2019.

Specifically, it is noted that the Preliminary Response to Submissions states:

- *"Boral will forward this comment to Marulan South Limestone Mine's management team for consideration during the continued operations environmental impact assessment process".*

The Resources Regulator has determined that sustainable rehabilitation outcomes can be achieved as a result of the project and that any identified risks or opportunities can be effectively regulated through the conditions of mining authorities issued under the *Mining Act 1992*.

Mine Safety

The Resources Regulator Mine Safety Operations is responsible for ensuring mine operators manage the risk to worker health and safety though compliance with the *Work Health and Safety (Mines and Petroleum Sites) Act 2013* and the subordinate mining legislation. In particular the effective management of risk associated with the principal hazards as specified in the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*.

The Resource Regulator Mine Safety Operations have not identified any risk that would require comment in relation to this matter.

For enquiries regarding this matter please contact Greg Kininmonth, Manager Environmental Operations (Southern) on (02) 4276 7428 or minres.environment@planning.nsw.gov.au

Yours sincerely

Greg Kininmonth

On behalf of
Matthew Newton
Director Compliance Operations
Resources Regulator
NSW Department of Planning and Environment
15 February 2019

From:	Malcolm Hughes
To:	Jack Murphy
Cc:	
Subject:	RE: Peppertree Quarry - Modification 5 Response to Submissions
Date:	Monday, 18 February 2019 3:00:21 PM
Attachments:	image005.png

Good Afternoon Mr Murphy

Thank you for providing WaterNSW with the opportunity to review and comment on Part A of the Response to Submissions (RTS) for the Peppertree Quarry modification application (06_0074 Mod 5).

WaterNSW has reviewed the RTS and notes that while our comments on the long term stability of the landform of the South West Overburden Emplacement (SWOE) have been considered, the project has not been amended to address these comments. We note that the RTS acknowledges that the material would be very erosive.

To address the long term stability issue of the SWOE, WaterNSW recommends that the Department require the revised Water Management Plan include:

- regular monitoring of the stability of the SWOE
- updates to the proposed management measures depending upon the outcome of the monitoring
- the monitoring reports and any changes to management measures be provided to WaterNSW, and
- provision for monitoring to continue (and appropriate response measures) until such time as an independent expert confirms the SWOE is geomorphologically stable.

WaterNSW considers that the revision to the Water Management Plan should also consider erosion and sediment control measures specified in Appendix B, Table B.1 of Soils and Construction Volume 2C – Unsealed Roads DECC NSW (2008) including nearly flat slope of the berms and the dedicated drainage channels armoured in some way.

WaterNSW recommends that above matters be addressed in the Department's assessment of the modification application and approval conditions.

It is requested that WaterNSW continue be included as a stakeholder for the project. Further, WaterNSW would appreciate being notified when the application has been determined.

If you have any further questions, please contact Jim Caddey on (02) 4824 3401.

Regards
Malcolm

Malcolm Hughes
Manager - Catchment Protection
WaterNSW
Level 14, 169 Macquarie Street, Parramatta NSW 2150

APPENDIX B

SUMMARY OF EPA DISCUSSION

Ref	Matters discussed	Direction/Action Agreed
L6.1	Inclusion of Lot and DP references	Boral to provide confirmation of the Lot and DPs as requested.
L6.2	Boral has requested that the time periods set out in the condition be updated to align with those presented in Table 1 of the 06_0074 Mod 4 project approval whereby the evening period extends to 7.00pm rather than 6.00pm.	The extended evening period, to 7.00pm, was permitted under the original consent to align with the shift changeover. The current modification does not seek to alter or modify these aspects and as such assessment of these matters should not be triggered. Discussion with the EPA has resolved that the extended period may be retained as it is unlikely to contribute to a diminished acoustic environment as the extension does not affect
L6.3	The meteorological condition with reference to "stability Category F with wind speeds" etc does not align with the meteorological conditions stated in 06_0074 Mod 4, Appendix 7: Noise Compliance Assessment, where criteria do not currently apply under Stability Category F conditions	Agreed to remove references to “stability category F” as this does not align with meteorological conditions on site.
L6.5	Some receptors cannot provide Boral access to these exact positions due to their own privacy and security preferences. Hence we suggest a new sentence at the bottom of L6.5 "*Measurements should occur at locations compliant with L6.5(a) and L6.5 (b) unless alternate arrangements, preventing compliance with these conditions, have been made with the property owner*" or an agreed GPS location that is suited to the EPA requirements	Boral is adjoined by two operating turkey farms. Owners of these properties have requested that noise monitoring not be undertaken within proximity to the buildings on the site (i.e. within 30 metres of residences) due to the disturbance on birds (noise and light) and quarantine requirements. The EPA did not agree to the proposed wording. However, it was recognised and agreed that alternative locations would need to be established to respond to the practical limitations of undertaking monitoring at the adjacent properties. Boral will need to establish “proxy” locations that are representative of noise at each receiver point. L6.5 (a) (iv) *at a representative location on the property. In determining if a location is representative the proponent must demonstrate that the localised conditions that influence noise at the receiver are similar to those conditions at locations identified in (i) or (ii)*

Ref	Matters discussed	Direction/Action Agreed
M8.1	Boral sought to confirm the intent of Condition M8.1 as it could be read to infer that monitoring is required at each location, during each assessment period (for the durations specified) on each of the three consecutive days. Boral raised concern as this condition would limit our ability to target the most affected locations, which generally varies from quarter to quarter due to the effects of noise enhancing meteorological conditions. Furthermore, Boral is seeking to implement real time noise monitoring for at least one residence from June 2019.	The EPA clarified that this condition would only be triggered in relation to compliance matters if there was an alleged breach. It is not a regular monitoring requirement.

Subject: RE: catch up on Modification 5 for Peppertree Quarry
From: Michael Heinze <Michael.Heinze@epa.nsw.gov.au>
To: "Makin, Sharon" <sharon.makin@boral.com.au>
Cc: "Snape, Rachael" <rachael.snape@boral.com.au>, "Shedden, Angus" <angus.shedden@boral.com.au>, Janine Goodwin <Janine.Goodwin@epa.nsw.gov.au>
Date Sent: Tuesday, February 26, 2019 9:29:47 AM GMT+11:00
Date Received: Tuesday, February 26, 2019 9:29:55 AM GMT+11:00

Hi Sharon

[redacted]

As discussed, below are the changes we all agreed on. See what you think of my wording, and if it accurately captures what was discussed.

Following this, I will write to Jack Murphy at DP&E this week and let him know of our discussions and changes.

Michael

Michael Heinze
Regional Operations Officer – South East Region
South and West Branch, NSW Environment Protection Authority
+61 2 6229 7002 +61 0408 695 070
michael.heinze@epa.nsw.gov.au www.epa.nsw.gov.au @EPA_NSW
Report pollution and environmental incidents 131 555 (NSW only) or +61 2 9995 5555

Please send all official electronic correspondence to queanbeyan@epa.nsw.gov.au

From: Makin, Sharon <sharon.makin@boral.com.au>
Sent: Wednesday, 20 February 2019 1:49 PM
To: Michael Heinze <Michael.Heinze@epa.nsw.gov.au>
Cc: Snape, Rachael <rachael.snape@boral.com.au>; Shedden, Angus <angus.shedden@boral.com.au>
Subject: Re: catch up on Modification 5 for Peppertree Quarry

Hi Micheal,

as discussed Boral has reviewed the EPA's comments and drafted EPL noise conditions submitted in response to the Peppertree Quarry modification 5
.
We agree with the intent of the drafted conditions to manage and understand our noise on the community but would like to discuss some of the details and implementation of said conditions. We importantly wish to keep consistency with the Approval conditions, currently in place for the Peppertree quarry operation.

Our comments on each drafted conditions are as follows...

- L6.1 - agree to use lot and DP rather than receiver numbers and / names.

· L6.2 - we would suggest that these time periods should be updated to align with those presented in Table 1 of the 06_0074 Mod 4 project approval whereby . evening extends to 7PM, rather than 6pm. **Agreed. This seems to be an artefact of the original Project approval, and is also reflected in the existing conditions in EPL 13088**.

· L6.3 – the meteorological condition with reference to "stability Category F with wind speeds" etc does not align with the meteorological conditions stated in 06_0074 Mod 4, Appendix 7: Noise Compliance Assessment, where criteria do not currently apply under Stability Category F conditions. **Given the noise impact assessment does show that temperature inversions are technically not a feature of the environment, the EPA is prepared to remove the reference to stability Category F conditions.**

- L6.4 - agree

- L6.5 – Some receptors cannot provide Boral access to these exact positions due to their own privacy and security preferences. Hence we suggest a new sentence at the bottom of L6.5 "*Measurements should occur at locations compliant with L6.5(a) and L6.5(b) unless alternate arrangements, preventing compliance with these conditions, have been made with the property owner*". or an agreed GPS location that is suited to the EPA requirements **The EPA accepts that access to measurement locations as stipulated in these conditions may be problematic. The EPA would expect that Boral should provide adequate justification that direct access to receptors is not available, and that they have determined a robust numerical relationship between noise measurements at the receptor(s) and the proxy location(s), ideally based on measurement data. The condition wording should stand, as L6.5(b) would still apply.**

- L6.6 - agree

- L6.7 - agree

- L6.8 - agree

- M7.1 and M7.2 -agree

- M8.1 - we would like to confirm the understanding of these requirements. It could infer that monitoring is required at each location, during each assessment period (for the durations specified) on each of the three consecutive days. We see that this would limit our ability to target the most affected locations which generally varies from quarter to quarter due to the effects of noise enhancing meteorological conditions and our aim as of June 2019 will be to have real time noise monitoring in place at least for one residence. **This condition should be read in conjunction with Condition 6.5 where compliance needs to be determined. The actual location of monitoring will be governed by the nature of the complaint, and where monitoring would be ineffectual, alternative monitoring points can be used. Condition wording to remain as is.**

- Section titled: Reporting Conditions - agree

- Section titled: Additions to Definition of Terms of the Licence - agree

We suggest that our discussion on Thursday afternoon, simply addresses each item and we agree on an approach. Boral has a requirement to formally provide a response to the Department of planning by the end of February and the outcome of our discussion will be included.

regards

SHARON MAKIN
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On Wed, 20 Feb 2019 at 08:57, Michael Heinze <Michael.Heinze@epa.nsw.gov.au> wrote:

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APPENDIX C

REVISED BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

niche
Environment and Heritage

Peppertree Modification 5

Biodiversity Development Assessment Report

Prepared for Boral Resources (NSW) Pty Ltd

February 2019

Document control

Project no.:	3557
Project client:	Boral Resources (NSW) Pty Ltd
Project office:	Sydney
Document description:	Biodiversity Assessment report for the proposed Peppertree Quarry Modification 5.
Project Director:	Matthew Richardson
Project Manager:	Luke Baker
Authors:	Luke Baker
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Author	Revision number	Internal review	Date issued
L. Baker	Draft 1	Rod Wallace (Boral Resources) and Mark Roberts (Element Environment)	29.8.18
L. Baker	Draft 2	Rod Wallace (Boral Resources) and Mark Roberts (Element Environment)	26.10.18
L. Baker	Rev 1		21.2.18

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Cover photograph: Location photo for the Peppertree Quarry Modification 5 site

Executive summary

Context

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Peppertree Quarry (the Quarry), a hard rock quarry in Marulan South.

Boral is seeking to modify the current Project Approval (PA 06_0074) under Section 75W of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) to provide for the following (hereafter referred to as the Project):

- develop a new overburden area (South-west Overburden Emplacement – SWOE)
- extend the consent boundary to the south to encompass the SWOE
- construct a new haul road from the pit to the SWOE
- construct a new intersection at Marulan South Road to link the new haul road with the SWOE
- amend the design of the Western Overburden Emplacement (WOE)
- remove the Western Earth Bund (which has not been constructed)
- relocate a powerline which runs through the proposed SWOE site.

This will be Modification 5 to the current Project Approval. The Minister for Planning is the consent authority for the proposed modification.

Aims

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Boral to assess the ecological values and impacts associated with the Peppertree Quarry Modification 5 Project, and provide a Biodiversity Development Assessment Report (BDAR). This BDAR has applied the OEH (2017) Biodiversity Assessment Methodology (BAM) to describe and assess the ecological values within the Study Area and surrounds, and determine how the Project is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). This report also has assessed the potential impacts of the Project on Matters of National Environmental Significance (MNES) under the Commonwealth Environment *Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Study area

The Study Area is approximately 48.33 ha, consisting of a mix of native woodland and gully forest vegetation and areas of introduced pasture grasses and is located immediately adjacent to Marulan South Road Boral's Marulan South Limestone Mine. A number of small farm dams also occur within the Study Area. Much of the Study Area and surrounds has been historically impacted by vegetation clearing and grazing.

Survey overview

Numerous surveys have been completed by Niche since 2015 within the Study Area and the surrounds, with an update of the flora survey completed from July 31st to the 1st of August 2018 and 19 December 2018 which followed the BAM.

Surveys within the Study Area have included the following:

- Field survey using the OEH (2014) Framework for Biodiversity Assessment (FBA) completed by a botanist and ecologist from the 3rd to the 6thof February 2015, and 5th February 2018. The survey

involved the collection of flora plot and transect data in accordance with the FBA and random meanders for threatened flora.

- Fauna survey completed by two ecologists on 3rd to the 6th of February 2015, 11th October 2015, and 5th February 2018. Fauna survey included: Ultrasonic call recording for bats, camera trapping, diurnal bird surveys, spotlighting, call playback and listening, stag watching, Koala Spot assessments and opportunistic survey.
- Flora plots and transects as per the BAM, and Koala SAT surveys completed on 31st July to 1st August 2018 and 19th December 2018.

Extensive survey also occurred within the surrounding lands as part of the Marulan South Project (which is subject to a separate approval however also encompasses the Study Area). The survey included BAM plots, threatened flora survey, and fauna trapping (including Ultrasonic call recording for bats, camera trapping, diurnal bird surveys, reptile survey, spotlighting, call playback and listening, stag watching, Koala Spot assessments and opportunistic survey). For the most part, the fauna survey effort was completed in habitat types similar, or that contained a greater potential for fauna occupancy, to that of the Study Area. As such, the survey area in combination with that completed within the Study Area, assisted in determining habitat for threatened biodiversity.

Native vegetation Assessment

Vegetation validation was undertaken as per the BAM which confirmed that the Study Area contained the following Plant Community Types (PCTs):

1. PCT778: Coast Grey Box – stringybarky dry woodland on slopes of the Shoalhaven Gorges -Southern Sydney Basin
2. PCT1334: Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands.

One non-native vegetation type that does not align to any PCT was also recorded within the Study Area. Different condition classes were given to the PCTs where obvious differences in structure and quality existed.

Vegetation alignment was confirmed and discussed on-site during consultation with OEH on the 16th June 2015.

Threatened flora

During the field survey, no threatened flora were recorded within the area proposed to be developed.

It is known based on previous field assessments for Boral, that the threatened *Solanum celatum* occurs within the locality, however this plant was not recorded during the targeted surveys within the Study Area or immediate surrounds.

Threatened fauna

Fifty-five threatened fauna have been recorded or are predicted to occur within 10 km of the Study Area according to database searches and/or the BAM Credit Calculator. However, only one 'species credit fauna' - Large-eared Pied Bat was recorded on an Anabat device positioned towards the south of the Study Area.

Whilst not detected, the Koala was also determined to have habitat within the Study Area given the presence of feed trees, and known records within the locality.

As such, the assessment concludes that two 'species credit fauna', the Koala and Large-eared Pied Bat, have habitat within the Study Area.

A total of eight EPBC Act listed threatened fauna were also regarded to have potential habitat within the Study Area. Species include: Fork-tailed Swift, Cattle Egret, Rainbow Bee-eater, Black-faced Monarch, Rufous Fantail, Large-eared Pied Bat, Koala and Grey-headed Flying Fox. The Regent Honeyeater was also identified in correspondence by the Department of Environment and Energy (DoEE) as likely to utilise the Study Area. However, it should be noted that the species was not detected during the field survey and no historic records within or immediately surrounding the Study Area.

SEPP 44. Koala habitat

The Study Area contains *potential Koala habitat* as defined under SEPP44, given Schedule 2 tree species meet at least 15% of the total number of trees within the Study Area.

The site does not constitute Core Koala habitat given the absence of a resident population of koalas utilising the Study Area. A discussion on SEPP 44 Koala habitat is provided in section 4.8.

Impacts – Native vegetation

The main impact on biodiversity associated with the Project is clearing of native vegetation and removal of habitat within the Study Area. The extent of clearing of native vegetation communities is conservatively estimated at 39.7 hectares.

One Threatened Ecological Community (TEC) will be impacted by the Project – White Box Yellow Box Blakely's Red Gum Grassy Woodland, which is listed as an Endangered Ecological Community (EEC) under the BC Act and Critically Endangered Ecological Community (CEEC) under the EPBC Act. Approximately 27.68 hectares of the TEC would be impacted. Two condition thresholds would be impacted, including:

- Moderate condition: Consisting of close patches of Eucalypt stands (comprising of *Eucalyptus blakelyi,* and *Eucalyptus melliodora* with the occasional *E. eugenioides* and *E. bosistoana*) with a mixture of native and introduced ground cover. This condition class has a vegetation integrity score of 36.4.
- Poor: Consisting of a few sparsely scattered Eucalypt stands, with a mixture of native and introduced ground cover. This condition class has a vegetation integrity score of 19.8.

An offset for the impact has been provided for this TEC as per the requirements of the BAM.

An Assessment of Significance under the EPBC Act has also been conducted for the impact on the TEC. The Assessment concluded the Project is likely to significantly impact the CEEC. An offset for the impact to the TEC has been provided to satisfy the Commonwealth offset requirement for the Project.

Impacts – Threatened flora

No threatened flora are likely to be impacted by the Project given the lack of suitable habitat and results of the field survey. It is therefore unlikely that the Project will result in a significant impact to any threatened flora.

Impacts – Threatened fauna

Two species credit fauna, and eight EPBC listed threatened and migratory fauna are considered to be affected by the Project. Most of these species are likely to utilise the foraging habitat of the Study Area on an intermittent basis.

Both the Koala and Large-eared Pied Bat would be offset according to the requirements of the BAM.

Assessments of Significance completed for the EPBC Act listed fauna, has indicated that a significant impact toward the Fork-tailed Swift, Cattle Egret, Rainbow Bee-eater, Black-faced Monarch, Rufous Fantail, Large-eared Pied Bat, and Grey-headed Flying Fox is unlikely.

The Assessment of Significance concluded that the Project would result in habitat fragmentation and loss of Koala habitat within the local area. An offset for the impact to the Koala has been provided to satisfy the Commonwealth offset requirement for the Project.

Given DoEE has identified the site to contain Regent Honeyeater habitat, and as such, an Assessment of Significance was completed for the species as precautionary measure. The Assessment of Significance concluded that a significant impact to the species was unlikely.

Avoidance and minimisation

As detailed in the Environmental Assessment, throughout the process of site planning Boral had identified three alternative overburden locations. Of the alternative options identified, a comparison between each has been made in the Environmental Assessment and included in section 5.1of the report. The comparison includes an evaluation on whether each of the three alternative options are better, worse or neutral in their potential impacts on the key environmental, social and economic matters assessed in the Modification 5 Environmental Assessment, when compared to the preferred SWOE.

Mitigation and management

The Project will reduce impacts to biodiversity through:

- Undertaking vegetation clearing in accordance with the Vegetation Clearance Protocol described in section 5.1.1 (impacts arising from the construction will primarily relate to vegetation clearing).
- Fencing and signposting erected as close as possible to the edge of the proposed overburden emplacement disturbance footprint as described in section 5.1.1.
- Educating employees and/or contractors involved in the construction of the overburden emplacement.
- Update and implementation of the existing Peppertree Quarry Landscape and Rehabilitation Management Plan as described in section 5.1.2.
- Dust suppression.
- Procedures for the management of spills throughout the Study Area including the requirements for vehicles to carry spill kits.
- Management and removal of all rubbish from the Study Area.

Credit calculations

The ecosystem credits required to offset the Project equate to the following:

- Total of 157 credits for PCT 774 Coast Grey Box - stringybark dry woodland on slopes of the Shoalhaven Gorges, southern Sydney Basin Bioregion (SR534)
- Total of 428 credits for PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670).

The species credit required for the Project include:

- A total of 487 credits for the removal of 27.1 hectares of Koala habitat
- A total of 731 credits for the removal of 27.1 hectares of Large-eared Pied Bat habitat.

Offset strategy

In order to satisfy the biodiversity offset requirement for the Project, Boral propose to establish Stewardship sites on two parcels of land which would ensure in perpetuity management and protection

native vegetation, White Box Yellow Box Blakely's Red Gum Grassy Woodland TEC, known Koala habitat and known Large-eared Pied Bat habitat. Both properties would satisfy the State and Commonwealth offset liability of the Project, with excess BAM credits that could be used for future Projects. The Stewardship Site Applications have been prepared to be submitted to the Biodiversity Conservation Trust (BCT) for their formal review.

Glossary

Term	Definition
Clearing area	Means the area directly impacted by the site either by clearing of vegetation or trimming of vegetation.
Development envelope	The location of the proposed development including overburden emplacement area, Western Overburden Emplacement (WOE), powerline, dam and haul road. Direct impacts occur wholly within this area.
Indirect impacts	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.
Locality	The site and surrounds, nominally a 10 km radius from the Site.
Subject site (Site)	Means the area directly affected by the Peppertree Quarry Modification 5 Project.
Study area	The area of direct and indirect impact.

Abbreviations

Acronym	Term/Definition
BAM	Biodiversity Assessment Methodology
BDAR	Biodiversity Development Assessment Report
BAM Calculator	Biodiversity Credit Calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BMP	Biodiversity Management Plan
BOS	*NSW Biodiversity Offsets Scheme*
CEEC	Critically Endangered Ecological Community
DP&E	NSW Department of Planning and Environment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ha	Hectare/s
IBRA	Interim Biogeographic Regionalisation for Australia
MNES	Matters of National Environmental Significance (from the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*).
OEH	Office of Environment and Heritage (formerly DECCW, DECC, DEC)
PEA	Preliminary Environmental Assessment
PCT	Plant Community Type
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
SWOE	South West Overburden Emplacement
TEC	Threatened Ecological Community

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1. Introduction to Biodiversity Development Assessment

1.1 Introduction

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Peppertree Quarry (the Quarry), a hard rock quarry located in Marulan South, New South Wales.

Boral is seeking to modify the current Project Approval (PA 06_0074) under Section 75W of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) to provide for the following (hereafter referred to as the Project):

- develop a new overburden area (South-west Overburden Emplacement – SWOE)
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- relocate a powerline which runs through the proposed SWOE site.

This will be Modification 5 to the current Project Approval. The Minister for Planning is the consent authority for the proposed modification.

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Boral to assess the ecological values and impacts associated with the Peppertree Quarry Modification 5 Project, and provide a Biodiversity Development Assessment Report (BDAR). This BDAR has applied the OEH (2017) Biodiversity Assessment Methodology (BAM) to describe and assess the ecological values within the Study Area and surrounds, and determine how the Project is likely to have an impact on threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). This report also has assessed the potential impacts of the Project on Matters of National Environmental Significance (MNES) under the Commonwealth Environment *Protection and Biodiversity Conservation Act 1999* (EPBC Act). This report also identifies avoidance, mitigation and offsets for the Project.

1.2 The project

1.2.1 General description of Site

The Quarry is located in Marulan South, 10 kilometres (km) southeast of Marulan, 35 km east of Goulburn and approximately 175 km south-west of Sydney, within the Goulburn Mulwaree Local Government Area (LGA) in the Southern Tablelands of NSW (Figure 1 and Figure 2).

Access is via Marulan South Road, which connects the Quarry and Boral's Marulan South Limestone Mine with the Hume Highway approximately 8 km to the north-west. Boral's private rail line connects the Quarry and Limestone Mine with the Main Southern Railway approximately 5 km to the north.

The Quarry is on approximately 650 ha of Boral owned land, which includes the Quarry site (occupying approximately 70 ha), additional granodiorite resources to the south and surrounding land.

1.3 Approved Project

1.3.1 Quarry Activities and Infrastructure

The approved quarrying activities are for extraction of 105 million tonnes of granodiorite over 30 years at an initial rate of 1 - 2 million tonnes per annum (Mtpa) and a maximum rate of 3.5 Mtpa. Granodiorite is an intrusive igneous rock suitable for use as a construction and building material. The hard rock aggregates produced at the site are a range of different shapes and sizes for different purposes. Primary production is of concrete and asphalt aggregates (10 mm) and railway ballast (28 - 50 mm) with capacity to produce larger aggregates (>100 mm) for rock armour and gabion baskets. Fines (generally <5 mm) produced during crushing of product are blended with limestone sand from Boral's adjacent Limestone Mine to produce a marketable manufactured sand.

Infrastructure at the Quarry includes a processing plant, rail loop and loading facilities, two water storage dams, an in-pit mobile crushing plant, overburden emplacement areas, noise and visual bunding, product stockpiles, and staff facilities.

Work to establish the Quarry commenced in July 2011. Production commenced early in 2014 following a lengthy commissioning and proving phase. The Quarry has approval to operate until the end of 2038.

1.3.2 Transport of Product

Product from the Quarry is transported entirely by rail except in an emergency where it would be transported by road with the written approval of the Secretary of Department of Planning and Environment (DP&E). The Quarry has approval to transport up to 3.5 Mtpa of product from the site. At full production the Quarry will operate up to four trains per day which will transport product north to the Sydney market and other customers. In addition, the Limestone Mine currently operates up to six trains per day transporting product north to Berrima and Maldon and east to Port Kembla.

Trains to the Quarry and the Limestone Mine access Boral's private rail line from the Main Southern Railway at the Medway Junction. The rail line is mostly single track with a 1 km length of triple line track used for shunting and train loading and a 1.2 km passing loop at Medway Junction. A rail loop has been constructed at the Quarry for separation of rail movements on the rail line between the two Boral sites. Rail loading facilities were also established on the rail loop adjacent to the Quarry's processing plant.

Loading of product from the Quarry onto trains and train movements occur 24 hours, seven days a week. This enables train trips on the Main Southern Railway to be scheduled away from peak commuter times.

1.3.3 Operating Hours and Workforce

The Quarry operates 24 hours, 7 days a week with in-pit activities restricted to the hours of 5am to 11pm. Approved operating hours are outlined in detail in Table 1.

Table 1. Approved operating hours

Activity	Day	Time
Construction works	Monday to Friday Saturday Sunday and public holidays	7.00 am to 6.00 pm 8.00 am to 1.00 pm None
Topsoil/overburden removal/emplacement	Any day	7.00 am to 7.00 pm
Blasting	Monday to Saturday Sunday and public holidays	9.00 am to 5.00 pm None
In-pit activities (including drilling, extraction, processing, and transfer of material out of the pit)	Any day	5.00 am to 11.00 pm
Out-of-pit activities (including processing, stockpiling, train loading and distribution, and maintenance)	Any day	24 hours

1.4 Proposed modifications

1.4.1 Description of the Proposed Modifications

Boral is seeking to modify the current Project Approval (PA 06_0074) under Section 75W of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) to provide for the following (hereafter referred to as the Project):

- develop a new overburden area (South-west Overburden Emplacement – SWOE)
- extend the consent boundary to the south to encompass the SWOE
- construct a new haul road from the pit to the SWOE
- construct a new intersection at Marulan South Road to link the new haul road with the SWOE
- amend the design of the Western Overburden Emplacement (WOE)
- remove the Western Earth Bund (which has not been constructed)
- relocate a powerline which runs through the proposed SWOE site.

1.4.2 New Overburden Emplacement

Overburden emplacement at the Quarry is currently approved within noise bunds located along the northern and eastern boundaries of the site, an emplacement area to the east of the approved quarry pit (Eastern Overburden Emplacement), an emplacement area to the south of the approved quarry pit (Southern Overburden Emplacement) and an emplacement area (Western Overburden Emplacement) and noise bund (Western Earth Bund) to the west of the Quarry. Remaining overburden is approved to be emplaced in the south pit of the Limestone Mine.

The noise bunds were completed during construction of the Quarry, the Eastern Overburden Emplacement reached capacity in 2017 and the Southern Overburden Emplacement is likely to be completed by late 2018. Part of the Western Overburden Emplacement is planned for a future shared road sales stockpile area for the Quarry and Limestone Mine.

Mine planning for the Limestone Mine has ruled out emplacement of the Quarry's remaining overburden in the south pit. There is substantial limestone remaining in the south pit and extraction of this will continue beyond the Quarry's need for additional overburden emplacement space. Additionally, as much in-pit space as possible needs to be created in the south pit to minimise the need for future out of pit emplacements at the Limestone Mine.

The Limestone Mine, under its forthcoming development application (Limestone Mine Project), was seeking to hold 5 million m3 (approximately 13 Mt) of overburden for the Quarry, however, this is unlikely to be approved until 2019. As the Quarry will run out of overburden emplacement space in 2018, Boral is seeking approval for this approximately 13 Mt overburden emplacement.

The proposed new SWOE will be located to the south of the WOE, south of Marulan South Road and in the north-western corner of the Limestone Mine. This new overburden emplacement area will be needed in late 2018 and will take approximately 4 years to establish.

An existing high voltage powerline that supplies power to the Limestone Mine traverses the proposed location of the new SWOE. This section of powerline will need to be relocated along the toe of the emplacement, adjacent to Marulan South Road.

As the proposed new SWOE is located outside Peppertree Quarry's consent boundary, an amendment to the consent boundary is part of this modification application.

The proposed emplacement will therefore be landscaped and rehabilitated in accordance with the existing Peppertree Quarry Landscape and Rehabilitation Management Plan.

1.5 Study area

The Study Area occurs within the Southern Rivers Catchment Management Area (CMA), South Eastern Highlands IBRA Bioregion (Interim Biogeographic Regionalisation for Australia), and, Bungonia Tableland and Gorge Mitchell Landscape (Figure 3). The Study Area is approximately 48.33 hectares.

Within the Study Area, the land directly disturbed by the Project is referred to as the subject site. The area of direct and indirect impact is referred to as the Study Area.

1.6 State approval and assessment process

1.6.1 Application of the BAM

This BDAR has applied the BAM in order to assess impacts on biodiversity. The BAM is a new framework for assessment of biodiversity impacts and determination of offsetting requirements for major projects under the NSW Biodiversity Offsets Scheme (BOS).

This assessment has used the BAM Calculator (version 1.2.1.00).

1.7 Commonwealth approval and assessment process

Matters of National Environmental Significance (MNES) are protected under the EPBC Act. The BAM requires proponents to identify and assess the impacts on all nationally listed threatened species and threatened ecological communities that may be present on or near the Study Area. Therefore, the BAM has partly been used to perform assessment of impacts under the EPBC Act. Further assessment of impacts under the EPBC Act has been undertaken via assessments of significance for EPBC Act listed species with the potential to be affected by the proposed project (Appendix 8).

In addition, a Commonwealth Referral, was prepared and submitted to the Department of the Environment and Energy (DoEE) in June 2018 (EPBC 2018/8243).

On the 15 October 2018, the Project was considered a Controlled Action by DoEE, and Supplementary SEARs provided to be addressed in the Biodiversity Impact Assessment. The key matters raised in the SEARs that are applicable to this BDAR, and the section within this report, is outlined in Table 2.

Table 2. Supplementary SEARs from DoEE

SEARS	Addressed in report
The project will be assessed under an accreditable process under Part 4, Division 4.7 of the Environmental Planning and Assessment Act 1979 (EP&A Act), addressing the matters outlined in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulation 2000 (Cth). These requirements do not stand alone but are a supplement to any assessment requirements provided by the New South Wales Department of Planning and Environment and must be addressed in conjunction with those requirements. The requirements are intended such that there is sufficient information in the assessment report relevant to MNES such that the Commonwealth decision-maker may make a determination whether or not to approve the action.	MNES addressed throughout this BDAR. Assessments of Significance completed for those EPBC Act listed threatened biodiversity potentially impacted by the Project.
3. The proponent must undertake an assessment of all the protected matters that may be impacted by the development under the controlling provision identified in paragraph 1. A list of protected matters the Department of the Environment and Energy considered likely to be significantly impacted is provided in Attachment A to these Guidelines. Note that this may not be a complete list and it is the responsibility of the proponent to ensure any protected matters under this controlling provision, likely to be significantly impacted, are assessed for the Commonwealth decision-maker's consideration. The Department of the Environment and Energy considers that there are likely to be significant impacts to: • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – critically endangered; • Regent Honeyeater (Xanthomyza phrygia) – critically endangered; • Large-eared Pied Bat (Chalinolobus dwyeri) – vulnerable; and • Koala (Phascolarctos cinereus) (combined populations of QLD, NSW and the ACT) – vulnerable.	EPBC Act Assessments of Significance have been completed for all EPBC Act listed threatened species that may be impact by the Project (Appendix 8) and discussed throughout sections 3 and 4.
The EA must provide the following details: 5. The title of the action, background to the action of the action and current status.	Section 1.2
6. The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES.	Section 1.4
7. How the action relates to any other actions that have been, or are being taken in the region affected by the action.	Section 5.3.3
8. How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	See discussion on avoidance and mitigation – section 5.1.
9. A justification for the proposal including consideration of any less detrimental sites for the emplacement area, for example other cleared sites within the property boundary.	See discussion on avoidance and mitigation – section 5.1.

SEARS	Addressed in report
10. The EA must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: i. a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts; ii. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; iii. analysis of the significance of the relevant impacts; and iv. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Section 5.3 details direct impacts associated with the Project. Table 13 details mitigation measures associated with indirect impacts.
Avoidance, mitigation and offsetting 11. For each of the relevant matters protected that are likely to be significantly impacted by the action, the EA must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: i. a description, and an assessment of the expected or predicted effectiveness of the mitigation measures, ii. any statutory policy basis for the mitigation measures; iii. the cost of the mitigation measures; iv. an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing; v. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Effectiveness of mitigation measures provided in Table 13. Cost of mitigation measures have been incorporated into the pre-feasibility assessment of the Project and discussed in section 5.1.1 An outline the Environmental Management Plan is provided in Appendix 10. The details of the agency responsible for endorsing or approving the mitigation measures is provided in the Environmental Management Plan.
12. Where a significant residual adverse impact to a relevant protected matter is considered likely, the EA must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	Offset strategy provided in section 6.
13. For each of the relevant matters likely to be impacted by the action the EA must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: i. conservation advice or recovery plan for the species or community, ii. relevant threat abatement plan for a process that threatens the species or community iii. wildlife conservation plan for the species iv. any strategic assessment.	Incorporated into the EPBC Act Assessments of Significance.

SEARS	Addressed in report
14. The EA must identify each EPBC Act listed threatened species and community likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	See section 5.2.
15. For each of the EPBC Act listed threatened species and communities and likely to be impacted by the action the EA must provide a separate: a. description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans; b. details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements; c. description of the relevant impacts of the action having regard to the full national extent of the species or community's range; and d. description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action; e. identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account; f. a description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established. g. details of how the current published NSW Biodiversity Assessment Method (BAM) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts; and h. details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the BAM and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites;	a) EPBC Act listed biodiversity impacted discussed in section 5.3, section 5.3.1, and Appendix 8. b) surveys detailed in section 3.2.3 and section 4.2 c) impacts in relation to Box Gum Woodland discussed in section 5.3.2 and Appendix 8. d) avoidance and mitigation detailed in section 5.1 e) impacts after mitigation provided in section 5.2 f) offsets provided in section 6 g) Detail regarding BAM and EPBC Offset Policy provided in section 6. h) details of the area and credits from the offset sites provided in section 6, however no figures have been provided due to confidentiality reasons – Boral can provide separately in confidence as required.
16. Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the Environment Protection and Biodiversity Conservation Act 1999 Environmental Offset Policy. http://www.environment.gov.au/epbc/publications/epbc-actenvironmental-offsets-policy.	Detail regarding BAM and EPBC Offset Policy provided in section 6.
19. For information given in an EA, the EA must state the source of the information, how recent the information is, how the reliability of the information was tested; and what uncertainties (if any) are in the information.	All text has been appropriately referenced where required. EPBC Act Protected Matters Search was completed in September 2018.

1.8 Assessment objectives and format

The primary objective of this assessment is to use the guidelines and methodology provided in the BAM to determine the impact the project would have on biodiversity, avoid and mitigate these impacts and then calculate the project's biodiversity offset requirement. In addition, impacts on Commonwealth MNES are addressed through the process of the BAM and by assessments of significance for potentially impacted species.

This BDAR has two broad stages consistent with the BAM methodology:

Stage 1 – Biodiversity Assessment

- assessment of landscape features
- assessment of native vegetation
- assessment of threatened species and populations.

Stage 2 – Impact Assessment

- avoid and minimise impacts on biodiversity values
- consider impact and offset thresholds
- determine and calculate offset requirements.

1.9 Assessment resources and assessor qualifications

This BDAR has been prepared by the following accredited assessors or experts:

- Luke Baker – Senior Ecologist/Ecology Team Leader/Accredited Biodiversity Assessor: flora and fauna field survey, data management, data entry, credit calculations, review of credit calculations, report preparation
- Simon Tweed – Field survey
- Amanda Griffiths – Field survey.

Other specialist staff involved in preparing the assessment include:

- Alex Christie – Ecologist: field survey, reporting
- Lucy Porter – Ecologist: field survey
- Dr Ross Jenkins and Greg Tobin: mapping.

1.10 Consultation

Consultation with the Office of Environment and Heritage (OEH) was undertaken in relation the Marulan South Limestone Mine Project, however the area that was investigated during the inspection was the Study Area. Table 2 below summarises they key issues covered during correspondence associated with the Marulan South Limestone Mine Project which overlaps with this BDAR.

Table 3. Relevant consultation with OEH

Dates of consultation	Relevant key issues/discussion points	How are the issues addressed in this report?
17/04/2015	17th of April 2015 Phone call with Catherine Ellis of OEH to discuss approval pathways and suggested approach to biodiversity assessment for Peppertree Modification 4 and Marulan South Project – the current Project is part of the initial Marulan South Project footprint.	Report has been undertaken using methods consistent with the FBA.

Dates of consultation	Relevant key issues/discussion points	How are the issues addressed in this report?
09/06/2015 11/06/2015	Phone call with Stewart Lloyd (GM Council). Enquired as to any Council mapping of vegetation with emphasis on EEC/CEECs. Council's mapping is limited – there is some collaboration between Council and the recent mapping project by OEH led by John Briggs with a focus on identification of White Box Yellow Box Blakely's Red Gum Woodland.	Consultation with OEH on latest mapping project. Ensures vegetation mapping used for wider locality is the best available and that corridors are identified. Enabled Council's input regarding any concerns or issues for addressing.

Dates of consultation	Relevant key issues/discussion points	How are the issues addressed in this report?
9/6/2016	Meeting on-site with Miles Beok, and John Briggs regards the difficulty with aligning the vegetation units recorded on-site with an appropriate Plant Community Type (PCT). This consultation overlaps with the Marulan South Project as both Projects utilise the same Study Area. Key conclusions from the meeting and site inspection include the following: Agreed that vegetation on-site was likely to align to the following best fit BVTs and their associated Tozer (2006) mapping unit: SR624 Silvertop Ash - Blue-leaved Stringybark shrubby open forest on ridges, north east South Eastern Highlands Bioregion (this is equivalent to P10. Eastern Tablelands Dry Forest). SR534 Coast Grey Box - stringybark dry woodland on slopes of the Shoalhaven Gorges, southern Sydney Basin Bioregion (this is equivalent to P27. Bungonia Slates Woodland). SR670 Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion (this is equivalent to P24. Tableland Grassy White Box Yellow Box Blakely's Red Gum Woodland). SR534 Coast Grey Box - stringybark dry woodland has an estimated cleared percentage of 15% within the CMA. Most of this vegetation community is within Bungonia State Conservation Area and Morton National Parks or Crown Land. Very restricted. It will therefore be difficult to find an offset for this BVT. Likely have Eucalyptus bosistoana predominantly within the gullies/slopes with some E. melliodora amongst them. Very difficult to distinguish between the two species as both are occurring together. The gullies/slopes also have a mix or hybrids of Red Gums (Eucalyptus tereticornis, E. blakelyi and E. amplifolia) which presents difficulties with identification. SR534 Coast Grey Box - stringybark dry woodland has an estimated cleared percentage of 15% within the CMA. Most of this vegetation community is within Bungonia State Conservation Area and Morton National Parks or Crown Land. Very restricted. It will therefore be difficult to find an offset for this BVT. Variation rule is likely to be accepted for this BVT. SR624 Silvertop Ash - Blue-leaved Stringybark shrubby open forest is Dry Sclerophyll Forest Formation with 40% cleared within the CMA. All efforts to directly offset this BVT would be made. If unlikely to offset directly a BVT of Dry Sclerophyll Forest Formation that has an equal of greater than 40% cleared would be proposed.	The conclusions from this meeting have assisted in aligning the vegetation to appropriate PCTs. The site inspection with OEH was vital in providing confidence in the PCT alignment. The variation criteria for SR534 and SR634 have been discussed in the offset strategy.

Dates of consultation	Relevant key issues/discussion points	How are the issues addressed in this report?
4/12/2018	Phone meeting with Luke Baker (Niche), Tania Ashworth and Allison Treweek (OEH), Rod Wallace (Boral) and Kate Jackson (Boral), Neville Haddingh (Element), Mark Roberts (Element) to discuss the adequacy of the initial Biodiversity Development Assessment Report. Key items discussed during the meeting include the following: - Avoidance on biodiversity values needs to be detailed in the report. Where avoidance is not possible, further justification is required for placement of the site. - Survey associated with the Marulan South Project should be incorporated into the report. - Additional survey effort required for the Regent Honeyeater should be incorporated into the report. This was done as part of the Marulan South Project. - Additional plot data to be brought in from Marulan South Project or collected to expand survey effort. - Large-eared Pied Bat habitat only extends approximately three kilometres from sandstone overhangs. Figures and discussions in report need to reflect this.	Avoidance chapter demonstrates the project design as indicated by Boral – section 5.1. Survey effort associated with the Marulan South Project incorporated in this assessment. Additional plot data incorporated into the credit calculations. Large-eared Pied Bat and Regent Honeyeater assessments re-assessed.

2. Landscape assessment

2.1 Landscape assessment - methods

As detailed in section 4 of the BAM (OEH 2017), a landscape assessment for the proposal is required, which was conducted within the BAM Calculator. Landscape value is an assessment of a number of factors including:

- native vegetation cover
- rivers, streams and estuaries
- areas of geological significance
- habitat connectivity.

For each factor the current state of the landscape is assessed then compared with the state of the landscape if the proposal were to proceed.

2.1.1 Landscape features and scoring

Table 4 below provides details of the landscape settings and scored landscape features for the proposed project.

Table 4: Landscape features and scoring under the NSW BAM

Landscape features	Description	Figure reference
IBRA bioregion/subregion	South Eastern Highlands IBRA region, and within the Bungonia IBRA subregion.	Figure 3
Mitchell Landscapes	One Mitchell landscape occurs across the Study Area: Bungonia Tableland and Gorge.	Figure 3
Rivers, streams and estuaries and Strahler stream order	No rivers, streams of estuaries occur within the Study Area. An ephemeral drainage channel occurs through the middle of the Study Area, which would only provide very limited flow during high rainfall events. There are a number of small farm dams which occur throughout the Study Area. These dams were empty during the warmer months of field survey.	Figure 3
Wetlands within and adjacent to development	None	-
Cleared areas	The native vegetation present within the Study Area has been subject to historic clearing. Much of the vegetation to the north, has been extensively cleared, leaving a combination of native pasture/introduced pasture with scattered eucalypts. Cleared areas are more prominent to the east and north where the existing Marulan South Mine Pit, and rail loop occurs.	Figure 4
Connectivity features	The Study Area adjoins native vegetation to the immediate west of Marulan South Road. The development would reduce the patch size of trees located along Marulan South road, by only leaving scattered trees that would occur between the emplacement and the proposed powerline adjacent to the road edge.	Figure 4
Buffer area (percent	A 1,500m buffer was applied to the Study Area resulting in an overall buffer	Figure 4

Landscape features	Description	Figure reference
native vegetation cover)	area of 1,299 ha. Aerial interpretation coupled with the results of the current field survey and additional surveys completed by Niche as part of the Marulan South Project, offsetting investigations, and Peppertree Modification 4 Biodiversity Assessment, was used to map the area of native vegetation, and introduced vegetation within the locality. In total, 561.2 ha is non-native vegetation (consisting of mine pit, existing emplacement and infrastructure, residential and roads/rail links etc.), and 738.1 ha is native vegetation. ***Woody vegetation cover*** The native vegetation extent and cover of woody vegetation was determined via aerial photography interpretation based on canopy cover. For woody vegetation 49.8% of the buffer area was determined to support native woody vegetation (647.5 ha). ***Non-woody vegetation cover*** For non-woody vegetation, experience of the Study Area was drawn upon in addition to aerial photography interpretation to estimate cover of native grassland vegetation. Areas that were naturally grassland correspond with high fertility depressions situated away from core infrastructure. Native grassland was conservatively estimated that 6.8 % of the buffer area (88.1 ha). ***Total native vegetation cover*** Combining the estimated woody and non-woody vegetation cover resulted in 56.81% of the buffer area supporting native vegetation. This falls into the 30-70% category within the BAM Calculator.	
Site context	Site based assessment.	-
Geological significance and soils	There are no karst, caves, crevices, cliffs or other areas of geological significance within the Study Area. There are no high hazard soil areas.	-

3. Native vegetation and flora assessment

3.1 Data review

3.1.1 Atlas of NSW Wildlife Database

A review of spatial records of threatened flora within a 10 km radius of the Study Area was undertaken using data obtained from the Atlas of NSW Wildlife. Records were obtained prior to field survey. Results were considered during field survey planning and the likelihood of occurrence analysis, performed prior to field survey and updated post field survey.

3.1.2 EPBC Act Protected Matters Search

A Protected Matters Search (EPBC Act) was carried out for a 10 km radius of the Study Area. Results were considered during field survey planning and the likelihood of occurrence analysis, performed prior to field survey and updated post field survey. The results of the search are provided in Appendix 1.

3.2 Plant community delineation and mapping

Vegetation within the Study Area and surrounds has been mapped previously as part of the Native vegetation of South Eastern NSW (Tozer et al. 2006). The mapping units of the Tozer et al. 2006 mapping have been aligned to an associated PCT in the OEH Vegetation Information System (VIS) database. This mapping project aided the initial vegetation mapping of the Study Area and surrounds.

The initial flora survey which was conducted from the 3rd to the 6th of February 2015, and 12th February 2018, followed the methodology specified in the OEH (2014) Framework for Biodiversity Assessment. This survey was also part of a greater area within Boral's landholdings that encompassed areas of land associated with the Marulan South Project, which is subject to a separate approval document.

An update of the flora survey was completed in July 30th to the 1st of August 2018 and 19th December 2018 which followed the BAM. In total, 35 BAM plots/transects were completed within the wider Marulan South Project area, and 13 BAM plots/transects within the Study Area to meet the minimum plot requirement as per the BAM.

Walking meanders were undertaken between plot locations. At a minimum, the combined foot traverses complied with the recommended number and length of traverses per area of stratification unit (vegetation community) according to DEC (2004) survey guidelines. The walking meanders were also used to survey for threatened flora species across the Study Area, in particular the presence of *Solanum celatum* which occurs widely across the locality.

The number of plots undertaken, along with the required survey effort as specified in the BAM is provided in Table 6 and shown in Figure 5. The BAM plots collected within the wider locality are shown in Figure 6.

The plot data and species list obtained during the field assessment is provided in Appendix 3.

The field survey presented a number of difficulties with eucalypt identification, due to the historic clearing of the site, and the overlap of *Eucalyptus bosistoana* and *E. melliodora,* which are quite similar in appearance. Similarly, the presence of *Eucalyptus tereticornis, E. blakelyi* and *A. amplifolia* were in combination, thus also presenting identification difficulties. To assist in identification of the eucalypts and alignment to relevant PCTs and Tozer *et al* 2006 mapping units, a site visit with John Briggs (OEH) was undertaken on 9th of June 2016 with Niche. The consultation was undertaken as part of the Marulan South

Project, which comprised of the current Peppertree Mod 5. The site visit and subsequent consultation (Table 3) assisted in aligning the PCTs within the Study Area.

3.2.3 Plant community delineation and mapping

As detailed above, the vegetation of the Study Area was validated originally using the methods of the FBA, and then revised and updated using methods consistent with the BAM.

Within the Study Area two native vegetation types and one non-native vegetation type were identified. These vegetation communities were aligned to the relevant Tozer *et al.* (2006) vegetation unit, and Plant Community Types (PCTs) required for use with the BAM.

Different condition classes were assigned to vegetation where obvious differences in structure and quality occurred, resulting in two PCTs and four vegetation categories as shown in Table 5.

Descriptions for those communities which occur within the Study Area are provided in Appendix 2. Vegetation community mapping is shown in Figure 7.

Table 5. Vegetation mapping and alignment for vegetation types within the Study Area

Plant Community Type (PCT)	Equivalent Tozer et al. (2006) mapping unit	Vegetation formation	Vegetation class	Threatened Ecological Community (TEC)*	PCT % cleared	Condition identifier input used in Calculator	Total (ha)
PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670)	P24. Tableland Grassy White Box Yellow Box Blakely's Red Gum Woodland	Grassy Woodlands	Southern Tableland Grassy Woodlands	EEC under BC Act. CEEC under EPBC Act.	92	Medium (36.4 site value)	18.64
						Poor (19.8 site value)	9.04
PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges - Southern Sydney Basin (SR534)	P27. Bungonia Slates Woodland	Dry Sclerophyll Forests (Shrub/grass subformation)	Central Gorge Dry Sclerophyll Forests	Not listed	15	Medium (42.4)	8.46
						Poor (17.4)	3.55
Exotic pasture/ Infrastructure	-	-	-	-	-		8.64
Total							48.33
Total native vegetation							39.69

Table 6: Vegetation zones within the proposed development envelope and associated plot/transect survey requirement

Vegetation Zone Number	Plant Community Type (PCT)	Equivalent Tozer et al. (2006) mapping unit	PCT % cleared	Condition identifier input used in BBCC	Total (ha)	Plots required (BAM)	Plots completed
1	PCT1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670)	P24. Tableland Grassy White Box Yellow Box Blakely's Red Gum Woodland	92	Moderate	18.64	3	5
2				Poor	9.04	3	3
3	PCT778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges - Southern Sydney Basin (SR534)	P27. Bungonia Slates Woodland	15	Moderate	8.46	3	3
4				Poor	3.55	2	2
5	Exotic pasture/ Infrastructure	-	-	-	8.64	None (however several plots and transects were conducted to test cover values and species richness)	0
	Total				48.33	11	13
	Total native vegetation				39.69		

3.2.4 Plant community descriptions

Refer to Appendix 2 for plant community descriptions and diagnostic species for each plant community.

3.2.5 Site values

Flora

Floristic data recorded from floristic plots performed throughout the identified vegetation zones (Figure 7) is included within Appendix 3.

Plot and transect values

The results of the plot data and species list obtained during the field assessment is provided in Appendix 4.

Site value scores

The Site value assessment was carried out by entering plot data into the BAM Calculator. The data provides quantitative measures of composition, structure and function for each vegetation zone (Appendix 4). The BAM Calculator compares the values recorded with the benchmark for the vegetation class to provide the Site value score. This score represents the overall condition of the vegetation compared against the benchmark.

The score from these inputs, coupled with data in the following section of this report, is used to determine the number of ecosystem credits that are required for development.

All vegetation zones within the development envelope scored within the threshold for offsetting (15 out of 100 for threatened ecological communities and 17 out of 100 for non-threatened ecological communities). Ecosystem credit offsets are therefore required for impacts to any vegetation within the Study Area.

3.2.6 High threat and priority weeds

During the field surveys, two high threat weeds listed under the NSW *Biosecurity Act 2015* were recorded: *Nassella trichotoma* (Serrated Tussock) and *Paspalum dilatatum* (Dallas Grass). The abundance and cover of *Nassella trichotoma* (Serrated Tussock) was quite high across most of the flora plots, in particular those completed within the open paddock areas where PCT1334 Yellow Box - Blakely's Red Gum grassy woodland occurs.

3.2.7 Threatened ecological communities

A list of Threatened Ecological Communities (TECs) occurring or potentially occurring within the locality as generated from the database searches detailed in section 3.1, is provided in Appendix 1. The database searches identified seven TECs that have been identified as potentially occurring within the locality.

Based on the results of the detailed vegetation validation, an analysis of existing vegetation mapping by Tozer *et al* (2006), and review of the Conservation Advice of the TECs, one TEC was identified as being present within the Study Area:

- Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland (Endangered Ecological Community (EEC) under the BC Act and Critically Endangered Ecological Community (CEEC) EPBC Act).

The Yellow Box Blakely's Red Gum Woodland community was identified as aligning to PCT1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670).

Based on the plot surveys within and surrounding the Study Area, two vegetation condition classes were attributed to TEC:

- Moderate condition: Consisting of close patches of Eucalypt stands (comprising of *Eucalyptus blakelyi,* and *Eucalyptus melliodora* with the occasional *E. eugenioides* and *E. bosistoana*) with a mixture of native and introduced ground cover. This condition class had a vegetation integrity score of 36.4.
- Poor: Consisting of a few sparsely scattered Eucalypt stands, with a mixture of native and introduced ground cover. This condition class had a vegetation integrity score of 19.8.

3.3 Threatened flora

Threatened flora with the potential to occur, as generated by the BAM Calculator, are presented in Table 7 and Appendix 1.

All are assumed to be absent from the Study Area based on non-detection of the species during targeted searches.

The walking meanders were used to survey for threatened flora species across the Study Area, in particular the presence of *Solanum celatum*, given the species has been previously recorded throughout the locality.

In total, approximately 14 hours of threatened flora random meanders were conducted between the 3rd to the 6th of February 2015, and 5th February 2018. And a further 5 hours completed 31st July to the 1st of August 2018.

During the field survey, no BC Act or EPBC Act listed threatened flora were recorded. Many of the threatened flora that have potential to occur are relatively conspicuous and are unlikely to remain undetected during the survey. Given the field survey was completed during the recommended survey times for those species identified in the BAM (Table 7), the flora habitat requirements, and the conspicuous nature of the species, it is highly unlikely that threatened flora occur within the Study Area.

Table 7. Recommended threatened flora survey time matrix as specified in BAM

Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Consideration
Eucalyptus macarthurii	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Survey completed during recommended survey time - conspicuous species that is unlikely to remain undetected during field survey.
Pimelea axiflora subsp. pubescens									Yes	Yes	Yes	Yes	Survey was not completed during known flowering time however quite conspicuous, particularly given the ground cover within the Study Area was not dense – not detected during targeted flora survey. Unlikely to remain undetected during the survey.
Pomaderris cotoneaster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Survey completed during recommended survey time – not detected during targeted flora survey. Unlikely to remain undetected during the survey.
Pultenaea pedunculata									Yes	Yes	Yes		Survey was not completed during the recommended survey time, however, the species is conspicuous. It is unlikely to remain undetected during the survey.
Solanum celatum									Yes	Yes	Yes		The survey was not completed during the recommended survey time However, the species has been recorded extensively throughout the locality by Niche during all times of the year. There is also a large population within Bungonia National Park and Morton National Park. Unlikely to remain undetected during the survey.
Swainsona sericea	Yes	Yes							Yes	Yes	Yes	Yes	Survey completed during recommended survey time – not detected during targeted flora survey. Unlikely to remain undetected during the survey.

4. Assessment of fauna and habitat

4.1 Bionet Atlas & EPBC Act Protected Matters Search

Similar to that in section 3.1, a review of spatial records of threatened fauna within a 10 km radius of the Study Area was undertaken using data obtained from the Bionet Atlas, and predicted threatened biodiversity were generated from an EPBC Act Protected Matters Search.

Fifty-five threatened fauna have been previously recorded or have modelled habitat within a 10 km radius of the Study Area (Appendix 1) according to the database searches. The potential for these species to occur within the Study Area is discussed in section 4.7 and Appendix 1. The results were considered during field survey planning and the likelihood of occurrence analysis, performed prior to field survey and updated post field survey.

4.2 Methods – field survey

The fauna field surveys incorporated both targeted survey using established survey techniques (as described in Table 8) and habitat-based assessment.

Habitat assessment considered the type and condition of habitats for fauna species. Habitat features recorded within the survey area included:

- Topographic features (such as slope, aspect and landscape position)
- Geology/soil type
- Dominant vegetation community composition, structure and condition of strata levels
- Form, quality and location of water sources
- The presence, number, size and condition of unique habitat features (such as tree hollows and crevices, loose tree bark, fallen timber mistletoe and any rock outcropping or scattered surface rock)
- The level of disturbance.

The fauna survey design effort had an emphasis on detection of species credit fauna and EPBC Act listed fauna where available habitat was present for such species. Since ecosystem credit species (see Appendix 1) have a high likelihood of being present on the site (based on the presence of habitat surrogates) specific targeted survey was not always performed for these species. However, the design attempted to detect the range of fauna using the Study Area in order to assist with evaluating its importance to fauna more generally.

Further to the survey effort within the Study Area, survey was completed immediately adjacent as part of the Marulan South Project. The survey effort completed as part of the Marulan South Project has assisted in determining the occupancy and likelihood of occurrence for threatened fauna in the Study Area.

Fauna survey effort completed within similar habitat types, or more intact habitat types within or adjacent to the Study Area are shown on Figure 10, with the effort associated with the Marulan South Project survey detailed in Table 9. This survey effort combined with that completed with the Study Area provides a rigorous survey effort that meets relevant survey guidelines for threatened fauna (eg. Regent Honeyeater adequate survey hours met).

Table 8. Fauna survey details and effort within the Study Area

Method	Effort and Timing	Details	Targeted species (NSW listed)	Targeted species (Commonwealth listed)
Ultrasonic call recording for bats	1 x night 04/02/2015 1 x night 05/02/2015	One Wildlife Acoustics SM2BAT ultrasonic recorders was deployed over one night along potential flyways or watercourses.	Large-eared Pied Bat, Eastern False Pipistrelle, Golden-tipped Bat, Eastern Bent-wing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat, Greater Broad-nosed Bat.	Large-eared Pied Bat
Harp Trapping	1 x night; 05/02/2015	A Harp traps was deployed overnight along identified flyways along tracks.		
Reptile survey	20 mins 05/02/2015 25 mins 05/02/2018	Random meander turning over surface rocks. Note that such habitat were very restricted and sparse.	Pink-tailed Legless Lizard Striped Legless Lizard Broad-headed Snake Little Whip Snake Rosenberg's Goanna	Pink-tailed Legless Lizard Striped Legless Lizard Broad-headed Snake
Diurnal bird surveys (2 hectare)	1 hour 04/02/2015 0.75 hours 05/02/2015 0.75 hours 05/02/2015 0.75 hours 11/10/2015 1 hours 01/08/2018	20 minute, 2 hectare bird surveys were extended in time due to relatively low bird activity in most areas and additional species being recorded after or at the end of the typical standard 20 min period. Incidental bird sightings were made throughout surveys activities with species of note being recorded spatially. Birds were identified with the use of 10 X 42 binoculars or from their calls.	All birds	All birds, including Regent Honeyeater
Remote Cameras	27 nights x 3 cameras (41,78,74) 06/02/2015	Moultrie 990i infrared cameras were deployed. Half of the cameras were baited with a mix of peanut-butter/oats/honey while the other half were baited with sardines. Cameras were placed along animal tracks near water points or other features.	Spotted-tail Quoll, Long-nosed Potoroo, Brush-tail Rock Wallaby, Rosenbergs Goanna.	Spotted-tail Quoll, Brush-tail Rock Wallaby, Long-nosed Potoroo, New Holland Mouse.
Spotlighting	30 mins 03/02/2015 45 mins 05/02/2015 60 mins 05/02/2018 30 mins 31/08/2018	Spotlighting surveys targeting arboreal mammals and nocturnal birds were performed, primarily on foot but also from a slow moving vehicle throughout parts of the Study Area.	Koala, Powerful Owl, Masked Owl, Sooty Owl, Koala, Yellow-bellied Glider, Greater Glider, Grey-headed Flying Fox and Sugar Glider.	Greater Glider, Grey-headed Flying Fox , Koala
Call playback and Owl Listening	3 x 45 minute surveys: 03/02/2015, 05/02/2015	Call-playback (Powerful Owl, Masked Owl, Sooty Owl, Koala, Yellow-bellied Glider and Sugar Glider) was undertaken within the Study Area over three nights. After an initial listening period of five minutes, calls of the target species were broadcast through a 10 watt megaphone for five minutes followed by a five minute listening period and a period of spotlighting.	Powerful Owl, Masked Owl, Sooty Owl, Koala, Yellow-bellied Glider and Sugar Glider.	Koala
Frog survey and aquatic habitat surveys.	30 mins 05/02/2015	Frogs were listened for at dams and ephemeral drainage lines throughout the Study Area. Active searching for frogs using spotlights was also conducted around dams, and watercourses within Peppertree landholdings.	Littlejohn's Tree Frog, Green and Golden Bell Frog, Giant Burrowing Frog.	Littlejohn's Tree Frog, Green and Golden Bell Frog, Giant Burrowing Frog.

Method	Effort and Timing	Details	Targeted species (NSW listed)	Targeted species (Commonwealth listed)
Stag watching	2 x 30 mins: 05/02/2015	Trees with hollows or cracks were watched immediately prior to sunset.	Yellow-bellied Glider, Squirrel Glider, Sooty Owl, Powerful Owl, Masked Owl, Barking Owl.	
Koala SAT	1 x survey 05/02/2015 1 x survey 05/02/2018 1 x survey 02/08/2018	SAT (Koala scat) surveys were conducted across the Study Area. In addition to SAT surveys random tree inspections were carried out during traverses of the Study Area at selected feed trees searching for scats and characteristic bark scratches.	Koala	Koala
Opportunistic survey	During all activities	Opportunistic observations were made of fauna aided with binoculars and photography as appropriate. Opportunistic survey included searches of habitat such as under logs, rocks or waste piles (where limited areas of such habitat existed) or within heaped leaf litter, casual bird or mammal observations or observations of their calls.	All species	All species

Table 9. Survey effort completed as part of the Marulan South Project

Method	Effort and Timing	Total effort	Details	Target species (NSW)	Target species (Commonwealth)	EPBC species survey guidelines met in relation to Study Area?
Ultrasonic call recording for bats	3 x 1 night = 3 nights; 29/10/2014 to 31/10/2014	90 hours	One Anabat II bat detector and Anabat CF recorder unit was deployed at three sites over one night along potential flyways or watercourses.	Large-eared Pied Bat, Eastern False Pipistrelle, Golden-tipped Bat, Eastern Bent-wing-bat, Eastern Freetail-bat, Southern Myotis, Yellow-bellied Sheathtail-bat, Greater Broad-nosed Bat.	Large-eared Pied Bat	Yes guidelines met for Large-eared Pied Bat. Recommended survey effort: 16 detector nights
Ultrasonic call recording for bats	2 x nights 02/02/2015 1 x night 04/02/2015 1 x night 05/02/2015 3 x nights 03/02/2015 3 x nights 02/02/2015	100 hours	Wildlife Acoustics SM2BAT ultrasonic recorders were deployed at five sites and set to record from dawn to dusk. The detectors were placed on the ground or elevated up to a metre where possible and, pointed upwards at approximately a 45 degree angle.			
Harp Trapping	2 x nights; 02/02/2015 1 x night; 04/02/2015 1 x night; 05/02/2015 2 x nights 04/02/2015	72 hours	Harp traps were deployed overnight along identified flyways along tracks or close to waterways. There were limited narrow flyways throughout the Study Area.			
Diurnal bird surveys (2 hectare)	0.75 hours; 02/02/2015 1 hour; 02/02/2015 1 hours; 03/02/2015 1 hour; 04/02/2015 0.75 hours; 05/02/2015 0.75 hours; 05/02/2015 0.75 hours; 02/03/2015 1.75 hours; 03/03/2015 1 hour; 20/05/2015 2 hours; 21/05/2015 1 hours; 01/08/2018 2 hours; 03/08/2018	27.5 hours	20 minute, 2 hectare bird surveys were extended in time due to relatively low bird activity in most areas and additional species being recorded after or at the end of the typical standard 20 min period. Incidental bird sightings were made throughout surveys activities with species of note being recorded spatially. Birds were identified with the use of 10 X 42 binoculars or from their calls.	All birds	All birds, including Regent Honeyeater	Yes survey guidelines met- Regent Honeyeater – 20 hours over 10 days using area searches.
Reptile survey	20 mins 05/02/2015 45 mins 06/02/2015 25 mins 05/02/2018	90 mins	Random meander turning over surface rocks. Note that such habitat was very restricted and sparse.	Pink-tailed Legless Lizard Striped Legless Lizard Broad-headed Snake Little Whip Snake Rosenberg's Goanna	Pink-tailed Legless Lizard Striped Legless Lizard Broad-headed Snake	Habitat in Study Area limited to non-existent. Survey effort therefore suitable given the lack of habitat present.

Method	Effort and Timing	Total effort	Details	Target species (NSW)	Target species (Commonwealth)	EPBC species survey guidelines met in relation to Study Area?
Remote Cameras	27 nights x 2 cameras (37,38) 06/02/2015 31 nights x 4 cameras (40,45,39,43) 02/03/2015 27 nights x 3 cameras (41,78,74) 06/02/2015 30 nights x 2 cameras (46,48) 03/02/2015 30 nights x 2 cameras (75,77) 03/02/2015	3,408 hours	Moultrie 990i infrared cameras were deployed. Half of the cameras were baited with a mix of peanut-butter/oats/honey while the other half were baited with sardines. Cameras were placed along animal tracks near water points or other features.	Spotted-tail Quoll, Long-nosed Potoroo, Brush-tail Rock Wallaby, New Holland Mouse.	Spotted-tail Quoll, Brush-tail Rock Wallaby, Long-nosed Potoroo, New Holland Mouse.	Yes – 3.408 hours of trapping is extensive for a range of threatened mammals.
Spotlighting	30 mins; 03/02/2015 30 mins; 03/02/2015 45 mins; 05/02/2015 30 mins; 03/02/2015 45 mins; 04/02/2015 45 mins; 05/02/2015 2 hours; 02/03/2015 2 hours; 03/03/2015 2 hours; 03/03/2015 60 mins 05/02/2018 30 mins 31/08/2018	19.5 hours	Spotlighting surveys targeting arboreal mammals and nocturnal birds were performed, primarily on foot but also from a slow moving vehicle throughout parts of the Study Area.	Koala, Yellow-bellied Glider, Squirrel Glider, Sooty Owl, Powerful Owl, Masked Owl, Barking Owl, Spotted-tailed Quoll.	Greater Glider, Grey-headed Flying Fox, Koala	Yes – Koala assumed present. No Grey-headed Flying Fox camp site as evident by field inspection. Greater Glider lacks habitat.
Call playback and Owl Listening	3 x 45 minute surveys: 03/02/2015, 05/02/2015 1 x 45 minute survey: 04/2/2015	3 hours	Target species – Powerful Owl, Masked Owl, Sooty Owl, Koala, Yellow-bellied Glider and Sugar Glider. Call-playback sites were established at three locations within the Study Area over the three nights. After an initial listening period of five minutes, calls of the target species were broadcast through a 10 watt megaphone for five minutes followed by a five minute listening period and a period of spotlighting.	Koala, Yellow-bellied Glider, Squirrel Glider, Sooty Owl, Powerful Owl, Masked Owl, Barking Owl.	Koala	Yes – Koala assumed to be present.
Frog chorus survey and aquatic habitat surveys.	15 mins; 03/02/2015 20 mins; 03/02/2015 30 mins; 05/02/2015 60 mins; 04/02/2015 30 mins; 04/02/2015 3 hours; 02/03/2015 3 hours; 03/03/2015 3 hours; 03/03/2015	11 hours	Frogs were listened for at dams and permanent and ephemeral drainage lines throughout the Study Area. Active searching for frogs using spotlights was also conducted around watercourses. Frog surveys were done outside of the Study area along the Shoalhaven River and its tributaries recognising the potential for indirect impacts through water discharge.	Littlejohn's Tree Frog, Green and Golden Bell Frog, Giant Burrowing Frog.	Littlejohn's Tree Frog, Green and Golden Bell Frog, Giant Burrowing Frog.	Yes – lack of habitat in Study Area.

Method	Effort and Timing	Total effort	Details	Target species (NSW)	Target species (Commonwealth)	EPBC species survey guidelines met in relation to Study Area?
Stag watching	2 x 30 mins; 03/02/2015 2 x 30 mins; 05/02/2015	2 hours	Trees with hollows or cracks were watched immediately prior to sunset.	Yellow-bellied Glider, Squirrel Glider, Sooty Owl, Powerful Owl, Masked Owl, Barking Owl.		
Koala SAT	3 x surveys; 03/02/2015 1 x survey; 05/02/2015 1 x survey 05/02/2018 1 x survey 02/08/2018	4 hours	SAT (Koala scat) surveys were conducted across the Study Area. In addition to SAT surveys random tree inspections were carried out during traverses of the Study Area at selected feed trees searching for scats and characteristic bark scratches.	Koala	Koala	Yes – Koala assumed to be present.
Opportunistic survey	During all activities	48 hours	Opportunistic observations were made of fauna aided with binoculars and photography as appropriate. Opportunistic survey included searches of habitat such as under logs, rocks or waste piles (where limited areas of such habitat existed) or within heaped leaf litter, casual bird or mammal observations or observations of their calls, including during overnight activities within the Shoalhaven River area, and observations of indirect evidence for certain species such as scats tracks and other traces.	All species	All species	

4.3 Recommended fauna survey effort in BAM

Threatened fauna predicted or potentially occurring within the IBRA subregion were reviewed. This list was refined post field survey for the Study Area within the BAM Calculator on the basis of the vegetation types, condition and habitat features as well as the results of field survey. The list of predicted and candidate species generated via the BAM Calculator is in Table 9. A status for each species is provided which represents the basis for deciding whether a species was present or absent from the Study Area. No ecosystem credit species were omitted from the BAM Calculator, despite there being very limited or no habitat present within the Study Area for many of the predicted species.

Table 10: List of candidate and predicted threatened fauna for the proposed project

Common Name	Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Consideration
Candidate threatened species														
Regent Honeyeater (Breeding)	*Anthochaera phrygia*									Yes	Yes	Yes	Yes	No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey. Surveys completed during recommended survey period in October. The total survey hours exceed the survey guidelines specified in DEWHA (2017).
Pink-tailed Legless Lizard	*Aprasia parapulchella*									Yes	Yes	Yes		No – lack of rocky habitat. Targeted reptile surveys did not record the species.
Gang-gang Cockatoo (Breeding)	*Callocephalon fimbriatum*	Yes									Yes	Yes	Yes	No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey.
Glossy Black-Cockatoo (Breeding)	*Calyptorhynchus lathami*			Yes	Yes	Yes	Yes	Yes	Yes					No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey.
Eastern Pygmy-possum	*Cercartetus nanus*	Yes	Yes	Yes						Yes	Yes	Yes	Yes	No – species not recorded during targeted survey. Unlikely to be present. Survey completed during recommended survey time.
Large-eared Pied Bat	*Chalinolobus dwyeri*	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes – recorded during the field survey.
Giant Burrowing Frog	*Heleioporus australiacus*	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes	Yes	No – no habitat present within the Study Area.
Little Eagle (Breeding)	*Hieraaetus morphnoides*								Yes	Yes	Yes			No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey. Surveys completed during recommended survey period in October.
Swift Parrot (Breeding)	*Lathamus discolor*					Yes	Yes	Yes	Yes					No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey. Surveys completed during recommended survey period in August.
Little Bentwing-bat (Breeding)	*Miniopterus australis*	Yes	Yes										Yes	No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey. Surveys completed during recommended survey time in February.

Common Name	Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Consideration
Eastern Bentwing-bat (Breeding)	*Miniopterus schreibersii oceanensis*	Yes	Yes									Yes	Yes	No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey.
Barking Owl (Breeding)	*Ninox connivens*					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey. Survey completed during recommended survey time in August.
Powerful Owl (Breeding)	*Ninox strenua*					Yes	Yes	Yes	Yes					No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey. Survey completed during recommended survey time in August.
Squirrel Glider	*Petaurus norfolcensis*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No – not detected during survey. Survey undertaken during recommended survey time.
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No – not detected during survey. No records within locality. Unlikely to be present.
Koala	*Phascolarctos cinereus*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not recorded during the field survey, however is known to occur within the locality. It may use the habitat features of the Study Area. The Koala is therefore considered further in the impact assessment.
Masked Owl (Breeding)	*Tyto novaehollandiae*					Yes	Yes	Yes	Yes					No – no breeding habitat identified within the Study Area. The species was also not recorded foraging during the survey. Survey completed during recommended survey time in August.
Predicted threatened species														
Regent Honeyeater	*Anthochaera phrygia*	No requirement to survey as assumed to be present based on habitat present												
Gang-gang Cockatoo	*Callocephalon fimbriatum*													
Glossy Black-Cockatoo	*Calyptorhynchus lathami*													
Speckled Warbler	*Chthonicola sagittata*													
Brown Treecreeper (eastern	*Climacteris*													

Common Name	Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Consideration
subspecies)	*picumnus victoriae*													
Varied Sittella	*Daphoenositta chrysoptera*													
Spotted-tailed Quoll	*Dasyurus maculatus*													
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*													
Little Lorikeet	*Glossopsitta pusilla*													
Painted Honeyeater	*Grantiella picta*													
Little Eagle	*Hieraaetus morphnoides*													
Swift Parrot	*Lathamus discolor*													
Hooded Robin (south-eastern form)	*Melanodryas cucullata*													
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*													
Little Bentwing-bat	*Miniopterus australis*													
Eastern Freetail-bat	*Mormopterus norfolkensis*													
Turquoise Parrot	*Neophema pulchella*													
Barking Owl	*Ninox connivens*													
Powerful Owl	*Ninox strenua*													
Yellow-bellied Glider	*Petaurus australis*													
Scarlet Robin	*Petroica boodang*													
Flame Robin	*Petroica phoenicea*													
Koala	*Phascolarctos cinereus*													
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*													
Diamond Firetail	*Stagonopleura*													

Common Name	Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Consideration
	guttata													
Little Whip Snake	*Suta flagellum*													
Masked Owl	*Tyto novaehollandiae*													
Rosenberg's Goannna	*Varanus rosenbergi*													
Regent Honeyeater	*Anthochaera phrygia*													

4.4 Fauna habitat

Numerous sources of disturbance operate throughout most of the Study Area, which have impacted upon the condition of fauna habitat. Disturbances include:

- Selective clearing - which has occurred throughout all accessible areas of the Study Area, with timber being used historically to fuel furnaces in the Marulan area (pers. comm. Rod Wallace – Boral). As a result, all trees were of similar ages, and the understorey had been extensively cleared. Large hollow-bearing logs were very sparse due to the prior clearing events.
- Weed invasion - weeds range in their density across the Study Area from moderately sparse in the dry sclerophyll shrubby vegetation types to common throughout the Study Area within grassland habitat. The weed spread is in response to levels of grazing or other disturbance factors. Infestations of Serrated Tussock (*Nassella trichotoma*) were common throughout the entire Study Area, with higher concentrations in the open grass areas. This has greatly contributed to the relatively low site values scores associated with the PCTs.
- Historic cattle grazing - as such, the ground cover is a mix of native and introduced pasture species.
- Macropod grazing - a high level of macropod grazing was observed in open grass areas. As such, much of the native ground cover within these areas were sparse in composition and species richness.
- Feral animals - feral animals were common throughout the entire Study Area. Rabbits and Brown Hares are moderately common throughout most of the Study Area. Feral goats have also been sighted in the Study Area by Niche and known to occupy the Study Area on a regular basis.

Available fauna habitat within the Study Area was relatively limited consisting of:

- Grassy Woodlands (mostly scattered trees with a mix of native and exotic grasses)
- Forest gullies and
- Farm dams.

Grassy Woodland

Grassy Woodland habitat within the Study Area consisted predominantly of sparse scattered trees mainly *Eucalyptus bosistoana, E. melliodora, E. eugenioides E. tereticornis* and *E. blakelyiX*) with areas of more consolidated woodland patches occasionally present (Photo 1). Habitat features had been subject to historic clearing and grazing.

Forest gullies

Forest gully habitat within the Study Area consisted predominantly of sparse scattered trees mainly *Eucalyptus bosistoana* and red gums (*E. tereticornis* and *E. blakelyiX*) with some stringybarks (*E. eugenioides, E. globoidea*) (Photo 2). Log density in these areas was greater than that of the grassy woodlands.

Farm dams

A number of small dams from 0.05 – 0.15 hectares in size occurred within the Study Area. The dams differ in their shape and depth. At the times of the field surveys, less than 30 cm of water was present during the wetter periods. In February and July 2018, the dams did not contain any water. During rainfall events, the dams may supply water supply for vertebrate fauna and may act as foraging habitat for bats, birds and common frogs.

Photo 1. Grassy woodland habitat with a mix of *Eucalyptus bosistoana, E. melliodora, E. blakelyi* and *E. eugenioides*.

Photo 2. Gully forest habitat dominated by a mix of *Eucalyptus bosistoana* and Red Gums (*E.tereticornis/E.blakelyi X)*

4.5 Connectivity of fauna habitat

The Study Area has limited connectivity to the east and north due to the Marulan South Mine Pit and Peppertree Quarry. To the west, there is connectivity to a patch of native vegetation adjacent to Marulan South Road, which provide scattered woodland habitat connectivity throughout the general locality. To the south of the site, connectivity exists within woodland habitat within similar disturbance and condition to that of the Study Area, however it is noted that this area of habitat is proposed to be cleared associated with the Marulan South Project (subject to a separate approval).

Due to the location of the Marulan South Mine Pit, connectivity to Bungonia State Conservation Area and Morton National Park is somewhat impeded, however connectivity via the scattered patches of vegetation to the south offers some connectivity.

The land to the west, being part of the more fertile tablelands, is predominantly cleared for agriculture. However, scattered patches of native vegetation occur across the tableland areas, some of which is connected to the Study Area.

The Study Area does not form part of any national landscape corridors (SEWPaC, 2012a) and no identified OEH wildlife corridors occur within the vicinity of the site.

Connectivity losses would occur for the life of the mine with connectivity being progressively reinstated during mine rehabilitation. However, the landforms reinstated during rehabilitation are likely to be a less favourable linkage for some fauna species due to their topography, heterogeneity and reduced quality in some areas. More mobile species, such as birds and bats, without highly specific habitat requirements (at least for certain lifecycle aspects) are likely to be most effective at using reinstated linkages.

4.6 Fauna recorded during field surveys

Fauna field surveys using the methods described in section 4.2 were undertaken in each of the identified habitats, with the suite of methods employed in each habitat type dependant on the potential presence of subject threatened fauna within that habitat type. Notable opportunistic sightings whilst travelling within the Study Area were also recorded. A complete species list is provided in Appendix 4.

A total of 45 fauna were recorded during field surveys within or immediately adjacent to the Study Area. The results comprised of one reptile, 22 mammals, and 22 birds. A complete fauna list is provided in Appendix 4.

The suite of fauna recorded were predominantly locally common species tolerant of at least moderate disturbance and lower condition vegetation or degraded habitats.

Some mobile species recorded would primarily be dependent on the adjacent woodland areas but would take advantage of parts of the Study Area to forage (e.g. common Wallaroo, Large-eared Pied Bat).

A high number of goats were recorded across the Study Area during the July 2018 field survey. Approximately 35 goats were recorded within the Study Area. According to Grant Thompson (Boral – Environmental officer), the goats have been in the area most days since the start of 2018.

Hares and foxes were also frequently recorded in the Study Area during the field surveys.

4.7 Threatened fauna

Two threatened fauna were recorded with the Study Area: Large-eared Pied Bat and Eastern Bentwing Bat.

A number of additional threatened fauna have the potential to occur within the Study Area but were not recorded, most likely due to their potential use of the Study Area or wider locality being limited to sporadic occurrences (e.g. nomadic birds) (Appendix 1). Of these threatened fauna, only the Koala and Large-eared Pied Bat are regarded as species credit fauna that would require offsetting under the BC Act.

The Eastern Bentwing Bat is regarded as both an ecosystem and species credit species, with the species credit component triggered by the presence of breeding habitat. The Eastern Bentwing Bat has breeding habitat within caves and artificial tunnels, neither of which occur within the Study Area. As such, the Eastern Bentwing has been regarded as an ecosystem credit species for this assessment.

4.7.1 Species credit fauna

As discussed in section 4.7, the survey resulted in only one species credit fauna being recorded within the Study Area: the Large-eared Pied Bat. The Koala, due to the presence of feed trees and proximity to the Koala population of Bungonia Gorge, has also been considered further as a species credit fauna as discussed below.

Large-eared Pied Bat habitat in the Study Area

The Large-eared Pied Bat was recorded at anabat survey locations within, and adjacent to the Study Area. As such, portions of native vegetation within the Study Area have been considered foraging habitat for the species.

Not a significant amount of information is known about the Large-eared Pied Bat, however, as indicated on the BioNet Atlas, the species is regarded as a 'species credit' species as it cannot be reliably predicted to occur on a site based on vegetation and other landscape features.

Breeding habitat, which as described on the BioNet Atlas as including PCTs associated with the species within 100m of rocky areas containing caves, overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. As the site, does not occur within 100 metres of any of these features known to contain the species, breeding habitat is unlikely to be present within the Study Area.

One cave is known to occur within 2,000 m of the Study Area, known as Main Gully Spring (Bauer and Bauer 1998). The cave is located beneath the Mine and in periods of high discharge this cave acts as an overflow. A number of chambers and tunnels are described as occurring in this cave by Baeuer and Bauer (1998) including a chamber 1 m x 2.7 m wide.

Main Gully Spring is a potential bat roosting site. It could not be inspected during the current field survey due to safety and access issues, however, a site inspection by Boral representatives accompanied by an experienced caver was undertaken in August 2017 at the base of the cave, and approximately 10 m inside the entrance. During the site inspection, approximately 5 microbats were observed. It was not possible to determine the species from photographs that were provided. As such, it is not possible to state with certainty that a maternal roost could not be established for Large-eared Pied Bat.

Whilst microbats were recorded it is unlikely that long-term maternity roosts would be established in the Main Gully Spring cave due to its occasional inundation of most, if not all parts of the cave in times of high flow.

Regardless of whether bat roosting or breeding occurs within the cave, it is highly unlikely that the Main Gully Spring Cave would experience any impact associated with the Project due to the distance of the subject cave from the Study Area. There has been an ongoing history of mining within the existing south pit throughout which any roosting bats would have persisted if present. The Project is not forecast to increase noise or vibration to the subject cave or any other known caves in the locality.

The Large-eared Pied Bat is known to forage in a range of vegetation types, including dry and wet sclerophyll forest, grassy woodland, Callitris dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland and sandstone outcrop country (Hoye & Dwyer 1995; Pennay 2002; DECC 2007). Almost all records of the species are within several kilometres of cliff lines or rocky terrain. Modelling based on presence-only data indicates that bats forage in fertile valleys and plains, as well as areas with moderately-tall to taller trees along water courses (DoEE 2018). Foraging habitat on fertile soils (or within fertile valleys) is also considered an important overall requirement for the Large-eared Pied Bat (Pennay 2008), however the species has been recorded extensively within sandstone associated vegetation, indicating that whilst foraging habitat on fertile soils is likely to be important, foraging would by no means be confined to such areas. Such foraging habitat is protected within Morton National Park and Bungonia State Conservation area along the Shoalhaven River and Bungonia Creek, which occur within the locality of the Study Area.

The area of foraging habitat within the Study Area includes PCTs with a 'medium condition' class. Approximately 27.1 ha of habitat for the Large-eared Pied Bat has therefore been mapped within the Study Area. This area has been regarded in this assessment as the Species polygon for the Large-eared Pied Bat, which has been addressed later in the report to generate the species credit required for the Project.

The impacts to foraging habitat for the Large-eared Pied Bat are discussed further in section 5.3.

Koala habitat in the Study Area

Surveys and collection of anecdotal evidence of Koala sightings conducted within the Study Area and surrounds as part of this assessment revealed that Koalas have been sighted sporadically within the locality of the Study Area over the past decade, with a Koala observed every 2- 3 years around the Marulan South Mine (pers. comm. Grant Thompson – Boral).

Scat surveys, spotlighting, call-playback and tree surveys did not identify repeated or on-going use of trees within the Study Area. Furthermore, surveys completed adjacent to the Study Area as part of the Marulan South Project also do not detect Koala usage.

There are 137 Koala records from the Bionet Atlas within a 10 km radius of the Study Area. The majority of these records (105) are from the Bungonia National Park and Bungonia State Conservation Area (SCA) which occur approximately 1 - 4 km south of the Project site. The large number of records from the Park can largely be attributed to establishment of a monitoring program based on park visitors and staff reporting Koala sightings. However, the program has not allowed for a reliable estimate of Koala numbers in the area (pers. comm. Audrey Kutzner NSW NPWS). Nonetheless the area where the majority of Koala records occur is considered one of the primary known active sites for a Koala population centred along the Shoalhaven Gorge and extending approximately 40 km to the south of the Study Area towards Nerrigan and approximately 30 km east towards Tallowa Dam (Allen 2002). The population area encompasses large areas of Morton National Park. Within the Shoalhaven Gorge population area, it has been estimated that some 7,500 ha of secondary koala habitat exists, supporting between 80 and 150 Koalas (Allen 2002). The Shoalhaven Gorge Koala population was described as a low-density population utilising secondary habitat,

spread at least in patches and consisting of breeding associations linked by the movements of dispersing young (Allen 2002).

North and west of the protected areas around the Bungonia and Shoalhaven gorges Koala records within the Bionet Atlas are very limited, with sporadic observations from private land and along roadsides, one being from the Marulan Quarry and two additional records (including road-kill) each from around the townships of Marulan and Tallong. These areas are more disturbed predominantly private tenure. They generally consist of more fertile areas that have been developed traditionally for agriculture. It is clear that Koalas are able to travel through such areas and feed trees, including primary feed trees, are available to them throughout such areas. Targeted Koala survey in these areas (private land on the tablelands) is likely to have been minimal and therefore actual Koala distribution and abundance within such areas is poorly known. Therefore, whilst it is acknowledged that limits exist regarding predictions of Koala distribution and abundance within the locality, given previous disturbance resulting in fragmented vegetation, and the lack of Koala records within the higher elevation areas away from the protected areas around the Bungonia and Shoalhaven gorges, it is considered unlikely that active Koala areas (with permanent and moderate to high densities of Koalas) such as those within the Bungonia National Park/SCA would extend into the Study Area.

Whilst the Koala was not recorded within the Study Area during the targeted surveys, it is recognised given previous sightings throughout the locality, that the Koala may use the habitat features of the Study Area on occasion. In order to determine the area of habitat within the Study Area that the Koala may utilise, the area of occupancy has been determined by considering the density and composition of preferred feed trees listed as primary, secondary and tertiary feed species under the National recovery plan for the Koala (DEC 2008). Occupiable habitat was considered as areas where either two or more known feed tree species occurred, or a single feed species occurred and occupied more than 50% of the canopy cover within a 400 m2 floristic quadrat. Highly disturbed and substantially cleared areas were excluded as habitat.

The area of habitat has been split into areas deemed poor/unsuitable (very limited use/if any), moderate (contains Koala feed trees however is limited in movement due to steepness of terrain), and good (containing Koala feed trees with relatively limited obstacles in regards to movement). The Koala has therefore been attributed to an area of 27.1 ha of occupiable habitat within the Study Area (Figure 12).

This area has been regarded in this assessment as the Species polygon for the Koala, which has been addressed later in the report to generate the species credits required for the Project.

4.7.2 EPBC Act listed fauna

A total of 35 EPBC Act listed fauna were considered in the assessment based on the database reviews detailed in section 4.1. Of these species, eight were considered to have a moderate to high likelihood to utilise the habitat features of the Study Area for foraging.

Three EPBC Act Vulnerable listed fauna that have foraging habitat within the Study Area include the Koala, Large-eared Pied Bat and Grey-headed Flying Fox. Both the Koala and large-eared Pied Bat have been discussed in detail in sections above. The Grey-headed Flying Fox is only likely to utilise the Study Area on occasion for foraging. No roosting camp sites were observed in the Study Area, nor known to occur within close proximity to the Study Area.

Threatened amphibians generated in the database searches include the Giant Burrowing Frog, Green and Golden Bell Frog and Littlejohn's Tree Frog. After considering the habitat requirements for these species, all have been regarded as unlikely to occur in the Study Area given the lack of suitable habitat (Appendix 1). It should be noted that none of these species have been previously recorded within the locality. Based on the

habitat requirement, nil detection during surveys, coupled with the absence of records within the locality, all three threatened amphibians are regarded as being absent from the Study Area and therefore have not been considered further.

Threatened birds with limited potential to occur in the Study Area listed as Vulnerable under the EPBC Act include the Regent Honeyeater, Australasian Bittern, Curlew Sandpiper, Painted Honeyeater, Swift Parrot, Eastern Curlew and Australian Painted Snipe. None of these species were detected during the bird surveys completed as part of this assessment. Only one record provided on the BioNet Atlas for the Australasian Bittern occurs approximately 2.5 kilometres to the south-east of the Study Area within native vegetation of the Bungonia State Conservation Area. Unlike the Study Area, the site of this record contains relatively intact native vegetation and is part of an extensive native vegetation corridor. Based on the specific habitat requirements of each of the species (Appendix 1), and the lack detection during targeted surveys, it is likely that the habitat features within the Study Area would only be used on an intermittent basis for foraging. The extensive native vegetation that occurs throughout the land to the south and east within Morton National Park and Bungonia State Conservation Area are likely to offer greater habitat availability for each of the species. As such, the species have been given a low likelihood of occurrence within the Study Area (Appendix 1).

During the field survey, no migratory species listed under the EPBC Act were recorded. However, a number of listed migratory species have been recorded from the locality and in some cases have the potential to fly over the Study Area (see Appendix 1). Species include: Fork-tailed Swift, Cattle Egret, Rainbow Bee-eater, Black-faced Monarch, and Rufous Fantail. The Vulnerable EPBC Act species – the Large-eared Pied Bat, and Grey-headed Flying Fox also have potential foraging habitat throughout the Study Area. Impacts of the Project on these EPBC Act listed species are considered further in section 5.

4.8 State Environment Planning Policy 44 – Koala Habitat

The State Environment Planning Policy 44 – Koala Habitat (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) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat, and

(b) by encouraging the identification of areas of core koala habitat, and

(c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

SEPP 44 Koala habitat applies to Local Government Areas (LGAs) listed in Schedule 1 of SEPP 44, and where the development has an area of more than 1 hectare.

The Study Area occurs within the Goulburn Mulawaree Local Government Area (LGA) which is not listed in Schedule 1 of SEPP 44. However, the Mulawaree LGA is listed in Schedule 1 which was amalgamated with Goulburn LGA in 2004. As such, the SEPP applies to the Study Area.

Under SEPP 44, potential Koala habitat includes: '*areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*'. Of the Trees listed in Schedule 2, only *Eucalyptus tereticornis* and *E. viminalis* applies to the Study Area. However it should be noted that *E. tereticornis* is likely a hybrid in the Study Area with *E. blakelyi X.* These trees are scattered throughout the Study Area amongst *E. bosistiana, E. melliodora* and *E.*

eugeniodes. The trees would meet at least 15% of the total number of trees within the Study Area, and therefore the habitat present is regarded as potential Koala habitat under the SEPP 44.

Core Koala habitat means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population. Surveys and collection of anecdotal evidence of Koala sightings conducted within the Study Area as part of this assessment revealed that Koalas have been sighted sporadically surrounding the Study Area over the past decade, with Koalas observed every 2- 3 years around the mine (pers. comm. Grant Thompson – Boral).

The Koalas sighted are quite likely to have been from the Bungonia National Park and Bungonia State Conservation Area population (Bungonia population) which is a well-known population which extends along the Shoalhaven Gorge and extending approximately 30 km to the south of the Study Area (e.g. Allen 2002). The Koala population occurs approximately 2 km south of the Study Area with the majority of records within the gorge/valley. This population would undoubtedly be regarded as occurring within core habitat given the number of records, and known breeding population.

The Bungonia population is separated from the Study Area by the Bungonia Gorge, a limestone gorge approximately 350 m deep. The steepness of the gorge would limit connectivity between the main known breeding area of Koalas in the locality (Bungonia population) and the Study Area, however there are records of the Koala from both sides of the gorge (albeit very limited from the northern side) and connectivity to the Study Area exists indirectly, west of the main gorge area.

North and west of the protected areas around the Bungonia Gorges, Koala records within the NSW Atlas of Wildlife are very limited with sporadic observations from private land and along roadsides, one being from the Marulan South Limestone Mine and two additional records (including road-kill) each from around the townships of Marulan and Tallong. These areas are more disturbed, predominantly private tenure. They generally consist of more fertile areas that have been developed traditionally for agriculture. It is clear that Koalas are able to travel through such areas and feed trees including primary feed trees are available to them throughout such areas.

Despite the limits regarding Koala distribution and abundance, given previous disturbance resulting in fragmented vegetation and the lack of Koala records within the higher elevation areas away from the protected areas around the Bungonia and Shoalhaven gorges, it is considered unlikely that active Koala areas (with permanent and moderate to high densities of Koalas) such as those within the Bungonia population would occur.

Within the Study Area, no Koala observations are known. Scat surveys, spotlighting, call-playback and tree surveys did not identify repeated or on-going use of trees within the Study Area. Therefore, whilst it is known that Koalas can occur on occasion within these areas of potential habitat similar to that of the Study Area near the existing mining operations, it is unlikely that a resident population of Koalas would reply on the habitat features of the Study Area on a regular basis. As such, 'core habitat' within the Study Area is unlikely.

5. Impact Assessment

The Impact Assessment below forms Stage 2 of the BDAR as detailed in the BAM.

5.1 Avoid and minimise impacts

In accordance with the BAM, proponents must demonstrate the measures employed to avoid, mitigate and offset impacts of a project on biodiversity values. This section of the report outlines the avoidance planning, management and mitigation measures that Boral has incorporated into the project design or will employ during construction, operation or completion of the project to reduce impacts on biodiversity values.

As detailed in the Environmental Assessment, throughout the process of site planning Boral had identified three alternative overburden locations as shown on Figure 11. The alternative options were:

- Option 1 north-west– west of the rail loop and near receiver labelled R4, Tangarang Dam and a dam upstream of Tangarang Dam;
- Option 2 north – north of the quarry pit and between Marulan and Tangarang creeks; and
- Option 3 far north – north of the Quarry, Option 2 and Marulan Creek.

The alternative options would all be further from the Quarry pit than the proposed SWOE (the preferred SWOE option). The alternative options would be closer to sensitive receivers (when measured from a potential emplacement area to a residence) than the preferred SWOE option, as shown in Table 11 and Figure 11. The only exception occurs in relation to Option 3 and R13, where the emplacement would be adjacent to the property boundary but approximately 1,500 m from buildings on the property.

Table 11. Distances of overburden emplacements to nearest receivers (m)

Receiver	Emplacement option			
	SWOE	1	2	3
R3	-	1,150m	1,000m	1,300m
R4	-	1,140m	1,130m	-
R8	1,450m	-	-	-
R13	-	3,800m	2,900m	1,500m

Of the alternative options identified, a comparison between each has been made in the Environmental Assessment and included in this section of the report.

The comparison includes an evaluation on whether each of the three alternative options are better, worse or neutral in their potential impacts on the key environmental, social and economic matters assessed in the Modification 5 Environmental Assessment, when compared to the preferred SWOE. Table 12 includes a comparison of all options compared to the preferred SWOE option.

The better, worse or neutral impacts were determined for the environmental aspects assessed in the Environmental Assessment, using the following methods:

- Noise and air quality: the distance of receivers to the proposed options were compared to the distances of the SWOE to its nearest receivers, in combination with local wind trends.

  It was assumed the impact would be worse if the option is closer to a receiver than the SWOE is to its nearest receivers.
- Visual amenity – like noise and air, distances from the options to nearest receivers were compared and the impact of intervening terrain and vegetation on sight lines was considered.
- Surface water – the requirements for new water management structures were considered against the use of existing structures by the SWOE. As the options would be near watercourses currently largely unaffected by the Quarry it was assumed this would result in additional impact over the SWOE associated with surface disturbance, changes to catchment areas and potential discharges from water management structures.
- Aboriginal heritage – the alternative locations were considered in their landscape context and compared to known Aboriginal heritage sensitivities in similar previously assessed landscapes, for example, the assessment of the proposed Marulan South Dam site for the Marulan South Limestone Mine Environmental Impact Statement (not yet publicly available).
- Historic heritage – the proximity of the alternative locations to known heritage items was determined and compared to that for the SWOE.
- Traffic – the need for the proposed intersection was considered as the alternative options would be north of Marulan South Road, whereas the SWOE would be south of the road.
- Biodiversity – the area of impact to native vegetation and threatened biodiversity habitat has been assessed for each option using desktop analysis and results of field surveys completed within the locality by Niche. Each of the options were assessed in terms of likely impacts and indicative biodiversity offsetting credits in comparison to the proposed SWOE.
- Greenhouse gas – haulage distances for the alternative options were compared to the SWOE haulage distance, it was assumed there would be more emissions if the options are further from the Quarry pit than the SWOE.

The following other aspects were considered in addition to the environmental aspects assessed in the Environmental Assessment:

- Resource sterilisation – the locations of the alternative options were considered in relation to known resource deposits and compared to the SWOE in relation to deposits it may overlie.
- Economic viability – changes to infrastructure, new infrastructure requirements and potential haulage distances were compared to those for the SWOE to determine which would be the most cost-effective option.
- Safety – preferred SWOE and alternative option haul route locations were considered with reference to the potential for haul vehicles to interact with light vehicles and pedestrians. It was assumed options resulting in less interaction would be safer than those resulting in more interaction.

The alternative options were considered using the above method and it was concluded by boral that the alternative options would:

- be closer to receivers and would have increased noise, air quality and visual impacts compared to the preferred SWOE option;
- require expensive changes to the quarry's processing/infrastructure area and Dam 1 dam wall to accommodate haul routes;
- have increased surface water impacts as they would be adjacent to Tangarang Creek and Marulan Creek;
- have increased water requirements for dust suppression;
- impact land with moderate to high archaeological sensitivity;
- result in increased greenhouse gas emissions due to the longer haul distances;

- sterilise granodiorite resource under options 2 and 3; and
- increase safety risks around the processing/infrastructure area as haul vehicles may have to cross areas used by other vehicles and pedestrians.

As demonstrated through the assessment included in Table 12 Boral has completed steps to avoid direct impacts on biodiversity through the consideration of alternative locations within the existing land holding as well as the potential to transport material off site. However, as discussed in the Environmental Assessment, on the balance of all factors, Boral determined the preferred SWOE option would be the most appropriate location for overburden emplacement. The preferred location is regarded by Boral to represent either an equal or better overall outcome across the majority key assessment criteria, as it will result have fewer amenity impacts associated with noise, air quality and views; fewer impacts on sensitive aquatic environments; fewer impacts on Aboriginal and historic heritage; will result in fewer greenhouse gases being generated; will not sterilise granodiorite resource; and will have fewer potential safety impacts whilst also being financially viable.

Table 12. Analysis of alternative SWOE emplacement locations

Environmental aspect	Option			Description
	1. North-west	2. North	3. Far north	
Noise	Worse	Worse	Worse	Options 1, 2 and 3 would extend haulage and emplacement activities further north and closer to Boral's boundaries and adjacent sensitive receivers (R3, R4 and R13). As there would be long haulage routes to Options 2 and 3, there is a risk haulage and emplacement noise emissions enhanced by the autumn, spring and summer easterly winds would impact receivers to the west (R3 and R4). There is also a risk that R3 and R13 could be impacted by emplacement noise emissions during winter southerlies and south-south-easterlies. The noise impacts, shown by the noise contours (representing noise levels in decibels emanating from the project area) in Appendix B of the noise impact assessment report (Wilkinson Murray 2018), may be extended further north and towards additional receivers (R3, R4 and R13) contributing to noise impacts at receivers that would be avoided by the preferred SWOE location.
Air quality	Worse	Worse	Worse	Similar to noise, alternative options would locate the overburden emplacement closer to sensitive receivers. The $PM_{2.5}$, PM_{10}, deposited dust and total suspended solids impacts, shown by the isopleths (representing pollutant concentrations emanating from the project area) in Appendix D of the air quality impact assessment report (Todoroski Air Sciences 2018), would extend towards R3, R4 and R13. There is a risk haulage and emplacement dust emissions enhanced by the autumn, spring and summer easterly winds would impact receivers to the west (R3 and R4). There is a risk that R3 and R13 could be impacted by emplacement dust emissions during winter southerlies and south-south-easterlies. Also, there would be much longer haul distances of between 1,700 m and 3,000 m on unsealed roads to Options 1, 2 and 3, while the haul distance to the SWOE would only be approximately 420 m. Therefore, the alternative options would generate significantly greater dust emissions from overburden hauling.
Surface water	Worse	Worse	Worse	All alternative options would require extensive new and extended water infrastructure and management devices, increasing the potential area of disturbance combined with construction of new and more extensive haulage routes, in turn increasing water demand associated with dust control. The options would contribute flows and potentially sediment to adjacent waterways. Option 1 would drain into an existing dam upstream of Dam 1, which is on Tangarang Creek. Option 2 would drain into Marulan Creek and Marulan Creek Dam, which is proposed in the limestone mine SSD

Environmental	Option			Description
				application. Option 3 would be adjacent to Marulan Creek and a tributary to the creek. Marulan Creek and its tributaries are not currently impacted by flows and sediment from the quarry. The preferred SWOE site will drain to the mine pit via sediment basins (existing and proposed)and avoid direct drainage into water courses
Aboriginal heritage	Worse	Worse	Worse	Previous investigations of landscapes like Option 1 (relatively flat and broad spurs near a water course) showed such areas have medium archaeological sensitivity. Option 1 would be between two major waterways for the area; Marulan Creek and Tangarang Creek, suggesting Aboriginal heritage items would be encountered as the landform is similar to those determined in the Marulan South Limestone Mine environmental impact statement (not yet publicly available) as having Aboriginal heritage sensitivity. Options 2 and 3 would be near Marulan Creek. Aboriginal investigations around Marulan Creek for the Marulan Creek Dam proposed in the Limestone Mine SSD application showed areas within 200 m of the creek and a spur crest have moderate archaeological sensitivity, and the broad prominent crests surrounding the creek have high archaeological sensitivity. Therefore, all three options are likely to support areas of both moderate and/or high archaeological sensitivity, and it is highly likely Aboriginal items would be impacted during emplacement activities at these alternative locations. There is one site of moderate significance in the proposed SWOE area, which comprises a subsurface artefact deposit (refer to EA). The alternative emplacements would be in landscapes of higher archaeological significance than the SWOE. On balance, the preferred SWOE site was considered to be that with least disturbance and impact potential.
Historic heritage	Neutral	Neutral	Worse	Similar to the preferred SWOE site, Options 1 and 2 are not located within proximity to any known or registered items (local or state) of historic significance. Option 3 would be within 1,500 metres of the boundary to the adjacent property containing Glenrock homestead and outbuildings, listed as an item of local heritage significance (I314) under Schedule 5 of Goulburn-Mulwaree Local Environmental Plan 2009 (LEP). Glenrock, is listed for its “built” heritage due to the style and form of the residence and associated agricultural structures along with its associative and historic themes (i.e. developing local, regional and national economies) (OEH. The statement of significance does not mention vistas and views to the buildings as important, so the impacts of potential views of the alternative emplacements on the item’s heritage significance cannot be determined. Notwithstanding the above, the item falls under the ‘farming and grazing’ group/collection, and Option 3 would be in proximity to the southern boundary of the property containing the item and has the potential to disrupt the

Environmental	Option			Description
				context and setting of the item throughout construction of the emplacement.
Visual amenity	Worse	Worse	Worse	The heights of the completed emplacement options were measured and compared to the heights of the nearest receivers to predict if the emplacements would be visible from residences. It was assumed the emplacement would be visible if it was higher than the receiver. The presence of intervening topography and vegetation was considered in each case to determine if it would provide visual screening. For all alternative options, a total of three (3) potential receivers were identified (R3, R4 and R13) refer to Figure 11. The alternative emplacement options would all be visible from nearby receivers. The SWOE would be partially visible from a public viewpoint (at the end of Long Point Road) and four residences would have minor views to the SWOE. For Option 1, the top of the emplacement would be 660 m when complete, which would be approximately 45 m higher than the residence at R4 and therefore be visible from R4 given there is no significant intervening topography. However, it is noted that trees could provide some screening. R3 (elevation 645 m) and R4 (elevation 614 m) are on top of the Marulan Creek valley slopes, to the north of the creek. Options 2 and 3 would be east of the identified receivers on the southern (Option 2) and northern (Option 3) slopes of the valley. They would be on the other side of the valley from the receivers, and there is no significant topography between the receivers and emplacement options. Options 2 and 3 would have maximum elevations of approximately 643 m prior to rehabilitation and up to 663 m after trees are established. Option 2 would be approximately the same height as R3 and R4 when complete, and vegetation on the rehabilitated emplacement would be up to 20 m higher than these receivers. There is minimal existing vegetation between R4 and Option 2, and some vegetation (downslope of the residence) between R3 and Option 2. However this vegetation could provide some screening of views to the emplacement options. Option 3 would be approximately the same height as R3 when complete, and vegetation on the rehabilitated emplacement would be up to 20 m higher than this receiver. There is minimal vegetation between R3 and Option 3. However this vegetation could provide some screening of views to the emplacement options. According to the visual impact assessment report prepared for the Environmental Assessment (Richard Lamb and Associates 2018), the Eastern Overburden Emplacement (650m in elevation) is partially visible from R13. Therefore, the alternative emplacement locations (Option 3 would be 653 m in elevation) would each likely be visible from R13 as they are closer to this receiver than the Eastern Overburden Emplacement.
Traffic	Neutral	Neutral	Neutral	The alternative emplacement options and Quarry would be on the northern side of Marulan South Road. Therefore, haul trucks would no longer need to cross the road as they would under the proposal (as the SWOE will be south of the road).

Environmental	Option			Description
				However, the SWOE is proposed to be shared with Marulan South Limestone Mine, which requires approximately 2 million tonnes of overburden space within the SWOE. Therefore, haulage trucks from Marulan South Limestone Mine would still need to cross Marulan South Road to access the alternative emplacements and the proposed intersection will still be required.
Biodiversity	Better	Better	Better	All three options would have a better biodiversity outcome compared to the proposed SWOE as detailed below: Option 1: would be in a grazed paddock which contains scattered eucalypts consisting of *Eucalyptus blakelyi X, E. melliodora* and *E. bosistiana*, with a predominantly non-native understorey. The vegetation would align to PCT1334 Yellow Box - Blakely's Red Gum grassy woodland, which would meet the definition of White Box Yellow Box Blakely's Red Gum Grassy Woodland TEC under both the BC Act and EPBC Act given the presence of canopy species, and patch size. It is likely given the condition of the TEC (scattered trees, with no midstorey and shrub layer, with predominantly introduced ground cover) it would equate to low vegetation integrity scores. In total, approximately 17.8 ha of the TEC would be impacted if this option were to proceed. This would require approximately 320 ecosystem credits based on an average of 18 credits per hectare. In regards to the potential for threatened flora to occur at the optional site, given the relatively degraded condition of the understorey and the existing grazing pressures, it is unlikely that any threatened flora would be impacted. Fauna habitat is limited to the scattered eucalypts throughout the optional area, which is likely to provide some habitat to more mobile species such as birds, microbats, and some mammals. Microhabitat features such as logs and hollows are likely to be sparse. In regards to threatened fauna, Option 1 would likely be regarded as moderate Koala habitat and Large-eared Pied Bat habitat, given both species have been recorded during the field investigations completed by Niche, or recorded previously within relatively close proximity to the option area. As such, biodiversity offsets for both species would be required under the BAM. It is estimated the following species credits would be required: Koala: approximately 320 species credits based on 17.8 ha of habitat impact (average of 18 credits per ha). Large-eared Pied Bat: approximately 463 species credited based on 17.8 hectares of habitat impact (average 26 credits per ha). In summary, Option 1 would provide a lesser impact and offsetting requirement to the TEC, Koala habitat and Large-eared Pied Bat habitat when compared to the proposed SWOE (see section 5.3.1 and 5.3.2 for SWOE offset liability). Option 2: would be in an open paddock with a patch of native vegetation toward the southern portion of the optional area.

Environmental	Option			Description
				This option would result in impacts to approximately 36 hectares of non-native vegetation, and 1.7 hectares of vegetation likely aligned to PCT778. This PCT is not listed as a TEC under the BC Act or EPBC Acts. In total, it is estimated that the option would require 31 ecosystem credits based on an average of 18 credits per hectare. In regards to the potential for threatened flora to occur at the optional site, given the relatively degraded condition of the understorey and the existing open pasture grass areas, it is unlikely that any threatened flora would be impacted. This is supported by Niche surveys within the general area which did not record any threatened flora. Fauna habitat is limited largely to the open grassland areas, and the patch of eucalypts to the south. The patch may offer 'island habitat' to mobile birds and microbats. It is unlikely that threatened mammals, such as the Koala would utilise the area given the patch of vegetation is already fragmented by the existing rail loop, and open paddocks. However, it is likely that the patch would be regarded as foraging habitat for the Large-eared Pied Bat, given the species have been recorded during the field investigations completed by Niche, or recorded previously within relatively close proximity to the option area. As such, biodiversity offsets for the Large-eared Pied Bat would be required under the BAM. It is estimated that approximately 44 species credits would be required for the Large-eared Pied Bat based on 1.7 hectares of foraging habitat impact. The option would be relatively close to Marulan Creek and therefore would require a number of mitigation measures to ensure indirect impacts are prevented from entering the creek system. In summary, Option 2 would provide a lesser impact and offsetting requirement to native vegetation and Large-eared Pied Bat habitat when compared to the proposed SWOE. Option 3: would be in an open paddock to the north of Marulan Creek, with thin strips of native vegetation along sections of an access track. This option would result in impacts to approximately 40 hectares of non-native vegetation, and 0.5 hectares to native vegetation. It is highly unlikely the native vegetation present would align to a TEC under the BC Act or EPBC Acts. It is likely that the vegetation would align to PCT778. In total, it is estimated that the option would require 9 ecosystem credits based on an average of 18 credits per hectare. In regards to the potential for threatened flora to occur at the optional site, given the relatively degraded condition of the understorey and the existing open pasture grass areas, it is unlikely that any threatened flora would be impacted.

Environmental	Option			Description
				Fauna habitat is limited largely to the open grassland areas, and the thin strip of trees located along the paddock boundary. The thin strip of trees is unlikely to contain any important habitat for threatened fauna, however, given the Large-eared Pied Bat has been recorded within the general area, and is within 3 kilometres of cliff line habitat, the trees would be regarded as foraging habitat and would need to be offset. As such, biodiversity offsets for the Large-eared Pied Bat would be required under the BAM. It is estimated that approximately 13 species credits would be required for the Large-eared Pied Bat based on 0.5 hectares of foraging habitat impact. This option would likely require a number of mitigation measures in relation to noise, dust and air quality controls compared to the other options given the distance for haulage. In summary, Option 3 would provide a lesser impact and offsetting requirement to native vegetation and Large-eared Pied Bat habitat when compared to the proposed SWOE.
Greenhouse gas	Worse	Worse	Worse	The proposed haul route to the SWOE will be approximately 420 m from the closest extent of the emplacement to the pit. The haul routes to the alternative locations would be at least 1,000 m, 1,300 m and 2,600 m longer for Options 1, 2 and 3 respectively. The haul truck trips on these routes would result in increased consumption of diesel and more greenhouse gas emissions compared to the SWOE.
Resource sterilisation	Neutral	Worse	Worse	Clause 13 of State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 applies to an application for consent for development on land that is identified by an Environmental Planning Instrument as being the location of significant resources of minerals, petroleum or extractive materials. Before determining an application to which clause 13 applies, the consent authority must consider whether the development is likely to have a significant impact on current or future extraction or recovery of extractive materials (including by limiting access to, or impeding assessment of, those resources). Map Sheet MRA-003 (Mineral Resource Area Map) of the LEP shows that Options 2 and 3 would be on mineral resources (the northern section of the granodiorite reserve). Options 2 and 3 would limit access to, and impede assessment of, the granodiorite resource, thus impacting future extraction of this resource. There is no granodiorite resource under the proposed SWOE or Option 1.
Economic viability	Worse	Worse	Worse	The alternative emplacement options would be north-west (Options 1 and 2) and north (Option 3) of the Quarry pit, Dam 1 and processing/infrastructure areas. Each options would need to be accessed via the processing/infrastructure area and Dam 1 dam wall. This would require the formation of new roads, movement of overhead impediments such as conveyors, and widening of the dam wall to accommodate a two-way haul route specification road. Additionally, a new crossing would need to be installed over the rail line to enable access to Option 1. These works would be expensive and may not be able to be carried out prior to the need for the new emplacement area due to the construction timeframes involved and the need to start emplacement activities.

Environmental	Option			Description
				Alternatively, a bridge could be constructed north of the pit and downstream of Dam 1 along Tangarang Creek. However, this area is vegetated and it would have high archaeological sensitivity given its proximity to the creek. A two-way bridge built to haul road specifications would be expensive. The haul routes to the alternative emplacement options would each be longer than the SWOE haul route and would have associated increased construction and on-going dust management and significantly higher fuel costs.
Safety	Worse	Worse	Worse	The alternative emplacement options would be less safe than the SWOE because their haul routes would need to pass through the Quarry's processing and infrastructure area. This would either require interaction with non-haul traffic and pedestrians, or require the construction of an expensive over/underpasses. Additionally, the haul routes would need to cross the Dam 1 dam wall, which would need to be widened to two-way haul road specifications. The risk of dangerous interactions with other vehicles and pedestrians in the highly trafficked processing and infrastructure area makes haulage for the alternative options a safety risk. Additionally, it is Boral policy to separate vehicle and pedestrian routes to ensure pedestrian safety.

5.1.1 Mitigation measures (construction and post-construction)

Impacts arising from the construction will primarily relate to vegetation clearing. Boral proposes to undertake the following mitigation and management actions during construction.

Fencing and signposting

Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the Study Area.

Signposting will be used to inform Project personnel and site visitors of areas of conservation value to restrict entry or inform behaviour that will reduce incidental interactions with threatened species - e.g. speed limits along access roads to reduce potential for fauna vehicle strikes.

Employee Education and General Environmental Controls

Employees and contractors would be educated on and required to implement the following controls, to avoid or at least minimise potential environmental impacts associated with the construction of the SOE:

- minimise dust generation by minimising the extent and time that bare soil is exposed and by appropriate dust suppression.
- procedures for the management of hydrocarbon and/or chemical spills throughout the Study Area including the requirements for vehicles to carry spill kits.
- ensuring vehicles remain on designated roads and tracks and abide by site speed limits, through use of signposting and driver education during the induction process and in on-going Project discussions.
- management and removal of all rubbish from the Study Area.

Vegetation Clearance Protocol

The vegetation clearing protocol provided in Boral's Peppertree Quarry Landscape and Rehabilitation Management Plan is to be adhered to. This Plan includes the following key protocols:

- Prior to clearing of grassland and woodland, ecologists are to survey for ground dwelling fauna and to remove any fauna/ fauna habitats to adjacent areas that would not be further disturbed.
- Prior to clearing of remnant hollow-bearing trees or habitat trees, ecologists are to be engaged to supervise felling. All hollow-bearing trees that are accessible safely from the ground are to be checked and identified fauna relocated. Hollows higher up and not accessible from the ground are to be identified and trees felled gently by an excavator or dozer and left overnight to allow fauna to relocate.
- Any fauna displaced during clearing are to be captured where possible and relocated to pre-planned areas (fauna to be captured and handled only by personnel trained to do so).
- In an event that fauna are injured during clearing, the NSW Wildlife Information, Rescue and Education Service (WIRES) will be contacted to handle and collect for appropriate care and rehabilitation.

5.1.2 Rehabilitation

The disturbance would be progressively rehabilitated in accordance with the Peppertree Quarry Landscape and Rehabilitation Management Plan, to create a stable landform that does not result in sediment laden runoff or fugitive dust emissions, blends well with the adjacent natural landscapes of the Morton National Park and re-establishes a native bushland dominated by White Box Yellow Box Blakely's Red Gum Grassy Woodland species, which outcompetes invasive weed species.

Update of Peppertree Quarry Landscape and Rehabilitation Management Plan

Boral's Peppertree Quarry Landscape and Rehabilitation Management Plan will need to be updated to reflect biodiversity management measures associated with the proposed overburden emplacement in order to protect and manage important biodiversity values. Currently, the existing Plan discusses key commitments relating to threatened species management, pest and weed management, fire management and site hygiene practices. The contents of the existing Landscape and Rehabilitation Management Plan has been provided in Appendix 9.

5.1.3 Pest and weed management

The existing Plan would be updated to include a section relating to pest and weed management activities of the Project including:

- Management protocols for feral animals such as foxes, goats, rabbits and cats within the rehabilitation area.
- Management protocols for the identification of noxious or important environmental weeds within areas to be cleared (in order to avoid transporting the weeds to rehabilitation areas or other parts of the site).

5.1.4 Fire management

Boral currently have a Bushfire Management Plan (Boral 2015) for the South Marulan Operations. Fire prevention and suppression are detailed within the Plan including emergency protocols should a fire occur. This Plan would be updated where required to reflect the Project.

5.2 Impact Summary

The project would affect biodiversity, including threatened biodiversity through both direct and indirect impacts during construction and operation. The majority of impacts on biodiversity would occur during construction from clearing of native vegetation and removal of habitat.

The direct and indirect impacts associated with project and measures to offset and manage biodiversity in the long term are outlined the following sections.

5.3 Direct Impacts

The following residual direct impacts would result from the project:

- Clearing of native vegetation and associated habitat, conservatively estimated to be 39.7 ha.
- The area of clearing includes impacts to 27.7 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodland, which is listed as a TEC.
- Clearing of species credit fauna habitat for the following:
    - Koala habitat estimated to be 27.1 ha
    - Large-eared Pied Bat estimated to be 27.1 ha.

The majority of vegetation likely to be affected by the Project has been subject to historic clearing and other agricultural activities such as grazing and is therefore thinned, fragmented and dominated in areas by Serrated Tussock.

5.3.1 Direct impact to native vegetation and habitat

The Project would result in the clearing of 39.7 ha of vegetation regarded as 'native vegetation,' as defined in the BAM. The majority of vegetation likely to be affected by the Project has been subject to historic logging, grazing, and other agricultural activities, and is therefore thinned in areas, and dominated in areas by Serrated Tussock. This site disturbance is evident in all condition classes of PCT1334 Yellow Box - Blakely's Red Gum grassy woodland generating a relatively low vegetation integrity score.

In total, the area attributed in this assessment as a moderate condition class (canopy present) is 27.1 ha, and the area attributed to a poor condition class is 12.6 ha.

5.3.2 Direct impact to White Box Yellow Box Blakely's Red Gum Grassy Woodland

The Project would result in a direct impact to 27.7 ha of the TEC White Box Yellow Box Blakely's Red Gum Grassy Woodland. As discussed in section 3.2, the TEC has been attributed to two different condition classes that make up PCT1334 Yellow Box - Blakely's Red Gum grassy woodland.

The TEC is located within the areas proposed Study Area on the gentle slopes and relatively flat terrain.

The TEC to be impacted is in a modified state, due to previous land clearing, grazing, feral pest grazing, over abundant herbivore grazing, and due to the abundance and spread of Serrated Tussock. This is a common theme for the TEC, as throughout its range, the TEC has been reduced in area and highly fragmented because of clearance for cropping and grazing and pasture improvement due to the ecological community's occurrence on fertile soils. Very few high quality remnants remain anywhere across its former range. The EPBC Policy Guidelines (DoE 2014) state that over 90% of the original extent of this ecological community has been cleared. This is supported by OEH (2014) who regarded the equivalent Biometric Vegetation Type to be 90% cleared, and Thomas et al. (2000) estimate that within South-Eastern NSW 59,468 ha remain from the pre-1750 extent of 1,012,052 ha (approximately 94% cleared).

The areas of the TEC within the Study Area are already fragmented by Marulan South Road and areas of cleared land to the east and north of the Study Area. This is a common theme for the TEC which is already highly fragmented in the locality. The Project will lead to increased fragmentation of the ecological community in the local context, however connectivity will be retained within contiguous habitat around the periphery of the Study Area.

As the TEC is regarded as a Serious and Irreversible Impact (SAII) candidate entry under the BAM, further consideration of the impacts on the TEC have been provided in Appendix 6.

An Assessment of Significance under the EPBC Act has also been completed for impacts on the TEC (Appendix 8). The Assessment concluded that a significant impact was likely, and thus triggering the need to offset the impacts under the EPBC Act (section 6).

5.3.3 Direct impact to Koala habitat

A discussed in section 4.6, the Koala is expected to use portions of the Study Area on a limited basis.

Impacts from the Project largely relate to the removal of foraging and dispersal habitat that has been defined as being critical to the survival of the Koala under the EPBC Act (DoE 2014; Appendix 8). Habitat mapped as good and moderate habitat potential, totalling 27.1 (Figure 12) contained either two or more known feed trees (listed as primary, secondary or tertiary species under the species Recovery Plan (DECC 2008) or a single feed species that occupied more than 50% of a 400 m2 floristic quadrat.

Such habitat is recognised as critical habitat using the EPBC Act Koala Guidelines due to past impacts on similar habitat limiting the Koalas ability to persist throughout its former distribution. The proposal includes the removal of 27.1 ha of such habitat, which through application of the guidelines is considered a significant impact under the EPBC Act (see Appendix 8 MNES Assessments of Significance). A further 105.2 ha of similar habitat would be impacted by the Marulan South Project (subject to a separate approval document) which has been taken into consideration in the MNES Assessment of Significance.

Due to the apparent limited use of the Study Area and its extremely small extent in relation to similar habitat for the Shoalhaven Gorge Koala population (7,500 ha), it is not considered that removal of this habitat alone, nor in combination with the Marulan South Project impacts, would significantly adversely impact the relevant Koala population (centred around the Shoalhaven Gorge) such that a decline would occur or that the population is placed at risk of extinction. Active sites for this population are concentrated within protected areas, and the Study Area is not likely to provide a significant link between active areas within the population's distribution or to any other Koala population. Furthermore, the habitat present is not regarded as *Core habitat* under SEPP 44 as discussed in section 4.8.

As the Koala is regarded as a SAII candidate entry under the BAM, further consideration of the impacts on the Koala have been provided in section 5.3.4.

An Assessment of Significance under the EPBC Act has also been completed for impacts on the Koala (Appendix 8). The Assessment concluded that a significant impact was likely, and thus triggering the need to offset the impacts under the EPBC Act (section 6).

5.3.4 Direct impact to Large-eared Pied Bat habitat

As detailed in section 4.6, 27.1 ha of foraging habitat for the Large-eared Pied Bat would be impacted by the Project which is shown on Figure 13. No breeding habitat would be impacted by the Project.

As previously discussed in section 4.7, the Large-eared Pied Bat is known to forage in a range of vegetation types, including dry and wet sclerophyll forest, grassy woodland, Callitris dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland and sandstone outcrop country (Hoye & Dwyer 1995; Pennay 2002; DECC 2007). Almost all records of the species are within several kilometres of cliff lines or rocky terrain, indicating that foraging habitat is limited to approximately 3 kilometres from clifflines. Foraging habitat is locally common given the species forages on a wide range of vegetation types, and given much of the land to the east of the Study Area which is centred along sandstone outcrops of Bungonia Creek and the Shoalhaven River are protected within Bungonia State Conservation Area, and Morton National Park. These areas provide well connected, intact remnant habitat for the Large-eared Pied Bat along Bungonia Creek and the Shoalhaven River. However it is noted that intact habitat (remnant undisturbed vegetation) within three kilometres of cliff lines and rock outcrops is scattered to the west and north of the Study Area compared to that of the east of Bungonia Creek and south in Bungonia Gorge. It is also noted that the Marulan South Project (subject to a separate approval) would result in direct impact to an additional 113.2 ha of foraging habitat, which consists of previously cleared woodland and forest gullies similar to that of the Study Area and planted vegetation.

The removal of the 27.1 ha of foraging habitat associated the Project, and combined with the additional 113.2 ha of foraging habitat associated with the Marulan South Project (subject to a separate approval) is unlikely to be critical to the overall species survival or the local occurrence of the species given the protection of foraging habitat for the Large-eared Pied Bat within Bungonia State Conservation Area and Morton Nation Park that occurs within the locality. The removal of foraging habitat is not likely to reduce the population of the Large-eared Pied Bat given the protected habitat available. Whilst not in the immediate term, it is worth noting that the site would be rehabilitated following decommissioning to a woodland structure, thus providing foraging habitat for the Large-eared Pied Bat.

As the Large-eared Pied Bat is regarded as a SAII candidate entry under the BAM, further consideration of the impacts on the Large-eared Pied Bat have been provided in Appendix 6.

An Assessment of Significance under the EPBC Act has also been completed for impacts on the Large-eared Pied Bat (Appendix 8). The Assessment concluded that a significant impact was unlikely to occur. A biodiversity offset under the EPBC Act is therefore not proposed for the impacts toward the Large-eared Pied Bat, however the species would be subsequently be offset in accordance with the BAM to satisfy the BAM offsetting requirement (section 6).

5.3.1 Direct impacts to EPBC Act listed fauna

As discussed above, the Project is likely to result in a significant impact to one EPBC Act listed fauna species: the Koala. Significant impacts to the Large-eared Pied Bat are considered unlikely.

As a precautionary and conservative approach, this assessment has also provided Assessments of Significance for impacts to threatened, migratory and relatively mobile EPBC Act listed fauna, which on occasion, may fly over the Study Area, or use it for foraging on an intermittent basis.

Assessments of Significance have been completed in Appendix 8 for the following EPBC Act listed threatened or migratory species: Fork-tailed Swift, Great Egret, Cattle Egret, Rainbow Bee-eater, Black-faced Monarch, Rufous Fantail and Grey-headed Flying Fox. The Assessments of Significance have concluded that a significant impact to these species is unlikely.

An Assessment of Significance was also completed for the Regent Honeyeater given the DoEE have regarded the site to be important habitat for the species. However the Assessment concluded that a significant impact for the species was unlikely due to the following:

- The species was not detected in the Study Area and surrounds during targeted survey
- The species has only been detected three times in the past 36 years within the Bungonia region that may suggest that the species potential usage of the Study Area is likely to be marginal/low.
- The closest historic records include the following:
    - Approximately 4.8 km south of the Study Area near Lockdown Road, Bungonia. This record was in made in 2005 within a gully environment near Bungonia Creek weir.
    - Approximately 5 km south of the Study Area near the Bungonia State Conservation Area office. This record was made in 1998.
    - Approximately 11.9 km south of the Study Area within private property. This record was made in 1983.
- The Project is unlikely to increase fragmentation for any population of the species.
- The species has potential habitat conserved within Morton National Park and Bungonia State Conservation Area, which occurs within the locality of the Project. Therefore the Project would not significantly limit the amount of potential habitat for the species within the immediate locality.

5.3.2 Indirect impacts

Indirect impacts associated with the Project will largely occur during the construction of the overburden emplacement resulting in a short term impact (i.e. the construction and rehabilitation phases of the overburden emplacement) and will be minimised where possible through management procedures. A range of indirect impacts are likely to, or could, occur as a result of the Project including:

- Increased noise and dust.
- Erosion or sedimentation in the drainage lines downslope.
- Increased spreading of weed propagules.

The indirect impacts described above are variable in terms of the distance they may extend from the Study Area, and in many cases, due to mitigation measures, indirect impacts will be completely contained within the Study Area.

Indirect impacts on the biodiversity values of areas surrounding the Study Area, along with recommended mitigation measures to minimise identified impacts, are discussed in Table 13. Boral would be responsible for carrying out the mitigation measures.

As required in the Commonwealth SEARs, the costs associated with the mitigation measures have been taken into account during the pre-feasibility assessment of the Project. Funds include (but not limited to):

- Improving Dam N2 to collect water from the western side of the SWOE (ie. mitigating sedimentation from adjacent areas) – approximately $35K.
- Weed management on SWOE (ie. preventing weed spread into adjacent areas) – approximately $15K/year.
- Dust management on SWOE (ie preventing impacts of dust settling on adjacent forest), truck maintenance, fuel and wages – approximately $250K/year.

Table 13. Indirect impacts and mitigation measures

Indirect impact	Likely impact from the Project	Potential extent of the indirect impact prior to mitigation measure	Mitigation measure	Expected success of mitigation measure
Edge effects	The establishment of the new overburden emplacement would result in the creation of new edges adjacent to areas of existing native vegetation to the south. The new edges could facilitate the establishment and spread of introduced plant species, however appropriate monitoring and control measures would be implemented during and after construction, to counter act the potential for weed occurrences. The overburden emplacement would be progressively rehabilitated and will eventually be entirely revegetated to a native, open woodland community, which will recreate fauna habitat and minimise the edge effect created during construction disturbance.	Varying distance from subject site. Potentially occurring within 50 metres from the disturbance area throughout the active life of the Project.	Fencing and/or the use of highly visible rope or tape boundaries will be used to delineate the boundary of vegetation clearing at the edge of the emplacement, in particular areas of White Box Yellow Box Blakely's Red Gum Grassy Woodland mapped adjacent to the Study Area as shown in Figure 7. Signposting and education will be also be used to inform Project personnel of no-go areas. Weed management and monitoring to be updated in the existing Biodiversity & Rehabilitation Management Plan 2017 (Boral 2017).	Active weed, and pest management are anticipated to be successful at managing edge effects from the Project.
Weeds	Weeds have the opportunity to establish themselves in areas of disturbed vegetation. The greatest establishment of weeds are in areas already disturbed or subject to agricultural land use. This is mainly toward the north of the Study Area. However, it should be noted that weeds were common throughout the entire Study Area. The Project has the potential to increase or lead to the establishment of weed species where they do not currently exist through the operation of machinery during construction. New weed species can potentially be introduced as a result of the movement of construction vehicles and materials into the Study Area. Areas more likely to be exposed to weed increases are areas of native vegetation that occur to the south of the Study Area. However, weeds will be controlled during and after construction in accordance with the Landscape and Rehabilitation Management Plan and thus indirect impacts from weeds is likely to be minor within the adjacent woodland areas.	Variable depending on topography. However, typically would occur within close proximity to disturbance area.	Weed management and monitoring to be implemented in accordance with the Landscape and Rehabilitation Management Plan.	Active weed control methods are likely to be successful in managing the spread of weeds within adjacent areas.
Erosion and	Erosion of soils and associated sedimentation associated with the	Variable depending on	Stormwater management measures	Sedimentation control are known

Indirect impact	Likely impact from the Project	Potential extent of the indirect impact prior to mitigation measure	Mitigation measure	Expected success of mitigation measure
sedimentation	proposed overburden emplacement may involve the following: • Alteration of soil structure beneath haul roads. • The increase of surface water flow from the Study Area during rain events into the woodland areas to the south may result in erosion. • The deposition of soil particulates in drainage lines and remnant vegetation along the toe of the emplacement.	topography and operation.	will be implemented in accordance with the recommendations in the Peppertree Quarry Modification 4 Surface Water Assessment (Advisian 2015) and in accordance with Peppertree Quarry Water Management Plan.	to reduce sedimentation spills.
Dust	Dust will be generated from the construction and operation of the overburden emplacement. The Peppertree Quarry Modification 5 Air Quality Impact Assessment (Todoroski Air Sciences 2018) concluded that the Project would comply with the applicable assessment criteria at all locations assessed except for one Boral owned property, and that the project would not lead to any unacceptable level of environmental impact. Through accumulation with existing dust generated from existing Quarry operations, dust generated during construction of the overburden emplacement has the potential to impact upon the health of plants and vegetation particularly in those areas of dense native woodland immediately adjacent to the site. Research shows that the impacts of dust on vegetation can have both positive and negative impacts, however the impacts of increased levels of dust on animals are unknown (Farmer 1993). Farmer (1993) anticipated that dust may increase the susceptibility of plants and vegetation to secondary stresses, such as drought, insects and pathogens, or allow penetration of toxic metals or phytotoxic gaseous pollutants.	Variable depending on wind conditions. Potential for dust emissions likely throughout life of mine.	Dust impacts will be mitigated through the onsite use of water suppression and the progressive rehabilitation of the subject site. Further, vegetation clearing protocols for the Project will seek to minimise exposed areas with the potential to generate dust by completing vegetation clearing as close to mining as practical.	Successful implementation of dust control would minimise dust. Current dust suppression mitigation works are on-going at the Marulan and Peppertree Quarry.
Noise	Noise will be generated from the construction and operation of the overburden emplacement. The Peppertree Quarry Modification 5 Noise Impact Assessment (Wilkinson Murray 2018) concluded that the Project is unlikely to result in exceedances of the relevant noise criteria during the day, evening or night time. Although relevant research is limited, studies have found that traffic noise can mask the important contact calls of certain birds such as the budgerigar, canary, and Zebra Finch, (Lohr et al. 2003). Parris and Schneider (2008) found that it was increased volumes of	Variable depending on wind conditions. Potential for noise impacts likely throughout life of mine.	It should be noted that noise emissions from the establishment and operation of the overburden emplacement would be managed and monitored in accordance the Peppertree Quarry Noise and Blast Management Plan, which includes all reasonable and feasible noise mitigation measures.	Details explored in Wilkinson and Murray (2018).

Indirect impact	Likely impact from the Project	Potential extent of the indirect impact prior to mitigation measure	Mitigation measure	Expected success of mitigation measure
	noise and not increased volumes of traffic that were important. Various studies have indicated that changes in bird calls in response to traffic noise are twofold, either the birds change the characteristics of their call to avoid interaction of the sound of the call with the created sounds or they limit calling to periods when the levels of noise are reduced. As the construction of the southern overburden emplacement will be undertaken immediately south of and after the completion of the eastern overburden emplacement, fauna inhabiting the adjacent woodlands of Barbers Creek Gorge will not be exposed to any greater noise than they are currently exposed to. The noise assessment of both the extension of in-pit operating hours and the establishment of the southern overburden emplacement has predicted that the proposed modifications to the approved operations, will not result in any perceptible changes in noise levels in the surrounding area. The Project is therefore unlikely to result in any additional noise impacts on local fauna.			
Increased lighting	In relation to night-time lighting, there is no proposed change to the existing Quarry lighting. The light that is currently emitted from the existing operations is from the lighting associated with the out-of-pit works, primarily the processing plant and surrounds, which is the main light source from the Quarry.	Light spill into nearby woodland areas to the west may occur – these areas currently exposed to lighting from vehicle usage along Marulan South Road.	Boral to continue with their existing night-time lighting as proposed.	No mitigation measures proposed.
Fire	Historically, arid zone bushfires tend to be associated with a proficient growth of native grasses following large rain events. During summer, following rain events, dry swards of grasses pose a bushfire hazard when placed near a source of ignition. Vehicles driven through long grass with hot exhausts may cause a fire particularly during the hotter months of the year.	Potential to be widespread in locality, though unlikely.	The Biodiversity Management Plan will incorporate bushfire management protocols to prevent and deal with the potential for bushfire.	Given the existing quarry operations have not resulted in any significant fires, the implementation of the Biodiversity Management Plan would likely assist in fire prevention.

5.3.3 Cumulative impacts

Cumulative impacts are the successive, incremental and combined impacts (both positive and negative) of an activity on the environment (Franks et al., 2010). They can arise from the compounding activities of a single operation given the interaction of that operation with past, current and future activities that may or may not be related to the existing development. Cumulative impacts may also arise through the interaction of one development with other types of activities and industries, such as grazing and broad scale agriculture.

In relation to the Project, the cumulative impacts are considered to be the total impact on the environment that would result from the current proposal plus any additional impacts likely to occur due to subsequent projects that are of a similar nature or that are partly or wholly contingent on the Project.

Identifiable cumulative impacts to be considered in the locality include:

- Marulan South Project – Environmental Impact Assessment has been submitted to the Department of Planning and Infrastructure as at January 2019. The Marulan South Project is for the approval of a 30 year mine plan, including associated overburden emplacement areas, mine water supply dam, and various associated infrastructure that occurs immediately adjacent to the Study Area. This Project would result in cumulative impacts immediately adjacent to the Study Area, including:
    - Removal of an additional 142.7 ha of native vegetation and fauna habitat.
    - Removal of an additional 60.9 ha of White Box Yellow Box Blakely's Red Gum Grassy Woodland TEC which is in a similar condition to that of the Study Area (ie. open structure, high dominance of weeds).
    - Removal of additional Koala habitat estimated to be 105.3 ha (noting that the habitat is regarded as potential Koala habitat when applying the criteria under SEPP 44, not core Koala habitat).
    - Removal of additional Large-eared Pied Bat estimated to be 113.2 ha.
    - A biodiversity offset for all residual impacts as per the BAM.
    - Rehabilitation of the areas impacted.

At a regional scale, the Marulan South Project site occurs within the Tablelands landscape of the Southern Rivers Bioregion of which approximately 44 % is occupied by the Goulburn Mulwaree LGA (ELA 2007). Agriculture is the main land use within the LGA which makes up 56% of the total area. Clearing has occurred predominately in the more fertile lands and along riparian zones. This is consistent with the Marulan South Project with grazing land occurring along the Inundation area and WOE. Only a small portion of the LGA (8%) is part of formal reserves and the remaining native vegetation represents only a small proportion of the pre-European vegetation. The main threat to remaining vegetation and to important ecosystem functions carried out by riparian zones and wetlands has been attributed to further clearing associated with agricultural practises and rural residential development in agricultural areas (ELA 2007), rather than mine associated clearing or impacts.

Whilst the Marulan South Project will result in degradation to native vegetation within the Southern Rivers Bioregion, the Project will also involve an offset that will contribute to in-perpetuity managed conservation areas within the Bioregion. This will contribute to objectives within the CMA's catchment action plan (Southern Rivers CMA 2013); within the Southern Rivers Bioregion it is proposed that an increase of 11,000 hectares to at least 41,000 hectares of land managed for conservation is to be achieved.

5.3.4 Serious and irreversible impacts

Threatened species which have potential to experience Serious and Irreversible Impacts (SAII) as a result of the project include the impacts to White Box Yellow Box Blakely's Red Gum Woodland TEC, Koala habitat and Large-eared Pied Bat habitat.

No clearing limit thresholds have been set by OEH to any of the SAII entities that are impacted by the Project. As required in section 10.2 of the BAM, the BDAR must address the SAII assessment criteria for each SAII entity potentially impacted by the Project. The SAII assessment criteria in relation to White Box Yellow Box Blakely's Red Gum Woodland TEC, Koala habitat and Large-eared Pied Bat habitat has been provided in Appendix 6.

5.3.5 Quantifying offset requirements

The BAM identifies the BAM Calculator as the appropriate tool for quantifying the offsets required in both Ecosystem Credit and Species Credit terms. A calculation of the nature and extent of offset credits required due to biodiversity impacts associated with the project has been undertaken using the BAM Calculator.

5.3.1 Summary of ecosystem credits required

The ecosystem credits to be retired for the Project as determined by the Biodiversity Credit Calculator are shown in Table 14.

Table 14 : Ecosystem credit requirements

Vegetation zone	Plant Community Type (PCT)	Vegetation formation	Vegetation class	Condition identifier input used in Calculator	Biodiversity risk rating	Total (ha)	Credits required
1	PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670)	Grassy Woodlands	Southern Tableland Grassy Woodlands	Medium	2	18.64	339
2				Poor	2	9.04	89
3	PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges -Southern Sydney Basin (SR534)	Dry Sclerophyll Forests (Shrub/grass subformation)	Central Gorge Dry Sclerophyll Forests	Medium	1.5	8.46	134
4				Poor	1.5	3.55	23

5.3.2 Summary of species credits required

Offsets required for species credit species are shown in Table 15. Species credits are required for the Koala and Large-eared Pied Bat.

Table 15: Species credit species requirements

Species Credit Species	Cleared habitat area (ha)	Risk rating	Required credits
Koala - (*Phascolarctos cinereus*)	27.1	2	487
Large-eared Pied Bat - (*Chalinolobus dwyeri*)	27.1	3	731

6. Offset strategy

Under the BAM, an offset strategy is not required to be submitted with the BDAR, as the credits are to be formally retired with the establishment of a Biodiversity Stewardship Site, or payment into the Biodiversity Conservation Trust (BCT) Fund. However, as noted in the DoEE Supplementary SEARs, a biodiversity offset strategy is required to be included in the Biodiversity Assessment.

6.1 One offset package to satisfy the NSW and EPBC Offset Requirements

Under the BAM, the biodiversity offsets must provide benefits to biodiversity to compensate for the adverse impacts of an action. Biodiversity offsets assist in achieving long-term conservation outcomes while providing development proponents with the ability to undertake actions that have unavoidable impacts on biodiversity.

Unavoidable impacts to biodiversity are those impacts that are residual (i.e. impacts that remain after impact avoidance, management and mitigation measures are employed to reduce the type or magnitude of biodiversity impacts). Section 5.1 of this report outlines the planning and consideration of alternative emplacement options that Boral has considered. Section 5.1.1 to Section 5.1.4 of this report outline the management and mitigation actions that Boral will employ to further reduce direct and indirect impacts to biodiversity values as a result of this Project.

This section of the report describes the approach to biodiversity offsetting proposed for the Project in order to satisfy the BAM and Commonwealth Offsetting requirements.

Based on the results of the MNES Assessments of Significance contained in this report, the Project would result in a significant impact to White Box Yellow Box Blakely's Red Gum Grassy Woodland and the Koala. As such, the biodiversity offset proposed would satisfy both the State and Commonwealth offsetting requirement for both threatened entities. It should be noted that whilst this assessment has not determined a significant impact to any other threatened biodiversity as listed under the EPBC Act, the proposed offsets discussed below would protect and enhance habitat for a range of threatened and migratory fauna listed on the EPBC Act.

6.2 Proposed offset strategy

Boral propose to offset the Project using two properties, which would be established as Stewardship Sites under the BAM to provide in-perpetuity protection and management of biodiversity values. The properties are listed in Table 16 and detailed below.

Table 16. Offset liability properties

Property	Biodiversity Credit Case No. (reference for BCT)	Size	Applicable biodiversity values present to offset the Project	Percentage of offset liability met (State and Commonwealth)
Property 1 – Boral owned	0001191	Approximately 1,000 ha	• PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges -Southern Sydney Basin (SR534) • Koala • Large-eared Pied Bat.	Area of vegetation and habitat meets 100% offset liability in the EPBC Act Policy Calculator
Property 2 – Private owned	00011444, 00011437, 00011449, 00011453	Approximately 360 ha	• PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670) – associated TEC as listed under the BC Act and EPBC Act.	Area of EPBC Act List Box Gum Woodland meets 100% offset liability in the EPBC Act Policy Calculator

6.2.1 Property 1 (Boral owned) – Biodiversity Credit Case No. 0001191

Boral has purchased a 1,000 hectare property within the Bungonia subregion for the purposes of offsetting for the current Project. The details of the property have been withheld from this assessment for confidentiality reasons, however can be provided in a separate report to the Departments should it be required.

To date, Niche have completed field surveys on the property in accordance with the BAM, and fauna surveys (spotlighting and anabat recording) to determine the presence of Koala and Large-eared Pied Bat.

The field surveys confirmed the presence of a Koala population on the site (four individuals recorded), and Large-eared Pied Bat foraging habitat (captured using anabat devices located in all habitat types of the property).

The area of both Koala and Large-eared Pied Bat habitat available on the site that would be managed in perpetuity is approximately 936 hectares. In particular, management would focus on feral animal control given the presence of feral dogs throughout the area.

The Biodiversity values at the site would satisfy the following biodiversity offset liabilities:

- PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges -Southern Sydney Basin (SR534)
- The BAM offset liability and the EPBC Act offset requirement for the Koala
- The BAM offset liability and the EPBC Act offset requirement for the Large-eared Pied Bat.

To date, reporting and Biodiversity credit calculations have been completed, which will be submitted to the BCT for review.

6.2.2 Property 2 (private owned) - Biodiversity Credit Case No. 00011444, 00011437, 00011449, 00011453

In order to satisfy the offset liability for PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670) and subsequent EPBC listed White Box Yellow Box Blakely's Red Gum Grassy Woodland, Boral have negotiated the security of credits within a 360 hectare property containing the TEC. The property would contain four separate stewardship sites given the subdivision of the land. Four Biodiversity Stewardship Site applications has been submitted to the BCT for this site (Case no. 00011444, 00011437, 00011449, 00011453) which is currently being reviewed by the BCT.

Through the retirement of 424 credits, the offset liability for the Project would be met for both the State and Commonwealth TEC requirement as the site meets 100% of the Commonwealth offset liability using the EPBC Act Policy Calculator.

7. Conclusion

This report provides a BDAR in accordance with the BAM in order to address the potential impacts associated with the Peppertree Modification 5 Project. This report also provides an assessments for threatened biodiversity listed under the EPBC Act.

The Project will result in the disturbance of 39.7 ha of native vegetation. Indirect impacts may include dust, noise, erosion and sedimentation which will be mitigated by measures provided in section 5.1 of this report.

During the field survey one TEC - White Box Yellow Box Blakely's Red Gum Woodland was found to occur within the Study Area. Two condition classes were attributed to the TEC to assist with offsetting the impacts. The Project will result in disturbance to approximately 27.7 ha of the TEC listed under the BC Act and EPBC Act. This TEC would be offset according to the requirements of the BAM and the offset site would meet 100% of the EPBC Policy Calculator.

A further 12 ha of native vegetation would also be offset in accordance with the BAM.

No threatened flora are likely to be impacted by the Project given the lack of habitat and absence of threatened flora during the field survey.

Seventeen threatened and migratory fauna species are considered to be affected by the Project. Most of these species are likely to utilise the foraging habitat of the Study Area on an intermittent basis. No further assessment of impact is required for the ecosystem credit species based on the requirements of the BAM and the offsetting of the associated PCTs Ecosystem Credit Species under the BAM which do not require further assessment of impact as they would be offset with their associated PCTs.

The Koala and Large-eared Pied Bat are the only listed Species Credit Species which require an offset for the Project given their detection within, or adjacent to the Study Area.

Those threatened fauna species which are listed under the EPBC Act that were attributed a moderate to high likelihood of occurrence within the Study Area include: Fork-tailed Swift, Cattle Egret, Rainbow Bee-eater, Black-faced Monarch, Rufous Fantail, Large-eared Pied Bat, and Grey-headed Flying Fox. An EPBC Act

Assessment of Significance for each of these species has been completed and concluded that a significant impact to any EPBC Act listed threatened fauna is unlikely.

Mitigation measures associated with indirect impacts have been proposed through the revision and implementation of existing management plans.

A total of 585 Ecosystem Credits are required to offset PCT impacts and associated threatened fauna habitat surrogates; 487 Koala credits and 731 Large-eared Pied Bat credits.

In order to satisfy the biodiversity offset requirement for the Project, Boral propose two properties which would be established as Stewardship Sites. The two sites would ensure the in perpetuity management and protection native vegetation, White Box Yellow Box Blakely's Red Gum Grassy Woodland TEC, known Koala habitat and known Large-eared Pied Bat habitat.

References

Allen, C. (2002). Distribution Surveys, Habitat Assessment and Management Recommendations for the Koala (Phascolarctos cinereus) in the Shoalhaven Gorge Region of NSW. Unpublished report on behalf of NSW NPWS.

Bauer, J. & Bauer, P. (1998). Under Bungonia. JB Books, Oak Flats, N.S.W.

Benson J (2008) New South Wales Vegetation Classification and Assessment: Part 2 Plant Communities of the NSW South-western Slopes Bioregion and update of NSW Western Plains plant communities, Version 2 of the NSWVCA database. Cunninghamia 10(4): 599-673

Boral Resources (2017) Biodiversity & Rehabilitation Management Plan 2017

Boral Resources (2015) South Marulan Operations Bushfire Management Plan 2015

Briggs, J. D. and Leigh, J. H. (1996). Rare or Threatened Australian Plants. CSIRO Publications.

Churchill, S. (2008). Australian Bats. Reed New Holland, Sydney.

Department of Environment and Conservation (2004). Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft. NSW Department of Environment and Conservation.

Department of Environment and Climate Change (2008). Recovery plan for the Koala (Phascolarctos cinereus). NSW Department of Environment and Climate Change.

Department of Environment and Climate Change (2009a). Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians. NSW Department of Environment and Climate Change.

Department of Environment and Climate Change (2009b). BioBanking Assessment Methodology and Credit Calculator Operational Manual. NSW Department of Environment and Climate Change.

Department of the Environment (2014). EPBC Act Referral Guidelines for the vulnerable Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory). Commonwealth of Australia.

Department of the Environment (undated). EPBC Act Policy Statement White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Grassland. Commonwealth of Australia.

Department of Environment, Climate Change and Water (2009). National Recovery Plan for Pomaderris cotoneaster (Cotoneaster pomaderris). Department of Environment, Climate Change and Water (NSW), Hurstville.

Department of Environment, Climate Change and Water (2010). Draft National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Environment, Climate Change and Water NSW (2011). National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Environment and Energy (2018) Protected Matters Search tool. Accessed September 2018.

Department of Sustainability Environment Water Population and Communities (2012). Environment Protection and Biodiversity Conservation Act Environmental Offsets Policy. Commonwealth Department of the Sustainability Environment, Water, Population and Communities.

Element Environment (2018) Peppertree Quarry Modification 5 – Environmental Assessment. Prepared for Boral Resources.

Environment Australia (2000). Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and development of Version 5.1 - Summary Report. Environment Australia, Canberra.

Famer 1993. The effects of dust on vegetation--a review. Environmental Pollution1993;79(1):63-75.

Law and Chidel (2004). Summer counts of the Large Bent-wing Bat at Drum Cave, Bungonia – 2003-2004. Unpublished Report - Research & Development Division State Forests of New South Wales.

Office of Environment and Heritage (undated). White Box Yellow Box Blakely's Red Gum Woodland (White Box Yellow Box Blakely's Red Gum Woodland) Action Statement. Available online at http://www.environment.nsw.gov.au/savingourspeciesapp/Project.aspx?ProfileID=10837. Accessed 23 April 2018.

Office of Environment and Heritage (2011). BioMetric Vegetation Types Database. Available online at: http://www.environment.nsw.gov.au/resources/nature/BioMetric_Vegetation_Type_CMA.xls

Office of Environment and Heritage (2018). NSW Threatened Species Information. http://www.environment.nsw.gov.au/threatenedspecies/. NSW Office of Environment and Heritage.

Office of Environment and Heritage (2018) Threatened Species Profiles. http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx

Office of Environment and Heritage (2016) Biodiversity Assessment Methodology

Office of Environment and Heritage (2012). Assessors' guide to using the BioBanking Credit Calculator v.2. NSW Office of Environment and Heritage.

Office of Environment and Heritage (2014a). Framework for Biodiversity Assessment - NSW Biodiversity Offsets Policy for Major Projects.

Office of Environment and Heritage (2014b). NSW Biodiversity Offsets Policy for Major Projects. State of NSW and Office of Environment and Heritage.

Parris, K. M., and A. Schneider 2008. Impacts of traffic noise and traffic volume on birds of roadside habitats. Ecology and Society 14(1): 29.

Pennay, M. (2008). A maternity roost of the Large-eared Pied Bat Chalinolobus dwyeri (Ryan) (Microchiroptera: Vespertilionidae) in central New South Wales Australia. Australian Zoologist. 34:564-569.

Prober SM, Thiele KR, Lunt ID and Koen TB (2005) Restoring ecological function in temperate grassy woodlands: manipulating soil nutrients, exotic annuals and native perennial grasses through carbon supplements and spring burns. Journal of Applied Ecology 42: 1073-1085.

Richard Lamb and Associates (2018) Peppertree Quarry MOD 5 Environmental Assessment – visual impact assessment. Report prepared for Boral Resource (NSW) Pty Ltd.

Scientific Committee NSW (2002) White box yellow box Blakely's red gum woodland - endangered ecological community listing NSW Scientific Committee - final determination.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

Thomas, V., Gellie, N. & Harrison, T. (2000) Forest ecosystem classification and mapping for the Southern CRA region, Volume II Appendices. NSW National Parks & Wildlife Service, Southern Directorate. A report undertaken for the NSW CRA/RFA Steering Committee.

Todoroski Air Sciences Pty Ltd (2018) Air Quality Impact Assessment Peppertree Quarry, Modification 5, Element Environment on behalf of Boral Resources (NSW) Pty Ltd

Tozer MG, Turner K, Simpson C, Keith DA, Beukers P, Tindall D, Pennay C (2006) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0. (Department of Environment and Conservation and Department of Natural Resources: Sydney).

Wilkinson and Murray (2018) Noise Impact Assessment – Peppertree Quarry Mod 5 Report No. 14250-A, August 2018 Prepared for Element Environment and Boral Resources (NSW) Pty Ltd.

Figures

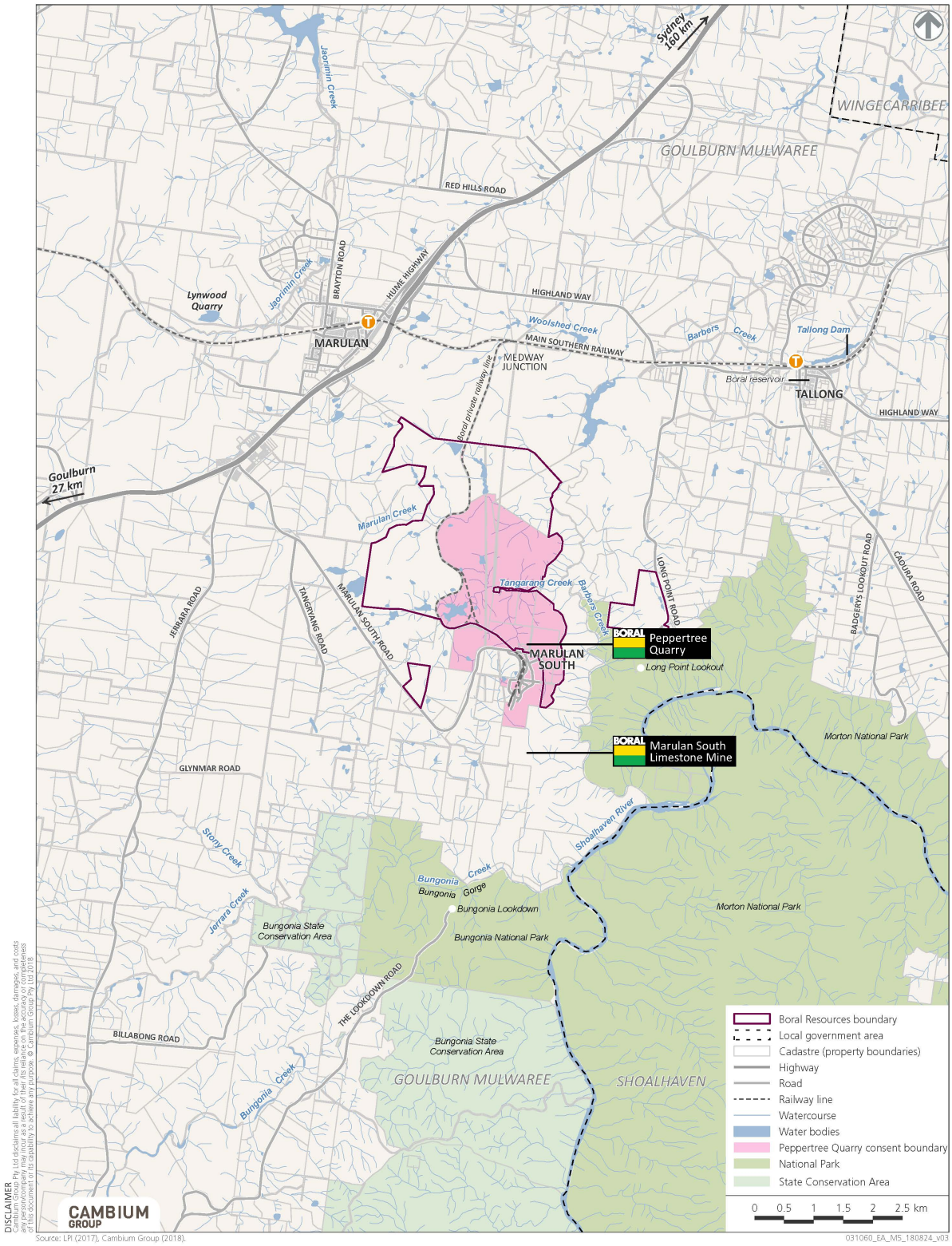
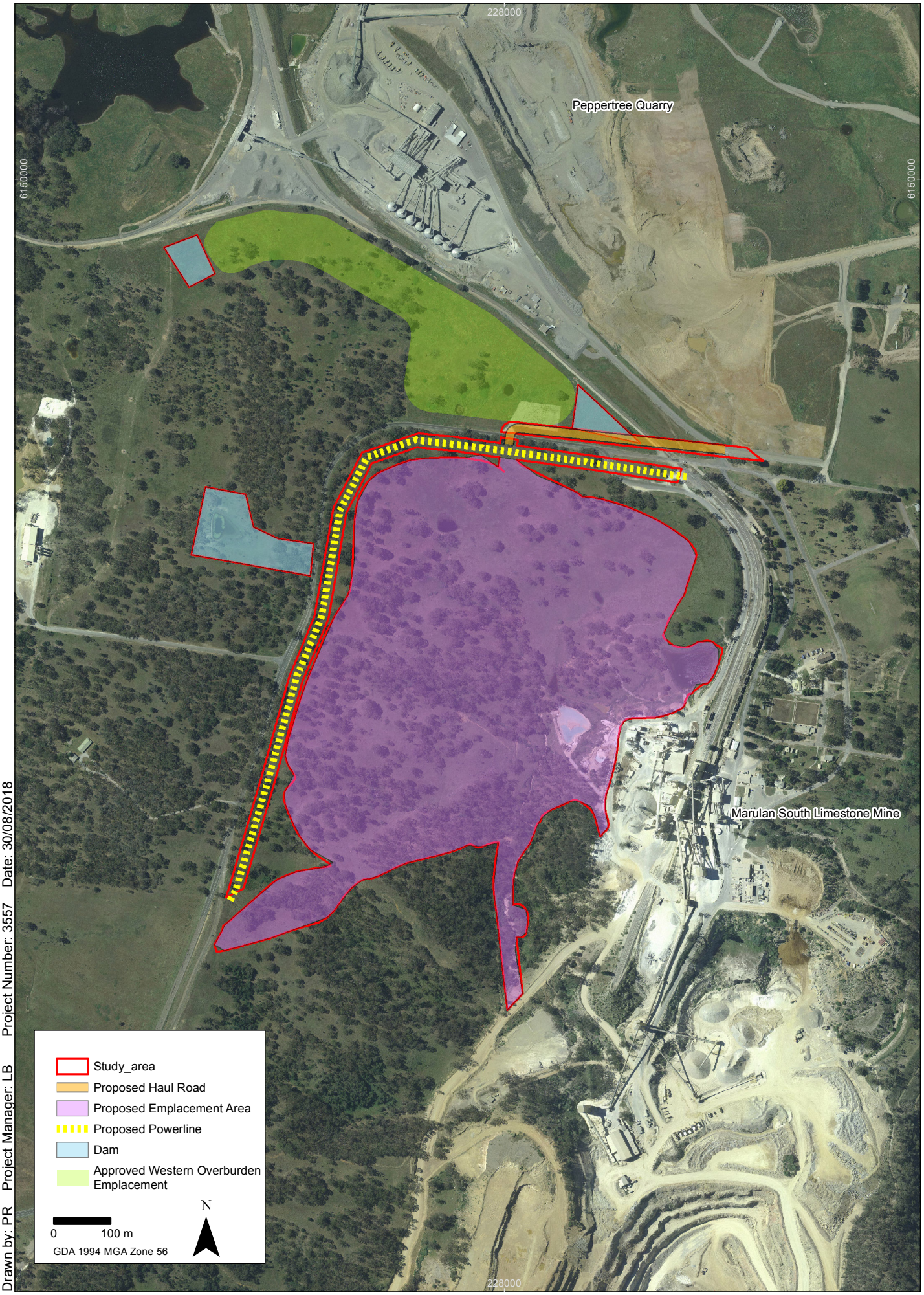


Figure 1. Local context



Site Map

Peppertree Modification 5 Biodiversity Assessment

FIGURE 2

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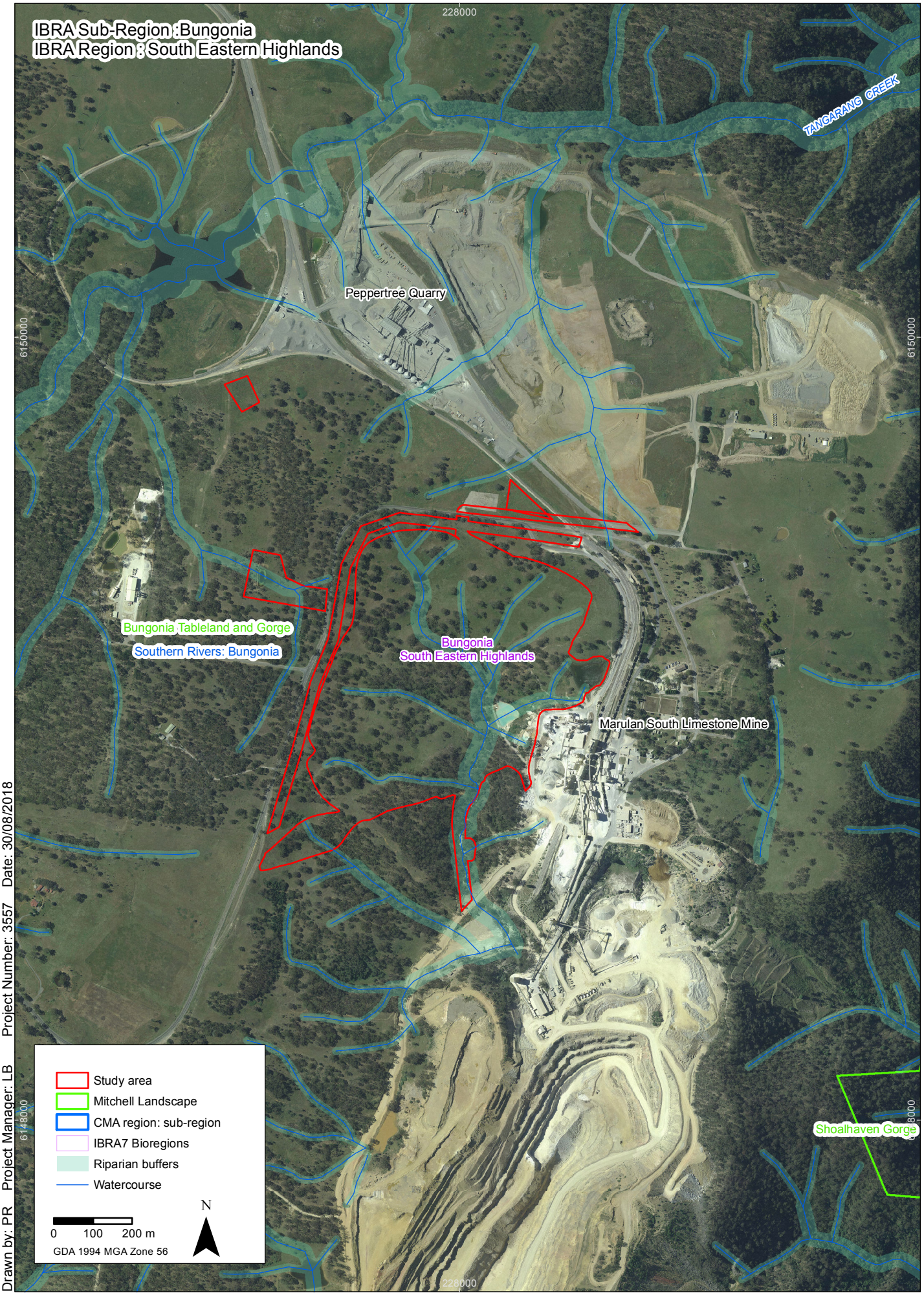

Geographic context

Peppertree Modification 5 Biodiversity Assessment

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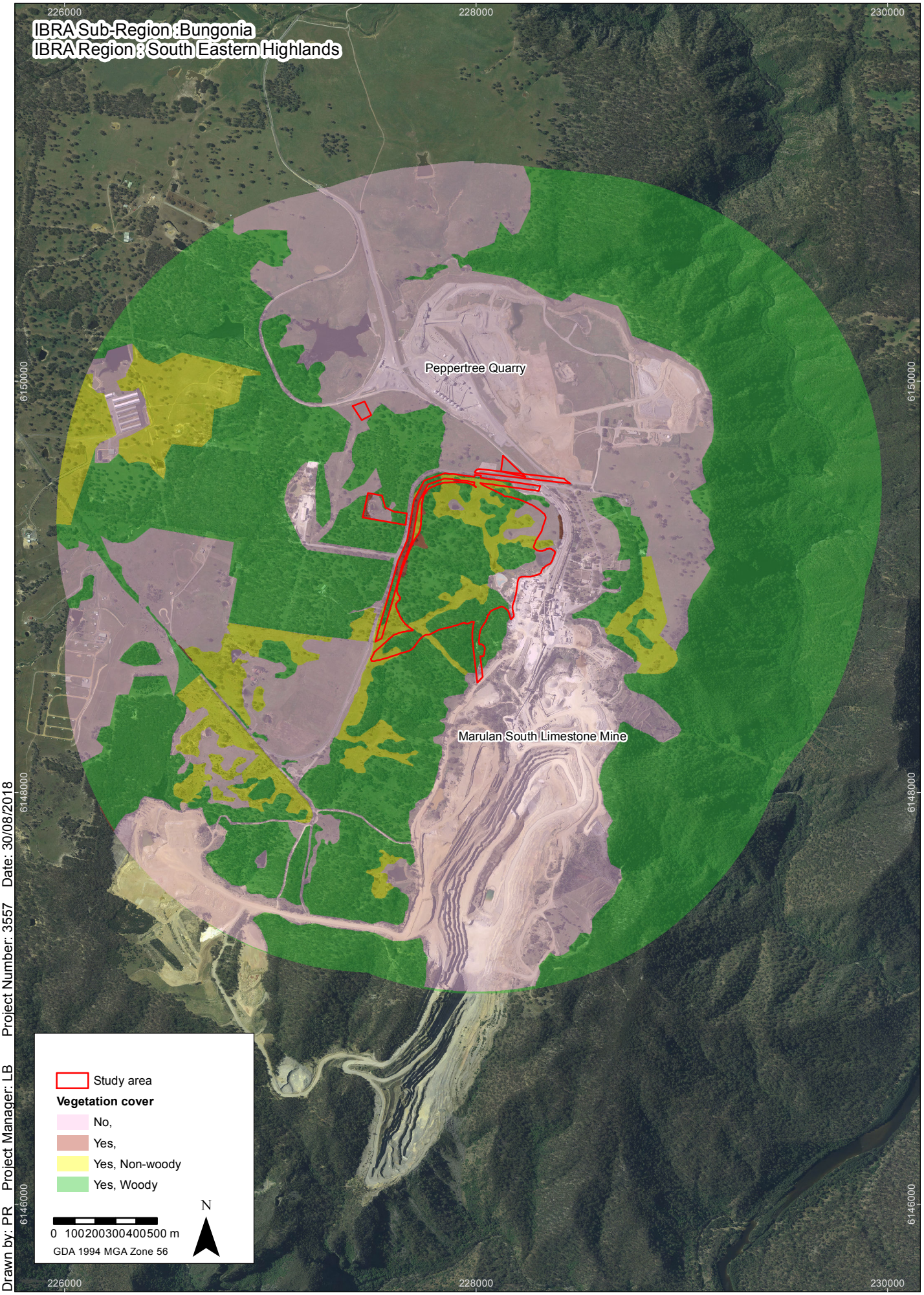

Landscape Assessment - Buffer of vegetation

Peppertree Modification 5 Biodiversity Assessment

FIGURE 4

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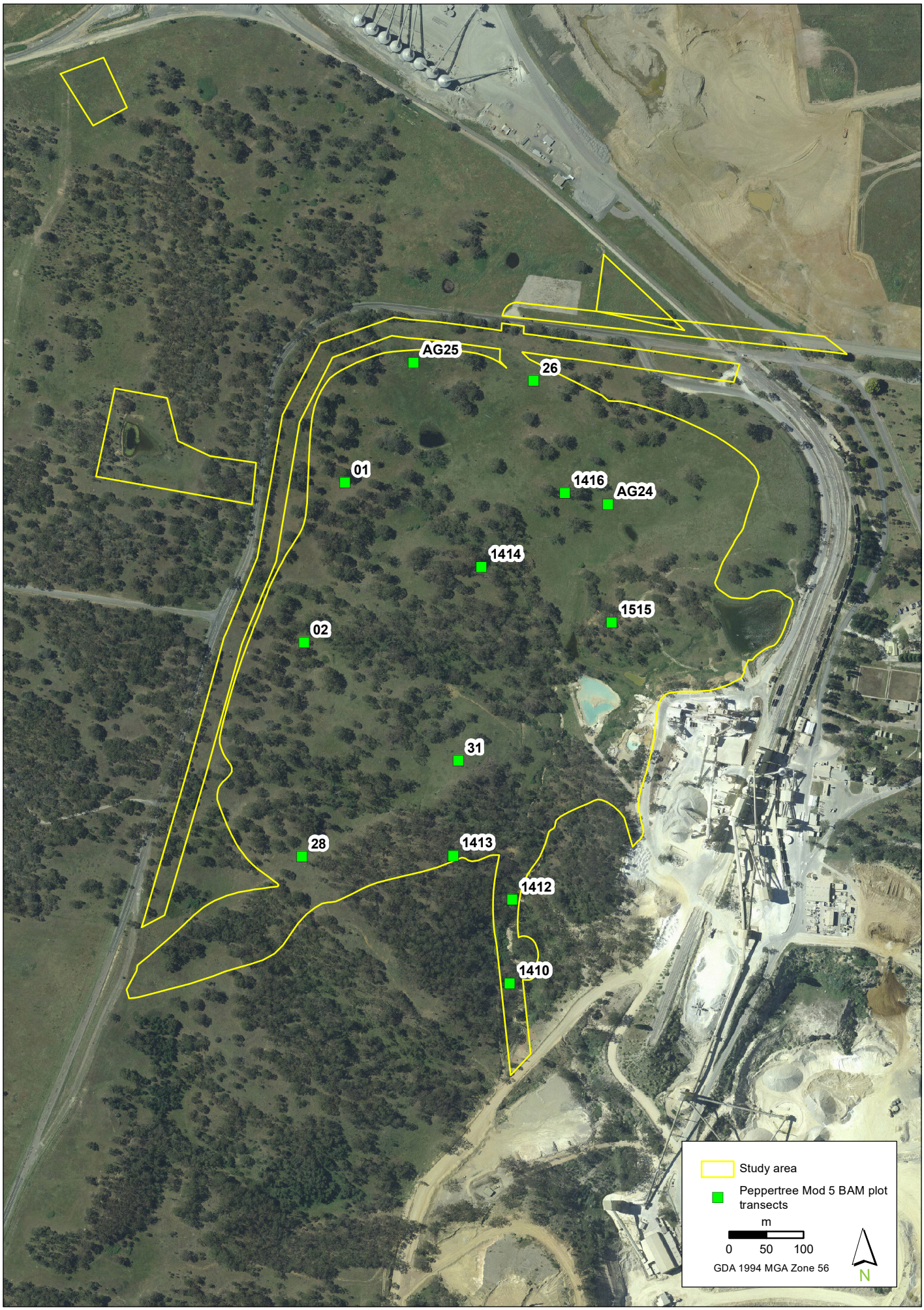

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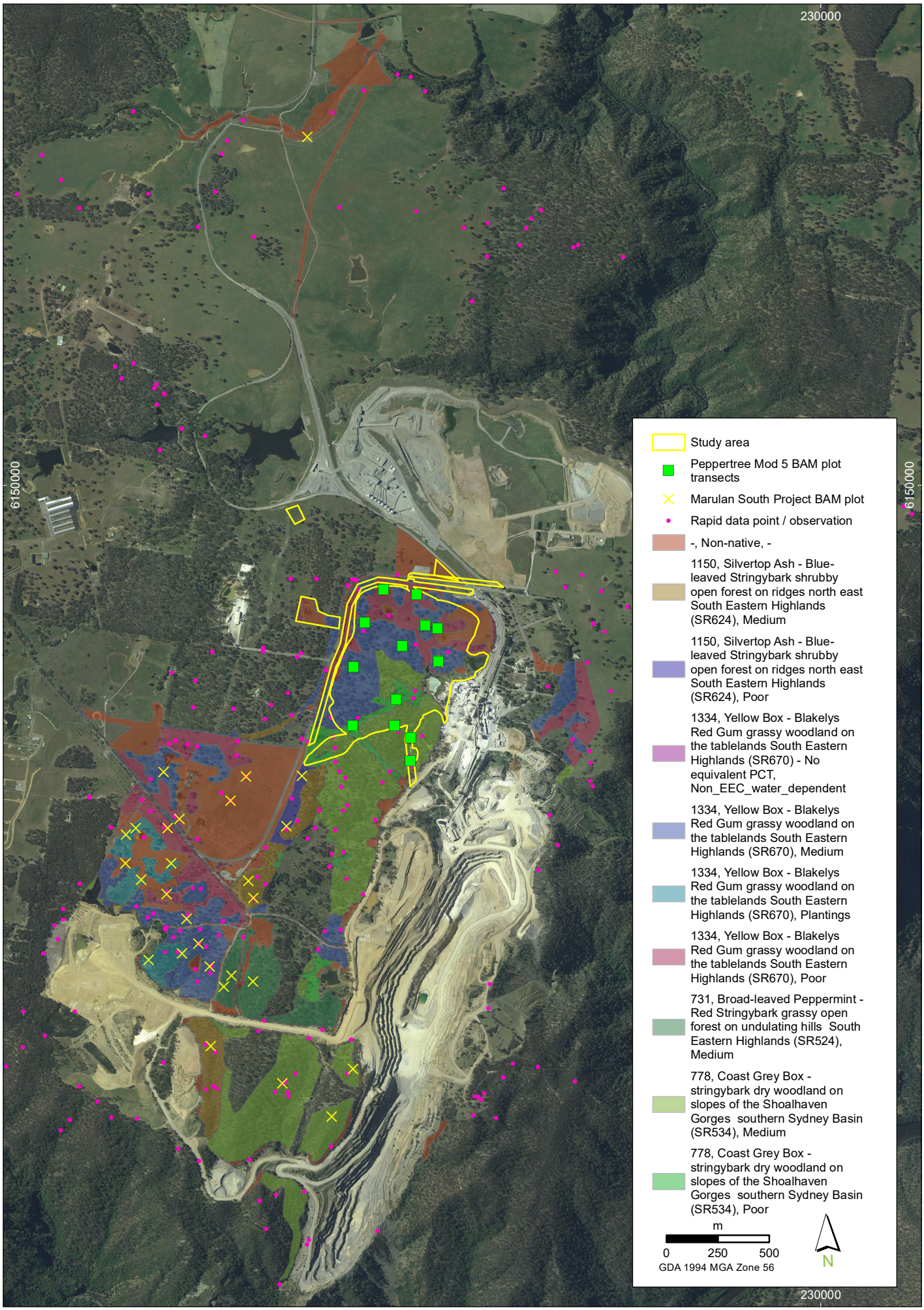
Flora survey effort within Study Area

Peppertree Modification 5

FIGURE 5

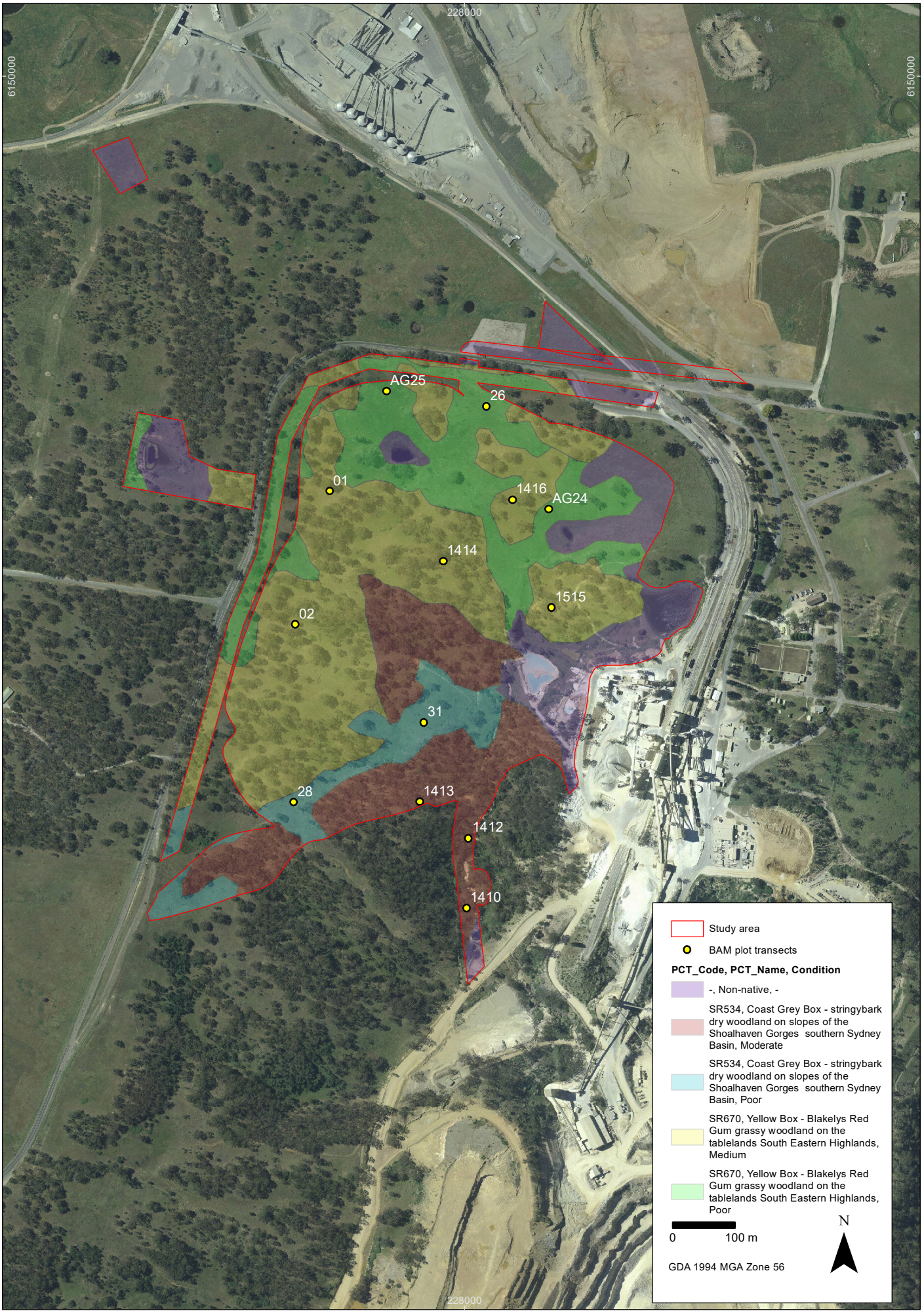
Imagery: (c) LPI 2013



Flora survey effort - wider locality

Peppertree Modification 5

FIGURE 6



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Niche Validated Vegetation Mapping

Peppertree Modification 5 Biodiversity Assessment

FIGURE 7

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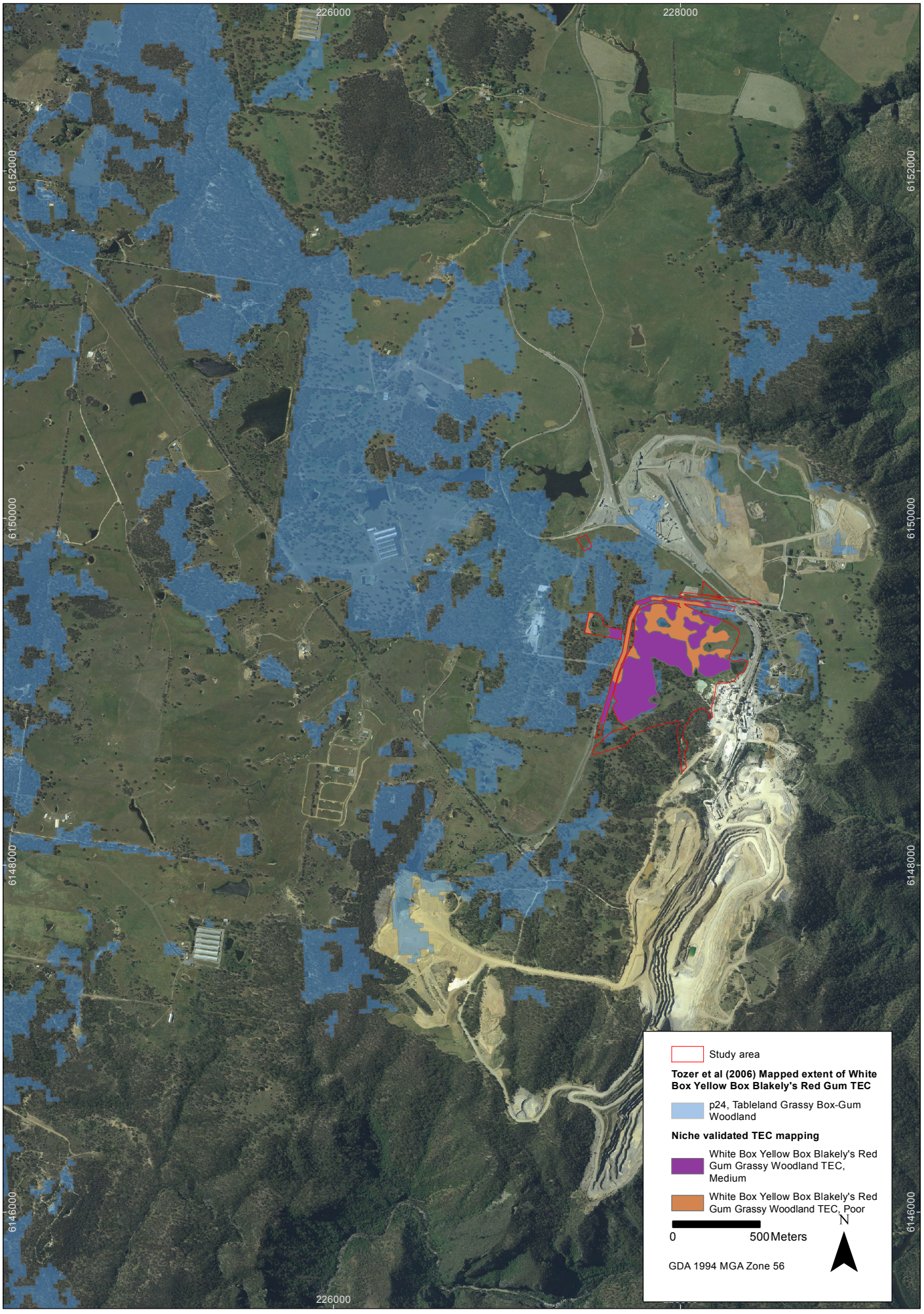

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Threatened Ecological Communities (SAII) mapped in study area

Peppertree Modification 5 Biodiversity Assessment

FIGURE 8

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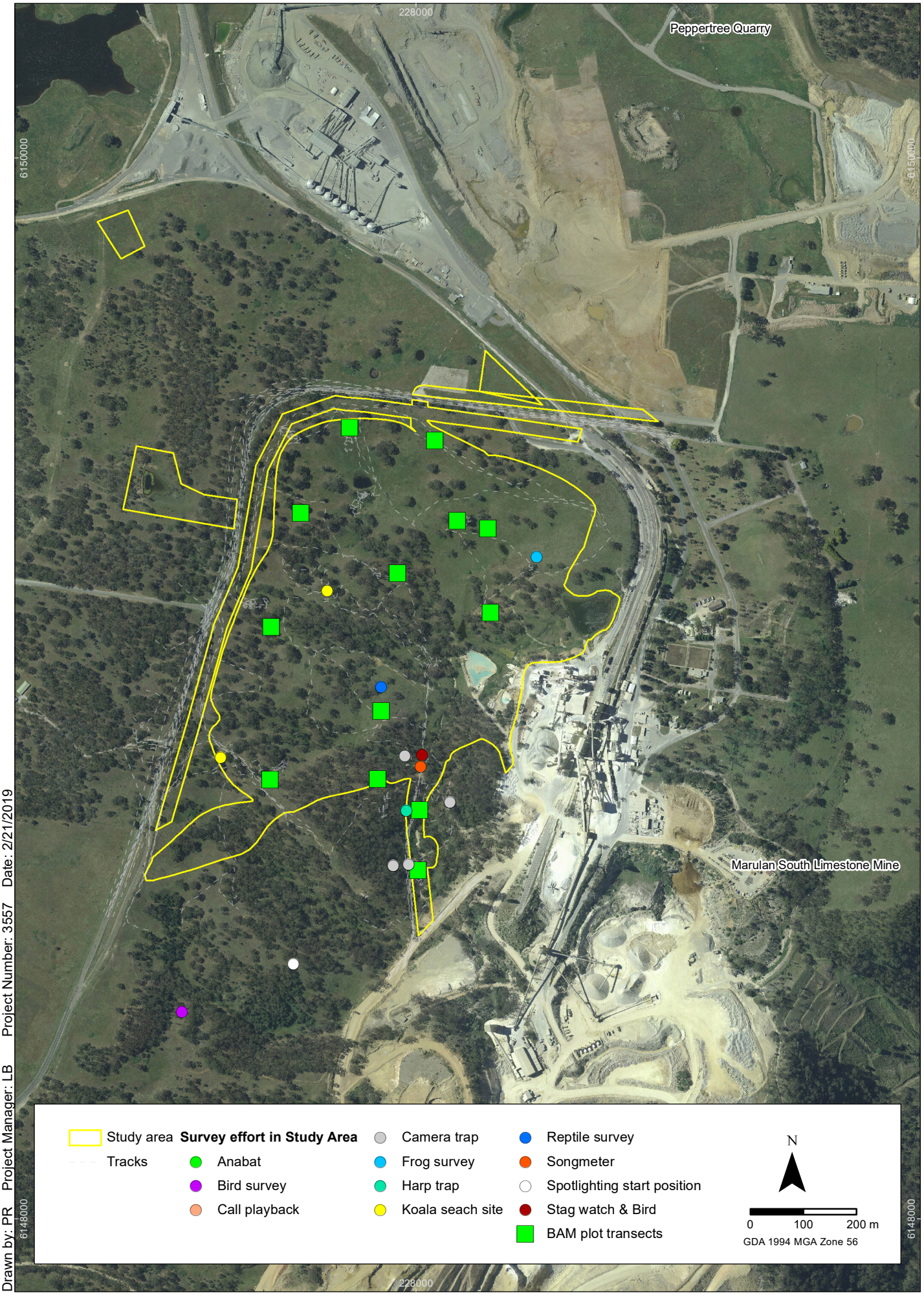

Fauna Survey Effort within Study Area

Peppertree Modification 5 Biodiversity Assessment

FIGURE 9

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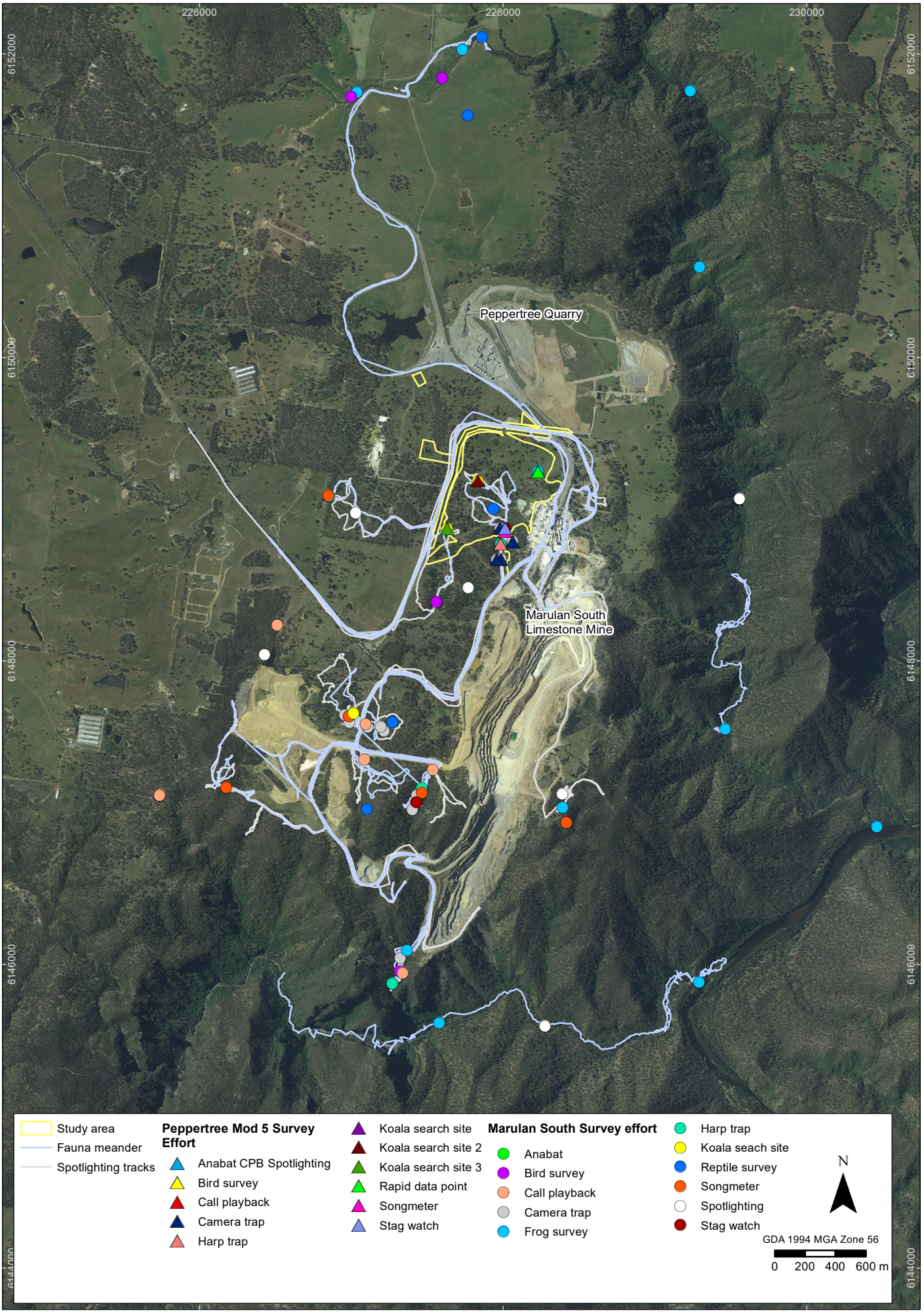

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Survey Effort - wider locality

Peppertree Modification 5 Biodiversity Assessment

FIGURE 10

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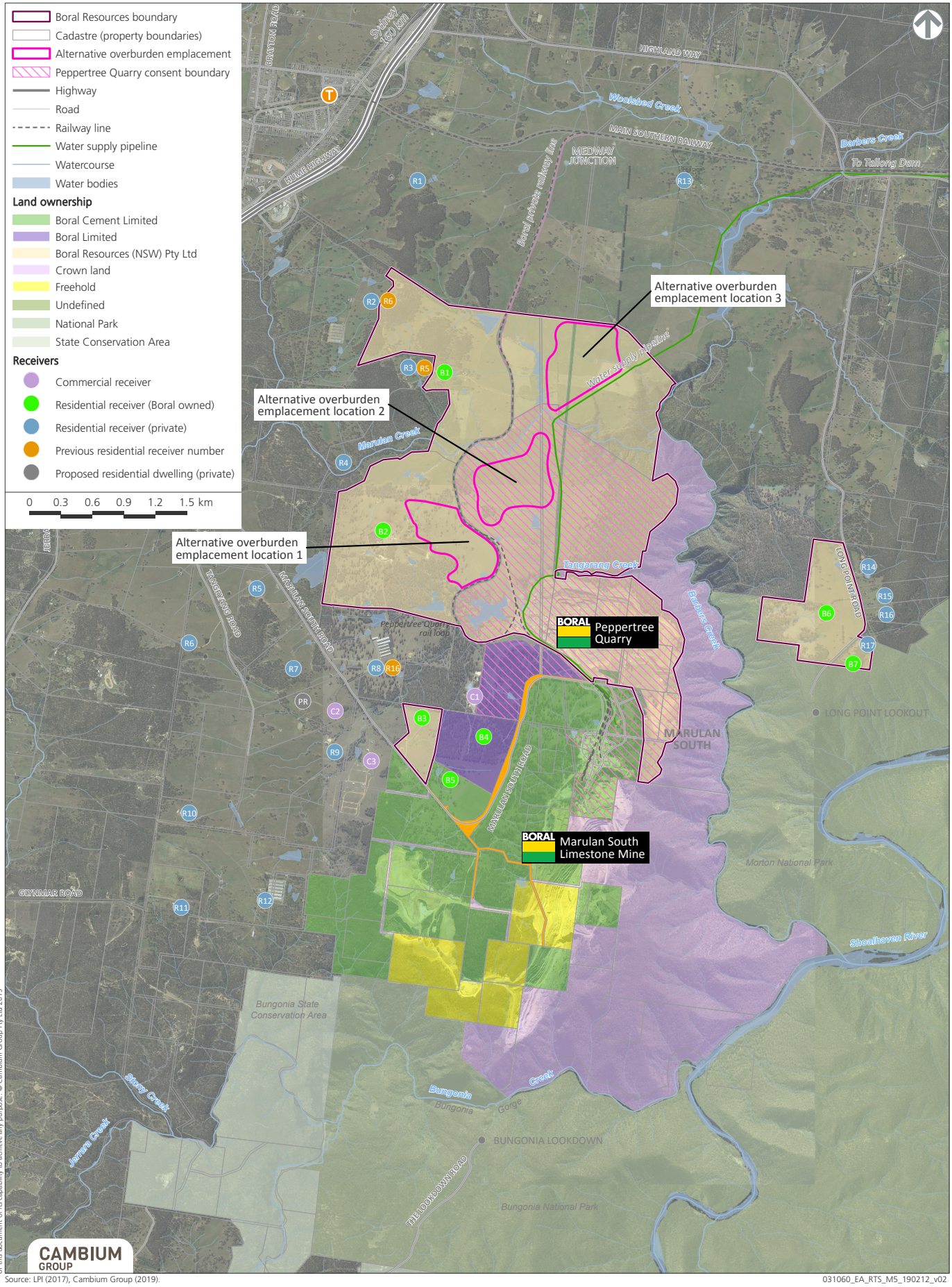
Imagery: (c) Boral 2014

Figure 11a.
Alternative overburden emplacement locations (provided by Element Environment)



CAMBIUM GROUP

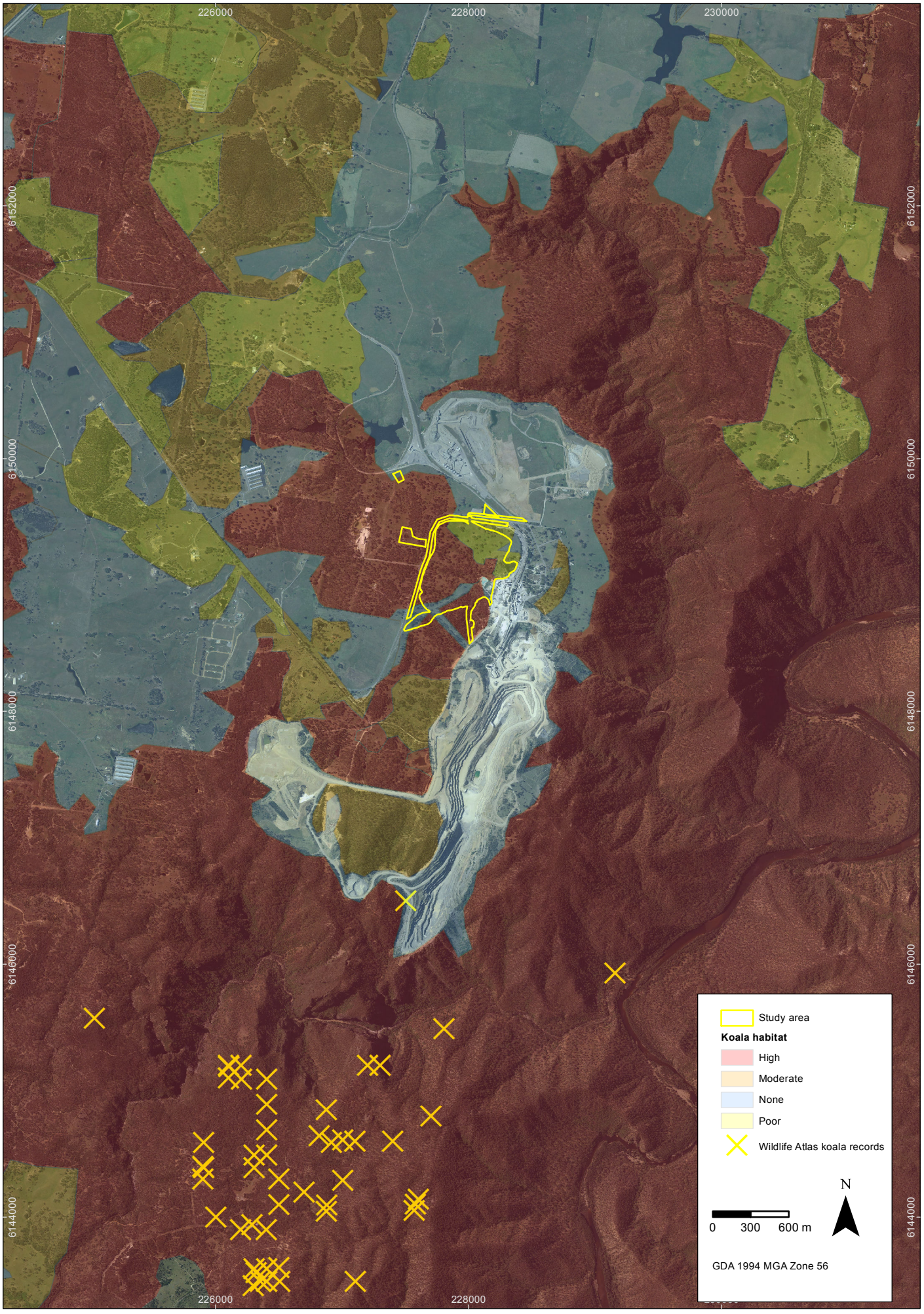
Source: LPI (2017), Cambium Group (2019).

Alternative Overburden Emplacement Locations

Peppertree Modification 5 Biodiversity Assessment

FIGURE 11b

Path: T:\SpatialWorking\LB\3557 Peppertree Mod 5\3557_Figure_X_Alternative.mxd



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Koala Habitat

Peppertree Modification 5 Biodiversity Assessment

FIGURE 12

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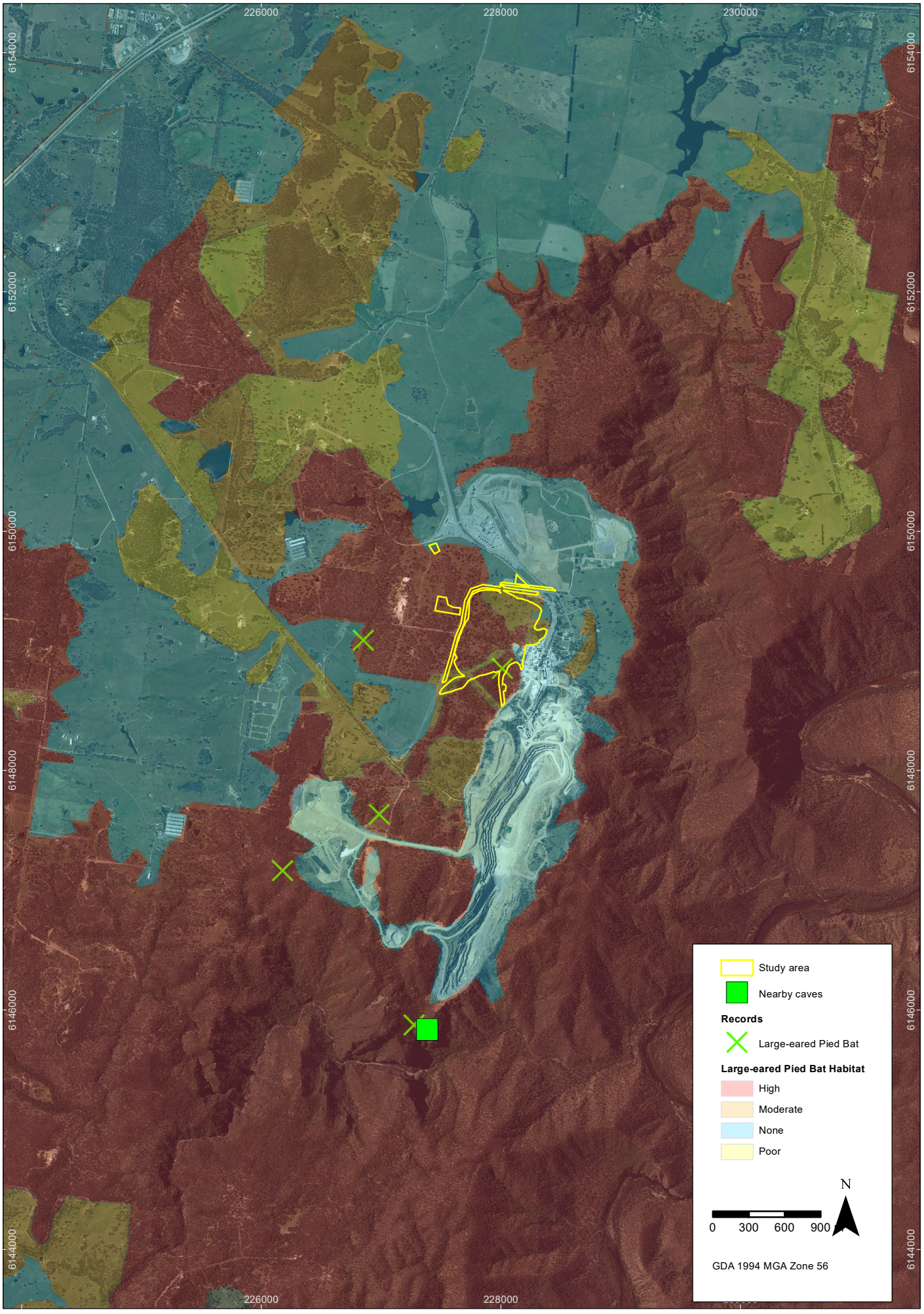

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Large-eared Pied Bat habitat

Peppertree Modification 5 Biodiversity Assessment

FIGURE 13

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Imagery: (c) Boral 2014

Appendix 1. Likelihood of occurrence

Threatened flora likelihood of occurrence

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence
Acacia bynoeana	Bynoe's Wattle	V	V	*A. bynoeana* occurs mainly in heath and dry sclerophyll forest (Morrison & Davies 1991). The substrate is typically sand and sandy clay, often with ironstone gravels and is usually very infertile and well-drained. The species seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds.	Low – habitat not suitable within Study Area and unlikely to remain undetected during survey if present.
Caladenia tessellata	Thick-lipped Spider-orchid	E	V	The Thick-lipped Spider-orchid is found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. is known to favour low, dry sclerophyll woodland (for example open Kunzea woodland) with a heathy or sometimes grassy understorey on clay loams or sandy soils. The population at Braidwood occurs in dry, low Brittle Gum (*Eucalyptus mannifera*), Inland Scribbly Gum (*E. rossii*) and *Allocasuarina* spp. woodland with a sparse understorey and stony soil.	Low – no records within 10km. Not detected during survey. Habitat within Study Area is not suitable.
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Grows in swamp-heath on sandy soils, chiefly in coastal districts, south from the Gibraltar Range. The Leafless Tongue-orchid has been reported to occur in a wide variety of habitats including heathlands, heathy woodlands, sedgelands, *Xanthorrheoa* spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests (grassy sub-formation). Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils	Low – no records within 10km. Habitat within Study Area is not suitable.
Eucalyptus aggregata	Black Gum	V	-	Found in the NSW Central and Southern Tablelands, with small isolated populations in Victoria and the ACT. Has a moderately narrow distribution, occurring mainly in the wetter, cooler and higher parts of the tablelands in the lowest parts of the landscape, on alluvial soils, on cold, poorly-drained flats and hollows adjacent to creeks and small rivers. Also occurs as isolated paddock trees in modified native or exotic pastures. Often grows with other cold-adapted eucalypts, such as Snow Gum or White Sallee (*Eucalyptus pauciflora*), Manna or Ribbon Gum (*E. viminalis*), Candlebark (*E. rubida*), Black Sallee (*E. stellulata*) and Swamp Gum (*E. ovata*). Black Gum usually occurs in an open woodland formation with a grassy groundlayer dominated either by River Tussock (*Poa labillardierei*) or Kangaroo Grass (*Themeda australis*), but with few shrubs.	Low - Recorded over 2 km to the north-east of the Study Area within Conservation Area. Relatively conspicuous species and unlikely to remain undetected during field survey.
Eucalyptus aquatica		V	V	Found primarily in the Penrose area near Goulburn where all records are either from State forest or private property. There is also one record from within Morton National Park. Occurs as scattered plants on open, swampy flats.	Low – habitat not suitable within Study Area and unlikely to remain undetected during survey if present.
Eucalyptus macarthurii	Paddys RiverBox	V	-	A moderately restricted distribution, recorded from the Moss Vale District to Kanangra Boyd National Park. In the Southern Highlands it occurs mainly on private land, often as isolated individuals in, or on the edges of paddocks. Isolated stands occur in the north west part of the range on the Boyd Plateau. The only known record in the conservation estate is within Kanangra Boyd National Park. Occurs on grassy woodland on relatively fertile soils on broad cold flats.	Low – recorded over 5 km to the west. Relatively conspicuous species which is unlikely to remain undetected during survey.
Genoplesium baueri	Yellow Gnat-orchid	-	E	The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections	None – no suitable habitat. No records. Not detected during

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence
				have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Grows in dry sclerophyll forest and moss gardens over sandstone.	field survey.
Genoplesium plumosum	Tallong Midge Orchid	CE	E	Occurs exclusively in heathland, generally dominated by violet kunzea, common fringe-mytre and parrot-peas. Grows on very shallow soils or within mosses on sandstone conglomerate shelves. Plants exist only as a dormant tuber for much of the year, with leaves or fruiting stems dying back in winter. Reproduces by seed and has no mechanism for vegetative reproduction.	Low – the disturbed area is not along sandstone shelves.
Grevillea molyneuxii	Wingello Grevillea	V	E	This species has only been recorded in low heathland on sandstone, where it grows in skeletal soil on flat, wet sandstone shelves above dissected valleys.	Low – no suitable habitat.
Haloragis exalata subsp. *exalata*	Square Raspwart	V	V	Occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the central coast, south coast and north-western slopes botanical subdivisions of NSW. The species appears to require protected and shaded damp situations in riparian habitats.	Low – not detected during field survey. Habitat marginal within Study Area.
Kunzea cambagei	Cambage Kunzea	V	V	Restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments.	Low – no potential habitat.
Lepidium hyssopifolium	Aromatic Peppercress	E	E	Currently, the species is known from near Bathurst and Bungendore, in the South Eastern Highlands Bioregion (Tumino 2010). Historically, the Basalt Pepper-cress has been recorded from the Northern and Central Tablelands, with an atypical specimen from Cooma on the Southern Tablelands (Harden 2000). The Central Tablelands records are from the Bathurst area; the Northern Tablelands collections are from Gostwyck, near Armidale, and there was an 1884 record from 'near Maryland', though this record may have been from either NSW or Queensland, as the Maryland Station once extended over the border. Most other records have been found to be misidentifications. Generally, the Aromatic Peppercress is known to establish on open, bare ground with limited competition from other plants. The Aromatic Peppercress was previously recorded from Eucalypt woodland with a grassy ground cover, low open Casuarina woodland with a grassy ground cover and tussock grassland. Recently recorded localities have predominantly been in weed-infested areas of heavy modification, high degradation and high soil disturbance such as road and rail verges, on the fringes of developed agricultural land or within small reserves in agricultural land. Many populations are now generally found amongst exotic pasture grasses and beneath exotic trees such as the Radiata Pine (*Pinus radiata*) and Monterey Cypress (*Cupressus macrocarpus*), often associated with other species of Lepidium. The lack of competition from other shade-tolerant species allows the Aromatic Peppercress to persist (Tumino 2010).	Low – despite having marginal habitat present, there are no records within 10 km. Unlikely to be present.
Leucochrysum albicans var. *tricolor*	Hoary Sunray	-	E	Occurs in a wide variety of grassland, woodland and forest habitats, generally on relatively heavy soils. The Hoary Sunray occurs at relatively high elevations in woodland and open forest communities, in an area roughly bounded by Goulburn, Albury and Bega. The species has been recorded in the Yass Valley, Tumut, Upper Lachlan, Snowy River and Galong The species is known from the South Eastern Highlands, Australian Alps and Sydney Basin bioregions (Sinclair 2010). Herbarium records indicate that the taxa once occurred more widely in inland NSW, near Cobar, Dubbo, Lithgow, Moss Vale and Delegate (Sinclair 2010).	Low – grassland areas are highly disturbed. No records within 10 km of site.
Pelargonium sp. *Striatellum*	Omeo's Stork's-bill	E	E	Flowering occurs from October to March. Occurs in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. The species is known to form clonal colonies by rhizomatous propagation. Known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. A population at a fourth known site on the Monaro has not been seen in recent years. The only other known population is at Lake Omeo, Victoria. It occurs at altitudes between 680 to 1030 m. It is known to occur in the local government areas of Goulburn-Mulwaree, Cooma-Monaro, and Snowy River, but may occur in other areas with suitable habitat; these may include Bombala, Eurobodalla, Palerang,	Low – no known records. No habitat present.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence
				Tumbarumba, Tumut, Upper Lachlan, and Yass Valley local government areas.	
Phyllota humifusa		V	V	The species occurs in dry sclerophyll forest, sometimes near swamps, in deep sandy soils or gravely loams over a sandstone substrate. Accompanying trees are often Brittle Gum *Eucalyptus mannifera*, Narrow-leafed Peppermint *E. radiata* or Sydney Peppermint *E. piperita*.	Low – closest record over 6 km to the north-east. Lack of sandstone present. Habitat very marginal.
Pimelea axiflora subsp. *pubescens*	Bungonia Rice-flower	E	-	Occurs on limestone cliff edges and outcrops. Endemic to NSW and currently only known to occur in the Bungonia State Conservation Area, south east of Goulburn. Occurs in a single population which is estimated to contain a total of 50 to 500 plants within an area of less than 4 square kilometres.	Low – Habitat within Study Area is not suitable given absence of cliff edges and outcrops.
Pomaderris cotoneaster	Cotoneaster Pomaderris	E	E	Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs. Habitat notes from specimens include: 'base of cliff, tall open forest (*E. fastigata*)'; 'alluvial terrace with tall open forest (*E. cypellocarpa*)'; 'alluvial terrace with tall open forest (*E. muelleriana*)'; 'rocky riparian site amongst tall open eucalypt forest (*E. viminalis*)'; 'rocky river bed'; 'Growing on dry south-westerly facing slope above river. Associated with *Westringia* sp. aff. *longifolia*, *Grevillea lanigera, Prostanthera* sp. *nov., Eucalyptus radiata, Olearia* sp., *Kunzea ericoides* and *Acacia pravissima'*; 'Growing in shrubby woodland of *Eucalyptus maidenii* & *E. elata*. south-facing slope with loamy soil on metasiltstone'	Low – Habitat within Study Area is not suitable.
Pomaderris pallida	Pale Pomaderris	V	V	This species usually grows in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or *Callitris* spp. woodland.	Low – Habitat within Study Area is not suitable.
Pultenaea pedunculata	Matted Bush-pea	E	-	The Matted Bush-pea occurs in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area. The ability of stems to creep and root from the nodes has made this species a very good coloniser of bare ground in many parts of its range. Matted Bush-pea is widespread in Victoria, Tasmania, and south-eastern South Australia. In NSW however, it is represented by just three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The Cumberland Plain occurrences were more widespread (Yennora, Canley Vale and Cabramatta were lost to development) and is now found at Villawood and Prestons, and north-west of Appin between the Nepean River and Devines Tunnel number 2 (Upper Sydney Water Supply Canal).	Low – out of known range. Unlikely to be present.
Rulingia prostrata	Dwarf Kerrawang	E	E	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: snow gum woodland at Rose Lagoon; blue leaved stringybark open forest at Tallong; and in brittle gum low open woodland at Penrose; scribbly gum - swamp mahogany ecotonal forest at Tomago.	Low – habitat not suitable within Study Area and unlikely to remain undetected during survey if present.
Rutidosis heterogama	Buttone Wrinkewart	V	V	Recorded from near Cessnock to Kurri Kurri with an outlying occurence at Howes Valley. On the Central Coast it is located north from Wyong to Newcastle. There are north coast populations between Wooli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes. Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides	Low – habitat not suitable within Study Area and unlikely to remain undetected during survey if present.
Rutidosis leptorrhynchoides	Button Wrinklewort	E	E	In the ACT and NSW, Button Wrinklewort occurs in box-gum woodland, secondary grassland derived from box-gum woodland or in natural temperate grassland; and often in the ecotone between the two communities.	Low – habitat not suitable within Study Area and unlikely to remain undetected during survey if present.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat	Likelihood of Occurrence
Solanum celatum		E	-	Grows on hills and slopes in eucalypt woodland; commonly found after fire or disturbance. Restricted to an area from Wollongong to a little south of Nowra and west to Bungonia Nature Reserve.	Low – Habitat within Study Area is not suitable. The species was recorded during the Niche (2014) for the Peppertree Mod 4 assessment, however this population is located approximately 1 kilometre to the east of the Study Area.
Thelymitra sp. Kangaloon	Kangaloon Sun Orchid	CE	CE	*Thelymitra* sp. Kangaloon is only known to occur on the southern tablelands of NSW in the Moss Vale - Kangaloon - Fitzroy Falls area at 550-700 m above sea level. It is known to occur at three swamps that are above the Kangaloon Aquifer. It is found in swamps in sedgelands over grey silty grey loam soils	None – no habitat present.
Thesium australe	Austral Toadflax	V	V	Grows in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland or grassy woodland. Grows on kangaroo grass tussocks but has also been recorded within the exotic coolatai grass.	None. No records within 10 km. Habitat not suitable.

Threatened fauna likelihood of occurrence

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
Amphibians							
Heleioporus australiacus	Giant Burrowing Frog	V	V	The Giant Burrowing Frog has been recorded breeding in a range of water bodies associated with more sandy environments of the coast and adjacent ranges from the Sydney Basin south the eastern Victoria. It breeds in hanging swamps, perennial non-flooding creeks and occasionally permanent pools, but permanent water must be present to allow its large tadpoles time to reach metamorphosis. No potential habitat is present within the area to be cleared. Some marginal habitat is present within the gullies to the east of the Study Area, however it was not recorded during field surveys for the Marulan South Limestone Mine Project (Niche 2015). It has not been recorded from the locality and there are no records in the region.	None	None	Species
Litoria aurea	Green and Golden Bell Frog	E	V	Inhabits a very wide range of water bodies including marshes, dams and streams, particularly those containing emergent vegetation such as bullrushes or spikerushes. It also inhabits numerous types of man-made water bodies including quarries and sand extraction sites. Optimum habitat includes water-bodies that are un-shaded, free of predatory fish such as Plague Minnow, have a grassy area nearby and diurnal sheltering sites available.	None	None	Species
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Occurs in wet and dry sclerophyll forests and heathland associated with sandstone outcrops between 280 and 1000 m on the eastern slopes of the Great Dividing Range from the Central Coast down into Victoria. Individuals have been collected from a wide range of water bodies that includes semi-permanent dams, permanent ponds, temporary pools and permanent streams, with calling occurring from fringing vegetation or on the banks. Individuals have been observed sheltering under rocks on high exposed ridges during summer and within deep leaf litter adjacent to the breeding site. Calling occurs in all months of the year, often in association with heavy rains. The tadpoles are distinctive, being large and very dark in colouration. No potential habitat is present within the area to be cleared. Some marginal habitat is present within the gullies to the east of the Study Area, however it was not recorded during field surveys for the Marulan South Limestone Mine Project (Niche 2015). It has not been recorded from the locality and there are no records in the region.	None	None	Species
Birds							
Actitis hypoleucos	Common Sandpiper	-	M, MA	Utilises a wide range of coastal wetlands and some inland wetlands, mostly found around muddy margins or rocky shores. Forages in shallow water and on soft mud, roosts on rocks or vegetation such as mangroves. Northern hemisphere breeding.	Low – transient visitor only.	Unlikely – negligible impacts.	Species - excluded from further assessment – not detected during survey.
Anthochaera phrygia	Regent Honeyeater	CE	E,M	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. This species has contracted dramatically in the last 30	Low – transient visitor only.	Unlikely – negligible impacts.	Species - excluded from further assessment – not detected during survey.

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
				years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests. Three records from the locality centred around the Bungonia National Park area to the south. As the species is migratory it may occur as a transient visitor to the site, including to forage, but would use the site rarely. No breeding habitat present. Not recorded during targeted bird survey.			
Apus pacificus	Fork-tailed Swift	-	M	The Fork-tailed Swift is almost exclusively aerial, flying from less than one metre to at least 300 m above ground and probably much higher.	Moderate	Unlikely – negligible impacts. May fly over site.	
Ardea alba	Great Egret	-	M	Great Egrets prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	Low	Unlikely – negligible impacts.	N/A
Ardea ibis	Cattle Egret	-	M	The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. May occur intermittently within the Study Area – species is common and widespread.	Moderate	Low	Not considered further - no real chance of impacts.
Botaurus poiciloptilus	Australasian Bittern	E	E	The Australasian Bittern is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes and spikerushes. Single record from Bungonia Conservation Area. Potential habitat is very limited within the proposed Study Areas with permanent wetlands very limited in extent.	None	None	Species - excluded from further assessment
Calidris acuminata	Sharp-tailed Sandpiper	-	M	Prefers muddy edges of shallow or brackish wetlands, with inundated or emergent sedges, saltmarsh or other low vegetation. Also found foraging in sewage ponds and flooded paddocks. Northern hemisphere breeding.	Low – transient visitor only.	Unlikely – negligible impacts.	Species - excluded from further assessment – not detected during survey.
Calidris ferruginea	Curlew Sandpiper	E	CE,M	It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland. Northern hemisphere breeding.	Low – transient visitor only.	Unlikely – negligible impacts.	Species - excluded from further assessment – not detected during survey.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine snow gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	Moderate Recorded on Peppertree Quarry by ERM (2006)	Potential – with negligible impacts.	Ecosystem – involved in Ecosystem Credit calculations. No casuarina species triggering the need to offset.

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
				The species has been recorded to the south and north of the Study Area and has the potential to use the site on occasion to forage. There is no particularly important breeding or foraging habitat to be impacted.			
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Inhabits forest with low nutrients, characteristically with key *Allocasuarina* spp. Tends to prefer drier forest types with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina. The species has been recorded to the south and north of the Study Area. Preferred foraging habitat is not present in areas to be impacted. The species was not detected during survey.	Low	Unlikely	Ecosystem - excluded from further assessment
Chthonicola sagittata	Speckled Warbler	V	-	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. This species has been recorded from the locality within grassy woodland areas to the west of the Study Area. While the species was not recorded during field survey there is potential habitat that may be used on occasion or by migrating individuals. Three records exist for Speckled Warbler from the locality west of the Study Area. The species was not recorded during field survey.	Moderate	Potential – with negligible impacts.	Ecosystem – involved in Ecosystem Credit calculations
Climacteris picumnus victoriae	Brown Treecreeper	V	-	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Whilst this species has been recorded within the locality, there is limited potential habitat within the Study Area as mature trees with hollows and large logs are rare. Conspicuous species not recorded during field survey.	High	Unlikely	Ecosystem – involved in Ecosystem Credit calculations
Daphoenositta chrysoptera	Varied Sittella	V	-	Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature Eucalypts with hollows. Four records exist from the locality to the west of the Study Area. A single observation of this species was made adjacent to the impact area during field survey.	High	Likely – non-significant impacts	Ecosystem – involved in Ecosystem Credit calculations
Gallinago hardwickii	Latham's Snipe	-	M	Latham's Snipe is a non-breeding migrant to the south east of Australia including Tasmania, passing through the north and New Guinea on passage. Latham's Snipe breed in Japan and on the east Asian mainland. Seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are	Low	Unlikely	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
				found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. No records from locality and not recorded during field survey.			
Glossopsitta pusilla	Little Lorikeet	V	-	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes. Most records from the region are from lower elevation near coastal areas. Not recorded during survey.	Low	Unlikely	Ecosystem – excluded from further assessment
Grantiella picta	Painted Honeyeater	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits boree, brigalow and box-gum woodlands and box-ironbark forests.	Low	Unlikely	Ecosystem – excluded from further assessment
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Inhabits coastal and near coastal areas, building large stick nests, and feeding mostly on marine and estuarine fish and aquatic fauna. Some potential habitat within the Study Area, though it would be infrequently used and for foraging only.	Low	Unlikely	N/A
Hieraaetus morphnoides	Little Eagle	V	-	Most abundant in lightly timbered areas with open areas nearby. Often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. May nest in farmland, woodland and forest in tall trees. Wide ranging species, not recorded during field surveys. One record exists from the north of the locality. Two records from Marulan area. No individuals or breeding nests were observed during field surveys. May use impacted area to forage but rarely.	Low	Unlikely	Ecosystem – involved in Ecosystem Credit calculations
Hirundapus caudacutus	White-throated Needletail	-	M	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges. Potential overfly habitat only.	Low	Unlikely	N/A
Lathamus discolor	Swift Parrot	E	E	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability. No records within the locality and not recorded from surveys. Closest record is approximately 50 km east and most records in the region are coastal. As the species is migratory it may occur as a transient visitor to the site, including to forage, but would use the site rarely given the lack of records from the region.	Low	Unlikely	Ecosystem – excluded from further assessment

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
Melanodryas cucullata cucullata	Hooded Robin	V	-	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. One recent and one dated record from locality to west of Study Area. Conspicuous bird that is primarily sedentary and was not recorded during survey.	Low	Unlikely	Ecosystem – involved in Ecosystem Credit calculations
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Two records from 30 years ago exist for this species from near Marulan and towards Goulburn. No other records occur from the region and the species was not recorded during field survey.	Low	Unlikely	Ecosystem – involved in Ecosystem Credit calculations
Merops ornatus	Rainbow Bee-eater	-	M	Found throughout mainland Australia most often in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels. Widespread migratory species that may move through Study Area occasionally.	Moderate	Unlikely	N/A
Monarcha melanopsis	Black-faced Monarch	-	M	Found along the coast of eastern Australia, becoming less common further south. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Predominant habitat within Study Area is in lower areas away from proposed cleared areas. May move through other parts of the Study Area.	Moderate	Unlikely	N/A
Motacilla flava	Yellow Wagtail	-	M	Breeds in temperate Europe and Asia. The Yellow Wagtail is a regular wet season visitor to northern Australia. Increasing records in NSW suggest this species is an occasional but regular summer visitor to the Hunter River region. The species is considered a vagrant to Victoria, South Australia and southern Western Australia. Habitat requirements for the Yellow Wagtail are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves.	Low	Unlikely	Ecosystem – excluded from further assessment
Myiagra cyanoleuca	Satin Flycatcher	-	M	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Low	Unlikely	N/A
Ninox strenua	Powerful Owl	V	-	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. It is most commonly recorded within red turpentine in tall open forests and black she-oak within open forests. Large mature trees with hollows at least 0.5 m deep are	Low	Potential – with negligible impacts.	Ecosystem – predicted associated within the PCTs of the Study Area.

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
				required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. Single record from locality. No individuals or breeding habitat was observed during field surveys. May use impacted area to forage but rarely.			
Numenius madagascariensis	Eastern Curlew	-	CE, MA, M	A primarily coastal distribution. Found in all states, particularly the north, east, and south-east regions including Tasmania. Rarely recorded inland. Mainly forages on soft sheltered intertidal sand flats or mudflats, open and without vegetation or cover. Breeds in the northern hemisphere.	Low	Unlikely	Ecosystem – excluded from further assessment
Pandion cristatus	Eastern Osprey		M	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. They exhibit a preference for coastal cliffs and elevated islands in some parts of their range, but may also occur on low sandy, muddy or rocky shores and over coral cays. They may occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging sites.	None	None	N/A
Petroica boodang	Scarlet Robin	V	-	The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Recorded at two sites during field survey, adjacent to impact area.	Known	Likely – non-significant impacts	Ecosystem – involved in Ecosystem Credit calculations
Petroica phoenicea	Flame Robin	V	-	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South Australian border. The species is also found in Tasmania. The preferred habitat in summer includes eucalyptus forests and woodland, whilst in winter prefers open woodlands and farmlands. It is considered migratory. The Flame Robin breeds from about August to January. Two records from the locality around Marulan, however not recorded during survey. As the species is somewhat migratory it may visit the site, particularly grassy woodlands during winter.	Moderate	Potential – with minimal impacts.	Ecosystem – involved in Ecosystem Credit calculations
Rhipidura rufifrons	Rufous Fantail	-	M	Mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns.	Moderate	Likely – non-significant impacts	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
Rostratula australis	Australian Painted Snipe	E	E, M	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Low	Unlikely	Ecosystem – excluded from further assessment
Stagonopleura guttata	Diamond Firetail	V	-	Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Found in grassy eucalypt woodlands, including box-gum woodlands and snow gum woodlands. Also occurs in open forest, mallee, natural temperate grassland, and in secondary grassland derived from other communities. Recorded at two sites during field survey on several occasions within impact area. Local population regularly uses parts of impact area to forage.	High	Likely – non-significant impacts	Ecosystem – involved in Ecosystem Credit calculations
Tyto novaehollandiae	Masked Owl	V	-	Inhabits a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. Mostly recorded in open forest and woodlands adjacent to cleared lands. Nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. Nest hollows are usually located within dense forests or woodlands. Masked owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet. Three records south of Study Area 4 – 6 km away. No individuals or breeding habitat was observed during field surveys. May use impacted area to forage but rarely.	Low	Potential – with negligible impacts	Ecosystem – excluded from further assessment
Tyto tenebricosa	Sooty Owl	V	-	Often found in tall old-growth forests, including temperate and subtropical rainforests. In NSW mostly found on escarpments with a mean altitude less than 500 metres. Nests and roosts in hollows of tall emergent trees, mainly eucalypts often located in gullies. Nests have been located in trees 125 to 161 centimetres in diameter. Single record from Shoalhaven Gorge (Niche 2015). No individuals or breeding habitat was observed during field surveys. May use impacted area to forage but rarely.	Low	Potential – with negligible impacts	Ecosystem – excluded from further assessment
Fish							
Macquaria australasica	Macquarie Perch	E (FM Act)	E	Macquarie perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. The conservation status of the different populations is not well known, but there have been long-term declines in their abundance. Macquarie Perch are found in both river and lake habitats; especially the upper reaches of rivers and their tributaries. They are quiet, furtive fish that feed on aquatic insects, crustaceans and molluscs. Sexual maturity occurs at two years for males and three years for females. Macquarie perch spawn in spring or summer in shallow	None	None	N/A

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
				upland streams or flowing parts of rivers and females produce around 50,000-100,000 eggs which settle among stones and gravel of the stream or river bed. Populations from the eastward-flowing Shoalhaven and Hawkesbury rivers are genetically distinct and may represent an undescribed species. Potential habitat exists in the upper reaches and tributaries of Shoalhaven River where one specimen has been recorded in 2007 (3km upstream of Bungonia confluence. However such habitat is not present within Bungonia or Barbers Creek.			
Prototroctes maraena	Australian Grayling	-	V	Historically, this species occurred in coastal streams from the Grose River Valley, southwards through NSW, Vic. and Tas, With occurences in the Shoalhaven catchment below Tallowa Dam. It also occasionally occurred high upstream in the Snowy R. A single juvenile specimen was collected from Lake Macquarie in 1974. This species spends only part of its lifecycle in freshwater. The Tambo River population inhabits a clear, gravel-bottomed stream with alternating pools and riffles, and granite outcrops. It has also been associated with clear, gravel-bottomed habitats in the Mitchell & Wonnangatta Rivers but was present in a muddy-bottomed, heavily silted habitat in the Tarwin River.	None	None	N/A
Mammals							
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals. Recorded at two out of two locations where bat recorders were placed within the Study Area including within the proposed Study Area. No breeding habitat.	Known	Likely – non significant impacts.	Assessed for impacts under the Commonwealth Assessment of Significance.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. One regional record only. Not recorded during field survey. Low abundance of preferred prey items (ground dwelling fauna), no denning habitat and widespread presence of foxes which is likely to prevent establishment of a population in the area. Quolls may occur on the site (more likely dispersing males) given proximity of conservation areas but are unlikely to use site with any frequency and there is limited value in regard to prey density.	Low	Unlikely	Ecosystem – involved in Ecosystem Credit calculations
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high. Two observations have been made of roosts in stem holes of living eucalypts. There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary but enter torpor. This species also appears to be highly mobile and records showing movements of up to 12 km between	Moderate	Potential – with low level impacts.	Ecosystem – involved in Ecosystem Credit calculations

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
				roosting and foraging sites. Three records from locality to the west of the Study Area near Marulan. Not recorded during survey but one single possible record from recent surveys at Marulan South Limestone Mine (Niche 2015).			
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Known maternity caves within Bungonia Gorge. Recorded at one harp trap location and from all sites where echolocation recording was performed.	Known	Likely – non significant impacts.	Ecosystem and Species. Species credit component (breeding habitat) excluded from assessment.
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits. One record from locality from Hume Highway near Marulan. Not recorded during field survey. Hollows/required breeding habitat is rare within the areas to be impacted by clearing. Single record just outside locality near Marulan. Not recorded during the current survey or recent surveys.	Low	Unlikely	Ecosystem – predicted associated within the PCTs of the Study Area.
Petaurus australis	Yellow-bellied Glider	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Recorded from Bungonia Gorge during Marulan South Limestone Mine surveys (Niche 2015). Not recorded during surveys of the Study Areas and no obvious glider incisions found. Habitat poor due to typical distance between trees and open paddock areas.	Low	Unlikely	Ecosystem – predicted associated within the PCTs of the Study Area.
Petauroides volans	Greater Glider	-	V	The Greater Glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows.	Low	Unlikely	Ecosystem – predicted associated within the PCTs of the Study Area.
Myotis macropus	Southern Myotis	V	-	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Has been recorded from locality near Bungonia gorge on three occasions. Limited water resources and roost habitat (e.g. hollow trees, bridges and culverts) within Study Areas.	Low	Unlikely	Ecosystem and Species. Species credit component (breeding habitat) excluded from assessment
Petaurus	Squirrel	V	-	Generally occurs in dry sclerophyll forests and woodlands but is absent from dense	Low	Unlikely	Species – Excluded from

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
norfolcensis	Glider			coastal ranges in the southern part of its range. Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias. There is only limited information available on den tree use by Squirrel gliders, but it has been observed using both living and dead trees as well as hollow stumps. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. Endangered population in the Wagga Wagga LGA. Not recorded during survey. No records from locality or region (one Atlas record from Marulan area with accuracy of 100 km).			further assessment
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices. No potential habitat within the Study Area and no habitat to be impacted indirectly. Not recorded during field survey.	Low	Unlikely	Species – excluded from further assessment
Phascolarctos cinereus	Koala	V	V	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall. There are preferred feed trees present on the site but these are predominantly scattered paddock trees. The majority of records from the locality are from the Bungonia National Park to the south. The species was not recorded during the current survey of the Study Area nor during previous surveys of the rest of the Peppertree Quarry nor surveys (spotlighting and aural surveys only) within the Barbers Creek gully for the Marulan South Limestone Mine Project (Niche 2015).	High	Likely	Species – not recorded during survey. No further assessment. Assessed for impacts under the Commonwealth Assessment of Significance.
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V	Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy.	Low	Unlikely	Ecosystem – predicted associated within the PCTs of the Study Area.
Pseudomys novaehollandiae	New Holland Mouse	-	V	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. No local records. Single record regionally. Habitat on site is not preferred habitat.	None	None	Ecosystem – however not predicted to occur
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km. Recorded from Bungonia Gorge and Barbers Creek during recent field survey for Marulan South Limestone Mine (Niche 2015) and expected to occur throughout area. Very limited foraging resources in impact area and would rarely occur within the Study Area. May fly over Study Area with some regularity, however such movements are unlikely to be impacted.	Moderate	Likely – negligible, non significant impacts.	Ecosystem and species. Species credit component (breeding habitat). excluded from further assessment.

Scientific Name	Common Name	BC Act	EPBC Act	Preferred habitat/previous records and habitat within impact area	Likelihood of Occurrence	Potential for Impacts	Species credit or Ecosystem Species
Reptiles							
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Inhabits sloping, open woodland areas with predominantly native grassy groundlayers, particularly those dominated by kangaroo grass. Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. No records locally or regionally. Preferred habitat not present.	Low	Unlikely	Species - excluded from further assessment
Delma impar	Striped Legless Lizard	V	V	Found mainly in natural temperate grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near natural temperate grassland and occasionally in open box-gum woodland. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. No records locally, single record from Goulburn area regionally. Not recorded during survey and preferred sheltering habitat not present.	Low	Unlikely	Species – excluded from further assessment
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Occurs almost exclusively in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they spend most of the year sheltering in and under rock crevices and exfoliating rock. However, some individuals will migrate to tree hollows to find shelter during hotter parts of summer. No records locally or regionally. Required habitat not present.	Low	Unlikely	Species – excluded from further assessment
Varanus rosenbergi	Rosenberg's Goanna	V	-	This species is a Hawkesbury-Narrabeen sandstone outcrop specialist. Occurs in coastal heaths, humid woodlands and both wet and dry sclerophyll forests. No local records. No termite mounds in Study Area, not recorded during survey and preferred habitat not present in areas to be impacted.	Low	Unlikely	Species – excluded from further assessment

Threatened Ecological Community (TEC) Likelihood of occurrence

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of occurrence within Study Area
Illawarra and South Coast Lowland Forest and Woodland	This community comprises vegetation types that occupy the Illawarra coastal plain and escarpment foothills. Characteristic tree species include Forest Red Gum Eucalyptus tereticornis, Thin-leaved Stringybark Eucalyptus eugenioides, Woollybutt Eucalyptus longifolia, Coast Grey Box Eucalyptus bosistoana and White Feather Honey-myrtle Melaleuca decora. The understorey is not necessarily grassy as moist forest vegetation types are also included within this broad community. Common shrub species include Acacia mearnsii and Dodonaea viscosa subsp. angustifolia. Floodplain vegetation dominated by Casuarina species or rainforests on latite soils are not part of this community.	Endangered	Critically Endangered	None – occurs more toward the coast. Was not recorded during the vegetation survey.
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	Montane Peatlands and Swamps comprises a dense, open or sparse layer of shrubs with soft-leaved sedges, grasses and forbs. It is the only type of wetland that may contain more than trace amounts of Sphagnum spp., the hummock peat-forming mosses. Small trees may be present as scattered emergents or absent. The community typically has an open to very sparse layer of shrubs, 1-5 m tall, (eg. *Baeckea gunnian*a, *B. utilis, Callistemon pityoides, Leptospermum juniperinum, L. lanigerum, L. myrtifolium, L. obovatum, L. polygalifolium).* Species of *Epacris (*eg. *E. breviflora, E. microphylla, E. paludosa)* and *Hakea microcarpa* are also common shrubs. In some peatlands and swamps, particularly those with a history of disturbance to vegetation, soils or hydrology, the shrub layer comprises dense thickets of Leptospermum species. In other peatlands and swamps with a history of grazing by domestic livestock, the shrub layer may be very sparse or absent.	Endangered	Endangered	None – not recorded during vegetation survey, Project Area out of known range and not previously mapped by within the Project Area.
Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory	In the Southern Tablelands of NSW and the ACT, dominant grasses include Kangaroo Grass Themeda triandra, wallaby grasses Austrodanthonia spp., spear grasses Austrostipa spp., Red Grass Bothriochloa macra and tussock grasses Poa spp.. Themeda triandra and Snow Grass Poa sieberiana are co-dominant in a variety of landscape positions and soil types. In wetter areas, such as moist flats, Themeda dominates the grassland with Pinrush Juncus filicaulis, while River Tussock Poa labillardieri is dominant along drainage lines, seepage areas, creeks and river flats. Poa sieberiana is dominant on the undulating basalt plains of the Monaro. The upper slopes, hill crests and ridges with well drained soils are generally dominated by Corkscrew Austrostipa scabra subsp. falcata and Tall Speargrass A. bigeniculata, while species of Austrodanthonia and Bothriochloa macra dominate gentle slopes, ridges and flats with well drained, shallow to skeletal soils. Present grass species dominance is thought to have changed significantly since European settlement because of past land uses. Other grasses such as Common Wheat Grass Elymus scaber and Nineawn Grass Enneapogon nigricans may also be present frequently, in the inter-tussock spaces.	Endangered	Endangered	None – out of range. Not recorded during field survey.

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of occurrence within Study Area
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Tableland Basalt Forest is dominated by an open eucalypt canopy of variable composition. *Eucalyptus viminalis, E. radiata, E. dalrympleana subsp. dalrympleana* and *E. pauciflora* may occur in the community in pure stands or in varying combinations. The community typically has an open canopy of eucalypts with sparse mid-story shrubs (e.g. *Acacia melanoxylon* and *A. dealbata*) and understory shrubs (e.g. *Rubus parvifolius*) and a dense groundcover of herbs and grasses, although disturbed stands may lack either or both of the woody strata. The structure of the community varies depending on past and current disturbances, particularly fire history, clearing and grazing. Contemporary tree-dominated stands of the community are largely relics or regrowth of originally taller forests and woodlands, which are likely to have had scattered shrubs and a largely continuous grassy groundcover. At some sites, mature trees may exceed 30 m tall, although regrowth stands may be shorter than 10 m tall. Tableland Basalt Forest is currently found in the Eastern Highlands and Southern and Central Tablelands, covering the local government areas of Bathurst Regional, Goulburn Mulwaree, Oberon, Palerang, Shoalhaven, Upper Lachlan and Wingecarribee. The community, however, may be found elsewhere within the designated bioregions.	Endangered	-	Low – not recorded during vegetation survey, or previously mapped by Tozer et al. (2006) within the Project Area.
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions	This community, commonly referred to as Tablelands Snow Gum Grassy Woodland, occurs as an open-forest, woodland or open woodland. This community may also occur as a secondary grassland where the trees have been removed, but the groundlayer remains. The main tree species are *Eucalyptus pauciflora* (Snow Gum), *E. rubida* (Candlebark), *E. stellulata* (Back Sallee) and *E. viminalis* (Ribbon Gum), either alone or in various combinations. Other eucalypt species may occur. A shrub layer may be present and sub-shrubs are common. The most common shrubs include Melicytus sp. 'Snowfileds' (Gruggly-bush) and *Melichrus urceolatus* (Urn Heath). The ground layer is grassy, with the most common species including *Themeda australis* (Kangaroo Grass), Poa spp. (snow-grasses), Austrostipa spp. (spear-grasses) and Rytidosperma spp. (wallaby-grasses). Sites in high condition have a range of forb (wildlfower) species, including *Leptorhynchos squamatus* (Scaly-buttons), *Chrysocephalum apiculatum* (Common Everlastings) and *Asperula conferta* (Native Woodlruff). Many threatened flora and fauna species have been recorded in this community.	Endangered	Critically Endangered	None – out of distribution range for this community.
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	The ecological community typically occurs as an open to tall open forest with a sparse to dense layer of shrubs and vines, and a diverse understorey of native grasses, forbs, twiners and ferns (Keith, 2004). However, the structure of the ecological community may vary from tall open forest with trees up to and above 30 m tall with a projected foliage cover of 30–70% (e.g. *Eucalyptus fastigata* forest on basalt near Sassafras in and around Morton National Park) to woodland with trees 10–30 m tall, with a projected foliage cover of 10–30% (e.g. exposed woodland on rocky microsyenite at Mt Jellore) depending on aspect, slope, soil conditions, soil depth, and previous clearing and disturbance (Fisher et al., 1995; NPWS & SCA, 2003; Eco Logical Australia, 2003; NSW Scientific Committee, 2001a, 2001b).	Endangered	Endangered	Low – not recorded during vegetation survey, or previously mapped by Tozer et al. (2006) within the Project Area.

Threatened Ecological Community	Description	BC Act Status	EPBC Act Status	Likelihood of occurrence within Study Area
White Box, Yellow Box, Blakely's Red Gum Derived Native Grassland	White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box Eucalyptus albens, Yellow Box E. melliodora and Blakely's Red Gum E. blakelyi. Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs. The community also includes a range of mammal, bird, reptile, frog and invertebrate fauna species. Intact stands that contain diverse upper and mid-storeys and groundlayers are rare. Modified sites include the following: •Areas where the main tree species are present ranging from an open woodland formation to a forest structure, and the groundlayer is predominantly composed of exotic species; and •Sites where the trees have been removed and only the grassy groundlayer and some herbs remain. The Australian Government listing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is slightly different to the NSW listing. Areas that are part of the Australian Government listed ecological community must have either: •An intact tree layer and predominately native ground layer; or •An intact native ground layer with a high diversity of native plant species but no remaining tree layer.	Endangered	Critically Endangered	Yes – recorded within the Study Area and will be impacted by the Project.

Appendix 2. Plant Community Type Descriptions

PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands (SR670)

Habitat: PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland occupies the flat terrain and gentle slopes on relatively fertile soils which is located to the north of the Study Area.

Structure/Characteristics: Two different condition classes of the community were recorded in the Study Area. Typically, the best condition of the community consisted of a tree layer ranging in height from 15 - 25 m consisting of *Eucalyptus blakelyi,* and *Eucalyptus melliodora* with the occasional *E. eugenioides* and *E. bosistoana.* A midstorey contained *Acacia mearnsii*, was sparse. The sparse shrub layer consisted of *Cassinia aculeata, Lissanthe strigosa* and *Olearia viscidula.* The ground layer consisted of *Einadia hastata Austrodanthonia racemosa, Microlaena stipoides, Bothriochloa macra, Acaena novae-zelandiae, Lomandra filiform*is subsp. *coriacea, Thysanotus patersonii, Anisopogon avenaceus, Poa sieberiana, Austrostipa scabra,* and *Aristida ramosa*.

Nassella trichotoma (Serrated Tussock) was in relatively high cover and abundance throughout portions of this PCT within the Study Area.

Condition classes:

Two condition classes were assigned to PCT1334 within the Study Area:

- Moderate condition: Consisting of close patches of Eucalypt stands (comprising of *Eucalyptus blakelyi,* and *Eucalyptus melliodora* with the occasional *E. eugenioides* and *E. bosistoana*) with a mixture of native and introduced ground cover. This condition class has a vegetation integrity score of 36.4.
- Poor: Consisting of a few sparsely scattered Eucalypt stands, with a mixture of native and introduced ground cover. This condition class has a vegetation integrity score of 19.8.

Conservation Status: This vegetation community in both condition classes aligns to the NSW BC Act - White Box Yellow Box Blakely's Red Gum Woodland TEC (EEC) due to the following listing criteria (Scientific Committee 2002) being satisfied within the Study Area:

- Characterised by the presence or prior occurrence of Yellow Box and/or Blakely's Red Gum
- The understorey in intact sites is characterised by native grasses and a high diversity of herbs
- Shrubs are generally sparse or absent, though they may be locally common
- Characteristic species are present as identified in the Scientific Committee (2012)
- Occurs within the known range of the TEC.

In regards to the EPBC Act listing, an analysis of the Determination and Flow Chart Diagram within the EPBC Act Policy Statement (DoE undated) was undertaken. The two different condition classes occurring in the Study Area meet the criteria in different ways. The alignment of each condition class to the CEEC criteria is provided in Table 17.

Resilience and ability to regenerate:

The historic clearing coupled with the existing and historic grazing within the Study Area has resulted in most of the Study Area having a moderate resilience. Serrated tussock was a dominant grass within much

of the Study Area. It is likely that the patches would continue to naturally regenerate and abundance and cover would increase, however given the small size of the patches, regular weed management would need to be established in order to assist natural regeneration from edge effects.

Table 17. Alignment to TEC determinations

Condition	Description	How it meets the BC Act Determination	How it meets the EPBC Act Determination
Moderate (site condition score of 33.1.)	▪ The presence of diagnostic mature trees including *Eucalyptus blakelyi, E. melliodora* and *E. eugenioides* in an open woodland formation. ▪ Presence of diagnostic groundcover plant species including some important species (excluding grasses). ▪ Presence of regenerating over-storey species. ▪ Moderate occurrence of exotic plant species. ▪ The patch has a high resilience.	▪ Characterised by the presence or prior occurrence of *Eucalyptus albens, E. melliodora* and/or *E. blakelyi*. ▪ The understorey is characterised by native grasses and a high diversity of herbs. ▪ Shrubs are generally sparse or absent, though they may be locally common. ▪ Characteristic species are present as identified in the Scientific Determination. ▪ Occurs within the known range of the TEC.	▪ Diagnostic species present. ▪ Predominantly native understorey. ▪ Whilst the plots undertaken did not contain greater than 12 native understorey species (excluding grasses), the size of the patch when adjacent grassland areas are included is greater than 2 ha. ▪ Mature trees and natural regeneration of eucalypts is present.
Poor (site condition score of 19.8)	▪ Reduced diversity of characteristic canopy dominants in the overstorey stratum with diagnostic tree species confined to *Eucalyptus blakelyi* and *E. melliodora.* ▪ Low to very low diversity of White Box Yellow Box Blakely's Red Gum Woodland CEEC groundcover plant species (excluding grasses). Rare occurrences of important species of which there were 0 to 2 of in floristic plots conducted within the degraded condition class. ▪ Regenerating over storey species ▪ Moderate to high occurrence of exotic plant species ▪ A long history of grazing.	▪ Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. ▪ The understorey in intact sites is characterised by native grasses and some diversity of herbs. ▪ Shrubs are generally sparse or absent. ▪ Characteristic species are present as identified in the Scientific Determination. ▪ Occurs within the known range of the TEC.	▪ Whilst in a disturbed condition, diagnostic species such as overstorey eucalypts are present. ▪ Whilst the plots undertaken did not contain greater than 12 native understorey species (excluding grasses), the size of the patch when adjacent grassland areas are included is greater than 2 ha. ▪ Mature trees and natural regeneration of eucalypts are present

Photo 3. PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands moderate condition

Photo 4. PCT 1334 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands poor condition

PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges - Southern Sydney Basin

Habitat: PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges -Southern Sydney Basin is equivalent to Tozer et al (2006) mapping unit p.27 Bungonia Slates Woodland. The PCT is found in the study are on the slopes where it comprise of a woodland to forest formation particularly toward the south-east of the Study Area. The vegetation community transitions into PCT 1334 on the gentle slopes and flat terrain. A degree of difficulty in determining the transition zone between the two communities was attributed due to the presence of *Eucalyptus bosistoana* which intergraded with *E. melliodora*. As discussed with OEH botanist John Briggs whilst on-site on the 16th June 2015, landscape position plays an important part in separating PCT 778 from PCT 778. As such, the steeper slopes have been attributed to the PCT 778 community.

Structure/Characteristics: Two different condition classes of the community were recorded in the Study Area. The best condition of the community consisted of a tree layer ranging in height from 15 - 25 m consisting of *Eucalyptus bosistiana,* and *E. blakelyi/E. tereticornis* with *E. eugenioides.* The sparse shrub layer consisted of *Cassinia aculeata, Lissanthe strigosa* and *Olearia viscidula.* The ground layer consisted of *Austrodanthonia racemosa, Microlaena stipoides, Bothriochloa macra, Acaena novae-zelandiae, Lomandra filiform*is subsp. *coriacea, Anisopogon avenaceus, Poa sieberiana* and *Aristida ramosa*.

Like that of PCT 1334, *Nassella trichotoma* (Serrated Tussock) was in relatively high cover and abundance throughout portions of this PCT within the Study Area.

Condition classes:

Two condition classes were assigned to PCT1334 within the Study Area:

Moderate: Consisting of a canopy dominated by *Eucalyptus bosistoana* and *E. blakelyi/E.tereticornis* with a mixture of native and introduced ground cover.

Poor: Typically lacked a canopy and shrub layer. Consisted predominantly of a native and introduced ground cover. This condition class typically occurred within the transmission line easement on steep slopes.

Conservation Status: This PCT does not align to a TEC under State or Commonwealth legislation.

Photo 5. PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges -Southern Sydney Basin – Moderate Condition

Photo 6. PCT 778 Coast Grey Box – stringybark dry woodland on slopes of the Shoalhaven Gorges -Southern Sydney Basin – Poor Condition

Non-native vegetation

Portions toward the north and north-east of the study have been extensively cleared, and have a soil profile which offers very little resilience to regenerate to a native vegetation community. These areas are dominated by introduced grasses and herbaceous weeds, including: *Plantago lanceolata, Hypochaeris radicata, Pennisetum clandestina, Setaria gracilis, Nassella trichotoma* and *Paspalum dilatatum.*

Photo 7. Non-native vegetation

Appendix 3. Floristic plot data

Plot Data extracted from Fulcrum digital data collection – Evidence of the raw Fulcrum data files can be provided upon request as handwritten datasheets are no longer used. The below species lists can be provided in excel format upon request.

PCT778 - medium

Plot 1410				Plot 1413			
Genus	Species	Cover	Abundance	Genus	Species	Cover	Abundance
Acacia	*parramattensis*	1	1	*Austrodanthonia*	*racemosa*	25	
Cassinia	*longifolia*	20		*Bromus*	*cartharticus*	5	
Cirsium	*vulgare*	0.1	1	*Carex*	*inversa*	0.1	1
Clematis	*aristata*	0.1	1	*Cassinia*	*uncata*	2	4
Cotoneaster	*glaucophyllus*	0.5	5	*Cirsium*	*vulgare*	0.5	10
Cotula	*australis*	0.5		*Convolulous*	*graminetinus*	0.1	1
Dichondra	*repens*	0.1	50	*Desmodium*	*varians*	0.1	4
Entolasia	*stricta*	1	20	*Dichondra*	*repens*	0.2	30
Eucalyptus	*tereticornisX*	5		*Eucalyptus*	*bosistiana*	15	
Eucalyptus	*bosistoana*	20		*Eucalyptus*	*blakelyi*	10	
Eucalyptus	*viminalis*	5		*Geranium*	*solanderi*	0.2	20
Geranium	*homeanum*	0.2	50	*Glycine*	*tabacina*	0.1	5
Geranium	*solanderi*	0.1	50	*Hymenanthera*	*dentata*	0.1	2
Hypochaeris	*radicata*	0.1	5	*Lissanthe*	*strigosa*	4	20
Lepidosperma	*laterale*	0.1	1	*Lomandra*	*filiformis*	0.3	15
Lomandra	*filiformis*	0.5	30	*Nassella*	*tenuissima*	30	
Microlaena	*stipoides*	5		*Passiflora*	*spp.*	0.1	1
Paspalum	*dilatatum*	2	50	*Plantago*	*debilis*	0.1	9
Plantago	*lanceolata*	0.1	5	*Poa*	*sieberiana*	5	
Poa	*sieberiana*	1	20				
Rubus	*fruticosus*	0.1	5				
Plot 1412							
Acacia	*parramattensis*	*1*	1				
Acaena	*novae-zelandiae*	*0.1*	5				
Austrostipa	*ramosissima*	*5*					
Cassinia	*longifolia*	*5*					
Cirsium	*vulgare*	*0.1*	2				
Dichelachne	*micrantha*	*5*					
Dichondra	*repens*	*0.1*	1				
Eucalyptus	*amplifolia*	*5*					
Eucalyptus	*tereticornis*	*2*					
Geranium	*solanderi*	*0.5*	1				
Microlaena	*stipoides*	*5*					
Nassella	*trichotoma*	*55*					
Olearia	*viscidula*	*0.5*	1				
Oxalis	*perennans*	*0.1*	1				
Paspalum	*dilatatum*	*15*					

Rhytidosporum	*spp.*	*5*	
Rumex	*brownii*	*0.1*	1
Senecio	*linearifolius*	*0.1*	1
Senecio	*madagascariensis*	*0.1*	3
Sporobolus	*creber*	*5*	
Urtica	*incisa*	*0.1*	3

PCT778 – poor

Plot 028	Species	Cover	Abundance
Nassella	*tenuissima*	45	
Bothriochloa	*macra*	25	
Austrodanthonia	*racemosa*	10	
Axonopus	*virginicus*	15	
Themeda	*australis*	5	
Austrostipa	*scabra*	3	100
Rubus	*fruticosus*	1	1
Acaena	*zelandiae*	0.1	10
Poa	*annua*	3	60
Cheilanthes	*seiberi*	0.1	3
Lissanthe	*strigosa*	1	5
Hypericum	*perforatum*	0.1	20
Lomandra	*filiformis*	0.5	25
Opuntia	*stricta*	0.1	2
Plot 031			
Genus	*Species*	Cover	Abundance
Hypericum	*peforatum*	0.1	5
Acaena	*novae-zelandiae*	0.1	5
Oxalis	*perennans*	0.2	20
Glycine	*tabacina*	0.1	15
Austrostipa	*scabra*	5	
Rubus	*fruiticosus*	1	2
Poa	*annua*	5	
Plantago	*lanceolata*	0.5	20
Centella	*asiatica*	0.2	10
Panicum	*effusum*	5	
Conyza	*bonariensis*	0.3	10
Medicago	*arabica*	0.1	10
Themeda	*australis*	5	
Bothriochloa	*macra*	15	
Austrodanthonia	*racemosa*	5	
Axonopus	*virginicus*	5	
Nassella	*tenuissima*	45	

PCT1334 – Moderate

Plot 1416				Plot 1415			
Genus	Species	Cover	Abundance	Genus	Species	Cover	Abundance
Nassella	*tenuissima*	35		*Acaena*	*novae-zelandiae*	0.5	10
Eucalyptus	*eugeniodes*	5		*Geranium*	*homeanum*	0.2	50
Austrodanthonia	*tenuior*	15		*Geranium*	*solanderi*	0.2	20
Bromus	*cartharticus*	10		*Galium*	*propinquum*	0.5	50
Plantago	*lanceolata*	0.5	20	*Dichondra*	*repens*	0.5	50
Austrostipa	*scabra*	5		*Lagenophora*	*spp.*	0.5	2
Lolium	*perenne*	15		*Bothriochloa*	*macra*	10	
Vulpia	*myuros*	5		*Dichelachne*	*micrantha*	5	
Asperula	*conferta*	0.2	5	*Lomandra*	*filiformis*	0.5	10
Dichondra	*repens*	0.3	5	*Nassella*	*trichotoma*	20	
Cirsium	*vulgare*	0.5	4	*Lycium*	*ferocissimum*	0.1	1
Dactylis	*glomerata*	0.2	4	*Glycine*	*tabacina*	0.1	10
Geranium	*solanderi*	0.1	10	*Lissanthe*	*strigosa*	0.5	5
Rumex	*brownii*	0.1	1	*Eucalyptus*	*eugenioides*	5	
Eucalyptus	*melliodora*	15		*Acacia*	*parramattensis*	5	
Plot 1414				*Eucalyptus*	*bosistoana*	5	
Dichondra	*repens*	0.5	100	*Plantago*	*lanceolata*	1	100
Geranium	*solanderi*	0.2	50	*Rubus*	*fruticosus*	0.1	5
Oxalis	*perennans*	0.1	30	*Hypochaeris*	*radicata*	1	100
Geranium	*homeanum*	0.2	50	*Solanum*	*nigrum*	0.1	1
Acaena	*novae-zelandiae*	0.1	5				
Galium	*propinquum*	0.1	2				
Rumex	*brownii*	0.1	2				
Dichelachne	*micrantha*	10					
Bothriochloa	*macra*	5					
Entolasia	*stricta*	0.5	5				
Nassella	*trichotoma*	50					
Glycine	*tabacina*	0.1	2				
Desmodium	*varians*	0.2	20				
Rhytidosporum	*spp.*	15					
Eucalyptus	*bosistoana*	5					
Eucalyptus	*viminalis*	2	1				
Plantago	*lanceolata*	3	200				
Hypochaeris	*radicata*	0.5	50				
Cirsium	*vulgare*	0.1	5				

Plot 249801			
Genus	Species	Cover	Abundance
Nassella	*tenuissima*	55	
Eucalyptus	*eugeniodes*	10	
Austrodanthonia	*tenuior*	5	
Austrodanthonia	*racemosa*	2.5	50
Bothiocloa	*macra*	5	
Bromus	*cartharticus*	2	50
Plantago	*lanceolata*	3	25
Austrostipa	*scabra*	5	
Lolium	*perenne*	3	20
Vulpia	*myuros*	3	
Asperula	*conferta*	0.2	5
Dichondra	*repens*	0.2	5
Oxalis	*perennans*	0.1	10
Lissanthe	*Strigose*	15	
Acaena	*novae-zelandiae*	0.1	2
Bidens	*pilosa*	0.1	4
Plot 02			
Dichondra	*repens*	0.7	100
Geranium	*solanderi*	0.5	30
Cheilanthes	*Seiberi*	0.1	2
Geranium	*homeanum*	0.3	20
Lissanthe	*strigosa*	4	20
Olearia	*Spp.*	1	3
Rumex	*brownii*	0.1	2
Dichelachne	*micrantha*	10	
Bothriochloa	*macra*	10	
Nassella	*trichotoma*	35	
Austrodanthonia	*Racemosa*	10	
Glycine	*tabacina*	0.1	5
Desmodium	*varians*	0.3	15
Rhytidosporum	*spp.*	5	
Eucalyptus	*melliodora*	10	
Eucalyptus	*blakelyiX*	5	
Plantago	*lanceolata*	0.5	20
Hypochaeris	*radicata*	0.5	25
Cirsium	*vulgare*	0.3	15

PCT1334 – Poor

Plot 25		SR670_mod		Plot 26			
Genus	Species	Cover	Abundance	Genus	Species	Cover	Abundance
Nassella	*tenuissima*	45		*Nassella*	*tenuissima*	25	
Austrodanthonia	*racemosa*	30		*Austrodanthonia*	*racemosa*	15	
Paspalum	*dilatatum*	10		*Paspalum*	*dilatatum*	5	
Austrostipa	*scabra*	5		*Wahlenbergia*	*gracilis*	0.1	1
Bothriochloa	*macra*	20		*Bothriochloa*	*macra*	20	
Plantago	*lanceolata*	0.5	5	*Pennisetum*	*cladenstina*	5	
Rubus	*fruticosus*	1	2	*Austrostipa*	*scabra*	5	
Setaria	*gracilis*	5		*Plantago*	*lanceolata*	0.5	5
Acaena	*zelandiae*	0.1	5	*Bidens*	*pilosa*	0.1	3
Asperula	*conferta*	0.1	5	*Setaria*	*gracilis*	5	
Carex	*inversa*	0.1	5	*Acaena*	*zelandiae*	0.1	2
Cheilanthes	*seiberi*	0.1	10	*Asperula*	*conferta*	0.1	2
Dichondra	*repens*	0.2	20	*Carex*	*inversa*	0.1	1
Hypochaeris	*radicata*	0.5	25	*Cheilanthes*	*seiberi*	0.1	3
Juncus	*spp.*	0.1	2	*Dichondra*	*repens*	0.2	4
Plot 24				*Hypochaeris*	*radicata*	0.5	5
Nassella	*tenuissima*	40					
Austrodanthonia	*racemosa*	25					
Axonopus	*virginicus*	5					
Dichelachne	*micrantha*	15					
Plantago	*lanceolata*	0.5	5				
Cheilanthes	*seiberi*	0.1	5				
Centella	*asiatica*	0.1	5				
Eucalyptus	*melliodora*	5					
Panicum	*effusum*	15					
Chrysophephalum	*apiculatum*	0.1	2				
Cyperus	*gracilis*	0.1	1				
Eucalyptus	*eugenioides*	5					
Lissanthe	*strigosa*	0.5	5				
Oxalis	*perennans*	0.1	20				

Appendix 4. Plot transect scores

Composition and structure

PCT	Condition	Plot	Easting	Northing	Zone	Compass direction	Tree	Shrub	Grass and grass like	Forb	Fern	Other
1334	Medium	1415	228141	6149142	56	40	3	1	3	6	0	1
1334	Medium	1414	227966	6149217	56	308	2	1	3	7	0	2
1334	Medium	1416	228078	6149316	56	195	2	1	2	5	0	0
1334	Medium	2498lb01	227783	6149329	56	130	1	1	3	3	0	0
1334	Medium	02	227727	6149114	56	167	2	2	4	6	1	3
1334	Poor	AG24	228136	6149301	56	101	1	2	6	4	0	2
1334	Poor	AG25	227875	6149491	56	100	2	3	4	2	0	2
1134	Poor	AG26	228036	6149467	56	96	0	0	5	2	0	2
778	Good	1410	228004	6148657	56	340	4	1	5	4	0	1
778	Good	1412	228007	6148770	56	10	3	3	4	7	0	0
778	Good	1413	227928	6148829	56	22	4	2	3	6	0	2
778	Derived	28	227725	6148828	56	56	0	1	4	2	0	2
778	Derived	31	227935	6148957	56	88	0	2	6	2	0	3

Function scores

PCT	Condition	Plot	Tree	Shrub	Grass and grass like	Forb	Fern	Other	Regen
1334	Medium	1515	15	0.5	15.5	2.4	0	0.1	Absent
1334	Medium	1414	7	15	15.5	1.3	0	0.3	Absent
1334	Medium	1416	14	15	13	3.5	0	0	Absent
1334	Medium	2498lb01	10	15	25.1	0.8	0	0	Present
1334	Medium	02	15	5	35	2.0	0.1	0.5	Absent
1334	Poor	AG24	1	1	10	3	0	4	Absent
1334	Poor	AG25	1	1	15	5	0	3	Absent
778	Good	1410	31	20	7.6	0.9	0	0.1	Absent
778	Good	1412	8	10.5	20	1.1	0	0	Absent

778	Good	1413	14	15	14	2	0	0.5	Present
778	Derived	28	0	0.5	16	0.1	0	0.2	Absent
778	Derived	31	0	1.5	12	0.5	0	0.6	Absent
1134	Poor	AG26	0	0	22	0.6	0	0.1	Absent

Function scores (continued)

PCT	Condition	**Plot**	0 -9	10 to 19	20-29	30-49	50-79	No >50cm	HBT	Litter cover	FL	High threat weed
1334	Medium	1515	N	Y	Y	Y	N	0	0	44	20	20
1334	Medium	1414	N	N	N	Y	N	1	1	68	5	50
1334	Medium	1416	N	Y	Y	Y	N	2	1	40	24	40
1334	Medium	2498lb01	Y	Y	N	N	N	0	1	55	1	55
1334	Medium	02	N	Y	Y	Y	N	0	0	75	6.5	35
1334	Poor	AG24	N	N	N	Y	N	0	0	60	0	50
1334	Poor	AG25	N	N	Y	N	N	0	0	65	0	55
1134	Poor	AG26	N	N	N	N	N	0	0	55	2.5	50
778	Good	1410	N	Y	Y	Y	N	1	0	74	25	2
778	Good	1412	N	N	N	N	N	1	1	62	30	65
778	Good	1413	Y	Y	Y	Y	N	0	0	75	42	45
778	Derived	28	N	N	N	N	N	0	0	55	0	45
778	Derived	31	N	N	N	N	N	0	0	65	0	55

Appendix 5. Fauna species list in Study Area

Common Name	Scientific	Quantity	Status	Date	Observation	Observer	Camera number
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	2	P	06/02/2015	O s	Simon Tweed	0
Yellow-rumped Thornbill	Acanthiza chrysorrhoa	2	P	06/02/2015	O s	Simon Tweed	0
Eastern Spinebill	Acanthorhynchus tenuirostris	1	P	06/02/2015	H s	Simon Tweed	0
Eastern Spinebill	Acanthorhynchus tenuirostris	1	P	06/02/2015	H s	Simon Tweed	0
Australian Owlet-nightjar	Aegotheles cristatus	1	P	06/02/2015	H	Simon Tweed	0
White-winged Chough	Corcorax melanorhamphos	1	P	06/02/2015	H distant	Simon Tweed	0
White-winged Chough	Corcorax melanorhamphos	1	P	06/02/2015	H distant	Simon Tweed	0
White-winged Chough	Corcorax melanorhamphos	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
White-throated Treecreeper	Cormobates leucophaea	1	P	06/02/2015	O s	Simon Tweed	0
White-throated Treecreeper	Cormobates leucophaea	1	P	06/02/2015	O s	Simon Tweed	0
Australian Raven	Corvus coronoides	1	P	06/02/2015	H	Simon Tweed	0
Australian Raven	Corvus coronoides	1	P	06/02/2015	H	Simon Tweed	0
Australian Magpie	Cracticus tibicen	1	P	06/02/2015	H distant	Simon Tweed	0
Australian Magpie	Cracticus tibicen	1	P	06/02/2015	H distant	Simon Tweed	0
Australian Magpie	Cracticus tibicen	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
White-throated Gerygone	Gerygone albogularis	1	P	06/02/2015	H s	Simon Tweed	0
White-throated Gerygone	Gerygone albogularis	1	P	06/02/2015	H s	Simon Tweed	0
Superb Fairy-wren	Malurus cyaneus	1	P	06/02/2015	H	Simon Tweed	0
Superb Fairy-wren	Malurus cyaneus	1	P	06/02/2015	H	Simon Tweed	0
Superb Fairy-wren	Malurus cyaneus	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
Spotted Pardalote	Pardalotus punctatus	1	P	06/02/2015	O s	Simon Tweed	0
Spotted Pardalote	Pardalotus punctatus	1	P	06/02/2015	O s	Simon Tweed	0
Scarlet Robin	Petroica boodang	1	V	06/02/2015	O	Simon Tweed	0
Tawny Frogmouth	Podargus strigoides	1	P	06/02/2015	O spot	Simon Tweed	0
Grey Fantail	Rhipidura albiscapa	1	P	06/02/2015	O	Simon Tweed	0
Grey Fantail	Rhipidura albiscapa	1	P	06/02/2015	O	Simon Tweed	0
Eastern Grey Kangaroo	Macropus giganteus	1	P	06/02/2015	O spot	Simon Tweed	0
Eastern Grey	Macropus	1	P	06/02/2015	Infrared Camera	Simon Tweed	37

Common Name	Scientific	Quantity	Status	Date	Observation	Observer	Camera number
Kangaroo	giganteus						
Eastern Grey Kangaroo	Macropus giganteus	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
Common Wallaroo	Macropus robustus	1	P	06/02/2015	Infrared Camera	Simon Tweed	37
Common Wallaroo	Macropus robustus	1	P	06/02/2015	Infrared Camera	Simon Tweed	43
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	O spotlight	Simon Tweed	0
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	IO	Simon Tweed	0
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	Infrared Camera	Simon Tweed	37
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	Infrared Camera	Simon Tweed	38
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	Infrared Camera	Simon Tweed	42
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	Infrared Camera	Simon Tweed	42
Sugar Glider	Petaurus breviceps	1	P	06/02/2015	H and various incisions seen.	Simon Tweed	0
Sugar Glider	Petaurus breviceps	1	P	06/02/2015	H spot approx 100m to sth	Simon Tweed	0
Rattus sp.	Rattus sp.	1	U	06/02/2015	Infrared Camera	Simon Tweed	42
Short-beaked Echidna	Tachyglossus aculeatus	1	P	06/02/2015	Infrared Camera	Simon Tweed	38
Common Brushtail Possum	Trichosurus vulpecula	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
Common Wombat	Vombatus ursinus	1	P	06/02/2015	O inc	Simon Tweed	0
Common Wombat	Vombatus ursinus	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
Fox	Vulpes vulpes	1	U	06/02/2015	O spot	Simon Tweed	0
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	37
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	37
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	38
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	37
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	38
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
Lace Monitor	Varanus varius	1	P	06/02/2015	Infrared Camera	Simon Tweed	38
Lace Monitor	Varanus varius	1	P	06/02/2015	Infrared Camera	Simon Tweed	42
Chestnut-rumped Thornbill	Acanthiza uropygialis	1	P	06/02/2015	Infrared Camera	Simon Tweed	77
Eastern Spinebill	Acanthorhynchus tenuirostris	1	P	06/02/2015	H	Simon Tweed	0
Black-faced Cuckoo-shrike	Coracina novaehollandiae	1	P	06/02/2015	O s	Simon Tweed	0
White-winged Chough	Corcorax melanorhamphos	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
White-throated Treecreeper	Cormobates leucophaea	1	P	06/02/2015	H s	Simon Tweed	0

Common Name	Scientific	Quantity	Status	Date	Observation	Observer	Camera number
Australian Raven	Corvus coronoides	2	P	06/02/2015	H	Simon Tweed	0
Brown Quail	Coturnix ypsilophora	1	P	06/02/2015	O	Simon Tweed	0
Australian Magpie	Cracticus tibicen	1	P	06/02/2015	H	Simon Tweed	0
Australian Magpie	Cracticus tibicen	1	P	06/02/2015	Infrared Camera	Simon Tweed	40
Australian Magpie	Cracticus tibicen	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
Eastern Yellow Robin	Eopsaltria australis	1	P	06/02/2015	Infrared Camera	Simon Tweed	77
Wonga Pigeon	Leucosarcia picata	1	P	06/02/2015	Infrared Camera	Simon Tweed	77
Superb Fairy-wren	Malurus cyaneus	1	P	06/02/2015	H s	Simon Tweed	0
Superb Fairy-wren	Malurus cyaneus	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Superb Fairy-wren	Malurus cyaneus	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Superb Fairy-wren	Malurus cyaneus	1	P	06/02/2015	Infrared Camera	Simon Tweed	77
Spotted Pardalote	Pardalotus punctatus	1	P	06/02/2015	H	Simon Tweed	0
Noisy Friarbird	Philemon corniculatus	1	P	06/02/2015	O	Simon Tweed	0
Grey Fantail	Rhipidura albiscapa	1	P	06/02/2015	H	Simon Tweed	0
Willie Wagtail	Rhipidura leucophrys	1	P	06/02/2015	O	Simon Tweed	0
White-browed Scrubwren	Sericornis frontalis	1	P	06/02/2015	Infrared Camera	Simon Tweed	43
Pied Currawong	Strepera graculina	1	P	06/02/2015	Infrared Camera	Simon Tweed	40
Pied Currawong	Strepera graculina	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
Large-eared Pied Bat	Chalinolobus dwyeri	3	V	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Gould's Wattled Bat	Chalinolobus gouldii	1	P	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Chocolate Wattled Bat	Chalinolobus morio	1	P	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Brown Hare	Lepus capensis	1	U	06/02/2015	Infrared Camera	Simon Tweed	39
Brown Hare	Lepus capensis	1	U	06/02/2015	Infrared Camera	Simon Tweed	39
Brown Hare	Lepus capensis	1	U	06/02/2015	Infrared Camera	Simon Tweed	43
Eastern Grey Kangaroo	Macropus giganteus	1	P	06/02/2015	O	Simon Tweed	0
Eastern Grey Kangaroo	Macropus giganteus	25	P	06/02/2015	O inc	Simon Tweed	0
Eastern Grey Kangaroo	Macropus giganteus	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Eastern Grey	Macropus	1	P	06/02/2015	Infrared Camera	Simon Tweed	39

Common Name	Scientific	Quantity	Status	Date	Observation	Observer	Camera number
Kangaroo	giganteus						
Eastern Grey Kangaroo	Macropus giganteus	1	P	06/02/2015	Infrared Camera	Simon Tweed	40
Eastern Grey Kangaroo	Macropus giganteus	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
Nyctophilus sp.	Nyctophilus sp.	1	P	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	O spot	Simon Tweed	0
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	Infrared Camera	Simon Tweed	40
Rabbit	Oryctolagus cuniculus	1	U	06/02/2015	Infrared Camera	Simon Tweed	45
Eastern Horseshoe-bat	Rhinolophus megaphyllus	1	P	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Short-beaked Echidna	Tachyglossus aculeatus	1	P	06/02/2015	Infrared Camera	Simon Tweed	43
Short-beaked Echidna	Tachyglossus aculeatus	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
Short-beaked Echidna	Tachyglossus aculeatus	1	P	06/02/2015	Infrared Camera	Simon Tweed	77
White-striped Freetail-bat	Tadarida australis	1	P	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Common Brushtail Possum	Trichosurus vulpecula	2	P	06/02/2015	O spot 100 m north and 200 m north	Simon Tweed	0
Common Brushtail Possum	Trichosurus vulpecula	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Common Brushtail Possum	Trichosurus vulpecula	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Common Brushtail Possum	Trichosurus vulpecula	1	P	06/02/2015	Infrared Camera	Simon Tweed	40
Common Brushtail Possum	Trichosurus vulpecula	1	P	06/02/2015	Infrared Camera	Simon Tweed	43
Common Brushtail Possum	Trichosurus vulpecula	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
Large Forest Bat	Vespadelus darlingtoni	1	P	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Little Forest Bat	Vespadelus vulturnus	1	P	06/02/2015	Ultrasonic Recording	Simon Tweed, Matthew Stanton	0
Common Wombat	Vombatus ursinus	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Common Wombat	Vombatus ursinus	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Common Wombat	Vombatus ursinus	1	P	06/02/2015	Infrared Camera	Simon Tweed	40

Common Name	Scientific	Quantity	Status	Date	Observation	Observer	Camera number
Common Wombat	Vombatus ursinus	1	P	06/02/2015	Infrared Camera	Simon Tweed	43
Common Wombat	Vombatus ursinus	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
Common Wombat	Vombatus ursinus	1	P	06/02/2015	Infrared Camera	Simon Tweed	77
Fox	Vulpes vulpes	1	U	06/02/2015	O	Simon Tweed	0
Fox	Vulpes vulpes	1	U	06/02/2015	O inc	Simon Tweed	0
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	39
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	39
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	40
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	43
Fox	Vulpes vulpes	1	U	06/02/2015	Infrared Camera	Simon Tweed	45
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	O	Simon Tweed	0
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	O inc	Simon Tweed	0
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	39
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	40
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	43
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	45
Swamp Wallaby	Wallabia bicolor	1	P	06/02/2015	Infrared Camera	Simon Tweed	77

Key: P = Protected; V = Vulnerable; E = Endangered; - = not listed under act (exotic/introduced species).

Appendix 6. Serious and Irreversible Impact (SAII) Criteria

White Box Yellow Box Blakely's Red Gum Grassy Woodland SAII criteria

SAII criteria	Address of SAII criteria
(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	See section 5.1 regarding avoidance.
(b) the area (ha) and condition of the TEC to be impacted directly and indirectly by the proposed development. The condition of the TEC is to be represented by the vegetation integrity score for each vegetation zone.	White Box Yellow Box Blakely's Red Gum Grassy Woodland occurs towards the north and west of the Study Area on the flat and gentle slopes. Historically, it is likely the community occupied much of the flat and gentle terrain of the Study Area, in particular those areas of exotic pasture adjacent to mapped units of PCT 1334. A total 27.7 hectares of White Box Yellow Box Blakely's Red Gum Grassy Woodland would be directly impacted by the Project. The extent of this community is shown on Figure 8. The area to be cleared consists of two different condition classes (Appendix 2): Moderate: Consisting of close patches of Eucalypt stands (comprising of *Eucalyptus blakelyi,* and *Eucalyptus melliodora* with the occasional *E. eugenioides* and *E. bosistoana*) with a mixture of native and introduced ground cover. This condition class had a vegetation integrity score of 36.4. Poor: Consisting of a few sparsely scattered Eucalypt stands, with a mixture of native and introduced ground cover. This condition class had a vegetation integrity score of 19.8. Indirect impacts to the remaining White Box Yellow Box Blakely's Red Gum Woodland would be avoided by carrying out weed control, pest control, demarcating 'no go' areas, and contractor education. Details regarding these are provided in section 5.1.1. It should be noted that the Marulan South Project which is subject to an additional approval would also contribute to a cumulative clearing impacts of an additional 60.9 ha of the TEC which is in a similar condition to that of the Study Area (<37 vegetation integrity score).
(c) a description of the extent to which the impact exceeds the threshold for the potential entity that is specified in the Guidance to assist a decision-	No impact threshold has been attributed to this TEC.

SAII criteria	Address of SAII criteria
maker to determine a serious and irreversible impact	
(d) the extent and overall condition of the potential TEC within an area of 1000ha, and then 10,000ha, surrounding the proposed development footprint	In an attempt to determine the extent of Box-Gum Woodland in the locality, mapping by Tozer et al. 2006 was examined as it covered the locality extent. A total of 3,304.6 ha of the best equivalent vegetation type (p24, Tableland Grassy Box Gum Woodland) has been mapped within a 10 km radius of the Study Area. The p24 mapping unit has been described by Tozer et al. (2006) as potentially aligning to the CEEC and the state listed EEC. The mapped occurrence of White Box Yellow Box Blakely's Red Gum Woodland based on Tozer et al (2006) surrounding the development footprint is as follows: • 1,000 ha circle = < 230 hectare • 10,000 ha circle = 600.6 hectares. The condition of White Box Yellow Box Blakely's Red Gum Woodland within both the 1,000 ha and 10,000 hectares circles is likely to be predominately in a low to moderate condition, given the rural pressure and historic clearing of the area. It is highly likely that weeds would occupy portions of the lower stratums. The largest patches of White Box Yellow Box Blakely's Red Gum Woodland have been mapped (Figure 8) include: • A patch greater than 20 hectares which occurs to the north of Peppertree Quarry. This patch has been assessed by Niche to be in a relatively good condition. • Scattered patches ranging in size from 5 hectares to 10 hectares occurring within private property, approximately 2 kilometres to the west of the Study Area.
(e) an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration	Throughout its range the TEC has been reduced in area and highly fragmented because of clearance for cropping, grazing and pasture improvement due to the ecological community's occurrence on fertile soils. Very few high quality remnants remain anywhere across its former range. The EPBC Policy Guidelines (DoE 2014) state that over 90% of the original extent of this ecological community has been cleared. This is supported by OEH (2014b) who regarded the equivalent Biometric Vegetation Type to be 90% cleared, and Thomas et al. (2000) estimate that within South-Eastern NSW 59,468 ha remain from the pre-1750 extent of 1,012,052 ha (approximately 94% cleared). Within the Bungonia IBRA subregion, Niche estimates that approximately 5,000 ha remain which is within a derived condition or as sparsely scattered woodland patches. The Project would reduce the extent of the Bungonia IBRA region extent by approximately 0.5 percent of the IBRA Subregion range.
(f) an estimate of the area of the potential TEC that is in the reserve system within the IBRA region and the IBRA subregion	Niche estimate that less than 3 percent of White Box Yellow Box Blakely's Red Gum Woodland that occurs within the Bungonia Subregion, and similarly for the IBRA region, is formally protected within National Parks or Conservation Areas.

SAII criteria	Address of SAII criteria
(g) the development, clearing or biodiversity certification proposal's impact on: (i) abiotic factors critical to the long-term survival of the potential TEC; for example, how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns (ii) characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants (iii) the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC	i. The Project will result in the loss to 27.7 ha of the TEC due to direct clearing. A cumulative impact associated with the Marulan South Project (separate development approval) would occur resulting in a further 60.9 ha of the TEC impacted. The position of the TEC to be impacted for both the current Project and the Marulan South Project occurs immediately adjacent to the existing Marulan South Pit, and is already in a disturbed condition due to historic land clearing and the occurrence of Serrated Tusk and grazing by goats and rabbits. The patch to be removed is unlikely to result in changes to the flow regime or ground water levels that may impact upon other patches of the TEC within the locality. ii. The Project will not result in inappropriate fire and flooding regimes that would impact upon surrounding patches of TEC. A Fire Management Plan would be developed as part of the Project to minimise any potential fire ignition from the site, and to ensure that recommended fire management is carried out. Flooding as a result of the Project will not result in an impact to the TEC that occurs outside the Study Area. iii. The removal of 74.3 ha of White Box Yellow Box Blakely's Red Gum Woodland opens the surrounding patches to edge effects. Edge effects include the invasion of weeds, erosion and sedimentation. Mitigation measures to be undertaken as part of the project include: weed control, pest control, demarcating 'no go' areas, and contractor education. Details regarding these are provided in section 5.1.1.
(h) direct or indirect fragmentation and isolation of an important area of the potential TEC	The condition of the TEC within the Study Area is of a moderate to poor condition, typically containing a scattered canopy layer and mixture of native and introduced ground cover. It is likely that the patch would continue to decline without weed management, particularly targeting Serrated Tussock and Blackberry, and assisted tubestock or direct seeding regeneration. The affected patches of White Box Yellow Box Blakely's Red Gum Woodland in the Study Area are already fragmented by access roads, exotic pasture and infrastructure. This is a common theme for the TEC which is highly fragmented in the locality (Tozer et al. 2006 mapping of map unit p24). The Project will lead to increased fragmentation of the ecological community in the local context through the development of the Project however connectivity will be retained within contiguous habitat around the periphery of the Study Area.
(i) the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion.	The Project will require a like-for-like offset to satisfy the requirements of the BAM and EPBC Act. As such, this will result in the establishment of a conservation area that will protect and enhance White Box Yellow Box Blakely's Red Gum Woodland. The proposed offset would achieving no net loss in extent and condition of the ecological community throughout its

SAII criteria	Address of SAII criteria
	geographic distribution as per the requirement of the BAM.

Koala habitat

SAII criteria	Address of SAII criteria
(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	See section 5.1 regarding avoidance.
(b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification	Impacts from the Project largely relate to the removal of foraging and dispersal habitat that has been defined as being critical to the survival of the Koala under the EPBC Act (DoE 2014; Appendix 8). Habitat mapped as good and moderate habitat potential within the Study Area (Figure 12) contained either two or more known feed trees (listed as primary, secondary or tertiary species under the species Recovery Plan (DECC 2008)) or a single feed species that occupied more than 50% of a 400 m2 floristic quadrat. Such habitat is recognised as critical habitat due to past impacts on similar habitat limiting the Koalas ability to persist throughout its former distribution. The Project would result in the removal of 27.1 ha of such habitat. Due to the apparent limited use of the Study Area and its extremely small extent in relation to similar habitat for the Shoalhaven Gorge Koala population (7,500 ha), it is not considered that removal of this habitat alone would significantly adversely impact the relevant Koala population (centred around the Shoalhaven gorge) such that a decline would occur or that the population is placed at risk of extinction. Active sites for this population are concentrated within protected areas and the Study Area is not thought to provide a link between active areas within the population's distribution or to any other Koala population. Mitigation measures detailed in section 5.1.1 would be employed to reduce the indirect impact toward the Koala.
(c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact	No impact threshold has been attributed to the Koala.
(d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of	i. The Project would result in the removal of approximately 27.1 hectares of habitat. ii. Impacts from the Project largely relate to the removal of foraging and dispersal habitat. Good to moderate quality habitat is recognised as critical habitat due to past impacts on similar habitat limiting the Koalas ability to persist throughout its former distribution. The Project would result in the

SAII criteria	Address of SAII criteria
the local population, including but not limited to: (i) an estimate of the change in habitat available to the local population as a result of the proposed development (ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and (iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.	removal of 27.1 ha of such habitat. Due to the apparent limited use of the Study Area and its extremely small extent in relation to similar habitat for the Shoalhaven Gorge Koala population (7,500 ha), it is not considered that removal of this habitat alone would significantly adversely impact the relevant Koala population (centred around the Shoalhaven gorge) such that a decline would occur or that the population is placed at risk of extinction. Active sites for this population are concentrated within protected areas and the Study Area is not thought to provide a link between active areas within the population's distribution or to any other Koala population. iii. The proposed development would result in the removal of approximately 27.1 hectares of koala habitat. This is a reduction less than 1 percent of the available occupiable habitat (7,500 ha of similar habitat for the Shoalhaven Gorge Koala population). The remaining habitat would not be impacted by the Project and therefore would not result in extinction of the population. The population is likely to utilise existing habitat within the surrounding area.
BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development (e) the likely impact on the ecology of the local population. At a minimum, address the following: (i) for fauna: breeding, foraging, roosting, and dispersal or movement pathways	As the area for removal is a small relative extent (less than 1percent) of habitat for the Shoalhaven population of Koala, it is unlikely that the removal of this habitat alone would significantly adversely impact the relevant koala population. Active sites for this population are concentrated within protected areas and the Study Area is not thought to provide a link between active areas within the population's distribution or to any other koala population.
(f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development	No Koalas or evidence of Koalas were recorded within the Study Area, however the eucalypt species present in the Study Area are Koala feed trees. As discussed previously, the Study Area is not thought to provide a link between active areas within the population's distribution or to any other koala population. It is unlikely that the local koala population will become fragmented or isolated as a result of the Project.

SAII criteria	Address of SAII criteria
(g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	It is unlikely that the Study Area provides a linkage to Koala populations. The species was not detected during field surveys, nor have there been any sightings within the Study Area historically.
(h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The Project is likely to result in edge effects in the form of weed invasion, sedimentation and erosion within habitat for Koala immediately adjacent to the areas being cleared. However, mitigation measures detailed in section 5.1.1 would be employed to reduce the impact of edge effects occurring on habitat for the remaining population.
(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	Based on previous mapping (Tozer et al 2006), the area of potential habitat in the locality is approximately 7,500 hectares. The proposed development would result in the removal of less than 1 percent of potential habitat in the locality. As can be seen from , the records for the Koala predominately occur to the south of the Study Area within Bungonia Gorge, away from the Study Area.
(j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.	The Project will require a like-for-like offset to satisfy the requirements of the BAM and EPBC Act. As such, this will result in the establishment of a conservation area that will protect and enhance Koala habitat. The proposed offset would be offset as per the requirement of the BAM.

Large-eared Pied Bat foraging habitat

SAII criteria	Address of SAII criteria
(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	See section 5.1 regarding avoidance.
(b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification	Impacts from the Project largely relate to the removal of foraging habitat for the Large-eared Pied Bat. Foraging habitat within the locality has been mapped on Figure 13. The Project would result in the removal of 27.1 ha of foraging habitat. The Project will not impact roosting habitat. Due to the small extent in relation to similar habitat within the locality (7,500 ha), it is not considered that removal of this habitat alone would significantly adversely impact the Large-eared Pied Bat such that a decline would occur or that the population is placed at risk of extinction. Much of the foraging habitat is already protected within Morton National Park and Bungonia State Conservation Area, which offers intact remnant habitat along Bungonia Creek and the Shoalhaven River. A known cave site (located approximately 2.6 kilometres) for this population would not be impacted by the Project. Mitigation measures detailed in section 5.1.1 would be employed to reduce the indirect impact toward the Large-eared Pied Bat habitat.
(c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact	Breeding habitat is identified as an SAII – however the Project would not impact upon breeding habitat for the Large-eared Pied Bat.
(d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to: (i) an estimate of the change in habitat available to	i. The Project would result in the removal of approximately 27.1 hectares of foraging habitat. No breeding habitat would be impacted. ii. Impacts from the Project largely relate to the removal of 27.1 ha of foraging habitat. Due to the relatively small extent of foraging habitat impacted in relation to similar habitat in the locality, it is not considered that removal of this habitat alone would significantly adversely impact to the Large-eared Pied Bat. Furthermore, no roosting or breeding sites would be impacted.

SAII criteria	Address of SAII criteria
the local population as a result of the proposed development (ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and (iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.	iii. The proposed development would result in the removal of approximately 27.1 hectares of foraging habitat for the Large-eared Pied Bat. This is a reduction less than 1 percent of the available occupiable habitat (7,500 ha of similar habitat for the Large-eared Pied Bat in the locality). The remaining habitat would not be impacted by the Project and therefore would not result in extinction of the population. The population is likely to utilise existing habitat within the surrounding area. Furthermore, no breeding habitat would be impacted by the Project.
BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development (e) the likely impact on the ecology of the local population. At a minimum, address the following: (i) for fauna: breeding, foraging, roosting, and dispersal or movement pathways	As the area for removal is a small relative extent (less than 1percent) of foraging habitat for the Large-eared Pied Bat. It is not considered that the removal of this habitat alone would significantly adversely impact Large-eared Pied Bat. The Study Area is located adjacent to the operating Marulan South Quarry, and would essentially expand the footprint of the exiting quarry to the west. The foraging habitat to be impacted is already located within a fragmented landscape, in particular to the east where the exiting Quarry footprint occurs. The expansion of development to the west from the Quarry is unlikely to result in any significant disruption to critical flight paths and mobility given there will still be native vegetation remaining around the development footprint to the west.
(f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development	It is highly unlikely that the local Large-eared Pied Bat population would be significantly impacted by the removal of 27.1 ha of foraging habitat given the extent available within the locality. The Project would also not result in any impact to known breeding or roosting sites.
(g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other	It is highly unlikely that the Project would significantly impact upon any local Large-eared Pied Bat population. The removal of 27.1 ha of foraging habitat is relatively minor given the extent available within the locality. The foraging habitat is positioned away from sandstone outcrops and cliffs lines which are potential roosting sites.

SAII criteria	Address of SAII criteria
population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	
(h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The Project has the potential to result in edge effects in the form of weed invasion, sedimentation and erosion within foraging habitat for Large-eared Pied Bat immediately adjacent to the areas being cleared. However, mitigation measures detailed in section 5.1.1 would be employed to reduce the impact of edge effects occurring on foraging habitat for the remaining population.
(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	Based on previous mapping (Tozer et al 2006), the area of potential habitat in the locality is approximately 7,500 hectares. The proposed development would result in the removal of less than 1 percent of potential habitat in the locality. As can be seen from Figure 13 a potential cave site occurs approximately 2.5 km to the south of the Study Area within Bungonia Gorge, away from the Study Area.
(j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.	The Project will require a like-for-like offset to satisfy the requirements of the BAM. As such, this will result in the establishment of a conservation area that will protect and enhance Large-eared Pied Bat habitat. The proposed offset would achieving no net loss in extent and condition of the Large-eared Pied Bat habitat as per the requirement of the BAM.

Appendix 7. Biodiversity Credit Calculator Report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011985/BAAS17066/19/00011987	3557 Peppertree Mod 5	04/01/2019
Assessor Name	Report Created	BAM Data version *
Sian Griffiths	23/01/2019	6
Assessor Number	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BAAS17066		

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
Coast Grey Box - stringybark dry woodland on slopes of the Shoalhaven Gorges, southern Sydney Basin Bioregion								
3	778_Good	42.4	8.5	0.25	High Sensitivity to Potential Gain	1.50		134
4	778_Poor	17.4	3.6	0.25	High Sensitivity to Potential Gain	1.50		23
							Subtotal	**157**

BAM Credit Summary Report

Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion								
1	1334_Medium	36.4	18.6	0.25	High Sensitivity to Potential Gain	2.00	TRUE	339
2	1334_Poor	19.8	9.0	0.25	High Sensitivity to Potential Gain	2.00	TRUE	89
							Subtotal	**428**
							Total	**585**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
778_Good	42.4	8.46	0.25	3	True	269
1334_Medium	33.1	18.64	0.25	3	True	462
					Subtotal	**731**
Phascolarctos cinereus / Koala (Fauna)						
778_Good	42.4	8.46	0.25	2	N/A	179
1334_Medium	33.1	18.64	0.25	2	N/A	308
					Subtotal	**487**

Appendix 8. Threatened species assessments of significance under the EPBC Act

Matters for Assessment

Assessments of Significance and supplementary information (where relevant) are presented for the following MNES in relation to the Project:

- Threatened Ecological Communities
  - Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Threatened Fauna
  - Koala
  - Large-eared Pied Bat
  - Grey-headed Flying-fox
  - Regent Honeyeater
- Migratory Species
  - Fork-tailed Swift
  - Great Egret
  - Cattle Egret
  - Rainbow Bee-eater
  - Black-faced Monarch
  - Rufous Fantail

Yellow Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	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: reduce the extent of an ecological community	
A total maximum area of 27.7 hectares of Yellow Box Yellow Box Blakely's Red Gum Woodland (hereafter referred to as Box-Gum Woodland) will be removed by the Project. Indirect impacts would be mitigated and managed as per section 5.3.2 as to prevent from occurring outside of the Study Area. The Box-Gum Woodland CEEC has been heavily cleared across its range, with the remaining extent of the ecological community being highly fragmented, occurring in small isolated patches within a cleared environment, or within a landscape of other disturbed woodlands (DoE 2014). This is evident throughout the Study Area and wider locality. The EPBC Policy Guidelines (DoE 2014) also state that over 90% of the original extent of this ecological community has been cleared. This is supported by OEH (2014) who regarded the equivalent Biometric Vegetation Type to be 90% cleared, and Thomas et al. 2000 estimate that within South-Eastern NSW 59,468 ha remain from the pre-1750 extent of 1,012,052 ha (approximately 94% cleared). In an attempt to determine the extent of Box-Gum Woodland in the locality, mapping by Tozer et al 2006 was examined as it covered the locality extent. A total of 3,304.6 ha of the best equivalent vegetation type (p24, Tableland Grassy Box Gum Woodland) has been mapped within a 10 km radius of the Project area. The p24 mapping unit has been described by Tozer et al (2006) as potentially aligning to the CEEC and the state listed EEC, however it would include some areas that do not meet the CEEC. It has been assumed in this assessment that half of the total p24 area would be an approximate representation of the remaining CEEC in the locality (i.e. 1,652.3 ha). The potential habitat removed by the Project is therefore estimated to represent 0.5 % of the community in the locality. It is unclear what the condition and security of the remaining CEEC is within the locality. It is likely that much of it is on private land and that it is similarly disturbed compared with the disturbance area.	Known
fragment or increase fragmentation of an ecological community	
All of the CEEC within the disturbance area has experienced weed invasion, grazing pressures and clearing, which has resulted in a predominantly degraded condition of this community. The CEEC within the disturbance area is currently fragmented, however the Project will increase fragmentation by removing the northern extent of the larger patch of native vegetation.	Likely to increase fragmentation.
adversely affect habitat critical to the survival of an ecological community	
The CEEC to be disturbed by the Project consists of two condition classes. Both of the condition classes meet the Commonwealth listing despite prior historic disturbance and clearing. This is due to the community meeting the patch size threshold for the CEEC when using the Determination Guidelines. The Box-Gum Woodland Recovery Plan regards all areas of Box-Gum Woodland which meet the minimum condition criteria to be considered critical to the survival of the ecological community. Based on this statement, it would mean that all patches of the CEEC within a disturbance area, no matter of condition or size, are critical to the survival of the community and similarly, this would extend to all areas of the community within the locality.	Likely

Yellow Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Likelihood
As stated in the EPBC Act Policy Guidelines, the CEEC has been heavily cleared across most of its range with the remaining extent of the ecological community being highly fragmented, occurring in small isolated patches within a cleared environment, or within a landscape of other disturbed woodlands. With this in mind, any clearing of large patches of the CEEC may result in an adverse effect to critical habitat.	
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 clearing of the CEEC will result in the destruction of abiotic factors within the disturbance area necessary for the CEEC survival given that the CEEC will be cleared. The clearing of the CEEC will modify soil and soil seed bank within the disturbance area. Outside of the disturbance area, the impacts associated with the proposal are not likely to significantly exacerbate currently operating edge-effects in areas of the CEEC (e.g. weed invasion, areas of erosion and grazing). Within remaining areas of the CEEC, the proposed surface water drainage follows natural drainage lines which are unlikely to be impacted such that water availability to the CEEC is altered.	Unlikely to be a factor outside of disturbance area– impacts restricted to clearing of the proposed disturbance area
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	
The Project will result in the loss of the CEEC within the disturbance area. Outside of the disturbance area, the vegetation is already subject to weed invasion, and feral pests. Boral propose a number of mitigation measures to prevent an increase in such disturbances occurring. These mitigation measures are detailed in section 5.3.2, and would be presented in the Biodiversity Management Plan. As such, it is unlikely that a substantial change to species composition would occur in the CEEC immediately adjacent to the disturbance area as a result of the Project. The Project has some potential to alter the fire frequency of the area, however fire is already discouraged from occurring around the mine area due to the presence of mine infrastructure. The Biodiversity Management Plan to be prepared for the site, will consider the potential to implement a fire frequency appropriate to the existing remaining vegetation communities.	Unlikely
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or	
The Project has the potential to increase edge effects for remaining areas of the CEEC that are adjacent to the proposed disturbance areas. However, through implementing the mitigation measures detailed in section 5.3.2, this would assist in preventing indirect impacts to adjacent patches of Box Gum Woodland.	Potential
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 Project will not involve any spraying of fertilizers, herbicides or other chemicals of pollutants which will kill or inhibit the growth of the CEEC. Herbicides and fertilizers may be required for bushland restoration and rehabilitation purposes to reduce the spread of weeds and promote seed	Unlikely

Yellow Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Likelihood
germination and growth of seedlings, however these will only be used in accordance within bushland restoration principles and best practise and will not result in any significant impacts to the CEEC.	
interfere with the recovery of an ecological community.	
The National Recovery Plan for White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland has been prepared under the provisions of the EPBC Act. The overall aim of the recovery plan is to promote the recovery and prevent the extinction of the CEEC. The specific objectives of the recovery plan is to minimise the risk of extinction of the ecological community through: achieving no net loss in extent and condition of the ecological community throughout its geographic distribution; increasing protection of sites in good condition; increasing landscape function of the community through management and restoration of degraded sites; increasing transitional areas around remnants and linkages between remnants; and bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland. The Project will interfere with recovery of the CEEC given that 27.7 hectares of the community will be cleared. The Project would not be consistent with the first objective of the above stated recovery aims for the community unless offsetting arrangements for the Project secure and improve the condition of the community elsewhere within the region to the extent that a 'no net loss' outcome is achieved. The Project will satisfy the NSW Offsets Policy for Major Projects which will result in a no net loss (otherwise known as improve or maintain) outcome for the community at a regional level by securing patches of the CEEC and managing these in perpetuity. In the long-term the offset is expected to benefit the recovery of the community given that a larger area of CEEC will be protected and managed in perpetuity.	Likely however greater recovery benefits will be achieved through an offset given the current site is not actively managed.
Conclusion: The proposal is likely to result in a significant impact on Box-Gum Grassy Woodland, primarily through the removal of habitat considered critical to the survival of the community.	

Koala

In assessing the significance of the impact from the proposed action on the Koala the '*EPBC Act referral guidelines for the vulnerable koala*' were applied to the assessment. The following information is presented prior to the Assessment of Significance for the Koala to demonstrate application of the guidelines and to assist with understanding the assessment and its conclusion.

Koala Habitat Assessment Scoring (REF referral guidelines):

Attribute	Score	Habitat Appraisal
Koala occurrence	+2	Koalas have been encountered infrequently adjacent to the existing mine (the most recent in December of 2017 along Marulan South Road approximately 1 km from the mine) according to communications with site personnel; A number of Koala records exist from contiguous habitat approximately 1-2 km south of the proposed disturbance area.
Vegetation Structure and composition	+2	Habitat scoring was applied across the Project area using floristic data and Braun Blanquet cover values from 400m^2 quadrats. The mapping indicated that the majority of the Project areas contained either 2 or more known feed trees or a single feed species that occupied more than 50% of the quadrat.
Habitat connectivity	+2	The area is part of a contiguous landscape of > than 1,000 hectares, however the existing mine and perimeter roads (incorporating steep rocky embankments in places) form a significant barrier to accessing the Study Area from the south, where extensive vegetated areas occur (the most extensive of which are within the Morton and Bungonia National Parks). There are no major barriers to Koala movement to the Study Area from the immediate south and west which allows for connectivity between the Study Area and the Bungonia State Conservation Area (despite the presence of steep terrain) where the majority of the Koala records for the region occur.
Key existing threats	+2	There is no known documented or anecdotal evidence of Koala mortality from dog attack or vehicle collision within the Study Area or surrounds. Dogs, trucks, and train movements are all present within the Study Area however wild dogs are not common (not detected on infrared cameras or seen during survey) and vehicle movements within the Study Area are regulated at low speeds.

Recovery value	+1	Uncertain whether the habitat within the proposed Study Areas will be important in achieving the interim recovery objectives. There is some relevance to the recovery objectives for inland areas (as per table 1 of the referral guidelines (REF)) in regard to the development area representing habitat on fertile soil, however the habitat is not thought to specifically act as a habitat refuge. There is some relevance to the objective of maintaining habitat around refuges (i.e. the area within Bungonia State Conservation Area is a known refuge). However connectivity to the known refuge area is somewhat limited though the existing mine and gorge habitat. Additionally, given the extensive reserve network surrounding the existing refuge areas, the importance of the Project area is lessened.
Total	**9/10**	

Koala (vulnerable)	
Preamble There are 137 Koala records from the NSW Atlas of Wildlife within a 10 km radius of the Study Area, all but three of which are post 1980 records. The majority of these records (105) are from the Bungonia National Park (NP) and Bungonia State Conservation Area (SCA) which occur approximately 1 - 2 km south of the Project area and collectively are considered one of the primary known active sites for a Koala population centred along the Shoalhaven Gorge and extending approximately 30 km to the south of the Study Area (e.g. Allen 2002) encompassing large areas of Morton National Park. The Bungonia NP/SCA active Koala area includes popular walking areas and a camping site and therefore observations of Koalas from this area are relatively frequent. Other unknown active Koala areas may exist within the locality where access is limited. The Bungonia NP/SCA areas are separated from the Study Area by the Bungonia Gorge, a limestone gorge approximately 350 m deep. The steepness of the gorge would undoubtedly limit connectivity between the main known breeding area of Koalas in the locality (Bungonia NP/SCA) and the Project area, however there are records of the Koala from both sides of the gorge (albeit very limited from the northern side) and connectivity to the Study Area exists indirectly, west of the main gorge area. North and west of the protected areas around the Bungonia and Shoalhaven gorges Koala records within the NSW Atlas of Wildlife are very limited with sporadic observations from private land and along roadsides, one being from the Marulan South Limestone Mine and two additional records (including road-kill) each from around the townships of Marulan and Tallong. These areas are more disturbed, predominantly private tenure. They generally consist of more fertile areas that have been developed traditionally for agriculture. It is clear that Koalas are able to travel through such areas and feed trees including primary feed trees are available to them throughout such areas. Targeted Koala survey in these areas (private land on the tablelands) is likely to have been minimal and therefore actual Koala distribution and abundance within such areas is poorly known. Despite the limits regarding Koala distribution and abundance, given previous disturbance resulting in fragmented vegetation and the lack of Koala records within the higher elevation areas away from the protected areas around the Bungonia and Shoalhaven gorges, it is considered unlikely that active Koala areas (with permanent and moderate to high densities of Koalas) such as those within the Bungonia NP/SCA would occur. Surveys and collection of anecdotal evidence of Koala sightings conducted within the Study Area as part of this assessment revealed that Koalas have been sighted sporadically within the south of Study Area over the past decade, with Koalas observed every 2- 3 years around the mine (pers. comm. Grant Thompson – Boral). However, no Koala observations are known from the Study Area. Scat surveys, spotlighting, call-playback and tree surveys did not identify repeated or on-going use of trees within any of the proposed disturbance areas. Therefore, whilst it is known that Koalas occur within these areas and that feed trees exist within them, it is likely that very low densities of Koalas occur or that Koalas use the areas whist moving through the landscape.	
Criteria (Vulnerable Species)	**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:	
lead to a long-term decrease in the size of an important population of a species;	
It is considered unlikely that the Project would lead to a long-term decrease in the size of an important population of the Koala. It is considered that the population of Koalas occurring around the Shoalhaven and Bungonia gorges (as described in Allen - 2002) is an important population, however it has not been listed specifically as such within a recovery plan. The identified active Koala area within the Bungonia NP/SCA, which acts as a known breeding and regular feeding habitat is one of several active areas for this population. The Project is not considered to have impacts on the population such that it will lead to a long-term decline as records away from protected areas within the locality of the Project area are very sparse and use of the Study Area is thought to be transient only or support a very limited number of individuals.	Very unlikely

reduce the area of occupancy of a important population;	
The Project would not impact the area of occupancy of any population of the Koala as the areas to be cleared are not sufficient in extent to impact the area of occupancy of the Koala at a 2km grid square scale (which is the standard unit for measuring area of occupancy according to the IUCN). Koalas would still be expected to occur within the vicinity of the Project area (e.g. to the west of Marulan South Road).	Unlikely
fragment an existing important population into two or more populations;	
The Project is unlikely to increase fragmentation for the identified population. There may be some minor impacts on potential north-south migration routes west of the existing Marulan South mine, however such migration will still be able to persist along Marulan South Road verge. There are no known important areas for Koalas to the north of the existing mine. Connectivity between the main active population areas would not be impacted.	Unlikely
adversely affect habitat critical to the survival of a species;	
Habitat within the Project area to be impacted constitutes habitat critical to Koala survival as determined through application of the Koala habitat assessment tool (DOE 2014), which is illustrated in the table above. The habitat within the disturbance area scores a 9/10.	Likely
disrupt the breeding cycle of an important population	
Habitat within the disturbance area is not thought to be a key breeding area due to the low number of records. Therefore removal of the habitat is unlikely to disrupt the breeding cycle of the population. The area constitutes a very small proportion of the overall habitat for the population, (considered to be the population centred on the Shoalhaven gorge (Allen 2002)), with active population areas, including the Bungonia NP/SCA site, being the prime candidate sites for breeding activity.	Unlikely
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	
The area to be removed is a patch supporting 27.1 of Koala habitat for the population and the species. Its removal may have a minor impact on patterns of Koala movement and no isolation between populations would occur from the Project.	Unlikely
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	
Invasive species such as foxes that may impact on the Koala are already established within the Project area. The Project is unlikely to further encourage these threats from occurring.	Unlikely
introduce disease that may cause the species to decline, or	
The main diseases affecting Koalas are chlamydial infections. The Project would not increase exposure to such infections as Koalas from the local population would not have increased contact with other Koala populations including infected populations.	Unlikely
interfere substantially with the recovery of the species.	
The following aspects are considered in relation to the possibility of the Project to interfere with the recovery of the Koala (from DOE 2014): *Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.* There is no reason to suspect that dogs would become more prevalent within the Project area or surrounds as a result of the Project;	Unlikely

Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities. There have been no reported Koala fatalities due to vehicle strike within the mine site or along access roads. Additional vehicle movements are expected to occur as a result of the Project but would be negligible, with the Project mostly ensuring the continuation of the current regime of vehicle movements within the Project area. There are strict speed controls on the vehicles operating within the mine (20 and 40 km/hr) and given the very low number of Koala sightings from this area and the absence of recorded fatalities it is considered that the risk of increased fatalities such that multiple ongoing fatalities occur is very low; *Facilitating the introduction or spread of disease or pathogens for example Chlamydia or Phytophthora cinnamomi, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat*; This is considered unlikely as there would be no new sources of contamination as a result of the Project. The Project would not lead to Koalas being transported to the site from other areas. If vehicles coming to and from the mine are considered to be a potential agent of *Phytophthora cinnamomi,* the Project would not lead to a change in the source areas where vehicles travel from to arrive at the mine and therefore it is not considered that the Project increases the risk of *Phytophthora cinnamomi* spread; *Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.* The proposed disturbance footprint is an extremely small proportion of Koala habitat for the population and the species. Its removal would have a minor impact on patterns of Koala movement and no isolation between populations would occur from the Project; and *Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.* The Project would strive to maintain, pre-development drainage regimes and water quality in areas outside the disturbance footprint. The Project is therefore unlikely to alter the hydrology to the extent that it would result in the degradation of remaining habitat critical to the survival of the Koala.	
Conclusion: Impacts from the Project largely relate to the removal of habitat that has been defined as being critical to the survival of the Koala. Such habitat is recognised as critical habitat due to past impacts on similar habitat limiting the Koalas ability to persist throughout its former distribution. The Project includes the removal of 27.1 hectares of critical habitat, which through application of the guidelines is considered a significant impact. Due to the apparent limited use of the Study Area and its extremely small extent in relation to other habitat where Koala records occur, it is not considered that removal of this habitat alone would significantly adversely impact the relevant Koala population (centred around the Shoalhaven gorge) such that a decline would occur, as active sites for this population are concentrated within protected areas and the Project area is not thought to provide a link between active areas within the population's distribution or to any other Koala population.	

Large-eared Pied Bat (Vulnerable)	
Criteria (Vulnerable Species)	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:	
lead to a long-term decrease in the size of an important population of a species;	
It is not expected that any impacts on breeding habitat for the Large-eared Pied Bat would result from the Project as preferred breeding habitat comprises caves and mine shafts, neither of which will be impacted by the Project. Potential breeding habitat would likely be within the forges of Bungonia State Conservation Area and Morton National Park, both of which would not be impacted by the Project. Impacts from the Project constitute impacts to foraging habitat of which approximately 27.1 hectares would be cleared. The foraging habitat is considered to be of moderate to good quality for the species, being a mix of moderate condition woodland. A further 113.2 hectares of foraging habitat would also be impacted from the Marulan South Project (subject to a separate development approval). Most of the foraging habitat to be removed associated with the current Project and the Marulan South project occurs on fertile soils that are connected indirectly to areas of sandstone outcrops within Morton National Park and Bungonia State Conservation Area via vegetated links, though, it should be noted that the linkages are relatively limited to the direct east of the Study Area given the Marulan South Mine. Foraging habitat on fertile soils has previously been recognised as being important for the species (e.g. Pennay 2008), but the species has also been recorded foraging within a wide range of habitats including dry and wet sclerophyll forest; Cyprus Pine (*Callitris glauca*) dominated forest; tall open eucalypt forest with a rainforest sub-canopy; sub-alpine woodland; and sandstone outcrop country (DOE 2015). Within the locality of the Study Area 7,400 hectares of potential foraging habitat has been mapped, with most occurring within the reserve systems of Bungonia National Park, Bungonia State Conservation Area and Morton National Park hectares within the Project's locality. Given the occurrence of the Large-eared Pied Bat in the centre of the Study Area and the quality of the surrounding woodlands in the Study Area and adjacent lands, it is assumed that the species forages over a wide range of habitats within the Study Area and wider locality. It is noted however that survey concentrated on identification of presence/absence of target species rather than attempts to investigate habitat preferences within the locality and data capture was not sufficient to confidently explain patterns of distribution. Despite the loss of foraging land due to the clearing proposed, and in combination with that of the Marulan South Project, potential foraging habitat would remain abundant within the locality due to the conservation areas protecting foraging habitat. The currently proposed removal of foraging habitat is not expected to cause a long-term decrease to any population of the species given the availability of habitat within the conservation areas and given the disturbance is not impacting roosting habitat. Furthermore, it appears that the species has wide habitat preferences of the species within 3 kilometres of the sandstone gullies of Bungonia and Barbers Creek. It should be further noted that upon Project decommissioning, the Study Area would be rehabilitated to create a woodland structure, thus providing future Large-eared Pied Bat habitat.	Unlikely
reduce the area of occupancy of an important population;	
The Project would not impact the area of occupancy of the Large-eared Pied Bat for the following reasons:	Minimal

- Large-eared Pied Bats would still be expected to forage surrounding the Study Area given that the species was recorded at all sites including close to mining activities. - Habitat within Morton National Park and Bungonia State Conservation Area is protected, and contains habitat immediately surrounding breeding sites. Such habitat would persist regardless of development. - The site would rehabilitated following decommissioning and re-establish foraging habitat for the species.	
fragment an existing important population into two or more populations;	
The Study Area is already fragmented from cliffs lines and rock outcrops along Bungonia Gorge and Shoalhaven River where the species is likely to roost. In particular, the Study Area is obstructed to the immediate east by the Marulan South Quarry. However, despite such fragmentation, the species was recorded across the Study Area and surrounds which suggests that the species is relatively mobile being able to utilise thin vegetative corridors and open areas. The Project will reduce the amount of foraging habitat, however it is unlikely that the fragmentation would result in any significant disturbance to a population given the extent of habitat available within in Morton National Park and Bungonia State Conservation Area that provides formal protection of a Large-eared Pied Bat habitat including that of breeding and roosting habitat.	Minimal
adversely affect habitat critical to the survival of a species;	
Habitat critical to the survival of the species has not been listed within guidelines or a recovery plan for the species. Such habitat is considered to include breeding caves and roost habitat. Such habitat would not be impacted from the Project. Foraging habitat within close proximity to cliff lines or rock outcrops of the type to be removed by the Project has been considered important for the species. Such habitat is formally protected within within Bungonia State Conservation Area and Morton Park. The habitat within these conservation reserves is relatively extensive and intact. As such, the habitat to be removed is not considered critical to the species survival given the species will still persist due to protection within the conservation reserves.	Unlikely
disrupt the breeding cycle of an important population	
The Project is unlikely to disrupt the breeding cycle of the species as breeding events for this species primarily take place within caves or other suitable roost habitats, none of which are expected to be adversely impacted by the Project.	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 extent of foraging habitat to be removed is unlikely to result in the decline of the species given the local abundance of habitat protected within Morton National Park and Bungonia State Conservation Area. The habitat within the conservation reserves contains intact and better quality habitat compared to that impacted by the Project. The removal of foraging habitat associated with the Project is therefore not likely to isolate areas of foraging habitat so much so that the species is likely to decline.	Unlikely
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	
The Project will include measures to control weeds becoming established in such areas through the implementation of a Biodiversity Management Plan. Through implementation of the Biodiversity Management Plan, the Project is unlikely to increase the likelihood of weeds being established in areas adjacent to disturbance areas that constitute potential foraging habitat for the species. Potential invasive predators such as the fox are already present within the Study Area and locality. The Project is not expected to increase the level of	Unlikely

predation threat for the Large-eared Pied Bat.	
introduce disease that may cause the species to decline, or	
There are no known documented diseases that are currently contributing to the decline of the species. The Project is not expected to cause an increased risk of any bat diseases.	Unlikely
interfere substantially with the recovery of the species.	
The list of recovery actions for this species on its DOE profile page (DOE 2015) includes: "Management of the species should focus on the protection and enhancement of higher fertility soils". Whilst some areas with higher fertility soils will be cleared, such areas are not in close proximity to breeding or maternity caves and constitute a very small proportion of similar habitat in the locality. As such, the Project is unlikely to interfere with the recovery of this species. Cleared areas will be rehabilitated and topsoil retained.	Unlikely
Conclusion: Impacts from the Project relate to the removal of foraging habitat for the Large-eared Pied Bat. Whilst foraging habitat on fertile soils (or within fertile valleys) is considered an important overall requirement for this species, impacts from the Project are not considered to be significant for the following reasons: - No roosting or breeding habitat would be impacted by the Project. - Better condition habitat types are protected within Morton National Park and Bungonia State Conservation Area which occur to the south and east of the Study Area. As such, the foraging habitat protected within these reserves would remain used by the Large-eared Pied Bat population. - The foraging habitat is not critical to the survival of the species given the habitat for the species in the conservation areas detailed above. - The Study Area would be rehabilitated to a woodland structure, thus providing future foraging habitat for the species.	

Grey-headed Flying-fox (Vulnerable)	
Preamble This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km. Recorded from Bungonia Gorge during field survey and expected to occur throughout area.	
Criteria (Vulnerable Species)	**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:	
lead to a long-term decrease in the size of an important population of a species;	
It is not expected that any impacts on breeding or roosting habitat for the Grey-headed Flying-fox would result from the Project as breeding/roosting camps will not be impacted and do not occur in the Study Area. Impacts from the Project constitute impacts to foraging habitat of which approximately 27.1 hectares would be cleared. The foraging habitat is considered to be of moderate quality for the species, being a mix of degraded and moderate-good condition woodland. There are a variety of different Eucalyptus species present within proposed disturbance areas, some of which may contribute to winter and spring food availability. The significance of this contribution is not expected to be high as the expanse of similar foraging habitat within the locality is high. Over time, foraging habitat would be at least partially restored through rehabilitation works and retention of the topsoil would occur as part of rehabilitation works, aiding in maintaining fertility of habitats. Regardless of rehabilitation works, potential foraging habitat would remain abundant within the locality and the currently proposed removal of foraging habitat is not expected to cause a long-term decrease to any population of the species.	Unlikely
reduce the area of occupancy of a important population;	
The Project would not impact the area of occupancy of the Grey-headed Flying-fox for the following reasons: The areas to be cleared are not sufficient in extent to impact the area of occupancy of the species at a 2km grid square scale (which is the standard unit for measuring area of occupancy according to the IUCN); and Grey-headed Flying-fox would still be expected to forage within the vicinity of the Project area given that it was recorded at all sites including close to mining activities.	Unlikely
fragment an existing important population into two or more populations;	
The Project is unlikely to increase fragmentation for any population of the species. The Grey-headed Flying-fox is a mobile species and the Project would not impact on areas where the species is known to breed and roost.	None
adversely affect habitat critical to the survival of a species;	
Habitat critical to the survival of the species has been loosely nominated within the National Recovery Plan for this species (DECC 2009) guidelines or a	Unlikely

recovery plan for the species, however "productive" areas are acknowledged as potentially being foraging habitat critical to the survival of the species. However no measure of productivity is given. There are no recognised 'prolific flowering or fruiting trees within the proposed disturbance areas. In addition, whilst the timing of productivity is considered to be important in determining whether habitat is critical to the survival of the species, the timing given as being important covers the entirety of the year (see DECC 2009). Foraging habitat of the type to be removed by the Project is considered important for the species, due to its capacity to add in some measure to locally available winter foraging resources. However, given that similar habitat is locally common, is well represented within adjacent conservation reserves, and that winter flowering pulses are not considered to be particularly high within the habitat to be cleared, the habitat to be removed is not considered critical to the species survival.	
disrupt the breeding cycle of an important population	
The Project is unlikely to disrupt the breeding cycle of the species as breeding events for this species primarily take place within camps, none of which would be adversely impacted by the Project.	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 extent of foraging habitat to be removed is not considered sufficient to result in the decline of the species given the local abundance of similar habitat. The Project would not isolate areas of foraging habitat.	Unlikely
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	
The Project is unlikely to increase the likelihood of weeds being established in areas adjacent to disturbance areas that constitute potential foraging habitat for the species. The Project will include measures to control weeds becoming established in such areas through the implementation of a Biodiversity Management Plan. Potential invasive predators such as the fox are already present within the Project area and the Project is not expected to increase the level of predation threat for the Grey-headed Flying-fox.	Unlikely
introduce disease that may cause the species to decline, or	
There are no known documented diseases that are currently contributing to the decline of the species. The Project in not expected to cause an increased risk of any bat diseases.	Unlikely
interfere substantially with the recovery of the species.	
The Project does not directly or substantially interfere with any of the specific recovery objectives under the National Recovery Plan (DECC 2009). A general objective is to lessen the currently operating threats to the species which includes the removal of foraging habitat. The Project is therefore not consistent with this general objective. However the level and type of foraging habitat removal is not considered to constitute substantial interference with the recovery of the species.	Unlikely
Conclusion: Impacts from the Project relate to the removal of foraging habitat for the Grey-headed Flying-fox within the proposed disturbance areas. Whilst protection of foraging habitat is considered important for this species, impacts from the Project are not considered to be significant for the following reasons:	

The habitat to be removed is not considered to be particularly important foraging habitat in terms of its constitution or size;
Similarly important foraging habitat occurs throughout the locality including within protected areas; and
Rehabilitation of areas to be cleared will occur which should mitigate the loss of foraging habitat to some extent.

Migratory Species - Fork-tailed Swift, Great Egret, Cattle Egret, Rainbow Bee-eater, Black-faced Monarch, Rufous Fantail	
Preamble: The above species all have potential habitat within the Study Area that would be impacted from the proposed action. All of the species subject to this assessment are considered to occur within the Project area on an irregular basis and the habitat within the Project area is similar to widespread and common habitat within the locality for these species.	
Criteria (Vulnerable Species)	**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:	
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, or	
No important habitat for any of the potentially occurring migratory species is considered to occur within the Project area.	Unlikely
result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	
No invasive species of particular significance to the identified migratory species are expected to be established as a result of the proposed action. The Project area is already affected by invasive plants including some noxious weeds and introduced fauna such as the Fox which have some potential to adversely impact most fauna occurring within the Project area and surrounds. New invasive species are unlikely to become established due to the proposed action.	Unlikely
seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	
None of the potentially occurring migratory species would have a significant proportion of their population occurring within the Project area.	Unlikely
Conclusion: The Project would remove 27.1 hectares of native vegetation. None of the above species occur in significant numbers within the Project area and the Project area does not support significant breeding habitat such that it may be used by a significant number of individuals to conduct any aspect of their lifecycle including foraging, breeding, overwintering or sheltering.	

Regent Honeyeater	
Criteria (Critically Endangered Species)	Likelihood
An action is likely to have a significant impact on a Critical Endangered species if there is a real chance or possibility that it will:	
lead to a long-term decrease in the size of an important population of a species;	
Any population of the Regent Honeyeater should be regarded as an important population given the status of the species is Critically Endangered. Based on the results of the targeted field survey which met the survey hours/days suggested in the DoE (2017) Survey Guidelines for Australia's Threatened Birds EPBC Act survey guidelines, the Regent Honeyeater was not recorded within the Study Area, nor within better condition habitat surveyed surrounding the Study Area. However, like many threatened birds, given the species is mobile, its potential use of the Study Area on a very limited level cannot be ruled out, as the species may fly over or through the Study Area on occasion. It is possible that there is some degree of potential foraging habitat within the Study Area given the species is known to forage a range of habitats including dry open forest and woodland. However, the lack of detection during the targeted survey may suggest that the Regent Honeyeater is unlikely to utilise the Study Area and surrounds on a regular or permanent basis. This conclusion is further supported by the fact that three historical records have been made since 1983 within 12 km of the Study Area as per below: - Approximately 4.8 km south of the Study Area near Lockdown Road, Bungonia. This record was in made in 2005 within a gully environment near Bungonia Creek weir. - Approximately 5 km south of the Study Area near the Bungonia State Conservation Area office. This record was made in 1998. - Approximately 11.9 km south of the Study Area within private property. This record was made in 1983. Given Bungonia State Conservation Area and Morton National Park are relatively popular for bird watchers, if the Regent Honeyeater were to frequent the area, it seems reasonable to suggest that the records would be greater than three records within 36 years. As such, whilst it is noted that there is the possibility the Regent Honeyeater may move through the Bungonia region on occasion, the removal of 27.1 hectares of potential foraging habitat, of which is in a relatively degraded condition, is unlikely to reduce the size of an important population given the species is unlikely to utilise the Study Area on a regular or permanent basis.	Unlikely
reduce the area of occupancy of an important population;	
The Regent Honeyeater is not known to occupy the Study Area. As discussed above, the species was not detected during the field survey and three records with the Bungonia region over 36 year seems to indicate that the species does not have a regular movement through the Bungonia region, or provide significant or important habitat that supports regular population movements of the species. Given the species is not known to occupy the Study Area based on the meeting the survey guidelines, any impact to native vegetation within the Study Area is therefore not reducing habitat occupied by the species.	Unlikely
fragment an existing important population into two or more populations;	
The Project is unlikely to increase fragmentation for any population of the species. The Regent Honeyeater is a mobile species and would still have	Unlikely

movement within the Morton National Park and Bungonia State Conservation Area should the species were to move through the Bungonia area.	
adversely affect habitat critical to the survival of a species;	
The National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia) states that any breeding or foraging areas where the species is likely to occur are all critical to the survival of the species. Breeding habitat within the Study Area is unlikely due to the absence of the species during field surveys, and due to the lack of recent records. In terms of foraging habitat, is it not possible to exclude any area of native vegetation with absolute certainty within the movement corridors of the species given the Regent Honeyeater can utilise a wide range of habitat types including that of orchards and urban gardens. However, the likelihood for the Regent Honeyeater to have foraging habitat with the Study Area and use it on a regular or intermittent basis seems relatively low given the species was not detected during field surveys, and the sparse records for the species with the locality over the past 30 years. Based on this, it is unlikely that the habitat within the Study Area is critical foraging habitat for the species. It should also be noted that foraging habitat is relatively well represented within adjacent conservation reserves with provide a well vegetated corridor throughout the locality.	Unlikely
disrupt the breeding cycle of an important population	
The Project is unlikely to disrupt the breeding cycle of the species as breeding habitat was not detected during the field survey. As discussed above, habitat removal in the Study Area is not likely to result in changes to flight movements given the availability of habitat with the adjacent conservation reserves.	Unlikely
modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	
The habitat within the Study Area has already been impacted by historic clearing events and high levels of weed and pest occurrence. As discussed above, the Study Area is only a marginal/low likelihood that foraging habitat existing for the Regent Honeyeater. The removal of such habitat is unlikely to reduce the availability of potential habitat for the species to an extent that the species is likely to decline. The clearing associated with the Marulan South Project (subject to separate approval) would contribute to vegetation clearing in the area, however the adjacent conservation reserves contain foraging habitat that would not be impacted by the Project.	Unlikely
result in invasive species that are harmful to a Critically Endangered species becoming established in the species' habitat;	
The Project is unlikely to increase the likelihood of invasive species being established in areas adjacent to Study Area that would result in die back of eucalypts and native vegetation. Mitigation measures have been proposed to minimise indirect impacts.	Unlikely
introduce disease that may cause the species to decline, or	
There are no known documented diseases that are currently contributing to the decline of the species. The Project in not expected to cause an increased risk of any bird diseases.	Unlikely
interfere substantially with the recovery of the species.	
The main objectives in the National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia) are: • 'Reverse the long-term population trend of decline and increase the numbers of Regent Honeyeaters to a level where there is a viable, wild breeding	Unlikely

population, even in poor breeding years; and to • Enhance the condition of habitat across the regent honeyeaters range to maximise survival and reproductive success, and provide refugia during periods of extreme environmental fluctuation.' The Recovery Strategies to achieve the objectives include: • 'Improve the extent and quality of regent honeyeater habitat.' The removal of native vegetation within the Study Area is unlikely to substantially interfere with the recovery of the species given the following: - No breeding habitat would be impacted. - The Study Area does not occur within an area that has had extensive records. - The Study Area is not a known refugia site. - As discussed previously, the potential for the species to use the Study Area is relatively low. - Rehabilitation of the site following decommissioning would provide foraging trees for the Regent Honeyeater (eg. Eucalyptus melliodora).	
Conclusion: It is unlikely that a significant impact to the Regent Honeyeater would occur as a result of the Project due to the following: - The species was not detected despite targeted survey - Breeding habitat is unlikely to be present due to lack of mature hollow bearing eucalypts - The species has only been detected three times in the past 36 years within the Bungonia region suggesting that the species potential usage of the Study Area is likely to be marginal/low. - The adjacent conservation areas of Morton National Park and Bungonia State Conservation Area occur within the locality of the Study Area, and offer a range of habitat features for the Regent Honeyeater.	

Appendix 9. Biodiversity Management Plan contents

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Boral Quarries

Peppertree Quarry
Biodiversity and Rehabilitation Management Plan

February 2017

Document Name	Peppertree Quarry: Biodiversity and Rehabilitation Management Plan
Document Filename	20170228 PtreeBRMP
Document Location	G:\090 Metro Quarries Marulan\Marulan\OPERATIONAL\03. OHSE\1.04 compliance with legislation\approval PA 06_0074\SCH 5 - EM&M CONDS\2-4 mgt plan requirements and revisions

Rev No.	Date	Prepared By	Approved By	Comments
1	20th January 2011	ERM	Rod Wallace (Boral)	Landscape Rehab plan prepared as part of project approval 2007
2		Sharon Makin (Boral)	Angus Shedden (Boral)	Revision based upon Modification 3 requirements. No changes required
3	24th February 2017	Sharon Makin (Boral), Luke Baker and Craig Bagnall (Niche)	Sharon Makin (Boral)	Draft Biodiversity and Rehabilitation MP based upon Modification 4 requirements
4	28th February 2017	Sharon Makin (Boral), Luke Baker and Crag Bagnall (Niche)	Angus Shedden (Boral)	Final MP based upon Modification 4 requirements

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Appendices

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