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Biodiversity Offset Area Management Plan

Karuah East Quarry Project

Karuah East Quarry Pty Ltd

27 April 2021

Biodiversity Offset Area Management Plan

Karuah East Quarry Project

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Prepared for:

KARUAH EAST QUARRY PTY LTD
BLUE ROCK CLOSE
KARUAH NSW 2324

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Kleinfelder Australia Pty Ltd
95 Mitchell Road
Cardiff, NSW 2285
Phone: 1300 881 869
Fax: 1300 881 035

ABN: 23 146 082 500

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1. INTRODUCTION

1.1 BACKGROUND AND PROJECT OVERVIEW

Following exploratory works adjacent to an existing approved quarry owned by the proponent located near Karuah NSW, additional resource were identified. The proponent lodged an application and on 17 June 2014 approval was granted by the Minister for Planning and Environment (PA 09_0175) for the extraction of this additional resource through the development of Karuah East, a stand-alone operation to the existing quarry.

Karuah East is located on Lots 12 and 13 DP 1024564, off the Pacific Highway approximately 3 km north of Karuah NSW within the Mid Coast Council (MCC) (formally Great Lakes Council) Local Government Area (LGA). Construction and vegetation clearing of the approved quarry commenced in April 2016, with quarry operations commencing in November 2017. The approved development includes the following key elements:

- Staged extraction of approximately 29 million tonnes of “andesite” over a 20-year timeframe (i.e. approximately 1.5 million tonnes of andesite per year);
- Removal and stockpiling of an estimated 380,000 m^3 of overburden (approximately 750,000 tonnes) from the quarry extraction area in accordance with the Landscape and Rehabilitation Management Plan (L&RMP) (SLR 2015) prepared for the project. Removal of overburden is not included in the proposed extraction rate of 1.5 million tonnes of andesite annually;
- Haulage of up to 1.5 million tonnes of andesite per year from the site to market by 25 to 30 tonne haul trucks via the Pacific Highway;
- Up to 216 truckloads per day (at maximum production);
- Implementation of water management and erosion and sediment control works to ensure no loss of sediment, dust minimisation and to control discharges from the site to ensure that all discharges are within acceptable volumetric and water quality criteria;
- Roadworks to secure access to the site including upgrade and extension of Blue Rock Close, realignment of Andesite Road and Blue Rock Close intersection and adjust road markings at Branch Lane and Andesite Road intersection;
- Employment of 28 on-site staff;

- Construction of new haul road and access through adjoining Roads and Maritime Service (RMS) land;
- Staged clearing;
- Drilling and blasting activities;
- Loading and hauling of extracted material;
- Crushing and screening of extracted material;
- Stockpiling of material on-site; and
- Location of plant on Lot 13 comprised of office buildings, workshops, parking areas, crushing plant, wash plant, weigh bridge and product storage areas.

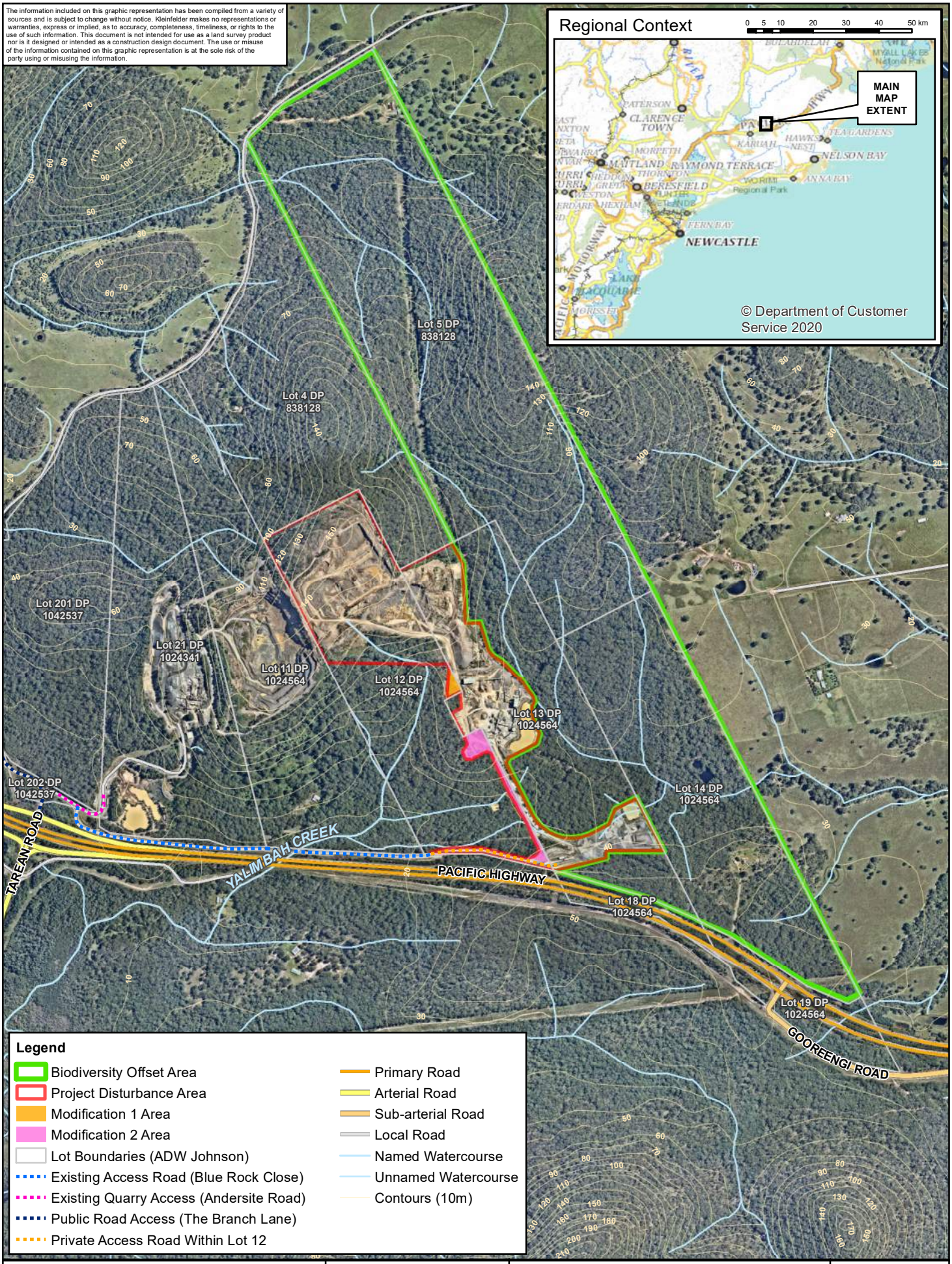
Figure 1 presents the Karuah East Quarry project disturbance area.

1.2 STATUTORY REQUIREMENTS

The statutory approvals for the Karuah East Quarry Project (KEQP) relevant to this Biodiversity Offset Area Management Plan (BOAMP) are shown in **Table 1**.

Table 1: Statutory approvals for the Karuah East Quarry Project relevant to this plan.

Reference	Approval Description	Date Approved	Legislation	Authority
PA 09_0175 (as per latest amendment)	State approval for the Karuah East Quarry Project	17 June 2014	Approved under Part 3A of EP&A Act 1979	Department of Planning and Environment (DP&E)
	Modification 1 Approval	27 April 2018	Section 75J of the EP&A Act 1979	
	Modification 2 Approval	19 December 2018	Section 75W of the EP&A Act 1979	
EPBC 2014/7282	Commonwealth approval for the action (Karuah East Quarry Project)	20 March 2015	Approved under Sections 130(1) and 133 of the EPBC Act 1999	Department of the Environment (DoTE)



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PROJECT REFERENCE: 20220262

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DATA SOURCE:
NSW DFSI - 2020
ADW Johnson - 2020
Nearmap - 2021

Karuah East Quarry and Biodiversity Offset Area

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Biodiversity Offset Area Management Plan
Karuah East Quarry Project

FIGURE:

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1.3 SCOPE AND REQUIREMENTS OF THE PLAN

This Biodiversity Offset Area Management Plan (BOAMP) has been prepared to satisfy relevant conditions of the Project Approval and EPBC Approval. Specifically, this plan addresses Schedule 3 Condition 33 of the Project Approval (as amended by MOD 1 and 2), and Conditions 7, 8 and 9 of the EPBC Approval. Additionally, this plan addresses conditions of the proposed Modification 1 and 2 to the Part 3A approval, under section 75W of the *Environment Planning and Assessment Act 1979*. In addition to the above conditions, several sections of the statement of commitments also relate to biodiversity offsets. The relevant approval conditions, statement of commitments, and a section reference for where each item of the conditions is addressed within this plan are provided in **Appendix 1**.

The BOAMP only applies to lands within the biodiversity offset area (BOA) located on part Lot 13 and Lot 14 DP 1024564, and Lot 5 DP 838128 as detailed in the Biodiversity Offset Strategy (ELA 2013) and Appendix 4 of the Project Approval (see Section 2 for details). A separate Landscape and Rehabilitation Management Plan (L&RMP) has also been prepared as required under Schedule 3 Condition 32 of the Project Approval for biodiversity management of the Karuah East quarry and all perimeter lands (hereafter referred to as the 'project area').

1.3.1 Allocation of Offset Credits within BOAMP

For clarity, the below sections provide a summary of the allocation of offset area and credits to the impacts of the original Project Approval and the Modification 1 and 2 Approved Projects.

Vegetation

The Biodiversity Offset Area for the Karuah East Quarry includes Part Lot 13 and Lot 14 DP 1024564, and Lot 5 DP 838128. The total area of these allotments is 138.22 ha, of which 131.44 ha is native vegetation. Schedule 3, Condition 33 of the Project Approval for the Karuah East Quarry required a total of 129.32 ha of 'existing vegetation' to be managed as an offset for impacts on 28.09 ha of vegetation, which generates an offset to impact ratio of 4.60:1.

With the inclusion of the additional impact area for the modification 1 (0.25 ha) and modification 2 (0.57 ha), the total impact area of the Karuah East Quarry will be 28.34 ha. Impacts relating to modification 2 are specific to areas of degraded and managed vegetation (not commensurate with any native vegetation community). As such, a total area of 130.36 ha of native vegetation will need to be managed as an offset in order to maintain the 4.60:1 offset to impact ratio, leaving a surplus of 1.08 ha of native vegetation within the Offset Area (**Table 2**).

Table 2: Vegetation Offsets

Project	Approved Vegetation Disturbance	Minimum Offset Area
Original Project Approval 09_0175 (17 June 2014)	28.09 ha	129.32 ha
MOD 1 to Project Approval (27 April 2018) Areas inclusive of original Project Approval	28.34 ha (inclusive of additional 0.25 ha of native vegetation)	130.36 ha
MOD 2 to Project Approval (19 December 2018) Areas inclusive of original Project Approval	28.91 ha (inclusive of additional 0.57 ha of exotic vegetation)	130.36 ha
Existing Native Vegetation Surplus within Offset Area		1.08 ha

Tetratheca juncea

State Offset Calculations

The original Approved Karuah East Quarry project directly impacted on a total of 243 individual *Tetratheca juncea* clumps, which generated a total of 3,574 species credits. When assessing both direct and indirect impacts, the original approved project impacted on a total of 1,575 individuals, which generated a total of 23,162 species credits. The additional impacts of Modification 1 would increase direct impacts by 13 clumps (256 total clumps, combined for Original and MOD 1) and combined direct and indirect impacts of 29 clumps (1,604 total clumps, combined for Original and MOD 1). This increased the species credits generated through direct impacts by 191 species credits (3,765 total clumps, combined for Original and MOD 1), and both direct and indirect impacts by 427 species credits (23,589 total clumps, combined for Original and MOD 1) (**Table 3**). No additional *Tetratheca juncea* credits are required for MOD 2 as impacts are specific to areas of degraded and managed vegetation.

The Biodiversity Offset Area contains a total of 6,907 clumps, which generates a total of 41,492 credits. With consideration of the indirectly impacted clumps, the offset area contains a total of 5,575 clumps, generating a total of 33,450 species credits. This produces a positive balance (surplus) of 9,861 species credits, when assessing both direct and indirect impacts of the Original Approval and MOD 1.

Table 3: *Tetratheca juncea* Species Credits (State offset Considerations)

Project	Approved Impact	Credit Requirements
Original Project Approval 09_0175 (17 June 2014)	243 – Direct	3,574 – Direct
	1,332 – Indirect	19,588 – Indirect
	1,575 - Total	23,162 – Total
MOD 1 to Project Approval (27 April 2018) Counts inclusive of original Project Approval	256 – Direct	3,765 – Direct
	1,348 – Indirect	19,824 – Indirect
	1,604 – Total	23,589 – Total
Tetratheca juncea Credits Surplus within Offset Area (considering both direct and indirect impacts).		9,861 Credits (Total)

Federal Offset Calculations

Eco Logical prepared an EPBC Act Assessment Report (2014), which included an assessment of the impacts on *T. juncea* using the EPBC Act offset calculator, required as part of the EPBC approval process for the original application (EPBC 2014/7282). This assessment concluded that the original approved project would fulfil 106.76% of the offset requirements for the impacts to *T. juncea* within the original impact area (**Table 4**). An assessment of the impacts from MOD 1 (including the original impact to 243 individuals) has also been conducted, to ensure the offset area would fulfil the offsetting requirements under the EPBC Act. This assessment used the same assumptions as used in the original Eco Logical report (2014), and includes the additional 583 *T. juncea* individuals identified within Lot 5 of the offset area. This assessment identified that the offset area would fulfil 104.72% of the offsetting requirements for the Karuah East Quarry, including the proposed modification area (**Table 4**).

Table 4: EPBC Act Offset calculations for *Tetratheca juncea*

Impact Calculator Attribute	Approved Project Offsets Calculations (Eco Logical, 2014)		Offsets Calculations including MOD 1	
	Impact Calculator Input	Notes	Impact Calculator Input	Notes
Number Impacted	243	-	256	-
Proposed Offset	6,324	Does not include Lot 5	6,907	Including counts within Lot 5
Risk Horizon	20 years	-	20 years	-
Start Value	6,324 individuals	-	6,907 individuals	-
Future Value without Offset	6,124 individuals	Assumed 3% decline (200 individuals)	6,700 individuals	Assumed 3% decline (207 individuals)
Future Value with Offset	6,424 individuals	Assumed 1.5% increase (100 individuals)	7,010 individuals	Assumed 1.5% increase (103 individuals)
Raw gain	300 individuals	As per Calculator	310 individuals	As per Calculator
Adjusted Gain	270 individuals	As per Calculator	279 individuals	As per Calculator
Net Present Value	259.42 individuals	As per Calculator	268.07 individuals	As per Calculator
Total % Residual impact offset	106.76%	As per Calculator	104.72%	As per Calculator

1.4 OVERALL OBJECTIVES OF THE BOAMP

The overall objective of this BOAMP is to bring together relevant approval conditions and information from project documentation into a single source to improve the efficiency and effectiveness of offset area management to protect and improve vegetation condition and habitat. In particular this document will:

- Identify the land managed under this BOAMP;

- Identify, and where relevant incorporate, the various documents that pertain to the baseline environment and required management within the BOA;
- Provide a clear, concise, staged and instructional working document outlining the management strategies and actions for the BOA; and
- Outline monitoring, performance/ completion criteria, and reporting procedures for the BOA.

1.5 CONSULTATION AND PLAN DEVELOPMENT

Kleinfelder was engaged by Karuah East Quarries Pty Ltd (Karuah East) to prepare this plan.

This plan was submitted to DoTE, OEH and MCC for review and consultation as per Schedule 3 Condition 33(b) of the PA and Condition 9 of the EPBC approval, and has been subsequently amended to incorporate feedback received (**Appendix 2**). The BOAMP has also been submitted to DP&E for review and has been subsequently amended to incorporate feedback received (**Appendix 2**).

1.6 ROLES AND RESPONSIBILITIES

Table 5 outlines the specific roles and responsibilities of Karuah East staff and contractors for the implementation of this BOAMP.

Table 5: Roles and responsibilities for BOAMP implementation

Role	Responsibilities
Quarry Manager	• To authorise this plan. • To provide the final authorised distribution of this management plan. • Organise revisions of this BOAMP as required (Section 6).
Quarry Manager (or delegate)	• Implement the management actions contained in this plan. • Maintain records of all activities within the offset area. • Inclusion of all relevant records and monitoring results within the Annual Review. • Ensure that all operations on site are undertaken in compliance with this management plan. • Ensure all site personnel have received the appropriate training for their responsibilities. • Provide feedback on the adequacy and effectiveness of this plan.
Staff and Contractors	• Report any incidences or complaints immediately to the Quarry Manager or delegate. • Ensure the implementation of this BOAMP with respect to their specific work practices. • Act in accordance with the management procedures or protocols outlined in this plan. • Ensure any potential or actual issues, including environmental incidents, are reported to the Quarry Manager or delegate in a timely manner.

2. BIODIVERSITY OFFSET AREA

2.1 LOCATION AND SURROUNDING LAND USES

The BOA for Karuah East is a 138.22 ha consolidated land parcel comprised of three lots:

- Lot 13 DP 1024564 (part) – 23.03 ha;
- Lot 14 DP 1024564 – 38.49 ha; and
- Lot 5 DP 838128 – 76.70 ha.

It is noted that the above areas are based on cadastre data supplied by ADW Johnson following recent survey by registered surveyors to accurately define the lot boundaries. As such, the total area of native vegetation within the BOA is larger than detailed in previous project documentation.

The BOA is located approximately 3 km north of Karuah NSW, and adjoins the eastern boundary of the project area (**Figure 1**). The BOA is located in a rural environment with surrounding lands zoned RU2 Rural Landscape under the Great Lakes Local Environmental Plan (LEP) 2014. The BOA is bounded by the Pacific Highway to the south, the project area to the south-west, and private landholdings to the north-west, north and east which comprise a mixture of forested and cleared grazing lands.

The BOA will not be subject to operational impacts from the adjoining Karuah East Quarry as all quarrying, processing and hauling activities are restricted entirely to the project area.

2.2 LAND TENURE AND SECURITY

Lot 5 DP 838128, Lot 13 and 14 DP 1024564 are currently owned by the Karuah East Quarry Pty Ltd. Karuah East Quarry Pty Ltd will secure the BOA via a Conservation Agreement under Part 4, Division 12 of the *National Parks and Wildlife Act 1974* in consultation with OEH as per Schedule 3 Condition 29 of the Project Approval (see 'Finalisation Biodiversity Offset Strategy' letter for further details in **Appendix 2**).

2.3 BASELINE ENVIRONMENT

2.3.1 Land Use History

The majority of the BOA is vegetated with native forest (131.76 ha) with the remaining 6.46 ha consisting of cleared and modified lands that contain dams, existing dwellings, access roads, and infrastructure. The BOA has been previously subject to logging and cattle grazing regimes, although both practices have ceased on all three lots. A managed electricity easement bisects the northern portion of Lot 13 and the central portion of Lot 5. Two dwellings are present in the BOA, one on the southern portion of Lot 14 and at the northern end of Lot 5; there is a small, cleared area surrounding each dwelling. A series of unsealed tracks (old logging and fire trails) occur across all lots within the BOA.

2.3.2 Climatic Information

The nearest Bureau of Meteorology (BOM) weather station which records long term climatic data is located approximately 17 km to the east of the BOA at Nelson Bay. This station holds climate records since 1881 and provides long term indications of weather in the area. A summary of the monthly temperature and rainfall averages in 2014 and long term historical averages in provided in **Table 6**.

Table 6: Climatic data from Nelson Bay weather station

Month	2014 Monthly Mean		Total Rainfall (mm)	Historical Averages		
	Min Temp (°C)	Max Temp (°C)		Min Temp (°C)	Max Temp (°C)	Rainfall Median (mm)
January	20.1	26.8	42.1	18.8	27.3	83.8
February	19.8	26.1	141.8	18.9	27	86.4
March	19.4	26.0	92.9	17.6	25.9	90.2
April	17.6	23.6	143.5	15.1	23.5	103.8
May	14.8	21.9	88.9	12.2	20.7	131.4
June	12.6	18.8	159.1	10	18.3	128.4
July	10.1	17.8	47.5	8.9	17.4	115
August	11.4	17.7	247.9	9.7	18.9	79.7
September	13.4	20.5	134.1	11.8	21.4	73.8
October	16.0	23.3	43.6	13.9	23.1	70.6
November	18.0	25.4	32.6	15.8	24.7	70.1
December	19.5	25.8	93.9	17.6	26.1	74.6
Average	**16.1**	**22.8**	**105.7**	**14.2**	**22.9**	**92.3**

2.3.3 Landform, Geology, Soils and Erosion

The BOA is situated in the Karuah River Basin and is overall undulating, but varies in slope and aspect considerably. Numerous steep, sometimes rocky, slopes and creek gullies are evident, particularly in the southern and central portions of Lot 5. The BOA generally has much lower relief in the southern portion (Lots 13 and 14) which is generally a south facing aspect toward the Pacific Highway with a more meandering watercourse and drainage line system (Bulga Creek and its tributaries). **Figure 1** provides the topography of the BOA.

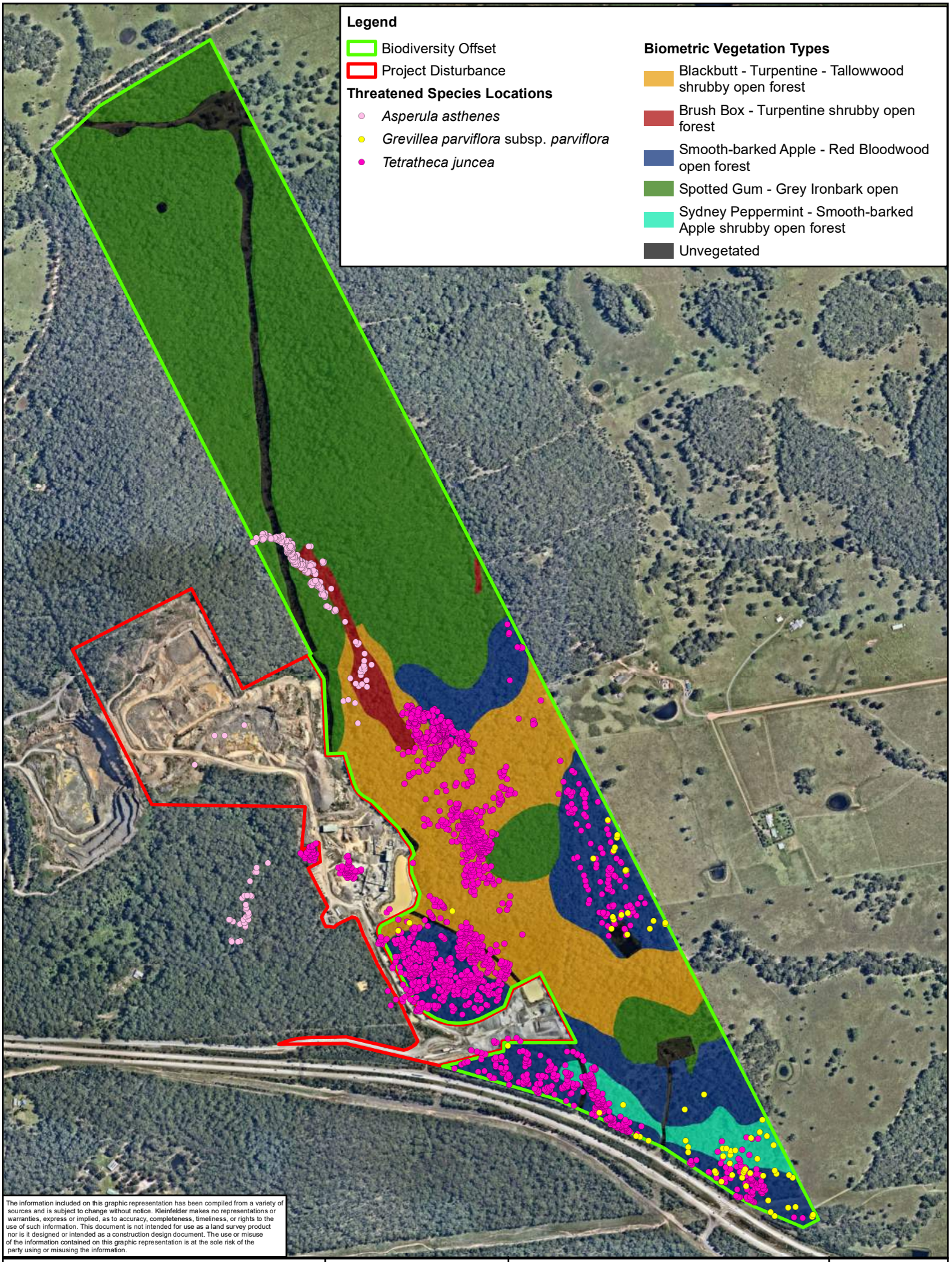
The BOA is mapped as occurring on both residual and colluvial soil landscape groups, namely North Arm Cove and Gan Gan, described as supporting undulating to steep hills on ignimbrites of the Nerong Volcanics comprising ignimbrite, toscanite, dacite, andesite, conglomerate, sandstone and siltstone (Murphy 1995). This Nerong Volcanics soil landscape is characterised by colluvial (steeper slopes and ridgelines) and alluvial (lower elevations and watercourses) areas. The distribution of the dominant vegetation types supported in the BOA is closely related to the distribution of these two soil types.

2.3.4 Vegetation Communities, Threatened and Migratory Species

RPS Australia Pty Ltd (2013) conducted an ecological assessment of the proposed Karuah East Quarry project area and adjoining lands (Lots 12, 13 and 14 DP1024564). Additional ecological surveys were also conducted by Eco Logical Australia (ELA) across Lots 12-14 and Lot 5 DP 838128 to inform the preparation of the Biodiversity Offset Strategy (ELA 2013) and EPBC Act Assessment Report (ELA 2014). Furthermore, in 2015 Kleinfelder conducted additional threatened flora surveys within Lot 5 of the BOA (not previously surveyed by RPS and ELA), and baseline fauna surveys across the entire BOA. For detailed survey methodologies see the *Baseline Ecological Surveys and Monitoring* Report (Kleinfelder 2016). The following sections provide a summary of the biodiversity values identified within the BOA across all of these surveys.

Vegetation Communities

ELA (2013) identified and mapped five biometric vegetation types in the BOA. A summary of the area (ha), and structure and floristics of each vegetation type recorded in the BOA is provided in **Table 7**. The distribution of these vegetation types is shown in **Figure 2**. None of the vegetation types recorded in either the project area or BOA are listed as threatened ecological communities under the NSW *Threatened Species Conservation Act* (TSC Act) 1995 or the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999.



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DATA SOURCE:
NSW DFSI - 2020
ADW Johnson - 2020
EcoLogical - 2014
Nearmap - 2021

Vegetation Types and Threatened Species Locations

Karuah East Quarry Pty Ltd
Biodiversity Offset Area Management Plan
Karuah East Quarry Project

FIGURE:
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Table 7: Summary of Vegetation Types in the BOA

Vegetation Type	Description (ELA 2013)	Area (ha)
Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Remnant open forest, with a distinct sub-canopy and an understorey, scattered shrubs and predominantly native perennial grasses and forbs. A small area (0.83 ha) consists of previously cleared regrowth open forest with young saplings and taller shrubs to 3 - 5 m and sparsely scattered larger remnant trees. It contains a denser shrub layer and primarily native grasses as a ground cover; although introduced grass species are common. **Dominant species** Canopy: *Corymbia maculata* (Spotted Gum), *Eucalyptus paniculata* subsp. *paniculata* (Grey Ironbark), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *Eucalyptus canaliculata* (Large-fruited Grey Gum) and *Eucalyptus acmenoides* (White Mahogany). Midstorey: *Allocasuarina torulosa* (Forest Oak). Groundcover: *Imperata cylindrica* (Blady Grass) and *Themeda australis* (Kangaroo Grass).	69.98
Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	Remnant open forest vegetation with a sparse sub-canopy. A distinct but variable shrub layer was present, sometimes moderately dense. The groundcover layer was generally dominated by native grass species. **Dominant species** Canopy: *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood). Midstorey: *Allocasuarina littoralis* (Black She-oak). Groundcover: *Imperata cylindrica*, *Entolasia stricta* and *Themeda australis*.	3.96
Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Remnant open forest with some large mature trees. Generally comprising a sparse sub-canopy, a variable shrub layer (often quite dense) and a grass dominated understorey predominantly native perennial grasses and forbs. A small area (3.02 ha) consists of previously cleared regrowth open forest with young saplings to 5 m and sparsely scattered larger trees. It contains a denser shrub layer and primarily native grasses as a ground cover; although introduced grass species are well established. **Dominant species** Canopy: *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus pilularis* (Blackbutt). Midstorey: *Allocasuarina littoralis* (Black She-oak). Groundcover: *Imperata cylindrica* and *Doryanthes excelsa* (Gymea Lily).	26.58
Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast	Remnant moderately tall moist open forest to forest vegetation including some areas of younger growth. A distinct but generally sparse sub-tree layer, as well as an often sparse shrub layer. Groundcover comprised of a combination of grasses and herbaceous species. **Dominant species** Canopy: *Eucalyptus pilularis* (Blackbutt), *Eucalyptus microcorys* (Tallowwood), *Syncarpia glomulifera* (Turpentine) and *Angophora costata* (Smooth-barked Apple). Midstorey: *Allocasuarina torulosa* (Forest Oak). Groundcover: *Themeda australis* (Kangaroo Grass), *Poa affinis*, *Imperata cylindrica* (Blady Grass) and *Doryanthes excelsa* (Gymea Lily).	28.30

Vegetation Type	Description (ELA 2013)	Area (ha)
Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast	Remnant and regrowth of moderately tall open forest to forest, comprising a distinct sub-canopy of small trees (mesic). Numerous climbers and twiners throughout. A dense understorey of ferns, rushes, grasses and various herbs. **Dominant species** Canopy: *Lophostemon confertus* (Brush Box) and *Syncarpia glomulifera* (Turpentine). Midstorey: *Melaleuca styphelioides* (Prickly Paperbark), *Glochidion ferdinandi* (Cheese Tree) and *Livistona australis* (Cabbage Tree Palm). Groundcover: *Lomandra longifolia* (Spiny-headed Mat-rush), *Doodia aspera* (Rasp Fern) and **Lantana camara* (Lantana).	2.62
	Total	**131.44**

Threatened and Migratory Species

A total of three threatened flora species listed as Vulnerable under both the TSC Act and EPBC Act were recorded during surveys of the study area: *Tetratheca juncea* (Black-eyed Susan), *Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes* (Trailing Woodruff). A summary of the population sizes and habitats in which these species occur within the project area and BOA is provided in **Table 8**. The locations of these threatened flora species are provided in **Figure 2** (data displayed in Figure 2 is a combination of data supplied to Kleinfelder on 15/7/2015 and 22/7/2015; source ELA 2013 survey and RPS 2010-2011 survey, and Kleinfelder 2015 baseline surveys).

A total of five threatened fauna species listed as Vulnerable under the TSC Act were recorded during surveys of the study area: Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Eastern Freetail-bat (*Mormopterus norfolkensis*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*). An additional 15 threatened fauna species and four EPBC-listed migratory species were considered to potentially occur in the project area and surrounding lands (RPS 2013).

Table 8: Threatened flora species recorded in the project area and BOA

Species	Habitat	Population Size
Tetratheca juncea	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin. Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	A total of 6,907 clumps have been recorded within the BOA across the surveys: • 6,324 recorded by RPS (2013) & ELA (2014) within Lot 14 and Part Lot 13. • 583 by Kleinfelder (2016) within Lot 5. A total of 256 clumps were recorded in the project area: • 243 within the original approved Project area (RPS and ELA) (note: additional individuals were identified and translocated by Firebird, 2017; see **Section 3.9**). • 13 within the Modification 1 Area (Kleinfelder).
Grevillea parviflora subsp. *parviflora*	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin.	At least 100 stems were recorded within the BOA. No stems were recorded within the project area.

Species	Habitat	Population Size
	Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	
Asperula asthenes	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	399 individuals were recorded in the BOA. 60 individuals were recorded in the project area.

2.3.5 Introduced Species

Weeds

Baseline weed surveys have been updated with information from the Kleinfelder annual monitoring (2017), to show the current extent of weed species within the BOA (**Figure 3**). *Lantana camara* (Lantana) is the most abundant weed species within the BOA and active management of Lantana should be prioritised given the abundance of Lantana and its location in close proximity to *Asperula asthenes* (Trailing Woodruff). A complete list of weed species recorded within the BOA is provided below as **Table 9**. All environmental weeds which represent a threat to the integrity of the ecological values within the BOA will be the focus of management actions.

Table 9: Exotic species recorded in the study area

Scientific Name	Common Name	Priority Weeds (Biosecurity Act 2015) in Mid Coast Council control area
Ageratina riparia	Creeping Crofton Weed	-
Anagallis arvensis	Scarlet Pimpernel	-
Andropogon virginicus	Whisky Grass	-
Asparagus aethiopicus	Ground Asparagus	Prohibition on dealings
Axonopus fissifolius	Narrow-leafed Carpet Grass	-
Bidens pilosa	Cobblers Pegs	-
Briza maxima	Quaking Grass	-
Chloris gayana	Rhodes Grass	-
Hypochaeris radicata	Catsear	-
Lantana camara	Lantana	Prohibition on dealings
Lolium perenne	Perennial Ryegrass	-
Melinis repens	Red Natal Grass	-
Paspalum dilatatum	Paspalum	-
Paspalum mandiocanum	Broadleaf Paspalum	-
Pennisetum clandestinum	Kikuyu	-
Plantago lanceolata	Lamb's Tongues	-
Senecio madagascariensis	Fireweed	Prohibition on dealings
Senna pendula var. glabrata	Cassia	-
Setaria sphacelata	South African Pigeon Grass	-

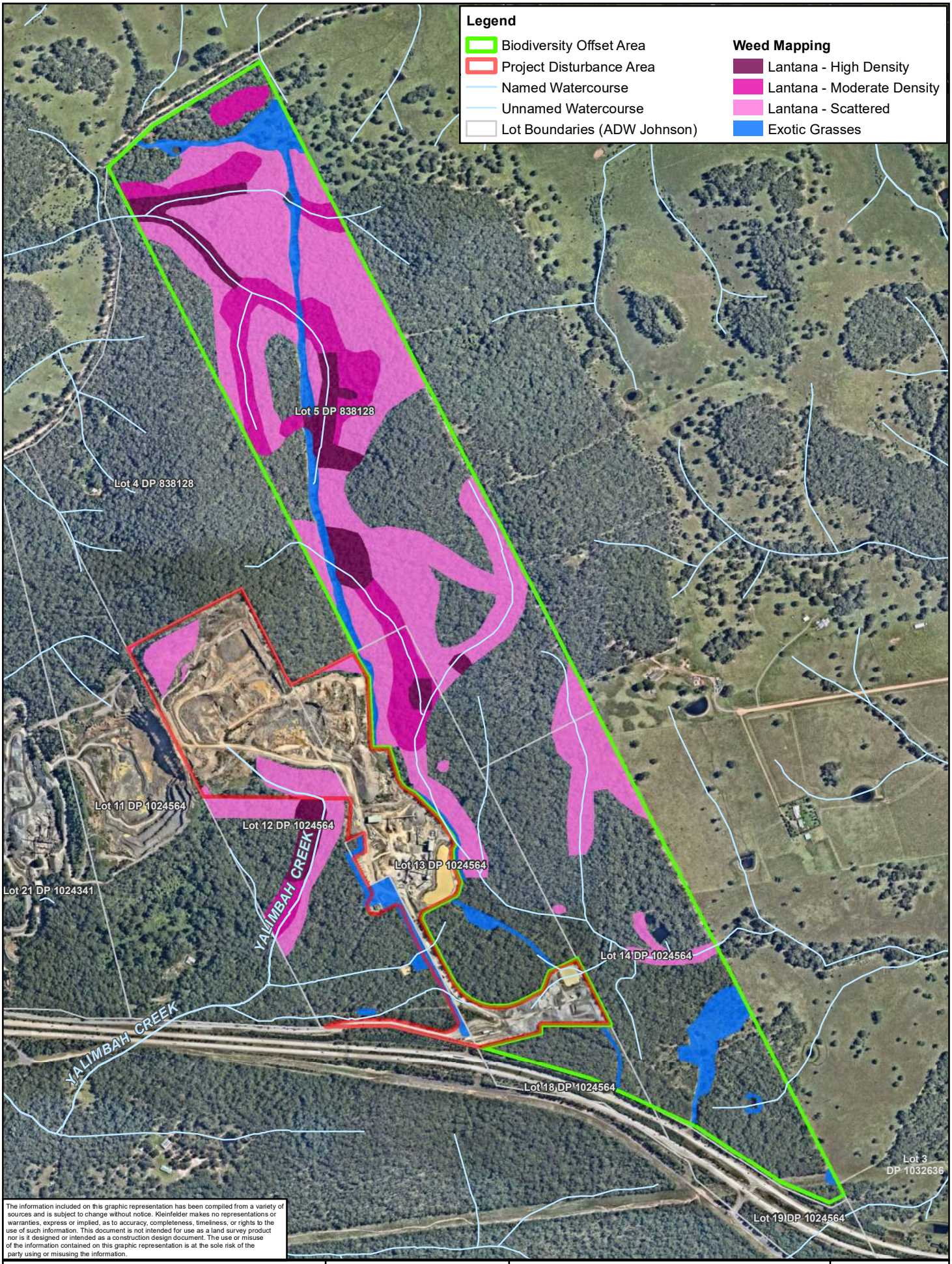
Scientific Name	Common Name	Priority Weeds (Biosecurity Act 2015) in Mid Coast Council control area
Solanum nigrum	Black-berry Nightshade	-
Stellaria media	Common Chickweed	-
Trifolium repens	White Clover	-
Verbena bonariensis	Purpletop	-
Vulpia myuros	Rat's Tail Fescue	-

Vertebrate Pests

No vertebrate pest species were recorded during field surveys of the BOA by RPS (2013) or ELA (2013). During additional baseline surveys conducted by Kleinfelder in 2015 Red Fox (*Vulpes Vulpes*), Feral Pig (*Sus scrofa*) and Feral Cat (*Felis catus*) were observed. These species will be the focus of monitoring and management actions until further scheduled monitoring events occur. **Table 10** provides a list of vertebrate pest species which may occur in the BOA.

Table 10: Vertebrate pest species which may occur in the BOA

Scientific Name	Common Name
Canis lupus familiaris	Wild Dog*
Felis catus	Cat
Lepis capensis	Brown Hare
Oryctolagus cuniculus	Rabbit*
Sus scrofa	Feral Pig*
Vulpes vulpes	Red Fox
**Declared pests under the Local Land Services Act 2013*	



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PROJECT REFERENCE: 20220262

DATE DRAWN: 2021/04/21 10:26Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
ADW Johnson - 2020
Nearmap - 2021

Weed Mapping

Karuah East Quarry Pty Ltd
Biodiversity Offset Area Management Plan
Karuah East Quarry Project

FIGURE:

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2.4 MANAGEMENT ZONE STRATIFICATION

Management zones within the BOA are based on the current vegetation types as mapped by ELA (2013). The majority of the management zones consist of remnant forest vegetation, while the remaining zones comprise relatively small areas of cleared land or regenerating forest. Over time as natural regeneration progresses and management actions are undertaken, the management zone boundaries may change as the cleared areas regenerate to a similar composition to the adjoining forest types.

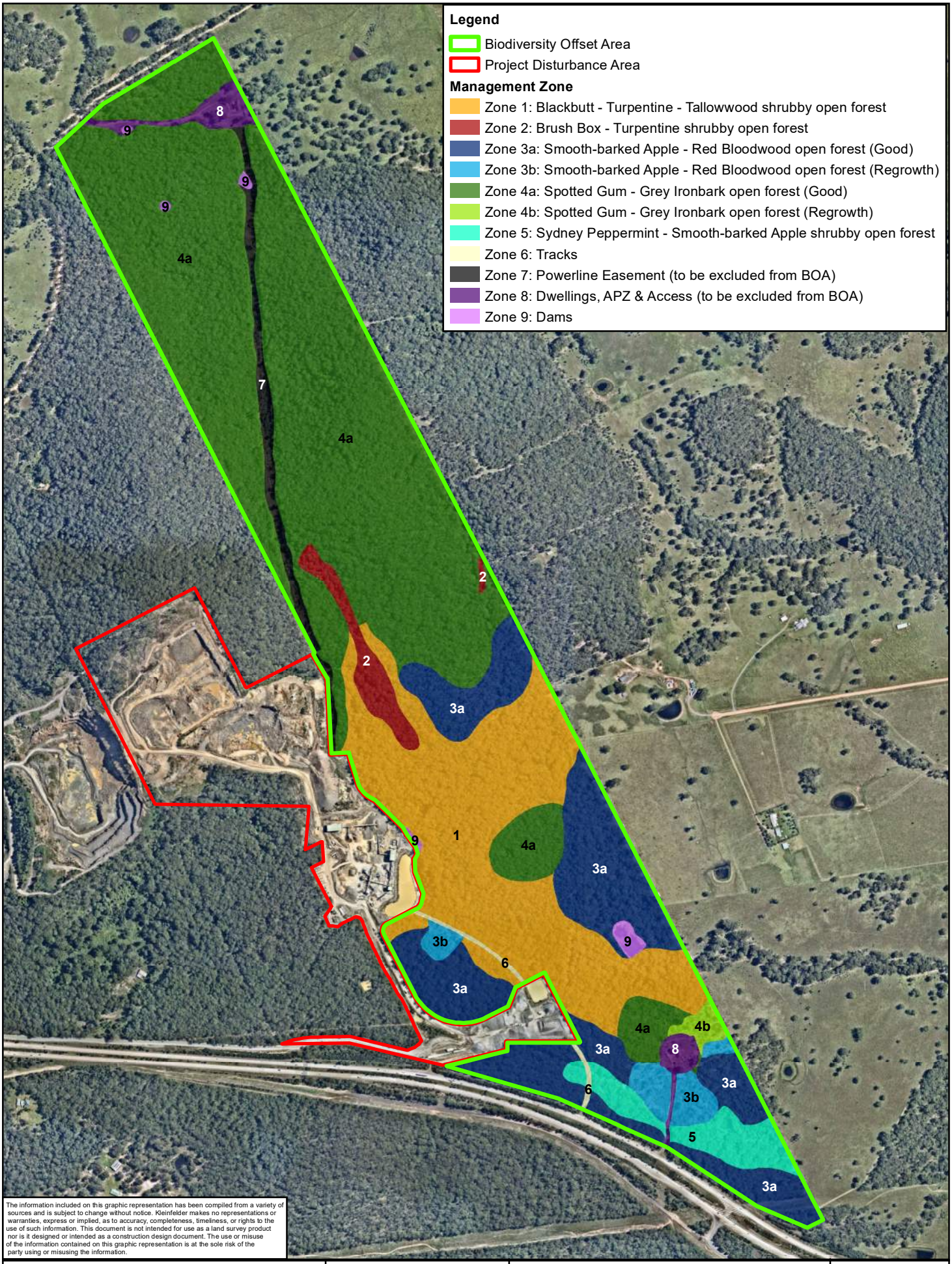
It is also noted that the BOA contains small areas of land that do not contribute to biodiversity conservation (i.e. powerline easement, existing dwellings and access tracks). These areas have been delineated as separate management zones (**Table 8**), and it is intended that these management zones will be excised from the Conservation Agreement to be prepared for the BOA. Excluding these areas, the BOA contains a total of 131.44 ha of native vegetation.

Irrespective of the management zone, the majority of management practices are relevant across the entire BOA. **Figure 4** and **Table 11** illustrate the BOA management zones.

Table 11: Management zones within the BOA

Management Zone	Vegetation Type	Condition	Objective	Area (ha)
1	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast	Moderate/ good	Conserve and maintain	28.30
2	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast	Moderate/ good	Conserve and maintain	2.62
3a	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Moderate/ good	Conserve and maintain	23.69
3b	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin	Moderate/ good (modified regrowth)	Allow natural regeneration to adjoining forest communities	2.89
4a	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Moderate/ good	Conserve and maintain	69.19
4b	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin	Moderate/ good (modified regrowth)	Allow natural regeneration to adjoining forest communities	0.79
5	Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	Moderate/ good	Conserve and maintain	3.96
			Total area of native vegetation	**131.44**

Management Zone	Vegetation Type	Condition	Objective	Area (ha)
6	Access tracks	N/A	Maintain to enable access for management activities	0.48
7	Powerline easement	N/A	Managed powerline easement	3.12
8	Excluded dwellings and associated asset protection zones (APZs), and access tracks	N/A	Dwellings, APZs, access tracks and managed grassland	2.48
9	Dams	N/A	Conserve and maintain	0.70
Total area of dams, cleared land, and land to be excised				**6.78**
Total				**138.22**



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DATA SOURCE:
NSW DFSI - 2020
ADW Johnson - 2020
EcoLogical - 2014
Nearmap - 2021

Management Zones

Karuah East Quarry Pty Ltd
Biodiversity Offset Area Management Plan
Karuah East Quarry Project

FIGURE:
4

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3. MANAGEMENT STRATEGIES

This section details the management measures to protect and manage the native vegetation and habitat within the BOA (**Table 12**). Short, medium and long-term measures to be implemented across the BOA are described for each management strategy. For the purpose of this plan, short-term measures will be undertaken within year 3 with long term measures occurring as required for the life of the quarry (LOQ). The timing and any specific reporting requirements of management actions are detailed in **Table 9**. Monitoring and maintenance requirements are also specified for each management strategy.

Implementation of the short-term measures will commence upon authorisation of this plan. The long-term management measures will be implemented for the life of the quarry operation (including all rehabilitation works; approx. 20 years); post operations management will be in accordance with the Conservation Agreement. Performance and completion criteria relating to each management action are provided in **Section 4**, and the overall reporting framework for the BOAMP is outlined in **Section 5**.

Table 12: Management measures to be implemented within the BOA

Action	Management Approach and Procedures	Timing	Reporting/ Records
3.1 CULTURAL HERITAGE MANAGEMENT **Objective**: To preserve and protect Aboriginal and European cultural heritage values within the BOA.			
Record and manage newly identified cultural heritage objects	• To be undertaken as per the Cultural Heritage Management Plan (CHMP).	As required	As per CHMP
Risk assessment to avoid disturbance to cultural heritage objects	• All staff and subcontractors undertaking any management activities in the BOA that may uncover cultural heritage items (e.g. access track maintenance) must be made aware of this potential risk and to adhere to the procedures outlined in the CHMP.	As required	Induction/ toolbox records
3.2 FENCING, GATES AND SIGNAGE **Objective**: To exclude stock, limit access, maintain biodiversity values (including protecting threatened species), protect cultural heritage values, enhance revegetation, and notify the presence of the offset area and conservation values.			
Fence mapping	• Map the locations of existing boundary and internal fencing, including fencing types and gates. • Identify locations requiring fencing and gate installation/ repairs • Identify redundant internal fencing to be removed.	Year 1 (Completed; Kleinfelder 2016a)	Baseline addendum report

Action	Management Approach and Procedures	Timing	Reporting/ Records
Boundary fencing, gates and signage installation/ repairs	• Install post and wire fencing (minimum three strand) at required locations around BOA perimeter (with the exception of the project area/ BOA interface – see L&RMP for details on fencing for this boundary). • Plain wire should be used instead of barbed wire to reduce injuries to native fauna moving between the BOA and adjacent lands, except for boundaries adjoining stock grazing properties (i.e. eastern boundary of BOA). • Repair any breaks in boundary fencing. • Install signage at appropriate locations around the BOA perimeter (primarily at access points) which indicate land ownership and tenure (i.e. Conservation Area).	Year 3 (ongoing repairs and maintenance as required)	Maintain records of installation/ repair dates, locations, and personnel
Redundant fencing removal	• Remove any internal stock exclusion fencing. • Retain timber posts where possible for habitat.	No fencing identified during baseline survey	Maintain records of fencing removal dates, quantity removed, and locations
Fencing inspections	• Inspections of boundary fencing will be undertaken as part of annual monitoring to identify maintenance requirements and record fencing activities undertaken in previous year. • The effectiveness of fencing in excluding stock and unauthorised activities (e.g. rubbish dumping) will also be evaluated during annual monitoring and any additional controls will be identified if required.	Annually for life of quarry (LOQ)	Annual monitoring report
Fencing maintenance	• Maintain boundary fencing as directed by annual inspection results.	As required for LOQ	Maintain records of fencing maintenance dates, locations and personnel
3.3 ACCESS TRACKS **Objective**: To provide suitable access for emergency vehicles and approved management/ maintenance activities, and to minimise erosion and sedimentation within the BOA.			
Access track mapping and assessment	• Map all internal access tracks. • Identify access tracks to be retained and maintained, and any repairs/ upgrades required. • Identify redundant access tracks to be rehabilitated.	Year 1 (Completed; Kleinfelder 2016a)	Baseline addendum report
Access track repairs	• Undertake track repairs as specified in the baseline track mapping and assessment. • Generally, track repairs will consist of rectifying any riling or scouring through grading, compacting and filling.	Years 2-3 (Completed; Kleinfelder 2016a)	Maintain records of track repairs including dates, locations and personnel

Action	Management Approach and Procedures	Timing	Reporting/ Records
Redundant access track rehabilitation	• Install suitable delineation, barriers and/ or signage to ensure redundant tracks are not used. • Where possible and appropriate, habitat features such as logs and branches salvaged during clearing of the project area will be placed along redundant tracks to reduce erosion/ sedimentation and promote natural regeneration (see **Section 3.8** for further details). • Assisted natural regeneration is the preferred method for rehabilitation of redundant tracks (as they occur within/ next to remnant vegetation). The adequacy of natural regeneration and the subsequent need for any supplementary planting would be determined through annual inspections.	Years 2-3	Maintain records of track rehabilitation including dates, locations and personnel
Access track inspections	• Inspections of retained and redundant access tracks will be undertaken as part of annual monitoring to identify maintenance requirements and record maintenance activities undertaken in previous year.	Annually for LOQ	Annual monitoring report
Track maintenance	• Maintain access tracks as directed by annual inspection results.	Annually following initial track repairs/ upgrades for LOQ	Maintain records of track repairs including dates, locations and personnel
3.4 EROSION, SEDIMENTATION AND SOIL MANAGEMENT **Objective**: To improve/ maintain the soil profile, protect cultural objects and promote natural regeneration in the BOA.			
Erosion and sedimentation mapping	• Map areas of active erosion and sedimentation in the BOA. • Prioritise erosion sites requiring repair depending on size and severity of impacts.	Year 1 (Completed; Kleinfelder 2016a)	Baseline addendum report
Erosion repair and management	• Undertake erosion repair and management as specified in the baseline erosion mapping and assessment. • Generally, erosion control will consist of stabilising soil erosion (e.g. installing jute matting over affected areas; placing logs or branches on affected areas to reduce surface water velocity) and minimising sediment-laden run-off (e.g. installing sediment control devices such as silt fencing or coir logs).	Years 2-3 (Completed; Kleinfelder 2016a)	Maintain records of erosion management activities including dates, locations and personnel
Erosion inspections	• Inspections of erosion sites will be undertaken as part of annual monitoring to identify maintenance requirements and record maintenance activities undertaken in previous year.	Annually for LOQ	Annual monitoring report
Maintenance	• Undertake repair and management of erosion sites as directed by annual inspection results.	Annually for LOQ	Maintain records of erosion repairs including dates, locations and personnel

Action	Management Approach and Procedures	Timing	Reporting/ Records
3.5 EXISTING DWELLINGS **Objective**: To manage potential indirect impacts from continued occupation of existing dwellings within the BOA.			
Exclusion of existing dwellings from BOA	• Two existing dwellings currently occur within the BOA on Lot 14 and Lot 5. These dwellings and associated access tracks will be excised from the Conservation Agreement (**Figure 4**). These excised areas only include the existing dwellings, access tracks, cleared land surrounding the dwellings, and provision for an Asset Protection Zone (APZ) for each dwelling. Karuah East will retain ownership of these excised lands for the life of the project.	Year 3	-
Restrictions and management of dwellings	• All tenants will be informed of the BOA adjoining the dwellings and associated access restrictions that apply to this land. • No domestic animals will be permitted at the two dwellings. • Noxious weeds must be managed within the excised areas in accordance with **Section 3.10**. • Fencing will be installed around the excised dwellings and associated access tracks in conjunction with the boundary fencing detailed in **Section 3.2** and as shown on **Figure 4**. • Signage will also be installed at appropriate locations near the dwellings to indicate land ownership and tenure of the adjoining BOA.	Before tenants take residency	Maintain records of fencing installation, dates and personnel
Inspections	• Inspections of the dwellings, access tracks, and asset protection zones (APZs) will be undertaken as part of annual monitoring to identify maintenance requirements. These inspections will focus on fencing, weeds, and unauthorised access/ disturbance.	Annually for LOQ	Annual monitoring report
Maintenance	• The cleared land surrounding each dwelling will be maintained as managed grassland for bushfire protection purposes (i.e. APZs). Mowing/ slashing of the APZ areas should be undertaken every three months.	Annually for LOQ	Maintain records of maintenance activities

Action	Management Approach and Procedures	Timing	Reporting/ Records
3.6 SEED COLLECTION AND PROPAGATION **Objective**: To collect native seed and plant material for propagation and revegetation purposes in a sustainable manner.			
Seed and/ or plant material collection	It is proposed that native seed and plant material be collected from the BOA for revegetation works within both the BOA (if required) and rehabilitation areas in the project area over the life of the quarry. Seed collection will be undertaken through the following protocol to ensure sustainable and appropriate use of these resources: • Native species to be collected will be those listed for revegetation areas within the BOA (**Section 3.7**) and rehabilitation areas in the project area (see L&RMP). • Seed collection and storage will be supervised by suitably trained personnel consistent with the relevant Florabank guidelines and codes of practice (available at https://www.florabank.org.au/). • Only the minimum quantity of seed or plant material required for rehabilitation will be collected; • A maximum of 20% of fruit and 10% of plant material will be collected from any one plant annually (i.e. larger seed quantities should be obtained by collecting from more plants); • No collection of seed or plant material from threatened flora species listed under the TSC Act or EPBC Act, or schedule 13 protected native plants under the *National Parks and Wildlife Act 1974* will be undertaken unless the appropriate permits or licences have been secured; and • Records of all seed collection activities within the offset area, including dates, locations, species collected, and quantity of plant material/seed/fruit, will be maintained. • Where seed cannot be sourced from the BOA, a seed mix containing locally endemic species will be purchased from a local seed supplier.	As required for revegetation	Maintain all seed collection records as described
Propagation	• Propagation of stock from seed will be undertaken by suitably trained personnel with appropriate facilities (i.e. nursery) to maximise germination and seedling survival. • Records on germination and propagation success rates (i.e. proportion of seed that germinates) will be maintained.	As required for revegetation	Maintain records on quantity of propagated stock, and propagation success rates

Action	Management Approach and Procedures	Timing	Reporting/ Records
3.7 REVEGETATION AND REGENERATION **Objective**: To establish native vegetation in cleared/modified areas and enhance the condition of remnant and regrowth vegetation in the BOA.			
Confirm extent of revegetation areas	• At this stage no areas within the BOA have been identified as requiring active revegetation as the BOA consists of either self-sustaining forest or areas with the capacity for natural regeneration. However, during the baseline surveys the extent of any areas assessed as not having the capacity to naturally regenerate and require active revegetation will be accurately mapped by a suitably qualified ecologist so that the quantity of seed, plant material or tubestock required for revegetation can be determined. • Generally, the need for any supplementary planting or revegetation across the BOA would be determined through annual monitoring in order to assess the adequacy of natural regeneration. • The two small, cleared areas surrounding the existing dwellings will be excised from the BOA and will not be revegetated (**Section 3.5**). Additionally, no revegetation is to occur along the powerline easement which extends through the BOA as this will be managed by the electricity service provider (Essential Energy) (**Figure 4**). • Should any revegetation be required within the BOA, the target vegetation communities, suitable native species for planting, and approximate densities will be specified for each revegetation area in the BOA and included in the baseline report/ annual monitoring report.	As required following annual monitoring recommendations	Annual monitoring report
Revegetation of cleared or modified areas	Revegetation will be undertaken as follows: • Site preparation of revegetation areas will first be undertaken if required, including weed control (**Section 3.10**), erosion control/ soil stabilisation (**Section 3.4**) and herbivore exclusion fencing (or tree guards). • Revegetation efforts will focus on establishing the canopy and midstorey layers as understorey species are likely to regenerate once a canopy is established. Subsequent revisions of this plan should include a list of suitable shrub and ground cover species to be established in these areas if required. • Revegetation can be undertaken using one of three methods (or a combination of these): (1) brush-matting; (2) direct seeding; (3) propagation and planting. These methods are described in **Appendix 3**.	As directed by annual monitoring	Maintain records on quantity of seed/ brush applied or seedlings planted, dates, locations and personnel
Revegetation maintenance	Revegetation areas will be maintained as follows: • Weed control around plants every three months for the first year after revegetation. • Reinstating and maintaining tree guards or herbivore exclusion fencing (if used) every three months for the first year after revegetation. • All tubestock plantings shall be initially watered in, watered on three separate occasions within the first month after planting, and then as required (in consideration of weather conditions). • Any other maintenance as directed by annual inspection results (see below).	After revegetation	Maintain records including works undertaken, dates, locations and personnel

Action	Management Approach and Procedures	Timing	Reporting/ Records
Revegetation monitoring	• Inspections of revegetation areas will be undertaken as part of annual monitoring to evaluate the success of revegetation works undertaken, and identify maintenance requirements for the following year.	Annually for 3 years after revegetation	Annual monitoring report
3.8 HABITAT AUGMENTATION **Objective**: To offset the loss of fauna habitat features in the project area, and enhance habitat in the BOA.			
Salvage and redistribution of habitat resources	The L&RMP details pre-clearing and clearing protocols, including salvage of resources during clearing. Where possible seed/ brush material and habitat resources including hollows, logs and large limbs will be salvaged and incorporated into the rehabilitation and/ or BOA. The redistribution of resources in the BOA will be undertaken as follows under the supervision of a suitably qualified ecologist: • Hollow logs and other large organic debris cleared from the project area will be stockpiled and either spread on rehabilitated areas immediately after redistribution of topsoil, or reinstated within the BOA where possible. Logs and large debris should only be salvaged and redistributed into the BOA where the transfer process will have minimal disturbance to the recipient area (e.g. placed along the project area/ BOA boundary; or transported to cleared revegetation areas, edges of the powerline easement or redundant access tracks). These resources must not be placed in areas where threatened flora species are present (see **Figure 2**). • Where possible, hollows should be salvaged from felled habitat trees by cutting at least 100 mm beyond the deepest point of the hollow and then stored in a dry safe place, or transported directly to the BOA for installation (see below).	Year 3	Maintain records on number/ quantity and locations of logs, branches and hollows salvaged and redistributed into BOA
Nest box installation	• Unless the hollows are salvaged and installed, one nest box will be installed in the BOA for each hollow lost (1:1 ratio) during clearing of the project area. The number of nest boxes required will be determined during clearing (see L&RMP for procedures). • A range of nest box designs will be installed to provide suitable habitat for the suite of hollow-dependent fauna (incl. threatened species, e.g. Squirrel Glider) known or likely to occur in the BOA. Nest boxes will be manufactured to an industry-accepted standard (e.g. designs in Franks and Franks 2003), which are typically made from plywood. • Nest box installation will be undertaken or supervised by a suitably qualified and experienced ecologist to ensure appropriate site selection and installation techniques. • Nest boxes and salvaged hollows will be installed at appropriate locations in the BOA on trees that do not already support hollows at a minimum height of three metres, preferably in a north or west orientation (based on recent nest box research undertaken by Kleinfelder (2015)) or at an aspect suitable for target species.	Following installation of salvaged resources, install nest boxes to ensure 1:1 ratio for hollow loss is achieved	Maintain records of number of nest boxes installed, designs used, and location of each nest box.

Action	Management Approach and Procedures	Timing	Reporting/ Records
Nest box monitoring and maintenance	• Nest boxes will be inspected and maintained every two years following installation. • Each nest box will be inspected to determine if any repairs or replacement is required. • If feral bees (or other pest animal species) are found to colonise the nest boxes they will be eradicated by a specialist pest contractor.	Every two years following installation for LOQ	Annual monitoring report
3.9 THREATENED FLORA TRANSLOCATION **Objective**: To translocate existing *Tetratheca juncea* clumps from the project area to the BOA.			
Tetratheca juncea translocation	A *Tetratheca juncea* Translocation Program (TjTP) has been prepared for the project. A total of 367 *Tetratheca juncea* clumps have been translocated from the project area to a site within the BOA (see **Figure 4** for location). As a result of the MOD 1 approval, an additional 13 *Tetratheca juncea* will be translocated from the additional disturbance area to the same site within the BOA The translocation site will be accessed via an existing track (also shown on **Figure 4**). The following measures will be implemented to ensure the TjTP is effectively integrated as part of the biodiversity management of the BOA: • Following translocation, the access track to the translocation site will be delineated with fencing (or similar) at the entrance of the site to prevent vehicle access. • Weed control within the translocation site will be undertaken in accordance with the methods specified in the TjTP (i.e. the weed control protocol in **Section 3.10** of this plan is superseded by the TjTP for the translocation site). • All other management actions detailed in this plan including seed collection, revegetation, and habitat augmentation will be excluded from the translocation site unless otherwise specified in the TjTP.	Prior to clearing and construction	As per TjTP
3.10 WEED CONTROL **Objective**: To reduce the spread and establishment of weeds and reduce the extent of existing weed infestations to maintain biodiversity values (including protecting threatened species) and promote natural regeneration in the BOA.			
Baseline weed mapping	• Under the *Noxious Weeds Act 1993*, there are statutory requirements for landholders to control weed species listed as noxious. • A list of all weed species recorded in the BOA and adjoining lands during previous surveys is provided in **Section 2.3.5**. • Baseline weed mapping will be undertaken to determine the current extent and density of noxious and significant environmental weed infestations in the BOA. This mapping will be undertaken by a suitably qualified and experienced ecologist or bush regenerator. • Weed infestations will be prioritised for control based on a number of criteria, including weed species, risk of further spread, size/ density of patch, and access. Weed infestations with threatened flora species present/ nearby (*Tetratheca juncea*, *Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes*) will be the first priority for control to ensure the protection and enhancement of these populations in the BOA.	Year 1 (Completed; Kleinfelder 2016a)	Baseline addendum report

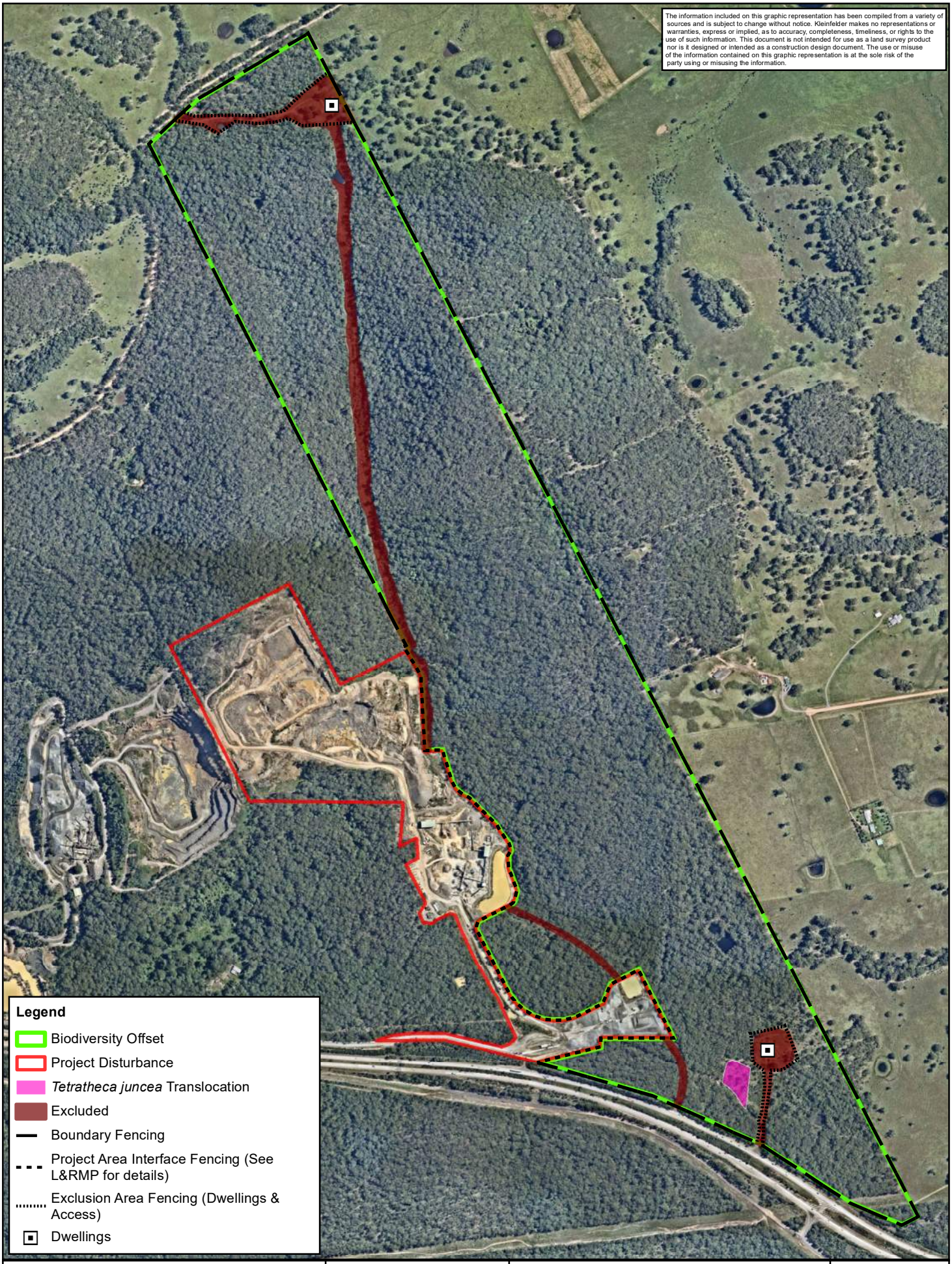
Action	Management Approach and Procedures	Timing	Reporting/ Records
Weed control within 20 m of threatened flora	• For each planned weed control area within 20 m of threatened flora locations, threatened flora must be delineated/ marked prior to control works by a suitably qualified botanist. The weed management contractor will then be briefed regarding the delineation measures, approved control methods, and any no-go areas. A map of threatened flora locations relevant to the planned weed control area must be provided to the weed control contractor. • Only manual removal weed methods are permitted within 20 m of threatened flora species unless otherwise specified in inspection/ monitoring report recommendations. Weed control undertaken within 20 m of threatened flora will be supervised by a suitably qualified botanist or bush regenerator with proven experience in threatened plant identification. • No chemical control (spraying) is to be undertaken within 20 m of threatened flora species. However, where large infestations occur the cut-and-poison method of chemical application can be used (as specified within inspection/ monitoring reports).	Post weed mapping and prior to any weed control works within the BOA. Commence year 4, then annually for LOQ	Maintain records of pre-weed treatment surveys
Weed control	• Weed control within the BOA will focus on environmental and priority weeds as directed by recommendations from the baseline assessment/ ongoing monitoring, • Weed management will be conducted by suitably qualified and experienced bush regenerators. All personnel undertaking weed control in the BOA must be made aware of the environmental sensitivities present in the area, in particular threatened flora species. • Weed control will generally be undertaken using a combination of manual removal and targeted chemical application using an appropriate herbicide (e.g. glyphosate). • Chemical methods should only be used for larger weed outbreaks and/ or where there is minimal risk for indirect impacts on native vegetation. Any weed infestations in which large areas of native understorey vegetation are present will not be treated with herbicide spraying. • Preferred chemical application methods for the most abundant target species in the BOA (i.e. Lantana) is splatter gun application, or cut-and-poison. • Follow-up control will be conducted approximately 3 months after primary control of each weed patch; this will involve a systematic sweep through the area to treat all regrowth and other target weeds using a combination of hand removal and targeted chemical application. The frequency of further follow-up control of each area would be determined by monitoring.	Commence year 4, then annually for LOQ	Maintain records on weed control methods, locations, dates, person hours works, chemical types and quantities used, and approximate area treated.
Weed monitoring	• Weed mapping for the BOA will be undertaken every two years and compared to the previous mapping to assess changes in the extent and density of target weeds. • Monitoring results will be used to develop a control strategy for the following two years, identifying target locations and timing for primary and follow-up control.	Every two years from baseline survey for LOQ	Annual monitoring report

Action	Management Approach and Procedures	Timing	Reporting/ Records
3.11 VERTEBRATE PEST MANAGEMENT **Objective**: To reduce the abundance of vertebrate pests across the BOA to maintain biodiversity values (including protecting threatened species) and promote natural regeneration in the BOA.			
Baseline vertebrate pest assessment	Under the *Rural Lands Protection Act 1998*, there are requirements for landholders to continually supress and destroy pest animals on their lands. A pest animal control program is to be implemented in the BOA to supress and prevent an increase in pest populations. A baseline assessment of vertebrate pest presence/ abundance and impacts will be undertaken using at least one of the following methods: • Conducting searches and spotlighting, and mapping evidence of pest species across BOA (e.g. rabbit warrens, pig scratching); • Standard 'sand plots'; • Installing remote motion sensing camera traps at a minimum of five locations across the BOA for a two-week period. The assessment will primarily target the pest species listed in **Section 2.3.5**. The results of this assessment will then be used to determine the key vertebrate pest species and locations to be targeted during the control program for the next two years.	Year 2	Baseline addendum report
Vertebrate pest control	The specific approach to vertebrate pest management within the BOA will be determined by the baseline assessment/ ongoing monitoring; the following general procedures are outlined: • All vertebrate pest control will be conducted in accordance with *Humane Pest Animal Control: Codes of Practice* (DPI 2014). • All vertebrate pest control works must be undertaken by suitably qualified and experienced personnel. • If pest control is required it would generally involve a routine (six monthly) baiting program. • Other control methods such as shooting or trapping can also be used if deemed necessary or appropriate with advice from OEH or the Local Land Service. • Control of over-abundant native herbivores (e.g. kangaroos) can only be undertaken with approval by way of a Section 121 licence issued under the NPW Act. Should monitoring indicate that an over-abundance of native herbivores is affecting the biodiversity values of the BOA, OEH must be consulted for further advice.	For LOQ	Maintain records for all vertebrate pest control works including timing/dates of works, techniques used, data on kills or baits taken.
Monitoring	• Monitoring of vertebrate pests will be undertaken using the same methods, locations and effort as the baseline assessment unless otherwise recommended in the annual monitoring reports. This will enable results to be accurately compared to the baseline assessment.	Every two years from baseline survey for LOQ	Annual monitoring report

Action	Management Approach and Procedures	Timing	Reporting/ Records
3.12 FIRE MANAGEMENT **Objective**: To provide suitable access for emergency vehicles and regulate the fire regime within the BOA to maintain and enhance biodiversity values, and minimise effects on regeneration/ revegetation success.			
Fire management strategy	A Fire Management Strategy will be prepared in consultation with the NSW RFS to provide detail on bushfire management and controlled ecological burning to be undertaken within the BOA. The strategy will include: • Stratifying the BOA into ecological burn management units (i.e. management zones) based on recommended burn frequencies for vegetation types (*Guidelines for Ecologically Sustainable Fire Management*, NSW Biodiversity Strategy, (2003)) and fire tolerance of threatened flora species present based appropriate literature sources. • Fire exclusion areas (e.g. revegetation areas) will be identified. • Procedures and timing for implementing controlled burning, including protocol for bushfire emergencies. • Identifying access points and tracks to be maintained within the BOA to facilitate emergency vehicle access.	Year 3	Fire management strategy
Bushfire mitigation	• Measures to manage the risk of unplanned fires resulting from the adjoining quarry operations are detailed in the L&RMP.	At all times for LOQ	N/A
3.13 ECOLOGICAL MONITORING **Objective:** To regularly assess the status of key ecological values within the BOA, such that edge effects from adjoining lands and management actions can be evaluated, and where necessary actions implemented to improve conservation values.			
Additional baseline surveys	The following additional baseline surveys will be undertaken prior to the commencement of clearing and construction as discussed in **Section 2.3.6**: • Targeted surveys for *Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora* on Lot 5; • Targeted surveys for *Asperula asthenes* within areas of potential habitat (ELA 2014) across the BOA; • Fauna surveys across the BOA in accordance with *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004); At this stage, these additional surveys are scheduled to be undertaken in September/October 2015. These data will be provided as an addendum to this plan and the results will be incorporated into the Conservation Agreement to be prepared for the BOA.	Prior to clearing (Completed; Kleinfelder 2016a)	Baseline addendum report

Action	Management Approach and Procedures	Timing	Reporting/ Records
Overview of ecological monitoring program	In addition to the inspections and monitoring requirements specified in the previous sections, the following key ecological values will also be monitored within the BOA: • Vegetation condition; and • Threatened flora populations. The vegetation condition and threatened flora monitoring to be undertaken in the BOA forms part of a broader monitoring program for the quarry detailed in the L&RMP. As such, the monitoring methods specified in the L&RMP will also be used in the BOA to ensure consistency (see below).	-	-
Vegetation and threatened flora monitoring	One monitoring point per 10 hectares (i.e. 13 monitoring points) has been permanently established across the BOA (with a capped star picket), with at least one monitoring point per vegetation type. The monitoring points have also been established in locations that target boundaries with different land uses (e.g. quarry; grazing land) to detect edge effects; weed infested areas; and threatened flora populations. A qualitative assessment of vegetation condition and photo monitoring will be undertaken at the monitoring points. At each monitoring point, the following data would be collected: • Vegetation type and structure, including dominant species in each stratum; • General health of vegetation, including evidence of foliage die-off; • Weed species and abundance; and • Any management issues or indirect impacts from the project area or adjoining lands. Of these, nine monitoring sites have been established in areas where *Tetratheca juncea, Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes* occur .. At these sites, all threatened flora individuals within 10 m of the monitoring point (i.e. 20 m diameter) are be recorded. The location of each clump/ stem ise recorded with a GPS and permanently marked with a steel peg (positioned 20 cm to the south of each clump to avoid damaging plants); a metal tag will be attached to each peg which provides a unique ID number. The size (*T. juncea* and *A. asthenes*), or height (*G. parviflora* subsp. *parviflora*), of each individual, and presence of flowers/ fruit is be recorded for each clump/individual. Annual collection of these data will enable changes in population size and health to be assessed over time. Annual monitoring will be undertaken in spring to coincide with the flowering times of threatened flora species in the BOA.	Annually for LOQ	Annual monitoring report

Action	Management Approach and Procedures	Timing	Reporting/ Records
Asperula asthenes population census	Condition 9 of the EPBC Act Approval requires corrective actions to be implemented where management actions (primarily weed control) fail to meet targets relating to an increase in the *Asperula asthenes* population size/ extent in the BOA (see **Section 4** for target). It is expected that a discernible increase in population size of *Asperula asthenes* following weed control would not occur for at least 5-10 years. As such, it is recommended that a population census of *Asperula asthenes* be undertaken across the BOA in year 10. The results will then be compared to the target, and if the target is not reached contingency measures detailed in **Section 7** will be implemented.	Year 10	Annual monitoring report



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PROJECT REFERENCE: 20220262

DATE DRAWN: 2021/04/21 10:32 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
ADW Johnson - 2020
Nearmap - 2021

Management Actions

Karuah East Quarry Pty Ltd
Biodiversity Offset Area Management Plan
Karuah East Quarry Project

FIGURE:

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4. PERFORMANCE AND COMPLETION CRITERIA

Table 13 provides the performance and completion criteria for all management actions described in **Section 3**. Where performance criteria are not achieved, potential causes will be investigated; corrective actions required to achieve the criteria and/or justification why criteria have not been achieved must then be provided as part of annual reporting.

Table 13: Performance and completion criteria

Action	Performance Criteria			Completion Criteria
	Year 1	Year 4	Years 5-20	
CULTURAL HERITAGE MANAGEMENT				
Record and manage newly identified cultural heritage objects	Undertaken in accordance with CHMP			Undertaken in accordance with CHMP
Risk assessment to avoid disturbance to cultural heritage objects	All management activities undertaken in accordance with CHMP			All management activities undertaken in accordance with CHMP
FENCING, GATES AND SIGNAGE				
Fence mapping	Completed (Kleinfelder 2016)	-	-	Mapping completed
Boundary fencing, gates and signage installation/ repairs	-	Completed by end of year 3	-	Completed in accordance with fence mapping
Redundant fencing removal	-	Following completion of boundary fencing, gates and signage installation	-	Completed in accordance with fence mapping
Fencing inspections	Completed annually			Annual inspections completed and maintenance recommendations implemented
Fencing maintenance	-	Boundary fencing in place and signage present		Boundary fencing, gates and signage maintained for LOQ

Action	Performance Criteria				Completion Criteria
	Year 1	Year 4	Years 5-20		
ACCESS TRACKS					
Access track mapping and assessment	Completed by end of year 1. (Completed; Kleinfelder 2016a).	-	-	-	Mapping completed
Access track repairs	-	Completed by end of year 3. Track repair does not impact on ecological values and is restricted to defined limits.		-	Completed in accordance with track mapping and assessment
Redundant access track rehabilitation	-	Completed by end of year 3.		-	Redundant tracks are stable and vegetated
Access track inspections	Completed annually.				Annual inspections completed
Track maintenance	Management actions implemented within 6 months of inspection. Track maintenance does not impact on ecological values and is restricted to defined limits.				Access tracks maintained in suitable condition for LOQ
EROSION, SEDIMENTATION AND SOIL MANAGEMENT					
Erosion and sedimentation mapping	Completed by end of year 1. (Completed; Kleinfelder 2016a).		-	-	Mapping completed
Erosion repair and management	-	Completed by end of year 3. Repair of erosion within BOA does not impact on ecological values.		-	Completed in accordance with track mapping and assessment
Erosion inspections	Completed annually				Completed annually
Maintenance	Management actions implemented within 6 months of inspection. Erosion repair does not impact on ecological values.				Access tracks maintained in suitable condition for LOQ
EXISTING DWELLINGS					
Exclusion of existing dwellings from Conservation Agreement	-	Completed by end of year 3.	-	-	Existing dwellings are excised from Conservation Agreement

Action	Performance Criteria				Completion Criteria
	Year 1	Year 4	Years 5-20		
Fencing and signage installation	-	Completed by end of year 3	-	-	Completed in accordance with fence mapping
Inspections	Completed annually				Annual inspections completed and maintenance recommendations implemented
Maintenance and weed control	-	Boundary fencing in place and signage present. No noxious weeds present within excised areas. No unauthorised disturbance outside of excised areas in the BOA.			Maintenance records complete and retained
SEED COLLECTION AND PROPAGATION					
Seed and/ or plant material collection	Seed collection undertaken in accordance with **Section 3.6**.				Records complete and retained.
Propagation	Records on seed germination success rates retained.				Records complete and retained.
REVEGETATION AND REGENERATION*					
Confirm extent of revegetation areas	Completed by end of year 1. (Completed; Kleinfelder 2016a).		-	-	Mapping completed
Revegetation of cleared or modified areas (if required)	Revegetation completed as directed by recommendations from annual monitoring. Native species used is consistent with surrounding vegetation (i.e. target vegetation communities). Stem densities of canopy and midstorey species similar to surrounding vegetation after three years.				Revegetation areas stable and species composition consistent with surrounding vegetation
Revegetation maintenance (if required)	Maintenance implemented as directed by inspection recommendations.				Revegetation areas maintained for a minimum three year period
Revegetation monitoring (if required)	Completed annually				Completed annually Records complete and retained.
HABITAT AUGMENTATION					
Salvage and redistribution of habitat resources	-	Completed by end of year 3. Redistribution of salvaged resources does not impact on ecological values of BOA, including threatened flora			Records complete and retained

Action	Performance Criteria				Completion Criteria
	Year 1	Year 4	Years 5-20		
Nest box installation	30 nest boxes installed in BOA prior to commencement of clearing. (Completed; Kleinfelder 2016b)	Remaining nest boxes installed within Year 2 following completion of clearing. (Completed; Kleinfelder 2018)	-	-	318 nest boxes have now been installed within BOA to offset the loss of hollows within the development site.
Nest box monitoring and maintenance	Nest boxes inspected every two years, post installation. Repairs/ maintenance implemented within 6 months of biennial inspection.				Nest boxes maintained for LOQ
THREATENED FLORA TRANSLOCATION					
Tetratheca juncea translocation	Translocation of clumps within project disturbance area completed by end of year 1. (Completed; see Tj translocation monitoring report)	Translocation of additional clumps within Modification 1 Area completed after approval from Minister, and prior to clearing.	Maintenance and monitoring undertaken in accordance with the TjTP		As per the TjTP
WEED CONTROL					
Baseline weed mapping	Completed by end of year 1. (Completed; Kleinfelder 2016a).	-	-	-	Mapping completed
Delineation of threatened flora prior to weed control works	No impacts on threatened flora populations within BOA from weed control activities.				Undertaken prior to any weed control works within 20 m of threatened flora locations for LOQ. Records complete and retained.

Action	Performance Criteria				Completion Criteria
	Year 1	Year 4	Years 5-20		
Weed control	-	20% reduction in extent or density (cover) of target weeds per year compared to baseline mapping. Weed control activities do not impact on ecological values.	5% reduction in extent or density (cover) of target weeds per year for years 5-10 or until weed cover is less than 10% compared to baseline mapping. Maintain or reduce extent or density of target weeds to less than 10% from year 10 to quarry closure. Weed control activities do not impact on ecological values.		Weed control completed and reported with targets met.
Weed monitoring	Completed annually				Completed and reported annually
VERTEBRATE PEST MANAGEMENT					
Baseline vertebrate pest assessment	-	Completed by end of year 3.	-	-	Baseline assessment completed
Vertebrate pest control	-	No non-target species affected by control works. Reduction in abundance of target species across BOA compared to baseline assessment.			Vertebrate pest control completed at least annually and reported. Feral animal control was undertaken in February 2019.
Monitoring	-	-	Completed biennially (every two years)		Completed biennially. 1080 baiting was undertaken within Lot 5 during December 2020.
FIRE MANAGEMENT					
Fire management strategy		Completed by end of year 3	Fire management strategy implemented, reviewed and updated as necessary.		Fire management strategy prepared and implemented.
Bushfire mitigation		Bushfire mitigation measures in the L&RMP adhered to at all times			N/A

Action	Performance Criteria			Completion Criteria
	Year 1	Year 4	Years 5-20	
FIRE MANAGEMENT				
Installation of aerial fauna crossings	Installed upon completion of Haul Road. A 12-month monitoring program of the aerial fauna crossings to be undertaken using remote motion sensing cameras mounted on each pole (four cameras in total) once the crossings have been installed.			Installed following Haul Road Completion and report in BOA annual monitoring report. Aerial fauna crossing installed in 2020. Remote Camera monitoring programmes for both crossings have commenced
ECOLOGICAL MONITORING				
Additional baseline surveys	Completed prior to clearing. (Completed; Kleinfelder 2016a)		-	Completed
Vegetation and threatened flora monitoring	Baseline ecological monitoring undertaken prior to clearing in year 1 (Completed; Kleinfelder 2016a). Less than 10% decline in *Tetratheca juncea, Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes* population sizes (at monitoring sites) compared to baseline assessment. No major changes in vegetation health or condition across BOA.			All annual monitoring events completed and reported for LOQ
Asperula asthenes population census	-	-	Survey completed during year 10. Increase in Asperula asthenes population size is consistent with the predicted conservation gain in the EPBC Act Assessment Report (ELA 2014) - i.e. 60 individuals or 50% increase from the original population size.	Survey completed and results reported. Target achieved.

*Criteria relating to revegetation within the project area is outlined in the Landscape and Rehabilitation Management Plan (L&RMP).

5. REPORTING

Annual Reporting

Reporting for the Karuah East Quarry Project will occur through an Annual Review (Schedule 5 Condition 4 of the Project Approval). The following summarises the reporting requirements of this BOAMP that would be incorporated into the Annual Review:

- Description of works undertaken within the BOA during the previous year and those expected in the coming year, with reference to:
    - Fencing, rubbish, erosion, and access tracks;
    - Fire management;
    - Habitat augmentation works;
    - Revegetation works;
    - Pest and weed management; and
    - Inspection and monitoring results.
- Evaluation of works completed against performance and completion criteria;
- Identify any non-compliance and describe actions to ensure compliance;
- Identify trends in the monitoring data over the life of the project;
- Identify any discrepancies between predicted and actual impacts from the adjoining quarry and the potential cause of significant discrepancies and
- Measures to be undertaken to improve environmental performance of the project.

6. REVIEW AND CONTINUOUS IMPROVEMENT

The BOAMP will be reviewed every three years as per Schedule 3 Condition 33(h) of the Project Approval to identify trends and opportunities for improvement. This program would aim to ensure continual improvement and best practice management through evaluating the effectiveness of management actions against the performance criteria. Where this review leads to any revisions or updates to the BOAMP, then within 4 weeks of the review the revised plan must be submitted to DP&E for approval.

Additionally, as per Schedule 5 Condition 5 of the Project Approval, the BOAMP must be reviewed within 3-months of:

a) The submission of an annual review

b) The submission of an incident report

c) The submission of an audit report

d) Any modification of the conditions of this approval (unless the conditions require otherwise).

The Karuah East Quarry must review the strategies, plans and programs required under this approval, to the satisfaction of the Secretary. Where this review leads to revisions in any such document, the within 4 weeks of the review the revised document must be submitted for the approval of the Secretary.

An Inspection and Reporting Proforma to be used in the review of the implementation of this plan is included in **Appendix 4**. The proforma provides a list of all management actions and associated performance criteria for the four to six-year review period and is intended to be updated for each reporting period. Information gathered from this audit will improve the management strategies within this BOAMP.

7. RISK ASSESSMENT AND CONTINGENCY PLAN

Table 14 outlines the potential risks to successful implementation of the management program detailed in **Section 3** and contingency measures that will be implemented to mitigate these risks.

Table 14: Potential risks and contingency measures for management plan implementation

Potential Risks	Contingency Measures
General non-compliance with management procedures in Section 3	• All staff and contractors must be inducted before conducting management activities within the BOA, and must be familiar with the relevant procedures in this plan. • Monitoring and the annual review required under Schedule 5 Condition 4 of the Project Approval will identify if management actions have not been undertaken in accordance with the plan or fail to achieve performance criteria. • Corrective actions will be stipulated as part of the annual review.
Unauthorised access or disturbance impacting on ecological values in BOA	• Investigate and determine unauthorised access points or source(s) of disturbance. • Re-instate exclusion measures (i.e. fencing, gates, signage) where required. • If necessary, increase frequency of inspections of exclusion measures to verify corrective actions are adequate.
Plant species mix of revegetation areas not consistent with final land use objectives	• Annual monitoring will identify where species composition is not consistent with this plan and provide detailed actions to rectify, which will include removing of all unsuitable species used in revegetation areas and reinstating suitable species.
Failure of revegetation works	• Annual monitoring will identify failed revegetation efforts, investigate potential causes, and provide detailed actions to rectify, including replanting/re-seeding.
Vegetation condition and/or threatened flora impacted during redistribution of habitat resources (e.g. logs) in the BOA	• Annual monitoring will identify if resource redistribution has impacted on ecological values and will detail actions to rectify. Corrective actions may include removal of logs/branches, or supplementary revegetation works.
Vegetation condition and/or threatened flora populations impacted during weed control activities in the BOA	• Annual monitoring will identify if weed control has impacted on threatened flora or vegetation condition within the BOA and will detail actions to rectify. Corrective actions may include revision of weed control procedures, or revegetation works.
Inadvertent disturbance to translocated *Tetratheca juncea*	• Annual monitoring will identify if any inadvertent disturbance has occurred within the *Tetratheca juncea* translocation site and will detail actions to rectify. Corrective actions may include re-instating / strengthening exclusion measures, or revegetation works.
Non-target fauna species affected by vertebrate pest control program	• All vertebrate pest control works must be undertaken by suitably qualified and experienced personnel, and in accordance with best practice guidelines including the *Humane Pest Animal Control: Codes of Practice* (DPI 2014). • Baiting programs will include methods to minimise the possibility affecting non-target fauna species by adhering to the most current and best practice guidelines.
Bushfire impacting on early stages of revegetation or high frequency fire impacting ecological values in the BOA	• A Fire Management Strategy will be prepared and implemented for the BOA. • Annual monitoring will identify any bushfire impacts to early revegetation areas and recommend specific actions rectify the loss and further mitigate bushfire risks.
Extreme natural weather events	• If any extreme weather events occur the regular monitoring events will detect impacts and recommend appropriate mitigation measures.
Increase in *Asperula asthenes* population size does not achieve predicted target (see **Sections 3.13** and **4**)	• Population census of *Asperula asthenes* will be completed during year 10 to determine if the target increase in population size has been achieved. Should the target not be achieved at year 10, the annual report will include specific actions to rectify, which may include further targeted weed control, protection from herbivores, or propagation and planting of *Asperula asthenes.*

8. REFERENCES

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APPENDIX 1. RELEVANT APPROVAL CONDITIONS

Condition	Condition Requirement	Section where Addressed
NSW Project Approval (09_0175) – as modified by MOD 1 and MOD 2		
33	**Biodiversity Offset Area Management Plan** The Proponent must prepare and implement a Biodiversity Offset Area Management Plan for the project to the satisfaction of the Secretary. This Plan would relate to the area of the Biodiversity Offset Area required in these Conditions. This plan must: a. be prepared by a suitably qualified expert whose appointment has been approved by the Secretary; b. be prepared in consultation with OEH and Council, and submitted to the Secretary within 12-months of the approval of the Biodiversity Offset Strategy required in these conditions;	This Biodiversity Offset Area Management Plan has been prepared by Kleinfelder and has been submitted to the Secretary for approval.
	c. describe how the implementation of the *Tetratheca juncea* Translocation Program would be integrated with the Biodiversity Offset Area management;	Section 3.9
	d. describe the short, medium and long-term measures that would be implemented to manage remnant vegetation and habitat on the Biodiversity Offset Area;	Section 3
	e. include detailed performance and completion criteria for evaluating the performance of the conservation, restoration and management of the Biodiversity Offset Area, including triggers for any remedial action;	Section 4
	f. providing for the transfer of environmental resources from the approved disturbance area - including tree hollows, vegetative and soil resources – for beneficial reuse in the enhancement of the Biodiversity Offset Area;	Section 3.8 and addressed in Section 6.3 of the L&RMP)
	g. providing for the incorporation of the final rehabilitated landform into the Biodiversity Offset Area and its management;	Section 6.5 of the L&RMP
	h. include a detailed description of the measures that would be implemented over the next 3 years (to be updated for each 3 year period following initial preparation of the plan), including the procedures to be implemented for:	Section 3
	• enhancing the quality of remnant vegetation and fauna habitat;	Section 3
	• restoring native endemic vegetation and fauna habitat within the parts of the Biodiversity Offset Area that are cleared or modified, including details of the target revegetation communities of the restored landform;	Sections 3.6, 3.7 and 3.8
	• coordinating the relocation of native fauna to protected habitats associated with pre-clearing fauna surveys;	Section 3.8 and addressed in Section 6.3 of the L&RMP
	• collecting and propagating seed;	Section 3.6

Condition	Condition Requirement	Section where Addressed
	• maximising the protection and restoration of threatened species, populations and habitats in the Biodiversity Offset Area;	Section 3
	• maximising fauna movement between the Biodiversity Offset Area and adjacent habitats;	Section 3.2
	• controlling weeds and feral pests;	Sections 3.10 and 3.11
	• controlling erosion;	Section 3.4
	• controlling access and providing for management trails; and	Section 3.3
	• bushfire management and implementation of ecologically appropriate bushfire intervals.	Section 3.12
	i. include a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;	Section 3 (monitoring) and Section 4 (performance and completion criteria)
	j. identify the potential risks to successful implementation of the Biodiversity Offset program, and include a description of the contingency measures that would be implemented to mitigate these risks;	Section 7
	k. include details of who would be responsible for monitoring, reviewing, and implementing the plan;	Section 1.6
	l. include details of the indicative costs of management actions; and	Section 5 (to be provided in the baseline addendum report)
	m. include details as to the timing of actions set-out in the plan.	Section 3
	The proponent must implement the plan as approved by the secretary	This Biodiversity Offset Area Management Plan has been prepared by Kleinfelder and has been submitted to the Secretary for approval.
EPBC Approval (EPBC 2014/7282)		
7	**Offsets** The person taking the action must comply with the offset conditions set out in the NSW Project Approval.	See above
8	Prior to the commencement of construction, to compensate for the impact to the Trailing Woodruff and habitat for the Koala, the person taking the action must secure suitable offset sites consistent with the Karuah East Quarry EPBC Act Assessment Report. In the case that offsets for the Trailing Woodruff or habitat for the Koala consistent with that set out in the Karuah East Quarry EPBC Act Assessment Report cannot be secured, alternative offset sites must be secured, consistent with the EPBC Act Offsets Policy.	See 'Biodiversity Offset Strategy Finalisation' letter submitted in conjunction with this plan
9	Prior to the commencement of construction, the person taking the action must provide the Minister with a Biodiversity Area Offset Management Plan for approval. The Biodiversity Area Offset Management Plan must be consistent with the NSW Project Approval and include:	This plan (see above)

Condition	Condition Requirement	Section where Addressed
	(a) survey information identifying the number of Trailing Woodruff present across all proposed offset sites; and	Sections 2.3.6 and 5 (provided in the baseline addendum report)
	(b) details on the management and monitoring of the Trailing Woodruff, and corrective actions and contingency plans to be implemented where the re-establishment of the Trailing Woodruff fails to meet targets specified in the Karuah East Quarry EPBC Act Assessment Report.	Sections 3.10, 3.13, 4 and 7
Statement of Commitments (Appendix 6 of Project Approval)		
Section 4.1, page 45	**Nest Box Program** One nest box will be installed for each hollow to be lost as a result of the proposal. Softwood pine (plywood) nest boxes will be used and will be specifically designed for Threatened hollow obligates. Nest boxes will have swivel mounts and be fitted with screw lids to prevent damage from brushtail possums. Nest boxes will be placed in retained habitats in the study area onto host trees that do not already support hollows at a minimum height of 3 metres (aboveground) in an orientation other than west and north-west to minimise exposure to the afternoon sun. Nest boxes will be erected prior to the commencement of clearing operations and will be subject to 2 yearly maintenance for the life of the quarry. Feral bees found to colonise the nest boxes will be eradicated by a specialist pest contractor. Nest box installation will be supervised by a suitably experienced fauna ecologist.	Section 3.8 and Appendix 3
Section 4.1, page 46	**Monitoring** Threatened plant sub-populations of *Tetratheca juncea*, *Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes* situated within retained bushland habitats on Lots 12-14 will be monitored annually by a suitably qualified and experienced botanist for the life of the quarry operation. A Monitoring Plan will be prepared prior to the commencement of clearing activity to detail survey design, data collection and reporting. Adaptive management will be employed for the life of the quarry to respond to population issues that are identified, including weed control.	Section 3.13
Section 4.2	The proposed offset site is identified as Part Lot 13 DP 1024564, Lot 14 DP 1024546 and Lot 5 DP 838128 (provided that an option to purchase Lot 5 has been secured by the proponent). In the event that Lot 5 DP 838128 is unable to be secured by the proponent, the proponent will purchase an alternate offset site, which, combined with Lots 13 and 14, will provide a total biodiversity offset area of not less than 129.32 ha. The alternate offset site will be required to be agreed to by NSW OEH and be to the satisfaction of the Director-General.	N/A (Lot 5 purchased, see 'Biodiversity Offset Strategy Finalisation' letter submitted in conjunction with this plan)
	The following will be undertaken by the proponent in relation to the proposed offset site identified as Part Lot 13 DP 1024564, Lot 14 DP 1024546 and Lot 5 DP 838128: • Seasonal flora and fauna survey of the offset site will be undertaken in accordance with relevant OEH guidelines. In particular, seasonal survey for *Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora* will be undertaken and reported to the NSW OEH;	Sections 2.3.6 and 5

Condition	Condition Requirement	Section where Addressed
	• Prior to establishment of the proposed quarry, the proponent will purchase Lot 5 DP 838128 (provided than an option to purchase has been secured). In the event that Lot 5 DP 838128 is unable to be secured by the proponent, as noted above, the proponent will purchase an alternate offset site (to be agreed to by NSW OEH and be to the satisfaction of the Director-General).	See 'Biodiversity Offset Strategy Finalisation' letter submitted in conjunction with this plan
	• Upon approval of the project, in consultation with the NSW OEH, the proponent will secure the offset lands via a Conservation Agreement under Part 4, Division 12 of the National Parks and Wildlife Act 1974;	Section 2.2
	• A Conservation Management Plan will be developed. The plan will:	This plan
	○ Confirm required on ground works such as weed control, fencing, signage and pest control; ○ Confirm the timing / schedule of the abovementioned works; and	Section 3
	○ Specify restrictions to the existing two (2) residences of Lot 5 and Lot 14 (if purchase of Lot 5 is secured by the proponent). If an alternate offset site is provided instead of Lot 5 (as noted above) any restrictions on this land will be specified in the Conservation Management Plan.	Section 3.5
	• Monitoring of the offset land will be undertaken annually. Results of the monitoring will be used to provide input into the priority areas for the following year(s) of ground maintenance works.	Section 3

APPENDIX 2. CORRESPONDENCE

APPENDIX 3. REVEGETATION METHODOLOGY

Revegetation Methods

Revegetation efforts will focus on establishing the canopy and midstorey layers as understorey species are likely to regenerate once a canopy is established. Revegetation will be undertaken using one of three methods (or a combination of these): (1) brush-matting; (2) direct seeding; (3) propagation and planting. These methods are outlined below:

Brush Matting

Brush matting involves collecting branches and plants with mature seed and applying them to revegetation areas. This method facilitates direct seeding, provides a protected microclimate for developing seedlings, adds nutrients to the soil, and minimises erosion. Large branches and whole plants are preferred for matting because they will not move in the wind.

Brush matting for revegetation in the BOA will primarily be collected and stored during clearing of the adjacent project area. When collecting brush material from the BOA, care will be taken so to not collect heavily in one area or too frequently; a maximum of 20% of fruit and 10% of plant material will be collected from any one plant within a one-year period.

Where possible individual plant species will be harvested when they are bearing mature seed. Bradysporous (seed retaining) species are best harvested and spread in autumn whereas geosporous (seed shedding) species are best harvested immediately prior to annual seed release in late spring.

Direct Seeding

Seed for direct seeding will be sourced locally from within the BOA as per **Section 3.6**, and will be treated and sown in the soil rather than broadcast where feasible. Harvesting of mature seed and direct sowing into areas requiring revegetation at the most appropriate time of year (usually autumn or spring) will be undertaken.

Propagation and Planting

Seed will be collected from the BOA and supplied to a local nursery for propagation. Planting programs in the BOA would be best undertaken between March and October for optimum seedling establishment success.

APPENDIX 4. INSPECTION AND REPORTING PROFORMA

The following table is a guide for annual reviews/ independent audits for the four to six-year implementation period.

BOAMP Section	Management Strategy	Action	Performance Criteria		Description of Current Achievements To Date	Met/ Not Met
			Year 4	Years 5-6		
3.1	Cultural Heritage Management	Record and manage newly identified cultural heritage objects	Undertaken in accordance with CHMP			
		Risk assessment to avoid disturbance to cultural heritage objects	All management activities undertaken in accordance with CHMP			
3.2	Fencing, Gates and Signage	Boundary fencing, gates and signage installation/ repairs	Completed by end of year 3.	-		
		Redundant fencing removal	Following completion of boundary fencing, gates and signage installation			
		Fencing inspections	Completed annually			
		Fencing maintenance	Boundary fencing in place and signage present			
3.3	Access Tracks	Access track repairs (initial)	Completed by end of year 3. Track repair does not impact on ecological values and is restricted to defined limits.			
		Redundant access track rehabilitation	Completed by end of year 3.			
		Access track inspections	Completed annually			
		Track maintenance	Management actions implemented within 6 months of inspection. Track maintenance does not impact on ecological values and is restricted to defined limits.			

BOAMP Section	Management Strategy	Action	Performance Criteria		Description of Current Achievements To Date	Met/ Not Met
			Year 4	Years 5-6		
3.4	Erosion, Sedimentation and Soil Management	Erosion repair and management	Completed by end of year 3. Repair of erosion within BOA does not impact on ecological values.			
		Erosion inspections	Completed annually			
		Maintenance	Management actions implemented within 6 months of inspection. Erosion repair does not impact on ecological values.			
3.5	Existing Dwellings	Exclusion of existing dwellings from Conservation Agreement	Completed by end of year 3.	-		
		Fencing and signage installation	Completed by end of year 3.	-		
		Inspections	Completed annually			
		Maintenance	Boundary fencing in place and signage present. No noxious weeds present within excised areas. No unauthorised disturbance outside of excised areas in the BOA.			
3.6	Seed Collection and Propagation	Seed and/ or plant material collection	Seed collection undertaken in accordance with **Section 3.6**.			
		Propagation	Records on seed germination success rates retained.			
3.7	Revegetation and Regeneration	Revegetation of cleared or modified areas (if required)	Revegetation completed as directed by recommendations from annual monitoring. Native species used is consistent with surrounding vegetation (i.e. target vegetation communities). Stem densities of canopy and midstorey species similar to surrounding vegetation after three years.			
		Revegetation maintenance (if required)	Maintenance implemented as directed by inspection recommendations.			
		Revegetation monitoring (if required)	Completed annually			

BOAMP Section	Management Strategy	Action	Performance Criteria		Description of Current Achievements To Date	Met/ Not Met
			Year 4	Years 5-6		
3.8	Habitat Augmentation	Salvage and redistribution of habitat resources	Redistribution of salvaged resources does not impact on ecological values of BOA, including threatened flora			
		Nest box monitoring and maintenance	Nest boxes inspected every two years, post installation. Repairs/ maintenance implemented within 6 months of biennial inspection.			
3.9	Threatened Flora Translocation	*Tetratheca juncea* translocation	Translocation of additional clumps within Modification 1 Area completed after approval from Minister, and prior to clearing.	Maintenance and monitoring undertaken in accordance with the TjTP		
3.10	Weed Control	Delineation of threatened flora prior to weed control works	No impacts on threatened flora populations within BOA from weed control activities.			
		Weed control	20% reduction in extent or density (cover) of target weeds per year compared to baseline mapping. Weed control activities do not impact on ecological values.	5% reduction in extent or density (cover) of target weeds per year for years 5-6 or until weed cover is less than 10% compared to baseline mapping. Weed control activities do not impact on ecological values.		
		Weed monitoring	Completed annually			
3.11	Vertebrate Pest Management	Baseline vertebrate pest assessment	Completed by end of year 3.	-		
		Vertebrate pest control	No non-target species affected by control works. Reduction in abundance of target species across BOA compared to baseline assessment.			
		Monitoring	-	Completed biennially		

BOAMP Section	Management Strategy	Action	Performance Criteria		Description of Current Achievements To Date	Met/ Not Met
			Year 4	Years 5-6		
3.12	Fire Management	Fire management strategy	Completed by end of year 3.	Fire management strategy implemented, reviewed and updated as necessary.		
		Bushfire mitigation	Bushfire mitigation measures in the L&RMP adhered to at all times			
3.13	Ecological Monitoring	Vegetation and threatened flora monitoring	Less than 10% decline in *Tetratheca juncea, Grevillea parviflora* subsp. *parviflora* and *Asperula asthenes* population sizes (at monitoring sites) compared to baseline assessment. No major changes in vegetation health or condition across BOA.			