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Via Email ONLY: joel.fleming@hunterquarries.com.au

25/06/2020

**Karuah East Quarry (MP09_0175)
Annual Review 2019**

Dear Mr Fleming

I refer to the Annual Environmental Management Report for the period 16 January 2019 to 15 January 2020, submitted to the Department of Planning, Industry and Environment (the Department) on 14 April 2020 as required under Schedule 5 Condition 4 of MP09_0175, as modified (the approval).

The Department has reviewed the Annual Environmental Management Report and considers it to satisfy the reporting requirements of the approval and the Department's *Annual Review Guideline* (October 2015). Please make publicly available a copy of the 2019 Annual Environmental Management Report on the company website.

Please note that the Department's acceptance of this Annual Environmental Management Report is not endorsement of the compliance status of the project. Non-compliances identified in the Annual Review will be assessed in accordance with the Department's Compliance Policy. Further correspondence may be sent in relation to non-compliances.

In particular, the Department notes that blasting carried out at Karuah East Quarry is reported to have been carried out outside the hours authorised by Schedule 3 Condition 9 of the approval.

Should you need to discuss the above, please contact Jennifer Sage, Compliance Officer on 0400 245 170 or email compliance@planning.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads 'H Watters'.

Heidi Watters
Team Leader Northern
Compliance
As nominee of the Secretary

Joel Fleming

From: Jennifer Sage <jennifer.sage@dpie.nsw.gov.au>
Sent: Friday, 26 June 2020 11:40 AM
To: Joel Fleming
Subject: MP09_0175 - Karuah East Quarry 2019 AEMR

Hello Joel

I refer to the Department's letter to Hunter Quarries accepting the 2019 Annual Environmental Management Report for Karuah East Quarry dated 25/6/2020 (Ref: MP09_0175-PA-2) and our subsequent phone conversation regarding a potential non-compliance with the approved blasting hours.

On further review of the AEMR, the blast results reported in Table 31 indicate that the blasts were conducted within the approved blasting hours. As such, no further information or action is required at this point in time.

Don't hesitate to contact me if you have any queries or wish to discuss the matter further.

Regards
Jen

Jennifer Sage
Compliance Officer

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Industry &
Environment**

Our Vision: Together, we create thriving environments, communities and economies.

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.



**ANNUAL REVIEW FOR THE KARUAH EAST
HARD ROCK QUARRY, KARUAH, NSW**

***Review Period: 1 January 2019 – 31 December
2019***

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APPENDIX 5 – Ecological Monitoring Report

APPENDIX 6 - Water Quality Monitoring

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APPENDIX 8 – Audit Action Plan Status Update

ABBREVIATIONS

CCC	Community Consultative Committee
DA	Development Application
DDG	Dust Deposition Gauge
DPIE	Department of Planning Industry and Environment (Formerly DPE)
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EPA	Environmental Protection Authority
EPL	Environment Protection Licence
Ha	Hectare
km	Kilometre
L	Litre
LDP	Licensed Discharge Point
OEH	Office of Environment and Heritage
POEO Act	Protection of the Environment Operations Act 1997
NPWS	NSW National Parks and Wildlife Service, now part of OEH
RFS	NSW Rural Fire Service
SLR	SLR Consulting Australia Pty Ltd
SWMP	Site Water Management Plan
tpa	tonnes per annum

i PURPOSE OF THE REPORT

Karuah East Quarry Pty Ltd (Karuah East Quarry) has prepared this report which fulfils the Annual Review requirement of the Project Approval PA 09_0175 (Schedule 5, Condition 4).

This Annual Review covers the reporting period from the **1 January 2019 to 31 December 2019**.

This report provides specific detail on the project including a summary of environmental monitoring data and environmental performance during the reporting period. All environmental data in full can be supplied at request.

Name of Operation	Karuah East Quarry Pty Ltd
Name of Operator	Karuah East Quarry Pty Ltd
Development Consent / Project Approval #	PA 06_C175
Name of holder of Development Consent / Project Approval	Karuah East Quarry Pty Ltd
Mining Lease #	None
Water Licences	None
Annual Review start date	1 January 2019
Annual Review end date	31 December 2019
<p>I, Greg Dressler, certify that this audit report is a true and accurate record of the compliance status of Karuah East Hardrock Quarry for the period 1 January 2019 to 31 December 2019 and that I am authorised to make this statement on behalf of Karuah East Quarry Pty Ltd.</p> <p><i>Note:</i></p> <p><i>The Annual Review is an 'environmental audit' for the purposes of section 122B (2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p><i>The Crimes Act 1900 contains other offences relating to false and misleading information: sections 192G (intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment), sections 307A, 307B and 307C (false or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
Name of authorised reporting officer	Greg Dressler
Title of authorised reporting officer	Quarry Manager
Signature of authorised reporting officer	
Date	09/04/2020

1.0 STATEMENT OF COMPLIANCE

Tables 1 - 3 outline the compliance status of the quarry operations at the end of the 2019 reporting period in accordance with relevant approval conditions.

Table 1 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Project Approval (PA 09_0175)	NO
Environment Protection Licence (No. 20611)	NO

Table 2 DPIE Compliance Status Key

Risk level	Colour code	Description
High	Non – compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non – compliant	Non-compliance with: <ul style="list-style-type: none"> potential for serious environmental consequences, but is unlikely to occur; or potential for moderate environmental consequences, but is likely to occur
Low	Non – compliant	Non-compliance with: <ul style="list-style-type: none"> potential for moderate environmental consequences, but is unlikely to occur; or potential for low environmental consequences, but is likely to occur
Admin NC	Non – compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

Table 3 Non-Compliance

Relevant Approval	Condition #	Condition Description (Summary)	Compliance Status	Site Comment	Where Addressed in Annual Review
PA 09_0175	Schedule 3 Condition 7	Noise Management Plan requirements	Non-compliance relating to the noise bund not being installed.	The site has been working on noise management improvements in 2019. The site has made several changes within 2019, including significant work around the crushing plant noise mitigation measures. The site will continue to liaise with DPIE regarding the EIS modification relating to noise criteria (MOD 8) and update the Noise Management Plan in 2020.	Section 6.2

Relevant Approval	Condition #	Condition Description (Summary)	Compliance Status	Site Comment	Where Addressed in Annual Review
PA 09_0175	Schedule 3 Condition 19	Surface Water Discharges	Non-compliance relating to exceedance of concentration limits	pH and TSS exceedances for each licenced discharge point is summarised below: <ul style="list-style-type: none"> LDP001 - 4 TSS exceedances; LDP002 - 2 TSS exceedances; and LDP003 - 2 TSS exceedances. 	Section 7.3.3 and Appendix 8
EPL 20611	Condition L2	Surface Water Discharges	Non-compliance relating to exceedance of concentration limits	As per above	Section 7.3.3 and Appendix 8
PA 09_0175	Schedule 3 Condition 21	Groundwater quality monitoring	Non-compliance relating to failure to record TDS data in accordance with the Karuah East Water Management Plans requirement to monitor groundwater quality on a 6-monthly basis.	The site will continue to monitor groundwater quality in accordance with the approved Water Management Plan.	Section 7.4.2
EPL 20611	Condition 07.1	Noise Management requirements	Non-compliance relating to failing to construct the required acoustic bunds.	The site has been working on noise management improvements in 2019. The site has made several changes within 2019, including significant work around the crushing plant noise mitigation measures. The site will continue to liaise with DPIE regarding the EIS modification (MOD 8) relating to noise criteria and update the Noise Management Plan in 2020.	Section 6.2

2.0 INTRODUCTION

This Annual Review covers the reporting period from the **1 January 2019** to **31 December 2019** for the Karuah East Quarry.

2.1 Project Overview

Karuah East Quarry is located on Lots 12 and 13 (DP 1024564) off the Pacific Highway, approximately three kilometres north of Karuah, NSW.

The approved development includes the following key elements:

- Staged extraction of approximately 29 million tonnes of “andesite” over a 20 year timeframe;
- Extraction of up to 1.5 million tonnes of andesite material per year;
- Removal and stockpiling of an estimated 380,000 m³ of overburden (approximately 750,000 tonnes) from the quarry extraction area. Removal of overburden is not included in the proposed annual extraction rate of 1.5 million tonnes of andesite;
- 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 erosion and sediment and water management control works to ensure no loss of sediment, minimise dust generation and 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 Lane, realignment of Andesite Road and Blue Rock Lane intersection, and adjust road markings at Branch Lane and Andesite Road intersection;
- Employment of up to 28 onsite staff;
- Construction of a new haul road and access through adjoining Roads and Maritime Services (RMS) land;
- Staged clearing;
- Expansion of approved disturbance area (MOD 1 and 2);
- Drilling and blasting activities;
- Loading and hauling of extracted material;
- Crushing and screening of extracted material;
- Stockpiling of material onsite;
- Location of plant on Lot 13 comprised of office buildings, workshops, parking areas, crushing plant, wash plant, weigh bridge and product storage areas;

Operations commenced on 16 November 2017, with further details provided in **Section 4**. During 2018 construction and operations continued until 31 August 2018. The construction of Stage 2 of the crushing plant suspended operations until recommencement in July 2019. **Figure 1** presents the Karuah East Quarry site plan and layout. **Figure 2** outlines the water management system.

2.2 Modifications

Modification 8 (MOD 8) was submitted to DPIE on 20 June 2019.

2.2.1 MOD 8

Following the commencement of quarrying activity in 2018, it was identified that improved targeted acoustic mitigation measures were necessary and would be beneficial to all stakeholders. MOD 8 proposes to implement improved acoustic mitigation measures and to modify the operational noise criteria of the Project Approval (Condition 3 of Schedule 3) in accordance with the NSW Noise Policy for Industry (2017).

Key proposed acoustic mitigation measures detailed below are proposed to replace acoustic mitigation measures specified in the Project Approval Statement of Commitments.

- Enclosure of the Jaw Crusher with 100mm thick concrete panels on the North, East and South sides. Roofing materials to have an acoustic rating of STC28;
- Enclosure of the Cone Crushers on the Northern and eastern elevations with materials having an acoustic rating of STC28. Southern and western elevations and roof to be enclosed with Colorbond; and
- Purchasing and use of generator sets which are acoustically treated including complete enclosure of the engine and generator, acoustically treated exhaust systems and cooling systems.

MOD 8 seeks to replace the existing operational noise criteria with the criteria detailed in **Table 4**.

Table 4 Recommended operational noise criteria

Location	Criteria (day)
A	42 dBA
G	44 dBA
H	45 dBA
All other residences	40 dBA

Other recent modifications include Modification 1 (MOD 1) and Modification 2 (MOD 2) detailed below.

MOD 1

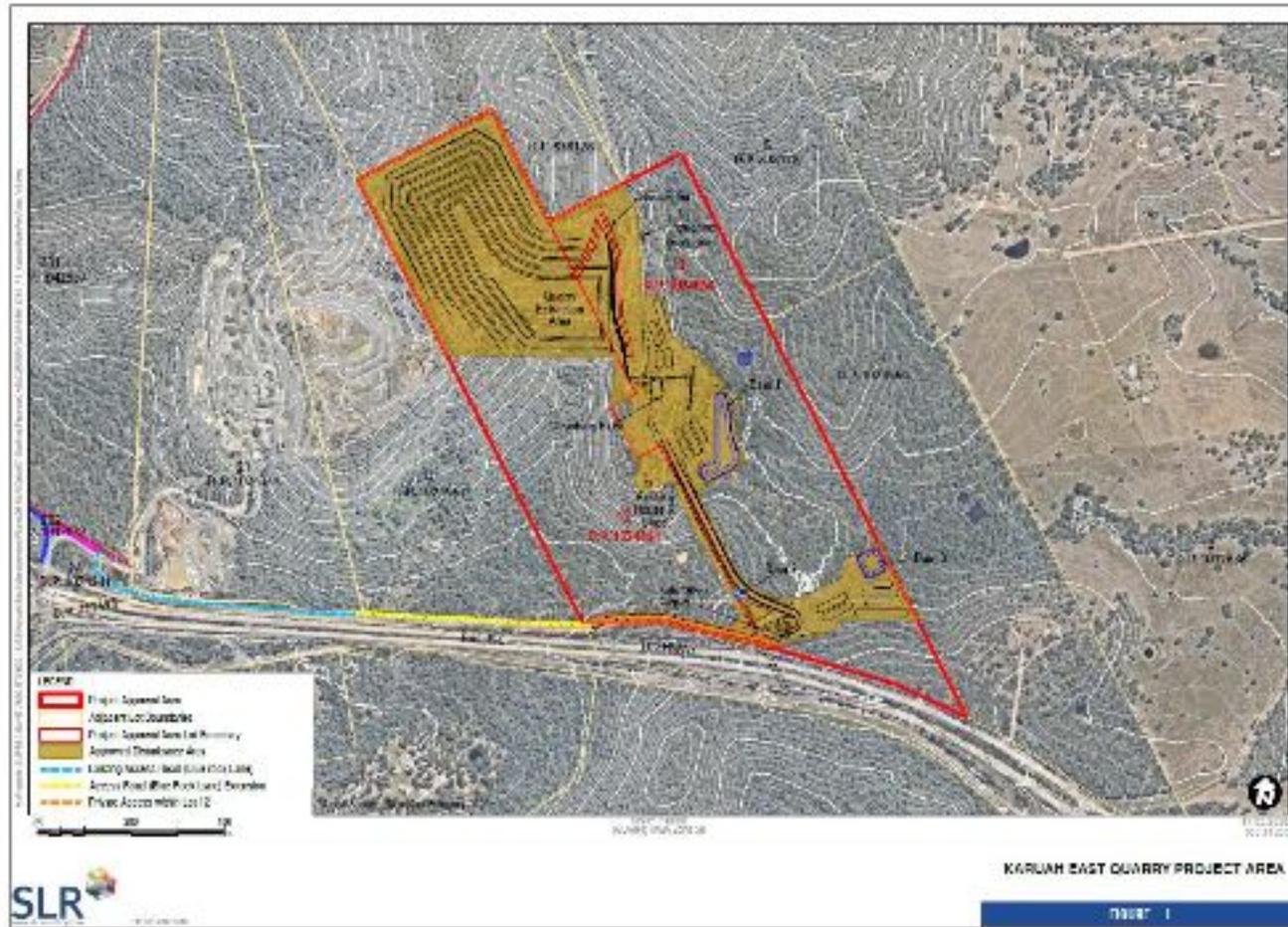
MOD 1 was approved by the DPIE on the 27 April 2018 and amends the existing Project Approval to nominally expand the area of disturbance of the Karuah East Quarry.

MOD 1 was minor in nature and it increased the area of disturbance (31.88ha) by an additional 2,500m² as shown in **Figure 1**.

MOD 2

MOD 2 was approved by the DPIE on the 19 December 2018 and amends the existing Project Approval to expand the area of disturbance of the approved Karuah East Quarry. MOD 2 was minor in nature and it increased the area of disturbance (31.88ha) by an additional 1.133ha as shown on **Figure 1**.

Figure 1 Karuah East Quarry – Site and Locality Plan



3.0 APPROVALS

The Karuah East Quarry is required to hold relevant approvals for the quarrying operations. These approvals are detailed in **Table 5** and attached as **Appendix 1 and 2**.

Table 5 Current Consents and Licences

Instrument	Date of Issue	Date of Expiration	Comments
Project Approval (PA 09_0175)	17 June 2014	31 December 2034	This is the main statutory document for the site
Federal Approval (EPBC 2014/7278)	20 March 2015	30 March 2045	Federal approval relating to the <i>Environment Protection Biodiversity Conservation (EPBC) Act 1999</i>
Environment Protection Licence (No. 20611)	26 August 2015	-	The EPL is a requirement of the <i>Protection of the Environment Operations Act (POEO Act) 1997</i>

MOD 1 and 2 were approved in 2018 and both amend the existing Project Approval to expand the area of disturbance of the Karuah East Quarry. Karuah East Quarry are currently consulting with DPIE and EPA regarding MOD 8 which proposes to amend current noise criteria at the site.

For more information regarding the approved and lodged modifications refer to **Section 2.2**.

The Karuah East Quarry Environment Protection Licence (EPL 20611) covers all activities at the Quarry. **Table 5** outlines the licensing limits for production and material handling.

EPL 20611 was varied on 16 January 2019 to include:

- Removal of Condition L3.2 - as it is a redundant condition and is being progressively removed from environment protection licences;
- Slight editing changes to Condition L4.4;
- Update to Condition L4.5 – to bring in line with the current Noise Policy for Industry;
- Update of Section L5 – to bring in line with best practice; and
- Inclusion of Section U1 - to reflect the required Pollution Reduction Study and a requirement that no quarrying is conducted on the premises until such time as the necessary noise mitigation works are successfully installed and commissioned.

EPL 20611 was varied on 25 June 2019 to include:

- Removal of Condition L6.1 - as it referred to construction work at the premises. The quarry is now in an operational phase and this condition is therefore no longer required;
- Removal of Condition L6.2 - as it referred to construction work at the premises;
- Removal of Condition O4.1 - and replaced with a Note containing the same text. The Pollution Incident Response Management Plan requirements are statutory obligations under Part 5.7A of the Act and hence do not require a condition in the licence.
- Addition of Condition O7.2 - which includes the requirement for procedural controls on mobile plant to limit engine RPM;

- Variation of Condition M8.1 - to increase the frequency of noise monitoring from annually to quarterly to ensure the commissioned noise mitigation works achieve compliance with the noise limits;
- Variation of Condition R4.3 - to reflect quarterly noise monitoring reporting, required in line with the increased monitoring frequency in condition M8.1. The variation also requires the licensee to stipulate what plant and activities were occurring at the time of the monitoring;
- Removal of Section U1 - following the completion of Pollution Reduction Study 1; and
- Addition of Condition G2.1 - detailing completed Pollution Reduction Programs and Studies.

Table 6 EPL Fee-Based Activity

EPL Fee-Based Activity	Current Scale (tpa)
Crushing, Grinding or Separating	> 500,000 t – 2,000,000 t processed
Land-based extractive activity	> 500,000 t – 2,000,000 t obtained

Copies of the approvals are attached as **Appendix 1** and **Appendix 2**. An Annual Compliance Report for EPBC Approval 2014/7282 is prepared each year and is available on the Hunter Quarries website <http://hunterquarries.com.au/karuah-east-documents/>.

3.1 Management Plans

The site operates under a series of approved environmental management plans, including:

- *Environmental Management Strategy;*
- *Air Quality and Greenhouse Gas Management Plan;*
- *Biodiversity Offset Area Management Plan;*
- *Blast Management Plan;*
- *Heritage Management Plan;*
- *Landscape and Rehabilitation Management Plan;*
- *Noise Management Plan;*
- *Traffic Management Plan;*
- *Water Management Plan;* and
- *Tetratheca juncea Translocation Management Plan.*

The following management plans were updated in 2019 to cover MOD 2:

- *Environmental Management Strategy;*
- *Air Quality and Greenhouse Gas Management Plan;*
- *Blast Management Plan;*
- *Landscape and Rehabilitation Management Plan;*
- *Noise Management Plan;* and
- *Water Management Plan.*

Note the management plans are currently being reviewed by DPIE.

3.2 Consent Conditions for Reporting in the Annual Review

The preparation of an Annual Review is required by Schedule 5, Condition 4 of PA 09_0175. This Annual Review has been prepared in accordance with the then Department of Planning and Environment's (DPE) *Annual Review Guidelines* (2015).

Table 7 details the requirements of Condition 4 of Schedule 5 of PA 09_0175 and the respective section(s) in this document where these consent conditions are addressed.

Table 7 Checklist for Annual Review Reporting

Condition Number	Condition Requirement for Annual Review	Document Section
Schedule 5, Condition 4(a)	<i>By the end of March each year, the Proponent must review the environmental performance of the project to the satisfaction of the Planning Secretary. This review must:</i>	This document. Annual Review
	<i>(a) describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;</i> <i>include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against:</i> <ul style="list-style-type: none"> • <i>the relevant statutory requirements, limits or performance measures/criteria;</i> • <i>the monitoring results of previous years; and</i> • <i>the relevant predictions in the EA;</i> 	Section 6
Schedule 5, Condition 4(b)	<i>identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;</i>	Section 1 and 11
Schedule 5, Condition 4(c)	<i>identify any trends in the monitoring data over the life of the project;</i>	No trends yet as less than one year of data
Schedule 5, Condition 4(d)	<i>identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and</i>	Section 6
Schedule 5, Condition 4(e)	<i>describe the measures that would be implemented over the current calendar year to improve the environmental performance of the project.</i>	Section 12

3.3 Government Agencies Feedback

A Show Cause letter was received from the EPA on 15 August 2019 in regard to uncontrolled discharge events at Dam 1 – 3 between 24 June and 27 June 2019 and an exceedance of the licence limit for TSS (40mg/L). This resulted in a failure to comply with condition L2.1 of EPL 20611.

Karuah East Quarry responded to the Show Cause Letter on the 12 July 2019 explaining a significant rainfall event during this time period was a major contributing factor to the uncontrolled discharges. Karuah East Quarry also installed an automatic treatment system to keep dam water TSS levels within the EPL concentration limits. This action mitigates the risk of TSS exceedance levels in the event that an uncontrolled water discharge occurs again in the future. Additionally, a water monitoring program was implemented immediately after it was observed that water was being discharged from the site dams; in order to establish pollutant concentrations levels.

Karuah East Quarry's response to the Show Cause regarding the June 2019 TSS exceedances was received by EPA on 2 August 2019. The EPA did not accept that rainfall slightly above the monthly average to be an acceptable cause of exceeding the TSS limits.

The EPA issued Karuah East Quarry Penalty Notice No. 3173528097 on 15 August 2019 for the breach of section 64 of the POEO Act for contravention of condition L2.1 of the licence at licence discharge point 1 on 24 June 2019.

The EPA has also decided to issue Karuah East Quarry Formal Warnings for the contravention of L2.1 of the licence at:

- Licence discharge point 1 on 25 June, 26 June and 27 June 2019;
- Licence discharge point 2 on 24 June 2019; and
- Licence discharge point 3 on 25 June, 26 June and 27 June 2019.

4.0 OPERATIONS SUMMARY

The following section briefly describes the general operation and environmental performance of Karuah East Quarry during this 2019 reporting period.

4.1 Land Preparation

During the reporting period there was approximately 0.27 ha a of land clearing. The ecological clearance was undertaken by a qualified ecologist.

4.2 Construction Activities

During 2019, the following construction activities were undertaken:

- Installation of a water treatment system; and
- Stage 2 of the crushing plant completed in 2019. This included additional acoustic screening.

4.3 Quarry Operations

Karuah East Quarry operated from the start of August 2019 until the end of the reporting period (31 December 2019). Operations involved progressive drilling and blasting, followed by crushing and screening to produce the required materials.

The monthly production summary during the reporting period is included in **Table 8**.

Table 8 2019 Monthly Production Summary (tonnes)

Month	Monthly total (tonnes)
Jan	-
Feb	-
Mar	-
Apr	-
May	-
Jun	-
Jul	-
Aug	33,257
Sep	51,843
Oct	84,737
Nov	71,326
Dec	63,868
Total:	305,031

Project Approval 09_0175 permits the extraction of up to 1.5 million tonnes per annum from Karuah East Quarry. As evident from **Table 8**, the 2019 production total was significantly below this annual limit.



Photo 1 –Dam 3 (January 2020)



Photo 2 –Stage 2 of the crushing plant (January 2020).



Photo 3 – Acoustic Screening (January 2020)



Photo 4 – Karuah Quarry Aerial fauna crossing (January 2020)

4.4 Operating Hours

In accordance with Schedule 2, Condition 7 of the PA 09_0175, Karuah East Quarry operates during the following hours (see **Table 9**):

Table 9 Approved Operating Hours

Activity	Operating Hours
Quarrying Operations	7.00 am to 6.00 pm, Monday to Friday; and 7.00 am to 1.00 pm, Saturdays. No quarrying operations on Sundays or Public Holidays
Construction activities	7.00 am to 6.00 pm, Monday to Friday; and 8.00 am to 1.00 pm, Saturdays. Unless noise from the activities does not exceed 35 dB(A) _{L_{Aeq}(15minute)} at any privately-owned residence.
Maintenance activities	24 hours a day, 7 days per week, providing maintenance activities are inaudible at any privately-owned residence.

Note: This condition does not apply in the event of a direction from police or other relevant authority for safety or emergency reasons regarding works which may need to be undertaken to avoid loss of life, property loss and/or to prevent environmental harm.

4.5 Operating Equipment

When operational during the 2019 reporting period the following equipment was used:

- Excavator x 4;
- Bulldozer x 1;
- Mobile crusher (screening and crushing equipment);
- Front end loader x 4;
- 25,000 L water tanker; and
- Onsite Haul trucks x 5.

4.6 Next Reporting Period

Table 10 outlines forecast operations for the next reporting period.

Table 10 Forecast Operations for Next Reporting Period

Aspect	Forecast for Next Reporting Period
Construction	None proposed.
Quarrying	Continuation of quarrying during 2020.

5.0 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The actions required as an outcome of the previous Annual Review are provided in **Table 11**. Note, the 2018 Annual Review was resubmitted in June 2019 following feedback from the DPIE.

Table 11 Actions Required from Previous Annual Review

Action Required from Previous Annual Review	Action taken by Operator	Where Discussed in Annual Review
DPIE Requests – 2018 Annual Review		
Section 6.2 Noise Provide commentary on 2018 noise levels in relation to EIS predictions.	Analysis of noise completed within the Annual Review in 2018. For 2019 there has been no noise exceedances.	Section 6.2
Section 6.4 Air Quality Provide trend analysis/commentary for all analytes.	Covered in 2018 and 2019 Annual Reviews	Section 6.4
Section 7 Water Provide trend analysis/commentary for all analytes.	More detailed analysis was provided in 2018 and 2019 Annual Reviews.	Section 7
Tables 37 and 38 list conflicting criteria for several analytes, please resolve	This was fixed in the 2018 Annual Review resubmission.	Section 7
7.3.3 states 32 discharge events for LDP1, 2 & 3 (8 uncontrolled and 24 controlled), however Table 41 lists 24 discharge events for LDP1, 2 & 3 (7 uncontrolled and 17 controlled), please resolve	This was fixed in the 2018 Annual Review resubmission.	Section 7
Section 11 The Department notes that in December 2018, the NSW Environmental Protection Authority issued Hunter Quarries with two Official Cautions and one Formal Warning in relation to Karuah East Quarry; please revise this section to include the requisite detail for all incidents and non-compliances during the reporting period.	Included in 2018 Annual Review resubmission.	Section 11
Karuah East Commitments from 2018 Annual Review		
Complete construction activities	Construction activities complete.	Section 4
Continue environmental monitoring in accordance with management plans and approval requirements	On-going. To be continued in 2020.	Section 6
Continue CCC and community support	On-going. To be continued in 2020.	Section 9
Continue to update the website with monitoring data and key environment and community information	On-going. To be continued in 2020.	Section 9
Update the management plans	The following management plans were updated and submitted to DPIE during 2019 and 2020: - Environmental Management Strategy; - Air Quality and Greenhouse Gas Management Plan;	Section 3.1

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Action Required from Previous Annual Review	Action taken by Operator	Where Discussed in Annual Review
	<ul style="list-style-type: none">- Blast Management Plan;- Landscape and Rehabilitation Management Plan;- Noise Management Plan;- Water Management Plan. <p>Note these management plans have not yet been approved.</p>	

6.0 ENVIRONMENTAL PERFORMANCE

Appendix 3 includes a number of figures that identify the location of the environmental monitoring sites discussed in the following sections.

6.1 Meteorological Monitoring

Schedule 3, Condition 17 of PA 09_0175 requires:

For the life of the project, the Proponent shall ensure that there is a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.

A new meteorological station was installed in August 2016 which is used by both the Karuah Quarry and Karuah East Quarry. The location of the station is shown in **Appendix 3**. It should be noted that although the meteorological data has been presented for the full year, operational activities associated with Karuah East Quarry recommenced in July 2019 and continued until the end of the review period (31 December 2019).

Table 12 presents a summary of the meteorological data collected by the meteorological station during the Annual Review reporting period.

Table 12 Annual Review Meteorological Data

Month	Temp (°C)			Rainfall			Wind
	Average (°C)	Min Temp (°C)	Max Temp (°C)	Total (mm)	Max Daily (mm)	No rain days < 1 mm	Max Wind Gust (km/h)
Jan-19	26.5	17.1	43.5	37.6	11.6	9	49.7
Feb-19	23.8	12.5	38.9	48.6	16.0	7	46.1
Mar-19	22.2	12.3	39.2	154.0	39.8	11	50.9
Apr-19	18.4	7.6	33.7	46.2	17.8	7	39.0
May-19	14.6	3.6	27.2	39.2	35.4	4	59.2
Jun-19	11.9	4.0	24.5	174.8	64.6	8	47.3
Jul-19	11.6	1.7	24.2	8.8	46.2	5	53.3
Aug-19	12.3	0.7	26.0	40.6	35.6	2	66.3
Sep-19	15.4	4.5	32.4	158.8	122.2	7	71.0
Oct-19	18.3	7.3	35.5	36.2	9.8	7	66.3
Nov-19	21.3	7.4	38.7	24.6	20.0	2	53.3
Dec-19	23.5	10.9	44.5	5.6	2.2	2	63.9

Average monthly temperatures during the reporting period ranged from 11.6 degrees Celsius (°C) to 26.5°C, with a maximum of 44.5°C recorded in December 2019. Limited rainfall occurred in 2019, with the results ranging from 5.6 mm to 174.8 mm per month. The maximum wind gust was recorded in September 2019 with a result of 71.0 km per hour. 2019 total rainfall was 775.0 mm as compared with 1130.6 mm in 2018.

6.2 Noise

6.2.1 EIS / Preferred Project Report Predictions

Construction

All predicted construction noise levels (stage 1 of quarry lifecycle) are below project specific noise criteria (SLR, 2012).

Operations

As part of the *Noise and Blasting Impact Assessment (SLR, 2012)*, noise levels are predicted based on the three stages of the quarry lifecycle. All predicted levels were below the project specific noise criteria. The EIS was based on different stages, with modelling suggesting that criteria would be met in the 2012 *Noise and Blasting Impact Assessment*.

The stages considered in the noise modelling include the following:

- Model Scenario 1 – quarry initialisation and closest operation to the nearest affected residences;
- Model Scenario 3 – stage at which quarry reaches northern extent of development; and
- Model Scenario 4 – quarry at outermost extent before going into lower, more shielded, operations.

EIS predictions were undertaken for the daytime period only, since the quarry was not expected to operate during the evening or night time periods. Stage 4 has not yet occurred at the quarry.

Table 13 EIS Predicted Noise Levels - Daytime

Location	Period	Predicted Quarry Plant Noise Level LAeq(15 minute) - ALM			Project specific Noise Criteria LAeq (15 minute)
		Model Scenario 1	Model Scenario 3	Model Scenario 4	
A (NM2)	Day	40	39	N/A	49
B	Day	37	37	N/A	49
C	Day	34	34	N/A	49
D	Day	<30	<30	N/A	49
E	Day	31	<30	N/A	49
F	Day	<30	<30	N/A	49
G	Day	38	37	N/A	49

A comparison of EIS predictions with results from Location F and G are outlined in **Section 6.2.4. Approved Criteria**

Approved noise criteria from PA 09_0175 are outlined in **Table 14** and are based on the *Interim Construction Noise Guidelines (ICNG)* (EPA, 2009).

Construction**Table 14 ICNG Construction Noise Management Levels**

Time of Day	Management Level	How to apply
Recommended standard hours: Monday to Friday 7:00am to 6:00pm Saturday 8:00am to 1:00pm No work on Sundays or public holidays	Noise affected RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq,(15mins) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly affected noise level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise levels of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

In accordance with the ICNG, **Table 15** presents the adopted construction noise goals for the project.

Table 15 Project Specific Construction Noise Goals (dBA LAeq(15minute))

Location	Adopted RBL ¹	Noise Management Level (dBA LAeq(15minute))	
		Noise Affected	Highly Noise Affected
Any approved Residence on Lot 11 DP 1024564 ²	44	54	75
A to E	44	54	
F	44	54	
G	34	44	

Note 1 – Adopted RBL as outlined in Noise Management Plan.

Note 2 – At present there is no approved residence on Lot 11.

Operational

Operational noise criteria are outlined in Schedule 3, Condition 3 of PA 09_0175 and state:

*The Proponent shall ensure that the operational noise generated by the project does not exceed the criteria in **Table 16**.*

Table 16 Operational Noise Criteria (dBA LAeq(15minute))

Location	Criteria (day)
Residence on Lot 11 DP 1024564	43
A	40
B	37
G	38
All other residences	35

The noise criteria in **Table 16** does not apply if the Proponent has an agreement with the relevant landowner to generate higher noise levels.

EPL Condition L4

The noise limits set out in Condition L4.1 of the EPL 20611 are reproduced in **Table 17** are generally consistent with the criteria detailed in PA 09_0175.

Table 17 EPL Noise Limits (dBA LAeq(15minute))

Location	Noise Limit dBA - Day LAeq(15minute)
Residence A on Lot 100 DP 785172	40
Residence B on Lot 3 DP 785172	37
Residence G on Lot 1 DP 1032636	38
Any other residence or sensitive receiver not subject to a private negotiated agreement	35
Any approved residence on Lot 11 DP 1024564	43

Operational Noise Limits on Lot 11

It is noted that the noise limits detailed in EPL 20611 for Lot 11 are for “*any approved residence on Lot 11 DP 1024564*”. Currently, there is not an approved residence on Lot 11, therefore it is considered that the noise limits do not currently apply at this location.

As outlined in Section 1.1 of the *Noise Management Plan*, the DPIE agree that criteria only applies to ‘Residence on Lot 11’ if there is a Council approved residence within Lot 11. At this point in time, there is not a Council approved residence on Lot 11. Karuah East Quarry is committed to undertaking noise monitoring to determine compliance at ‘approved residences’ only. Should a residence be approved by Council on Lot 11, the *Noise Management Plan* will be updated to include noise monitoring at this location.

6.2.2 Key Environmental Performance or Management Issues

6.2.2.1 Attended Noise Monitoring

Both attended and unattended noise monitoring has been conducted at the nearest residential receivers to the quarry during the 2019 reporting period.

A summary of the results are provided in **Tables 18 to 26** below, with full copies of the noise monitoring reports appended to this Annual Review (see **Appendix 4**). Noise levels were within the consent condition criteria at all locations during the monitoring period.

February 2019 Operational Noise Monitoring**Table 18 Operator Attended Noise Survey Results (February 2019)**

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels L _{Amax} – dBA
	L _{Amax}	LA1	LA10	LA90	L _{Aeq}	
Location F Day 14/2/2018 07:45 W = 2.5 m/s ESE Temp = 21°C	79	57	51	46	52	Car pass-by 60-79 Pacific Highway 50-52 Plane 49 Birds 47-50 Karuah East Project Inaudible
Location G (NMP Monitoring Location) Day 6/2/2019 10:48 W = 1.5 m/s SE Temp = 29°C	54	43	37	32	35	Residential Construction 33 – 34 Birds 54 Insects 34 – 35 Pacific Highway 29-32 Karuah East Project Inaudible
Location Karuah Quarry (weighbridge) Day 14/2/2018 08:11 W = 2.5 m/s ESE Temp = 22°C	66	63	57	48	54	Pacific Highway traffic 57 – 66 Birds 45-49 Karuah East Project Inaudible

Note 1: Weather data was obtained from the automatic weather station located at Karuah East Quarry.

Table 19 Compliance Noise Assessment – Operations (February 2019)

Location	Estimated L _{Aeq} (15minute) Contribution	Consent Conditions L _{Aeq} (15minute)	Compliance
Location F (Day)	Inaudible	35	Yes
G (NMP Monitoring Location)	Inaudible	38	Yes

Results presented in **Table 18** and **19** indicate that compliance with the relevant consent conditions was achieved at Location F and G for February 2019 monitoring.

Karuah East Quarry operational activities were found to be inaudible at Location F and G. Therefore, results were found to be within the relevant consent condition criteria at location F and G.

Meteorological data from the Karuah Quarry onsite weather station has shown stable light winds of approximately 2.0 m/s at 10 m above ground level travelling in a south east to east south east direction towards the monitoring locations.

May 2019 Operational Noise Monitoring**Table 20 Operator Attended Noise Survey Results (May 2019)**

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels L _{Amax} – dBA
	L _{Amax}	LA1	LA10	LA90	L _{Aeq}	
Location F Day 22/05/2019 09:54 W = 1.7 m/s SW Temp = 17°C	84	58	54	45	54	Car pass-by 84 Pacific Highway 45-52 Plane 50 Karuah East Project Inaudible
Location G (NMP Monitoring Location)	79	60	57	40	49	Cattle 48-79 Pacific Highway Traffic 39-44 Dogs 49-56

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Day 22/05/2019 09:23 W = 1.2 m/s WSW T = 15°C						Plane 53-55 Karuah East Project Inaudible
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Table 21 Compliance Noise Assessment – Operations (May 2019)

Location	Estimated LAeq(15minute) Contribution	Consent Conditions LAeq(15minute)	Compliance
Location F (Day)	Inaudible	35	Yes
G (NMP Monitoring Location)	Inaudible	38	Yes

Results presented in **Table 20** and **21** indicate that compliance with the relevant consent conditions was achieved at Location F and G for May 2019 monitoring.

Karuah East Quarry operational activities were found to be inaudible at Location F and G. Therefore, results were found to be within the relevant consent condition criteria at location F and G.

Meteorological data from the Karuah Quarry onsite weather station has shown stable light winds of approximately 1.5 m/s at 10 m above ground level travelling in a south west to west south west direction towards the monitoring locations.

September 2019 Noise Monitoring

Table 22 Operator Attended Noise Survey Results (September 2019)

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels LAmax – dBA
	LAmax	LA1	LA10	LA90	LAeq	
Location F Day 04/09/2019 9:47 W = Calm	77	67	52	42	54	Pacific Highway 45 dBA Plane 65 dBA Insects 40 dBA Birds 40 dBA Karuah East Project Inaudible
Location G (NMP Monitoring Location) Day 04/09/2019 10:29 W = Calm	71	62	52	40	50	Birds 43-48 dBA Dogs Barking 44-60 dBA Karuah East Project Inaudible

Table 23 Compliance Noise Assessment – Operation (September 2019)

Location	Estimated LAeq(15minute) Contribution	Consent Conditions LAeq(15minute)	Compliance
F	Inaudible	35	Yes
G (NMP Monitoring Location)	Inaudible	38	Yes

Results presented in **Table 22** and **23** indicate that compliance with relevant consent conditions were achieved at noise monitoring location F and G for operation.

Noise recorded at Location F was dominated by traffic on the Pacific Highway, insects, birds and a plane. Noise recorded at Location G was dominated by birds and barking dogs.

Meteorological data from the Karuah Quarry onsite weather station show conditions at both monitoring locations were calm.

December 2019 Operational Noise Monitoring

A further operator-attended survey was conducted at the Karuah Quarry weighbridge during the December Noise Monitoring period (**Table 24**).

Table 24 Operator Attended Noise Survey Results (December 2019)

Date/Start Time Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission and Typical Maximum Levels LAmax – dBA
	LAmx	LA1	LA10	LA90	LAeq	
Location F Day 03/12/2019 12:35 W = 2.7m/s	65	55	50	44	49	Pacific Highway 45 dBA Insects 40 dBA Birds 45 to 50 dBA Karuah East Project Inaudible
Location G (NMP Monitoring Location) Day 03/12/2019 13:22 W = 2.7 m/s	78	57	51	45	49	Pacific Highway 40 dBA Birds 40 to 45 dBA Karuah East Project Inaudible

Karuah East was inaudible for the December noise monitoring.

Table 25 Compliance Noise Assessment – Operations (December 2019)

Location	Estimated LAeq(15minute) Contribution	Consent Conditions LAeq(15minute)	Compliance
F	Inaudible	35	Yes
G (NMP Monitoring Location)	Inaudible	38	Yes

Results presented in **Table 24** and **Table 25** indicate that compliance with relevant consent conditions were achieved at noise monitoring location F and G for operation.

Noise recorded at Location F was dominated by traffic on the Pacific Highway, insects and birds. Noise recorded at Location G was dominated by traffic on the Pacific Highway and birds.

Meteorological data from the Karuah Quarry onsite weather station has shown stable light winds of approximately 2.7 m/s at 10 m above ground level travelling in a south west direction towards the monitoring locations.

6.2.2.2 Unattended Noise Monitoring

The unattended noise monitoring February 2019 is outlined in the table below. Unattended noise monitoring was conducted at location G during the reporting period. **Table 26** to **Table 29** outline unattended noise monitoring results.

Table 26 Unattended Continuous Monitoring Ambient Noise Levels (February 2019)

INP Period	LA1	LA10	LA90	LAeq
Location G				
Daytime ¹	54	48	35	51
Evening ²	53	48	38	49
Night ³	55	51	40	54

Given the results of operator attended noise monitoring Karuah East Quarry contributes to overall noise levels at the Location G noise logger during the daytime operational period. However, it is noted that other noise sources such as road noise from the Pacific Highway, local road traffic and other noise sources such as birdsong, insects and livestock also contribute to overall noise levels at this location.

Unattended noise monitoring was conducted at Location G from Wednesday 6 February 2019 to Thursday 14 February 2019 inclusive.

Table 27 Unattended Continuous Monitoring Ambient Noise Levels – Operations (May 2019)

INP Period	LA1	LA10	LA90	LA _{eq}
Location G				
Daytime ¹	52	45	35	50
Evening ²	46	43	36	43
Night ³	46	42	34	43

Given the results of operator attended noise monitoring, Karuah East Quarry contributes to overall noise levels at the Location G noise logger during the daytime operational period. However, it is noted that other noise sources such as road noise from the Pacific Highway, local road traffic and other noise sources such as birdsong, insects and livestock also contribute to overall noise levels at this location.

Unattended noise monitoring was conducted at Location G from Tuesday 14 May 2019 to Wednesday 22 May 2019 inclusive.

Table 28 Unattended Continuous Monitoring Ambient Noise Levels – Operations (September 2019)

INP Period	LA1	LA10	LA90	LA _{eq}
Location G				
Daytime ¹	57	50	41	50
Evening ²	53	50	42	48
Night ³	54	50	36	48

Unattended noise monitoring was conducted at Location G from 23 September 2019 to 2 October 2019 inclusive.

Table 29 Unattended Continuous Monitoring Ambient Noise Levels – Operations (December 2019)

INP Period	LA1	LA10	LA90	LA _{eq}
Location G				
Daytime ¹	56	49	41	48
Evening ²	55	49	40	47
Night ³	53	49	39	46

Unattended noise monitoring was conducted at Location G from 3 December 2019 to 21 December 2019 inclusive.

6.2.2.3 Noise Summary 2019

The information below summarises compliance against Development Consent criteria.

Quarter 1

- Location F: No exceedances.
- Location G: No exceedances.

Quarter 2

- Location F: No exceedances.
- Location G: No exceedances.

Quarter 3

- Location F: No exceedances.
- Location G: No exceedances.

Quarter 4

- Location F: No exceedances.
- Location G: No exceedances.

6.2.3 Management Measures

The following best practice noise control measures shall continue to be implemented:

- Adherence to operating hours;
- Noise monitoring will be undertaken on site and within the community;
- Keep plant and equipment well maintained;
- Regular inspection and maintenance of equipment to ensure it is in good working order and operating at the lowest feasible noise level;
- Equipment is not to be operated until it is maintained or repaired;
- Regular training for staff and contractors (i.e. toolbox talks) for the use of equipment in ways to minimise noise;
- Operate mobile plant in a quiet, efficient manner;
- Switching off vehicles and plant when not in use;
- A speed limit of 40 km/hour or less will be applied and enforced for all construction related vehicles onsite;
- Incorporate clear signage at the site including relevant contact numbers for community enquiries; and
- Prompt response to any community concerns.

6.2.4 Proposed Improvements to Management Measures

There have been numerous noise management upgrades in 2019 with these already outlined in Section 2.2. At this point there are no further upgrades proposed.

6.3 Blasting

6.3.1 EIS Predictions

The Noise Impact Assessment (NIA) (SLR, 2012) prepared as part of the EIS, developed blasting site laws for Karuah East Quarry based on blast monitoring results from the existing Karuah Quarry. The site laws were utilised to determine limiting factors to blast design for the site in order to achieve the criteria described in **Section 6.3.2**. Based on the predicted blast results the blast emission criteria are predicted to be met without imposing any significant constraints on blast design throughout the life of the quarry.

6.3.2 Approved Criteria

Blasting criteria for the site are provided in Schedule 3, Condition 8 of PA 09_0175 and are summarised in **Table 30**.

Table 30 Project Approval Blasting Criteria

Location	Airblast overpressure (dB (Lin Peak))	Ground Vibration (mm/s)	Allowable Exceedance
Any residence on privately-owned land, or any public infrastructure	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months

Conditions L5.1 to 5.7 of EPL 20611 detail the blast limits for the project. The blast limits contained in the EPL are consistent with those presented in PA 09_0175.

6.3.3 Key Environmental Performance or Management Issues

There have been 15 blasts during the reporting period at Karuah East Quarry, the results of the blast monitoring undertaken are contained in **Table 31**. Blast monitoring results are shown in **Appendix 3**.

Table 31 Blast Results 2019

Date and time	Overpressure and vibration	Location B (Nearest Resident)
28-03-2019 12:30 PM	Overpressure dB(L)	108.1
	Vibration (mm/s)	0.68
18-04-2019 12:26 PM	Overpressure dB(L)	114.9
	Vibration (mm/s)	0.68
03-05-2019 1:56 PM	Overpressure dB(L)	n/t
	Vibration (mm/s)	n/t
15-07-2019 2:10 PM	Overpressure dB(L)	n/t
	Vibration (mm/s)	n/t
26-08-2019 1:02 PM	Overpressure dB(L)	n/t
	Vibration (mm/s)	n/t
10-09-2019 11:36 AM	Overpressure dB(L)	n/t
	Vibration (mm/s)	n/t
30-09-2019 1:09 PM	Overpressure dB(L)	n/t
	Vibration (mm/s)	n/t
09-10-2019 1:00 PM	Overpressure dB(L)	95.4
	Vibration (mm/s)	0.49
16-10-2019 1:02 PM	Overpressure dB(L)	112.8
	Vibration (mm/s)	0.71
23-10-2019 1:03 PM	Overpressure dB(L)	101.1
	Vibration (mm/s)	0.64
05-11-2019 1:02 PM	Overpressure dB(L)	101.5
	Vibration (mm/s)	0.56
13-11-2019 1:06 PM	Overpressure dB(L)	n/t
	Vibration (mm/s)	n/t
25-11-2019 12:32PM	Overpressure dB(L)	n/t
	Vibration (mm/s)	n/t
29-11-2019 12:30PM	Overpressure dB(L)	105.0
	Vibration (mm/s)	0.72
06-12-2019 1:04 PM	Overpressure dB(L)	104.8
	Vibration (mm/s)	0.75
19-12-2019 11:36 AM	Overpressure dB(L)	101.9
	Vibration (mm/s)	0.68

*No Trigger (n/t)

During the 2019 Annual Review reporting period:

- All blasts were within the overpressure criteria of 115 dB(L); and
- All blasts were within the vibration criteria of <5 mm/s.

6.3.4 Management Measures

Section 6 of the *Blast Management Plan* outlines the proposed blasting controls on site. In summary these include:

- Considerations of explosive loading, initiation sequence and firing;

- Use of experienced blast contractors;
- Monitoring of meteorological conditions prior to blasting; and
- Notifying landowners (at their request) and occupiers of blast events.

Additionally, all blasting activities at Karuah East Quarry are monitored by a licensed blasting contractor.

6.3.5 Proposed Improvements to Management Measures

Karuah East Quarry will continue to monitor all blasts at Receptor B as per the approved *Blast Management Plan*. Blast design and management will be completed in accordance with the approved *Blast Management Plan*.

6.4 Air Quality

6.4.1 EIS Predictions

The revised Air Quality Impact Assessment (AQIA) (updated for the Preferred Project Report) indicates that Karuah East Quarry may operate without significant impact on the surrounding environment. In particular, the updated AQIA has confirmed that potential cumulative impacts of Karuah East Quarry and existing Karuah Quarry are well below acceptable criteria levels and will not impose adverse impacts. Overall, it has been demonstrated that the AQIA for Karuah East Quarry is acceptable in terms of air quality considerations for both the construction and operational phases.

6.4.2 Approved Criteria

AQIA criteria relevant to the Project are provided in Schedule 3, Condition 13 and Tables 3 to 5 of PA 09_0175 and have been reproduced in **Table 32**, **Table 33**, and **Table 34**. The criteria are prescribed by the NSW Environment Protection Authority (EPA) in their document, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2005)* (Approved Methods).

All reasonable and feasible avoidance and mitigation measures are to be employed so that particulate matter emissions generated by the project do not exceed the air quality criteria in at any residence on privately owned land.

Table 32 Long-term impact assessment criteria for particulate matter

Pollutant	Averaging Period	^d Criterion
Total suspended particulate (TSP) matter	Annual	^a 90 µg/m ³
Particulate matter < 10 µm (PM ₁₀)	Annual	^a 30 µg/m ³

Table 33 Short-term impact assessment criteria for particulate matter

Pollutant	Averaging Period	^d Criterion
Particulate matter < 10 µm (PM ₁₀)	24 hour	^a 50 µg/m ³

Table 34 Long-term impact assessment criteria for deposited dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
^c Deposited dust	Annual	^b 2 g/m ² /month	^a 4 g/m ² /month

Notes to **Table 32** to **Table 34** above:

- Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to all other sources).
- Incremental impacts (i.e. incremental increase in concentrations due to the project on its own).
- Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003 Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter - Deposited Matter - Gravimetric Method.
- Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the Director-General in consultation with EPA.

No specific limit conditions are specified for air quality emissions in EPL 20166.

6.4.3 Key Environmental Performance or Management Issues

The principle source of air pollution at the quarry is in the form of airborne dust, which arises from activities such as construction, quarrying, vehicle movements and crushing. Air quality monitoring has been performed to meet the *Approved Methods of Sampling and Analysis of Air Pollutants in NSW*.

Depositional Dust

Depositional dust results are outlined within **Table 35** . All dust gauges were below the annual average for Karuah East Quarry during the reporting period.

Table 35 Depositional Dust Monitoring Summary (g/m²/month)

Date	DDG 1	DDG 2	DDG 3	DDG 4	DDG 5
18-01-2019 to 18-02-2019	1.7	2.7	1.2	1.0	2.5
18-02-2019 to 20-03-2019	2.4	2.5	1.7	1.7	3.7
20-03-2019 to 16-04-2019	2.1	4.0	0.9	1.0	1.8
16-04-2019 to 15-05-2019	0.8	1.2	0.5	4.8	1.1
15-05-2019 to 12-06-2019	0.4	0.6	0.3	<0.1	0.3
12-06-2019 to 15-07-2019	0.4	0.5	0.2	0.1	0.3
15-07-2019 to 14-08-2019	0.7	0.7	0.3	0.5	0.8
14-08-2019 to 12-09-2019	0.6	2.4	0.7	2.5	0.7
12-09-2019 to 16-10-2019	0.3	0.7	<0.1	1.1	0.9
16-10-2019 to 14-11-2019	3.8	2.0	3.5	2.4	2.9
14-11-2019 to 12-12-2019	2.6	2.0	3.1	2.5	4.1
12-12-2019 to 13-01-2020	2.0	2.7	1.9	2.0	2.8
Annual Average (Jan 2019 to Dec 2019)	1.5	1.8	1.3	1.6	1.8
Minimum (Jan 2019 to Dec 2019)	0.3	0.5	0.2	0.1	0.3
Maximum (Jan 2019 to Dec 2019)	3.8	4.0	3.5	4.8	4.1

High Volume Air Sampler

Table 36 outlines the High Volume Air Sampler (HVAS) results during the 2019 reporting period.

Table 36 High Volume Air Sampler Results ($\mu\text{g}/\text{m}^3$)

Date	TSP ($\mu\text{g}/\text{m}^3$)	PM10 ($\mu\text{g}/\text{m}^3$)	Comments
02-01-2019	25	15	
08-01-2019	25	14	
14-01-2019	24	10	
20-01-2019	28	18	
26-01-2019	42	23	
01-02-2019	31	14	
07-02-2019	16	8	
13-02-2019	120	30	Dust across the region.
19-02-2019	57	31	
25-02-2019	26	14	
03-03-2019	16	8	
09-03-2019	40	19	
15-03-2019	24	13	
21-03-2019	14	9	
27-03-2019	31	18	
02-04-2019	12	8	
08-04-2019	47	19	
14-04-2019	17	13	
20-04-2019	16	11	
26-04-2019	34	17	Recent burn off nearby
02-05-2019	33	16	
08-05-2019	18	12	
14-05-2019	14	8	
20-05-2019	24	11	
26-05-2019	18	9	
01-06-2019	20	14	
07-06-2019	12	8	
13-06-2019	30	12	
19-06-2019	9	6	
25-06-2019	5	2	
01-07-2019	17	1	
07-07-2019	2	1	
13-07-2019	12	3	
19-07-2019	13	6	
25-07-2019	10	5	
31-07-2019	5	3	
06-08-2019	13	6	
12-08-2019	15	4	
18-08-2019	17	10	

Date	TSP ($\mu\text{g}/\text{m}^3$)	PM10 ($\mu\text{g}/\text{m}^3$)	Comments
24-08-2019	35	17	
30-08-2019	22	8	
05-09-2019	24	11	
11-09-2019	12	6	
17-09-2019	17	6	
23-09-2019	17	7	
29-09-2019	21	11	
05-10-2019	22	9	
11-10-2019	15	6	
17-10-2019	51	21	
23-10-2019	60	18	
29-10-2019	140	47	Affected by regional dust storms.
04-11-2019	43	11	
10-11-2019	92	10	Affected by regional dust storms.
16-11-2019	47	19	Bushfires in vicinity, excluded from annual average
22-11-2019	165	98	Bushfires in vicinity, excluded from annual average
28-11-2019	125	61	Bushfires in vicinity, excluded from annual average
04-12-2019	63	37	Bushfires in vicinity, excluded from annual average
10-12-2019	130	100	Bushfires in vicinity, excluded from annual average
16-12-2019	61	29	Bushfires in vicinity, excluded from annual average
22-12-2019	55	33	Bushfires in vicinity, excluded from annual average
28-12-2019	30	18	Bushfires in vicinity, excluded from annual average
All Data Annual Average (Jan 2019 to Dec 2019)	35.7	17.0	
Data Annual Average (Bushfire and dust storm extraordinary events removed)	25.1	11.5	
Minimum (Jan 2019 to Dec 2019)	2	1	
Maximum (Jan 2019 to Dec 2019)	165	100	
Maximum (Bushfire extraordinary events removed)	120	31	

Notes:

- ¹= Maximum criteria as specified in PA 09_0175
- The dates highlighted red in November and December were affected by bushfire smoke and have been removed from the annual average as these are 'extraordinary events, as per the wording of Schedule 3 Condition 13 of the Development Consent.

The TSP average during 2019 was 35.7 $\mu\text{g}/\text{m}^3$, well below the annual average criteria of 90 $\mu\text{g}/\text{m}^3$. This was an increase of 9.15 $\mu\text{g}/\text{m}^3$ from the 2018 TSP average. The TSP average was 25.1 $\mu\text{g}/\text{m}^3$ when extraordinary events as per the wording of Schedule 3 Condition 13 of the Development Consent were removed. The highest short-term TSP result for the reporting period was 165 $\mu\text{g}/\text{m}^3$ which occurred on the 22 November 2019. When extraordinary events were excluded the highest TSP was 120 $\mu\text{g}/\text{m}^3$ occurring on 13 February 2019.

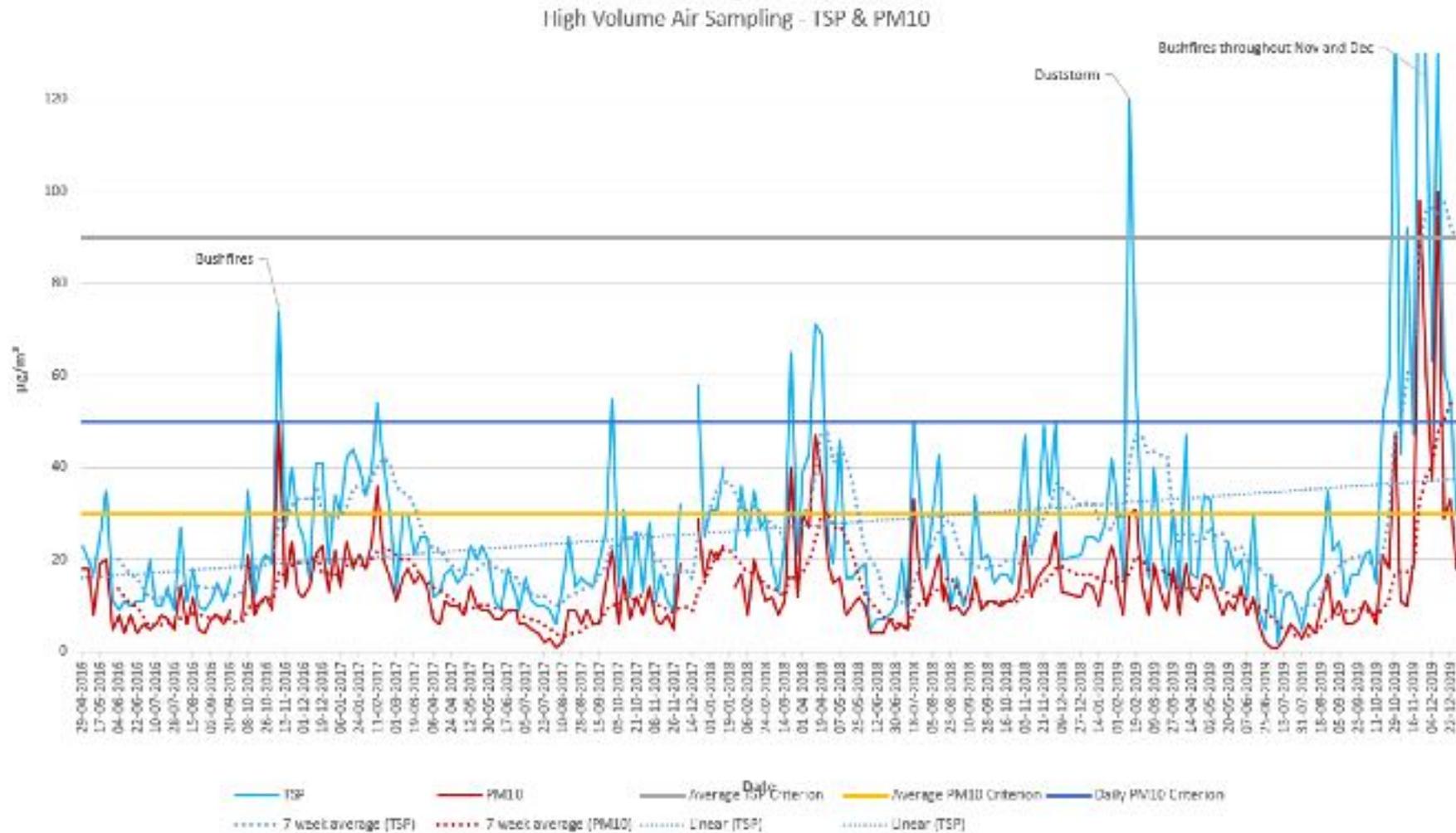
The annual average for PM_{10} ($\mu\text{g}/\text{m}^3$) even with extraordinary events included was 17.0 $\mu\text{g}/\text{m}^3$ which was well below the long-term impact assessment criteria of 30 $\mu\text{g}/\text{m}^3$. This was a slight increase from the average PM_{10} result of 15.09 $\mu\text{g}/\text{m}^3$ from 2018. However, the annual average for PM_{10} ($\mu\text{g}/\text{m}^3$) was 11.5 $\mu\text{g}/\text{m}^3$ when extraordinary events were excluded. The maximum PM_{10} result recorded during 2019. The short-term PM_{10} impact assessment criteria of 50 $\mu\text{g}/\text{m}^3$ were exceeded on:

- 22 November 2019 (98 $\mu\text{g}/\text{m}^3$);
- 28 November 2019 (61 $\mu\text{g}/\text{m}^3$); and
- 10 December 2019 (100 $\mu\text{g}/\text{m}^3$).

However as discussed previously these were impacted by bushfire events and have been excluded from being short term criteria exceedances and the annual average.

See **Figure 3** for long-term HVAS trends.

Figure 3 High Volume Air Sampling – Long-term Trends



6.4.4 Management Measures

The following best practice air quality control measures will be implemented operational phase of the quarry:

- Disturb only the minimum area necessary for onsite activities;
- Exposed areas are rehabilitated as soon as practicable with inert material and vegetation;
- Perform regular inspections of weather conditions to identify conditions which would be unfavourable in terms of dust levels at nearest sensitive locations blowing in the direction of sensitive receptors and implement remedial measures where required;
- All trafficable areas and vehicle manoeuvring areas in or on the premises will be maintained in a condition that will minimise the emission of dust to the air, or emission from the premises of wind-blown or traffic generated dust;
- Trucks entering and leaving the premises that are carrying loads of dust generating materials will have their loads covered at all times, except during loading and unloading;
- All vehicles exiting site are directed across a cattle grate/wheel wash to remove any mud and avoid tracking of material onto public roads and
- All plant and equipment to be installed at the site to be maintained and operated in a proper and efficient condition, in accordance with manufacturer's instructions and POEO Act and Regulation.

6.4.5 Proposed Improvements to Management Measures

The Karuah East Quarry will continue to monitor air quality in accordance with the conditions of PA 09_0175 and will also review measures for improving dust management on site.

6.5 Biodiversity

6.5.1 EIS Predictions

Major design amendments were undertaken in an effort to substantially decrease potential flora and fauna impacts associated with the Karuah East Quarry. This has resulted in a significant reduction in potential direct impacts on two state and federally listed threatened flora species - *Tetratheca juncea* and *Grevillea parviflora ssp parviflora*.

No Endangered Ecological Communities or Critically Endangered Ecological Communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) and EPBC Act were recorded.

6.5.2 Approved Criteria

There are no specific criteria associated with biodiversity management for the Karuah East Quarry. Activities are completed in accordance with the Preferred Project Report, Federal Approval, *Biodiversity Offset Area Management Plan* and *Land and Rehabilitation Management Plan* (LRMP).

6.5.3 Key Environmental Performance or Management Issues

Biodiversity Offset Area and Lot 12

The Biodiversity Offset Area (BOA) for the Karuah East Quarry is a 130.36 ha consolidated land parcel comprised of three lots:

- Lot 13 DP 1024564 (part);
- Lot 14 DP 1024564; and
- Lot 5 DP 838128.

Ecological monitoring for the Karuah East Quarry was completed by Kleinfelder in October 2019. A copy of the 2019 Ecological Monitoring Report is attached as **Appendix 5**.

A total of 18 vegetation monitoring sites were established and surveyed within the BOA and Lot 12 in October 2015. These permanent monitoring sites were surveyed in October 2016, October 2017, October 2018 and October 2019 using the same methods as the baseline survey (see **Appendix 5**). A series of criteria have been developed as part of the overall ecological monitoring program, including:

- Fencing, gates and signage;
- Access tracks;
- Erosion, sedimentation and soil management;
- Existing dwellings;
- Revegetation and regeneration;
- Habitat augmentation;
- Threatened flora translocation;
- Weed control;
- Vertebrate pest management; and
- Fire management.

The results from the 2019 monitoring indicate that while some species are stressed from dry conditions, the vegetation and fauna habitats within the Karuah East Biodiversity Offset Area (BOA) and Lot 12 are in good condition and remain relatively unchanged since the baseline survey in 2016 (Kleinfelder, 2020).

A significant change was recorded within the threatened flora populations sampled at some of the monitoring sites. It is likely these declines are a result of a dry years with below average rainfall. There was no obvious association between the monitoring site proximity to the disturbance area and the level of decline in threatened species; decline was observed both close to and away from the disturbance area. Continued annual monitoring is required to ensure the species respond as conditions become more favourable.

The 2019 threatened species monitoring identified a decrease in threatened flora abundance at approximately half of the monitoring locations. monitoring points: MP4, MP7, MP8, MP15 and MP17 are considered close to the impact area (as per BOAMP) and MP3, MP11, MP12 and MP18 are located further away from the impact area within the BOA.

There remains an overall decline in threatened species abundance since baseline monitoring, however, this percentage has reduced since the previous monitoring round, as plant numbers have increased or remained constant since the last monitoring round (2018). Previous declines in plant numbers were likely due to poor rainfall conditions and could not be confidently attributed to the quarry disturbance as there is no correlation between monitoring points with higher percentage of decline and proximity to the quarry; high levels of decline (>10%) was observed at both sites close to and away from the impact area.

Flowering was observed at all monitoring points, with the exception of *G. parviflora* at MP11. Fruits had formed on plants at all monitoring points with the exception of MP12 (*G. parviflora*) and MP17 (*A. asthenes*).

Dense infestations of Lantana were primarily observed along the drainage lines in Lot 5. Two other Priority Weed species have also been identified in the BOA: *Asparagus aethiopicus* (Ground Asparagus) and *Senecio madagascariensis* (Fireweed) are both listed as Priority Weeds within the Mid Coast LGA. These two species only occur as small discrete patches in a few locations in the BOA.

The dominant exotic grass species in these areas include *Setaria sphacelata* (South African Pigeon Grass), *Andropogon virginicus* (Whisky Grass), and *Axonopus fissifolius* (Narrow-leafed Carpet Grass), as well as a variety of annual and perennial exotic herbs. The areas dominated by exotic grasses are primarily restricted to the power line easement, around existing dwellings, track edges, perimeter of quarry disturbance area and previously cleared regrowth areas on the southern part of Lot 14. While the dense areas of exotic grasses have been mapped, they are not considered target weed species at this stage as they represent a relatively low threat to the integrity of ecological values within the site. Note the exotic grasses occurring in the areas of native regrowth are also likely to be shaded out over time as the canopy and midstorey cover continue (Kleinfelder, 2020).

A decline in percentage cover of exotic species (Lantana and South African Pigeon Grass) was recorded at four monitoring locations in 2019. Dry conditions have reduced native ground covers and impacted weed species across site.

It was observed during the 2019 annual monitoring event that density of grasses along disturbed areas (roadsides and dam areas) had increased. These grasses are facilitating erosion control across disturbed areas. However, due to the proximity to the road, there is potential for weed seed to be carried by vehicles trafficking this area.

Successful weed control has been observed in Lot 14, along the creek line where an infestation has been sprayed and has been reduced to mostly scattered individuals within only a small area of moderate density Lantana remaining.

Tetratheca juncea Translocation

In accordance with the Translocation Plan for *Tetratheca juncea* (*T.juncea*) (Firebird ecoSultants, 2018), monitoring of *T.juncea* was undertaken by Firebird ecoSultants (2019) to satisfy the requirements of the PA 09_0175 for the Karuah East Quarry.

The site was originally surveyed and found that the approved impact area had 243 clumps of *T.juncea*. However, at the time of translocation (May 2016) 367 individuals were recorded. Translocation of the *T.juncea* located within the impact area to the offset area will assist in protecting the genetic diversity of the population.

The 367 *T.juncea* individuals were translocated into prepared areas within the offset area which covered between 2,500m² and 3,000m². The offset area was selected to ensure that an appropriate vegetation community and aspect would replicate the source environment as much as practicable.

The collection method entailed digging within the offset before collecting a translocation section from the impact area and placing the section into the hole within the offset. Site preparation included the removal of threatening processes that may impact upon the success of plant survival. These include weed control, protection from herbivory and management of fire risks. An irrigation system was installed to ensure moisture levels remain adequate for plant survival.

The monitoring of the *T. juncea* translocation, as of September 2019, has shown a survival rate of 38% for the fourth year of monitoring. Kleinfelder (2020) have also observed a decline in the *T. juncea* numbers within the Biodiversity Offset for the past four years. It is noted that the yearly rainfall totals as recorded by the Bureau of Meteorology's official weather station at Nelson Bay has been below the long-term average in 2016, 2017, 2018 and 2019. This suggests that the natural decline in *T. juncea* population is potentially related to the drier than normal conditions.

T. juncea appear to be healthier and show a higher rate of survival in rows that have canopy cover or in rows that are considerably overgrown with grassy or shrubby vegetation. Rows A20 to A30 have a much higher number of surviving plants and have significantly more canopy cover than rows A1 to A19, which in contrast have significantly lower rates of survival and very little canopy cover. It is possible that *T. juncea* within rows A1 to A19 may be experiencing too much direct sunlight. As such, it is recommended that native shrubs are planted adjacent to and within rows A1 to A19 to create more shade for the *T. juncea* within these rows. It is also recommended that any future translocations are to be replanted in areas with canopy cover.

It should also be noted that the translocation site is considerably more overgrown with grassy native vegetation than the previous years. *T. juncea* are quite difficult to find when they are not in flower, particularly in heavily vegetated areas. Thus, it is considered that there was a chance of potentially missing individual *T. juncea* that were not in flower during the survey effort which would result in a lower predicted rate of survival.

A further one (1) year of monitoring will be able to show more certainty of the success of translocation of *T. juncea*.



Photo 6 - *T. juncea* in flower (October 2019)

Please see **Appendix 7** for the full report.

The short-term performance criteria is to reach a success rate of 25%, with this reached in the 2019 monitoring. The monitoring of the *T. juncea* translocation, as of September 2019, has shown a survival rate of 38% for the fourth year of monitoring.

6.5.4 Management Measures

A large number of management strategies are proposed within the BOA based on the key aspects listed in **Section 6.5.3**. These are outlined in Section 3 of the BOA Management Plan.

A large number of management strategies relating to land management and rehabilitation are outlined within the LRMP, including:

- Inductions;
- Controlling access to the site;
- Weed and feral animal management;
- Pre-clearing protocol;

- Salvaging of key resources during clearing (including removal of habitat trees); and
- Fauna displacement and relocation.

6.5.5 Proposed Improvements to Management Measures

The Karuah East Quarry will continue to implement the BOA Management Plan and LRMP during 2020. Kleinfelder (2020) recommend that the following actions will be undertaken during 2020 in accordance with the relevant sections of the BOA Management Plan:

- Repair of erosion;
- Fence repair;
- Install boundary fence, gates and signage;
- Salvage and redistribute habitat resources including installation of nest boxes (77);
- Monitor nest boxes 1-25;
- Weed control;
- Complete a fire management strategy; and
- Complete vertebrate pest monitoring.

6.6 Heritage (Aboriginal and Non-Aboriginal)

6.6.1 EIS Predictions

An Aboriginal Heritage Impact Assessment was completed as part of the EIS specialist report prepared by RPS (2012). A search of the Aboriginal Heritage Information Management System (AHIMS) database revealed no listed sites inside the project area and the pedestrian survey revealed no Aboriginal cultural heritage items. No evidence of Aboriginal cultural heritage was found during the survey and no impacts were predicted.

A Due Diligence Report was completed by RPS on 17 August 2018 as part of MOD 2. The inspection confirmed the MOD 2 Project Area contains low archaeological sensitivity. Recommendations from the report are contained in **Section 6.6.4**.

6.6.2 Approved Criteria

There are no specific Project Approval criteria associated with heritage relating to the project. Heritage is managed in accordance with the approved *Heritage Management Plan* (RPS, 2015).

The process for managing any unexpected heritage items is outlined in **Section 6.6.4**.

6.6.3 Key Environmental Performance or Management Issues

There were no issues relating to Aboriginal cultural heritage during the reporting period.

6.6.4 Management Measures

The process for managing unexpected Aboriginal objects/items is outlined in the *Heritage Management Plan* (RPS, 2015).

In accordance with Condition 36(c) of Project Approval 09_0175 for the Karuah East Quarry and the approved HMP (RPS 2015), RAPs must be provided the option to monitor initial surface disturbance within the Project Area for the identification of unrecorded Aboriginal objects. RAPs must be notified 14 days in advance of work.

Should unexpected Aboriginal objects/features be encountered, work must stop immediately, and the area cordoned off with a high visibility barrier. The Quarry Manager is to then contact a heritage consultant and Registered Aboriginal Parties (RAPs). The heritage consultant, in consultation with the RAPs, is to conduct a field survey to assess the Aboriginal objects/features identified. The heritage consultant, in consultation with the RAPs, will then recommend appropriate mitigation measures.

The Quarry Manager is to implement the mitigation measures that are recommended by the heritage consultant and agreed to by the RAPs and in accordance with the Office of Environment and Heritage regulations. If additional visual inspection and salvage is recommended, the Quarry Manager is to arrange for the heritage consultant and RAPs to undertake those works.

If human remains are identified, work must cease immediately within that area and the area cordoned off. The Karuah East Quarry Manager must contact the NSW Police. The NSW Police will assess if the remains are part of a crime scene or possible Aboriginal remains. If determined to be Aboriginal remains, the NSW Police will contact OEH and OEH will confirm the determination in writing. If determined to be a NSW Police matter, NSW Police instructions must be followed. Clearance to recommence work must be sought from the NSW Police. If OEH confirms the remains are Aboriginal, OEH in consultation with RAPs will develop a management plan. The Karuah East Quarry Manager will document the implementation of the plan.

Provided that these heritage contingency protocols have been followed, works within the project area may proceed.

6.6.5 Proposed Improvements to Management Measures

There are no further proposed management responses other than those outlined in the *Heritage Management Plan (RPS)*.

6.7 General Waste Management

6.7.1 Environmental Management

Karuah East Quarry uses a licensed contractor for waste removal at the site.

Typical waste generation at the quarry now the site is operational has consisted of non-hazardous and general wastes, metals as well as oily wastes. The general and non-hazardous wastes were placed in a skip bin and removed from site. Metals are placed in a yellow recycling bin which is removed from site.

6.7.2 Environmental Performance

JR Richards, a waste contractor, removes waste from a 3 metre cubed waste bin at the site. Over the year, approximately 60 cubic metres of waste (including construction waste) was removed from the site.

6.7.3 Proposed Improvements to Management Measures

The Karuah East Quarry will continue to implement a waste management strategy similar to the adjacent Karuah Quarry.

6.8 Summary of Environmental Performance

Table 37 provides a summary of the environmental performance at the site for the reporting period.

Table 37 Summary of Environmental Performance

Aspect	Approval Criteria/EIS Prediction	Performance During the Operating Period	Trend/Key Management Implications	Implemented / Proposed Management Actions
Noise	See Section 6.2.1	Compliant	Within criteria	Continued monitoring
Blasting	See Section 6.3.1	Non - Compliant	Not within criteria	Continued monitoring
Air Quality	See Section 6.4.1	Compliant	Short term exceedances in November and December have not been included due to extraordinary bushfire events (see Schedule 3 Condition 3 of the Development Consent)	Continued monitoring
Biodiversity	See Section 6.5.1	Compliant	Within criteria	Continued monitoring
Heritage	See Section 6.6.1	Compliant	No specific criteria	Continued monitoring
Waste	No predictions	Compliant	Minimal change over successive years	Continued monitoring

7.0 WATER MANAGEMENT

7.1 Summary of Water Management at Site

7.1.1 Environmental Management

Surface water at Karuah East Quarry is managed in accordance with the *Water Management Plan (WMP)*. The primary objective of water management is to remain compliant with EPL 20611 and ensure there is no uncontrolled discharge of water from the site. The goal for any water that leaves the site from a controlled or uncontrolled discharge is that this water meets the required EPL criteria. This objective is intrinsic to erosion and sedimentation designs and controls for the quarry. As such, the following specific objectives of this WMP have been established as part of the construction and operational phases:

- Conducting best practice land clearing procedures for all proposed disturbance areas;
- Implementation of erosion and sediment controls during construction and operation as per the Blue Book and WMP;
- Separating undisturbed runoff from disturbed runoff where possible to minimise and isolate the amount of disturbed or dirty water runoff;
- Directing sediment-laden runoff into designated sediment control dams;
- Diverting clean runoff from areas upstream of the operation into natural depressions and creeks;
- Allowing sediments to settle in sediment control dams so that the water can be re-used for onsite dust suppression, thereby maintaining dam capacities for subsequent rainfall events;
- Maintaining sediment control structures to ensure that the designed capacities are maintained for optimum settling of sediments; and
- Implementing an effective revegetation and maintenance program for the site.

Water Storage and Use

The Karuah East Quarry has three sediment dams, including:

- Dam 1 - Catchment (crushing plant and product stockpiles);
- Dam 2 - Catchment (product stockpiles and office infrastructure area); and
- Dam 3 - Catchment (product stockpiles area).

7.1.2 Improvements to Management Measures

There are likely to be some upgrades to water management in 2020 within the existing disturbance footprint associated with MOD 1 and 2 described in **Section 7.1.2**. Other minor updates to erosion and sediment control will be completed to ensure the site is effectively operating.

The current water management system and location of dams are shown in **Figure 2**.

7.2 EIS/Preferred Project Report Predictions

Surface water was assessed for the Karuah East Quarry EIS and then updated for the Preferred Project Report (2013).

The only direct disturbance to occur to the local drainage system will be in the upper reaches of the northern most drainage line in Lot 12. The length of the channel which will be disturbed as a result of excavation in the upper reaches of the catchment with no clearly defined bed or banks. Therefore, the impact on the wider catchment as a result of disturbance to the upper reaches of this drainage line is not anticipated to be significant.

With regards to offsite discharges, a water balance model has been developed to predict the frequency and volume of discharges from the project. The water balance predicts that uncontrolled discharges will be minimal, averaging only one discharge day per year in Stage 2 (which represents approximately half of the total disturbance area) and two days in Stage 5 (at full disturbance).

7.3 Surface Water Monitoring Results

7.3.1 Approved Criteria

Discharge criteria for the Karuah East Quarry is provided in Condition L2.4 of EPL 20611 and outlined in **Table 38**. These pollutants will be tested during discharge events from LDP001, LDP002 and LDP003. Discharge events are discussed in **Section 7.3.3**.

Table 38 Discharge Surface Water Criteria

Pollutant	Units of Measure	50 Percentile Concentration Limit	90 Percentile Concentration Limit	3DGM Concentration Limit	100 Percentile Concentration Limit
Oil and Grease	Milligrams per litre	-	-	-	5 and/or none visible
pH	pH	-	-	-	6.5 - 8.5
Total Suspended Solids	Milligrams per litre	-	-	-	40

The ANZECC Guidelines provide guidance criteria which are outlined in **Table 39**.

Table 39 Water Quality Data - ANZECC Guidelines

Parameter	Unit	ANZECC Guidelines ¹
Conductivity (Field)	uS/cm	125 – 2200
Conductivity (Lab)	uS/cm	125 – 2200
Total Dissolved Solids	mg/L	-
Total Phosphorus	mg/L	0.025
Ammonia	mg/L	0.02
Nitrogen (Nitrate)	mg/L	0.350
Total Hardness (as CaCO ₃)	mg/L	--
Arsenic	mg/L	0.024
Cadmium	mg/L	0.0002
Calcium	mg/L	--
Chromium	mg/L	0.001
Copper	mg/L	0.0014
Lead	mg/L	0.0034
Magnesium	mg/L	--
Manganese	mg/L	1.9
Nickel	mg/L	0.011
Potassium	mg/L	--
Sodium	mg/L	--
Vanadium	mg/L	--
Zinc	mg/L	0.0312

Note 1 - Key default trigger values presented in ANZECC 2000 for slightly disturbed upland rivers in NSW. Heavy metals based on hard water (120-179 mgCaCO₃/L)

As detailed in the WMP, surface water monitoring is undertaken at the following locations:

- Dam 1;
- Dam 2;
- Dam 3;
- SW 1 and SW 2 - Existing second order drainage line (within Lot 13 flowing along the eastern boundary of the PA Area); both upstream and downstream of the quarry;
- SW 3 - Existing drainage line downstream of Dam 2; and
- SW 4 - Existing drainage line downstream of the quarry extraction area.

SW 1 - 4 will be tested biannually (when flowing) during operations to determine ongoing compliance with the water quality performance criteria. SW2 and SW3 will be tested within 24 hours any discharge.

7.3.2 Surface Water Monthly Monitoring Results

The tables in this section summarise the surface water quality results. A full list of monitoring results is outlined in **Appendix 6**. Discharge results are outlined separately in **Section 7.3.3**. A summary of monitoring frequency is outlined below:

- Dam 2 and 3 were sampled every month from January 2019 while Dam 1 was sampled every month from January 2019 with the exception of December 2019 (eleven occasions, with this being a safety issue to access the dam).
- SW1 was not monitored in 2019, with the requirement to monitor monthly if the creek is flowing as per the Water Management Plan. There were no flows at SW1 during monthly monitoring events;
- SW2 was monitored monthly from during every month of 2019 with the exception of February (eleven occasions), with the requirement to monitor monthly if the creek is flowing and within 24 hours of any discharge as per the Water Management Plan;
- SW3 was monitored in March and June 2019 (two occasions), with the requirement to monitor monthly if the creek is flowing and within 24 hours of any discharge as per the Water Management Plan. Most months there was no flow in the creek; and
- SW4 rarely flows and was not monitored during 2019. SW4 has a requirement to monitor monthly if the creek is flowing as per the Water Management Plan.

Table 40 Monthly Surface Water Quality Results for Dams

Parameter	Criteria	Dam 1			Dam 2			Dam 3		
		Min	Max	Average	Min	Max	Average	Min	Max	Average
pH (pH unit)	6.5 - 8.5	6.5	8.0	6.9	5.3	7.3	6.6	7.0	8.6	7.7
TSS (mg/L)	40	10	415	36	9	185	52	6	164	34
TDS (mg/L)	-	103	646	396.8	141	1047	423	504	836	649
Turbidity (NTU)	-	13	673	86.5				12	157	46
EC (µS/cm)	125-2200	494	975	609	182	1417	603	846	1309	1067
Nitrogen (Nitrate) (mg/L)	0.35	7.80	11.70	8.8	0.02	1.30	0.39	0.0	3.00	1.29
Total Nitrogen (mg/L)	0.02	9.20	12.80	9.8	0.40	1.80	0.94	0.1	3.30	1.76
Total Phosphorous (mg/L)	0.025	0.010	0.200	0.02	0.010	0.100	0.034	0.010	0.060	0.029
Ammonia (mg/L)	0.02	0.01	0.12	0.08	0.01	0.07	0.04	0.01	0.23	0.06
Oil and Grease (mg/L)	5	<5	<5	<5	5.00	5.00	5.00	<5	<5	<5
Calcium (mg/L)	-	1.0	29.0	3.5	2.0	141.0	42.3	17	51	29
Magnesium (mg/L)	-	3	7	4.	2	23	8	14.0	27	20
Sodium (mg/L)	-	85	125	100.8	29	86	45	134	211	166
Potassium (mg/L)		1	2	2	1	2	1	1.0	3.0	2.3
Total Hardness (as CaCO ₃)		15	101	27.5	13	447	140	105	238	152
Arsenic (mg/L)	0.024	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0006	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001
Chromium (mg/L)	0.001	0.001	0.010	0.001	0.001	0.004	0.002	0.001	0.002	0.001
Copper (mg/L)	0.001	0.001	0.011	0.01	0.001	0.012	0.004	0.0010	0.0060	0.0025
Nickel (mg/L)	0.011	0.001	0.006	0.004	0.001	0.006	0.002	0.001	0.002	0.002
Lead (mg/L)	0.003	0.001	0.007	0.001	0.001	0.007	0.002	0.0010	0.0020	0.0014
Manganese (mg/L)	1.9	0.02	0.29	0.1	0.0	0.3	0.1	0.02	0.37	0.11
Vanadium (mg/L)	-	0.01	0.04	0.007	0.010	0.040	0.016	0.01	0.01	0.01
Zinc (mg/L)	0.021	0.01	0.05	0.03	0.003	0.057	0.018	0.01	0.04	0.02

Table 41 Monthly Surface Water Quality Results for SW1-4

Parameter	Criteria	SW1			SW2			SW3			SW4		
		Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
pH (pH unit)	6.5 - 8.5	-	-	-	6.2	7.8	6.9	5.6	5.8	5.7	-	-	-
TSS (mg/L)	40	-	-	-	8	121	31	12	51	32	-	-	-
TDS (mg/L)	-	-	-	-	309	815	473	192	1147	670	-	-	-
Turbidity (NTU)	-	-	-	-	16	291	94	64	403	234	-	-	-
EC ($\mu\text{S}/\text{cm}$)	125-2200	-	-	-	496	584	535	202	268	235	-	-	-
Nitrogen (Nitrate) (mg/L)	0.35	-	-	-	0.06	7.07	3.56	0.47	1.01	0.74	-	-	-
Total Nitrogen (mg/L)	0.02	-	-	-	1.10	8.10	4.38	1.00	2.70	1.85	-	-	-
Total Phosphorous (mg/L)	0.025	-	-	-	0.01	0.16	0.07	0.04	0.23	0.14	-	-	-
Ammonia (mg/L)	0.02	-	-	-	0.01	0.32	0.08	0.03	0.03	0.03	-	-	-
Oil and Grease (mg/L)	5	-	-	-	<5	<5	<5	<5	<5	<5	-	-	-
Calcium (mg/L)	-	-	-	-	2.0	9.0	4.5	2.0	4.0	3.0	-	-	-
Magnesium (mg/L)	-	-	-	-	3.0	8.0	5.1	2.0	5.0	3.5	-	-	-
Sodium (mg/L)	-	-	-	-	77	108	90	37.0	38.0	37.5	-	-	-
Potassium (mg/L)	-	-	-	-	1.0	4.0	2.1	1.0	2.0	1.5	-	-	-
Total Hardness (as CaCO_3)	-	-	-	-	17	55	32	13.0	30.0	21.5	-	-	-
Arsenic (mg/L)	0.024	-	-	-	0.001	0.002	0.001	0.003	0.003	0.003	-	-	-
Cadmium (mg/L)	0.0002	-	-	-	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001	-	-	-
Chromium (mg/L)	0.001	-	-	-	0.001	0.021	0.007	0.00	0.02	0.011	-	-	-
Copper (mg/L)	0.001	-	-	-	0.001	0.008	0.003	0.01	0.02	0.01	-	-	-
Nickel (mg/L)	0.011	-	-	-	0.001	0.005	0.003	0.001	0.012	0.007	-	-	-
Lead (mg/L)	0.003	-	-	-	0.001	0.006	0.002	0.013	0.013	0.013	-	-	-
Manganese (mg/L)	1.9	-	-	-	0.03	6.00	0.65	0.02	0.23	0.12	-	-	-
Vanadium (mg/L)	-	-	-	-	0.01	0.03	0.02	0.06	0.06	0.06	-	-	-
Zinc (mg/L)	0.021	-	-	-	0.01	0.05	0.02	0.02	0.10	0.06	-	-	-

*Criteria for SW sites are goals only. pH, TSS and oil and grease have discharge criteria from the licenced discharge point. These do not relate to SW1-4.

Table 42 Comparison between 2019, 2018 and 2017 Dam Averages

Parameter	Dam 1 2019 Average	Dam 1 2018 Average	Dam 1 2017 Average	Dam 2 2019 Average	Dam 2 2018 Average	Dam 2 2017 Average	Dam 3 2019 Average	Dam 3 2018 Average	Dam 3 2017 Average
pH (pH unit)	7.0	6.9	6.5	6.6	6.6	6.2	7.7	7.3	6.5
TSS (mg/L)	119	36	68	52	108	97	34	96	276
TDS (mg/L)	411	397	641	423	289	444	649	432	1073
Turbidity (NTU)	181	86	-	-	-	-	46	178	
EC (µS/cm)	655	609	530	603	417	443	1067	661	492
Nitrogen (Nitrate) (mg/L)	9.51	8.763	4.7	0.39	0.858	1.2	1.29	3.897	5.2
Total Nitrogen (mg/L)	10.95	9.81	-	0.94	1.23	-	1.76	4.500	-
Total Phosphorous (mg/L)	0.07	0.02	0.1	0.03	0.04	0.1	0.03	0.07	0.3
Ammonia (mg/L)	0.04	0.08	0.1	0.04	0.05	0.1	0.06	0.08	0.06
Oil and Grease (mg/L)	<5.0	<5.0	10.6	<5.0	<5.0	8.3	<5.0	<5.0	11.9
Calcium (mg/L)	8.8	3.6	5.2	42.3	16.5	5.2	29.0	17	8.9
Magnesium (mg/L)	5.0	4.9	5.4	8.0	5.0	6.7	20.0	9.3	11.6
Sodium (mg/L)	96.0	100.8	87.7	45.0	51.1	81.5	166.0	101.3	82.9
Potassium (mg/L)	2.00	2.07	2.30	1.00	1.43	2.30	2.30	1.65	3.30
Total Hardness (as CaCO ₃)	42.0	27.5	35.3	140.0	59.7	40	152.0	78.3	70.3
Arsenic (mg/L)	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.004

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Parameter	Dam 1 2019 Average	Dam 1 2018 Average	Dam 1 2017 Average	Dam 2 2019 Average	Dam 2 2018 Average	Dam 2 2017 Average	Dam 3 2019 Average	Dam 3 2018 Average	Dam 3 2017 Average
Cadmium (mg/L)	0.0001	0.0006	0.0001	0.0001	0.0007	0.0001	<0.0001	0.0001	0.0001
Chromium (mg/L)	0.004	0.001	0.010	0.002	0.004	0.005	0.001	0.003	0.014
Copper (mg/L)	0.004	0.012	0.01	0.004	0.015	0.007	0.003	0.014	0.01
Nickel (mg/L)	0.003	0.004	0.003	0.002	0.004	0.004	0.002	0.003	0.008
Lead (mg/L)	0.003	0.001	0.010	0.002	0.003	0.004	0.0014	0.002	0.010
Manganese (mg/L)	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.6
Vanadium (mg/L)	0.02	0.01	0.03	0.02	0.01	0.02	0.01	0.02	0.05
Zinc (mg/L)	0.03	0.03	0.1	0.02	0.03	0.09	0.02	0.04	0.1

Table 43 Comparison between 2019, 2018 and 2017 SW Averages

Parameter	SW 1 2019 Average	SW 1 2018 Average	SW 1 2017 Average	SW 2 2019 Average	SW 2 2018 Average	SW 2 2017 Average	SW 3 2019 Average	SW 3 2018 Average	SW 3 2017 Average	SW4 2019 Average	SW 4 2018 Average	SW 4 2017 Average
pH (pH unit)	-	-	6.5	6.9	6.5	5.9	5.7	5.5	5.4	-	6.5	5.5
TSS (mg/L)	-	-	68	31	25	26	32	186	803	-	61	7
TDS (mg/L)	-	-	641	473	360	396	670	505	501	-	224	186
Turbidity (NTU)	-	-		94	82	-	234	309	-	-	105	-
EC (µS/cm)	-	-	530	535	451	385	235	274	222.3	-	259	261
Nitrogen (Nitrate) (mg/L)	-	-	4.7	3.6	2.6	0.5	0.7	0.2	0.09	-	0.002	0.005
Total Nitrogen (mg/L)	-	-	-	4.4	3.9	-	1.9	1.1	-	-	0.8	-

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Parameter	SW 1 2019 Average	SW 1 2018 Average	SW 1 2017 Average	SW 2 2019 Average	SW 2 2018 Average	SW 2 2017 Average	SW 3 2019 Average	SW 3 2018 Average	SW 3 2017 Average	SW4 2019 Average	SW 4 2018 Average	SW 4 2017 Average
Total Phosphorous (mg/L)	-	-	0.1	0.07	0.05	0.3	0.14	0.12	0.80	-	0.02	0.02
Ammonia (mg/L)	-	-	0.1	0.08	0.05	0.1	0.03	0.05	0.03	-	0.15	0.02
Oil and Grease (mg/L)	-	-	10.6	<5	<5	6.5	<5	<5	13.3	-	<5	60.5
Calcium (mg/L)	-	-	5.2	4.5	3.3	8.9	3.0	2.5	4.8	-	4.0	3.7
Magnesium (mg/L)	-	-	5.4	5.1	4.5	12.5	3.5	2.7	10.2	-	6.0	5.3
Sodium (mg/L)	-	-	87.7	90.0	75.9	86.6	37.5	37.7	29.3	-	39	27.5
Potassium (mg/L)	-	-	2.3	2.1	2.1	5.5	1.5	1.2	3.4	-	2.0	2
Total Hardness (as CaCO ₃)	-	-	35.3	32.0	25.3	73.7	21.5	18	53.7	-	35	30.5
Arsenic (mg/L)	-	-	0.002	0.001	0.001	0.001	0.003	0.001	0.004	-	0.001	0.001
Cadmium (mg/L)	-	-	0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	0.0001	0.0001
Chromium (mg/L)	-	-	0.01	0.007	0.002	0.003	0.01	0.01	0.02	-	0.001	0.001
Copper (mg/L)	-	-	0.01	0.003	0.002	0.004	0.01	0.01	0.02	-	0.001	0.001
Nickel (mg/L)	-	-	0.003	0.003	0.001	0.002	0.007	0.005	0.01	-	0.001	0.001
Lead (mg/L)	-	-	0.01	0.002	0.001	0.002	0.013	0.007	0.02	-	0.001	0.001
Manganese (mg/L)	-	-	0.2	0.65	0.06	0.09	0.12	0.12	0.3	-	0.04	0.01
Vanadium (mg/L)	-	-	0.03	0.02	0.009	0.01	0.06	0.035	0.06	-	<0.01	0.001
Zinc (mg/L)	-	-	0.1	0.02	0.014	0.03	0.06	0.054	0.08	-	0.005	0.007

Summary of Dams (2017-2019):

Dam 1 –

- Slight increase in pH between 2017 and 2019 with results of 6.5, 6.9 and 7.0 for 2017, 2018 and 2019 respectively.
- Slight decrease in TSS from 68 mg/L to 36 mg/L between 2017 to 2018 and a significant increase to 119 mg/L in 2019.
- Slight increase in EC between 2017 and 2019 with results of 530 us/cm, 609 us/cm and 655 us/cm for 2017, 2018 and 2019 respectively.
- Average nitrate levels were above the criteria of 0.35 mg/L in 2019 (9.5 mg/L), 2018 (8.8 mg/L) and 2017 (4.7 mg/L). The 2019 result was a slight increase from both 2018 and 2017 levels. The site naturally has high levels of nitrate.
- Average phosphorous levels were above the criteria of 0.025 mg/L in 2019 at 0.07 mg/L which was an increase from 2018 (0.2 mg/L) and 2017 (0.1 mg/L).
- Average ammonia levels were above the criteria of 0.02 mg/L in 2019 at 0.04 mg/L which was a decrease from 2018 (0.08 mg/L) and 2017 (0.1 mg/L).
- Average chromium levels were above the criteria of 0.001 mg/L in 2019 at 0.004 mg/L which was an increase from 2018 (0.001 mg/L) and 2017 (0.001 mg/L).
- Average copper levels were above the criteria of 0.001 mg/L in 2019 at 0.004 mg/L which was an increase from 2018 (0.01 mg/L) and 2017 (0.004 mg/L).
- Average zinc levels were above the criteria of 0.021 mg/L in 2019 at 0.03 mg/L which was identical to 2018 at 0.03 mg/L and a slight increase from 2017 (0.01 mg/L).
- Average lead levels were equal to the criteria of 0.003 mg/L in 2019 (0.003 mg/L) which was an increase from 2018 (0.001 mg/L) and a decrease from 2017 (0.01 mg/L).

Dam 2 –

- No increase of pH between 2018 (6.6) and 2019 (6.6) with a slight increase from 2017 (6.2).
- Increase in TSS from 97 mg/L to 108 mg/L between 2017 and 2018 and a slight decrease in 2019 (52 mg/L).
- A slight decrease in EC from 443 us/cm to 417 us/cm between 2017 and 2018 and a slight increase in 2019 (603 us/cm).
- Average nitrate levels were above the criteria of 0.35 mg/L in 2019 at 0.39 mg/L which was a decrease from 2018 (0.86 mg/L) and 2017 (1.20 mg/L).
- Average phosphorous levels were above the criteria of 0.025 mg/L in 2019 at 0.03 mg/L which was a decrease from 2018 (0.04 mg/L) and 2017 (0.1 mg/L).
- Average ammonia levels were above the criteria of 0.02 mg/L in 2019 at 0.04 mg/L which was a decrease from 2018 (0.06 mg/L) and 2017 (0.1 mg/L).
- Average chromium levels were above the criteria of 0.001 mg/L in 2019 at 0.002 mg/L which was a decrease from 2018 (0.004 mg/L) and 2017 (0.005 mg/L).
- Average copper levels were above the criteria of 0.001 mg/L in 2019 at 0.004 mg/L which was a decrease from 2018 (0.015 mg/L) and 2017 (0.007 mg/L).
- Average zinc levels were below the criteria of 0.021 mg/L in 2019 at 0.02 mg/L which was a decrease from 2018 (0.03 mg/L) and 2017 (0.09 mg/L).
- Average lead levels were below the criteria of 0.003 mg/L in 2019 at 0.002 mg/L which was a slight decrease from 2018 (0.003 mg/L) and 2017 (0.004 mg/L).

For other parameters the main changes included an increase of TDS from 289 mg/L in 2018 to 423 mg/L in 2019 which was similar to the level recorded in 2017 (444 mg/L). Calcium increased from 5.2 mg/L to 16.5 mg/L between 2017 and 2018 and increased further in 2019 to 42.3 mg/L. **Dam 3 –**

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- Slight increase in pH between 2017 and 2019 with results of 6.5, 7.3 and 7.7 for 2017, 2018 and 2019 respectively. Slight decrease in TSS from 276 mg/L (2017) and 2018 (96 mg/L) to 34 mg/L in 2019. An increase in EC from 492 us/cm (2017) and 661 us/cm (2018) to 1067 mg/L in 2019.
 - Average nitrate levels were above the criteria of 0.35 mg/L in 2019 at 1.29 mg/L which was an increase from 2018 (0.8 mg/L) and 2017 (1.2 mg/L).
 - Average phosphorous levels were above the criteria of 0.025 mg/L in 2019 at 0.03 mg/L which was a decrease from 2018 (0.07 mg/L) and 2017 (0.3 mg/L).
 - Average ammonia levels were above the criteria of 0.02 mg/L in 2019 at 0.06 mg/L which was a slight decrease from 2018 (0.08 mg/L) and identical to 2017 (0.06 mg/L).
 - Average chromium levels were equal to the criteria of 0.001 mg/L in 2019 at 0.001 mg/L which was a slight decrease from 2018 (0.003 mg/L) and 2017 (0.014 mg/L).
 - Average copper levels were above the criteria of 0.001 mg/L in 2019 at 0.003 mg/L which was a slight decrease from 2018 (0.014 mg/L) and 2017 (0.01 mg/L).
 - Average zinc levels were above the criteria of 0.021 mg/L in 2019 at 0.02 mg/L which was a decrease from 2018 (0.04 mg/L) and 2017 (0.1 mg/L).
 - Average lead levels were below the criteria of 0.003 mg/L in 2019 at 0.0014 mg/L which was a slight decrease from 2018 (0.002 mg/L) and 2017 (0.01 mg/L).

For other parameters the main changes included an increase of TDS from 432 mg/L in 2018 to 649 mg/L in 2019 which was still lower than 2017 (1073 mg/L). Additionally, Calcium increased from 8.9 mg/L to 17.0 mg/L from 2017 to 2018 and increased further to 29.0 mg/L in 2019. Sodium increased from 82.9 mg/L to 101.3 mg/L from 2017 to 2018 and increased further to 166.0 in 2019. Magnesium decreased slightly from 11.6 mg/L to 9.2 mg/L between 2017 and 2018 and increased to 20.0 mg/L in 2019.

Summary of Creeks (2017-2019):

SW1 was not monitored during 2019 or 2018 due to no flow in the creek at the monitoring location. As required, SW 2-3 were monitored monthly during creek flow. SW4 was not monitored due to no flow in the creek. During creek flow SW4 will be 'tested biannually (when flowing) during operations'.

SW1 –

- No monitoring occurred during 2019 due to no flow in the creek at the monitoring location.

SW 2 –

- Slight increase in pH between 2017 and 2019 with results of 5.9, 6.5 and 6.9 for 2017, 2018 and 2019 respectively.
- TSS remained essentially neutral between 2017 and 2018 but increased from 25 mg/L in 2018 to 31 mg/L in 2019.
- Increase in EC between 2017 and 2019 with results of 385 us/cm, 451 us/cm and 535 us/cm for 2017, 2018 and 2019 respectively.
- Average nitrate levels were above the criteria of 0.35 mg/L in 2019 at 3.6 mg/L which was an increase from 2018 (2.6 mg/L) and 2017 (0.5 mg/L).
- Average phosphorous levels were above the criteria of 0.025 mg/L in 2019 at 0.07 mg/L which was an increase from 2018 (0.05 mg/L) and 2017 (0.3 mg/L).
- Average ammonia levels were above the criteria of 0.02 mg/L in 2018 at 0.08 mg/L which was an increase from 2018 (0.05 mg/L) but lower than 2017 (0.1 mg/L).
- Average chromium levels were above the criteria of 0.001 mg/L in 2019 at 0.007 which was an increase from 2018 (0.002 mg/L) and 2017 (0.003 mg/L).
- Average copper levels were above the criteria of 0.001 mg/L in 2019 at 0.003 mg/L which was an increase from 2018 (0.002 mg/L) but lower than 2017 (0.004 mg/L).

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- Average zinc levels were below the criteria of 0.021 mg/L in 2019 at 0.020 mg/L which was a slight increase from 2018 (0.014 mg/L) but lower than 2017 (0.03 mg/L).
 - Average lead levels were below the criteria of 0.003 mg/L in 2019 at 0.002 mg/L which was a slight increase from 2018 (0.001 mg/L) and identical to 2017 (0.002 mg/L).

For other parameters the main change included a decrease of TDS from 396 mg/L to 360 mg/L between 2017 and 2018 with an increase to 473 mg/L in 2019.

SW 3 –

- Slight increase in pH between 2017 and 2019 with results of 5.4, 5.5 and 5.7 for 2017, 2018 and 2019 respectively.
- Decrease in TSS between 2017 and 2019 with results of 803 mg/L, 186 mg/L and 32 mg/L for 2017, 2018 and 2019 respectively.
- Slight increase in EC between 2107 and 2108 from 222 us/cm to 274 us/cm and a slight decrease in 2019 (235 us/cm).
- Average nitrate levels were above the criteria of 0.35 mg/L in 2019 at 0.7 mg/L which was an increase from 2018 (0.2 mg/L) and 2017 (0.09 mg/L).
- Average phosphorous levels were above the criteria of 0.025 mg/L in 2019 at 0.14 mg/L which was a slight increase from 2018 (0.12 mg/L) but lower than 2017 (0.8 mg/L).
- Average ammonia levels were above the criteria of 0.02 mg/L in 2019 at 0.03 mg/L which was a decrease from 2018 (0.05 mg/L) and identical to 2017 (0.03 mg/L).
- Average chromium levels were above the criteria of 0.001 mg/L in 2019 at 0.011 mg/L which was identical to 2018 (0.01 mg/L) and lower than 2017 (0.02 mg/L).
- Average copper levels were above the criteria of 0.001 mg/L in 2019 at 0.01 mg/L which was identical to 2018 (0.01 mg/L) and lower than 2017 (0.02 mg/L).
- Average zinc levels were above the criteria of 0.021 mg/L in 2019 at 0.06 mg/L which was slightly higher than 2018 (0.054 mg/L) and lower than 2017 (0.08 mg/L).
- Average lead levels were above the criteria of 0.003 mg/L in 2019 at 0.013 mg/L which was a decrease from 2018 (0.007 mg/L) and 2017 (0.02 mg/L).

For other parameters the main changes included an increase in TDS from 501 mg/L and 505 mg/L during 2017 and 2018 respectively to 670 mg/L during 2019. Calcium decreased from between 2017 and 2018 from 4.8 mg/L to 2.5 mg/L and increased slightly to 3.0 mg/L during 2019. Magnesium decreased from between 2017 and 2018 from 10.2 mg/L to 2.7 mg/L and increased slightly to 3.5 mg/L during 2019. Sodium increased between 2017 to 2018 from 29.3 mg/L to 37.7 mg/L and decreased slightly to 37.5 mg/L during 2019.

SW4 –

- No monitoring occurred during 2019 due to no flow in the creek at the monitoring location.

7.3.3 Discharge Results

Controlled and uncontrolled discharges from each licenced discharge point is summarised below:

- LDP 001 – 3 discharge events over 8 days;
- LDP002 – 8 discharge events over 11 days; and
- LDP003 – 8 discharge events over 17 days.

pH and TSS exceedances for each licenced discharge point is summarised below:

- LDP001 - 4 TSS exceedances;
- LDP002 - 2 TSS exceedances; and

- LDP003 - 2 TSS exceedances.

There have been 19 discharge events across 36 days during 2019 from the combined LDP001, LDP002 and LDP003.

There was a total of 8 TSS exceedances from the combined LDP001, LDP002 and LDP003 discharges.

The monitoring results for these discharge events are presented in **Table 44**.

Table 44 Discharge Monitoring Results 2019

Discharge Point	Date	pH	EC ($\mu\text{S/cm}$)	Turbidity (NTU)	TSS (mg/L)	Oil and Grease (mg/L)	Comment
	EPL Criteria	6.5 - 8.5	-	-	40	5	
LDP001	24-June-2019	6.7	481	300	182	<5	Uncontrolled discharge. Non-Compliant for TSS
	25-June-2019	6.6	463	300	139	<5	Uncontrolled discharge Non-Compliant for TSS
	26-June-2019	6.9	476	240	96	<5	Uncontrolled discharge Non-Compliant for TSS
	27-June-2019	7.0	496	200	103	<5	Uncontrolled discharge Non-Compliant for TSS
	09-September-2019	6.7	679	8	15	<5	Controlled discharge.
	10-September-2019	7.0	672	7	13	<5	Controlled discharge.
	11-September-2019	7.4	638	8	13	<5	Controlled discharge.
	15-October-2019	7.0	528	17	40	<5	Controlled discharge.
LDP002	23-January-2019	6.9	251	50	18	<5	Controlled discharge.
	08-April-2019	6.6	247	60	10	<5	Controlled discharge
	09-April-2019	6.6	270	75	22	<5	Controlled discharge
	21-May-2019	6.8	326	140	93	<5	Controlled discharge. Non - compliant for TSS
	11-June-2019	7	446	55	24	<5	Controlled discharge
	24-June-2019	6.7	352	90	49	5	Uncontrolled discharge Non-Compliant for TSS
	25-June-2019	6.6	354	55	27	<5	Uncontrolled discharge
	30-July-2019	6.9	450	17	10	<5	Controlled discharge.
	10-September-2019	7.1	357	75	29	<5	Controlled discharge.

2019 Annual Review

Karuah East Quarry Pty Ltd

Discharge Point	Date	pH	EC (µS/cm)	Turbidity (NTU)	TSS (mg/L)	Oil and Grease (mg/L)	Comment	
	11-September-2019	6.8	342	70	33	<5	Controlled discharge.	
	30-September-2019	7	227	50	18	<5	Controlled discharge.	
LDP003	23-January-2019	8.3	975	50	19	<5	Controlled discharge	
	24-January-2019	7.9	983	50	19	<5	Controlled discharge	
	08-April-2019	7.4	546	90	15	<5	Controlled discharge	
	09-April-2019	7.5	525	90	18	<5	Controlled discharge.	
	10-April-2019	7.3	574	120	34	<5	Controlled discharge.	
	15-May-2019	7.9	952	25	16	<5	Controlled discharge	
	16-May-2019	7.8	1,010	22	14	<5	Controlled discharge	
	17-May-2019	7.7	942	26	17	<5	Controlled discharge	
			7.6	722	90	51	<5	Uncontrolled discharge Non-Compliant for TSS
	26-June-2019		7.5	748	80	46	<5	Uncontrolled discharge Non-Compliant for TSS
	27-June-2019							
	30-July-2019	7.7	984	28	11	<5	Controlled discharge	
	01-August-2019	7.7	907	60	36	<5	Controlled discharge	
	09-September-2019	8.3	1,160	18	10	<5	Controlled discharge	
	10-September-2019	8.4	1,170	19	9	<5	Controlled discharge	
	11-September-2019	8.2	1,100	18	7	<5	Controlled discharge	
	12-September-2019	8.3	1,120	21	9	<5	Controlled discharge	
30-September-2019	7.9	829	31	13	<5	Controlled discharge		

Discharge Analysis

- All four TSS exceedances for LDP001 occurred during June 2019 with the largest exceedance recording 182 mg/L on the 24 June 2019;
- The two TSS exceedances for LDP002 occurred between May and June 2019, the largest exceedance recording 93 mg/L on the 21 May 2019; and
- The two TSS exceedances for LDP003 occurred during June 2019 with the largest exceedance recording 51 mg/L on 26 June 2019.

Due to the fact that the quarry was not operational until mid-year, less water was required for operational purposes than what would be anticipated and planned for (as per the SWMP). For this reason, the number of discharges conducted was atypically elevated.

7.4 Groundwater Monitoring Results

7.4.1 Approved Criteria

There are no criteria applicable to groundwater monitoring in Project Approval 09_0175 or EPL 20611.

In accordance with the approved WMP, groundwater levels are monitored on a quarterly basis to identify any adverse impacts arising from the operation of the quarry in the future, and to identify long-term groundwater level trends. Groundwater samples will be collected for laboratory analysis on a 6-monthly basis. The groundwater quality results will be laboratory analysed for the parameters below and compared to background water quality results:

- pH, EC, Total Dissolved Solids (TDS); Alkalinity;
- Total nitrogen, total phosphorus;
- Major ions, calcium, magnesium, sodium, potassium, chloride, sulphate, carbonate, bicarbonate;
- Total Petroleum Hydrocarbon (TPH); and
- BTEX (benzene, toluene, ethyl benzene, xylene). Additional Analysis – 12 monthly (every second sample only):
- Nutrient suite: total nitrogen, nitrate, total Kjeldahl nitrogen, total phosphorus, phosphate;
- Metals (arsenic, cadmium, chromium, copper, lead, zinc, nickel, manganese, mercury, total iron, filterable iron);
- Polycyclic Aromatic Hydrocarbon (PAH); and
- Organophosphorus pesticides, phenoxy acid herbicides.

The existing monitoring bores at BH205, BH207, BH208 and BH303 are used for monitoring groundwater of the quarry area. BH207 was relocated in September 2016 and BH205 was relocated on 11 March 2017. Both of these piezometers were relocated within 30m to their original locations to allow construction to progress.

New monitoring bores will be installed if any existing monitoring bores are destroyed during the quarry operations or are subject to general failure. The locations of new bores will be added to the Water Management Plan and provided to DPIE and Water in NSW.

7.4.2 Monitoring Results

Groundwater Level

Table 45 shows a comparison of groundwater levels in 2017, 2018 and 2019. All groundwater locations were monitored four times during 2019 with a requirement for quarterly monitoring of groundwater levels as per the WMP. As evident, water levels have remained relatively consistent across all locations, with only BH205 showing a consistent decrease in water level since the start of monitoring.

Table 45 Groundwater Quality Results for Key Parameters in 2017, 2018 and 2019

Date	Groundwater level (metres below ground level)			
	BH205	BH207	BH208	BH303
April 2017	25.3	9.4	20.0	30.7
October 2017	22.9	8.9	19.9	30.6
January 2018	21.9	9.1	20.3	30.7
April 2018	21.7	9.2	20.5	30.8
July 2018	20.5	8.9	20.5	30.9
October 2018	20.4	9.3	19.9	30.8
January 2019	20.1	9.2	20.4	31.0
April 2019	20.3	9.2	20.5	30.6
July 2019	19.7	9.1	20.6	31.1
October 2019	18.6	8.2	20.6	30.7

Groundwater Quality

Sampling of groundwater monitoring locations occurred on 30 May 2019 and 30 October 2019 in accordance with GW the six-monthly requirement to monitor groundwater quality data as per the WMP. Note: BH 208 was only monitored once during 2019 due to insufficient water levels on the 30 October 2019. Results have been compared against data sampled from 2010 (pre-Karuah East Quarry) in **Table 46**.

Table 46 Average Groundwater Quality Results for Key Parameters

Monitoring Location	pH	TDS (mg/L)	EC (µS/cm)	Number of Samples
Pre-Karuah East (Average results from 2010 data)				
BH 205	7.2	665	Not sampled	2
BH 207	7.4	1540	Not sampled	1
BH 303	6.3	600	Not sampled	1
Average Results 2016				
BH 205	7.3	1182	2015	2
BH 207	6.9	1578	2780	2
BH 208	6.4	2000	3010	2
BH 303	6.4	889	1555	2

Monitoring Location	pH	TDS (mg/L)	EC (µS/cm)	Number of Samples
Average Results 2017				
BH 205	8.7	1200	2230	2
BH 207	7.2	1800	3600	2
BH 208	6.6	1900	3500	2
BH 303	6.9	1175	2350	2
Average Results 2018				
BH 205	8.8	1150	2500	2
BH 207	7.2	1020	1940	2
BH 208	7.10	3000	3000	1
BH 303	7.5	1250	2550	2
Average Results 2019				
BH 205	8.3	1734	2432	2
BH 207	6.9	1579	2527	2
BH 208	6.9	-*	2505	1
BH 303	6.2	1557	2404	2

*No data was recorded during 2019 resulting in a non-compliance in accordance with the Karuah East Water Management Plans requirement to monitor groundwater quality on a 6-monthly basis.

The pH results in 2019 are slightly higher than those recorded in pre-Karuah East but lower than results from 2018. TDS levels continued to be highly variable across the years. Average EC was lower at BH 205, BH 208 and BH 303 in 2019 as compared with 2018 and higher at BH 207. EC was not sampled during 2010 monitoring.

Karuah East will continue to monitor groundwater quality during 2020.

7.5 Water Take

There is no Water Take at the Karuah East Quarry, with the site having no groundwater extraction licences.

7.6 Salinity Trading Scheme Credit Use

Not applicable to Karuah East Quarry.

7.7 Compensatory Water to Other Users

Not applicable to Karuah East Quarry.

8.0 REHABILITATION

There have been no opportunities to establish rehabilitation at the quarry site in its current form. Future rehabilitation activities will be undertaken in accordance with the approved LRMP.

8.1 Rehabilitation Performance During Reporting Period

A summary of rehabilitation at Karuah East Quarry is outlined in **Table 47**.

Table 47 Summary of Rehabilitation Performance During Reporting Period

Guideline Requirement	Site Comment
Extent of the operations and rehabilitation at completion of the reporting period	No Rehabilitation.
Agreed post- rehabilitation land use	Final landuse is outlined within the LRMP. The vegetation at closure will be native woodland consistent with the surrounding bushland. The LRMP was resubmitted to DPIE on 13 February 2020 to allow for the movement of overburden material to Karuah Quarry to assist with rehabilitation of the final landform.
Key rehabilitation performance indicators	No Rehabilitation.
Renovation or removal of buildings	No Rehabilitation.
Any other Rehabilitation Taken including: <ul style="list-style-type: none"> • Exploration activities; • Infrastructure; • Dams; and • The installation or maintenance of fences, bunds and any other works. 	No Rehabilitation.
Any rehabilitation areas which have received formal sign off from the Resources Regulator.	No Rehabilitation.
Variations to activities undertaken to those proposed (including why there were variations and whether the Resources Regulator was notified)	No Rehabilitation.
Outcomes of trials, research projects and other initiatives	No Rehabilitation.
Key issues that may affect successful rehabilitation	No Rehabilitation.

Table 48 Disturbance and Rehabilitation Status

Quarry Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
Total Quarry Footprint (including access road in)	24.8 ha	25.07 ha	26.5 ha
Total Active Disturbance	24.8 ha	25.07 ha	26.5 ha
Land Being Prepared for Rehabilitation	0	0	0
Land Under Active Rehabilitation	0	0	0
Completed Rehabilitation	0	0	0

8.2 Actions for the next Reporting Period

The DPE (2015) *Annual Review Guidelines* requires an outline of the rehabilitation actions proposed during the next reporting period. These actions are detailed in **Table 49**.

Table 49 Actions for the Next Reporting Period

Action	Site Comment
Describe the steps to be undertaken to progress agreement during next reporting period, where final rehabilitation outcomes have not yet been agreed between stakeholders.	There is no planned additional rehabilitation at the site in the next Annual Review period.
Outline proposed rehabilitation trials, research projects and other initiatives to be undertaken during next reporting period.	There are no additional rehabilitation trials during the next Annual Review period.
Summary of rehabilitation activities proposed for next report period.	There is no planned additional rehabilitation at the site in the next Annual Review period.

9.0 COMMUNITY

9.1 Community Engagement Activities

A Community Consultative Committee (CCC) was formed for the Karuah East Quarry in accordance with Schedule 5, Condition 6 of PA 09_0175, which states:

The Proponent shall establish and operate a Community Consultative Committee (CCC) for the project. The CCC must:

(a) be established and operated in general accordance with the Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects (Department of Planning, 2007, or its latest version); and

(b) be established prior to the commencement of construction activities, to the satisfaction of the Secretary.

Meetings were held on the following dates:

- 4 March 2019; and
- 2 September 2019.

The CCC comprises of an independent chair, three community members, two company representatives and two environmental consultants. Other attendees include a representative from the Midcoast council. Meeting minutes are found on the website <http://hunterquarries.com.au/karuah-east-documents/>.

Key aspects discussed include:

- Site inspection
- Penalty infringement notice regarding failure of Karuah East to construct 4m noise barriers;
- The purpose and nature of MOD 2;
- Proposed modification to noise criteria ,stockpiling area and the changed legislative process;
- Proposed feral pig trapping in the KEQ biodiversity offset site and discussions around the prevalence of pest species in the locality;
- Presentation of the Company Report;
- Process of storing overburden;
- A blast which occurred during June 2018 which was within the blast criteria but appeared to be abnormally loud;
- Schedule for next blast; and
- Discussions around the nature and purpose of a new modification that intends update the noise criteria.

9.2 Community Contributions

The Karuah East Quarry feels strongly about supporting the local community and has a history of community contributions. Community contributions are being made through Hunter Quarries Pty Limited.

9.3 Complaint Management

If a complaint is received, it is logged and investigated by the Quarry Manager. Feedback is then provided to the complainant and government agencies, as required. This process forms a part of the Karuah East Environmental Management Strategy (EMS).

A telephone number has been established for the purpose of receiving complaints and enquiries from the community and this number is available on the Karuah East Quarry website (www.hunterquarries.com.au) and is provided on a sign at the entrance to the quarry. The community can contact the quarry on (02) 4997 5966 as well as through the Karuah East Quarry website.

9.3.1 2019 Complaints

There were two complaints received regarding Karuah East Quarry during this Annual Review reporting period. This is the same number of complaints received in the 2018 and the 2017 reporting period.

Karuah East Quarry received a complaint on 23 July 2019 regarding the escape of cattle through a broken perimeter fence at Karuah East Quarry onto a resident's lawn. Karuah East Quarry repaired the fence and notified the owner of the cattle's whereabouts.

A complaint was received on 30 January 2019 regarding what was believed to be excessive vibration from a blast at Karuah East Quarry. Karuah East informed the complainant that no blasts were scheduled for the day and that Karuah East could add the resident to a blast registry. The resident was satisfied with this action.

10.0 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit is required for at Karuah East Quarry in accordance with Schedule 5 Condition 9 of PA 09_0175. This is to be completed “within 12 months of the commencement of development on the site, and every 3 years thereafter”. The first Independent Environmental Audit was completed in July 2017 by EMM Consulting. A copy of the Independent Environmental Audit is available on the website <http://hunterquarries.com.au/karuah-east-documents/>.

The Audit Action Plan and current progress against the recommendations is contained in **Appendix 8**.

11.0 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

11.1 Summary of Incidents

Four buckets (approx. 20L) filled with used oil were discovered on 21 August 2019 in the water drain along Blue Rock Close which is not Hunter Quarries Property. The buckets were relocated to waste oil disposal at Karuah Quarry workshop. Staff was made aware of the incident through a Toolbox talk and urged to be vigilant of unknown vehicles using Blue Rock Close. Due to the minor nature of this incident, Karuah did not need to activate the Pollution Incident Response Management Plan or report the spill to authorities.

Three buckets (approx. 15L) filled with used oil were discovered on 10 September 2019 on the left handside of Blue Rock Close heading towards Karuah East Quarry. The buckets (2 full and 1 empty) were relocated to waste oil disposal at Karuah Quarry workshop. Staff was made aware of the incident through a Toolbox talk and urged to be vigilant of unknown vehicles using Blue Rock Close. Staff was made aware of the incident through a Toolbox talk and urged to be vigilant of unknown vehicles using Blue Rock Close. Due to the minor nature of this incident, Karuah did not need to activate the Pollution Incident Response Management Plan or report the spill to authorities.

11.2 Summary of Non-compliance

A summary of other non - compliances is outlined in **Table 2**.

11.3 Environmental Training

Training of Karuah East Quarry employees and contractors is undertaken monthly throughout the year with a focus on environmental awareness and incidents. Toolbox talks focusing on pollution incidents occurred following oil drums being discovered in the vicinity of Blue Rock Close (**refer to Section 11.1**)

12.0 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Table 50 outlines the proposed actions in the next Annual Review.

Table 50 Proposed Actions in the Next Annual Review

Proposed Action	Timeline	Management Plan Requires Revision
Continue environmental monitoring in accordance with management plans and approval requirements	On-going	Possibly
Continue CCC and community support	On-going	No
Continue to update the website with monitoring data and key environment and community information	On-going	No
Complete Independent Environmental Audit	2020	Possibly
Install fauna crossing	2020	No

13.0 REFERENCES

The following documents and reports have been used to assist in writing the quarry's Annual Review:

Management Plans

- *Air Quality and Greenhouse Gas Management Plan (SLR 2019);*
- *Biodiversity Offset Area Management Plan (Kleinfelder 2018);*
- *Blast Management Plan (SLR 2019);*
- *Environmental Management Strategy (SLR 2019);*
- *Heritage Management Plan (RPS 2019);*
- *Landscape and Rehabilitation Management Plan (Kleinfelder and SLR 2019);*
- *Noise Management Plan (SLR 2019);*
- *Tetratheca juncea Translocation Program (Firebird 2019);*
- *Traffic Management Plan (Streetwise 2015); and*
- *Water Management Plan (SLR 2019).*

Monitoring Reports

- *2019 Annual Monitoring Report - Karuah East Quarry Biodiversity Offset Area and Lot 12 (Kleinfelder 2020);*
- *Karuah East Quarry-Quarterly Noise Monitoring September 2019 (Thearle Acoustics 2019);*
- *Karuah East Quarry-Quarterly Noise Monitoring December 2019 (Thearle Acoustics 2019a);*
- *Operational Compliance Noise Monitoring-Karuah East Quarry Quarter 1 February 2019 (SLR 2019); and*
- *Operational Compliance Noise Monitoring-Karuah East Quarry Quarter 2 May 2019 (SLR 2019a).*
- *Tetratheca juncea Monitoring Report for the Karuah East Quarry Site (Project Approval 09-0175) (Firebird, 2020).*

Statutory Documents

- *Section 75W Application (MOD 1) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area (ADW Johnson 2018a);*
- *Section 75W Application (MOD 2) to amend Part 3A Project Approval 09_0175 Minor Increase to Approved Disturbance Area (ADW Johnson 2018b);*
- *Environmental Assessment Report – Proposed Karuah East Quarry (ADW Johnson 2013);*
- *Environment Protection Licence (No. 20611);*
- *Preferred Project Report - Proposed Karuah East Quarry (ADW Johnson July 2013);*
- *Project Approval (PA 09_0175); and*
- *Federal Approval (EPBC 2014/7278).*

APPENDIX 1 – Project Approval and Federal Approval

Project Approval

Section 75J of the *Environmental Planning and Assessment Act 1979*

As delegate of the Minister for Planning, the Planning Assessment Commission approves the project application referred to in Schedule 1, subject to the conditions in Schedules 2 to 5.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

Alan Coutts
Member of the Commission

David Johnson
Member of the Commission

Sydney

17 June 2014

SCHEDULE 1

Application Number: 09_0175
Proponent: Karuah East Quarry Pty Limited
Approval Authority: Minister for Planning
Land: Lot 12 DP 1024564
Lot 13 DP 1024564
Lot 202 DP 1042537
Lot 26 DP 1024341
Lot 27 DP 1024341
Lot 16 DP 1024564
Lot 17 DP 1024564
Project: Karuah East Quarry Project

Green text represents Mod 1 (Increased disturbance area) – April 2018

Red text represents Mod 2 (Increased disturbance area) – December 2018

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DEFINITIONS

Annual review	The review required under condition 4 of Schedule 5
BCA	Building Code of Australia
Biodiversity offset strategy	The conservation and enhancement strategy described in the EA, and depicted conceptually in the figure in Appendix 4
CCC	Community Consultative Committee
Conditions of this approval	Conditions contained in Schedules 2 to 5 inclusive
Council	MidCoast Council
CPI	Australian Bureau of Statistics Consumer Price Index
Department	Department of Planning and Environment
DoI-Water	Department of Industry – Crown Lands and Water Division
DRG	Division of Resources and Geoscience within the Department
EA	Environmental Assessment titled <i>Environmental Assessment Report, Proposed Karuah East Hard Rock Quarry</i> , prepared by ADW Johnson Pty Limited and dated 31 January 2013, including the response to submissions prepared by ADW Johnson Pty Limited and dated 31 May 2013 and the Preferred Project Report titled <i>Preferred Project Report Proposed Karuah East Quarry</i> , prepared by ADW Johnson Pty Limited and dated 30 July 2013
EA (MOD 1)	Environmental Assessment titled <i>Karuah East Quarry Section 75W Application (MOD 1) Minor Increase to Approved Disturbance Area</i> prepared by ADW Johnson Pty Limited and dated 18 January 2018; including the response to submissions prepared by ADW Johnson Pty Limited and dated 9 March 2018
EA (MOD 2)	Environmental Assessment titled <i>Karuah East Quarry Section 75W Application (MOD 2) Minor Increase to Approved Disturbance Area</i> prepared by ADW Johnson Pty Limited and dated 30 August 2018, including the response to submissions prepared by ADW Johnson Pty Limited and dated 25 October 2018
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPL	Environment Protection Licence under the <i>POEO Act</i>
Extraction Area	Extraction Area shown in Figure 1 in Appendix 1
Feasible	Feasible relates to engineering considerations and what is practical to build
Incident	The occurrence of a set of circumstances that causes or threatens to cause material harm which may or may not be or cause a non-compliance
Land	As defined in the EP&A Act, except where used in the noise and air quality conditions in schedules 3 and 4 of this approval where it is defined to mean the whole of a lot, or contiguous lots, owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Material harm	Is harm that: <ul style="list-style-type: none">• involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial; or• results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)

	This definition excludes “harm” that is authorised under either this consent or any other statutory approval.
Minister	Minister for Planning, or delegate
Mitigation	Activities associated with reducing the impacts of the project
Modification 1	The modification to the project, as described in EA (MOD 1)
Modification 2	The modification to the project, as described in EA (MOD 2)
Planning Secretary	Planning Secretary under the EP&A Act, or nominee
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Privately-owned land	Land that is not owned by a public agency or the Proponent (or its subsidiary)
Project	The development as described in the EA
Project layout	The layout of the project as shown in the figures in Appendix 1
Proponent	Karuah East Quarry Pty Limited, or its successors in title, or any other person who seeks to carry out the project
Public infrastructure	Linear and other infrastructure that provides services to the general public, such as roads, railways, water supply, drainage, sewerage, gas supply, electricity, telephone, telecommunications, etc.
Quarrying operations	Includes the removal of overburden and extraction, processing, handling, storage and transportation of quarry products on the site
Quarry products	Extractive material which extracted from and transported from the site
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Rehabilitation	The treatment or management of land disturbed by the project for the purpose of establishing an appropriately revegetated, safe, stable and non-polluting environment
Residence	Existing or approved dwelling at the date of approval of Modification 1
RMS	Roads and Maritime Services
Site	The land listed under “Land” in schedule 1
Statement of commitments	The Proponent’s commitments in Appendix 6
Waste	Has the same meaning as the definition of the term in the Dictionary to the POEO Act

SCHEDULE 2 ADMINISTRATIVE CONDITIONS

OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT

1. In addition to meeting the specific performance criteria established under this approval, the Proponent **must** implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation, or rehabilitation of the project.

TERMS OF APPROVAL

2. The Proponent **must** carry out the project generally in accordance with the:
 - (a) EA;
 - (b) statement of commitments;
 - (c) EA (MOD 1); **and**
 - (d) EA (MOD 2).
- 2A The Proponent **must** carry out the project in accordance with the conditions of this approval.
3. The conditions of this approval and directions of the **Planning** Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and a document referenced in condition 2 of this Schedule. If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency.

*Note: For the purposes of this condition, there will be an inconsistency between documents if it is not possible to comply with both documents, or in the case of a condition of approval or direction of the **Planning** Secretary, and a document, if it is not possible to comply with both the condition or direction, and the document.*

4. Consistent with the requirements of this approval, the **Planning** Secretary may make written directions to the Proponent in relation to:
 - (a) the content of any strategy, study, system, plan, program, review, audit, notification, report or correspondence submitted under or otherwise made in relation to this approval, including those that are required to be, and have been, approved by the **Planning** Secretary; and
 - (b) the implementation of any actions or measures contained in any such document referred to in (a) above.

LIMITS ON APPROVAL

Quarrying Operations

5. The Proponent may carry out quarrying operations on the site until 31 December 2034.

*Note: Under this approval, the Proponent is required to rehabilitate the site and carry out additional undertakings to the satisfaction of the **Planning** Secretary. Consequently, this approval will continue to apply in all other respects other than the right to conduct quarrying operations until the rehabilitation of the site and those undertakings have been carried out to a satisfactory standard.*

Production Limit

6. The Proponent **must** not extract, process and transport more than 1.5 million tonnes of quarry products from the site in any calendar year.

Hours of Operation

7. The Proponent **must** comply with the operating hours in Table 1.

Table 1: Operating hours

Activity	Operating Hours
Quarrying Operations	7.00 am to 6.00 pm, Monday to Friday; and 7.00 am to 1.00 pm, Saturdays. No quarrying operations on Sundays or Public Holidays.
Construction activities	7.00 am to 6.00 pm, Monday to Friday; and 8.00 am to 1.00 pm, Saturdays, unless noise from these activities does not exceed 35dB(A) $L_{Aeq}(15\ min)$ at any privately-owned residence.
Maintenance activities	24 hours a day, 7 days per week, providing maintenance activities are inaudible at any privately-owned residence

Note: This condition does not apply in the event of a direction from police or other relevant authority for safety or emergency reasons regarding works which may need to be undertaken to avoid loss of life, property loss and/or to prevent environmental harm.

STRUCTURAL ADEQUACY

8. The Proponent **must** ensure that any new buildings and structures, and any alterations, or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

Notes:

- Under Part 6 of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for proposed building works.
- Part 8 of the EP&A Regulation sets out the requirements for the certification of the project.

DEMOLITION

9. The Proponent **must** ensure that all demolition work on site is carried out in accordance with AS 2601-2001: *The Demolition of Structures*, or its latest version.

PROTECTION OF PUBLIC INFRASTRUCTURE

10. The Proponent **must**:
- repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the project; and
 - relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the project.

DEVELOPER CONTRIBUTIONS

11. The Proponent **must** pay Council, in accordance with Council's *Great Lakes Wide Development Contributions Plan (November 2007) – Amended*:
- a one-off Headquarters Building contribution of \$1.00 per \$1,000.00 of capital value of the project; and
 - annual road maintenance contributions of \$.037 per tonne per km, for every tonne of quarry products transported from the site on local roads in accordance with Council's *Great Lakes Wide Development Contributions Plan (November 2007) – Amended*. Each payment must be:
 - paid to Council at the end of each calendar year;
 - based on weighbridge records of the quantity of quarry products transported from the site; and
 - increased annually over the life of the project in accordance with the CPI.

Note: If the parties are not able to agree on any aspect of the road maintenance contributions, either party may refer the matter to the **Planning** Secretary for resolution.

OPERATION OF PLANT AND EQUIPMENT

12. The Proponent **must** ensure that all plant and equipment used at the site is:
- (a) maintained in a proper and efficient condition; and
 - (b) operated in a proper and efficient manner.

STAGED SUBMISSION OF ANY STRATEGY, PLAN OR PROGRAM

13. With the approval of the **Planning** Secretary, the Proponent may submit any strategy, plan or program required by this approval on a progressive basis.

Notes:

- *While any strategy, plan or program may be submitted on a progressive basis, the Proponent will need to ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times; and*
- *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*

PRODUCTION DATA

14. The Proponent **must**:
- (a) provide annual quarry production data to **DRG** using the standard form for that purpose; and
 - (b) report this data in the Annual Review (see condition 4 of Schedule 5).

COMPLIANCE

15. The Proponent **must** ensure that all employees, contractors and sub-contractors are made aware of, and instructed to comply with, the conditions of this approval relevant to activities they carry out in respect of the development.

APPLICABILITY OF GUIDELINES

16. References in the conditions of this approval to any guideline, protocol, Australian Standard or policy are to such guidelines, protocols, standards or policies in the form they are in as at the date of this approval.

However, consistent with the conditions of this approval and without altering any limits or criteria in this approval, the **Planning** Secretary may, when issuing directions under this approval in respect of ongoing monitoring and management obligations, require compliance with an updated or revised version of such a guideline, protocol, standard or policy, or a replacement of them.

EVIDENCE OF CONSULTATION

17. Where conditions of this approval require consultation with an identified party, the Proponent **must**:
- (a) consult with the relevant party prior to submitting the subject document for approval; and
 - (b) provide details of the consultation undertaken including:
 - (i) the outcome of that consultation, matters resolved and unresolved; and
 - (ii) details of any disagreement remaining between the party consulted and the Proponent and how the Proponent has addressed the matters not resolved.

SCHEDULE 3 ENVIRONMENTAL PERFORMANCE CONDITIONS

IDENTIFICATION OF APPROVED LIMITS OF EXTRACTION

1. The Proponent shall, prior to carrying out quarrying operations on the site:
 - (a) engage a registered surveyor to mark out the boundaries of the approved limits of extraction within the Extraction Area; and
 - (b) submit a survey plan of the extraction boundaries, to the satisfaction of the **Planning** Secretary.
2. The Proponent **must** ensure that the extraction boundaries are clearly marked at all times while quarrying operations are being carried out, in a manner that allows the limits of extraction to be clearly identified.

NOISE

Operational Noise Criteria

3. The Proponent **must** ensure that the operational noise generated by the project does not exceed the criteria in Table 2.

Table 2: Operational noise criteria (dB(A) $L_{Aeq}(15\text{ min})$)

Location	Criteria (day)
Residence on Lot 11 DP 1024564	43
A	40
B	37
G	38
All other residences	35

Notes:

- Receiver locations are shown in Appendix 2.
- Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.
- Appendix 4 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, the noise criteria in Table 2 do not apply if the Proponent has an agreement with the relevant landowner to generate higher noise levels, and the Proponent has advised the Department in writing of the terms of the agreement.

Road Traffic Noise Criteria

4. The Proponent **must** take all reasonable and feasible measures to ensure that the traffic noise generated by the project does not cause additional exceedances of the criteria in Table 3 at any residence on privately-owned land.

Table 3: Road traffic noise criteria (dB(A) $L_{Aeq}(\text{period})$)

Road	Criteria (day)
Pacific Highway	60
Local roads	55

Cumulative Noise Criteria

5. The Proponent **must** implement all reasonable and feasible measures to ensure that the noise generated by the project combined with the noise generated by adjacent quarrying operations does not cause any exceedances of the criteria in Table 4.

Table 4: Cumulative noise criteria (dB(A) $L_{Aeq(period)}$)

Location	Criteria (day)
F	50
G	50
All other privately-owned residences, except the residence on Lot 11	55

Notes:

- Receiver locations are shown in Appendix 2.
- The structure used as a residence on Lot 11 is excluded from Table 4 because the other major contributor to cumulative noise totals is quarrying operations conducted on this Lot, under agreement with the Lot owner.
- Cumulative noise is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.
- Appendix 4 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

Operating Conditions

6. The Proponent **must**:
- implement best management practice, to minimise the construction, operational and traffic noise of the project;
 - minimise the noise impacts of the project during meteorological conditions when the noise limits in this approval do not apply; and
 - regularly assess noise monitoring data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this approval;
 - apply and enforce a speed limit of 40 km/hour for all project-related vehicles on site;
 - ensure that project-related trucks slowing to use the intersection of Branch Lane and Andesite Road do not use engine or compression braking systems, to the satisfaction of the **Planning** Secretary.

Noise Management Plan

7. The Proponent **must** prepare a Noise Management Plan for the project to the satisfaction of the **Planning** Secretary. This plan **must**:
- be prepared by a suitably qualified expert whose appointment has been approved by the **Planning** Secretary;
 - be prepared in consultation with EPA, and submitted to the **Planning** Secretary for approval prior to the commencement of construction activities;
 - describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this approval;
 - describe the proposed noise management system in detail; and
 - include a monitoring program that:
 - uses attended and unattended monitoring to evaluate the compliance of the project against the noise criteria in this approval;
 - evaluates and reports on:
 - the effectiveness of the on-site noise management system; and
 - compliance against the noise operating conditions; and
 - defines what constitutes a noise incident and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

The Proponent **must** implement the plan as approved by the **Planning** Secretary.

BLASTING

Blasting Criteria

8. The Proponent **must** ensure that blasting on the site does not cause exceedances of the criteria in Table 5.

Table 5: Blasting criteria

Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Any residence on privately-owned land, or any public infrastructure	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months

However, these criteria do not apply if the Proponent has a written agreement with the relevant landowner or infrastructure provider/owner, and the Proponent has advised the Department in writing of the terms of this agreement.

Blasting Hours

9. The Proponent **must** ensure that blasting on site is only carried out during the hours in Table 6.

Table 6: Blasting hours

Day	Blasting hours
Monday – Friday	9.00 am to 4.00 pm
Saturdays, Sundays and Public Holidays	No blasting

Blasting Frequency

10. The Proponent **must** not carry out more than 2 blasts a week on the site, unless an additional blast is required following a blast misfire.

Note: A blast may involve a number of explosions within a short period, typically less than two minutes.

Operating Conditions

11. The Proponent **must**:
- implement best blast management practice to:
 - protect the safety of people and livestock in the surrounding area;
 - protect public or private infrastructure/property in the surrounding area from any damage; and
 - minimise the dust and fume emissions of any blast;
 - schedule blasts to avoid the blasting schedule of any nearby quarrying operation;
 - operate a suitable system to enable the public to get up-to-date information on the proposed blasting schedule on the site, and
 - not undertake blasting within 500 metres of:
 - any public road without the approval of the relevant road authority; or
 - any land outside the site not owned by the Proponent, unless:
 - the Proponent has a written agreement with the relevant landowner to allow blasting to be carried out closer to the land, and the Proponent has advised the Department in writing of the terms of this agreement, or
 - the Proponent has:
 - demonstrated to the satisfaction of the **Planning** Secretary that the blasting can be carried out closer to the land without compromising the safety of the people or livestock on the land, or damaging the buildings and/or structures on the land; and

- updated the Blast Management Plan to include the specific measures that would be implemented while blasting is being carried out within 500 metres of the land,
to the satisfaction of the **Planning** Secretary.

Blast Management Plan

12. The Proponent **must** prepare a Blast Management Plan for the project to the satisfaction of the **Planning** Secretary. This plan must:
- (a) be prepared by a suitably qualified expert whose appointment has been approved by the **Planning** Secretary;
 - (b) be prepared in consultation with Council and EPA, and submitted to the **Planning** Secretary for approval prior to the commencement of construction activities;
 - (c) describe the measures that would be implemented to ensure:
 - best management practice is being employed; and
 - compliance with the relevant conditions of this approval;
 - (d) include a road closure protocol if blasting occurs within 500 metres of a public road;
 - (e) include a specific blast fume management protocol, to demonstrate how emissions will be minimised including risk management strategies if blast fumes are generated; and
 - (f) include a monitoring program for evaluating the performance of the project including:
 - compliance with the applicable criteria; and
 - minimising fume emissions from the site.

The Proponent **must** implement the plan as approved by the **Planning** Secretary.

AIR QUALITY

Air Quality Criteria

13. The Proponent **must** ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the project do not exceed the criteria in Tables 7 to 9 at any residence on privately-owned land.

Table 7: Long-term impact assessment criteria for particulate matter

Pollutant	Averaging period	^d Criterion
Total suspended particulates (TSP)	Annual	^a 90 µg/m ³
Particulate matter < 10 µm (PM ₁₀)	Annual	^a 30 µg/m ³

Table 8: Short-term impact assessment criteria for particulate matter

Pollutant	Averaging period	^d Criterion
Particulate matter < 10 µm (PM ₁₀)	24 hour	^a 50 µg/m ³

Table 9: Long-term Impact Assessment Criteria for Deposited Dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
^c Deposited dust	Annual	^b 2 g/m ² /month	^a 4 g/m ² /month

Notes to Tables 7-9:

- ^a Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources);
- ^b Incremental impact (ie incremental increase in concentrations due to the project on its own);
- ^c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.

- ^d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the **Planning Secretary** in consultation with EPA.

Greenhouse Gas Emissions

14. The Proponent **must** implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site.

Operating Conditions

15. The Proponent **must**:
- implement best management practice to minimise dust emissions by the project;
 - regularly assess air quality monitoring data and relocate, modify, and/or stop operations on site as may be required to ensure compliance with the air quality criteria in this approval;
 - minimise the air quality impacts of the project during adverse meteorological conditions and extraordinary events (see note d under Tables 7-9); and
 - minimise surface disturbance of the site, other than as permitted under this approval.

Air Quality Management Plan

16. The Proponent **must** prepare an Air Quality Management Plan for the project to the satisfaction of the **Planning Secretary**. This plan must:
- be prepared by a suitably qualified expert whose appointment has been approved by the **Planning Secretary**;
 - be prepared in consultation with Council and EPA, and submitted for approval to the **Planning Secretary** prior to the commencement of construction activities;
 - describe the measures that would be implemented to ensure:
 - compliance with the relevant air quality conditions of this approval;
 - best management practice is employed; and
 - the air quality impacts of the project are minimised during adverse meteorological conditions and extraordinary events;
 - describe the proposed air quality management system; and (e) include a monitoring program that:
 - is capable of evaluating the performance of the project;
 - includes a protocol for determining any exceedances of the relevant conditions of approval;
 - effectively supports the air quality management system; and
 - evaluates and reports on the adequacy of the air quality management system.

The Proponent **must** implement the plan as approved by the **Planning Secretary**.

METEOROLOGICAL MONITORING

17. For the life of the project, the Proponent **must** ensure that there is a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the *Approved Methods for Sampling of Air Pollutants in New South Wales* guideline.

SOIL & WATER

Note: The Proponent is required to obtain the necessary water licences for the project under the Water Act 1912 and/or the Water Management Act 2000.

Water Supply

18. The Proponent **must** ensure it has sufficient water during all stages of the project, and if necessary, adjust the scale of quarrying operations on site to match its available supply.

Surface Water Discharges

19. The Proponent **must** comply with the discharge limits in any EPL, or with Section 120 of the POEO Act.

Effluent Management

20. The Proponent **must**:
- (a) not irrigate, discharge or dispose of sewage or bathroom effluent from the site; and
 - (b) operate and maintain a suitable effluent storage facility, to the satisfaction of Council and EPA.

Water Management Plan

21. The Proponent **must** prepare a Water Management Plan for the project to the satisfaction of the **Planning** Secretary. This plan must:
- (a) be prepared in consultation with the EPA and NOW by suitably qualified and experienced person/s whose appointment has been approved by the **Planning** Secretary;
 - (b) be submitted to the **Planning** Secretary for approval prior to the commencement of construction activities;
 - (c) include:
 - (i) a Site Water Balance that includes details of:
 - sources and security of water supply, including contingency planning;
 - water use on site; and
 - measures that would be implemented to minimise use of clean water and maximise recycling of dirty water on the site;
 - (ii) a Surface Water Management Plan, that includes:
 - baseline data on surface water flows and quality in the watercourses that could be affected by the project;
 - a detailed description of the surface water management system on the site, including the design objectives and performance criteria for the:
 - clean water diversions;
 - erosion and sediment controls;
 - water storages (including Maximum Harvestable Rights requirements); and
 - control of water pollution from areas of the site that have been rehabilitated;
 - surface water impact assessment criteria, to be developed following analysis of baseline data, including trigger levels for investigating any potentially adverse surface water quality impacts;
 - a program to monitor:
 - any surface water discharges;
 - the effectiveness of the water management system;
 - surface water flows and quality in local watercourses; and
 - ecosystem health of local watercourses; and
 - an assessment of appropriate options to improve storage and retention times in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom);
 - (iii) a Groundwater Monitoring Program that includes:
 - baseline data of groundwater levels surrounding the site;
 - groundwater impact assessment criteria, to be developed following analysis of baseline data, including trigger levels for investigating any potentially adverse groundwater impacts; and
 - a program to monitor and/or validate the impacts of the project on groundwater resources; and
 - (iv) a Surface and Ground Water Response Plan that describes the measures and/or procedures that would be implemented to:
 - respond to any exceedances of the surface water impact assessment criteria and groundwater impact assessment criteria; and
 - mitigate and/or offset any adverse impacts on surface water and groundwater resources located within and adjacent to the site.

The Proponent **must** implement the plan as approved by the **Planning** Secretary.

TRANSPORT

Roadworks

22. The Proponent **must**, at its own cost, complete the following roadworks shown conceptually in Figure 2 of Appendix 1, prior to transporting quarry products from the site:
- (a) extending Blue Rock Close, with tar seal and appropriate pavement, road markings and advance warning signage, to the satisfaction of Council and RMS;
 - (b) realigning and upgrading the Blue Rock Close/Andersite Road intersection with appropriate road markings, pavement thickening and advance warning signage, to the satisfaction of Council;
 - (c) upgrading the Branch Lane/Andersite Road intersection with appropriate road markings and advance warning signage, to the satisfaction of Council;
 - (d) constructing the site access road on Lots 12 and 13 DP 1024564 with appropriate pavement and advance warning signage, to the satisfaction of Council; and (e) installing a wheel-wash facility on the site.

Monitoring of Product Transport

23. The Proponent **must**:
- (a) keep accurate records of:
 - the amount of quarry products transported from the site (per calendar month and year); and
 - the number of laden truck movements from the site (per hour, day, week, calendar month and year); and
 - (b) publish these records on its website quarterly.

Parking

24. The Proponent **must** provide sufficient parking on-site for all project-related traffic, in accordance with Council's parking codes, to the satisfaction of the **Planning** Secretary.

Operating Conditions

25. The Proponent **must** ensure that all project-related heavy vehicles:
- (a) enter and exit the site in a forward direction; and
 - (b) exit the site with loads covered.

Transport Management Plan

26. The Proponent **must** prepare a Transport Management Plan for the project to the satisfaction of the **Planning** Secretary. This plan must:
- (a) be prepared by a suitably qualified traffic consultant whose appointment has been approved by the **Planning** Secretary;
 - (b) be prepared in consultation with RMS and Council, and submitted to the **Planning** Secretary for approval prior to the commencement of construction activities;
 - (c) include a Driver Code of Conduct;
 - (d) describe the measures that would be implemented to ensure:
 - compliance with the relevant conditions of this approval;
 - that drivers of project-related heavy vehicles are aware of potential safety issues along the haulage routes; and
 - that drivers of project-related heavy vehicles comply with the Driver Code of Conduct;and
 - (e) include a program to monitor the effectiveness of these measures.

The Proponent **must** implement the plan as approved by the **Planning** Secretary.

LANDSCAPE

Tetratheca Juncea Translocation

27. The Proponent **must** develop a translocation program for *Tetratheca juncea* to the satisfaction of the **Planning** Secretary. This program must:
- be prepared in consultation with OEH, by a suitably qualified and experienced ecologist whose appointment has been approved by the **Planning** Secretary;
 - be submitted to the **Planning** Secretary for approval prior to the commencement of construction activities that involve clearing of or potential harm to *Tetratheca juncea*;
 - include measures for the translocation of all *Tetratheca juncea* stems in the area of disturbance to nearby areas with similar physical and biological habitat features;
 - include a monitoring program to study the *Tetratheca juncea* stems before and after translocation;
 - include short and long-term goals and performance criteria to measure the effectiveness of the program; and
 - provide for the transfer of information obtained as a result of implementing the program to OEH and **the Department**.

The Proponent must implement the program as approved by the **Planning** Secretary.

Biodiversity Offset Strategy

28. The Proponent **must**, prior to the commencement of vegetation clearing activities, finalise the Biodiversity Offset Strategy, as described in **documents listed in condition 2 of Schedule 2**, summarised in Table 10 and shown conceptually in Figure 1 of Appendix 4, in consultation with OEH and Council, and to the satisfaction of the **Planning** Secretary.

Table 10: Biodiversity Offset Strategy

Area	Offset Type	Minimum Size (ha)
Offset Area	Existing vegetation to be managed and enhanced	130.36 ha

Note: The Biodiversity Offset Strategy **must** direct that the land proposed as the Biodiversity Offset **must** be free of any dwelling-houses and associated sheds, bushfire asset protection zones and other related utilities or structures so as to preserve the integrity and function of that offset area. The Biodiversity Offset Strategy **must** also provide details of the revegetation of any parts of the offset area that are cleared of native vegetation or are in an otherwise substantially modified state, other than required management trails and boundary fencing buffer distances.

The Proponent must implement the strategy as approved by the **Planning** Secretary.

Long Term Security of Offsets

29. The Proponent **must**, within 12 months of the finalisation of the Biodiversity Offset Strategy, make suitable arrangements to provide appropriate long-term security for the offset area, in consultation with OEH and Council, and to the satisfaction of the **Planning** Secretary.

Note: In order of preference, mechanisms to provide appropriate long-term security to the land within the Biodiversity Offset Strategy include transfer to the National Park Estate, Biobanking Agreement, Voluntary Conservation Agreement, or restrictive covenant on land titles.

Rehabilitation Objectives

30. The Proponent **must** rehabilitate the site to the satisfaction of the **Planning** Secretary. This rehabilitation must:
- be generally consistent with the rehabilitation strategy as described in the EA and shown conceptually in Figure 1 in Appendix 5; and
 - comply with the objectives in Table 11.

Table 11: Rehabilitation Objectives

Feature	Objective
Site (as a whole)	Safe, stable & non-polluting.
Surface Infrastructure	To be decommissioned and removed, unless the Planning Secretary agrees otherwise.
Quarry Wall Benches	Landscaped and revegetated utilising native tree and understorey species, ensuring that the tree canopy is restored and integrated with the surrounding tree canopy.
Quarry Pit Floor	Landscaped and revegetated with wetland vegetation.
Other land affected by the project	Restore ecosystem function, including maintaining or establishing self-sustaining eco-systems comprised of: <ul style="list-style-type: none"> • native endemic species; and • a landform consistent with the surrounding environment.
Community	Ensure public safety. Minimise the adverse socio-economic effects associated with quarry closure.

Progressive Rehabilitation

31. The Proponent **must**:
- (a) rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance;
 - (b) take all reasonable and feasible measures to minimise the total area of the site exposed at any time; and
 - (c) implement interim rehabilitation strategies where areas prone to dust generation cannot yet be permanently rehabilitated.

Landscape and Rehabilitation Management Plan

32. **Within 6 months of the date of approval of Modification 1, the Proponent must** prepare a Landscape and Rehabilitation Management Plan for the project to the satisfaction of the **Planning** Secretary. This Plan would relate to the area of the quarry and all perimeter lands. This plan must:
- a. be prepared by a suitably qualified expert whose appointment has been approved by the **Planning** Secretary;
 - b. be prepared in consultation with OEH and Council, and submitted to the **Planning** Secretary for approval prior to the commencement of construction activities;
 - c. describe how the implementation of the *Tetratheca juncea* Translocation Program would be integrated with the overall rehabilitation of the site;
 - d. describe the short, medium and long-term measures that would be implemented to:
 - manage remnant vegetation and habitat on the site; and
 - ensure compliance with the rehabilitation objectives and progressive rehabilitation obligations of this approval.
 - e. include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, including triggers for any remedial action;
 - f. 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:
 - ensuring compliance with the rehabilitation objectives and progressive rehabilitation obligations of this approval;
 - enhancing the quality of remnant vegetation and fauna habitat;
 - restoring native endemic vegetation and fauna habitat within the rehabilitation area, including details of the target revegetation communities of the rehabilitated landform;
 - coordinating the relocation of native fauna to protected habitats associated with pre-clearing fauna surveys;
 - maximising the salvage of environmental resources within the approved disturbance area - including tree hollows, vegetative and soil resources - for beneficial reuse in the enhancement of the rehabilitation area;
 - collecting and propagating seed;

- ensuring minimal environmental consequences for threatened species, populations and habitats;
 - minimising the impacts on native fauna on site, including the details and implementation of appropriate pre-clearance surveys;
 - minimising the impacts on fauna movement between undisturbed areas of the site and nearby vegetation (including potential fauna crossings);
 - controlling weeds and feral pests;
 - controlling erosion;
 - controlling access and providing for management trails; and
 - bushfire management and implementation of ecologically appropriate bushfire intervals.
- g. include a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;
- h. identify the potential risks to successful implementation of the *Tetratheca juncea* Translocation Program and rehabilitation of the site, and include a description of the contingency measures that would be implemented to mitigate these risks;
- i. include details as to how the rehabilitated land would be permanently conserved and managed as part of the broader Biodiversity Offset Area approved in these conditions;
- j. include details of who would be responsible for monitoring, reviewing, and implementing the plan; and
- k. include details as to the timing of actions set-out in the plan

The Proponent must implement the plan as approved by the Planning Secretary.

Biodiversity Offset Area Management Plan

33. The Proponent **must** prepare a Biodiversity Offset Area Management Plan for the project to the satisfaction of the Planning 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 Planning Secretary;
 - b. be prepared in consultation with OEH and Council, and submitted to the Planning Secretary within 12-months of the approval of the Biodiversity Offset Strategy required in these conditions;
 - c. describe how the implementation of the *Tetratheca juncea* Translocation Program would be integrated with the Biodiversity Offset Area management;
 - d. describe the short, medium and long-term measures that would be implemented to manage remnant vegetation and habitat on the Biodiversity Offset Area;
 - 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;
 - 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;
 - g. providing for the incorporation of the final rehabilitated landform into the Biodiversity Offset Area and its management;
 - 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:
 - enhancing the quality of remnant vegetation and fauna habitat;
 - 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;
 - coordinating the relocation of native fauna to protected habitats associated with pre-clearing fauna surveys;
 - collecting and propagating seed;
 - maximising the protection and restoration of threatened species, populations and habitats in the Biodiversity Offset Area;
 - maximising fauna movement between the Biodiversity Offset Area and adjacent habitats;

- controlling weeds and feral pests;
 - controlling erosion;
 - controlling access and providing for management trails; and
 - bushfire management and implementation of ecologically appropriate bushfire intervals.
- i. include a program to monitor the effectiveness of these measures, and progress against the 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;
 - k. include details of who would be responsible for monitoring, reviewing, and implementing the plan;
 - l. include details of the indicative costs of management actions; and
 - m. include details as to the timing of actions set-out in the plan

The Proponent must implement the plan as approved by the Planning Secretary.

Conservation & Rehabilitation Bond

34. The Proponent **must** lodge a Conservation and Rehabilitation Bond with the Department within 6 months of the approval of the Landscape and Rehabilitation Management Plan, to ensure that the Biodiversity Offset Strategy and the rehabilitation of the site is implemented in accordance with the performance and completion criteria set out in the Landscape and Rehabilitation Management Plan. The sum of the bond **must** be determined by:
 - (a) calculating the cost of implementing the Biodiversity Offset Strategy over the next 3 years;
 - (b) calculating the cost of rehabilitating disturbed areas of the site, taking into account the likely surface disturbance over the next 3 years of quarrying operations; and
 - (c) employing a suitably qualified quantity surveyor or other expert to verify the calculated costs, to the satisfaction of the Planning Secretary.

Notes:

- *If capital and other expenditure required by the Landscape and Rehabilitation Management Plan is largely complete, the Planning Secretary may waive the requirement for the lodgement of a bond in respect of the remaining expenditure.*
- *If the Biodiversity Offset Strategy and rehabilitation of the site area are completed to the satisfaction of the Planning Secretary, then the Planning Secretary will release the bond. If the Biodiversity Offset Strategy and rehabilitation of the site are not completed to the satisfaction of the Planning Secretary, then the Planning Secretary will call in all or part of the bond, and arrange for the completion of the relevant works.*
- *The component of the bond relating to the implementation of the Biodiversity Offset Strategy may be waived, if a separate arrangement is entered into between the Proponent and OEH which satisfactorily replaces that component, to the satisfaction of the Planning Secretary.*

35. Within 3 months of each Independent Environmental Audit (see condition 9 of schedule 5), the Proponent **must** review, and if necessary revise, the sum of the Conservation and Rehabilitation Bond to the satisfaction of the Planning Secretary. This review must:
 - (a) consider the performance of the implementation of the Biodiversity Offset Strategy and rehabilitation of the site to date;
 - (b) consider the effects of inflation; and
 - (c) calculate the cost of implementing the Biodiversity Offset Strategy and rehabilitating the disturbed areas of the site (taking into account the likely surface disturbance over the next 3 years of quarrying operations); and

HERITAGE

Heritage Management Plan

36. The Proponent **must** prepare a Heritage Management Plan for the project to the satisfaction of the Planning Secretary. This plan must:
 - (a) be prepared by a suitably qualified expert whose appointment has been approved by the Planning Secretary;

- (b) be prepared in consultation with the local Aboriginal community and OEH, and submitted to the **Planning** Secretary for approval prior to the commencement of construction activities;
- (c) describe the measures that would be implemented to:
 - monitor initial surface disturbance on site for Aboriginal cultural heritage sites or objects;
 - manage the discovery of Aboriginal cultural heritage sites, objects or human remains on site; and
 - ensure ongoing consultation with Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage values on site.

The Proponent must implement the plan as approved by the **Planning** Secretary.

VISUAL

37. The Proponent **must**:
- (a) ensure that clearing vegetation from any visually prominent ridgeline is undertaken in a progressive manner, to provide for a maximum of 6 months of future quarrying operations; and
 - (b) mitigate the visual impact of the project through the progressive and early rehabilitation of the upper quarry benches in accordance with the objectives in Table 11, to the satisfaction of the **Planning** Secretary.

Advertising Signage

38. The Proponent **must** not erect or display any advertising structure or sign on the site without the written approval of the **Planning** Secretary.

Note: This condition does not apply to business identification, traffic management, and/or safety or environmental signs.

EMERGENCY AND HAZARDS MANAGEMENT

Dangerous Goods and Hazardous Materials

39. The Proponent **must** ensure that the storage, handling, and transport of dangerous goods and hazardous materials is conducted in accordance with the relevant *Australian Standards*, particularly AS1940 and AS1596, and the *Dangerous Goods Code*.

Safety

40. The Proponent **must** secure the site to ensure public safety at all times, to the satisfaction of the **Planning** Secretary.

Bushfire Management

41. The Proponent **must**:
- (a) ensure that the project is suitably equipped to respond to any fires on site; and
 - (b) assist the Rural Fire Service and emergency services as much as possible if there is a fire in the surrounding area.

WASTE

42. The Proponent **must**:
- (a) minimise the waste generated by the project; and
 - (b) ensure that the waste generated by the project is appropriately stored, handled, and disposed of,
- to the satisfaction of the **Planning** Secretary.

SCHEDULE 4 ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. As soon as practicable after obtaining monitoring results showing an:
 - (a) exceedance of any relevant criteria in Schedule 3, the Proponent **must** notify affected landowners in writing of the exceedance, and provide regular monitoring results to each affected landowner until the project is again complying with the relevant criteria; and
 - (b) an exceedance of the relevant air quality criteria in Schedule 3, the proponent **must** send a copy of the NSW Health fact sheet entitled “*Mine Dust and You*” (as may be updated from time to time) to the affected landowners and/or existing tenants of the land.

INDEPENDENT REVIEW

2. If an owner of privately-owned land considers the project to be exceeding the relevant criteria in schedule 3, then the landowner may ask the **Planning** Secretary in writing for an independent review of the impacts of the project on its land.

If the **Planning** Secretary is satisfied that an independent review is warranted, then within 2 months of the **Planning** Secretary’s decision the Proponent **must**:

- (a) commission a suitably qualified, experienced and independent expert, whose appointment has been approved by the **Planning** Secretary, to:
 - consult with the landowner to determine its concerns;
 - conduct monitoring to determine whether the project is complying with the relevant criteria in Schedule 3; and
 - if the project is not complying with these criteria, then identify the measures that could be implemented to ensure compliance with the relevant criteria; and
 - (b) give the **Planning** Secretary and landowner a copy of the independent review.
3. If the independent review determines that the project is complying with the relevant criteria in Schedule 3, then the Proponent may discontinue the independent review with the approval of the **Planning** Secretary.

If the independent review determines that the project is not complying with the relevant criteria in Schedule 3, then the Proponent **must**:

- (a) implement all reasonable and feasible mitigation measures, in consultation with the landowner and appointed independent expert, and conduct further monitoring until the project complies with the relevant criteria; or
- (b) secure a written agreement with the landowner to allow exceedances of the relevant criteria, to the satisfaction of the **Planning** Secretary.

SCHEDULE 5 ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

1. The Proponent **must** prepare an Environmental Management Strategy for the project to the satisfaction of the **Planning** Secretary. This strategy must:
 - (a) be submitted to the **Planning** Secretary for approval prior to the commencement of construction activities;
 - (b) provide the strategic framework for environmental management of the project;
 - (c) identify the statutory approvals that apply to the project;
 - (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
 - (e) describe the procedures that would be implemented to:
 - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
 - receive, handle, respond to, and record complaints;
 - resolve any disputes that may arise during the course of the project;
 - respond to any non-compliance; and
 - respond to emergencies; and (f) include:
 - copies of any strategies, plans and programs approved under the conditions of this approval; and
 - a clear plan depicting all the monitoring required to be carried out under the conditions of this approval.

The Proponent must implement the strategy as approved by the **Planning** Secretary.

Adaptive Management

2. The Proponent **must** assess and manage project-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 3. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation.

Where any exceedance of these criteria and/or performance measures has occurred, the Proponent **must**, at the earliest opportunity:

- (a) take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur;
- (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
- (c) implement remediation measures as directed by the **Planning** Secretary; to the satisfaction of the **Planning** Secretary.

Management Plan Requirements

3. The Proponent **must** ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include:
 - (a) detailed baseline data;
 - (b) a description of:
 - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
 - any relevant limits or performance measures/criteria; and
 - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;
 - (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
 - (d) a program to monitor and report on the:

- impacts and environmental performance of the project; and
 - effectiveness of any management measures (see (c) above);
- (e) a contingency plan to manage any unpredicted impacts and their consequences;
- (f) a program to investigate and implement ways to improve the environmental performance of the project over time;
- (g) a protocol for managing and reporting any:
- incidents;
 - complaints;
 - non-compliances with statutory requirements; and
 - exceedances of the impact assessment criteria and/or performance criteria; and
- (h) a protocol for periodic review of the plan.

*Note: The **Planning** Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*

Annual Review

4. By the end of March each year, the Proponent **must** review the environmental performance of the project to the satisfaction of the **Planning** Secretary. This review must:
- (a) describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;
- include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against:
- the relevant statutory requirements, limits or performance measures/criteria;
 - the monitoring results of previous years; and
 - the relevant predictions in the EA;
- (b) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- (c) identify any trends in the monitoring data over the life of the project;
- (d) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
- (e) describe the measures that would be implemented over the current calendar year to improve the environmental performance of the project.

Revision of Strategies, Plans and Programs

5. Within 3 months of:
- (a) the submission of an annual review under Condition 4 above;
- (b) the submission of an incident report under Condition 7 below;
- (c) the submission of an audit report under Condition 9 below; or
- (d) any modification to the conditions of this approval, (unless the conditions require otherwise), the Proponent **must** review the strategies, plans, and programs required under this approval, to the satisfaction of the **Planning** Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted for the approval of the **Planning** Secretary.

Note: The purpose of this condition is to ensure that strategies, plans and programs are regularly updated to incorporate any measures recommended to improve environmental performance of the project.

Community Consultative Committee

6. The Proponent **must** establish and operate a Community Consultative Committee (CCC) for the project. The CCC must:
- (a) be established and operated in general accordance with the *Community Consultative Committees Guidelines for State Significant Projects (Department of Planning and Environment, 2016)*; and
- (b) be established prior to the commencement of construction activities, to the satisfaction of the **Planning** Secretary.

Notes:

- *The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Proponent complies with this approval.*
- *In accordance with the guideline, the Committee should comprise an independent chair and appropriate representation from the Proponent, Council, recognised environmental groups and the local community.*

REPORTING

Incident Notification

7. The Proponent must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing to compliance@planning.nsw.gov.au and identify the Project (including the project application number and name) and set out the location and nature of the incident.

Non-compliance Notification

- 7A. Within seven days of becoming aware of a non-compliance, The Proponent must notify the Department of the non-compliance. The notification must be in writing to compliance@planning.nsw.gov.au and identify the Project (including the project application number and name), set out the condition of this approval that the Project is non-compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

Note: *A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.*

Regular Reporting

8. The Proponent **must** regularly report on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval.

INDEPENDENT ENVIRONMENTAL AUDIT

9. Within 12 months of the commencement of development on the site, and every 3 years thereafter, unless the **Planning** Secretary directs otherwise, the Proponent **must** commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
- be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the **Planning** Secretary;
 - include consultation with the relevant agencies;
 - assess the environmental performance of the project and whether it is complying with the relevant requirements in this approval and any relevant EPL and/or Water Licence (including any assessment, plan or program required under these approvals);
 - review the adequacy of any approved strategy, plan or program required under these approvals; and
 - recommend measures or actions to improve the environmental performance of the project, and/or any assessment, plan or program required under these approvals.

*Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the **Planning** Secretary.*

10. Within three months of commencing an Independent Environmental Audit, or within another timeframe agreed by the **Planning** Secretary, the Proponent must submit a copy of the audit report to the **Planning** Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of the recommendations. The recommendations must be implemented to the satisfaction of the **Planning** Secretary.

Note: *The audit team must be led by a suitably qualified auditor and include experts in any fields specified by the **Planning** Secretary.*

ACCESS TO INFORMATION

11. The Proponent **must**:
- (a) make the following information publicly available on its website:
 - the EA;
 - any statutory approvals for the project;
 - approved strategies, plans and/ programs;
 - a summary of the monitoring results of the project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval;
 - a complaints register, updated quarterly;
 - minutes of CCC meetings;
 - annual reviews;
 - any independent environmental audit, and the Proponent's response to the recommendations in any audit; and
 - any other matter required by the **Planning** Secretary; and
 - (b) **keep this information up-to-date, to the satisfaction of the **Planning** Secretary.**

APPENDIX 1 PROJECT LAYOUT

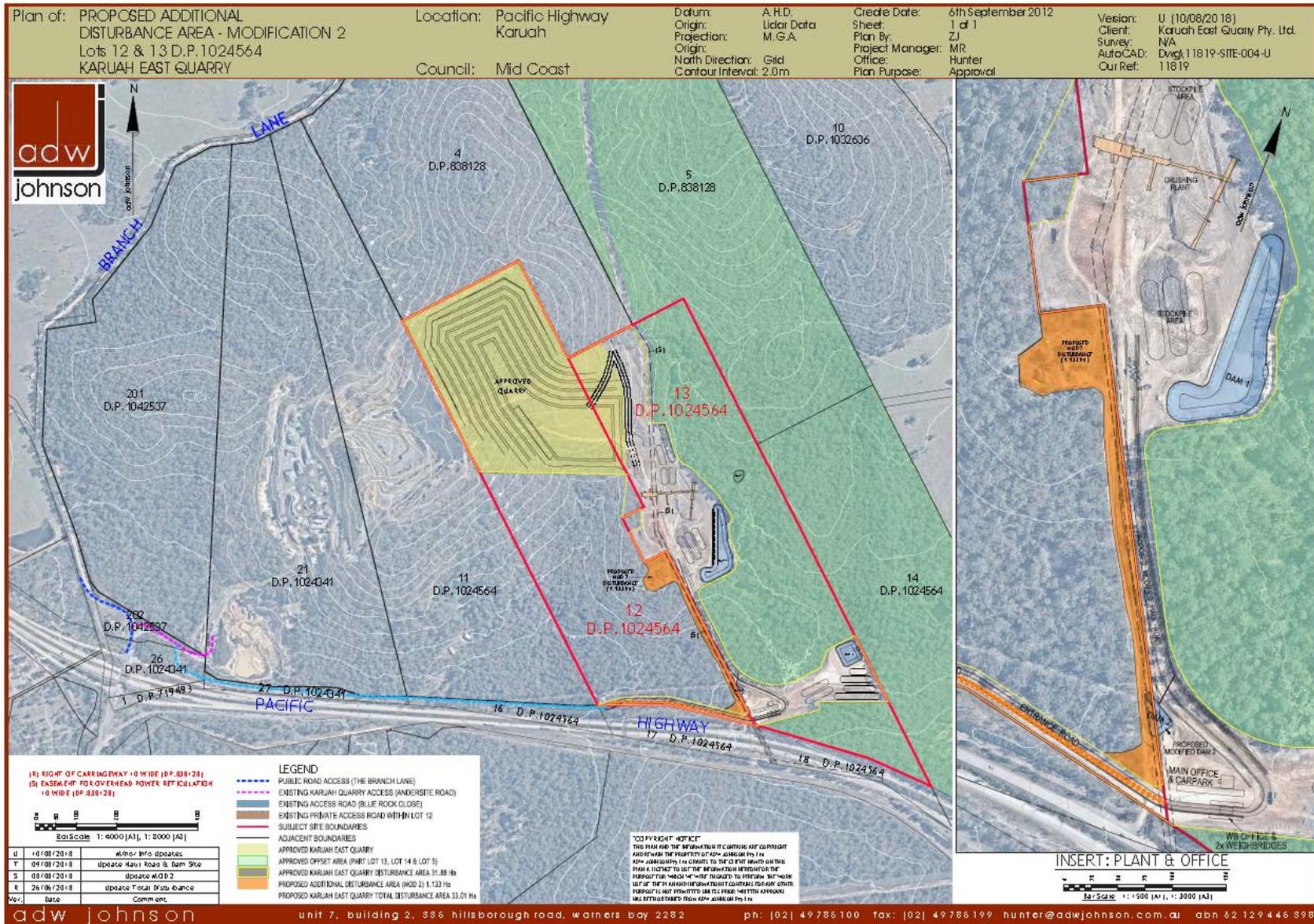


Figure 1: Project Layout

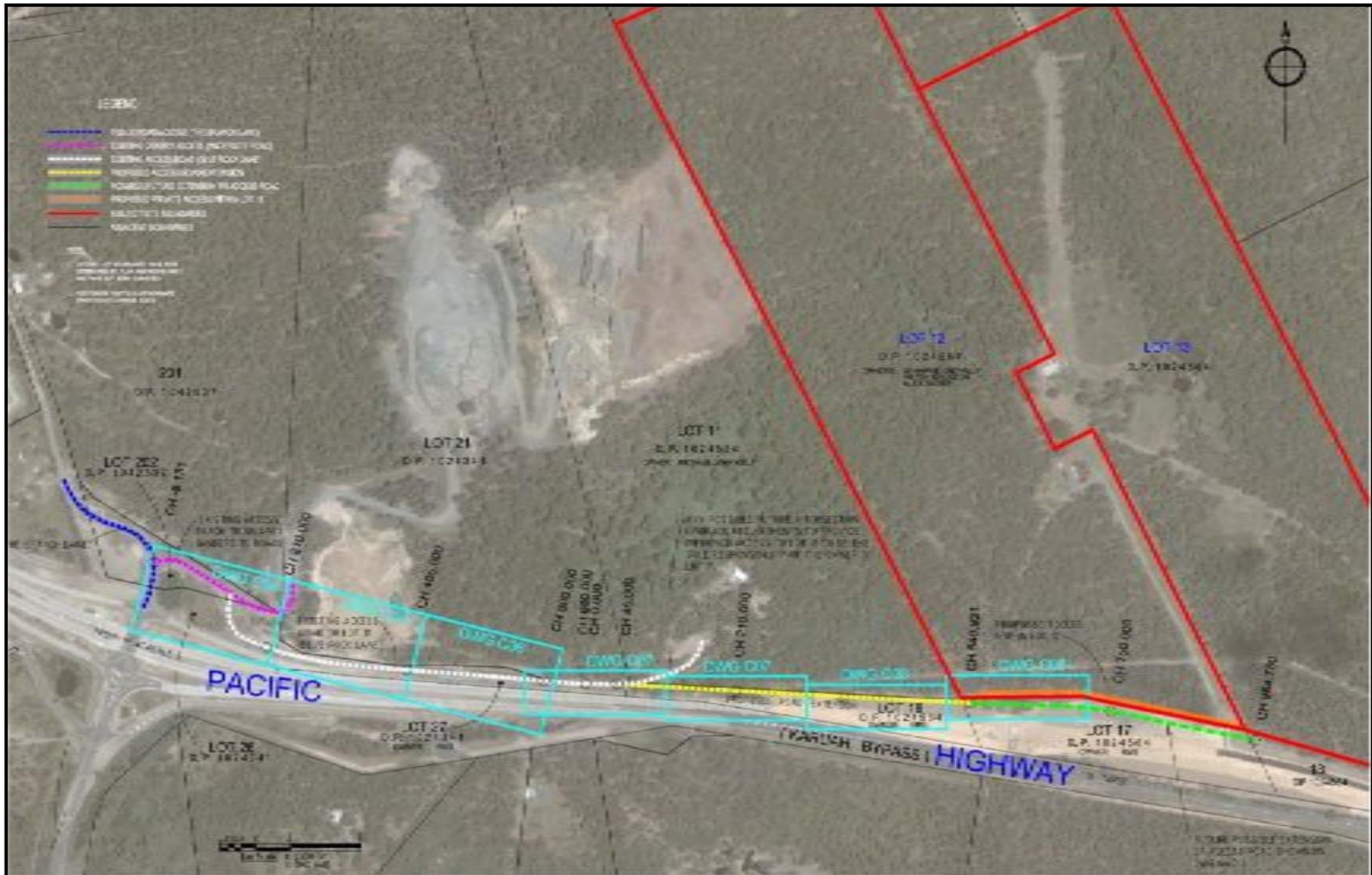


Figure 2: Proposed roadworks

APPENDIX 2
NOISE RECEIVER LOCATIONS



Figure 1: Closest residences

APPENDIX 3 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

1. The noise criteria in Tables 2 and 4 are to apply under all meteorological conditions except the following:
 - (a) during periods of rain or hail; or
 - (b) wind speeds greater than 3 m/s measured at 10 m above ground level.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions **must** be that recorded by the meteorological station in the vicinity of the site.

Compliance Monitoring

3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.
4. Unless otherwise agreed with the **Planning** Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
 - (a) monitoring locations for the collection of representative noise data;
 - (b) meteorological conditions during which collection of noise data is not appropriate;
 - (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
 - (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

APPENDIX 4
CONCEPTUAL BIODIVERSITY OFFSET AREA



Figure 1: Conceptual Biodiversity Offset Area

APPENDIX 5
REHABILITATION STRATEGY



Figure 1: Conceptual Rehabilitated Landform

**APPENDIX 6
STATEMENT OF COMMITMENTS**

STATEMENT OF COMMITMENTS

The following section outlines the proponent's commitment to implement construction and operational strategies relating to environmental management and mitigation measures. This section details how the proposal and its environmental safeguards will be implemented and managed in an integrated and feasible manner.

1.0 PLANS, DOCUMENTS AND APPROVALS

The proposed development will be completed in accordance with the submitted plans and descriptions of the proposed development provided in the Environmental Assessment Report (31 January 2013) and the Preferred Project Report (30 July 2013).

Any changes to the proposed development will require further approval of the relevant authorities.

The proposed development will be carried out in accordance with all approvals granted by relevant authorities.

2.0 SUMMARY OF MANAGEMENT PLANS

The following management plans will be prepared prior to commencement of construction works:

- Construction Environmental Management Plan (CEMP);
- Environmental Management Plan (EMP). The EMP will ensure that the commitments made in the EA Report and Preferred Project Report and the requirements under subsequent approval and license conditions are fully implemented. The EMP will confirm who is responsible and when the commitments associated with the mitigation and monitoring strategies should be implemented/undertaken;
- Annual Environmental Management Report (AEMR);
- Pre- clearing survey;
- Vegetation Management / Monitoring Plan;
- Conservation Management Plan;
- Soil Management Plan;
- Groundwater Monitoring Plan;
- Surface Water Management Plan (including erosion and sediment control and monitoring);
- Noise Monitoring Plan;
- Blasting Management Plan;
- Air Quality Monitoring Plan;
- Construction Traffic Management Plan;
- Environmental Management Strategy;
- Quarry Closure and Rehabilitation Plan; and
- Waste Management Plan.

3.0 SOIL AND WATER

3.1 Soil Management

Soil Management

The following will be undertaken:

- Topsoil will be stripped in accordance with the recommended stripping depth for each soil type, together with area of land and calculated volume which are provided in the table below;

Table 1 - Recommended Stripping Depths

Soil Type	Project Soil Name	Soil Layer	Recommended Stripping Depth (m)	Area (ha)	Volume (m ³)
1	Brown Chromosols	Topsoil	0.30	8.63	25,890
		Subsoil	0.90	8.63	77,670
2	Red Dermosols	Topsoil	0.10	4.55	4,550
		Subsoil	1.10	4.55	50,050
3	Leptic Tenosols	Topsoil	0.0	16.4	0
		Subsoil	0.0	16.4	0
Total Volume					158,160

Total Volume (10% handling loss allowance)	142,344
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- Topsoil disturbance resulting from the excavation of the open cut pit will not be stripped. Areas to be disturbed within the infrastructure boundary will be stripped and stockpiled for re-use in rehabilitation for the area from where it was stripped;
- Only the sandy clay loam topsoil of Soil Type 1 will be used as the final surface topdressing in rehabilitation;
- Rehabilitation involving topsoil respreading will occur on the entire infrastructure area. The open cut footprint will be rehabilitated through direct tree planting and more specific rehabilitation measures; and
- Topsoil will be respread on final landforms at a minimum of 15cm, and an intermediate layer will be established at a minimum of 30cm.

Where topsoil stripping and transportation is required, the following topsoil handling techniques will be implemented to prevent excessive soil deterioration, note this also applies to subsoil stripping:

- Strip material to the depths stated in the table above, subject to further investigation as required;
- Topsoil will be maintained in a slightly moist condition during stripping. Material will not be stripped in either an excessively dry or wet condition;
- Place stripped material directly onto reshaped overburden and spread immediately to avoid the requirement for stockpiling;
- Clay material will be applied first to create an intermediate layer. The loam topsoil will then be spread to overlie this layer;
- The surface of soil stockpiles will be left in as coarsely structured a condition as possible in order to promote infiltration and minimise erosion until vegetation is established, and to prevent anaerobic zones forming;
- Maintain a maximum stockpile height of 3m;
- If long-term stockpiling is planned (i.e. greater than 12 months), stockpiles will be seeded and fertilised as soon as possible; and
- Prior to re-spreading stockpiled topsoil onto reshaped overburden an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require herbicide application and/or “scalping” of weed species prior to topsoil spreading.

An inventory of available soil will be maintained to ensure adequate topsoil materials are available for planned rehabilitation activities.

The respread topsoil surface will be scarified prior to, or during seeding, to reduce run-off and increase infiltration.

3.2 Groundwater Management

- Prior to commencement of works, further investigation of groundwater conditions will be conducted in consultation with the NSW Office of Water;
- Benches and the pit floor will be graded to promote drainage toward the entrance to the pit;
- Minor seepage and ponding water from excessive rainfall will be managed by conventional drainage measures within the quarry such as periodic pumping out to the surrounding drainage controls. Water will be retained on site for quarry operations and for environmental mitigation;
- Only emergency vehicle repairs will be carried out onsite and any major vehicle repairs/maintenance will occur offsite;
- Refuelling will be undertaken in a designated non-permeable (compacted clay or concrete) area;
- Runoff water from the Project site will be collected and monitored for environmental mitigation to prevent chemicals and hydrocarbon pollutants such as petroleum, diesel, and oil seeping into the groundwater system;
- Fuel storage facilities will be installed in accordance with relevant statutory requirements. Handling and storage of fuel and oil within the project site will be in accordance with Australian Standards, AS 1940-2004 (Storage and Handling of Flammable and Combustible Liquids) and NSW Work Cover 2005 Code of Practice for Storage and Handling of Dangerous Goods to reduce the risk of any spills or environmental release. Above ground storage in a bunded facility will be used;
- Material Safety Data Sheets (MSDS) will be kept in the site safety system for all chemicals used on site. The MSDS will contain information on the environmental impacts of the use of certain chemicals and include detail on emergency response, clean up and disposal. Handling and storage of all chemicals within the project site will be in accordance with Dangerous Goods Act 1975 (NSW), and Australian standards, including AS 1940-2004 (Storage and Handling of Flammable and Combustible Liquids); and
- Quarry rehabilitation will use spoil, and clean fill fit for purpose and in accord with relevant statutory requirements.

Contingency, Monitoring and Reporting for Groundwater Management

Contingency Plans

Emergency Response Procedures will be developed and implemented for the proposed Karuah East quarry.

Contingency plans will be developed to address actions that are required where unforeseen events occur. Contingency plans will consider the following:

- Groundwater levels: If groundwater level monitoring indicates abrupt changes, additional investigations will be carried out to implement necessary measures; and

- Groundwater quality: In the event that the groundwater quality monitoring indicates a deteriorating change of groundwater quality in relation to the proposed quarrying operations, the appropriate authority will be contacted to discuss the implementation of necessary measures.

Monitoring Plan

Monitoring of groundwater levels and groundwater quality will be conducted prior to the start of quarry operations. The existing monitoring bores at BH205, BH207, BH208 and BH303 will be used for monitoring groundwater of the quarry area.

New monitoring bores will be installed if any existing monitoring bores are destroyed during the quarry operations, or are subject to general failure. Surface runoff water will also be monitored.

Groundwater Levels

Groundwater levels will be monitored on a quarterly basis to identify any adverse impacts arising from the operation of the quarry in the future, and to identify long-term groundwater level trends.

Groundwater Quality

Groundwater samples will be collected for laboratory analysis on a 6-monthly basis. The groundwater quality results will be laboratory analysed for the parameters below and compared to background water quality results. The groundwater sampling will be carried out by an experienced groundwater professional or environmental scientist in accordance with Australian sampling standards.

The basic analyte and parameter suite applies to all samples. The additional extended analytic suite should apply annually together with the basic suite.

Basic Analytes and Parameters – 6 monthly (every sample):

- pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS); Alkalinity;
- Total nitrogen, total phosphorus;
- Major ions, calcium, magnesium, sodium, potassium, chloride, sulphate, carbonate, bicarbonate;
- Total Petroleum Hydrocarbon (TPH); and
- BTEX (benzene, toluene, ethyl benzene, exylene).

Additional Analysis – 12 monthly (every second sample only):

- Nutrient suite: total nitrogen, nitrate, total Kjeldahl nitrogen, total phosphorus, phosphate;
- Metals (arsenic, cadmium, chromium, copper, lead, zinc, nickel, manganese, mercury, total iron, filterable iron);
- Polycyclic Aromatic Hydrocarbon (PAH); and
- Organophosphorus pesticides, phenoxy acid herbicides.

Reporting

The recording date, time and parameters of monitoring data will be collected and tabulated. All original laboratory reports will be maintained on file. Monitoring records will be kept until the closure stage of the quarry for inspection on request by government agencies.

3.3 Surface Water – Proposed Water Management System

The following surface water management measures will be implemented:

Dam 1 Catchment (crushing plant and product stockpiles)

- An existing farm dam will be upgraded and used as a sediment dam (Dam 1);
- The crushing plant area will be graded such that runoff from this area will flow into Dam 1;
- Water for haul road and some stockpile dust suppression, as well as for the crushing plant will be sourced from Dam 1; and
- A diversion bund will be constructed along the eastern boundary of this catchment area, to direct runoff from the area into Dam 1.

Dam 2 Catchment (product stockpiles and office infrastructure area)

- A second sediment dam, Dam 2, will be constructed adjacent to the main haul road to capture runoff from this area. Water collected in Dam 2 will be re-used for dust suppression on the product stockpiles.

Dam 3 Catchment (product stockpiles)

- A third sediment dam, Dam 3, will be constructed in the north-east corner of the southern stockpile area. Water collected in dam 3 will be re-used for dust suppression on the adjacent product stockpiles.

During Construction

Sediment laden runoff from disturbed areas during construction will be managed by implementing the following erosion and sedimentation control principles:

- Conducting best practice land clearing procedures for all proposed disturbance areas;
- Minimising the disturbance footprint;
- Coordinating construction sequences to minimise exposure of disturbed soils to the elements;
- Separate/diversion of upslope 'clean' water catchment runoff prior to land disturbance;
- Ensuring sediment-laden runoff is treated via designated sediment control devices;
- Appropriate storage of topsoil stockpiles in areas away from roadways and other drainage lines;
- Revegetation of disturbed areas as soon as possible following the completion of construction activities; and
- Implementing an effective maintenance period.

Surface Water Management – Final Landform

- Dams 1, 2 & 3 will remain in place for post-mining landuse. Consultation will be undertaken with relevant government agencies in relation to licensing conditions at that time; and
- If deemed necessary by the relevant government agency, the dams will be removed.

Dam Design

Each dam will be constructed to the following capacity in accordance with 'Blue Book' requirements:

Table 2 – Summary of Proposed Dams

Dam	Sediment Zone (ML)	Settling Zone (ML)	Additional water storage capacity (ML)	Total Capacity (ML)
Dam 1	3.4	5.4	3.6	12.4
Dam 2	0.4	0.9	0	1.3
Dam 3	0.6	1.7	0	2.3

Management and Maintenance of Dams

- In the event that water is required to be discharged offsite, the water will be tested prior to discharge to ensure appropriate discharge criteria are met, such as Total Suspended Solids (TSS) below a concentration of 50mg/L. Where this is not the case, water will be treated, for example through the use of chemical flocculation, to achieve a suitable water quality; and
- An inspection of the sediment dams will be undertaken as part of the routine site environmental inspection program or following significant rainfall. Various information, such as the general condition of the dam, evidence of overflow, condition of downstream catchments, water colour, evidence of eroding surfaces and approximate retained capacity, will be recorded.

Mitigation Measures for Drainage Lines

- A sediment fence will be installed along the downstream side of the entire southern face of the quarry as a sediment control measure to minimise the transport of any sediment into the remaining section of the first order drainage line to the south of the extraction area;

This drainage line will be reinstated as close as possible to its original path following completion of extraction activities at the quarry as part of the final rehabilitation of the site;

- A Site Water Management Plan (SWMP) for Karuah East will be prepared and include details on the drainage line rehabilitation works. Works within the restored drainage lines will be generally undertaken in accordance with Section 5.3.3 of the Blue Book (Volume 1) and the 'Guidelines for Controlled Activities – In-Stream Works' (DWE, 2008) for watercourse rehabilitation and riparian zone rehabilitation. Key design elements of channel establishment works will include:
 - Implement temporary erosion controls to provide for the short-term stabilisation of the channel;
 - Design and construct the stream channel so that it will be stable for the longterm and minimizes the potential for the migration of any erosion upstream or downstream;
 - The drainage line will be re-instated as a compound channel with a main channel conveying the small to medium flows, and a floodplain used to convey the high overbank flows;
 - The main channel forming part of the re-instated central drainage line will be generally trapezoidal in shape with 3:1 (H:V) bank batters;
 - Natural meanders will be used instead of straight lines to reflect natural stream characteristics;
 - Where there are high erosive forces (such as high flow velocity or steep grades) the channel bed will be rock lined where required and constructed in accordance with the 'Blue Book', including the placement of appropriately sized rocks above a filter layer of suitable geotextile; and
 - Soil will be packed in between rocks to allow sedges and grasses to be established within the channel to provide for long-term channel stability.

Following earthworks and channel establishment, a riparian corridor will be established with a minimum width of 10 m, measured horizontally and at right angles to the flow from the top of both banks on the streams. Key design elements of the riparian corridor establishment will include:

- Implement temporary erosion controls to provide for the short-term stabilisation of the riparian corridor;
- Restore a vegetated riparian corridor along the stream channel (10 m from top of bank);
- Establish a diverse range of locally occurring vegetation species;
- Establish a full range of vegetation types, including trees, shrubs and grass covers;
- No exotics species are to be introduced; and
- Maintain the rehabilitated riparian corridor for two years after initial rehabilitation.

Licensed Discharge Point / Licensing Requirements

- A Licensed Discharge Point (LDP) will be installed is required at the outlets of Dam 1, Dam 2 and Dam 3. An application to the NSW OEH for the establishment of the LDP's will be made; and
- The controlled release of water will preferentially be made from Dam 1 and Dam 3. The water management system will be set up to allow for water to be pumped from Dam 2 to Dam 1 as required for release.

Site Water Balance

- The proposed dams will be built to at least the specified sizes (Table 2 above), and made larger where practical in consultation with NOW;
- That controlled discharge of treated (e.g. flocculated) water be undertaken when total site storage levels are above 4.3ML, which would provide the capacity to contain more rainfall events and reduce wet weather discharges (this assumes the dams are built to the capacities presented in Table 2 above); and
- All water usage will be monitored across the site to enable an update of the water balance using actual metered water usage data after 12 months of operation.

Site Water Management Plan

A Site Water Management Plan (SWMP) will be prepared following project approval in accordance with regulatory requirements and conditions of consent. The SWMP will be developed in accordance with the *Blue Book* (Volume 1 and Volume 2E).

The SWMP will incorporate the following:

- On-site soil and water management principles and objectives, including the following:
 - o Containment of dirty water runoff from the active quarry area by directing this water into in-pit sumps;
 - o Directing sediment-laden runoff from disturbance areas and rehabilitated areas into designated sediment control dams;
 - o Installing temporary erosion and sediment control devices as required (i.e. sediment fences sand bag weirs) to minimise the discharge of sediment laden water from newly disturbed areas;

- Diverting clean water runoff unaffected by the operations away from disturbed areas and offsite, where possible;
 - Maintaining sediment control structures to ensure that the designed capacities are maintained for optimum settling of sediments; and
 - Implementing an effective revegetation and maintenance program for the site.
- Identification of sources of sedimentation and erosion.
 - Soil Best Management Practices (BMPs) to be implemented on-site, including:
 - quarry planning considerations (such as minimising disturbance); o topsoil/subsoil handling and stockpiling procedures; and o topsoil/subsoil respreading procedures.
 - Water BMPs to be implemented on-site, including; o clean water diversions;
 - dirty water capture and treatment;
 - additional sediment protection measures to be employed during the life of the Project; and o maintenance of sediment control structures.
 - Drainage line rehabilitation.
 - Water monitoring procedures.
 - Documentation and reporting procedures.

Surface Water Monitoring Program

A Surface Water Monitoring Program will be implemented to monitor both the surface water quality upstream and downstream of the site, and the effectiveness of the Site Water Management Plan, including:

- The results of Surface water monitoring undertaken during quarrying operations at Karuah East will be compared against the baseline data collected as part of the Surface Water Assessment;
- A baseline ecological health condition assessment of Yalimbah Creek will be undertaken prior to commencement of operations, and monitoring of Yalimbah Creek will continue as part of the annual ecological monitoring of offset areas;
- The following parameters (see Table 3 below) will be measured at each monitoring location via collection of a grab sample. The recorded values for the parameters measured will be assessed as a minimum against baseline water quality results as well as the ANZECC trigger values presented below, and plotted to identify any trends over time. The OEH will be notified in the event of increasing levels of any parameter; and
- The range of analytes measured will be reviewed following the first 12 months of monitoring and a diagnostic set of analytes adopted for ongoing monitoring.

Table 3 – Surface Water Monitoring Parameters

Parameter	Unit	ANZECC Guidelines¹
pH (Field)	--	6.5 – 8.5
Conductivity (Field)	uS/cm	125 – 2200
Conductivity (Lab)	uS/cm	125 – 2200
Total Dissolved Solids	mg/L	-
Parameter	Unit	ANZECC Guidelines¹
Total Phosphorus	mg/L	0.025
Ammonia	mg/L	0.02
Nitrogen (Nitrate)	mg/L	0.350
Total Hardness (as CaCO ₃)	mg/L	--
Oil & Grease	mg/L	--
Arsenic	mg/L	0.024
Cadmium	mg/L	0.0002
Calcium	mg/L	--
Chromium	mg/L	0.001
Copper	mg/L	0.0014
Lead	mg/L	0.0034
Magnesium	mg/L	--
Manganese	mg/L	1.9

Nickel	mg/L	0.011
Potassium	mg/L	--
Sodium	mg/L	--
Vanadium	Mg/L	--
Zinc	mg/L	0.0312

¹ Key default trigger values presented in ANZECC 2000 for slightly disturbed upland rivers in NSW. Heavy metals based on hard water (120-179 mgCaCO₃/L)

Surface water monitoring locations will be as follows:

- Dam 1;
- Dam 2;
- Dam 3;
- SW 1 & SW 2 - Existing second order drainage line (within Lot 13 flowing along the eastern boundary of the Study Area); both upstream and downstream of the quarry;
- SW 3 - Existing drainage line downstream of Dam 2; and
- SW 4 - Existing drainage line downstream of the quarry extraction area.

The table below identifies the monitoring point locations, the type of monitoring point, and the frequency of sampling.

Table 4 - Proposed Surface Water Monitoring Locations

Location	Type of Monitoring Point	Description of Location	Frequency
Dam 1	Water Quality	Proposed dam located in crushing plant area	Monthly, and within 24 hours of any discharge. Also prior to any controlled (i.e. planned) discharge.
Dam 2	Water Quality	Proposed dam located in western section of stockpile area	Monthly, and within 24 hours of any discharge. Also prior to any controlled (i.e. planned) discharge.
Dam 3	Water Quality	Proposed dam located in eastern section of stockpile area	Monthly and within 24 hours of any discharge. Also prior to any controlled (ie. planned) discharge.
SW1	Water Quality	Existing second order drainage line upstream of site	Monthly (if creek flowing)
SW2	Water Quality	Existing second order drainage line downstream of site	Monthly (if creek flowing) and within 24 hours of any discharge.

SW3	Water Quality	Downstream of Dam 2	Monthly (if creek flowing) and within 24 hours of any discharge.
SW4	Water Quality	Downstream of quarry extraction area.	Monthly (if creek flowing).
Water management (erosion and sediment)	Erosion and Sediment Control	All noted erosion and sediment control structures.	Monthly and after significant rainfall events.

Reporting of Monitoring Data

- Karuah East Quarry Pty Ltd will collate surface water analysis data and maintain an up to date record of analysis both in hard copy (laboratory reports) and electronic (results) format. These results will be interpreted as they are received in order to ensure appropriate operational guidance on maintaining water quality within desired parameters;
- The results of water quality analysis will be reported in the Annual Environmental Management Report (AEMR); and
- In the event that an exceedance in surface water quality criteria is identified, the exceedance will need to be reported to the relevant agencies in accordance with the requirements of the EPL.

4. BIODIVERSITY & CONSERVATION OFFSET

4.1 Flora and Fauna

The following will be implemented by the proponent:

Vegetation Clearing Management

Site Survey and Exclusion Fencing

The extraction area/forest interface will be delineated to protect retained bushland areas on Lot 12 and 13. To achieve this, the quarry footprint boundary will be surveyed and pegged by a Registered Surveyor prior to the conduct of clearing operations. Plastic mesh fencing or star pickets and flagging tape will be installed along the extraction boundary for use as exclusion fencing. The fencing will function as a clearly marked 'exclusion' boundary for the machinery operations.

Permanent chain wire metal exclusion fencing will be installed around the entire perimeter of the quarry footprint (except at the designated aerial fauna crossings) prior to the commencement of quarry operations.

Clearing Protocol

The following protocol will be undertaken as part of the clearing activity on the subject site:

- All contractors conducting clearing, earth works or quarrying activities within the subject site will be informed of the restrictions to the clearing of vegetation outside the 'exclusion fencing'. A construction protocol will be prepared requiring all earthworks, machinery and personnel be strictly controlled and be restricted to the extraction footprint. No storage of materials, vehicle parking or other disturbance will be undertaken outside the exclusion fencing. Contractors will be supplied with the construction protocol regarding the clearing restrictions through a work site induction program;
- Trees will be felled away from the refined bushland on the subject site back into the extraction areas; and
- Domestic fauna (ie. dogs) will be prohibited from entering the subject site with Contractors.

Fauna Management

Pre-Clearing Surveys

Where possible, vegetation clearing activity will be timed so as to avoid the following breeding periods for hollow dependant fauna:

- October – February (microbats); and
- June – August (large forest owls and microbats in torpor).

If restricting the clearing to these limited times is not found to be practical, then ecological pre-clearing surveys will be undertaken within two weeks prior to the commencement of the clearing.

If required, components of the pre-clearing surveys will include:

Threatened Fauna Searches

Within one week prior to commencement of vegetation clearing, searches for signs of Threatened species occurring within the quarry footprint will be undertaken. These searches would include but not be limited to;

- Searches for nests of threatened raptors; and
- Searches for whitewash or other signs of roosting or nesting Powerful and Masked Owls.

If a threatened raptor or owl nest site is recorded within the subject site during the surveys, clearing activity will not take place in the vicinity of the nest (within 50 metres) until the nest is vacated by the affected species (including fledglings). Recorded nest sites would be subject to a monitoring program to ensure that no clearing activity is undertaken until the nest sites are vacated.

Small Mammal Trapping

Elliott trapping will be undertaken within one week prior to commencement of vegetation clearing over a 4 night period, targeting the Brush-tailed Phascogale (*Phascogale tapoatafe*) and Squirrel Glider (*Petaurus norfolcensis*). A total of 4 trap lines (equating to 160 arboreal Elliott traps and 400 terrestrial Elliott trap nights) will be established across the subject site (2 lines/stratification unit).

Stag Watching and Anabat Survey

A combined Stag Watching and Anabat survey would be conducted within the subject site over a 4 night period in an attempt to identify potential Microchiropteran bat roost trees. Should further investigations reveal the presence of a maternity colony, no clearing would be undertaken until after the completion of the breeding period (mid October – mid February inclusive).

Reporting

A report detailing the methods and results of the pre-clearing surveys will be prepared and submitted to OEH immediately prior to the commencement of the clearing operations.

Ecological Clearing Supervision

The removal of all identified hollow bearing trees will be undertaken with the presence of a qualified and suitably experienced fauna ecologist.

A tree felling protocol will be developed to minimise harm to hollow obligates during the clearing of trees for the proposal. The tree felling protocol will be developed by a suitably qualified and licenced ecologist with previous experience supervising felling trees. The tree felling protocol will comprise pre-felling identification and mapping of hollow bearing trees, inspections of trees on the day of clearing, procedures for the safe removal of fauna species from trees prior to and post felling, a relocation/release procedure and a methodology for salvaging (and relocating) tree hollows where practicable.

The relevance of the marked hollow bearing trees and requirements for ecological clearing supervision and hollow resource recovery will be communicated to the clearing Contractor as part of a site induction program.

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.

Aerial Fauna Crossings

Two (2) dedicated aerial fauna crossings will be installed.

- The western aerial fauna crossing will be located at the existing quarry haul road approximately 250 metres north east from the existing quarry site office; and
- The eastern aerial fauna crossing is proposed on Lot 13 along the north-south running access road.

The canopy bridges will comprise rope netting suspended across the entire width of the haul roads connected to two (2) poles placed on opposite side of the roads. The western canopy bridge would be approximately 40-45m in length and 50cm wide whilst the eastern canopy bridge would be approximately 55 metres in length and 50cm in width.

The netting of both canopy bridges would comprise 14mm diameter marine grade 'silver rope' in a flat lattice-work configuration (ie. analogous to a rope ladder laid horizontally).

The height of the poles and canopy crossing above the road surface would be between 6 – 12 metres, depending on the road profile.

Single strands of rope will extend from the timber poles into the canopy of adjacent trees to facilitate access by arboreal mammals.

The final design of the canopy rope bridges would be chosen as part of detailed design following project approval.

A twelve month monitoring program will be undertaken using a motion detecting camera system mounted on each pole at each of the two (2) aerial crossings.

Salvage and Relocation of Terrestrial Habitat Structures

Large fallen logs will be salvaged during the clearing operations and relocated into retained forested habitats on Lots 12 and 13.

Threatened Plant Populations

Salvage and Reintroduction

A salvage program for *Tetratheca juncea* will be implemented. The salvage program will comprise the excavation of clumps (along with rhizomes and surrounding root balls) proposed for removal and their reintroduction into prepared 'beds' within suitable habitats nearby.

Application for a Section 91 licence from OEH for the salvage program will be made and will be subject to a detailed Salvage Plan to be prepared by the Proponent (and endorsed by OEH and Department of Planning) prior to commencement of the works.

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.

4.2 Biodiversity Offset Strategy

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.

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* ssp *parviflora* will be undertaken and reported to the NSW OEH;
- 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).
- 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;
- A Conservation Management Plan will be developed. The plan will:
 - Confirm required on ground works such as weed control, fencing, signage and pest control;

- Confirm the timing / schedule of the abovementioned works; and
- 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.
- 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.

5.0 NOISE, BLASTING AND VIBRATION

The following will be undertaken:

- Four (4) metre noise barriers will be included around stockpile and stacker locations to reduce noise emissions from mobile plant items in these areas;
- Noise compliance monitoring will be undertaken in accordance with conditions of consent by a suitably qualified acoustic expert. The monitoring will consider the performance of the quarry in relation to the project specific noise, vibration and blast criteria established in the SLR Noise and Blasting Impact Assessment (dated 2 November 2012);
- The proponent will not fire blasts at the existing quarry and the proposed Karuah East quarry at the same time;
- The proponent will implement a blasting program where nearby receivers are notified in advance of a blast;
- The following control measures for vibration will be undertaken:
 - Reducing the maximum instantaneous charge (MIC) by using delays, reduced hole diameter and/or deck loading;
 - Changing the burden and spacing by altering the drill pattern and/or delay layout or altering the hole inclination;
 - Use the minimum practicable sub drilling which gives satisfactory toe conditions; and - Investigate alternative rock breaking techniques.
- The following control measures for air blasting will be undertaken:
 - Reducing the maximum instantaneous charge (MIC) by using delays, reduced hole diameter and/or deck loading;
 - Ensure stemming depth and type is adequate;
 - Eliminate exposed detonating cord and secondary blasting;
 - Restrict blasting events to favourable weather conditions;
 - Orient quarry faces away from potentially sensitive receivers;
 - Use a hole spacing and burden which will ensure that the explosive force is just sufficient to break the ore to the required size; and
 - The proponent will take particular care where the face is already broken and consider deck loading where appropriate to avoid broken ground or cavities in the face.

6.0 TRANSPORT

Karuah East Quarry Pty Ltd will undertake the following road works as part of the proposed development:

- Upgrade and extend Blue Rock Lane;
- Realign Andesite Drive and Blue Rock Lane intersection; and
- Adjust road marking at Branch Lane and Andesite Road intersection.

The works will be undertaken in accordance with the upgrade plans prepared by GCA numbered C00-C27. Road construction and drainage works will comply with Great Lakes Council and NSW RMS standards.

7.0 AIR QUALITY & GREENHOUSE GAS EMISSION

7.1 Air Quality

The following will be undertaken:

- Air quality monitoring will be undertaken in accordance with conditions of consent by a suitably qualified acoustic expert. The monitoring will consider the performance of the quarry in relation to the criteria outlined in the SLR Air Quality Impact Assessment (dated July 2013); Haul Roads from the site to the Pacific Highway will be sealed;
- Watering of any unsealed roads – Level 1 Watering at 2L/m²/hour;
- The crusher will be enclosed; and
- Stockpiles will be subject to both water spraying and wind breaks will be installed.

7.2 Greenhouse Gas

The following practices will be adopted to assist in the reduction of Greenhouse Gas emissions from operations at the project site:

Relating to diesel / petroleum consumption:

- Emissions from construction / transport vehicles and on site machinery will comply with the relevant Australian Standards;
- All vehicles and machinery will be regularly maintained to ensure proper and efficient working order and therefore minimise emissions;
- Optimum vehicle / equipment tire pressures will be maintained;
- Vehicle idling time will be reduced where possible;
- The finished site topography will ensure that no excessive engine use is required; and
- Optimisation of incline / decline of roads within the construction area on the project site will be considered to reduce transport distances for vehicles entering / exiting the project site.

Relating to electricity consumption:

- Use of efficient construction equipment technology;
- Use of efficient crushing and processing plant technology; and
- Continued monitoring of site electricity usage and review of techniques to reduce usage (if possible).
-

8.0 HERITAGE

The following will be will be adopted by the proponent.

8.1 Aboriginal Archaeology

- If Aboriginal site/s are identified in the study area during works, then all activity in the area will cease, the area cordoned off and contact made with the Office of Environment and Heritage Enviroline 131 555, a suitably qualified archaeologist and the relevant Aboriginal stakeholders, so that it can be adequately assessed and managed; and
- In the event that skeletal remains are uncovered, work will cease immediately in the vicinity and the site fenced. The proponent will need to contact the NSW Police Coroner to determine if the material is of Aboriginal origin. If determined to be Aboriginal, contact will be made with the OEH Enviroline 131 555 and relevant Aboriginal stakeholders in order to determine an action plan for the management of the skeletal remains prior to works re-commencing on site.

8.2 European Heritage

- If, during the course of development works, significant European cultural heritage material is uncovered, work will cease in that area immediately. The OEH will be notified and works only recommenced when an appropriate and approved management strategy has been instigated.

9.0 VISUAL

The following will be undertaken:

- Trees will be planted as soon as practical on the initial benches on the western face of the quarry; and
- The proposed infrastructure area will be painted in an appropriate colour to blend in with the natural surroundings.

10.0 ENVIRONMENTAL MANAGEMENT STRATEGY

The Environmental Management Strategy dated August 2011 developed by GSS Environmental for the Karuah East Quarry will be adopted & implemented in full by Karuah East Pty Ltd.

11.0 QUARRY CLOSURE & REHABILITATION

The Quarry Closure & Rehabilitation Plan dated November 2012 prepared by GSS Environmental for the Karuah East Quarry will be adopted and implemented in full by the proponent for the Karuah East Hard Rock Quarry (**Appendix H** of the EA Report dated 31 January 2013) will be adopted & implemented in full by Karuah East Pty Ltd.

11.1 Rehabilitation Management Plan

Until such time that extraction has ceased, rehabilitation will occur around the perimeter of the pit only along the benches and will not involve the pit floor. As the extraction progresses through the resource, 15m wide benches will be left every 15m of depth to provide a horizontal platform on which native flora species will be established.

The revegetation program will re-establish native tree / shrub / ground cover and will stabilise reshaped and benched areas. Benches will be deep ripped to actively promote infiltration of water which will enhance soil moisture requirements for direct tree seeding and minimise surface runoff to underlying benches and the pit floor dirty water control system.

On completion of quarry operations, the pit floor will be re-shaped and revegetated with wetland plant species to form a free draining wetland environment.

Topsoil Management

Topsoil stripping within the disturbed area will be undertaken when the soil is in a slightly moist condition to reducing damage to soil structure. Stripped material will be placed directly onto the disturbed areas and spread immediately if excavation sequences, equipment scheduling and weather conditions permit.

A maximum stockpile height of 3m will be maintained to preserve viability and reduce soil deterioration.

Stockpiles will be protected with sediment fencing and planted with a sterile cover crop (annual species) to ensure stabilisation. Surface drainage in the vicinity of the stockpiles will be configured so as to direct any runoff around the stockpile.

Where the stockpile is not wholly contained within the “closed loop” water management system, temporary sediment control measures such as sand bags and silt fences will be used to prevent sediment from leaving the disturbed areas.

Topsoil will be re-spread in the reverse sequence to its removal, so that the organic layer, containing any seed or vegetation, is returned to the surface. Topsoil will be spread to a minimum depth of 50mm on 3:1 or steeper slopes and to a minimum depth of 150mm on flatter slopes.

Re-spread topsoil will be levelled to achieve an even surface, avoiding a compacted or an over-smooth finish.

Surface Preparation

Thorough site preparation will be undertaken to ensure rapid establishment and growth of seedlings. All areas proposed for seeding will be deep ripped to an approximate depth of 400 – 500mm.

Where ripping on slopes is required, the ripping will be undertaken around the contour of the land at right angles to water flow.

Direct Seeding

A mixture of native trees and shrubs endemic to the area will be sown onto the majority of the reshaped and benched pit areas following topdressing and site preparation.

The seed will be sourced from reputable seed supply agents. Native seed for revegetation of the quarry will be appropriately pre-treated in order to break dormancy restrictions.

The native tree and shrub seed mix will be sown at a total combined rate of approximately 6.3 kg/ha. Seed will be broadcast evenly onto top-dressed areas. Seeding will be conducted in late spring, summer and early autumn.

Exotic pasture species (warm season perennial, cool season perennial, year long green perennial and annual) will be sown where the risk of erosion is less and on the more protected aspects of landforms.

All legumes will be inoculated and lime pelleted prior to seeding. Oats and/or ryecorn/millet (depending on season) will be utilised as the cover crop species.

Revegetation activities will generally be undertaken in spring and autumn; however opportunistic revegetation will be undertaken if areas become available for sowing in summer or winter. After surface soil amelioration and tillage is completed for any given area, revegetation will commence as soon as practicable. The proposed method of sowing will be via conventional spreading using agricultural broadcasting equipment, or by hand if the terrain is difficult and machinery use is not possible.

Slope stabilising techniques such as hydro seeding and straw mulching will be undertaken on slopes exceeding 180 for enhancement of pasture germination.

Fencing and Weed Control

Fencing (or a similar barrier) will be erected and maintained to exclude and prohibit the movement of persons and vehicles into areas that have been rehabilitated. The fencing will be routinely checked and repaired where necessary. Signs will be placed in prominent locations to indicate areas that are undergoing rehabilitation. Weed control will be undertaken on an “as required” basis should cyclical weed invasion events occur.

Rehabilitation Maintenance

All erosion and sediment control measures will be maintained in a functioning condition until individual areas have been deemed “successfully” rehabilitated. Structural soil conservation works will be inspected after high intensity rainfall so that de-silting and prompt repairs and/or replacement of damaged works can be initiated as required.

Rehabilitation Monitoring

Regular monitoring of the revegetated areas will be undertaken during the initial vegetation establishment period and beyond. The table below presents the monitoring program, including the specific aspects and elements to be monitored and frequencies for those various aspects.

Monitoring will be conducted periodically by independent, suitably qualified persons at locations which will be representative of the range of conditions on the rehabilitating areas. Annual reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness. The outcome of these reviews will be included in each Annual Environmental Management Report (AEMR).

In addition to the rehabilitated areas, at least two reference sites will be monitored to allow a comparison of the development and success of the rehabilitation against a control. Reference sites indicate the condition of surrounding un-disturbed areas.

Table 5 - Proposed Rehabilitation Monitoring Program

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
Ecosystem Establishment		
General Description	<input type="checkbox"/> Describe the vegetation in general terms, e.g. mixed eucalypt woodland with grass understorey and scattered shrubs, dense Acacia scrub, etc.	12 months after establishment and then every 2 years
2m x 2m quadrants	<ul style="list-style-type: none"> • Count the number of plants of all species, excluding grass. • Measure live vegetation cover for understorey and grasses (separately) using a line intercept 	12 months after establishment and then every 2 years

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
	method. <input type="checkbox"/> Record details of ground cover (litter, logs, rocks etc).	

20m x 10m plots	<ul style="list-style-type: none"> • Count, by species, all trees >1.6m tall. • Tag and measure DBH of trees >1.6m tall, to a maximum of 10 for any one species. • Record canopy cover over the whole 20m centreline when trees are tall enough. • Subjectively describe tree health, by species if relevant, noting signs of drought stress, nutrient deficiencies, disease and severe insect attack. Where health problems are noted record the percentage of unhealthy trees. • Record any new plant species not present in the smaller plots, including any problem and declared noxious weeds. • Take five surface soil samples (e.g. at approx. 5m intervals along the centreline) and bulk these for analyses of: PH, EC, chloride and sulfate; exchangeable Ca/Mg/K/Na; cation exchange capacity; particle size analysis and R1 dispersion index; 15 bar and field capacity moisture content; organic carbon; total and nitrate nitrogen; total and extractable phosphorus; Cu, Mn and Zn. 	12 months after establishment and then every 2 years
50m transect	<ul style="list-style-type: none"> • Along the 50m erosion monitoring transect, record the location, number and dimension of all gullies >30cm wide and/or 30cm deep. • Erosion pins may be established in plots located in newer rehabilitation to record sheet erosion if present. 	12 months after establishment and then every 2 years
Rehabilitation in general	<ul style="list-style-type: none"> • When traversing between monitoring plots, note the presence of species of interest not previously recorded (e.g. key functional or structural species, protected species, noxious weeds), as well as obvious problems including any extensive bare areas (e.g. those greater than 0.1ha). • Observation such as this can provide useful, broad scale information on rehabilitation success and problems. 	12 months after establishment and then every 2 years

Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
Photographic record	<input type="checkbox"/> For each 20m x 10m plot, a photograph should be taken at each end of the plot, along the centreline looking in.	12 months after establishment and then every 2 years

Habitat	<ul style="list-style-type: none"> • General observations relating to the availability and variety of food sources (e.g. flowering/ fruiting trees, presence of invertebrates etc). • Availability and variety of shelter (e.g. depth of leaf litter, presence of logs, hollows etc). • Presence/absence of free water in the rehabilitation areas. 	12 months after establishment and then every 2 years
Fauna	<ul style="list-style-type: none"> • General observations of vertebrate species (including species of conservation significance). • Detailed fauna surveys including presence and approximate abundance and distribution of vertebrate species (focusing on species of conservation significance). 	After rehabilitation is three years old undertake monitoring in every 2 years after establishment in both Autumn and Spring
Weeds and pests	<ul style="list-style-type: none"> • Species identity. • Approximate numbers/level of infestation. • Observation of impact on rehabilitation (if any). 	Quarterly during the first two years and biannually after that. Inspections should be opportunistic after significant rainfall events.
Geotechnical Stability		
	<ul style="list-style-type: none"> • Assessment of the stability of batters and also looking at surface settlements (sink holes). In particular where these features could impact on the performance of any surface water management system. • Surface integrity of landform cover/capping (measurement of extent of integrity failure). • Presence/ absence of landform slumping. 	Annually
Aspect of Rehabilitation	Elements to be Monitored	Monitoring Frequency
Surface and Groundwater		

	<ul style="list-style-type: none"> • Groundwater quality and depth • Efficiency of landform surface water drainage systems (integrity of banks and drains). • Water quality including pH, EC and total suspended solids of water in water storages, and pits, sedimentation dams. 	<p>Quarterly or following rainfall events. Monitoring of receiving waters during a rainfall event which results in runoff.</p>
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11.2 Final Void Management s

Void Water Quality

Water will only be permitted to accumulate in the void if it maintains a quality that does not compromise its intended final use or surrounding groundwater systems. The following aspects will be considered with respect to managing final void water quality:

- Concentration of elements resulting from the quarrying of material;
- Control of surface flow into the void; and ☐ Rainfall and evaporation.

Post closure a water monitoring program will remain in place to monitor any changes to chemistry within the void.

Void Slope Stability

The surrounding final slopes will be left in a condition where the risk of slope failure is minimised. This may require the benches to be battered back from the vertical to enable a stable overall slope angle.

The following will be considered when assessing the geotechnical stability of highwalls:

- Long term final void water levels;
- Height and inclination of slope and number and spacing of intermediate benches;
- Shear strength of the highwall soils and rocks;
- Density and orientation of fractures, faults, bedding planes, and any other discontinuities, and the strength along them; and
- The effects of the external factors, such as surface runoff.

Prior to closure, investigations will be undertaken to confirm the criteria above.

Control of Surface Inflow

Drainage will be directed away from the highwall face through the construction of interceptor channels around the perimeter of the highwall and spoon drains will be utilised on the upslope side of all benches.

The catchment area of the final void will be minimised by the installation of diversion drains.

Safety

The following will be considered at the time of closure to ensure that the void is left in a safe manner.

- All high will to be left geotechnically stable;
- A barrier at a safe distance from the perimeter of the void to prevent human access will be constructed. The highwall areas will be secured by the construction of a trench and a safety berm, as well as a security fence along the entire length of the remaining high wall;
- Suitable signs, clearly stating the risk to public safety and prohibiting public access will be erected at 50m intervals outside the safety fence;
- Surface runoff from land surrounding the void will be diverted from entering the void; and
- Shrub and/or tree planting along the outside edge of the bund wall will be implemented where practicable to lessen the visual impact of the wall, and will be in accordance with the agreed post mining rehabilitation criteria and land use.

Monitoring and Management

After decommissioning works have been undertaken, whether progressive or final, a monitoring program will be designed to demonstrate that the completion criteria have been met and that the site is not resulting in any off-site effects.

Closure Liability

In accordance with the Department of Trade and Investment Regional Infrastructure and Services ESG1 – Rehabilitation Cost Estimate Guidelines, the closure liability for the Karuah East Quarry is **\$468,134**.

12.0 WASTE MANAGEMENT

All waste or recyclable material will be handled as follows:

During Construction

Material Type

Excavation Material & Green Waste - Will be stockpiled on site in accordance with the quarry rehabilitation plan.

Bricks – Any remaining bricks will be removed from the site by a suitably qualified contractor and transported to a local crushing and recycling company.

Concrete - Any remaining concrete will be removed from the site by a suitably qualified contractor and transported to a crushing and recycling company.

Timber – Any excess timber will be removed from the site by a suitably qualified contractor and transported to a landscaping supply company for chipping and composting.

Plasterboard – Any excess plasterboard will be removed from the site by a suitably qualified contractor and taken to landscape supply company.

Metals – Any excess metal will be removed from the site by a suitably qualified contractor and transported to a metal recycling facility.

Other – Any other materials not noted above will be removed from the site by a suitably qualified contractor and transported to an appropriate facility.

During Operation

Quarry Activity

Excavation Material & Green Waste - Will be stockpiled on site in accordance with the quarry rehabilitation plan.

Bricks – Any remaining bricks will be removed from the site by a suitably qualified contractor and transported to a local crushing and recycling company.

Concrete - Any remaining concrete will be removed from the site by a suitably qualified contractor and transported to a crushing and recycling company.

Timber – Any excess timber will be removed from the site by a suitably qualified contractor and transported to a landscaping supply company for chipping and composting.

Metals – Any excess metal will be removed from the site by a suitably qualified contractor and transported to a metal recycling facility.

Other – Any other materials not noted above will be removed from the site by a suitably qualified contractor and transported to an appropriate facility.

General Waste & Recyclables from Staff within the Plant Area

Recyclables

Paper, cardboard, glass, aluminium & plastic

Temporary recycle bins will be provided within staff areas of the plant. Management will ensure that bins are regularly collected and transported to an appropriate recycling facility.

Non Recyclables

Food scraps and other waste

Temporary waste bins will be provided within staff areas of the plant. Management will ensure that bins are regularly collected and transported to an appropriate recycling facility.

Quarry Closure

Waste and recyclable material associated with the quarry closure and decommissioning will be undertaken in accordance with the Quarry Closure and Rehabilitation Plan. This will include:

Site Services

All services including power, water, data and telephone on the site will be isolated, disconnected and terminated to make them safe. All underground services will be made safe and left buried in the ground. Overhead power lines (where they are not used by others) will be removed and the materials (i.e. poles and wire) recovered for potential re-sale or recycling as applicable.

Infrastructure and Buildings

- All sumps will be de-watered and de-silted prior to the commencement of demolition. In addition all items of equipment will be de-oiled, degassed, depressurised and isolated and any hazardous materials (HAZMATs) removed from the site;
- All infrastructure, including the office buildings, workshops, parking areas, crushing plant, wash plant and product storage areas will be demolished and removed from the site. Where possible assets may be reused or sold to other operations. Otherwise they will be removed from the site by a suitably qualified contractor and transported to an appropriate recycling facility;
- The remaining items will be demolished, removed and transported from the site as required. All recoverable scrap steel will be sold and recycled, with the remaining non-recyclable wastes being taken to a licenced landfill. Prior to disposal, all wastes will be assessed and classified in accordance with *Waste Classification Guidelines (DECC, 2008)*; and
- All concrete footings and pads will be broken up to at least 1.5m below the surface. The waste concrete will be crushed to produce an aggregate that can either be used on the site or sold for some other beneficial use.

Roadways, Car Parks and Hardstand

The roadways, car parks, and hardstand areas around the processing and administration areas will be ripped up. All areas will be reshaped, deep ripped, topsoiled and seeded in accordance with the rehabilitation plan.

Fuel Farm and Lubricant Storage Area

Leading up to closure, a preliminary sampling and analysis programme (Phase 1) will be implemented to determine whether a more detailed assessment (Phase 2 – detailed investigation of contamination involving drilling, etc) should be conducted.

13.0 HAZARDOUS MATERIALS / DANGEROUS GOODS

All fuel storage and storage of any required chemicals will be within the specified bunded area of the infrastructure plant. Material Safety Data Sheets will be recorded in the site safety system for all chemicals used on site. This will contain information on the environmental impacts for the use of certain chemicals and include detail on emergency response, clean up and disposal should a highly unlikely event of a spill occur.

14.0 UTILITIES

The proposed development will comply with the requirements of the relevant utility authorities and evidence of the necessary approvals will be provided to the NSW DoPI prior to construction works.

15.0 OUTDOOR LIGHTING

All outdoor lighting associated with the proposed development will be designed to comply with the requirements of AS 4282, Control of Obtrusive Effects of Outdoor Lighting.



Australian Government
Department of the Environment

Approval

Karuah East Quarry, Pacific Highway, 3 km from Karuah, NSW (EPBC 2014/7282)

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

Person to whom the approval is granted Karuah East Quarry Pty Ltd

Proponent's ACN 141 505 035

Proposed action To develop a hard rock (andesite) quarry and associated infrastructure in the Lower North Coast, Pacific Highway, 3 km north of Karuah, NSW

Approval decision

Controlling Provision	Decision
Listed threatened species and communities (sections 18 & 18A)	Approved

Conditions of approval

This approval is subject to the conditions specified below.

Expiry date of approval

This approval has effect until 30 March 2045.

Decision-maker

name and position Tim Wyndham
 Acting Assistant Secretary
 South-Eastern Australia Environment Assessments Branch

signature

Date of decision

20.3.15

Conditions attached to the approval

Proposed project area

1. The person taking the action must not impact on any **Black-eyed Susan** or **Trailing Woodruff** outside the **project area** identified at **Appendix A**.
2. The person taking the action must not impact on any habitat for the **Koala** outside the **project area** identified at **Appendix B**.

Mitigation

3. Prior to the **commencement of construction**, the person taking the action must install fencing around the perimeter of the **project area** and identify signed **no-go areas**. Fencing and **no-go areas** must be maintained for the life of the action.
4. Prior to the **commencement of construction** and for the life of the action, all on-site personnel must be inducted on environmental sensitivities in the area, including the risk of **Koala** vehicle strike. Induction material is to be prepared by a **suitably qualified ecologist**.
5. Should injury to Koalas occur, advice from a **wildlife expert** must be sought and action taken in accordance with that advice. Records of any Koala injury within the **project area** must be documented and maintained.
6. Within 48 hours before the clearing of vegetation, pre-clearance surveys must be undertaken by a **suitably qualified ecologist** to ensure the absence of the **Koala** in the **project area**. If any **Koalas** are found to be present, **salvage and translocation** must be undertaken by a **suitably qualified ecologist**.

Offsets

7. The person taking the action must comply with the offset conditions set out in the **NSW Project Approval**.
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 those 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**.

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:
- a) **survey information** identifying the number of **Trailing Woodruff** present across all proposed offset sites; and
 - 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**.

The approved Biodiversity Area Offset Management Plan must be implemented.

Administrative

10. Within 30 days after the **commencement of construction**, the person taking the action must advise the **Department** in writing of the actual date of **commencement of construction**.
11. The person taking the action must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the management plan, and make it available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.
12. Within three months of every 12 month anniversary of the **commencement of construction**, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval over the previous 12 months, including implementation of any management plan, as specified in the conditions. Documentary evidence providing proof of the date of publication must be provided to the Department at the same time as the compliance report is published. The compliance reports must remain on the website for 12 months from the date of publishing. Potential or actual contraventions of the conditions of the approval must be reported to the **Department** in writing within 2 business days of the person taking the action becoming aware of the potential or actual contravention. All contraventions must also be included in the compliance reports.
13. Upon the direction of the **Minister**, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The independent auditor must be approved by the **Minister** prior to the commencement of the audit. Audit criteria must be agreed to by the **Minister** and the audit report must address the criteria to the satisfaction of the **Minister**.
14. If the person taking the action wishes to carry out any activity otherwise than in accordance with the management plan as specified in the conditions, the person taking the action must submit to the Department for the **Minister's** written approval a revised version of that management plan. The varied activity shall not commence until the **Minister** has approved the varied management plan in writing. If the **Minister** approves the revised management plan, that management plan must be implemented in place of the management plan originally.

15. If the **Minister** believes that it is necessary or convenient for the better protection of listed threatened species and ecological communities to do so, the **Minister** may request that the person taking the action make specified revisions to the management plan specified in the conditions and submit the revised management plan for the **Minister's** written approval. The person taking the action must comply with any such request. The revised approved management plan must be implemented. Unless the **Minister** has approved the revised management plan then the person taking the action must continue to implement the management plan originally approved, as specified in the conditions.
16. If, at any time after 5 years from the date of this approval, the person taking the action has not **substantially commenced** the action, then the person taking the action must not **substantially commence** the action without the written agreement of the **Minister**.
17. Unless otherwise agreed to in writing by the **Minister**, the person taking the action must publish all management plans referred to in these conditions of approval on their website. Each management plan must be published on the website within 1 month of being approved. The person taking the action must notify the **Department** within 5 business days of publishing the management plan on their website and the management plan must remain on the website for the period this approval has effect.

Definitions:

Black-eyed Susan is the EPBC listed threatened species *Tetratheca juncea*.

Commencement of construction is the date that preparatory works are first undertaken, including but not limited to clearing of vegetation, the erection of any onsite temporary structures and the use of heavy duty equipment for the purpose of breaking the ground for infrastructure or earthworks. This does not include investigative activities such as accessing the site for surveying or planning purposes.

Contingency plans include compensatory measures such as additional direct offsets which would be required to meet the EPBC Act Offsets Policy.

Department means the Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999*.

EPBC Act Offsets Policy means the Australian Government policy document titled: *EPBC Act environmental offsets policy Department of the Environment, 2013 Policy guiding the use of offsets under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

Karuah East Quarry EPBC Act Assessment Report means the report prepared by Eco Logical Australia, October 2014.

Koala is the EPBC listed threatened species *Phascolarctos cinereus*.

Minister means the Australian Government Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* and includes a delegate of the Minister.

No-go areas means areas adjacent to the **project area** containing habitat for EPBC listed threatened species, to be excluded from construction, vehicles, personnel and equipment.

NSW Project Approval means Project Approval number 09_0175, granted under section 75J of the *Environmental Planning and Assessment Act 1979* by the Minister for Planning to Karuah East Quarry Pty Ltd and dated 17 June 2014.

Project area means the Karuah East Hard Rock Quarry identified by the red line at Appendix A and Appendix B.

Salvage and translocation means the relocation of animals or plants from an area adversely affected by development to an area reserved or protected from ongoing impacts.

Substantially commence/d means the installation of any permanent infrastructure associated with the action excluding signage and fences.

Suitably qualified ecologist means an ecologist with relevant tertiary qualifications and at least 2 years of experience in koala surveying and salvage and translocation.

Survey information is data gathered by a **suitably qualified ecologist**.

Trailing Woodruff is the EPBC listed threatened species *Asperula asthenes*.

Wildlife expert means a practicing expert (such as a veterinarian) with qualifications in caring for injured wildlife and access to adequate equipment to provide appropriate care.

Appendix A – locations of the Black-eyed Susan and Trailing Woodruff in the project area and surrounding properties.

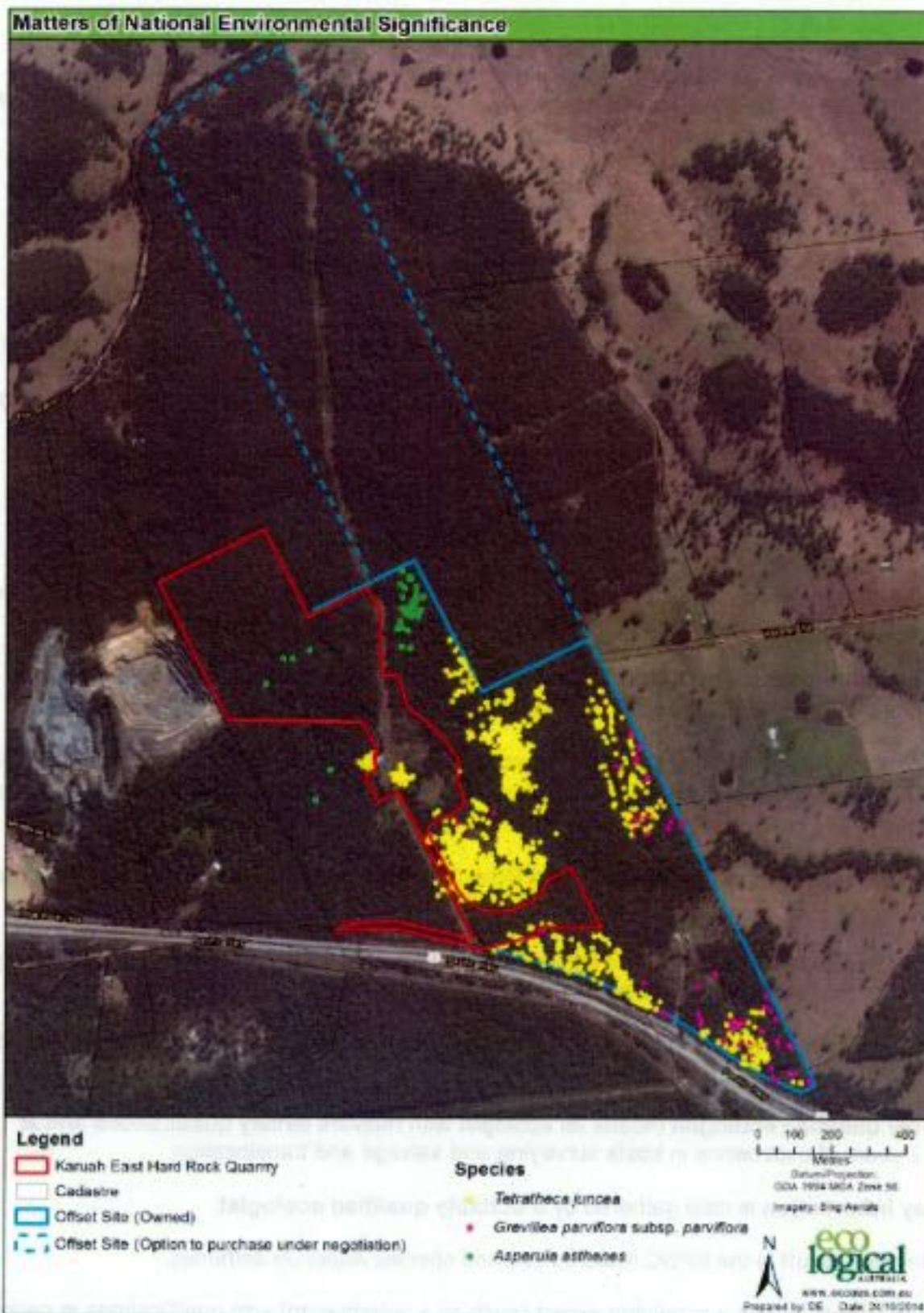


Figure 11 Threatened species recorded within the offset site

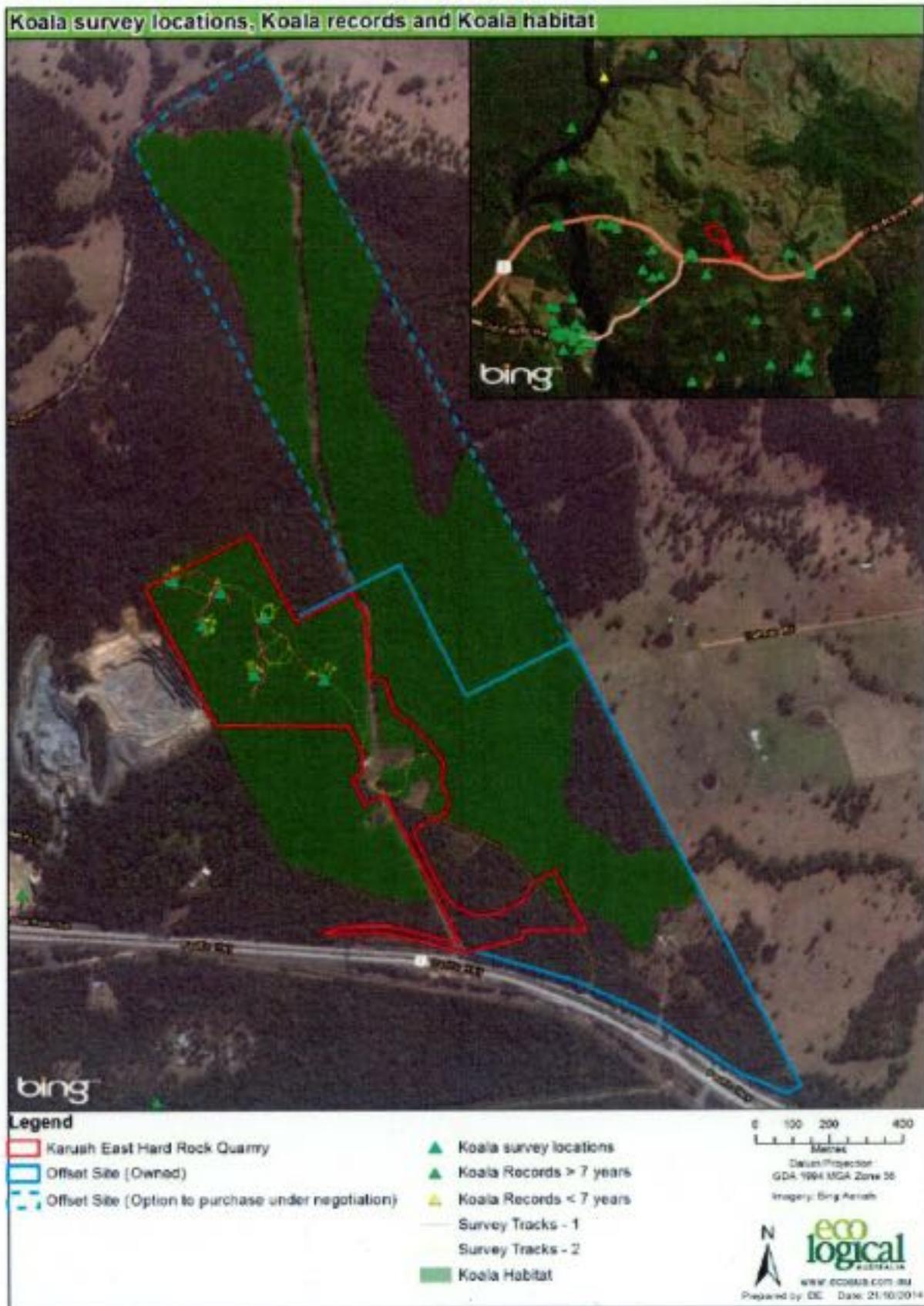


Figure 9 Koala habitat within both the quarry impact area and the adjacent offset areas

APPENDIX 2 – Environment Protection Licence

Environment Protection Licence

Licence - 20611

Licence Details	
Number:	20611
Anniversary Date:	26-August

Licensee
KARUAH EAST QUARRY PTY LIMITED
PO BOX 3284
THORNTON NSW 2322

Premises
KARUAH EAST QUARRY
PACIFIC HIGHWAY
KARUAH NSW 2324

Scheduled Activity
Crushing, grinding or separating
Extractive activities

Fee Based Activity	Scale
Crushing, grinding or separating	> 500000-2000000 T annual processing capacity
Extractive activities	> 500000-2000000 T annual capacity to extract or process

Region
North - Hunter
Ground Floor, NSW Govt Offices, 117 Bull Street
NEWCASTLE WEST NSW 2302
Phone: (02) 4908 6800
Fax: (02) 4908 6810
PO Box 488G
NEWCASTLE NSW 2300



Environment Protection Licence

Licence - 20611

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Environment Protection Licence

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Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

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The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

KARUAH EAST QUARRY PTY LIMITED
PO BOX 3284
THORNTON NSW 2322

subject to the conditions which follow.

Environment Protection Licence

Licence - 20611

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled development work listed below at the premises listed in A2:

Works necessary to commence quarry operations (eg stormwater controls, development of roads).

A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Crushing, grinding or separating	Crushing, grinding or separating	> 500000 - 2000000 T annual processing capacity
Extractive activities	Extractive activities	> 500000 - 2000000 T annual capacity to extract or process

A1.3 Notwithstanding the condition above, the scale of the land-based extractive activity and / or scale of crushing, grinding and separating authorised under this licence must not exceed 1.5 million tonnes of quarry products per annum, being the amount equivalent to the extraction limit approved by the project approval MP09_0175 granted under the *Environmental Planning and Assessment Act 1979* for the premises specified in A2.

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
KARUAH EAST QUARRY
PACIFIC HIGHWAY
KARUAH
NSW 2324
LOT 26 DP 1024341, LOT 27 DP 1024341, LOT 12 DP 1024564, LOT 13 DP 1024564, LOT 16 DP 1024564, LOT 17 DP 1024564, LOT 202 DP 1042537

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A3 Information supplied to the EPA

- A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

- a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
- b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

Any other document and/or management plan is not to be taken as part of the documentation in condition A4.1, other than those documents and/or management plans specifically referenced in this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

- P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

<i>Air</i>			
EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
4	Air emissions monitoring		Adjacent to Residence C at 5760 Pacific Highway, Karuah, referred to as DDG1 on Figure 2 "Sensitive Receivers & Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558.
5	Air emissions monitoring		Adjacent to Residence B at 5770 Pacific Hwy, Karuah, referred to as DDG2 on Figure 2 titled "Sensitive Receivers & Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558
6	Air emissions monitoring		Located Lot 24 DP 1024341 Pacific Karuah, referred to as DDG3 on Figure 2 titled "Sensitive Receivers and Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558.

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7	Air emissions monitoring	Located at 21 Halloran Road, North Arm Cove, referred to as DDG4 on Figure 2 titled "Sensitive Receivers and Air Quality Monitoring Locations" in draft Karuah East Quarry Project Air Quality Plan", July 2015. Located within EPA document DOC15/281558.
8	Air emission monitoring	Located on Lot21 DP1024341 Pacific Hwy, Karuah, referred to as DDG5 on Fig 2 "Karuah East Quarry - Sensitive Receivers & Air Quality Monitoring Locations" attached to licence variation application received 16/12/16. Located within EPA document DOC16/58114
9	Air emission monitoring	Residence B located at Lot 3 DP 785172, Karuah, referred to as "B" HVAS on Fig 2 "Karuah East Quarry - Sensitive Receivers & Air Quality Monitoring Locations" in licence variation application received 16/12/16. Located within EPA document DOC16/581149

P1.2 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

P1.3 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to waters	Discharge to waters	The discharge point from Dam 1 as shown on the plan titled "Proposed Surface Water Management Plan - Figure 3", which is filed as part of EPA document DOC15/253402.
2	Discharge to waters	Discharge to waters	The discharge point from Dam 2 as shown on the plan titled "Proposed Surface Water Management Plan - Figure 3", which is filed as part of EPA document DOC15/253402.
3	Discharge to waters	Discharge to waters	The discharge from Dam 3 as shown on the plan titled "Proposed Surface Water Management Plan - Figure 3", which is filed as part of EPA document DOC15/253402.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

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Noise/Weather

EPA identification no.	Type of monitoring point	Location description
11	Air blast overpressure & ground vibration peak particle velocity monitoring	Blast monitor located adjacent to Residence B as identified in 'Figure 1 - Appendix 2 - Noise Receiver Locations' located in EPA document DOC15/253402.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\& below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\&.

L2.4 Water and/or Land Concentration Limits

POINT 1,2,3

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	milligrams per litre				5 &/or none visible
pH	pH				6.5 - 8.5
Total suspended solids	milligrams per litre				40

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L3 Waste

- L3.1 The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.

L4 Noise limits

- L4.1 Noise generated at the premises must not exceed the noise limits in the table below. The locations referred to in the table below are indicated in Table 3 and Figure 10 of the document entitled Environmental Assessment Report - Proposed Karuah East Quarry (ADW Johnson Pty Limited 2013) which has been filed on EPA file LIC08/1088-03.

Location	Noise Limit dB(A)
	Day LAeq (15 minute)
Residence A on Lot 100 DP 785172	40
Residence B on Lot 3 DP 785172	37
Residence G on Lot 1 DP 1032636	38
Any other residence or sensitive receiver not subject to a private negotiated agreement	35
Any approved residence on Lot 11 DP 1024564	43

- L4.2 For the purpose of the table above, Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays.
- L4.3 The noise limits set out in this licence apply under all meteorological conditions except for the following:
- Wind speed greater than 3 metres/second at 10 metres above ground level; or
 - Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or
 - Stability category G temperature inversion conditions.

L4.4 Determining Compliance

To determine compliance with the noise limits set out in the table above, the licensee must locate monitoring equipment:

- within 30 metres of a dwelling façade (but not closer than 3 metres) where any dwelling on the property is situated more than 30 metres from the property boundary that is closest to the premises;
- approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises;
- at the most affected point at a location where there is no dwelling at the location; and
- within approximately 50 metres of the boundary of a national park or nature reserve.

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Note: A non-compliance of the Noise Limits table will still occur where noise generated from the premises in excess of the appropriate limit is measured:

- i) at a location other than an area prescribed in part (a) and part (b); and/or
- ii) at a point other than the most affected point at a location.

L4.5 For the purposes of determining the noise generated at the premises the modification factors in Fact Sheet C of the EPA's "Noise Policy for Industry" must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

L5 Blasting

L5.1 Blasting in or on the premises must only be carried out between the hours of 9:00 am and 4:00 pm Monday to Friday. No blasting is permitted on Saturdays, Sundays or public holidays. Blasting outside of the hours specified in this condition can only take place with the written approval of the EPA.

L5.2 Blasting is not permitted simultaneously with adjacent quarry(s).

L5.3 The airblast overpressure level from blasting operations in or on the premises must not exceed:
a) 115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period; and
b) 120 dB (Lin Peak) at any time,
at monitoring point 11 detailed in Condition P1.4.

L5.4 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:
a) 5 mm/second for more than 5% of the total number of blasts during each reporting period; and
b) 10 mm/second at any time,
at monitoring point 11 detailed in Condition P1.4.

L5.5 Error margins associated with any monitoring equipment used to measure airblast overpressure or peak particle velocity are not to be taken into account in determining whether or not the limit has been exceeded.

L5.6 The airblast overpressure and ground vibration levels in the conditions above do not apply at noise sensitive locations that are owned by the licensee or subject to a private agreement, relating to airblast overpressure and ground vibration levels, between the licensee and land owner.

L5.7 Offensive blast fume must not be emitted from the premises.

Definition:

Offensive blast fume means post-blast gases from the detonation of explosives at the premises that by reason of their nature, duration, character or quality, or the time at which they are emitted, or any other circumstances:

- 1. are harmful to (or likely to be harmful to) a person that is outside the premises from which it is emitted, or*
- 2. interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.*

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L6 Hours of operation

L6.1 All quarrying operations, including extraction, processing and loadings / transport must be conducted between 7am to 6pm Monday to Friday and 7am to 1pm Saturdays and at no time on Sundays and public holidays.

Maintenance activities may occur 24 hours per day, 7 days per week, provided these activities are inaudible at any privately owned residence.

L7 Potentially offensive odour

L7.1 No condition of this licence identifies a potentially offensive odour for the purposes of Section 129 of the Protection of the Environment Operations Act 1997.

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

- a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
- b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:

- a) must be maintained in a proper and efficient condition; and
- b) must be operated in a proper and efficient manner.

O3 Dust

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- O3.1 All areas in or on the premises must be maintained in a condition that prevents or minimises the emission of dust to the air.
- O3.2 Any activity carried out in or on the premises must be carried out by such practical means as to prevent dust or minimise the emission of dust to the air.
- O3.3 Any plant operated in or on the premises must be operated by such practical means to prevent or minimise dust or other air pollutants.
- O3.4 All trafficable areas and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the emission of dust to the air, or emission from the premises of wind-blown or traffic generated dust.
- O3.5 The licensee must ensure it has sufficient water during all stages of the quarry, and if necessary adjust the scale of quarrying operations on the premises to match its available supply.
- O3.6 Trucks entering and leaving the premises that are carrying loads of dust generating materials must have their loads covered at all times, except during loading and unloading.

O4 Emergency response

Note: The licensee must maintain, and implement as necessary, a current Pollution Incident Response Management Plan (PIRMP) for the premises. The licensee must keep the incident response plan on the premises at all times. The incident response plan must document systems and procedures to deal with all types of incidents (e.g. spills, explosions or fire) that may occur at the premises or that may be associated with activities that occur at the premises and which are likely to cause harm to the environment.

The PIRMP must be tested at least annually or following a pollution incident.

The licensee must develop the PIRMP in accordance with the requirements in Part 5.7A of the Protection of the Environment Operations (POEO) Act 1997 and POEO Regulations.

O5 Processes and management

- O5.1 All tanks and storage areas for drums containing material that has potential to cause environmental harm must be bunded or have an alternative spill containment system in-place.

The bunding and/or spill containment systems must be properly designed, engineered, and constructed to be suitable for the material types and quantities stored therein in accordance with all appropriate standards, including Australian Standards (AS)1940 and AS1596.

- O5.2 Bunds must:
 - a) have walls and floors constructed of impervious materials;
 - b) be of sufficient capacity to contain 110% of the volume of the tank (or 110% volume of the largest tank where a group of tanks are installed);
 - c) have floors graded to a collection sump;
 - d) not have a drain valve incorporated in the bund structure;

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or be constructed and operated in a manner that achieves the same environmental outcome.

- O5.3 All refuelling must be undertaken in a dedicated refuelling area. The refuelling area must be a hardstand and suitably bunded in accordance with EPA bunding guidance.
- O5.4 The licensee must, before undertaking any earthmoving or vegetation removal works, implement erosion and sediment control measures to prevent pollution of waters in accordance with Soils and Construction: Managing Urban Stormwater 2004 (Landcom, 2004).
- O5.5 Stormwater from all areas of the premises which has the potential to mobilise sediments and other material must be controlled and diverted through the appropriate erosion and sediment control and/or pollution control measures/structures, so as not to cause, permit or allow water pollution to occur.
- O5.6 The in-pit sump must be sized at all times to prevent a discharge to waters in the event of pump failure.

O6 Waste management

- O6.1 The licensee must not irrigate, discharge or dispose of sewage effluent, on the premises.
- O6.2 The licensee must operate and maintain a wastewater collection and storage tank/s to enable the pump out and offsite disposal of any sewage effluent.
- O6.3 The licensee must ensure that sewage effluent collected at the premises is pumped out and disposed of in a lawful manner.

O7 Other operating conditions

Noise and Blast Management

- O7.1 All acoustic bunds necessary to achieve compliance with the noise limits specified in this licence must be constructed prior to the commencement of quarrying activities and be maintained throughout the operational life of the premises to the height and location described in the Noise Management Plan.
- O7.2 The licensee must implement all necessary procedural controls to all mobile plant to limit engine RPM (revolutions per minute) so as to reduce noise in order to achieve compliance with the noise limits specified in this licence.

Bitumin Pre-coat Plant

- O7.3 The licensee must not have a bitumin pre-coat plant on the site. Project Approval MP09_0175 did not assess or approve such a plant.

5 Monitoring and Recording Conditions

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M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:

- in a legible form, or in a form that can readily be reduced to a legible form;
- kept for at least 4 years after the monitoring or event to which they relate took place; and
- produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:

- the date(s) on which the sample was taken;
- the time(s) at which the sample was collected;
- the point at which the sample was taken; and
- the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 4,5,6,7,8

Pollutant	Units of measure	Frequency	Sampling Method
Particulates - Deposited Matter	grams per square metre per month	Monthly	AM-19

POINT 9

Pollutant	Units of measure	Frequency	Sampling Method
PM10	micrograms per cubic metre	Every 6 days	AM-18
Total suspended particles	micrograms per cubic metre	Every 6 days	AM-15

M2.3 Water and/ or Land Monitoring Requirements

POINT 1,2,3

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Pollutant	Units of measure	Frequency	Sampling Method
Oil and Grease	milligrams per litre	Special Frequency 1	Visual Inspection
pH	pH	Special Frequency 1	Grab sample
Total suspended solids	milligrams per litre	Special Frequency 1	Grab sample
Turbidity	nephelometric turbidity units	Special Frequency 1	Grab sample

Note: For the purposes of the table above 'Special Frequency 1' means:

- (a) within 12 hours prior to any controlled discharge; and
- (b) daily during a controlled discharge; or
- (c) daily during any uncontrolled discharge.

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:

- a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
- b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
- c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Weather monitoring

M4.1 Prior to the commencement of operation of the development, the Proponent must establish a permanent meteorological station complying with the Approved Methods for Sampling and Analysis and the Australian Standard AS2923 - 1987, at the facility. The meteorological station must monitor the following parameters:

Parameter	Units of measure	Averaging period	Frequency	Sampling Method
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Rainfall	mm/hr	1 hour	Continuous	AM-4
Sigma Theta @ 10m	degrees	1 hour	Continuous	AM-2
Siting	-	-	-	AM-1
Temperature @ 10m	Kelvin	1 hour	Continuous	AM-4
Temperature @ 2m	Kelvin	1 hour	Continuous	Am-4
Total Solar Radiation @ 10m	W/m ²	1 hour	Continuous	AM-4
Wind direction @ 10m	degrees	1 hour	Continuous	AM-2
Wind speed @ 10m	m/s	1 hour	Continuous	AM-2

Note: Sampling methods as identified in the table above refer to those outlined in NSW EPA, 2001, Approved Methods for the Sampling and Analysis of Air Pollutants in NSW.

M4.2 The location of the site chosen for the station and details of equipment, measurement and maintenance / service procedures and schedules to be installed and maintained must be submitted to the EPA and approved in writing by the EPA before any sampling or analysis is carried out.

M4.3 The meteorological monitoring station must be calibrated at least once every 12 months. The EPA is to be provided with data on request in a Microsoft Office software compatible format.

M5 Recording of pollution complaints

M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M5.2 The record must include details of the following:

- a) the date and time of the complaint;
- b) the method by which the complaint was made;
- c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- d) the nature of the complaint;
- e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
- f) if no action was taken by the licensee, the reasons why no action was taken.

M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of

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receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M6.3 The preceding two conditions do not apply until 1 month after the date of the issue of this licence.

M7 Blasting

M7.1 To determine compliance with Blast Limit conditions of this licence:

- a) Airblast overpressure and ground vibration levels must be measured and electronically recorded for monitoring point 11 for the parameters specified in Column 1 of the table below; and
- b) The licensee must use the units of measure, sampling method, and sample at the frequency specified opposite in the other columns.

Parameter	Units of Measure	Frequency	Sampling Method
Airblast Overpressure	Decibels (Linear Peak	All blasts	Australian Standard AS 2187.2-2006
Ground Vibration Peak Particle Velocity	millimetres/second	All blasts	Australian Standard AS 2187.2-2006

M8 Noise monitoring

M8.1 To assess compliance with the noise limits for this premises attended noise monitoring must be undertaken in accordance with all noise conditions and:

- a) during a period of normal quarry operations;
- b) at each one of the locations listed in the noise limits table of this licence;
- c) occur quarterly in the reporting period;
- d) occur during each day period as defined in the NSW Noise Policy for Industry.

Note: The frequency of noise monitoring will be reviewed, upon request, after two years of quarterly monitoring (approximately June 2021).

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:

1. a Statement of Compliance,
2. a Monitoring and Complaints Summary,

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3. a Statement of Compliance - Licence Conditions,
4. a Statement of Compliance - Load based Fee,
5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,
6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and
7. a Statement of Compliance - Environmental Management Systems and Practices.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:

- a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
- b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:

- a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
- b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect *EPA* or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:

- a) the licence holder; or
- b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R2 Notification of environmental harm

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

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R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:

- a) where this licence applies to premises, an event has occurred at the premises; or
 - b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
- and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:

- a) the cause, time and duration of the event;
- b) the type, volume and concentration of every pollutant discharged as a result of the event;
- c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
- d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
- f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
- g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

Reporting blasting limit exceedance

R4.1 The licensee must report any exceedance of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedance becomes known to the licensee or to one of the licensee's employees or agents.

Annual Blast Monitoring Report

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- R4.2 The licensee must supply a Blast Monitoring Report with the EPA licence Annual Return, which must include the following information relating to each blast carried out within the premises during the respective reporting period:
- a) the date and time of the blast;
 - b) the location of the blast on the premises;
 - c) the blast monitoring results at each blast monitoring station;
 - d) an explanation for any missing blast monitoring results.

Noise Monitoring Report

- R4.3 A quarterly noise monitoring report must be submitted to the EPA within 30 days of completion of each round of quarterly noise monitoring. The assessment must be prepared by a suitably qualified and experienced acoustical consultant and include:
- a) a description of the plant in operation and activities being undertaken on the premises during each noise monitoring assessment;
 - b) an assessment of compliance with noise limits presented in this licence; and
 - c) an outline of any management actions taken within the monitoring period to address any exceedances of the limits contained in this licence.

7 General Conditions

G1 Copy of licence kept at the premises or plant

- G1.1 A copy of this licence must be kept at the premises to which the licence applies.
- G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.
- G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Other general conditions

G2.1 Completed Programs

Program	Description	Completed Date
Pollution Reduction Study 1 - Design the Necessary Noise Mitigation Measures	Engage an acoustic engineer to investigate the site-specific noise mitigation measure/s that are necessary to meet the noise limits of this licence at all times.	01-March-2019

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 months. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste

Mr Peter Jamieson

Environment Protection Authority

(By Delegation)

Date of this edition: 26-August-2015

End Notes

- | | | |
|---|---------------------------|-------------------------------|
| 2 | Licence varied by notice | 1533596 issued on 21-Sep-2015 |
| 3 | Licence varied by notice | 1547416 issued on 06-Dec-2016 |
| 4 | Licence varied by notice | 1571215 issued on 16-Jan-2019 |
| 5 | Licence varied by notice | 1578081 issued on 25-Jun-2019 |
| 6 | Licence format updated on | 18-Jul-2019 |

APPENDIX 3 – Key Figures/Plans

APPENDIX 4– Noise Monitoring Reports

OPERATIONAL COMPLIANCE NOISE MONITORING

**Karuah East Quarry
Quarter 1
February 2019**

Prepared for:

Karuah East Quarry Pty Ltd
PO Box 23
Karuah NSW 2324

SLR Ref: 630.12317-R06
Version No: -v1.0
March 2019



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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Karuah East Quarry Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.12317-R06-v0.1	7 March 2019	Jordan Murray	Robert Hall	Robert Hall

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APPENDICES

Appendix A	Acoustical Terminology
Appendix B	Statistical Ambient Noise Monitoring Results – Location G (Property Gate)

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Karuah East Quarry Pty Ltd to conduct operational compliance noise monitoring for the Karuah East Quarry (KEQ) located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah, NSW (the Project Site). KEQ operational hours are from 7 am to 6 pm Monday – Friday and 8 am to 12 pm on Saturdays.

The objectives of the operational noise compliance monitoring were as follows:

- Conduct operator-attended noise surveys at two locations (F and G) surrounding the Project Site and quantify discernible sources of noise including measured and/or estimated contribution and maximum level of individual sources.
- Conduct an operator attended noise survey close to the Project Site to enable the calculation of Project Site noise levels at locations A and B. Calculated noise levels can then be used to determine compliance at these residential receiver locations.
- Conduct unattended noise monitoring at Location G to supplement the operator-attended noise measurements.
- Assess noise emissions of the Project Site with respect to the operational noise goals for the Project Site.

The operational noise compliance monitoring has been prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the Karuah East Quarry Noise Management Plan (NMP) 630.11235-R1 *Karuah East Quarry Project Noise Management Plan* dated October 2015.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

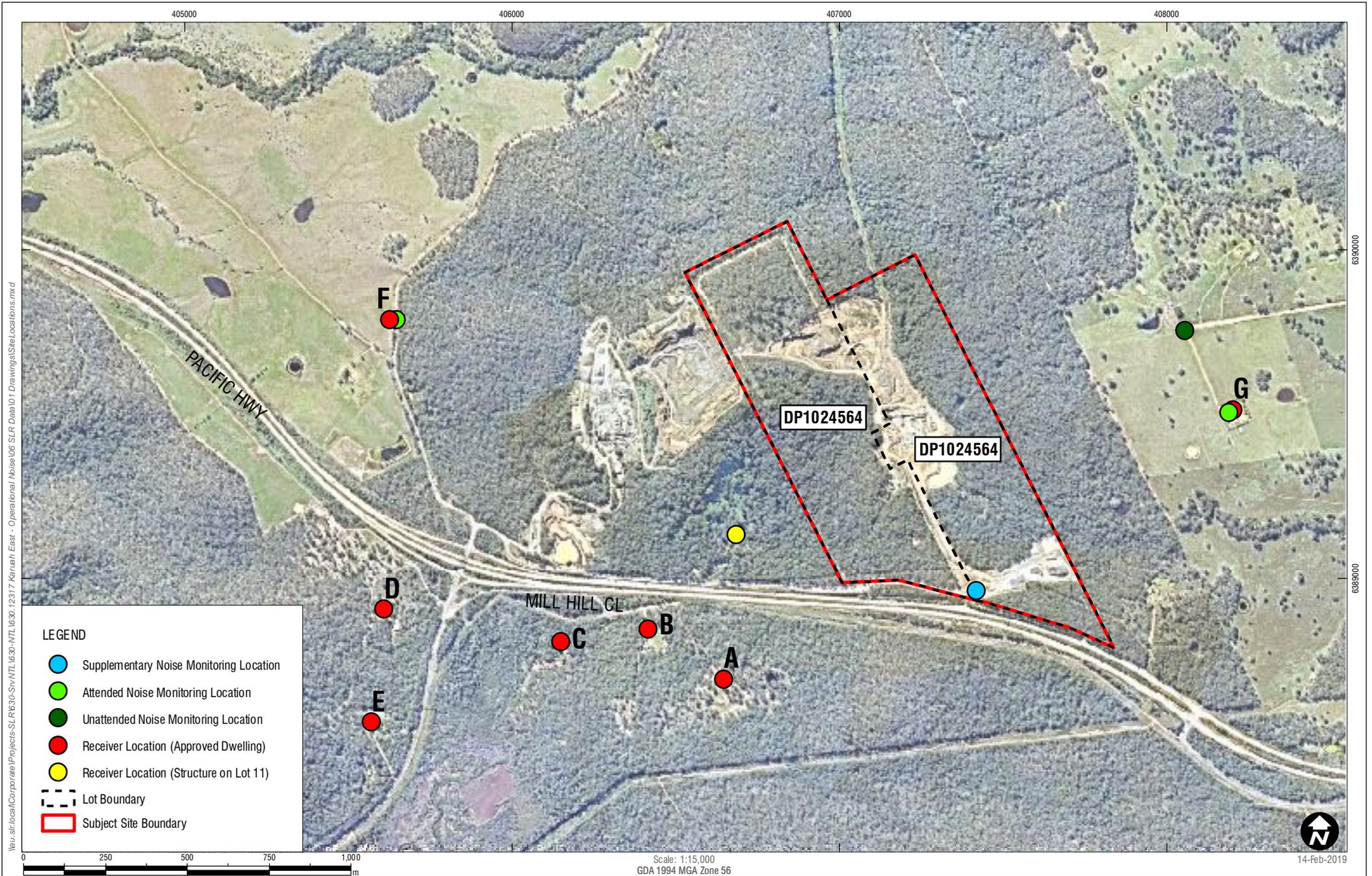
2 Sensitive Receptors

The KEQ NMP identified the closest sensitive receptors to the Project Site. These locations are listed in **Table 1** and shown in **Figure 1**.

Table 1 Sensitive Receptor Locations Used in this Assessment

Receiver ID	Details
Existing Approved Dwellings	
A	Lot 100 DP 785172
B	Lot 3 DP 785172
C	Lot 2 DP 785172
D	Lot 22 DP 1024341
E	Lot 250 DP 1092111
F	Lot 50 DP 1036893
G	Lot 1 DP 1032636
Other Structures	
Lot 11 ¹	Lot 11 DP1024564

Note 1: No currently approved residential dwelling exists on Lot 11.



3 Operational Compliance Criteria

In accordance with the NMP, **Table 2** presents the adopted operational noise goals for the Project Site.

Table 2 Operational Noise Criteria (dBA LAeq(15minute))

Location	Criteria (day)
Residence on Lot 11 DP 1024564 ¹	43
A	40
B	37
G	38
All other residences	35

Note 1: No currently approved residential dwelling exists on Lot 11 and therefore it is considered that the noise limits do not currently apply at this location.

3.1 General Methodology

Operator-attended noise surveys were conducted to characterise and quantify the noise emissions from the Project Site. In accordance with the NMP, operator attended noise monitoring was undertaken at two locations, Location F and Location G and unattended noise monitoring undertaken at Location G. A supplementary measurement was undertaken close to KEQ in order to predict likely noise levels at receivers A and B (refer to **Figure 1**).

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672 2004 “*Electroacoustics – Sound Level Meters*” (parts 1 and 2) and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ± 0.5 dBA.

Unless otherwise noted all operator-attended noise surveys were conducted for 15 minutes in duration.

3.2 Operator Attended Noise Compliance Monitoring

Operator-attended noise measurements were conducted during the daytime period on Wednesday 6 February 2019 and Thursday 14 February 2019. Details of the monitoring locations are provided in **Table 3**.

Table 3 Ambient Noise Monitoring Locations

Sound level meter Type/ Serial No.	Location	Location (m, UTM)	
		Easting	Northing
Bruel & Kjaer 2270 / 2679354	Location F – Eastern Boundary of property.	405644	6389785
	Location G – Conducted at dwelling.	408190	6389502
	Project Site – Conducted at Karuah East Quarry weighbridge.	407415	6388962

3.3 Unattended Continuous Noise Monitoring

An environmental noise logger was deployed at the gate of monitoring Location G (refer to **Figure 1**).

Noise monitoring was undertaken from Wednesday 6 February 2019 to Thursday 14 February 2019, inclusive. Details of the noise loggers used for the unattended continuous noise monitoring are given in **Table 4**.

The environmental noise logger was programmed to record statistical noise level indices continuously in 15 minute intervals.

Table 4 Noise Logger and Noise Monitoring Location

Location	Noise Logger/Serial Number	Date of Logging
G	ARL EL-316-16-203-505	6/2/2019 – 14/2/2019

4 Operator Attended Noise Monitoring Results

4.1 Results of Operator-attended Noise Monitoring

The results of the operator attended noise measurements are given in **Table 5**. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, and any other industrial operations. The table provides the following information:

- Monitoring location
- Date, start time, Wind velocity (m/s) and Temperature (°C) at the measurement location
- Typical maximum (L_{Amax}) and contributed noise levels.

Project related noise contributions listed in the tables are stated only when a contribution could be reasonably quantified.

Table 5 Operator Attended Noise Survey Results

Location	Date/ Start time/ Period/ Weather ¹	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission, Typical Maximum Levels L _{Amax}
		L _{Amax}	LA1	LA10	LA90	L _{Aeq}	
F	14/2/2018 07:45 Day 2.5 m/s ESE 21°C	79	57	51	46	52	Car pass-by 60-79 Pacific Highway 50-52 Plane 49 Birds 47-50 Karuah East Project Inaudible
G (NMP Monitoring Location)	6/2/2019 10:48 Day 1.5 m/s SE 29°C	54	43	37	32	35	Residential Construction 33 – 34 Birds 54 Insects 34 – 35 Pacific Highway 29-32 Karuah East Project Inaudible
Karuah Quarry (weighbridge)	14/2/2018 08:11 Day 2.5 m/s ESE 22°C	66	63	57	48	54	Pacific Highway traffic 57 – 66 Birds 45-49 Karuah East Project Inaudible

Note 1: Weather data was obtained from the automatic weather station located at Karuah East Quarry.

4.1.1 Predicted Noise Levels at Receiver Locations A & B

In accordance with **Section 8.3.1** of the NMP operator-attended noise monitoring was conducted at a location closer to the Project Site (refer **Figure 1** and “Karuah Quarry” in **Table 5**). The purpose of this measurement was to enable the calculation of Project Site noise levels at locations A and B. Calculated noise levels can then be used to indicate the likely compliance at these residential receiver locations.

As the Project was inaudible at the monitoring location compliance is indicated at locations A and B.

5 Unattended Continuous Noise Monitoring

The unattended ambient noise logger data from monitoring Location G is presented graphically on a daily basis and attached as **Appendix B**. Due to a lack of property access the noise logger was placed at the property gate. A summary of the results of the unattended continuous noise monitoring is given in **Table 6**. The ambient noise level data quantifies the overall noise level at a given location independent of its source or character.

Precautions can be taken to minimise influences from extraneous noise sources (eg optimum placement of the loggers away from creeks, trees, houses, etc), however, not all these sources or their effects can be eliminated. This is particularly the case during the warmer times of year when noise from insects, frogs, birds and other animals can become significant.

Weather data was obtained from the automatic weather station located at Karuah East Quarry. Unattended noise data corresponding with periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 18km/hr) were discarded in accordance with the INP data exclusion methodology.

Table 6 Unattended Continuous Monitoring Ambient Noise Levels (dBA)

INP Period	LA1	LA10	LA90	LAeq
Location G				
Daytime	54	48	35	51
Evening	53	48	38	49
Night	55	51	40	54

Given observations made during the operator attended noise survey at the monitoring location, it is likely that daytime noise levels at Location G were dominated by road traffic noise from the Pacific Highway and natural sources such as birdsong, insects, and livestock.

6 Conclusion

SLR Consulting Australia Pty Ltd (SLR) has undertaken operational noise compliance monitoring for the Karuah East Project in accordance with the NMP.

Operator-attended noise compliance measurements were conducted during the daytime period on Wednesday 6 February 2019 at monitoring location G and Thursday 14 February 2019 at monitoring location F. A further operator-attended survey was conducted at the Karuah Quarry weighbridge.

Unattended noise monitoring was conducted at Location G from Wednesday 6 February 2019 to Thursday 14 February 2019 inclusive.

Karuah East Quarry was deemed to be inaudible at all NMP receiver locations.

APPENDIX A

Acoustic Terminology

The following is a brief description of the acoustic terminology.

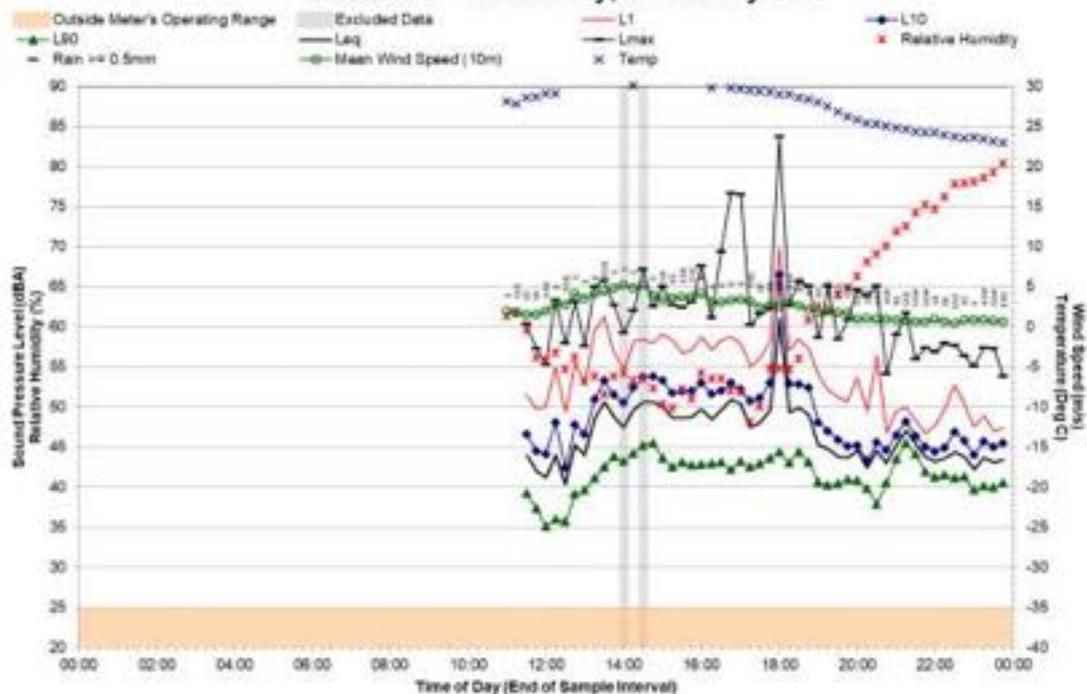
Acoustic Terminology	Description
'A' Weighted	Frequency filter applied to measured noise levels to represent how humans hear sounds.
dBA	'A' Weighted overall sound pressure level.
L90 , L10, L1	A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, i.e., L90 is the level which is exceeded for 90 percent of an observation period. L90 is commonly referred to as the background sound level.
L _{Amax}	Highest value of the A-weighted sound pressure level with a specified time weighting that occurs during a given event.

APPENDIX B

Statistical Ambient Noise Monitoring Results Location G (Property Gate)

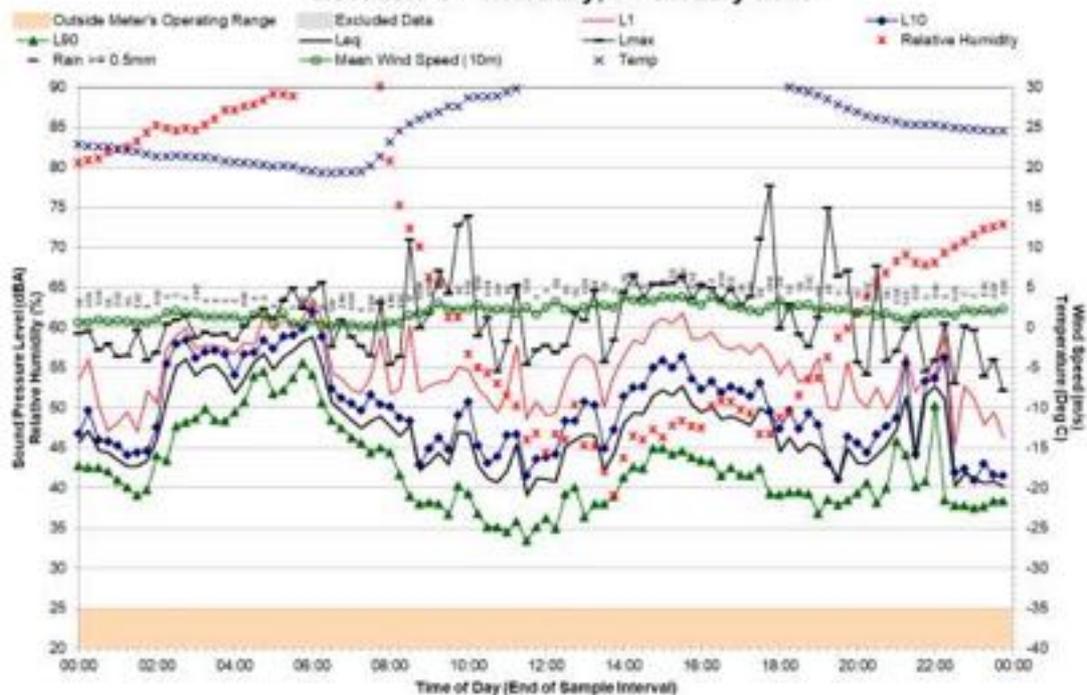
Statistical Ambient Noise Levels

Location G - Wednesday, 6 February 2019

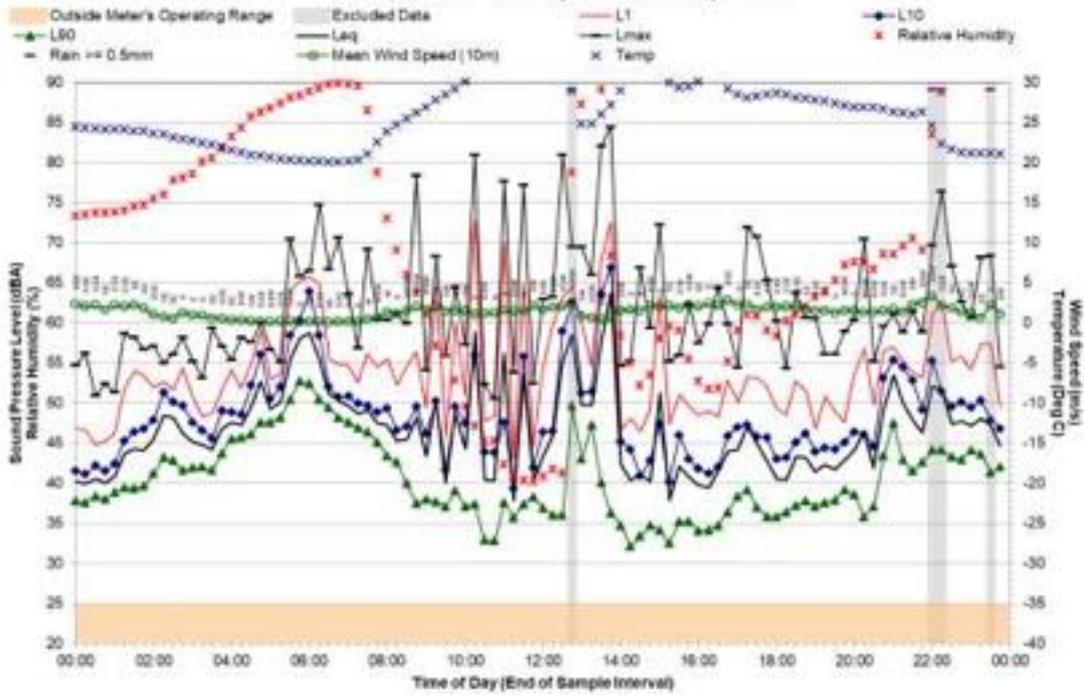


Statistical Ambient Noise Levels

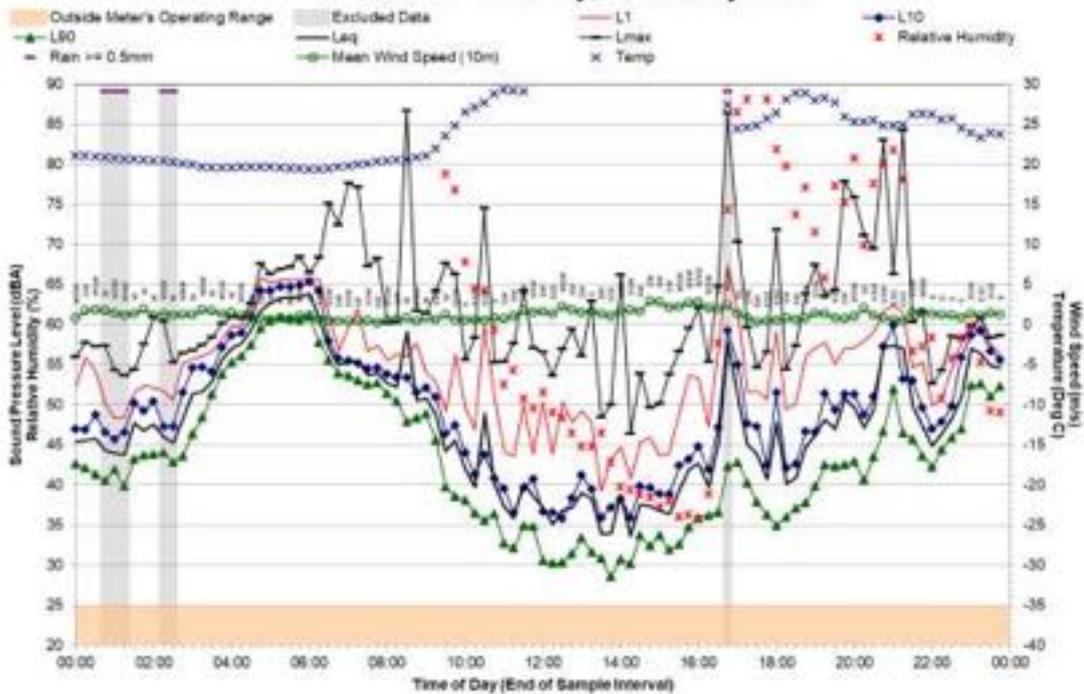
Location G - Thursday, 7 February 2019



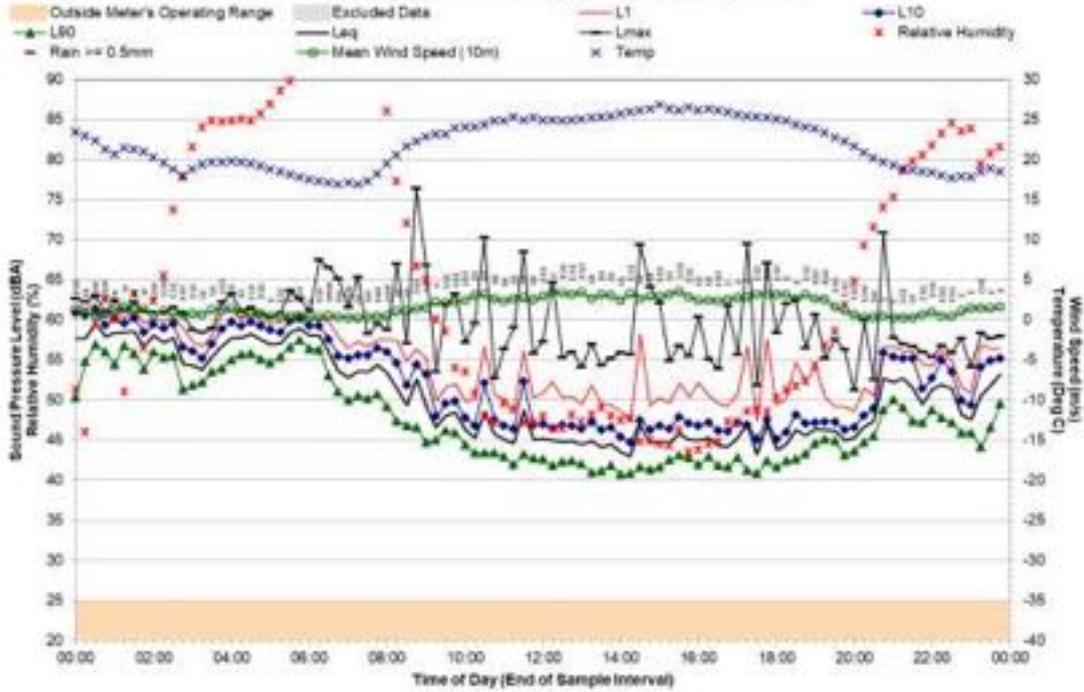
Statistical Ambient Noise Levels Location G - Friday, 8 February 2019



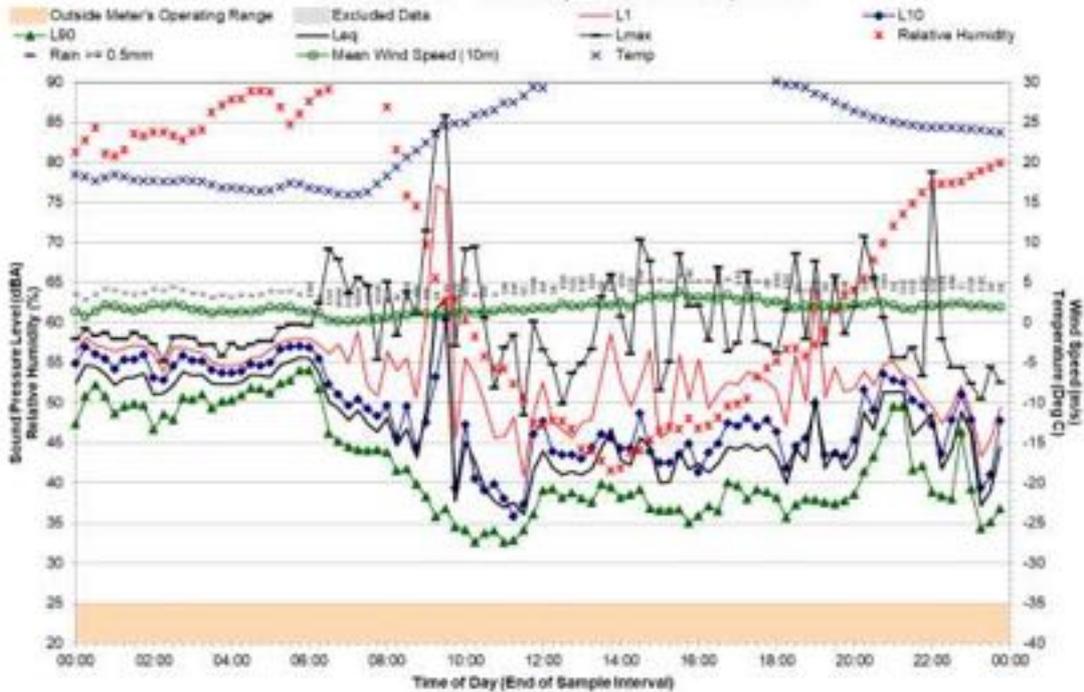
Statistical Ambient Noise Levels Location G - Saturday, 9 February 2019



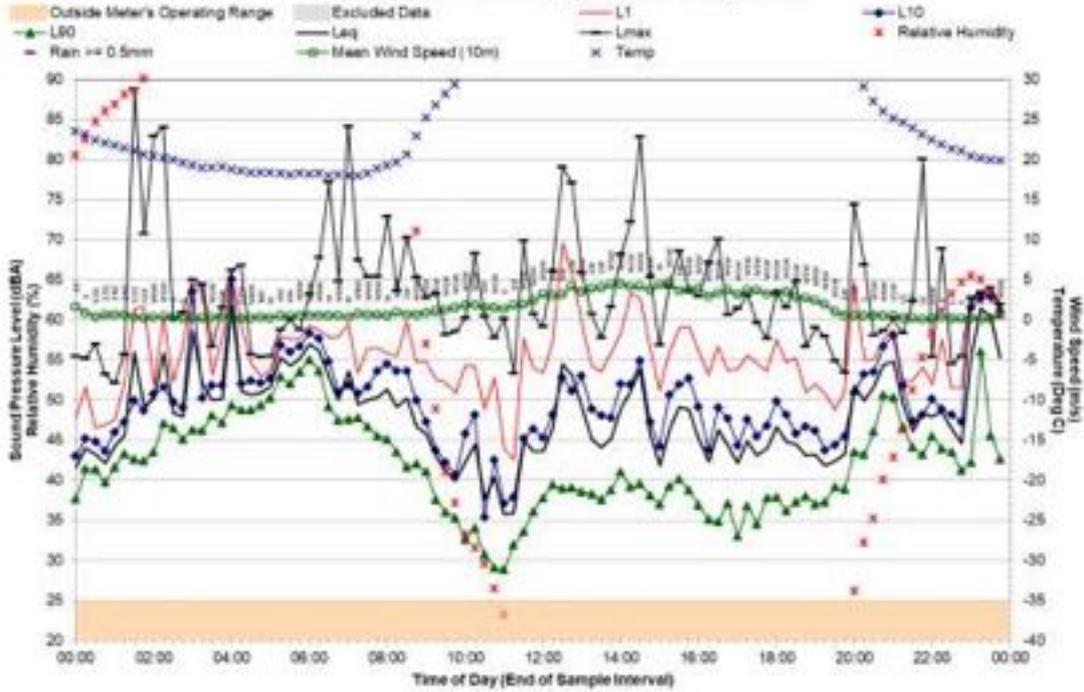
Statistical Ambient Noise Levels Location G - Sunday, 10 February 2019



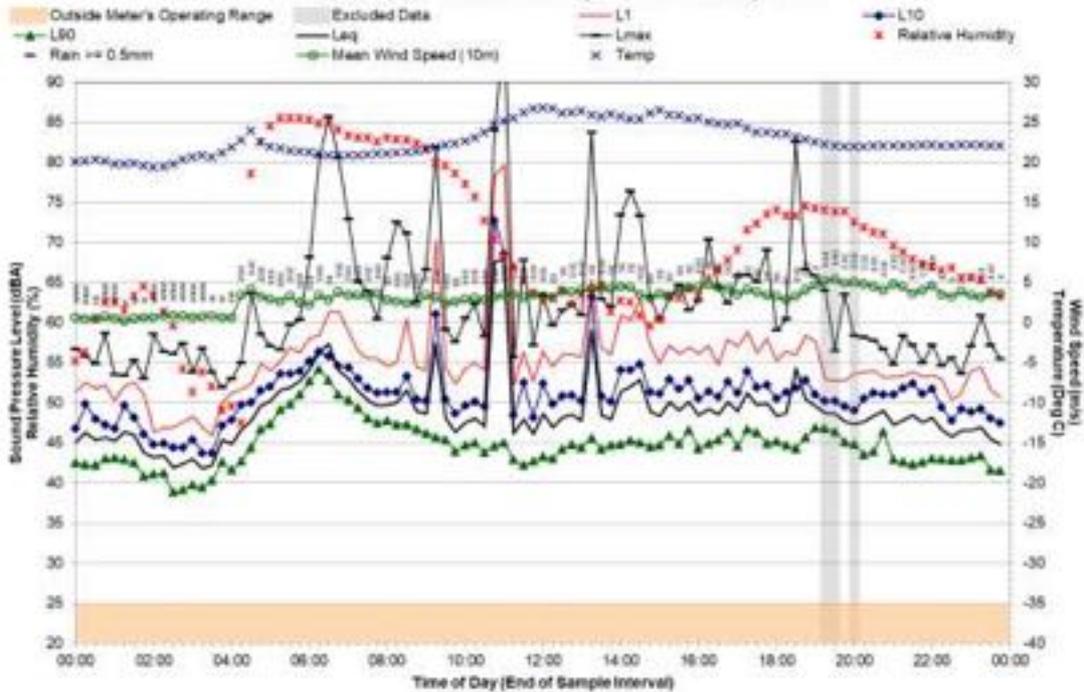
Statistical Ambient Noise Levels Location G - Monday, 11 February 2019



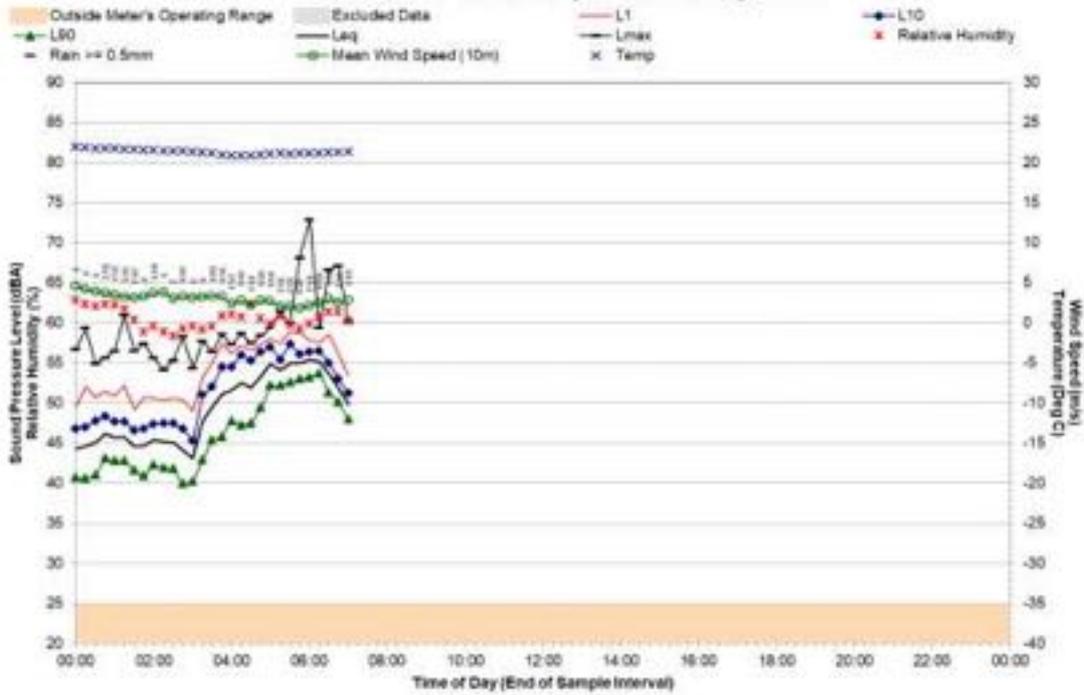
Statistical Ambient Noise Levels Location G - Tuesday, 12 February 2019



Statistical Ambient Noise Levels Location G - Wednesday, 13 February 2019



Statistical Ambient Noise Levels Location G - Thursday, 14 February 2019



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OPERATIONAL COMPLIANCE NOISE MONITORING

**Karuah East Quarry
Quarter 2
May 2019**

Prepared for:

Karuah East Quarry Pty Ltd
PO Box 23
Karuah NSW 2324

SLR Ref: 630.12317-R07
Version No: -v1.0
June 2019



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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Karuah East Quarry Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.12317-R07-v0.1	18 June 2019	Jordan Murray	Martin Davenport	Martin Davenport

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APPENDICES

Appendix A	Acoustical Terminology
Appendix B	Statistical Ambient Noise Monitoring Results – Location G (Property Gate)

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Karuah East Quarry Pty Ltd to conduct operational compliance noise monitoring for the Karuah East Quarry (KEQ) located on Lots 12 and 13 DP 1024564, off the Pacific Highway, approximately 3 km north of Karuah, NSW (the Project Site). KEQ operational hours are from 7 am to 6 pm Monday – Friday and 7 am to 1 pm on Saturdays.

The objectives of the operational noise compliance monitoring were as follows:

- Conduct operator-attended noise surveys at two locations (F and G) surrounding the Project Site and quantify discernible sources of noise including measured and/or estimated contribution and maximum level of individual sources.
- Conduct an operator attended noise survey close to the Project Site to enable the calculation of Project Site noise levels at locations A and B. Calculated noise levels can then be used to determine compliance at these residential receiver locations.
- Conduct unattended noise monitoring at Location G to supplement the operator-attended noise measurements.
- Assess noise emissions of the Project Site with respect to the operational noise goals for the Project Site.

The operational noise compliance monitoring has been prepared with reference to Australian Standard AS 1055:2018 *Description and Measurement of Environmental Noise* and in accordance with the Karuah East Quarry Noise Management Plan (NMP) 630.11235-R1 *Karuah East Quarry Project Noise Management Plan* dated October 2015.

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

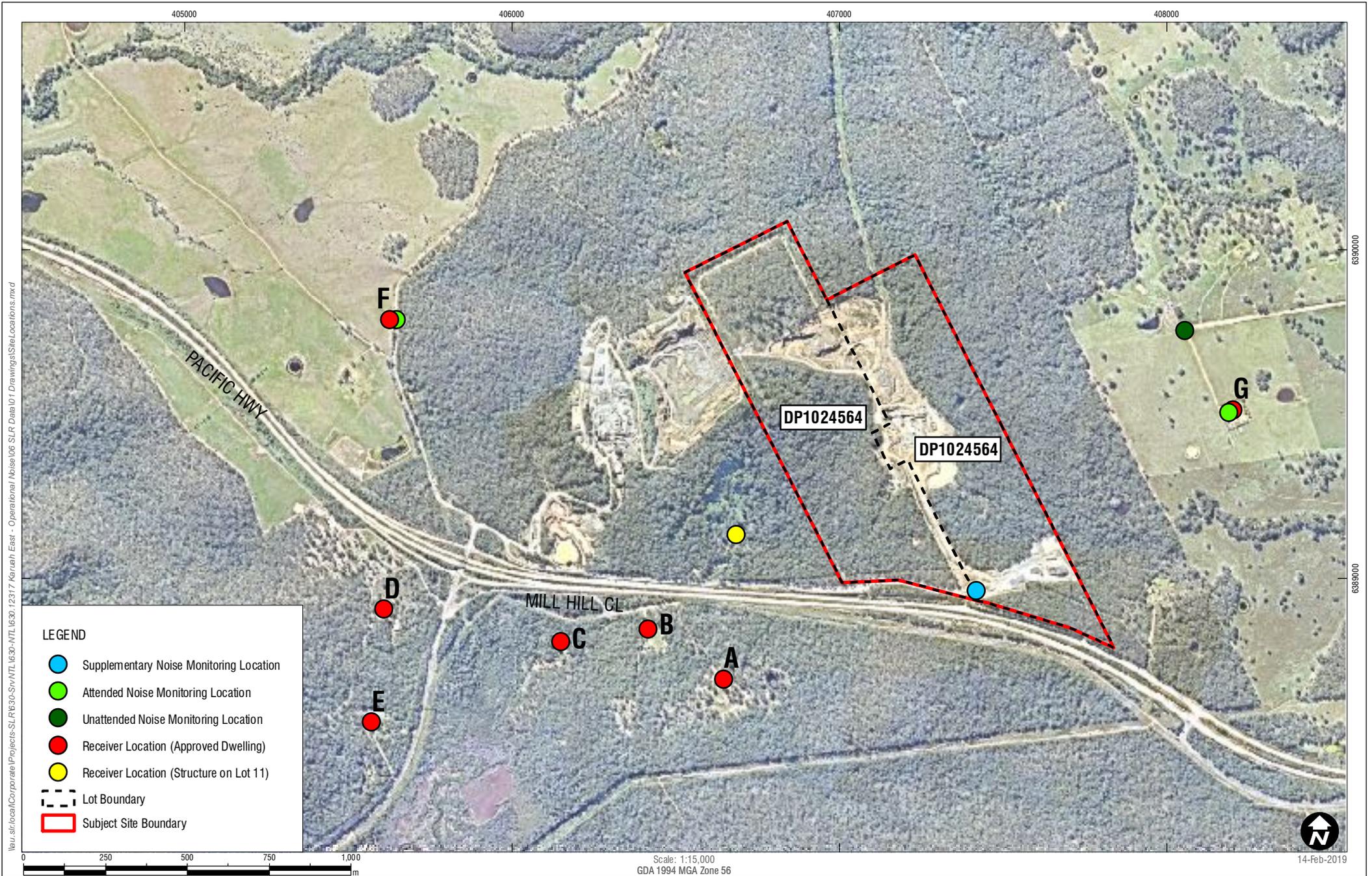
2 Sensitive Receptors

The KEQ NMP identified the closest sensitive receptors to the Project Site. These locations are listed in **Table 1** and shown in **Figure 1**.

Table 1 Sensitive Receptor Locations Used in this Assessment

Receiver ID	Details
Existing Approved Dwellings	
A	Lot 100 DP 785172
B	Lot 3 DP 785172
C	Lot 2 DP 785172
D	Lot 22 DP 1024341
E	Lot 250 DP 1092111
F	Lot 50 DP 1036893
G	Lot 1 DP 1032636
Other Structures	
Lot 11 ¹	Lot 11 DP1024564

Note 1: No currently approved residential dwelling exists on Lot 11.



3 Operational Compliance Criteria

In accordance with the NMP, **Table 2** presents the adopted operational noise goals for the Project Site.

Table 2 Operational Noise Criteria (dBA LAeq(15minute))

Location	Criteria (day)
Residence on Lot 11 DP 1024564 ¹	43
A	40
B	37
G	38
All other residences	35

Note 1: No currently approved residential dwelling exists on Lot 11 and therefore it is considered that the noise limits do not currently apply at this location.

3.1 General Methodology

Operator-attended noise surveys were conducted to characterise and quantify the noise emissions from the Project Site. In accordance with the NMP, operator attended noise monitoring was undertaken at two locations, Location F and Location G and unattended noise monitoring undertaken at Location G. A supplementary measurement was undertaken close to KEQ in order to predict likely noise levels at receivers A and B (refer to **Figure 1**).

All acoustic instrumentation employed throughout the monitoring programme has been designed to comply with the requirements of AS IEC 61672 2004 “*Electroacoustics – Sound Level Meters*” (parts 1 and 2) and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ± 0.5 dBA.

Unless otherwise noted all operator-attended noise surveys were conducted for 15 minutes in duration.

3.2 Operator Attended Noise Compliance Monitoring

Operator-attended noise measurements were conducted during the daytime period on Wednesday 22 May 2019. Details of the monitoring locations are provided in **Table 3**.

Table 3 Ambient Noise Monitoring Locations

Sound level meter Type/ Serial No.	Location	Location (m, UTM)	
		Easting	Northing
Bruel & Kjaer 2250L / 3003389	Location F – Eastern Boundary of property.	405644	6389785
	Location G – Conducted at dwelling.	408190	6389502
	Project Site – Conducted at Karuah East Quarry weighbridge.	407415	6388962

3.3 Unattended Continuous Noise Monitoring

An environmental noise logger was deployed at the gate of monitoring Location G (refer to **Figure 1**).

Noise monitoring was undertaken from Tuesday 14 May 2019 to Wednesday 22 May 2019, inclusive. Details of the noise loggers used for the unattended continuous noise monitoring are given in **Table 4**.

The environmental noise logger was programmed to record statistical noise level indices continuously in 15 minute intervals.

Table 4 Noise Logger and Noise Monitoring Location

Location	Noise Logger/Serial Number	Date of Logging
G	ARL EL-316-16-203-505	13/5/2019 – 22/5/2019

4 Operator Attended Noise Monitoring Results

4.1 Results of Operator-attended Noise Monitoring

The results of the operator attended noise measurements are given in **Table 5**. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, and any other industrial operations. The table provides the following information:

- Monitoring location
- Date, start time, Wind velocity (m/s) and Temperature (°C) at the measurement location
- Typical maximum (L_{Amax}) and contributed noise levels.

Project related noise contributions listed in the tables are stated only when a contribution could be reasonably quantified.

Table 5 Operator Attended Noise Survey Results

Location	Date/ Start time/ Period/ Weather ¹	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emission, Typical Maximum Levels L _{Amax}
		L _{Amax}	LA1	LA10	LA90	LAeq	
F	22/05/2019 09:54 1.7 m/s SW 17°C	84	58	54	45	54	Car pass-by 84 Pacific Highway 45-52 Plane 50 Karuah East Project Inaudible
G (NMP Monitoring Location)	22/05/2019 09:23 1.2 m/s WSW 15°C	79	60	57	40	49	Cattle 48-79 Pacific Highway Traffic 39-44 Dogs 49-56 Plane 53-55 Karuah East Project Inaudible
Karuah East Quarry (weighbridge)	22/05/2019 11:23 1.4 m/s SW 24°C	69	62	60	53	57	Pacific Highway traffic 50 – 69 Birds 45-49 Karuah East Project Inaudible

Note 1: Weather data was obtained from the automatic weather station located at Karuah East Quarry.

4.1.1 Predicted Noise Levels at Receiver Locations A & B

In accordance with **Section 8.3.1** of the NMP operator-attended noise monitoring was conducted at a location closer to the Project Site (refer **Figure 1** and “Karuah Quarry” in **Table 5**). The purpose of this measurement was to enable the calculation of Project Site noise levels at locations A and B. Calculated noise levels can then be used to indicate the likely compliance at these residential receiver locations.

As the Project was inaudible at the monitoring location compliance it is likely that compliance was achieved at locations A and B.

5 Unattended Continuous Noise Monitoring

The unattended ambient noise logger data from monitoring Location G is presented graphically on a daily basis and attached as **Appendix B**. Due to a lack of property access the noise logger was placed at the property gate. A summary of the results of the unattended continuous noise monitoring is given in **Table 6**. The ambient noise level data quantifies the overall noise level at a given location independent of its source or character.

Precautions can be taken to minimise influences from extraneous noise sources (eg optimum placement of the loggers away from creeks, trees, houses, etc), however, not all these sources or their effects can be eliminated. This is particularly the case during the warmer times of year when noise from insects, frogs, birds and other animals can become significant.

Weather data was obtained from the automatic weather station located at Karuah Quarry. Unattended noise data corresponding with periods of rainfall and/or wind speeds in excess of 5 m/s (approximately 18km/hr) were discarded in accordance with the INP data exclusion methodology.

Table 6 Unattended Continuous Monitoring Ambient Noise Levels (dBA)

INP Period	LA1	LA10	LA90	LAeq
Location G				
Daytime	52	45	35	50
Evening	46	43	36	43
Night	46	42	34	43

Given observations made during the operator attended noise survey at the monitoring location, it is likely that daytime noise levels at Location G were dominated by road traffic noise from the Pacific Highway and natural sources such as birdsong and livestock.

6 Conclusion

SLR Consulting Australia Pty Ltd (SLR) has undertaken operational noise compliance monitoring for the Karuah East Project in accordance with the NMP.

Operator-attended noise compliance measurements were conducted during the daytime period on Wednesday 22 May at monitoring location F and G. A further operator-attended survey was conducted at the Karuah East Quarry weighbridge.

Unattended noise monitoring was conducted at Location G from Tuesday 14 May 2019 to Wednesday 22 May 2019 inclusive.

Karuah East Quarry was deemed to be inaudible at all NMP receiver locations.

APPENDIX A

Acoustic Terminology

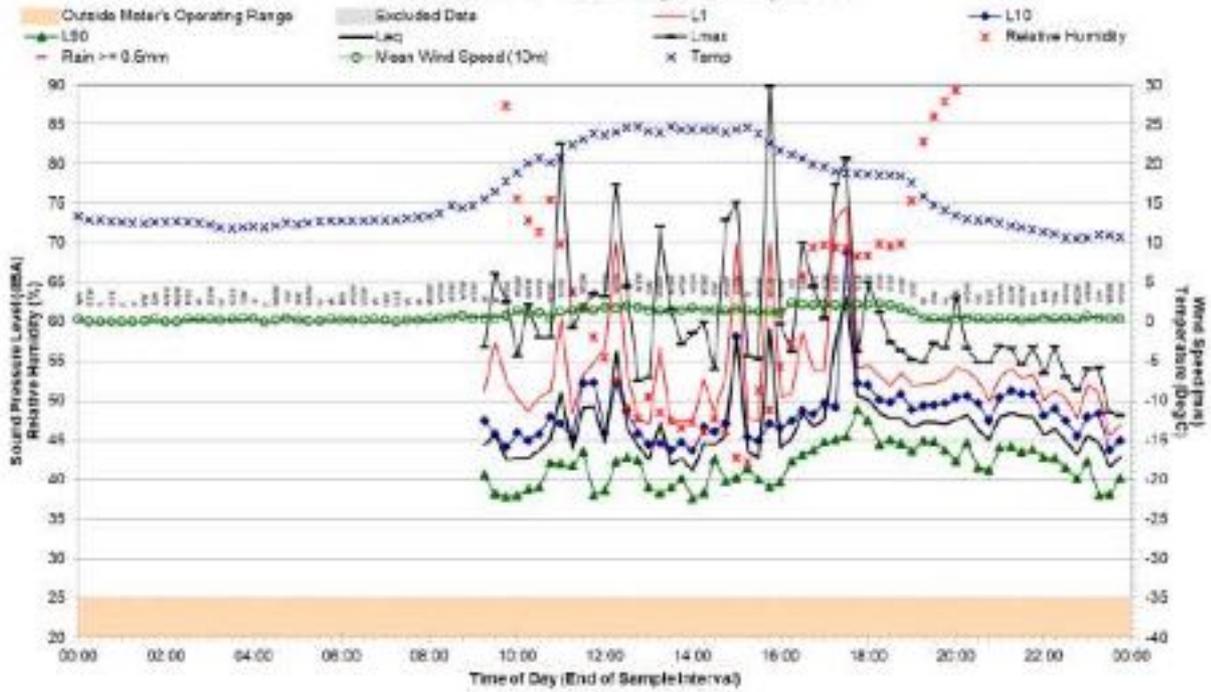
The following is a brief description of the acoustic terminology.

Acoustic Terminology	Description
'A' Weighted	Frequency filter applied to measured noise levels to represent how humans hear sounds.
dBA	'A' Weighted overall sound pressure level.
L90 , L10, L1	A statistical measurement giving the sound pressure level which is exceeded for the given percentile of an observation period, i.e., L90 is the level which is exceeded for 90 percent of an observation period. L90 is commonly referred to as the background sound level.
L _{Amax}	Highest value of the A-weighted sound pressure level with a specified time weighting that occurs during a given event.

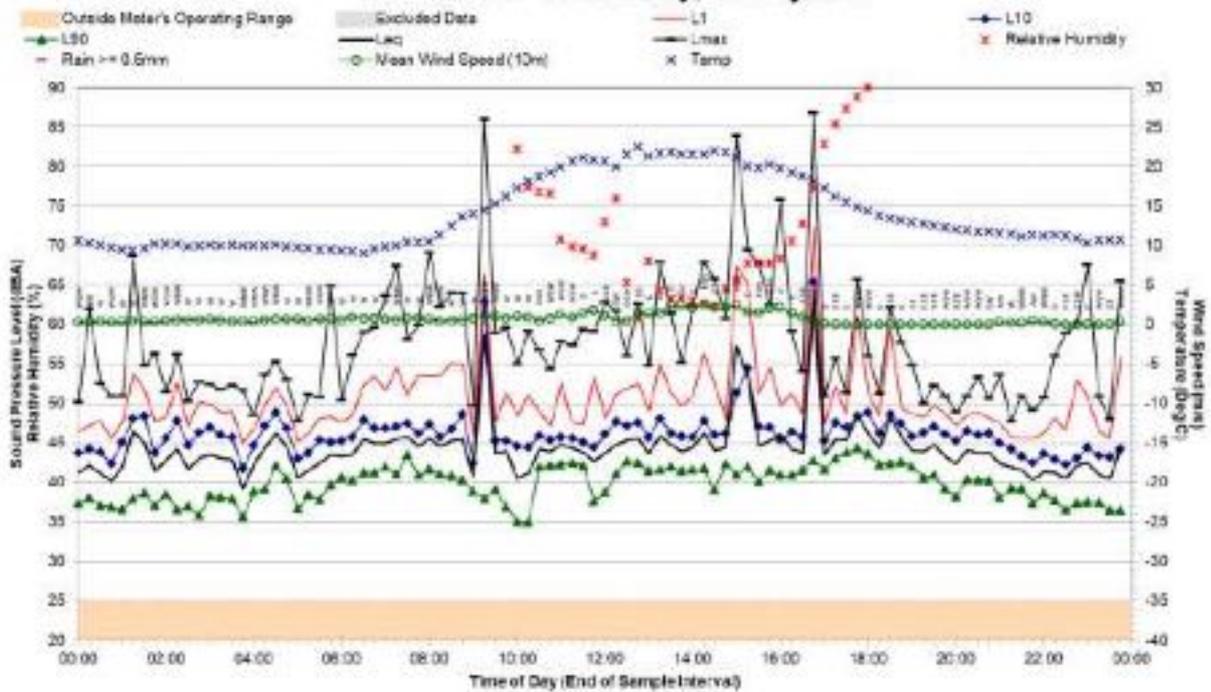
APPENDIX B

Statistical Ambient Noise Monitoring Results Location G (Property Gate)

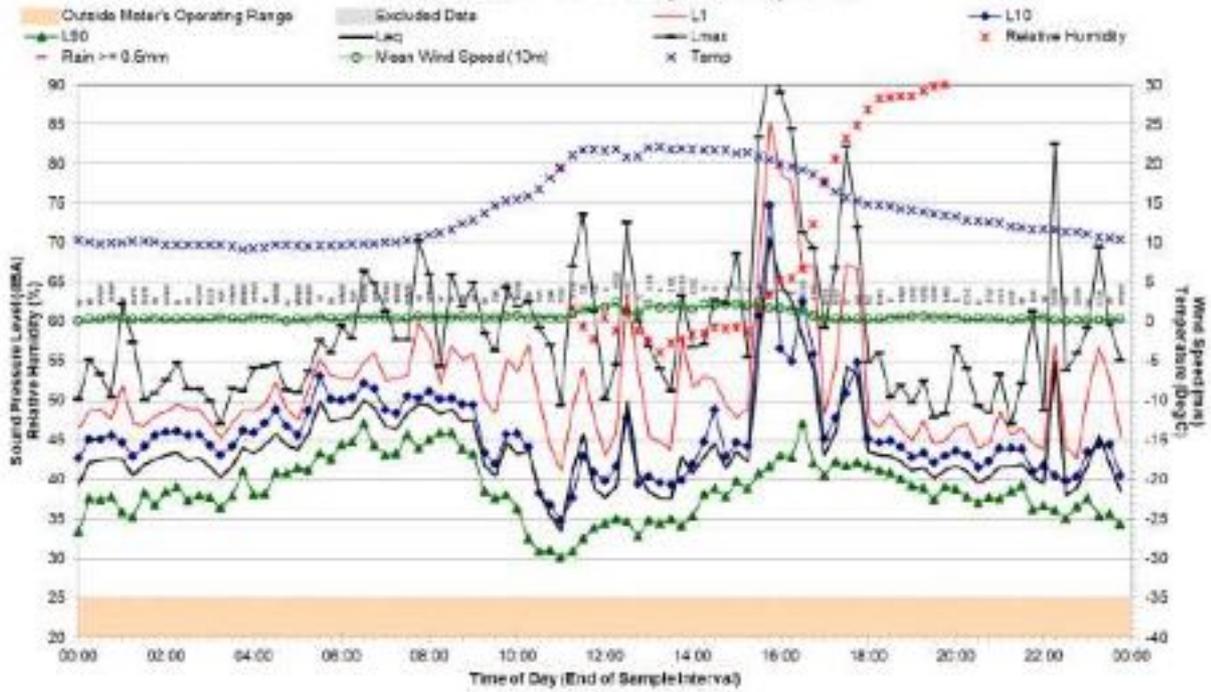
Statistical Ambient Noise Levels Location G - Tuesday, 14 May 2019



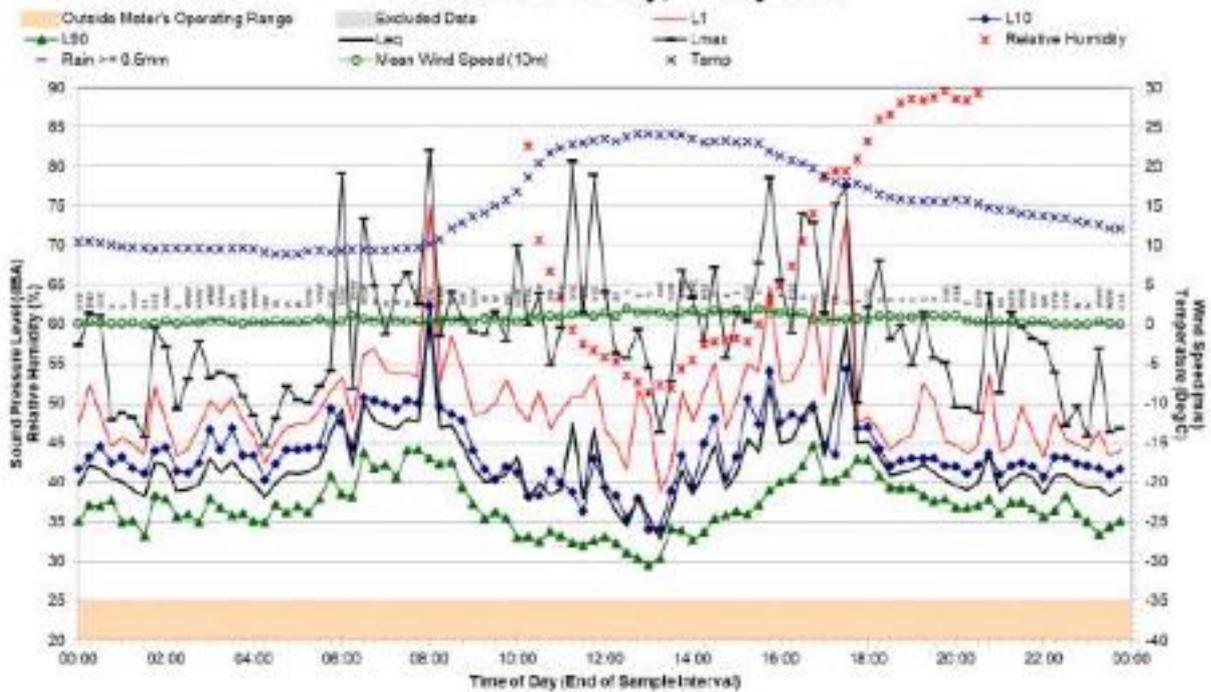
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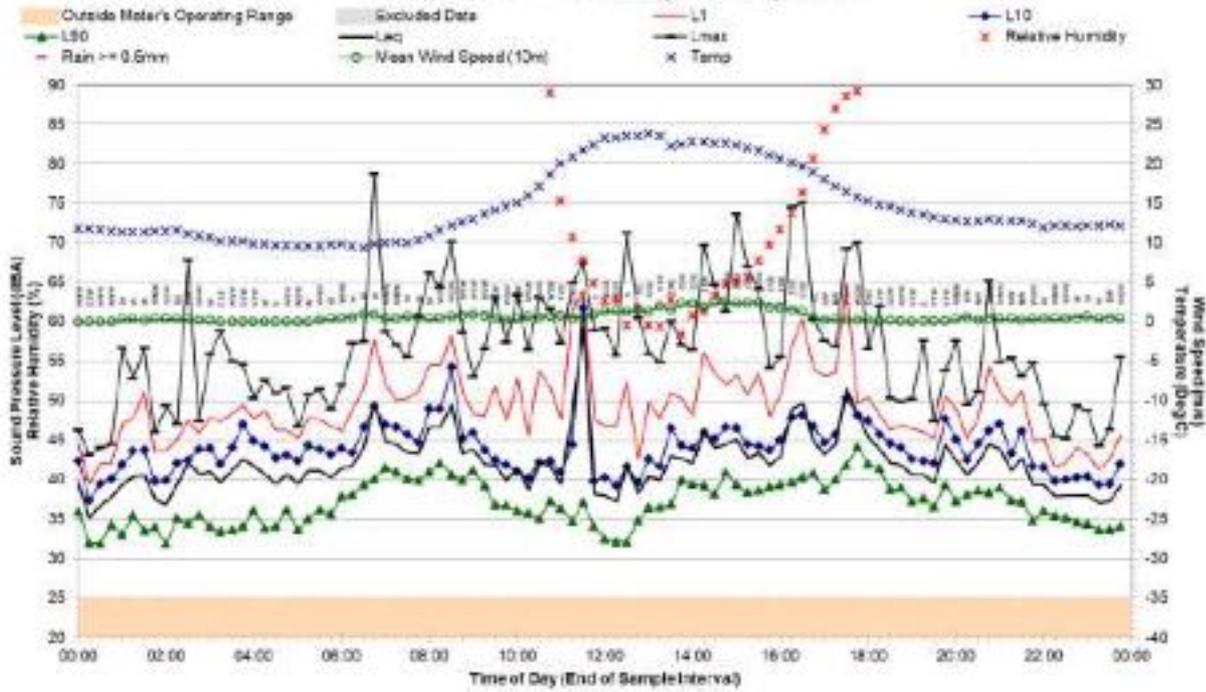
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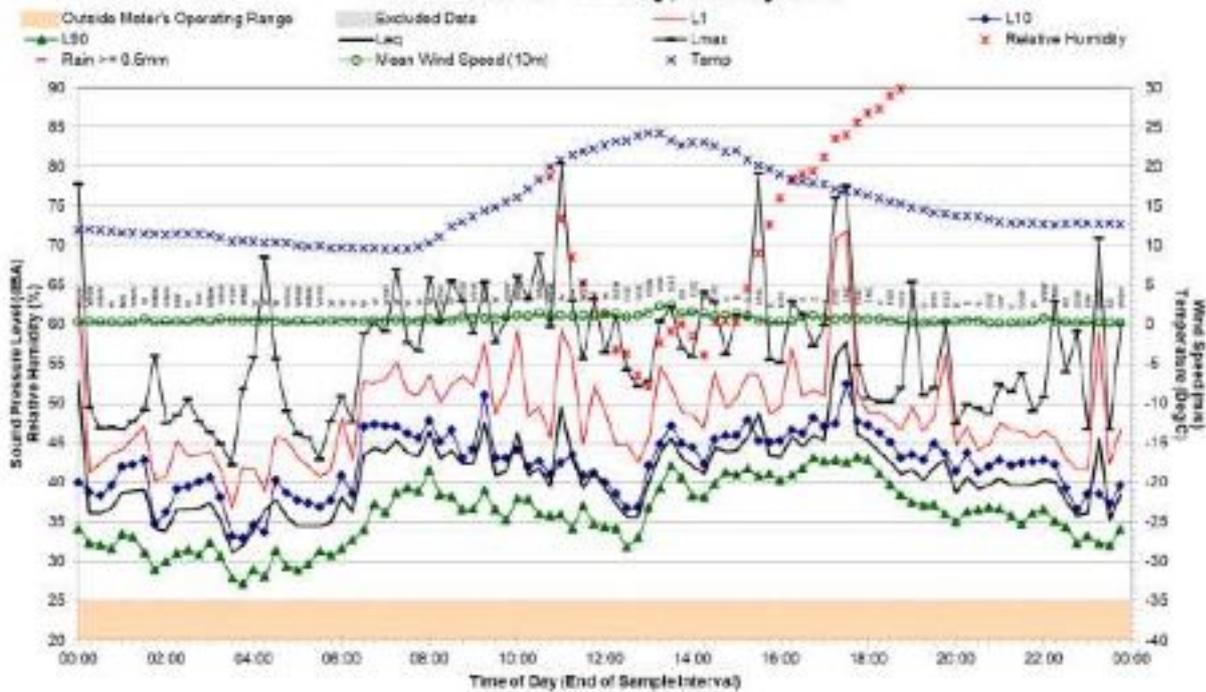
Statistical Ambient Noise Levels Location G - Friday, 17 May 2019



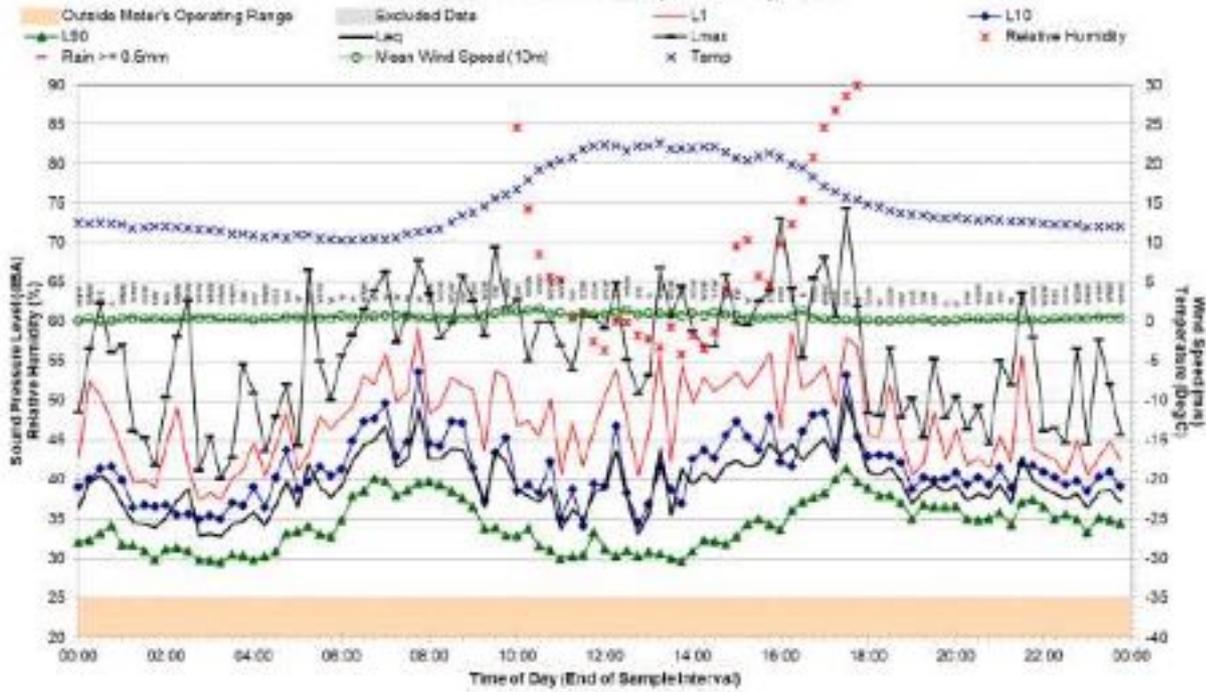
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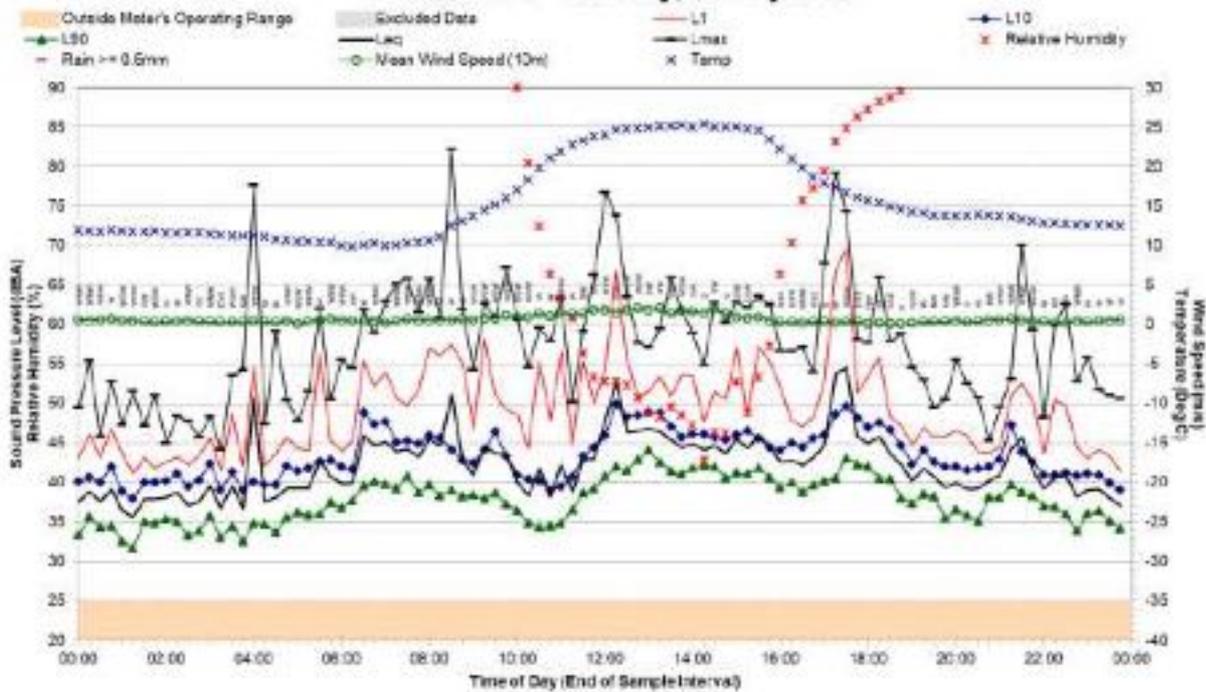
Statistical Ambient Noise Levels Location G - Sunday, 19 May 2019



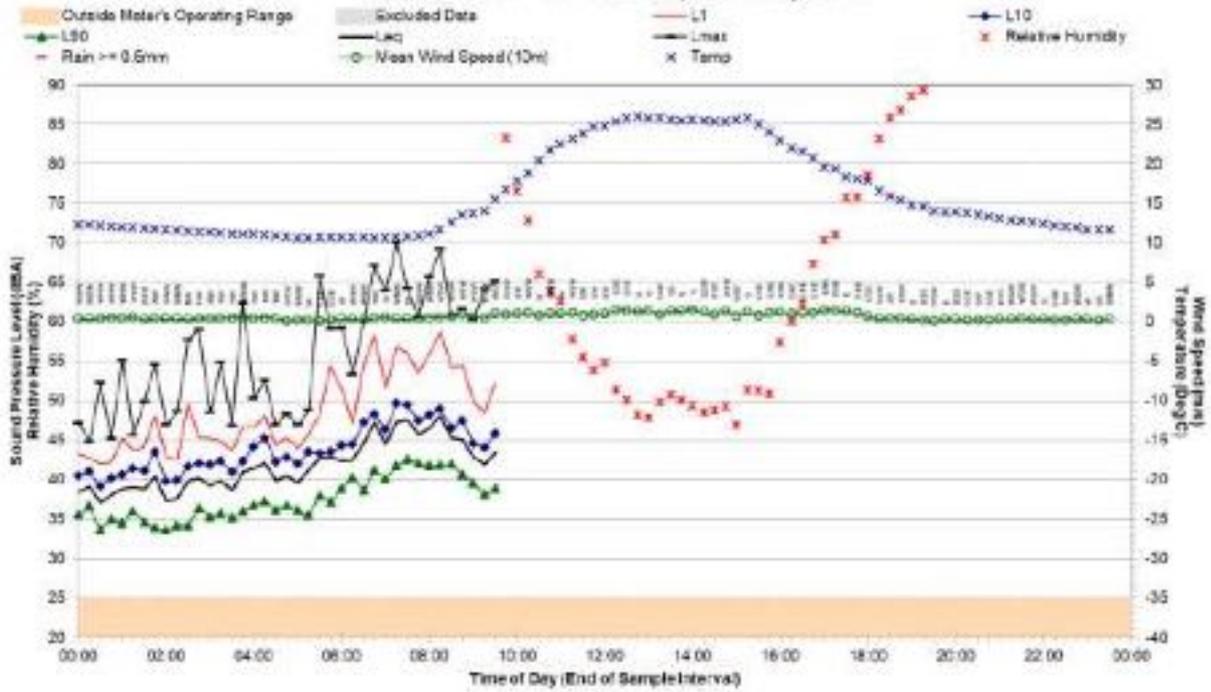
Statistical Ambient Noise Levels Location G - Monday, 20 May 2019



Statistical Ambient Noise Levels Location G - Tuesday, 21 May 2019



Statistical Ambient Noise Levels Location G - Wednesday, 22 May 2019



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KARUAH EAST QUARRY
Quarterly Noise Monitoring
September 2019



1. INTRODUCTION

This report summarises the quarterly noise monitoring at Karuah East Quarry completed to meet the requirements of Section 66(6) of the Protection of the Environment Operations Act 1997 and the NSW Environmental Protection Authority's Requirements for Publishing Pollution Monitoring Data (October 2013). Included is the required monitoring data under Environmental Protection License (EPL) 20611, Project Approval 09_0175 and the approved Statement of Commitments for the Karuah East Quarry.

Table 1 - Licence Information

Environmental Protection License Number	20611
Licensee's Name	Karuah East Quarry Pty Ltd
Licensee's Address	Postal Address: PO Box 3284 Thornton NSW 2322 Quarry Location: Lot 12 DP1024564 Pacific Highway Karuah NSW 2324

The monitoring was conducted as per Schedule 3 Condition 3 of the Project Approval and Condition L4.1 of the EPL to ensure the noise generated by the quarry operations does not exceed the criteria outlined in Table 2.

The report has been prepared in accordance with the requirements of the NSW Noise Policy for Industry (2017).

Table 2 - Operational Noise Criteria (dBA LA_{eq(15min)})

LOCATION	CRITERIA (DAY ¹)
RESIDENCE ON LOT 11 DP 10244564	43
A	40
B	37
G	38
ALL OTHER RESIDENCE	35

Note 1: Day period defined as Monday to Saturday 7am to 6pm, Sunday and Public Holidays 8am to 6pm

The quarry is operational with no construction activities being completed. As such construction noise is not being considered.

The noise monitoring has been completed in accordance with the Noise Management Plan (SLR, 2015). A summary of requirements is presented in Table 3.

Table 3 - Operational Noise Monitoring Program

MONITORING METHOD	LOCATION	FREQUENCY	CRITERIA
Attended Noise Monitoring	F,G	Quarterly	As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015)
Unattended Noise Monitoring	G	Quarterly	As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015)



Figure 1 - Noise Monitoring Locations

2. OPERATOR ATTENDED MONITORING RESULTS

Results are presented in Table 4. Ambient noise levels in the table include all sources such as traffic, insects, birds, Karuah Quarry and Karuah East Quarry.

Quarry contributions listed are noted only when a contribution could be quantified.



Table 4 - Attended Noise Monitoring Results

LOCATION	DATE START TIME WEATHER	L _{MAX}	L _{A1}	L _{A10}	L _{A90}	L _{AEQ}	DESCRIPTION OF NOISE AND TYPICAL MAXIMUM NOISE LEVELS (DBA)
F	04/09/2019 9:47 am W = Calm	77	67	52	42	54	Pacific Highway 45 Plane 65 Insects 40 Birds 40 Karuah East Quarry Inaudible
G	04/09/2019 10:29 am W = Calm	71	62	52	40	50	Birds 43 - 48 Dogs Barking 55 60 Karuah East Quarry Inaudible

3. UNATTENDED NOISE MONITORING

Table 5 - Unattended Noise Monitoring Results

INP PERIOD	L _{A1}	L _{A10}	L _{A90}	L _{AEQ}
DAY	57	50	41	50
EVENING	53	50	42	48
NIGHT	54	50	36	48

4. SUMMARY

The attended noise monitoring conducted during September 2019 identified that Karuah East Quarry was not audible at location F and G.



KARUAH EAST QUARRY

Quarterly Noise Monitoring

December 2019



1. INTRODUCTION

This report summarises the quarterly noise monitoring at Karuah East Quarry completed to meet the requirements of Section 66(6) of the Protection of the Environment Operations Act 1997 and the NSW Environmental Protection Authority's Requirements for Publishing Pollution Monitoring Data (October 2013). Included is the required monitoring data under Environmental Protection License (EPL) 20611, Project Approval 09_0175 and the approved Statement of Commitments for the Karuah East Quarry.

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A	40
B	37
G	38
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Note 1: Day period defined as Monday to Saturday 7am to 6pm, Sunday and Public Holidays 8am to 6pm

The quarry is operational with no construction activities being completed. As such construction noise is not being considered.

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MONITORING METHOD	LOCATION	FREQUENCY	CRITERIA
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Unattended Noise Monitoring	G	Quarterly	As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015)



Figure 1 - Noise Monitoring Locations

2. OPERATOR ATTENDED MONITORING RESULTS

Results are presented in Table 4. Ambient noise levels in the table include all sources such as traffic, insects, birds, Karuah Quarry and Karuah East Quarry.

Quarry contributions listed are noted only when a contribution could be quantified.



Table 4 - Attended Noise Monitoring Results

LOCATION	DATE START TIME WEATHER	L _{MAX}	L _{A1}	L _{A10}	L _{A90}	L _{AEQ}	DESCRIPTION OF NOISE AND TYPICAL MAXIMUM NOISE LEVELS (DBA)
F	03/12/2019 12:35 pm W = 10 kph	65	55	50	44	49	Pacific Highway 45 Insects 40 Birds 45-50 Karuah East Quarry Inaudible
G	03/12/2019 01:22 pm W = 10 kph	78	57	51	45	49	Birds 40 - 45 Pacific Highway 40 Karuah East Quarry Inaudible

3. UNATTENDED NOISE MONITORING

Table 5 - Unattended Noise Monitoring Results

INP PERIOD	L _{A1}	L _{A10}	L _{A90}	L _{AEQ}
DAY	56	49	41	48
EVENING	55	49	40	47
NIGHT	53	49	39	46

4. SUMMARY

The attended noise monitoring conducted during December 2019 identified that Karuah East Quarry was not audible at location F and G.

APPENDIX 5 – Ecological Monitoring Report



2019 Annual Monitoring Report



Karuah East Quarry Biodiversity Offset Area and Lot 12

Karuah East Quarry Pty Ltd

25 February 2020

2019 Annual Monitoring Report

Karuah East Quarry Biodiversity Offset Area and Lot 12

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Project No: 20202448
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Prepared for:

KARUAH EAST QUARRY PTY LTD
 BLUE ROCK CLOSE
 KARUAH NSW 2324

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		19 February 2020		J. Fleming (KEQ)
1.1	Final	25 February 2020		S. Schulz

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- Appendix 1. Threatened Flora Monitoring
- Appendix 2. Vegetation Monitoring Data
- Appendix 3. Photo Monitoring Points
- Appendix 4. Exotic Species Recorded in the Offset Area
- Appendix 5. Staff Contributions
- Appendix 6. Licensing

1. INTRODUCTION

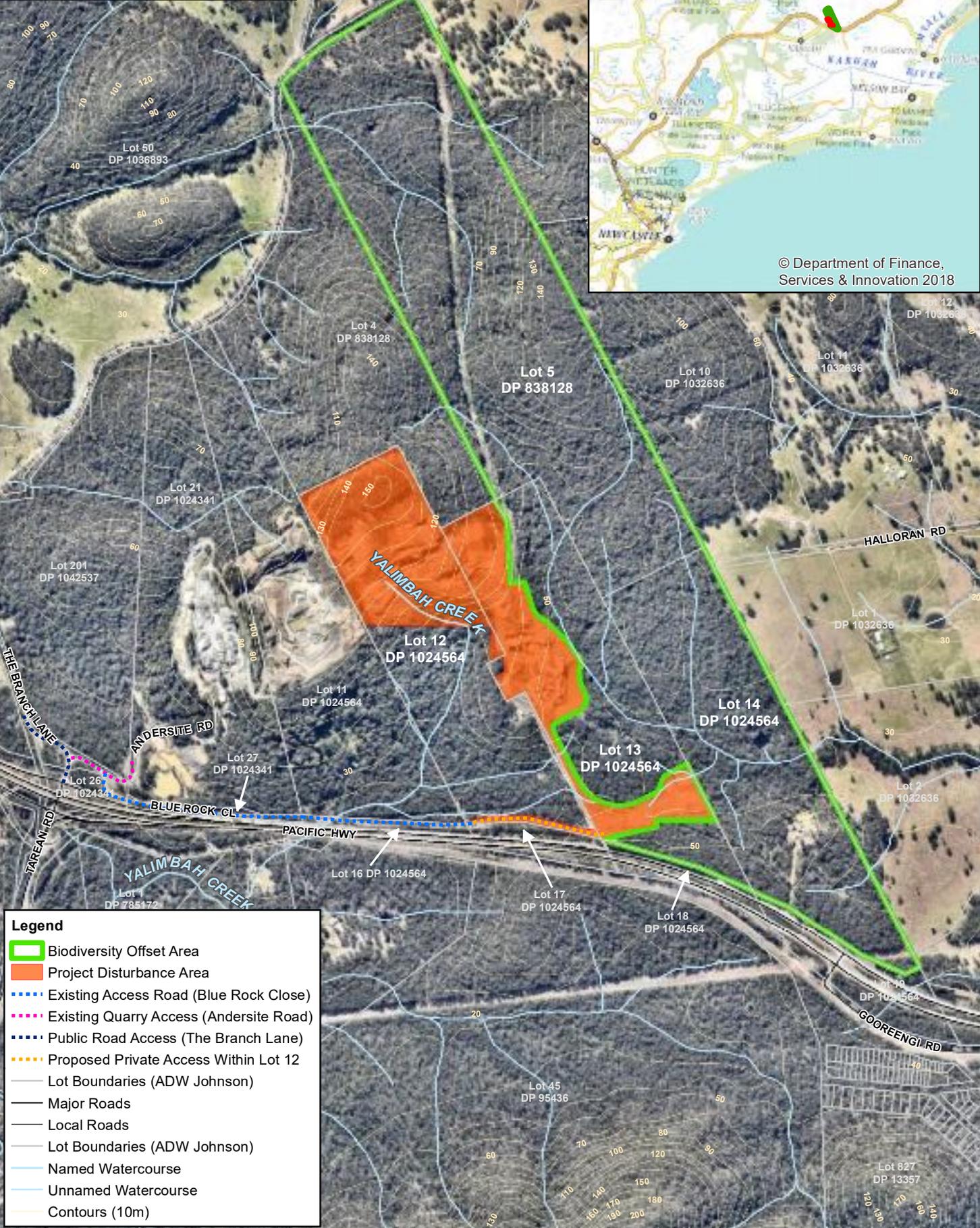
1.1 BACKGROUND

The Karuah East Quarry (KEQ) Project was subject to an assessment under part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The project was approved by the Planning Assessment Commission on 17 June 2014 subject to conditions set out in Schedules 2 to 5 of the Project Approval (09_0175). A subsequent modification was approved on 27 April 2018 under Section 75J of the EP&A Act (Modification 1). A referral under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the project was also lodged with the Department of the Environment (DotE) on 29 July 2014 (EPBC 2014/7282). On 25 August 2014 the project was determined as a Controlled Action under the EPBC Act requiring further assessment subject to the controlling provision 'listed threatened species and communities'. The action was approved by DotE on 20 March 2015 subject to 17 conditions of approval.

Condition 33 of the NSW Project Approval and Condition 9 of the EPBC Act approval require the implementation of a Biodiversity Offset Area Management Plan (BOAMP) for the KEQ biodiversity offset area (BOA), which is a 138.22 ha consolidated land parcel adjoining the western boundary of the project disturbance area (**Figure 1**). The BOAMP was prepared by Kleinfelder (2015) and subsequently approved by the NSW Department of Planning and Environment (DP&E) on 14 December 2015, and approved by the DotE on 16 March 2016.

Baseline ecological surveys and monitoring were undertaken in October 2015 prior to commencement of clearing and construction as required under Section 3 of the BOAMP. The baseline monitoring surveys involved the establishment of 13 permanent monitoring sites within the Karuah East BOA in accordance with the BOAMP. An additional five permanent monitoring sites were also established on the adjoining Lot 12 DP 1024564 as per Sections 3.2 and 4.1 of the Statement of Commitments in accordance with Section 11.1.3 of the Landscape and Rehabilitation Management Plan (L&RMP) (SLR 2015). In addition to establishing the permanent monitoring sites, the surveys also involved baseline assessment of fencing, access tracks, erosion, weeds and vertebrate pests in accordance with Section 3 of the BOAMP. The baseline ecological surveys and monitoring report (Kleinfelder 2016) was submitted as an addendum to the BOAMP in January 2016 (available from <http://hunterquarries.com.au/karuah-east-documents/>).

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Legend

- Biodiversity Offset Area
- Project Disturbance Area
- Existing Access Road (Blue Rock Close)
- Existing Quarry Access (Andersite Road)
- Public Road Access (The Branch Lane)
- Proposed Private Access Within Lot 12
- Lot Boundaries (ADW Johnson)
- Major Roads
- Local Roads
- Lot Boundaries (ADW Johnson)
- Named Watercourse
- Unnamed Watercourse
- Contours (10m)

Metres
0 50 100 200 300 400 500

PROJECT REFERENCE: 20202448
 DATE DRAWN: 2019/11/20 11:12 Version 1
 DRAWN BY: GJoyce
 DATA SOURCE:
 NSW DFSI - 2017
 ADW Johnson - 2015
 Nearmap - 2019

**Karuah East Quarry
and Biodiversity Offset Area**

Karuah East Quarry Pty Ltd
2019 Annual Monitoring Report
Karuah East Quarry Project

FIGURE:
1

The first year of annual monitoring of the BOA and Lot 12 was undertaken in October 2016. This report provides the results of the fourth annual monitoring event undertaken in October 2019. Monitoring including analysis of monitoring data to date to evaluate changes in vegetation condition and threatened flora populations in the BOA. This report also provides a summary of management actions completed within the BOA to date, and recommendations for implementation of management actions in Year 4 of the BOAMP implementation to ensure compliance with relevant performance criteria.

1.2 SCOPE

Section 3 of the BOAMP details the annual monitoring requirements for the Karuah East BOA. Additionally, Section 12.1 of the L&RMP details the ecological monitoring requirements for the Karuah East Quarry project area, adjoining vegetation within 50 m of the project area boundary on Lots 12 and 13, and along Yalimbah Creek (Lot 12). A summary of the Karuah East annual ecological monitoring requirements is provided in **Table 1**. It is noted that not all monitoring activities listed in **Table 1** are required for the 2019 monitoring (refer to the timing / frequency).

Table 1: Summary of annual monitoring requirements for Karuah East Quarry BOA and Lot 12

Monitoring Requirements	BOAMP / L&RMP Section(s)	Timing / Frequency	Completed in 2019
<p>Vegetation and Threatened Flora Monitoring</p> <ul style="list-style-type: none"> The 18 permanent monitoring sites established in the BOA and Lot 12 during the baseline are to be surveyed annually in accordance with Section 3.13 of the BOAMP and Section 12.1.3 of the L&RMP. Monitoring is to be undertaken during spring to coincide with the flowering times of threatened flora species in the BOA. 	<p>Section 3.13 of BOAMP</p> <p>Section 12.1.3 of L&RMP</p>	<p>Annually for life of quarry (LOQ)</p>	<p>Completed</p>
<p>Fencing</p> <ul style="list-style-type: none"> 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. 	<p>Section 3.2 of BOAMP</p> <p>Section 12.1.2 of L&RMP</p>	<p>Annually for LOQ</p>	<p>Outstanding.</p> <p>Boundary fencing around the BOA commenced prior to the 2018 monitoring round, and requires completion. This has been planned the first quarter of 2020.</p> <p>There was no evidence of stock or unauthorised entry across the surveyed areas.</p>
<p>Tracks</p> <ul style="list-style-type: none"> 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. 	<p>Section 3.3 of BOAMP</p>	<p>Annually for LOQ</p>	<p>Completed</p>

Monitoring Requirements	BOAMP / L&RMP Section(s)	Timing / Frequency	Completed in 2019
<p>Erosion</p> <ul style="list-style-type: none"> • Inspections of erosion sites will be undertaken as part of annual monitoring to identify maintenance requirements and record maintenance activities undertaken in previous year. • Erosion and sediment control structures installed within the project disturbance area to protect retained vegetation will be inspected as part of annual ecological monitoring. 	<p>Section 3.4 of BOAMP</p> <p>Section 12.1.2 of L&RMP</p>	<p>Annually for LOQ</p>	<p>Completed</p>
<p>Existing Dwellings</p> <ul style="list-style-type: none"> • 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. 	<p>Section 3.5 of BOAMP</p>	<p>Annually for LOQ</p>	<p>Completed</p>
<p>Habitat Augmentation and Nest Boxes</p> <ul style="list-style-type: none"> • Nest boxes will be inspected and maintained (or replaced) every two years following installation: <ul style="list-style-type: none"> ○ Nest boxes 1 – 30 installed in April 2016 ○ Nest boxes 31 – 125 installed in February 2018 	<p>Section 3.8 of BOAMP</p>	<p>Boxes 1-30 and 31 – 125 monitoring required in 2020.</p>	<p>No monitoring required until 2020</p>
<p>Weeds</p> <ul style="list-style-type: none"> • Target weed species will be mapped on an annual basis within the Project Disturbance Area and adjoining vegetation on Lots 12 and 13 (within 50 m of the project disturbance area boundary). Additionally, weed mapping along Yalimbah Creek will also be undertaken as part of the ecological monitoring program. • 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. 	<p>Section 12.1.1 of L&RMP</p> <p>Section 3.10 of BOAMP</p>	<p>Annually (KEQ, 50 m buffer and Yalimbah Creek)</p> <p>Every 2 years from baseline survey for LOQ (BOA)</p>	<p>Completed (KEQ, 50 m buffer, Yalimbah Creek)</p> <p>Weed mapping for BOA due in 2020 monitoring</p>
<p>Vertebrate Pest Assessment</p> <ul style="list-style-type: none"> • 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. 	<p>Section 3.11</p>	<p>Every 2 years from baseline survey for LOQ (BOA)</p>	<p>Outstanding</p>
<p>Aerial Fauna Crossings</p> <ul style="list-style-type: none"> • A 12-month monitoring program of the two aerial fauna crossings will be undertaken using remote motion sensing cameras mounted on each pole (four cameras in total) once the crossings have been installed. 	<p>Section 12.1.4 of L&RMP</p>	<p>12 months from installation of the crossings</p>	<p>N/A – construction of aerial fauna crossing is planned for the first half of 2020.</p>
<p>Threatened Flora Translocation – refer to <i>Tetratheca juncea</i> Translocation Management Plan (TjMP; Firebird 2015).</p>	<p>Refer to TjMP</p>	<p>Refer to TjMP</p>	<p>Completed – refer to Tj Translocation Monitoring Report (Firebird 2018)</p>

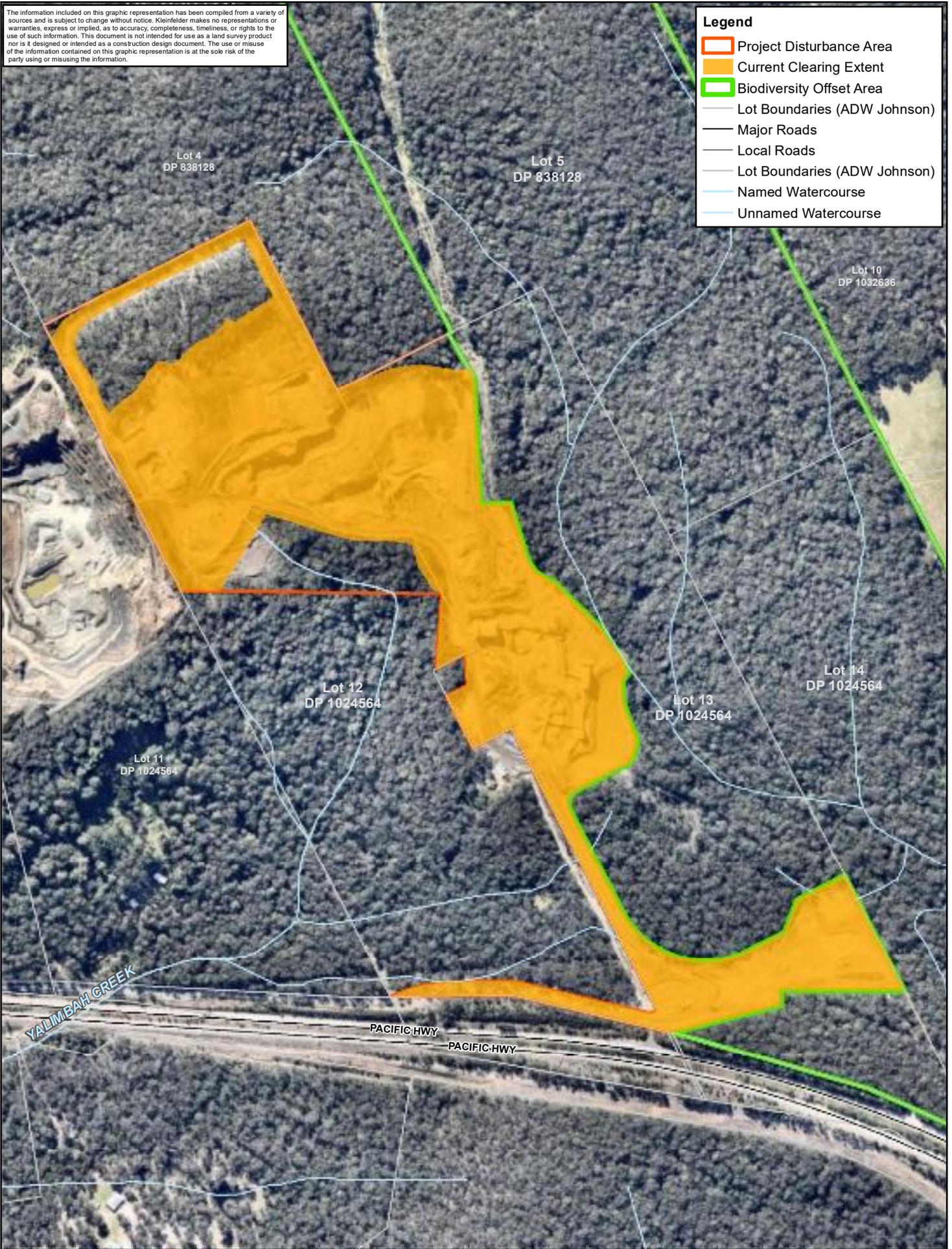
1.3 KARUAH EAST QUARRY PROGRESS

The Karuah East Quarry (KEQ) Project commenced operations in May 2019 after construction of the plant in 2018. Vegetation clearing commenced in April 2016 and the majority of the KEQ project area was primarily cleared between April and June 2016, with some clearing also occurring in November 2016. The majority of the disturbance area has been cleared to-date. Major earthworks have also been completed including construction of the haul road, detention basins, and other infrastructure areas. The current extent of clearing within the KEQ project area is shown in **Figure 2**.

The remaining vegetation within the northern part of the project area is unlikely to be cleared for some time as the areas cleared to date contain andesite resources that will take several years to extract.

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- Legend**
- Project Disturbance Area
 - Current Clearing Extent
 - Biodiversity Offset Area
 - Lot Boundaries (ADW Johnson)
 - Major Roads
 - Local Roads
 - Lot Boundaries (ADW Johnson)
 - Named Watercourse
 - Unnamed Watercourse



Metres
0 25 50 100 150 200 250

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DATA SOURCE:
NSW DFSI - 2017
ADW Johnson - 2015
Nearmap - 2019

Current Extent of Clearing
within the Karuah East
Quarry Project Area

Karuah East Quarry Pty Ltd
2019 Annual Monitoring Report
Karuah East Quarry Project

FIGURE:
2

1.4 BIODIVERSITY VALUES

Section 2.3 of the BOAMP provides a detailed description of the biodiversity values identified in the Karuah East BOA during previous assessments (RPS Australia Pty Ltd 2013; Eco Logical Australia (ELA) 2013, 2014). Additional baseline ecological surveys were also undertaken within the BOA in October 2016 (Kleinfelder 2016). A summary of the key biodiversity values present (or previously recorded) within the site are provided in **Table 2**. The locations of threatened flora species and the distribution of vegetation communities across the BOA are shown in **Figure 3**.

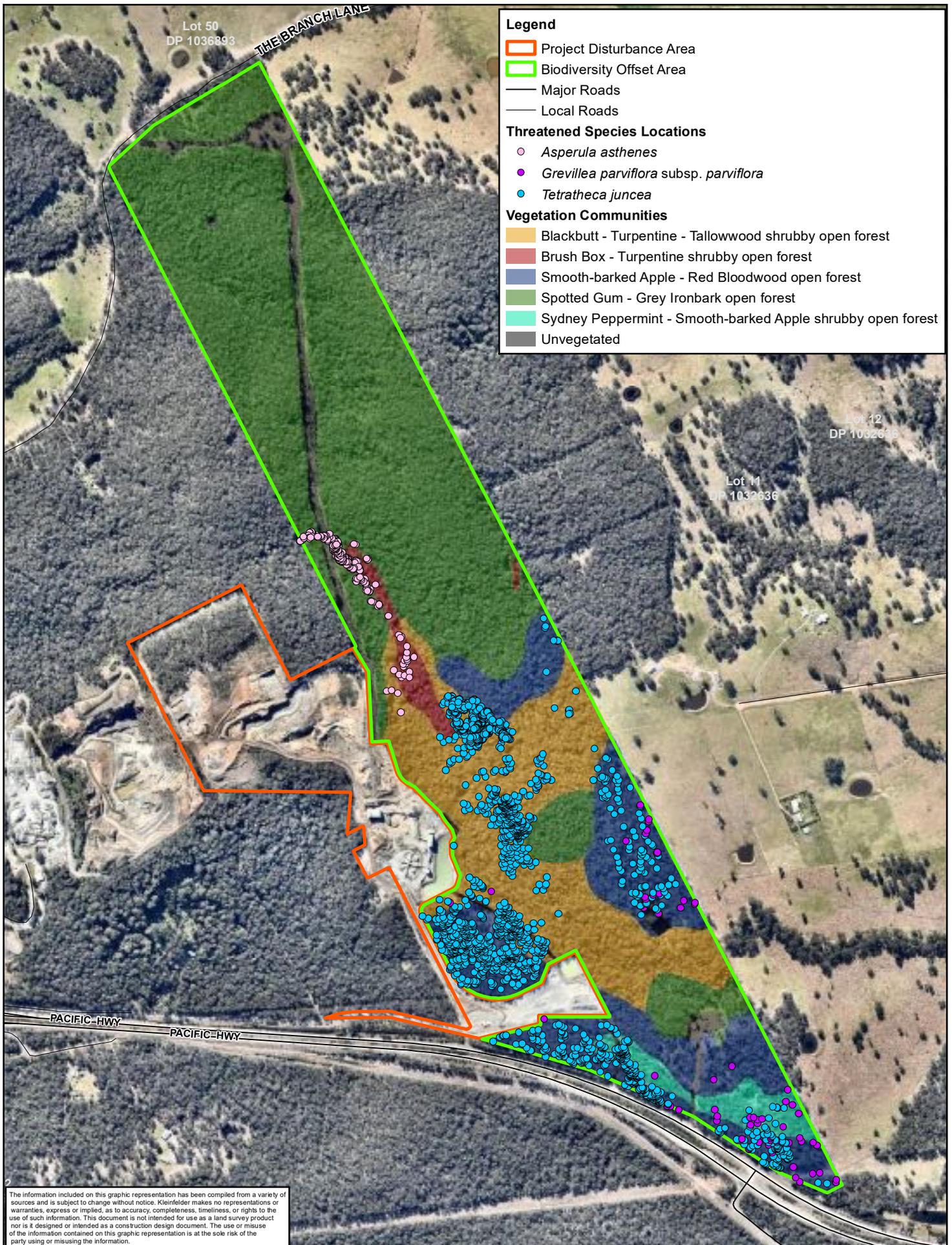
Table 2: Key biodiversity values recorded within the Karuah East BOA

Biodiversity Values		Area (ha) / No. of individuals
Vegetation Communities	Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin.	69.98
	Sydney Peppermint – Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin.	3.96
	Smooth-barked Apple - Red Bloodwood open forest on coastal plains on the Central Coast, Sydney Basin.	26.58
	Blackbutt - Turpentine - Tallowwood shrubby open forest of the coastal foothills of the central North Coast.	28.30
	Brush Box - Turpentine shrubby open forest of the coastal ranges of the North Coast.	2.62
Threatened Flora Species	* [^] <i>Tetratheca juncea</i> (Black-eyed Susan)	6,907
	* [^] <i>Grevillea parviflora</i> subsp. <i>parviflora</i> (Small-flower Grevillea)	100+
	* [^] <i>Asperula asthenes</i> (Trailing Woodruff)	399
Threatened and Migratory Fauna Species	*Eastern Falsistrelle (<i>Falsistrellus tasmaniensis</i>)	-
	*Little Bent-winged Bat (<i>Miniopterus australis</i>)	-
	*Eastern Bent-winged Bat (<i>Miniopterus orianae oceanensis</i>)	-
	*Eastern Coastal Free-tailed Bat (<i>Mormopterus norfolkensis</i>)	-
	*Southern Myotis (<i>Myotis macropus</i>)	-
	*Eastern Cave Bat (<i>Vespadelus troughtoni</i>)	-
	*Glossy Black-Cockatoo (<i>Calyptorhynchus lathami</i>)	-
	*Varied Sittella (<i>Daphoenositta chrysoptera</i>)	-
	*Powerful Owl (<i>Ninox strenua</i>)	-
+Rufous Fantail (<i>Rhipidura rufifrons</i>)		

* = listed as Vulnerable under the BC Act 2016

[^] = listed as Vulnerable under the EPBC Act 1999

+ = listed as Migratory under the EPBC Act 1999



Legend

- Project Disturbance Area
- Biodiversity Offset Area
- Major Roads
- Local Roads

Threatened Species Locations

- *Asperula asthenes*
- *Grevillea parviflora* subsp. *parviflora*
- *Tetratheca juncea*

Vegetation Communities

- Blackbutt - Turpentine - Tallowood shrubby open forest
- Brush Box - Turpentine shrubby open forest
- Smooth-barked Apple - Red Bloodwood open forest
- Spotted Gum - Grey Ironbark open forest
- Sydney Peppermint - Smooth-barked Apple shrubby open forest
- Unvegetated

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Metres

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DATA SOURCE: NSW DFSI - 2018 ADW Johnson - 2015 Nearmap - 2019

**Vegetation Types and
Threatened Flora Locations**

Karuah East Quarry Pty Ltd
 2019 Annual Monitoring Report
 Karuah East Quarry Project

FIGURE:

3

2. METHODS

2.1 VEGETATION AND THREATENED FLORA MONITORING

Thirteen vegetation monitoring sites were established and surveyed within the BOA in October 2015 as per Section 3.1.3 of the BOAMP. An additional five vegetation monitoring sites were also established and surveyed within 50 m of the project disturbance area and along Yalimbah Creek on Lot 12 DP 1024564 as per Section 11.1.3 of the L&RMP. The location of each monitoring site was recorded with a handheld GPS (Trimble™ Juno 5S unit) and permanently marked with a capped star picket. As such, a total of 18 vegetation monitoring sites were established and surveyed within the BOA and Lot 12 in October 2015. These permanent monitoring sites have subsequently been surveyed in October 2016, 2017, 2018 and 2019 using the same methods as the baseline survey, which are described in the following subsections.

Vegetation Monitoring

A qualitative assessment of vegetation condition and photo monitoring was undertaken at each of the 18 monitoring points, involving collection of the following data:

- Vegetation type and structure, including dominant species and estimated percentage foliage cover of each stratum (within 20 m radius of monitoring point);
- General health and condition 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.

Additionally, four photographs (north, south, east and west) were taken at each of the monitoring points. The locations of the vegetation monitoring points are shown on **Figure 4**.

Threatened Flora Monitoring

Monitoring of threatened flora species was also undertaken at nine of the monitoring sites as per the BOAMP and L&RMP. At these sites, all threatened flora individuals within 10 m of the monitoring point were recorded. The bearing and distance of each clump / individual from the star picket recorded during the baseline survey was used to accurately re-locate known individuals in the survey area. The bearing (degrees) for each clump was measured using a Suunto compass and the distance was determined using a tape measure attached to the star picket. Additionally, each clump / individual was permanently marked with a steel peg (positioned 20 cm to the south of each clump / individual to avoid damaging plants); a metal tag was attached to each peg which provides a unique ID number.

Tetratheca juncea individuals or 'clumps' were delineated and counted in accordance with the standardised method described by Payne *et al.* (2002), in which individual clumps occurring 30 cm or more apart are considered separate, individual plants. A 30 cm separation distance between *Grevillea parviflora* subsp. *parviflora* stems was also used to identify separate individuals. *Asperula asthenes* were delineated based on the methodology used by ELA (2014) during previous targeted surveys to ensure a consistent approach for population surveys and monitoring across the BOA. Based on this method, stems (or groups of stems) of *Asperula asthenes* occurring 40 cm or more apart are considered separate individuals.

For each individual identified in the survey area, the following information was recorded:

- Clump number;
- Distance and bearing from centre star-picket to the clump;
- The size of the clump measured across the widest and narrowest points (cm) (for *A. asthenes* and *T. juncea*) or max height (for *G. parviflora* subsp. *parviflora*);
- Presence or absence of flowers (for *A. asthenes* and *G. parviflora* subsp. *parviflora*). The number of flowers and fruit on *T. juncea* plants were recorded to enable monitoring of reproductive output of this species; and
- Notes on general health of the plant, including any die-back or disease.

Following assessment of all previously recorded individuals, an additional survey of the area was performed at each site to identify any new individuals. For all new individuals identified within the survey area, the above listed information was collected. A summary of the vegetation and threatened flora monitoring sites within the BOA and Lot 12 is provided in **Table 3**.

Table 3: Summary of vegetation and threatened flora monitoring sites

Monitoring Point	Site	Threatened Flora Species Monitored
1	BOA – Lot 5	-
2	BOA – Lot 5	-
3	BOA – Lot 5	<i>Asperula asthenes</i>
4	BOA – Lot 13	<i>Asperula asthenes</i>
5	BOA – Lot 14	-
6	BOA – Lot 13	-
7	BOA – Lot 13	<i>Tetratheca juncea</i>
8	BOA – Lot 13	<i>Tetratheca juncea</i> and <i>Grevillea parviflora</i> subsp. <i>parviflora</i>
9	BOA – Lot 13	-
10	BOA – Lot 14	-
11	BOA – Lot 14	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>
12	BOA – Lot 14	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>
13	BOA – Lot 14	-
14	Lot 12	-
15	Lot 12	<i>Tetratheca juncea</i>
16	Lot 12	-

Monitoring Point	Site	Threatened Flora Species Monitored
17	Lot 12	<i>Asperula asthenes</i>
18	Lot 12	<i>Asperula asthenes</i>

2.2 SITE WALKOVER AND INSPECTION

Inspection of key management features was undertaken across the BOA and Lot 12 (within 50 m of the project area and along Yalimbah Creek) in October 2018 in accordance with Section 3 of the BOAMP. The following features were inspected and assessed:

- Internal and external fencing;
- Access tracks and gates;
- Areas of active erosion and sedimentation;
- Areas surrounding the two existing dwellings within the BOA;
- Redistribution of habitat resources salvaged during clearing for the KEQ Project;
- Extent and density of priority and environmental weeds within the project disturbance area, adjoining vegetation within 50 m of the disturbance area boundary on Lots 12 and 13, and along Yalimbah Creek.

Weed Mapping

Weeds for which detailed mapping was undertaken (i.e. target weed species) are those:

- Listed under the Biosecurity Act 2015 as priority weeds within the Mid Coast Council control area;
- Identified as a Weed of National Significance (WoNS); and / or
- Environmental weeds which represent major infestations and / or have the potential to adversely affect ecological values within the BOA.

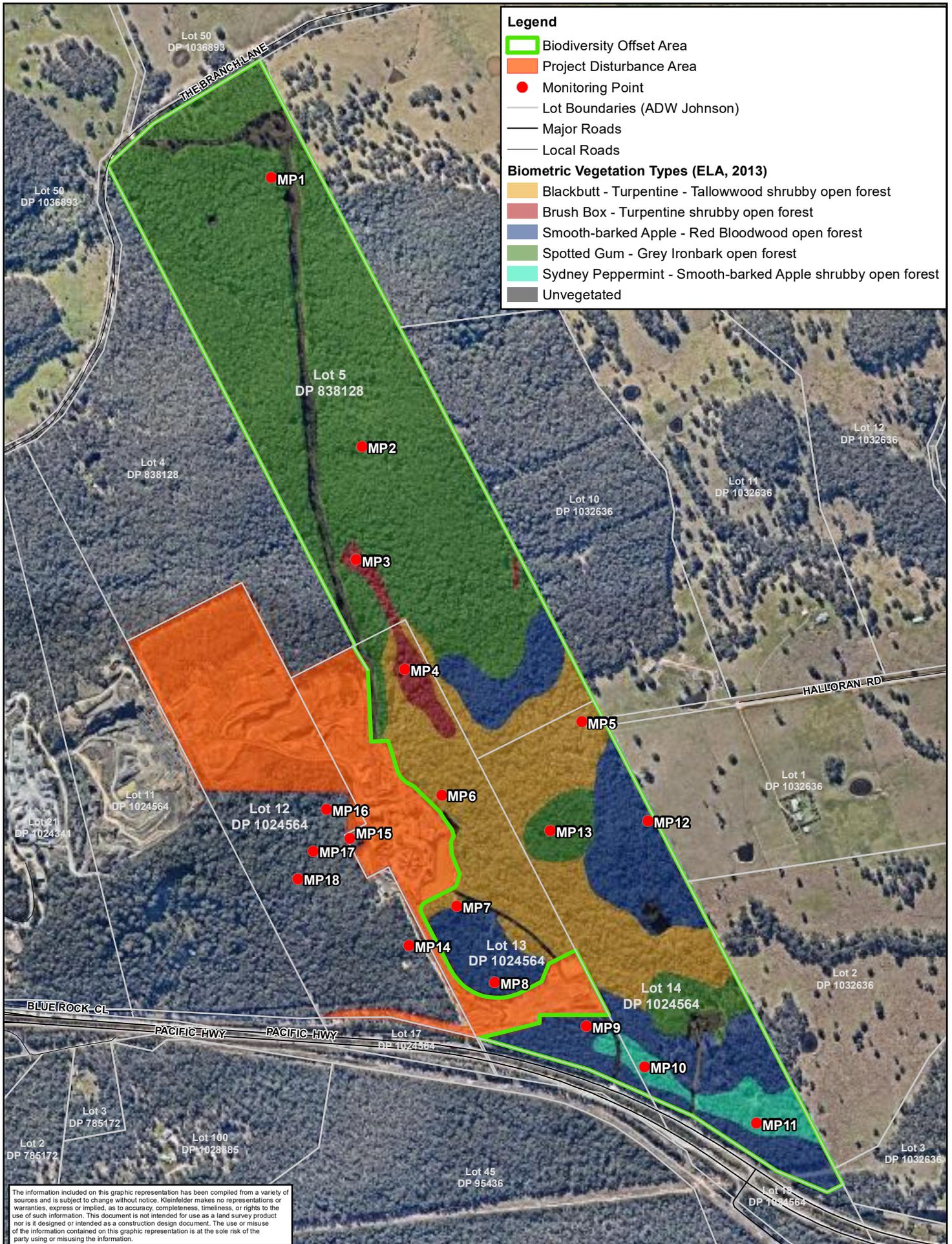
The most widespread and abundant weed species across the site is *Lantana camara* (Lantana). Four categories were used during field surveys to map areas of different Lantana density based on the percentage foliage cover:

- Nil: no Lantana observed;
- Scattered: ≤20% Lantana cover;
- Moderate: 21-60% Lantana cover; and



- High: >60% Lantana cover.

Other target weed species occurring outside moderate to high Lantana areas were mapped separately (i.e. weeds which may not be identified and treated as part of Lantana control).



Legend

- Biodiversity Offset Area
 - Project Disturbance Area
 - Monitoring Point
 - Lot Boundaries (ADW Johnson)
 - Major Roads
 - Local Roads
- Biometric Vegetation Types (ELA, 2013)**
- Blackbutt - Turpentine - Tallowood shrubby open forest
 - Brush Box - Turpentine shrubby open forest
 - Smooth-barked Apple - Red Bloodwood open forest
 - Spotted Gum - Grey Ironbark open forest
 - Sydney Peppermint - Smooth-barked Apple shrubby open forest
 - Unvegetated

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<p>Metres</p> <p>0 50 100 200 300 400 500</p> <p style="text-align: center;">N</p>	PROJECT REFERENCE: 20202448	<h2 style="margin: 0;">Vegetation and Threatened Flora Monitoring Locations</h2>	FIGURE:
	DATE DRAWN: 2019/11/20 11:15 Version 1		4
<p>www.kleinfelder.com</p>	<p>DRAWN BY: G.Joyce</p> <p>DATA SOURCE: NSW DFSI - 2017 ADW Johnson - 2015 Nearmap - 2019</p>	<p>Karuah East Quarry Pty Ltd 2019 Annual Monitoring Report Karuah East Quarry Project</p>	

3. RESULTS AND DISCUSSION

3.1 VEGETATION AND THREATENED FLORA MONITORING

The results of the vegetation and threatened flora monitoring within the BOA are summarised in **Table 4**. The data from the 2015 (baseline), 2016, 2017, 2018 and 2019 surveys of threatened flora monitoring and vegetation structure/cover is provided in **Appendix 1 and 2**, respectively. Photo monitoring points (north) taken at each of the sites in 2015, 2016, 2017, 2018 and 2019 are also provided in **Appendix 3**. Due to the large number of photos, only the photos taken from the northern direction at each monitoring site are presented in this report; the remaining photos from the south, east and west directions have been provided as separate files with the report.

Table 4: Summary of 2019 vegetation and threatened flora monitoring results

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP1	Spotted Gum – Grey Ironbark open forest	<ul style="list-style-type: none"> No evidence of canopy or mid-story foliage die-back. Conditions appeared dry with reduced grass cover observed. Canopy and midstory regeneration present. High fallen logs / timber. Moderate to dense ground cover. Low rock cover. <p>Conclusion: No significant changes in vegetation and habitat condition since the previous survey (2018) at MP1, however, slight reduction in grass cover due to dry conditions.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP1.</p>	N/A

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP2	Spotted Gum – Grey Ironbark open forest	<ul style="list-style-type: none"> No evidence of canopy or midstory foliage die-back Grasses have dried off and died back. Percentage cover has reduced. Percentage cover of <i>Lomandra longifolia</i> and associated species increased (Appendix 2). Moderate ground cover. Canopy and midstorey regeneration present. High fallen logs / timber. Rocky areas present. Hollow-bearing trees present. <p>Conclusion: No significant changes in vegetation and habitat condition since the previous survey (2018) at MP2, however, slight change in groundcover composition (decline in grass cover, and associated increase in <i>Lomandra longifolia</i> cover).</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. Heavy <i>Lantana</i> infestation in the gully south west of MP2 remains. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP2.</p>	N/A
MP3	Brush Box – Turpentine shrubby open forest	<ul style="list-style-type: none"> No evidence of foliage die-back. All vegetation strata in healthy condition. Canopy and midstory regeneration present. High structural complexity of vegetation. High fallen timber. No ephemeral pools within stream. Estimated foliage cover increased for the shrub layer (Appendix 2). Estimated cover of <i>Lantana camara</i> decreased. Scattered <i>Ageratina riparia</i> (Mistflower) within creek <p>Conclusion: No significant or notable changes in vegetation and habitat condition since the previous survey (2018) at MP3.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP3.</p>	<ul style="list-style-type: none"> A total of 11 <i>Asperula asthenes</i> individuals were recorded at MP3 in 2019. The number of individuals has decreased from 13 individuals in 2018, a further decline from 17 individuals in 2016, with an initial number of 16 in 2015 (31% reduction from baseline). <ul style="list-style-type: none"> Five individuals recorded at MP3 in 2018 were absent in 2019. Two individuals were recorded in 2019, that had not been found since 2017. One individual was recorded that had not been found since 2016. One plant merged with another plant. One new individual was recorded. All recorded <i>A. asthenes</i> plants at MP3 were observed to be in healthy condition; three individuals were recorded as having new growth, nine individuals had flowers and five had fruit at the time of survey (some plants had flowers & fruit as well as new growth).

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP4	Brush Box – Turpentine shrubby open forest	<ul style="list-style-type: none"> • No evidence of canopy, midstory or ground layer foliage die-back was observed. • All vegetation strata in healthy condition. • Some dieback of vines was observed. • Canopy and midstory regeneration present. • High structural complexity of vegetation. • Dense ground cover. • High fallen timber. • Estimated foliage cover increased across the canopy (Appendix 2). • Weed invasion (<i>Lantana</i> and <i>Tradescantia</i>). <p>Conclusion: No significant or notable changes in vegetation and habitat condition since the previous survey (2018) at MP4.</p>	<ul style="list-style-type: none"> • No evidence of erosion and sedimentation. • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. • No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP4.</p>	<ul style="list-style-type: none"> • A total of 17 <i>Asperula asthenes</i> individuals were recorded at MP4 in 2019 compared to 17 individuals recorded in 2018, and 15 in 2015 (13% increase from Baseline): <ul style="list-style-type: none"> ○ Six individuals recorded at MP4 in 2018 were not recorded in 2019. ○ Four new individuals. ○ Two individual not recorded in 2018 was recorded in 2019. • All <i>A. asthenes</i> plants at MP4 were observed to be in healthy condition. Some dieback was observed, however most plants also had new growth. Five plants had flowers or buds, four had fruit and nine were observed to have grown (some plants had flowers & fruit as well as new growth).
MP5	Blackbutt – Turpentine – Tallowood shrubby open forest	<ul style="list-style-type: none"> • No evidence of foliage die-back was observed in the canopy or ground layer • Canopy and midstory regeneration present. • Moderate fallen logs / timber. • Dense ground cover. • No changes in estimated foliage cover for each vegetation stratum (Appendix 2). <p>Conclusion: No significant or notable changes in vegetation and habitat condition since the previous survey (2018) at MP5.</p>	<ul style="list-style-type: none"> • No evidence of erosion and sedimentation. • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. • No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP5.</p>	N/A

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP6	Blackbutt – Turpentine – Tallowood shrubby open forest	<ul style="list-style-type: none"> Some evidence of foliage die-back in the mid-story. Canopy in healthy condition. Canopy and midstory regeneration present but drying off. High fallen logs / timber. Moderate level of ground cover. Standing pools within creek. A large decrease in estimated percentage cover of midstory (Appendix 2). <p>Conclusion: Notable change in the decline of midstorey cover since the previous survey (2018) at MP6. No other significant changes in vegetation and habitat condition.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. Disturbance from tree falling (<i>Glochidion ferdinandi</i>) within western half of MP6. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal or dust was observed. No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP6.</p>	N/A
MP7	Smooth-barked Apple – Red Bloodwood open forest	<ul style="list-style-type: none"> No evidence of foliage die-back in canopy or midstory. All vegetation strata in healthy condition. Canopy and midstory regeneration present. Regrowth vegetation to the north and east (previously cleared). Low fallen timber. Some drying off of grasses was observed. Estimated percentage of ground cover decreased (Appendix 2). <p>Conclusion: There were only minor changes in vegetation and habitat condition since the previous survey (2018) at MP7.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP7.</p>	<ul style="list-style-type: none"> A total of 15 <i>Tetratheca juncea</i> individuals were recorded at MP7 in 2019 compared to 11 individuals recorded in 2018, and 14 in 2015 (a 7% increase since Baseline): <ul style="list-style-type: none"> Three individuals were found in 2019 that were not recorded in 2018. One new plant was identified. The majority of the <i>T. juncea</i> plants at MP7 were observed to be in healthy condition, however, there were some plants that declined in size. Conversely, five individuals have grown, and one is reshooting. Eleven plants had flowers, while fourteen had fruit (some plants had flowers as well as fruit).

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP8	Smooth-barked Apple - Red Bloodwood open forest	<ul style="list-style-type: none"> No dieback of canopy stratum was observed. There was no change to previous dieback of <i>Eucalyptus eugenioides</i> from the previous year. Evidence of some die back in midstory stratum, especially <i>Allocasuarina littoralis</i> was observed. Canopy and midstorey regeneration present Moderate fallen timber Dense ground cover and midstory Estimated foliage cover decreased for midstory, shrub and ground cover (Appendix 2) <p>Conclusion: Minor changes in vegetation and habitat condition since the previous survey (2018) at MP8.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust No signs of recent fire Old track to north-east <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP8.</p>	<ul style="list-style-type: none"> A total of ten <i>Tetratheca juncea</i> clumps were recorded at MP8 in 2019, which is the same number as recorded in all previous surveys (not change since baseline): <ul style="list-style-type: none"> Two <i>T. juncea</i> clumps recorded in 2018 were not recorded in 2019. One <i>T. juncea</i> clump was recorded in 2019 that had not been recorded since 2018. One additional clump was recorded in 2019. One <i>Grevillea parviflora</i> subsp. <i>parviflora</i> individual was recorded at MP8 in all monitoring rounds (no change from baseline). All <i>T. juncea</i> plants at MP8 were observed to be in healthy condition, however six individuals decreased in size since previously measured. Six <i>T. juncea</i> clumps were in flower, and nine clumps had fruit (some plants had both flowers & fruit). The <i>G. parviflora</i> individual was observed to be in healthy condition but did not have flowers or fruit, and no buds were present.
MP9	Smooth-barked Apple - Red Bloodwood open forest	<ul style="list-style-type: none"> There was slight die-back of foliage in the understory. Dead wood was observed throughout the canopy. Canopy and midstory regeneration present. High fallen timber. Moderate-dense ground cover and midstory. A minor decrease (3%) in estimated cover of the shrub layer. A decrease of 10% estimated ground cover was observed, due to a major dieback of <i>Lomandra longifolia</i> and <i>Pteridium esculentum</i> drying out since the previous survey (Appendix 2). <p>Conclusion: Only minor changes occurred in vegetation and habitat condition since the previous survey (2018) at MP9.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rock / timber removal, or dust. No recent evidence of rubbish dumping was present, however some rubbish was present in the area. No signs of recent fire. Old track to south. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP9.</p>	N/A

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP10	Sydney Peppermint - Smooth-barked Apple shrubby open forest	<ul style="list-style-type: none"> Two <i>Eucalyptus piperita</i> were observed to have some natural foliage die-back in canopy cover. All vegetation strata in healthy condition. Canopy and midstory regeneration present. High fallen timber. Moderate to dense ground cover. There was a decrease in estimated foliage cover of 10% for the grass and ground cover layer (Appendix 2). <p>Conclusion: No major changes in vegetation and habitat condition since the previous survey (2018) at MP10.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. Several old dead stags present. Some canopy gaps (from past clearing/logging). <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP10.</p>	N/A
MP11	Sydney Peppermint - Smooth-barked Apple shrubby open forest	<ul style="list-style-type: none"> No evidence of foliage die-back. All vegetation strata in healthy condition. Canopy and midstory regeneration present. Low fallen timber. Moderate Dense ground cover. There was a decrease (10%) in estimated percentage cover of grasses as well as in the ground layer (Common Bracken) (Appendix 2). <p>Conclusion: No significant or notable changes in vegetation and habitat condition since the previous survey (2018) at MP11.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. Previous disturbance from tree falling along North-North/East 20 metre buffer boundary. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. <p>Conclusion: No recent disturbance was observed since the previous survey (2018) at MP11.</p>	<ul style="list-style-type: none"> A total of 12 <i>Grevillea parviflora</i> subsp. <i>parviflora</i> individuals were recorded at MP11 in 2019 compared with 10 in 2018, 12 in 2017 and 16 individuals in 2016, and 2015 (25% reduction from Baseline): <ul style="list-style-type: none"> One individual recorded at MP11 in 2018 died off by 2019 Three new individuals were identified in 2019 Another individual died back and re-sprouted a new plant 20cm away Four individual <i>G. parviflora</i> were observed to be in healthy condition in 2019, with new growth / shoots. The remaining 7 individuals presented varying degrees of senescence of which only 1 was also observed to have re-sprouted. In 2019, no individuals were observed to have flowers or fruits.

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP12	Smooth-barked Apple – Red Bloodwood open forest	<ul style="list-style-type: none"> • Some evidence of foliage die-back for midstorey species. • Vegetation is generally in healthy condition across all strata. • Canopy and midstorey regeneration present. • Very high levels of fallen timber. • Dense ground cover. • No changes in estimated foliage cover for each vegetation stratum (Appendix 2). <p>Conclusion: Felled timber remains (from previous impact due to fence maintenance), however, no significant changes have occurred to vegetation and habitat condition since the previous survey (2018) at MP12.</p>	<ul style="list-style-type: none"> • No evidence of erosion and sedimentation. • No recent evidence of disturbance from pest animals, rubbish dumping, rock / timber removal, or dust (in past year, area previously subject to clearing due to fence line maintenance). • Some evidence of herbivory on shrub and ground layer. • No signs of recent fire. • Cleared grazing land 20 m to east adjacent to BOA with exotic grasses, but no weeds within BOA in this area. <p>Conclusion: No evidence of new disturbance was observed since the previous survey (2018) at MP12.</p>	<ul style="list-style-type: none"> • A total of eight <i>Grevillea parviflora</i> subsp. <i>parviflora</i> individuals were recorded at MP12 in 2019, compared to 11 individuals in 2018, five individuals recorded in 2017, and seven in 2015 (14% increase from Baseline): <ul style="list-style-type: none"> ○ Four individuals recorded at MP12 in 2018 were absent in 2019. ○ 1 new individual was recorded in 2019. • Five individual <i>G. parviflora</i> plants at MP12 had grown in height, and three of these were observed to be in flower at the time of the survey.
MP13	Spotted Gum – Grey Ironbark open forest	<ul style="list-style-type: none"> • No further changes to some natural die-back present in canopy trees from 2018. • All vegetation strata in healthy condition. • Canopy and midstorey regeneration present. • High fallen logs / timber. • Dense ground cover. • Moderate rock cover. • A minor increase (10%) in estimated canopy cover was recorded within the survey area since the previous survey (Appendix 2). <p>Conclusion: No significant or notable changes in vegetation and habitat condition since the previous survey (2018) at MP13.</p>	<ul style="list-style-type: none"> • No evidence of erosion and sedimentation. • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. • No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP13.</p>	N/A

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP14	Smooth-barked Apple - Red Bloodwood open forest	<ul style="list-style-type: none"> No change to previous die-back of foliage in one <i>Eucalyptus eugenioides</i> and one <i>Eucalyptus paniculata</i>. All vegetation strata in healthy condition. Canopy and midstorey regeneration present. Low fallen/ timber. Dense ground cover. No changes in estimated foliage cover for most vegetation stratum. There was a small decrease in exotic grasses due to dry conditions (Appendix 2). <p>Conclusion: No significant or notable changes in vegetation and habitat condition since the previous survey (2018) at MP14.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. Exotic grasses around dam to south and along access track. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP14.</p>	N/A
MP15	Blackbutt - Turpentine - Tallowood shrubby open forest	<ul style="list-style-type: none"> Some evidence of continued foliage die-back in <i>Acacia irrorata</i> towards edge of disturbance area. All vegetation strata in moderately healthy condition. Canopy and midstorey regeneration present. Regrowth vegetation to the north and east (previously cleared). High fallen timber. Moderate-dense ground cover and leaf litter. Rocky areas present. Some dieback in the ground layer, particularly drying off of grasses (Appendix 2). <p>Conclusion: Only minor changes in vegetation and habitat condition since the previous survey (2018) at MP15.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. There are some edge effects from adjacent clearing. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. <p>Conclusion: No new disturbance or significant changes in existing disturbance severity were observed since the previous survey (2018) at MP15.</p>	<ul style="list-style-type: none"> A total of 13 <i>Tetratheca juncea</i> individuals were recorded at MP15 in 2019 compared to 11 individuals in 2018, 17 individuals recorded in 2017, and 30 in 2015 (57% decline from Baseline): <ul style="list-style-type: none"> One individual recorded at MP15 in 2018 was absent in 2019. Three individuals were recorded at MP15 that had not been recorded since 2017. All <i>T. juncea</i> plants that were recorded at MP15 were observed healthy with eight of plants having new growth. Seven individuals had flowers or buds and ten had fruits. The significant decline in the <i>T. juncea</i> at MP15 is most likely due to the lower than average rainfall during the past couple of years, exacerbated by the location of the monitoring point; upper slopes of exposed hill side.

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP16	Spotted Gum – Grey Ironbark open forest	<ul style="list-style-type: none"> Some evidence of foliage die-back in the midstory due to dry conditions. All vegetation strata in moderately healthy condition. Canopy and midstory regeneration present. Moderate fallen timber. Dense leaf litter and moderate ground cover. Low rock cover. There was a (10%) decrease from the previous year in <i>Lantana</i> cover as well as ground cover and grass cover (Appendix 2). <p>Conclusion: Some minor changes in vegetation and habitat condition since the previous survey (2018) at MP16.</p>	<ul style="list-style-type: none"> No evidence of erosion and sedimentation. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. Several old dead stags present. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP16.</p>	N/A
MP17	Brush Box - Turpentine shrubby open forest	<ul style="list-style-type: none"> No evidence of foliage die-back. All vegetation strata in healthy condition. Canopy and midstorey regeneration present. High fallen timber. Dense ground cover. Rocky areas along ephemeral creek. No changes in estimated foliage cover for each vegetation stratum (Appendix 2). <p>Conclusion: No significant or notable changes in vegetation and habitat condition since the previous survey (2018) at MP17.</p>	<ul style="list-style-type: none"> Very minor scouring along creek bank. No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP17.</p>	<ul style="list-style-type: none"> A total of seven <i>Asperula asthenes</i> individuals were recorded at MP17 in 2019 compared to six individuals in 2018, two individuals recorded in 2017 and eleven individuals recorded in 2015 (36% decline from Baseline): <ul style="list-style-type: none"> One new individual was recorded in 2019. One group of plants reduced in size and formed 2 clumps. One plant recorded in 2018 was not found in 2019. All <i>A. asthenes</i> were observed to have reduced in size. One plant had flowers, and another had fruit. The decline in <i>A. asthenes</i> in 2019 since the baseline survey is most likely due to lower than average rainfall over the previous couple of years and MP17 being positioned on a rocky area on the periphery of the creek (less protected than other monitoring locations).

Site	Vegetation Community	Vegetation and Habitat Condition	Evidence of Disturbance	Threatened Flora Monitoring
MP18	Brush Box - Turpentine shrubby open forest	<ul style="list-style-type: none"> • No evidence of foliage die-back • All vegetation strata in healthy condition • Canopy and midstorey regeneration present • High fallen timber and leaf litter • Dense ground cover • Rocky areas along ephemeral creek. • There was a (10%) decrease from the previous year in ground cover. • No changes in estimated foliage cover for all other vegetation strata(Appendix 2). <p>Conclusion: Some minor changes in vegetation and habitat condition since the previous survey (2018) at MP18.</p>	<ul style="list-style-type: none"> • Very minor scouring along creek bank. • No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust. • No signs of recent fire. <p>Conclusion: No new disturbance or changes in existing disturbance severity were observed since the previous survey (2018) at MP18.</p>	<ul style="list-style-type: none"> • A total of five <i>Asperula asthenes</i> individuals were recorded at MP18 in 2019 compared to four individuals in 2018 and 2017, and 13 individuals recorded in 2016 and 2015 (62% decline from Baseline): <ul style="list-style-type: none"> ○ One individual recorded at MP18 in 2018 was absent in 2019. ○ Two individuals not recorded since 2017 were identified in 2019. • The remaining <i>A. asthenes</i> were observed to be healthy condition, with only one plant observed to have flowers and fruits. One of these plants was reshooting after dying back in previous years. Previous years of below average rainfall have impacted this population, however with signs of plants reshooting and flowering, as well as plants sighted outside the monitoring point, this population has potential to recover.

The 2019 threatened species monitoring identified a decrease in threatened flora abundance at approximately half of the monitoring locations. **Table 5** illustrates the percentage of decline in threatened flora from the baseline to the current surveys. It should be noted that monitoring points: MP4, MP7, MP8, MP15 and MP17 are considered close to the impact area (as per BOAMP) and MP3, MP11, MP12 and MP18 are located further away from the impact area within the BOA.

Table 5: Threatened species percentage change from baseline survey.

Monitoring Point	Proximity to impact area	Species	Change from Baseline (%)	Average Change
MP3	Away	<i>Asperula asthenes</i>	-31%	29% Decrease
MP4	Close		13%	
MP17	Close		-36%	
MP18	Away		-62%	
MP7	Close	<i>Tetradlea juncea</i>	7%	17% Decrease
MP8	Close		0%	
MP15	Close		-57%	
MP8	Close	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	0.00	4% Decrease
MP11	Away		-25%	
MP12	Away		14%	

There remains an overall decline in threatened species abundance since baseline monitoring, however, this percentage has reduced since the previous monitoring round, as plant numbers have increased or remained constant since the last monitoring round (2018). Previous declines in plant numbers were likely due to poor rainfall conditions and could not be confidently attributed to the quarry disturbance as there is no correlation between monitoring points with higher percentage of decline and proximity to the quarry; high levels of decline (>10%) was observed at both sites close to and away from the impact area.

Flowering was observed at all monitoring points, with the exception of *G. parviflora* at MP11. Fruits had formed on plants at all monitoring points with the exception of MP12 (*G. parviflora*) and MP17 (*A. asthenes*). The last 12 months rainfall has been slightly less than average levels, as shown in the graph below illustrating the previous 12 months of rainfall (2018-2019) against the average rainfall from 1881 to 2018 (**Chart 1**). Higher than average rainfall occurred at the beginning of Spring (September), assisting plants to form new growth as well as flowers and fruits. Continued ecological monitoring is required to ensure that the species recover as conditions continue to become more favourable.

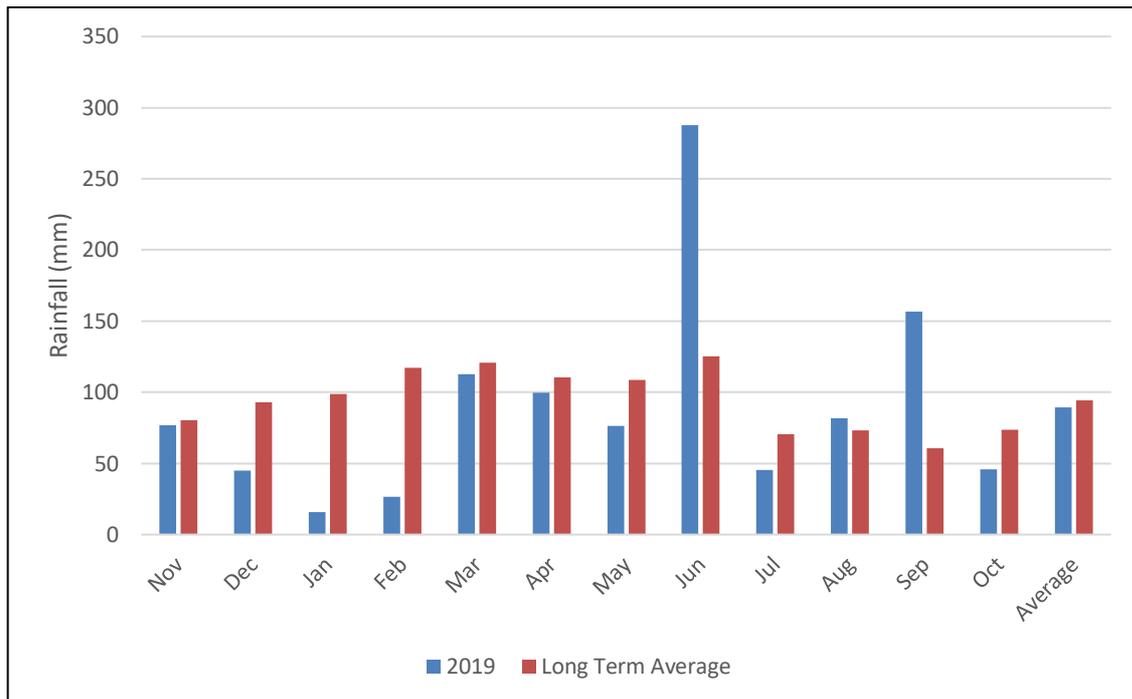


Chart 1: Monthly rainfall for the 12 months (2018 – 2019) prior to monitoring, compared to average rainfall at Nelson Bay weather station (source BOM)

3.2 WEEDS

Figure 5 shows the distribution of weeds mapped across the BOA, within the project disturbance area, within 50 m of the project disturbance area, and along Yalimbah Creek on Lot 12. *Lantana camara* (Lantana) (Priority Weed within the Mid Coast LGA) is the most abundant weed species across the site, with the majority of infestations occurring on the northern part of the BOA. Dense infestations of Lantana were primarily observed along the drainage lines in Lot 5. Two other Priority Weed species have also been identified in the BOA: *Asparagus aethiopicus* (Ground Asparagus) and *Senecio madagascariensis* (Fireweed) are both listed as Priority Weeds within the Mid Coast LGA. These two species only occur as small discrete patches in a few locations in the BOA.

Notable areas of exotic perennial grasses have also been mapped previously (**Figure 5**). The dominant exotic grass species in these areas include *Setaria sphacelata* (South African Pigeon Grass), *Andropogon virginicus* (Whisky Grass), and *Axonopus fissifolius* (Narrow-leafed Carpet Grass), as well as a variety of annual and perennial exotic herbs. The areas dominated by exotic grasses are primarily restricted to the power line easement, around existing dwellings, track edges, perimeter of quarry disturbance area and previously cleared regrowth areas on the southern part of Lot 14. While the dense areas of exotic grasses have been mapped, they are not considered target weed species at this stage as they represent a relatively low threat to the integrity of ecological values within the site. The exotic grasses occurring in the areas of

native regrowth are also likely to be shaded out over time as the canopy and midstorey cover continue to regenerate. However, the distribution of exotic grasses will continue to be monitored, and any increases will be evaluated to determine if management is required.

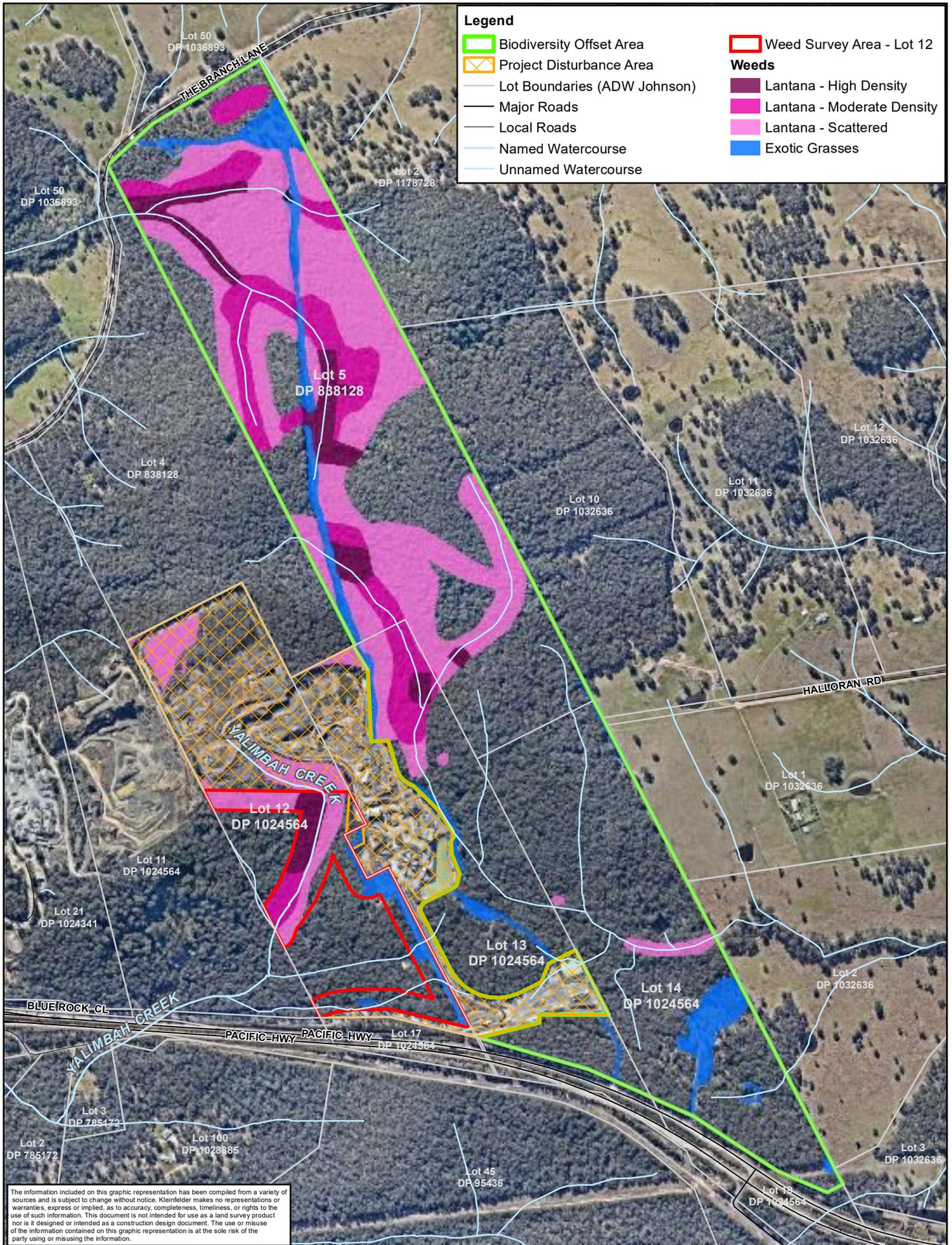
A decline in percentage cover of exotic species (Lantana and South African Pigeon Grass) was recorded at four monitoring locations in 2019. Dry conditions were observed with the reduction of native grasses and ground covers across all monitoring locations, and this has also impacted weed species across site.

It was observed during the 2019 annual monitoring event that density of grasses along disturbed areas (roadsides and dam areas) had increased (**Plate 1**). These grasses are facilitating erosion control across disturbed areas. However, due to the proximity to the road, there is potential for weed seed to be carried by vehicles trafficking this area.

Successful weed control has been observed in Lot 14, along the creek line where an infestation has been spayed and has been reduced to mostly scattered individuals within only a small area of moderate density Lantana remaining.

It is recommended weed control works for the next 12 months should focus on the Lantana infestations in the south-west portion of Lot 5 and north-east part of Lot 13. Additionally, manual control of exotic grasses within 10 m of the *Asperula asthenes* individuals in the powerline easement on Lot 5 should also be undertaken. These weed control activities must be undertaken in spring in accordance with the procedures detailed in Section 3.10 of the BOAMP due to the presence of threatened flora (*Asperula asthenes*) in these areas.

A combined list of weed species from the surveys completed by ELA (2013) and Kleinfelder (2017) across the BOA is provided in **Appendix 4**. No additional weed species were added during the 2019 surveys.



Legend

- Biodiversity Offset Area
- Project Disturbance Area
- Lot Boundaries (ADW Johnson)
- Major Roads
- Local Roads
- Named Watercourse
- Unnamed Watercourse
- Weed Survey Area - Lot 12

Weeds

- Lantana - High Density
- Lantana - Moderate Density
- Lantana - Scattered
- Exotic Grasses

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 DATA SOURCE:
 NSW DFSI - 2017
 ADW Johnson - 2015
 Nearmap - 2019

Weed Mapping

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FIGURE:

5



Plate 1: Exotic Grasses fringing the Light Vehicle Road between the Weighbridge and Plant Area

3.3 FENCING AND TRACKS

Figure 6 shows the layout of existing and required fencing, gates and tracks across the BOA. Boundary fencing is required around the entire KEQ project area. Fencing of KEQ project area / BOA boundary has commenced (approximately 70% completed in 2017). A new fence was installed along the eastern boundary of the BOA adjoining Lot 10 in 2017. Fencing along the remaining 30% of project area / BOA boundary, and Lot 5 / Lot 14 boundary is required. Internal fencing is also required around the existing dwellings on Lot 5 and Lot 14. It is noted that that the dwelling in Lot 5 is not currently occupied. This internal fencing must be installed prior to this dwelling being occupied. All fencing works shall be undertaken in accordance with Section 3.2 of the BOAMP.

Several access tracks occur throughout the BOA. The majority of these tracks are important for facilitating access for management activities across the BOA, and as such it is recommended that these tracks be maintained. Several sections of tracks on the southern part of the BOA are not considered critical for ongoing management. These sections have been rehabilitated with branches, hollow logs / sections and other organic debris salvaged from the KEQ disturbance area during vegetation clearing.

The existing tracks to be retained in the BOA were assessed as being in adequate condition for 4WD access during the 2019 surveys and no maintenance is recommended at this stage. However, it is noted that some initial repairs may be required for the tracks to be suitable for emergency fire-fighting vehicles. Additionally, the track located within the powerline easement is overgrown and while still in decent condition, will require some slashing to facilitate access. The need for initial repairs will be determined during development of the Fire Management Strategy as per Section 3.12 of the BOAMP.

3.4 EROSION

No areas of major active erosion were identified within the BOA during the 2019 monitoring. Areas of bare ground previously identified on the access tracks within the BOA still appeared to be stable with no substantial active erosion or sedimentation observed. Minor scouring was still evident in several locations along the drainage lines within Lot 5. However, this scouring is considered to be natural stream bank erosion as there was no evidence of unnatural disturbance in these areas, and overall the streams have relatively high ground vegetation cover and appear stable.

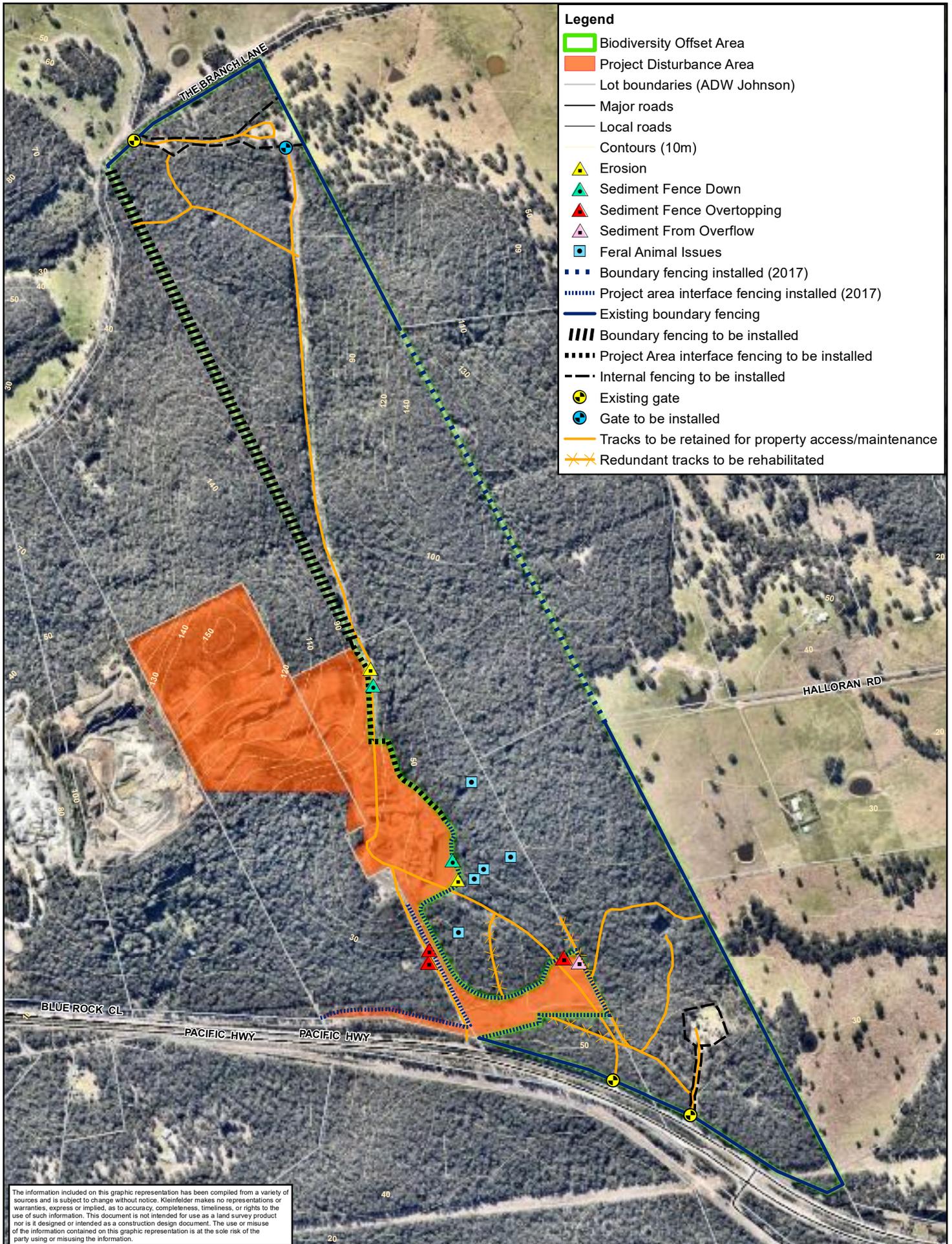
Certain areas of the BOA (primarily the steep slopes on Lot 5) have the potential to develop erosion following Lantana control works. The need for erosion or soil stabilisation measures following initial treatment of moderate and high density Lantana areas on steep slopes will be assessed at each maintenance / monitoring event. No weed control had taken place throughout Lot 5 over previous monitoring round, therefore no change to conditions was observed.

The creek line area, where Lantana control activities have taken place in Lot 14 was observed to have dense vegetation re-invading the areas where Lantana has died off, therefore no erosion control is currently required for this area.

Sediment fencing and bund walls / diversion drains were in place in all areas downslope of disturbed areas except for the area north of Dam 1. However, the sediment fences installed along the eastern side of the overburden stockpile and the area south east of Dam 1 had failed at the time of the 2018 and 2019 inspection. Active erosive processes are evident in several locations where rill erosion can be observed along the wall of Dam 1 and the overburden stockpile wall. These processes are washing away sediments and rocks overtopping the sediment fence and spilling over the surrounding bushland. Many of these areas have begun to stabilise in some areas through the spread of exotic grass species over the disturbed areas including road sides and dam walls.

Erosion issues were observed at three areas surrounding the quarry disturbance area:

- In three locations the installed sediment fencing was overtopping (observed in 2018 & 2019) and therefore no longer providing active sediment control (**Figure 6**). It was observed in these locations that some sediment had been deposited within the surrounding environment but it was still contained within the project disturbance area and no sediment overflow had entered the BOA as shown in **Plate 2**.
- It was noted during the 2017 monitoring event that the overflow for Dam 3 was depositing small amounts of sediment into the receiving environment with water being retained in the bushland east of the basin for a period. It was noted during the 2018 monitoring event that a small trough had been dug to allow the overflow from the dam to drain out of the area and into Bulga Creek. While some minor erosion and sedimentation was observed on the discharge side of the dam wall, it was still contained within the project disturbance area. This management action has remediated the waterlogging issue and no die-back or change in vegetation structure and composition was observed in 2018. No further changes were noted in 2019. Ongoing annual monitoring will be required to assess the effectiveness of the drainage and ensure no die-back or change in vegetation structure and composition occurs.
- Two areas of unmanaged active erosion were observed along the eastern side of the overburden stockpile area and the south-eastern bank of Dam 1 in 2018 monitoring. The bank is actively eroding due to a lack of ground cover and / or erosion control devices. No



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Fencing, Track, Erosion,
and Pest Issues

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FIGURE:
6

changes were noted in this area over 2019 monitoring. Sediment fences had been installed prior to the 2018 monitoring event, however they have been buried by eroded material, and sediment is being depositing along the fringe of the adjacent bushland. These fences should be re-erected to provide active sediment control.



Plate 2: Sediment fencing along the light vehicle road

3.5 VERTEBRATE PESTS

A number of diggings have been observed in the southern half of the BOA area during previous site inspections (**Figure 6**). These disturbances were identified as Feral Pig diggings. Karuah East Quarry has engaged a contractor to undertake feral animal control in the BOA. Pig trapping in Lot 14 has commenced in March 2019.

3.6 HABITAT RESOURCES

Salvage and Redistribution of Habitat Resources

Section 6.3.1 of the L&RMP and Section 3.8 of the BOAMP detail the protocol and requirements for salvaging habitat resources (i.e. logs, hollows and other large organic debris) during the KEQ project and redistributing into the rehabilitation or offset areas. Vegetation clearing undertaken in 2016 for the KEQ project has included the salvage of a large quantity of organic material (primarily large trees and logs). These resources are currently stockpiled on the boundaries of the KEQ project area (**Figure 7**), which will be respread across rehabilitation areas as the project progresses.

In addition to this, a total of 77 hollows and hollow log sections were previously salvaged and set aside for redistribution into the BOA (**Plate 3**). The location of the hollow logs to be redistributed throughout the BOA is shown on **Figure 7**. These hollows should be inspected prior to preparation for installation to check for cracking and confirm suitability for use, as they have been stored outside and exposed to weathering. Any hollows that are not in good condition should be replaced with an equal number of nest boxes.

As clearing for the first stage of the KEQ project has been completed as of November 2016, the salvaged hollows will need to be installed to offset loss of hollows at a 1:1 ratio as per Section 3.8 of the BOAMP. In addition, further clearing was completed in May and August 2018, as well as October and November 2019, in areas previously identified in 2016 surveys. A total of 116 hollows (42 small, 50 medium and 24 large) were removed in 58 trees during these works. A further 116 nest boxes will need to be installed to offset the loss of habitat from these areas.

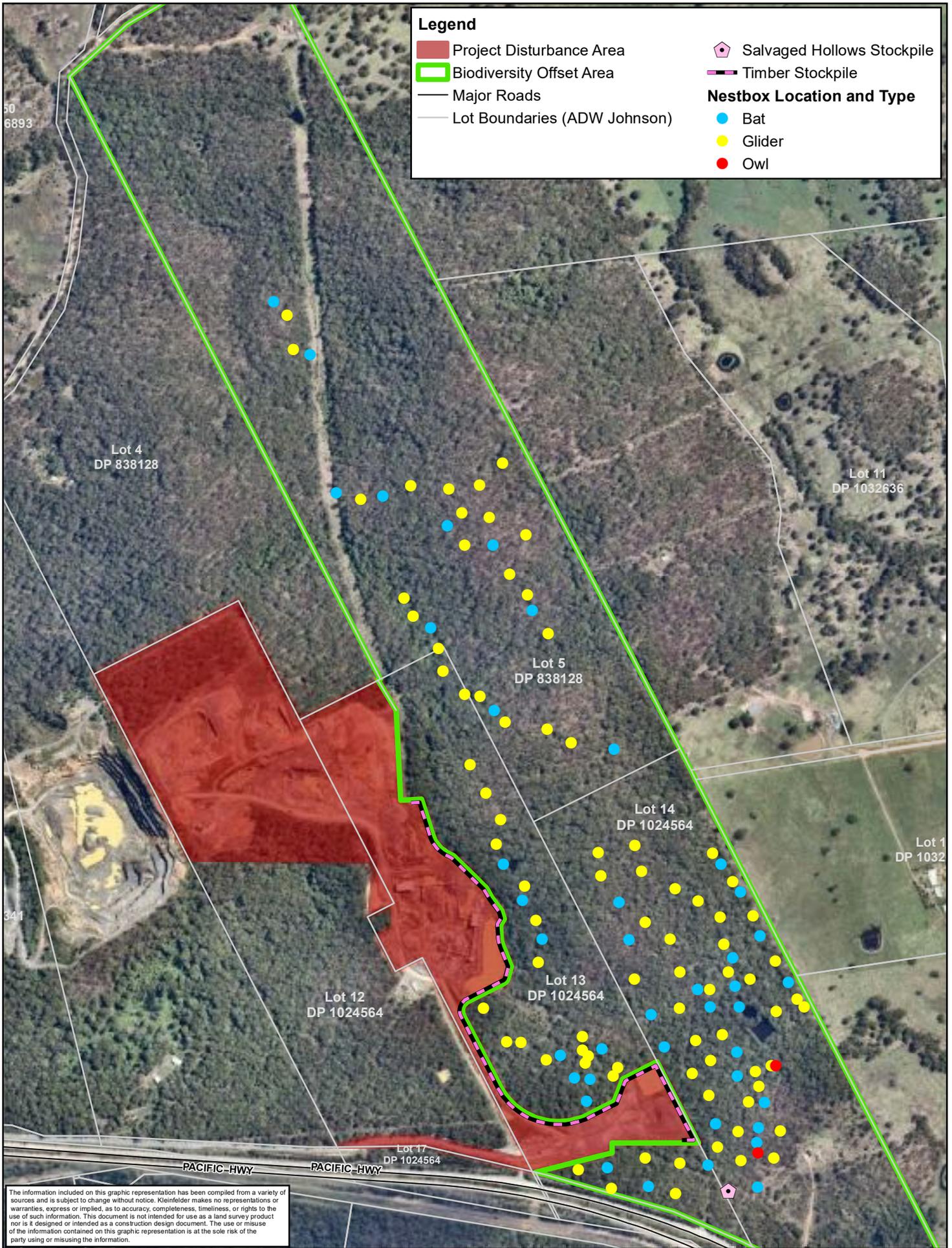


Plate 3: Hollow sections salvaged for redistribution into the BOA

Nest Boxes

A total of 30 nest boxes were installed within the BOA in April 2016 as per Section 3.8 of the BOAMP. A further 93 nest boxes were installed between the 3rd and 6th of February 2018 and two large owl boxes were installed by quarry staff on 14 February 2018 (totalling 125) offsetting the original clearing works and loss of hollows at a 1:1 ratio assuming the 77 salvaged hollows are distributed throughout the BOA. The locations of these nest boxes are shown in **Figure 7**.

In June 2018, the initial 30 nest boxes were monitored as per Section 3.8 of the BOAMP. Results showed that all 30 boxes were deemed to be available for use with no damaged or unusable boxes. Eight Glider boxes showed signs of use including one being actively occupied by two Sugar Gliders (*Petaurus breviceps*). None of the Microchiropteran bat exhibited signs of use during the survey. Monitoring was not required to be undertaken in 2019.



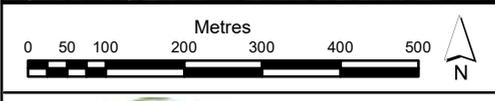
Legend

- Project Disturbance Area
- Biodiversity Offset Area
- Major Roads
- Lot Boundaries (ADW Johnson)
- Salvaged Hollows Stockpile
- Timber Stockpile

Nestbox Location and Type

- Bat
- Glider
- Owl

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Habitat Resources and NestBox Locations

FIGURE:
7



DATA SOURCE:
 NSW DFSI - 2017
 ADW Johnson - 2015
 Nearmap - 2019

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4. PERFORMANCE CRITERIA EVALUATION

Table 5 details the management actions and associated BOAMP performance criteria relevant to the BOAMP implementation. This provides an evaluation of the current status of each relevant management action and indicates if further works are required to complete the action (priority actions in **bold text**).

It is noted that the BOAMP was endorsed by all consent authorities (i.e. Council, NSW DP&E and Commonwealth DotE) as of March 2016. As such, all Year 1 management actions were due to be completed before March 2017 to ensure compliance with the relevant performance criteria.

Table 6: Current status of BOAMP performance criteria

Action	Performance Criteria	Current Status (2019)
FENCING, GATES AND SIGNAGE		
Fence mapping	Completed by end of year 1	Baseline fence mapping completed in October 2015.
Boundary fencing, gates and signage installation / repairs	Completed by end of year 1	Outstanding Installation of boundary fencing, gates and signage required.
Redundant fencing removal	Completed by end of year 3	N/A – no redundant fencing identified during baseline fence mapping.
Fencing inspections	Completed annually	Annual inspection completed.
Fencing maintenance	Boundary fencing in place and signage present by end of year 1	Outstanding Installation and repair of boundary fencing, gates and signage required.
ACCESS TRACKS		
Access track mapping and assessment	Completed by end of year 1	Baseline track mapping and assessment completed in October 2015.
Access track repairs	Completed by end of year 3 Track repair does not impact on ecological values and is restricted to defined limits	No major track repair requirements identified. Access tracks assessed as being in suitable condition for 4WD access during the 2019 monitoring. The Lot 5 access track requires slashing to ensure safe access for the 2020 monitoring event.
Redundant access track rehabilitation	Completed by end of year 3	Rehabilitation of redundant tracks completed and natural regeneration occurring.
Access track inspections	Completed annually	Annual inspection completed.
EROSION, SEDIMENTATION AND SOIL MANAGEMENT		
Erosion and sedimentation mapping	Completed by end of year 1	Baseline assessment completed in October 2015.

Action	Performance Criteria	Current Status (2019)
Erosion repair and management	Completed by end of year 3 Repair of erosion within BOA does not impact on ecological values	The 2018 & 2019 survey identified areas requiring repair or management, these actions should be undertaken immediately. The effectiveness of erosion and sediment control measures within the Karuah East Quarry project area such as silt fencing and diversion drains should be inspected and maintained regularly and after rain events.
Erosion inspections	Completed annually	Annual inspection completed in November 2019.
EXISTING DWELLINGS		
Exclusion of existing dwellings from Conservation Agreement	Completed by end of year 1	The survey plan excluded the two existing dwellings.
Fencing and signage installation	Completed by end of year 1	Outstanding Installation of fencing, gates and signage required.
Inspections	Completed annually	Annual inspection completed in November 2019.
Maintenance and weed control	No noxious weeds present within excised areas. No unauthorised disturbance outside of excised areas in the BOA.	No environmental weeds impacting on the integrity of the BOA were identified in excised areas during 2019 monitoring. No unauthorised disturbance observed outside of excised areas in the BOA during 2019 monitoring.
REVEGETATION AND REGENERATION*		
Confirm extent of revegetation areas	Completed by end of year 1	Completed. No revegetation works were assessed as being required within the BOA during the 2015, 2016, 2017, 2018 or 2019 monitoring. The requirement for revegetation works within the BOA will be reassessed each year.
HABITAT AUGMENTATION		
Salvage and redistribution of habitat resources	Redistribution of salvaged resources by end of Year 3 Redistribution of salvaged resources does not impact on ecological values of BOA, including threatened flora	Salvaged and redistribution of habitat resources in progress (refer to Section 3.5). Outstanding: the installation of 77 hollows.
Nest box installation	30 nest boxes installed in BOA prior to commencement of clearing. Remaining nest boxes installed within three months following completion of clearing.	Thirty nest boxes were installed in the southern part of the BOA in April 2015 prior to commencement of clearing. An additional 95 were installed in February 2018. Installation of an additional 116 nest boxes by February 2020 is required for clearing completed in November 2019.
Nest box monitoring and maintenance	Nest boxes inspected every two years. Repairs / maintenance implemented within 6 months of biennial inspection.	Monitoring of nest box 1-30 was carried in April 2018, monitoring of boxes 1-125 due in February to April 2020.

Action	Performance Criteria	Current Status (2019)
THREATENED FLORA TRANSLOCATION		
<i>Tetratheca juncea</i> translocation	Translocation completed by end of year 1 Maintenance and monitoring undertaken in accordance with the TjMP	Refer to Tj Translocation Monitoring Report (Firebird 2018).
WEED CONTROL		
Baseline weed mapping	Completed by end of year 1	Baseline assessment completed in October 2015 (Kleinfelder 2015).
Delineation of threatened flora prior to weed control works	No impacts on threatened flora populations within BOA from weed control activities.	N/A – no weed control works undertaken surrounding threatened species locations to date.
Weed control	20% reduction in extent or density (cover) of target weeds per year compared to baseline mapping by end of Year 3. Weed control activities do not impact on ecological values.	Outstanding There has been little change in weed density over the Lot 5 area since the 2018 monitoring round. Small area of Lantana along the creek line in Lot 14 was sprayed in September 2018. Substantial amount of dieback in this area has occurred by February 2019. Additional weed control was undertaken in February 2019. Further dieback was recorded in November 2019, so that only scattered individuals now occur. Weed control has been undertaken along the boundary fence of Lot 12 in February 2019, and along the entire perimeter of Lot 12 in November 2019.
Weed monitoring	Completed biennially (every two years) (for BOA). Completed annually (KEQ, 50 m buffer and Yalimbah Creek).	Weed mapping revisited for KEQ project area, adjoining vegetation within 50 m of the project area boundary on Lots 12 and 13, along Yalimbah Creek (Lot 12) in November 2019 and BOA in October 2018.
VERTEBRATE PEST MANAGEMENT		
Baseline vertebrate pest assessment	Completed by end of year 1	Baseline assessment completed in October 2015 (Kleinfelder 2015).
Vertebrate pest control	No non-target species affected by control works. Reduction in abundance of target species across BOA compared to baseline assessment.	Feral animal control was undertaken in February 2019.
Monitoring	Completed biennially (every two years).	Outstanding 2017 biennially vertebrate pest monitoring required.
FIRE MANAGEMENT		
Fire management strategy	Completed by end of year 1	Outstanding A fire management strategy is to be prepared for the BOA.
Bushfire mitigation	Bushfire mitigation measures in the L&RMP adhered to at all times	Refer to KEQ Annual Environmental Report.

Action	Performance Criteria	Current Status (2019)
Aerial Fauna Crossing		
Installation of aerial fauna crossings	<p>Installed upon completion of Haul Road.</p> <p>A 12-month monitoring program of the two aerial fauna crossings will be undertaken using remote motion sensing cameras mounted on each pole (four cameras in total) once the crossings have been installed.</p>	N/A - aerial fauna crossing not installed as Haul Road not completed.
ECOLOGICAL MONITORING		
Additional baseline surveys	Completed prior to clearing	Baseline surveys completed (refer to Kleinfelder 2016).
Vegetation and threatened flora monitoring	<p>Baseline ecological monitoring undertaken prior to clearing in year 1.</p> <p>Less than 10% decline in <i>Tetratheca juncea</i>, <i>Grevillea parviflora</i> subsp. <i>parviflora</i> and <i>Asperula asthenes</i> population sizes (at monitoring sites) compared to baseline assessment.</p> <p>No major changes in vegetation health or condition across BOA.</p>	<p>Baseline ecological monitoring completed (refer to Kleinfelder 2016).</p> <p>No major changes in vegetation health or condition were observed in the BOA in 2019.</p> <p>An average of 8% decline in threatened flora species at monitoring sites was observed during 2019 survey.</p>

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

5. CONCLUSION

While some species are stressed from dry conditions, the results from the 2019 monitoring indicate that the vegetation and fauna habitats within the Karuah East Biodiversity Offset Area (BOA) and Lot 12 are in good condition and remain relatively unchanged since the baseline survey in 2016.

A significant change was recorded within the threatened flora populations sampled at some of the monitoring sites. It is likely these declines are a result of a dry years with below average rainfall. There was not obvious association between the monitoring site proximity to the disturbance area and the level of decline in threatened species; decline was observed both close to and away from the disturbance area. Continued annual monitoring is required to ensure the species respond as conditions become more favourable.

Some of the management and monitoring actions required prior to the end of Year 1 (i.e. March 2017), Year 2 (i.e. March 2018) and Year 3 (i.e. March 2019) have not been completed. The 2019 monitoring has identified several key management actions that are required to be completed, which have been highlighted in **Section 4** of this report. These include sediment fence repair, fence installation, salvaged habitat installation, nest box installation, weed control, fire management plan and vertebrate pest monitoring. These actions should be undertaken in accordance with the relevant sections of the BOAMP and this monitoring report.

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APPENDIX 1. THREATENED FLORA MONITORING

Appendix 1.1 – Biodiversity Offset Area Monitoring Sites

Monitoring Point 3 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)					Flowers / Fruit Present (2019)	Comments
			2015	2016	2017	2018	2019		
3A	160	140	30 x 25	70 x 40	10 x 5	30 x 10	-		merged with 3C
3B	280	150	20 x 25	-	5 x 5	-	-		not found
3C	160	120	40 x 30	40 x 30	170 x 90	200 x 50	110 x 110	Flowers and Fruit	several large clumps
3D	460	110	50 x 20	30 x 20	-	-	-		not found, dense litter
3E	500	110	55 x 30	30 x 30	45 x 40	5 x 5	-		not found, dense litter
3F	530	105	50 x 10	30 x 30	60 x 20	60 x 20	80 x 60	Flowers and Fruit	
3G	590	115	25 x 35	25 x 40	170 x 80	-	10 x 5		New shoots
3H	650	110	20 x 20	40 x 20	-	100 x 100	60 x 40	flowers and fruit	Some dieback and new shoots
3I	690	130	40 x 25	30 x 20	-	-	-		Not found
3J	780	120	35 x 20	20 x 20	-	80 x 50	-		Not found
3K	850	120	30 x 30	30 x 30	60 x 15	-	10 x 5	none	
3L	900	145	35 x 45	20 x 10	-	-	-		not found, dense litter
3M	680	260	40 x 35	40 x 35	25 x 30	40 x 20	60 x 40	flowers	buds, new shoots
3N	790	270	30 x 25	30 x 20	-	-	120 x 50	flowers	multiple stems
3O	990	300	55 x 25	-	-	20 x 5	-		not found
3P	240	90	40 x 20	40 x 15	40 x 15	40 x 20	150 x 90	flower and fruit	
3Q	590	105	-	40 x 10	-	-	-		not found
3R	930	115	-	30 x 30	-	-	-		not found
3S	700	275	-	20 x 30	5 x 5	-	-		not found, dense litter
3T	300	80			5 x 25	-	-		merged with 3P
3U	800	280			30 x 20	50 x 20	30 x 30	flowers	
3V	800	105				5 x 5	-		not found, fallen branches
3W	780	115				80 x 50	80 x 30	flowers	new shoots
3X	770	125				5 x 5	-		not found
3Y	85	125					40 x 60	flower and fruit	new, multiple stems

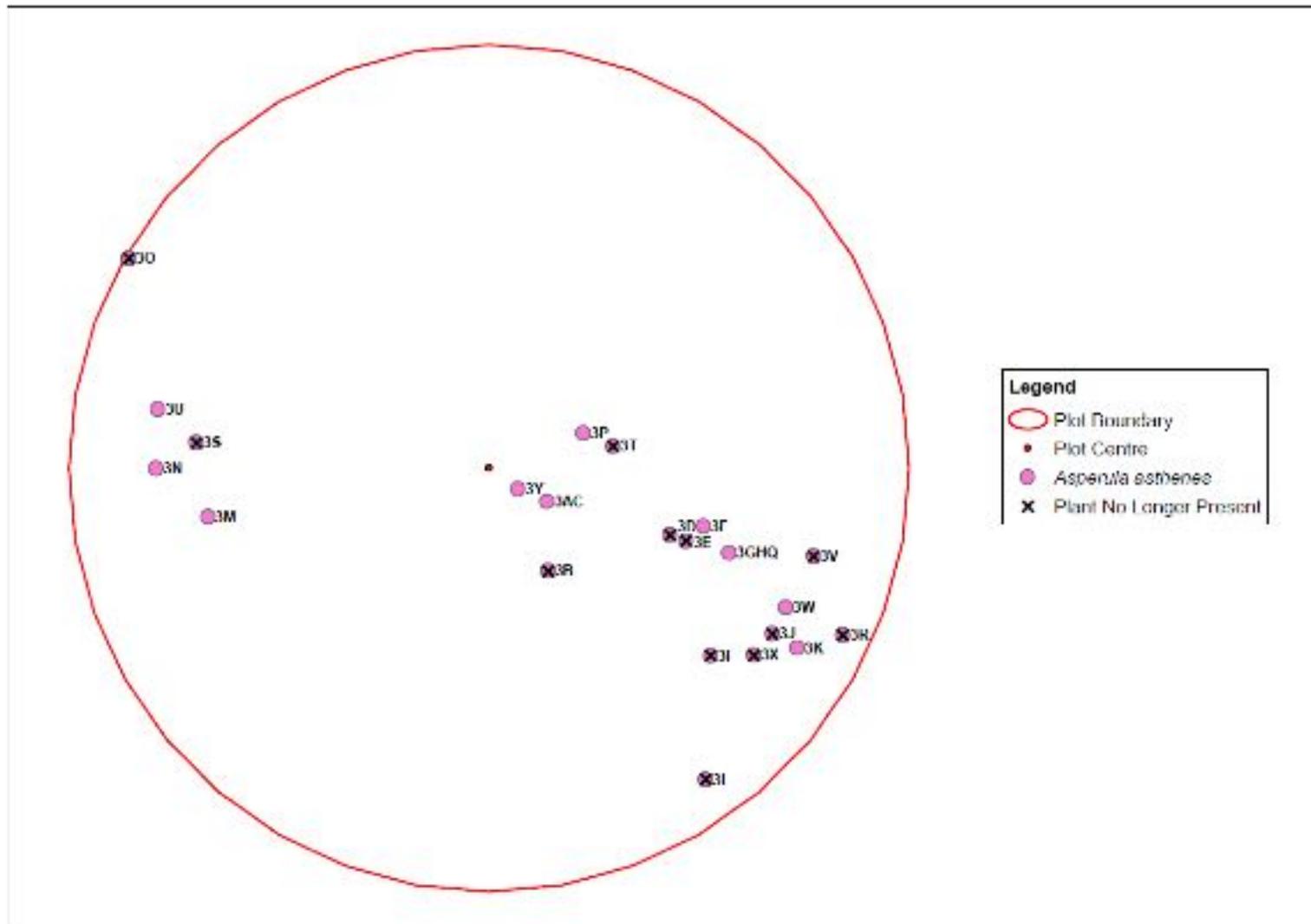


Figure A1-1: *Asperula asthenes* locations – monitoring point 3

Monitoring Point 4 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)					Flowers / Fruit Present (2019)	Comments
			2015	2016	2017	2018	2019		
4A	160	195	30 x 20	30 x 20	5 x 5	-	-		not found
4B	620	215	55 x 20	45 x 25	-	20 x 10	-		not found, fallen log, dense litter
4C	660	215	30 x 15	30 x 30	-	5 x 5	-		not found, dense litter
4D	630	220	20 x 20	20 x 20	-	20 x 10	45 x 45	buds	dieback, multiple stems within 30 cm
4E	760	220	65 x 20	40 x 20	10 x 5	-	10 x 5	none	new shoots
4F	810	210	70 x 45	70 x 40	10 x 5	-	-		not found
4G	940	205	40 x 15	50 x 10	30 x 10	5 x 10	70 x 50	fruit	new shoots, multiple stems
4H	740	205	50 x 30	50 x 30	20 x 10	40 x 30	50 x 40	buds, fruit	
4I	740	200	80 x 15	60 x 40	-	5 x 10	-		dense litter and timber
4J	110	325	80 x 30	60 x 30	70 x 10	10 x 70	100 x 80	buds, flowers and fruit	multiple stems, and new shoots
4K	890	25	30 x 30	40 x 30	60 x 60	-	-		not found, dense litter
4L	920	20	55 x 35	50 x 25	50 x 30	5 x 3	-		not found
4M	210	105	115 x 30	90 x 40	90 x 10	-	-		not found
4N	840	185	110 x 30	100 x 40	50 x 10	40 x 30	40 x 25	none	multiple stems, 20 cm apart
4O	590	70	40 x 25	50 x 50	80 x 5	-	-		not found, dense litter
4P	850	235	-	20 x 20	40 x 2	-	-		not found, dense litter
4Q	680	355	-	20 x 30	180 x 80	60 x 20	50 x 20	buds, fruit	dieback
4R	155	270	-	-	20 x 5	50 x 10	100 x 40		2 clumps within 30 cm, some dieback
4S	590	80	-	-	10 x 15	-	-		not found, dense litter
4T	890	15	-	-	10 x 5	-	10 x 5	none	dieback and new shoots
4U	30	0	-	-	20 x 10	-	-		not found
4V	680	225	-	-	80 x 50	-	-		not found
4W	770	350	-	-	-	20 x 5	50 x 40	buds	3 stems, new shoots
4X	640	345				50 x 20	80 x 60	buds	5 clumps within 30 cm, some dieback
4Y	600	345				50 x 20	-		merged with 4X

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)					Flowers / Fruit Present (2019)	Comments
			2015	2016	2017	2018	2019		
4Z	875	350				30 x 5	70 x 30	none	multiple shoots, 2 shoots within 30 cm
4Aa	995	345				10 x 10	80 x 50	flowers	new shoots, 2 shoots within 30 cm
4Ab	700	215				10 x 5	-		Not found
4Ac	900	345					10 x 5	none	new. single shoot
4Ad	610	235					35 x 20	none	new, multiple stems, new shoots
4Ae	380	105					10 x 5	none	new, 1 stem
4Af	1000	20					55 x 30	none	new

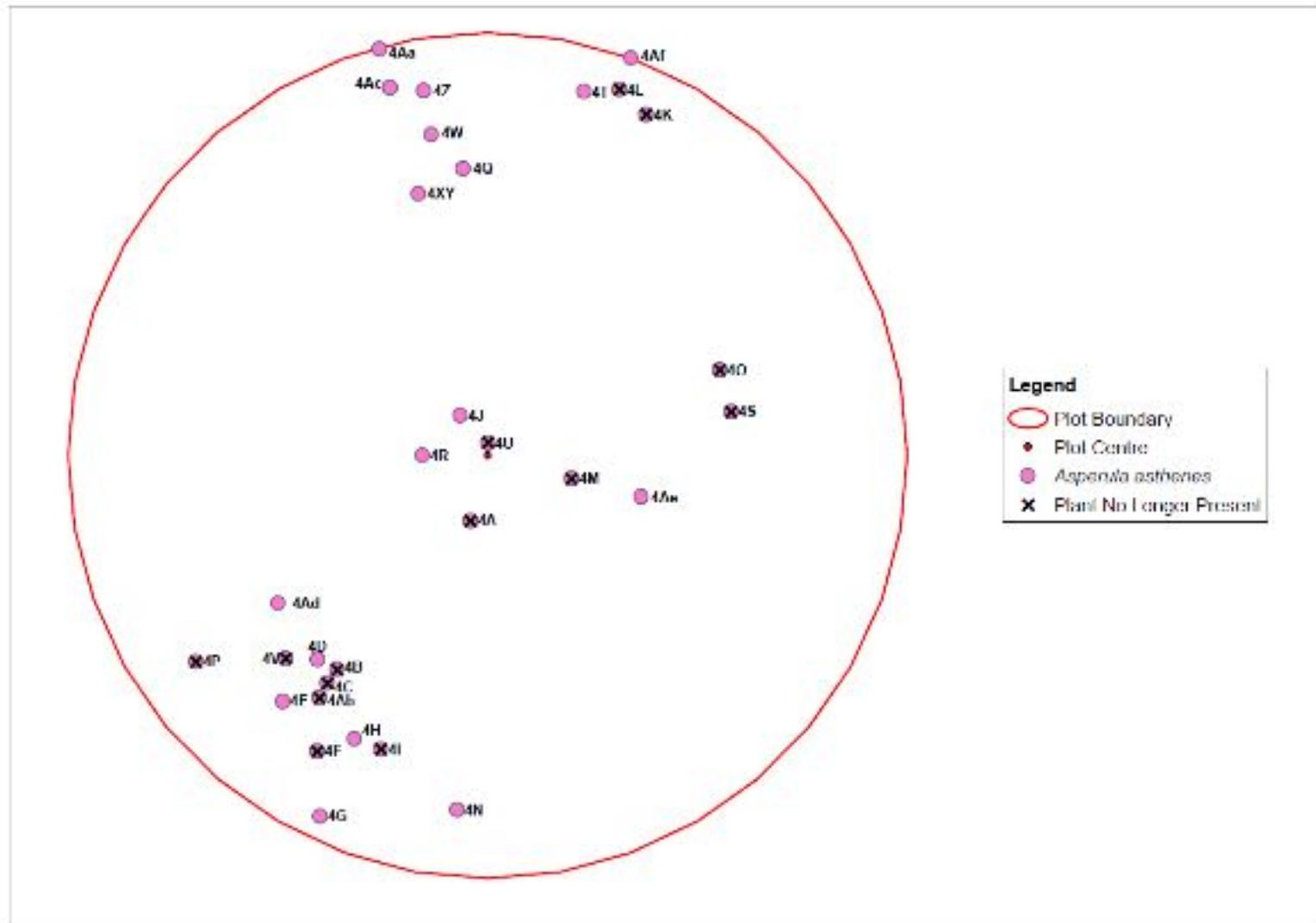


Figure A1-2: *Asperula asthenes* locations – monitoring point 4

Monitoring Point 7 - *Tetradlea juncea* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)					Flower (2019)	Fruits (2019)	Comments
			2015	2016	2017	2018	2019			
7A	480	160	70x40	60x40	60x50	10x60	70x40	3	3	
7B	470	155	5x 5	10x5	-	10x10	30x20		2	1 bud
7C	500	155	35x15	40x15	70x30	60x30	50x20	3	10	
7D	800	135	50x20	60x40	90x50	70x40	10x10			reshooting
7E	730	95	60x50	90x40	100x70	100x50	110x80	5	21	5 buds
7F	800	275	60x10	70x20	20x5	-	40x30	0	5	
7G	780	270	40x40	40x40	60x20	-	130x80	4	25	
7H	710	270	50x10	50x10	90x20	100x50	70x80	11	60	8 buds
7I	510	265	30x10	30x10	20x5	-	20x5	0	1	
7J	460	255	40x20	40x30	90x30	100x50	90x60	6	5	1 bud
7K	420	260	70x45	80x40	70x70	100x80	120x85	16	36	1 bud
7L	400	240	45x10	50x10	55x10	20x10	25x10		1	
7M	570	205	110x70	110x70	110x80	60x20	80x130	2	4	new growth, 4 buds
7N	610	195	45x35	45x35	35x50	80x30	40x25	1	2	
7O	310	240	-	20x20	20x15	-	-			not found
7P	700	195					80x60	1	3	New plant, 1 bud

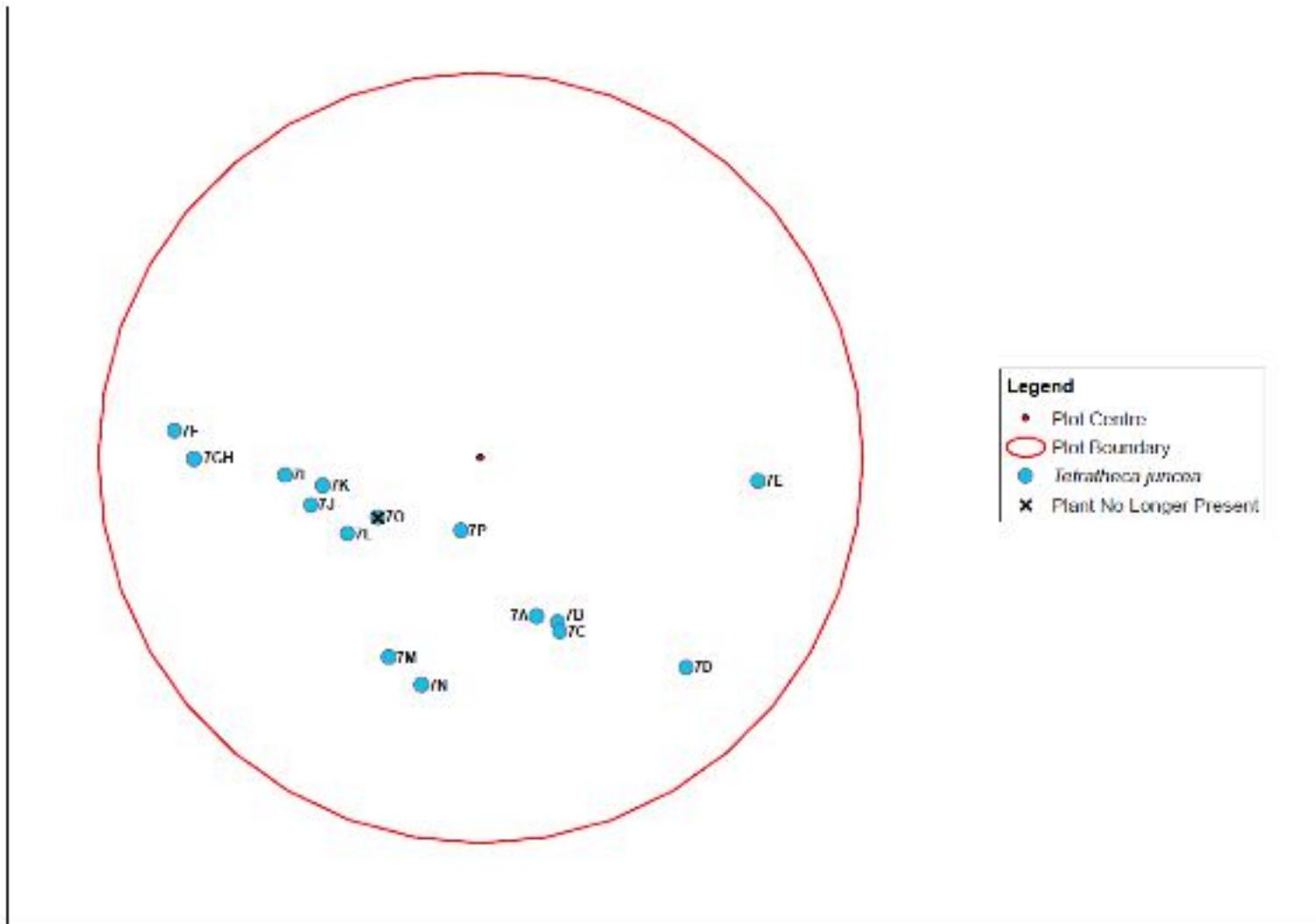


Figure A1-3: *Tetratheca juncea* locations – monitoring point 7

Monitoring Point 8 – *Tetradlea juncea* and *Grevillea parviflora* monitoring results

Number	Species	Distance (cm)	Bearing (degrees)	Clump Size (cm) / Maximum Stem Height					Flowers 2019	Fruit 2019	Comments
				2015	2016	2017	2018	2019			
8A	<i>Tetradlea juncea</i>	210	235	110x70	110x80	130x80	80x110	110x50	6 and 1 bud	5	
8B	<i>Tetradlea juncea</i>	480	225	40x30	60x30	90x20	80x20	50x50	1	1	
8C	<i>Tetradlea juncea</i>	560	225	120x110	120x100	-	-	-			not found
8D	<i>Tetradlea juncea</i>	650	230	110x110	110x110	120x60	45x10	30x5	0	0	new growth
8E	<i>Tetradlea juncea</i>	750	230	65x30	65x30	40x80	60x30	50x20	0	2	new growth
8F	<i>Tetradlea juncea</i>	620	240	80x30	90x30	120x50	120x40	60x30	0	4	new growth
8G	<i>Tetradlea juncea</i>	710	240	100x50	100x50	80x50	100x50	-			not found
8H	<i>Tetradlea juncea</i>	730	250	60x50	60x50	100x40	-	90x30	1	4	
8I	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	310	280	30	30	30	70	60			
8J	<i>Tetradlea juncea</i>	390	275	50x10	50x10	65x10	60x20	60x20	0	1	
8K	<i>Tetradlea juncea</i>	400	195	60x20	60x20	90x90	170x50	130x60	6	7	
8L	<i>Tetradlea juncea</i>	920	280	-	-	70x70	70x80	100x90	2	6	
8M	<i>Tetradlea juncea</i>	850	280	-	-	-	40x20	-			not found, dense litter
8N	<i>Tetradlea juncea</i>	280	235					50x20	2	2	New

Monitoring Point 11 - *Grevillea parviflora* monitoring results

Number	Distance (cm)	Bearing (degrees)	Maximum Stem Height (cm)					Flowers / fruit (2019)	Comments
			2015	2016	2017	2018	2019		
11A	560	165	90	90	50	45	60		3 stems 20cm apart, new growth
11B	565	110	20	45	-	-	-		not found
11C	610	105	55	-	-	-	-		not found
11D	650	105	100	65	-	-	-		not found
11E	720	100	75	75	41	-	-		not found
11F	770	100	20	10	-	-	-		not found
11G	830	85	110	110	80	100	90		dieback
11H	900	100	60	60	30	65	70		
11I	620	80	50	50	60	60	55		poor condition
11J	460	70	45	35	40	-	-		not found
11K	620	80	40	40	40	40	-		dead
11L	610	75	45	55	55	65	65		
11M	700	75	65	70	65	75	80		2 clumps 10 cm apart, 1 with dieback
11N	540	80	35	40	45	45	40		dieback
11O	630	70	20	30	-	-	-		not found
11P	490	80	45	70	50	30	30		one dead plant, new growth 20 cm from plant
11Q	430	80	-	20	60	-	-		not found
11R	730	80	-	-	-	65	65		
11S	740	70					20		
11T	1010	75					80		New, 2 plants 30 cm apart
11U	710	175					40		dieback

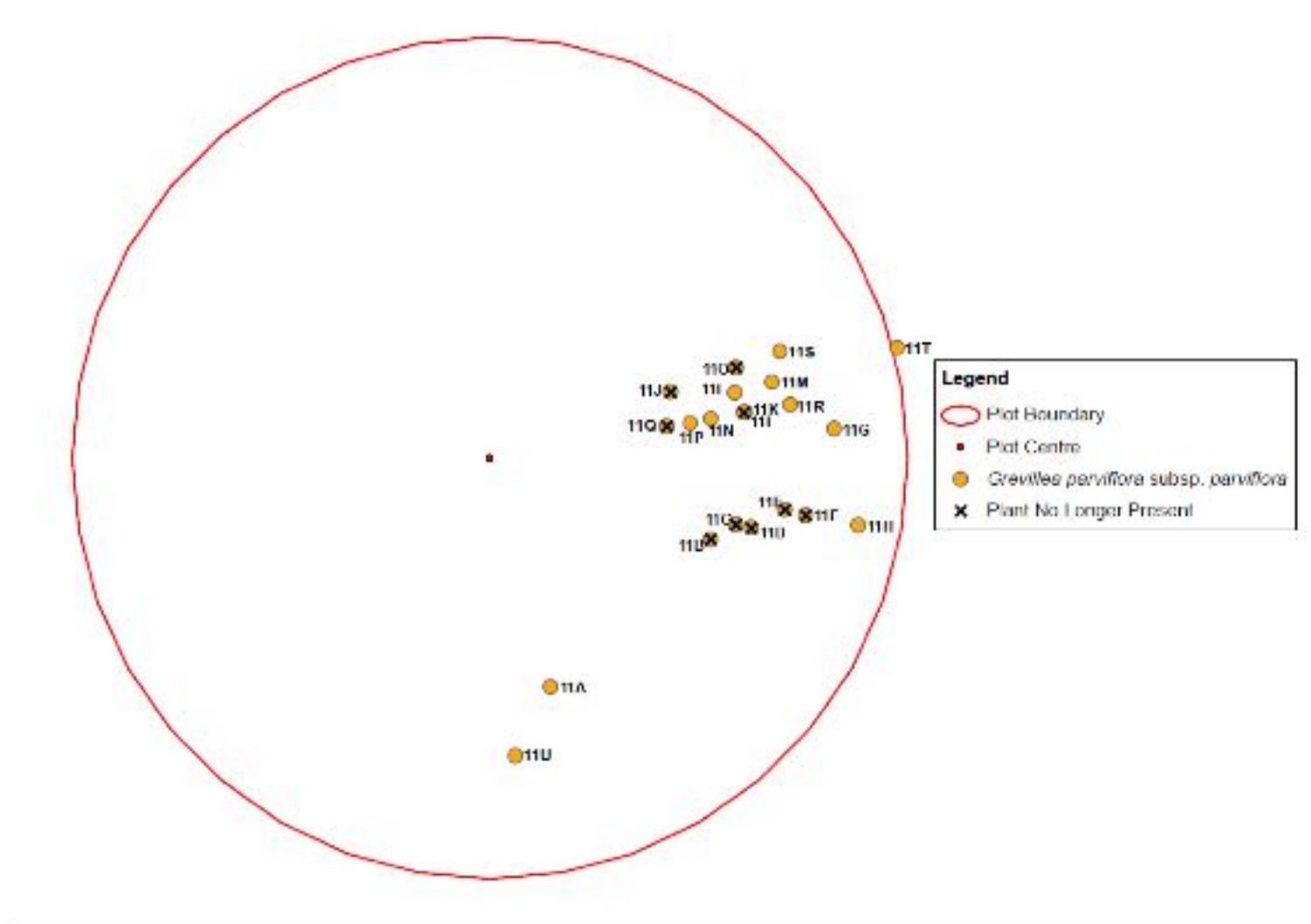


Figure A1-5 *Grevillea parviflora* locations – monitoring point 11

Monitoring Point 12 - *Grevillea parviflora* monitoring results

Number	Distance (cm)	Bearing (degrees)	Maximum Stem Height (cm)					Flowers / fruit (2019)	Comments
			2015	2016	2017	2018	2019		
12A	430	40	80	80	80	50	-		not found, high leaf litter
12B	570	40	80	90	60	25	50		
12C	580	35	65	70	-	50	45		
12D	540	35	20	25	40	30	-		not found
12E	710	35	25	30	-	-	-		not found
12F	660	30	25	25	-	-	-		not found
12G	550	25	50	50	40	10	-		not found
12H	260	110	-	25	55	70	78		
12I	430	30	-	-	-	50	60		flowering, healthy
12J	570	30	-	-	-	25	-		not found, high leaf litter
12K	590	45	-	-	-	60	50		not found
12L	550	45	-	-	-	30	50		flowering
12M	570	50	-	-	-	55	65		flowering
12N	610	50					40		New

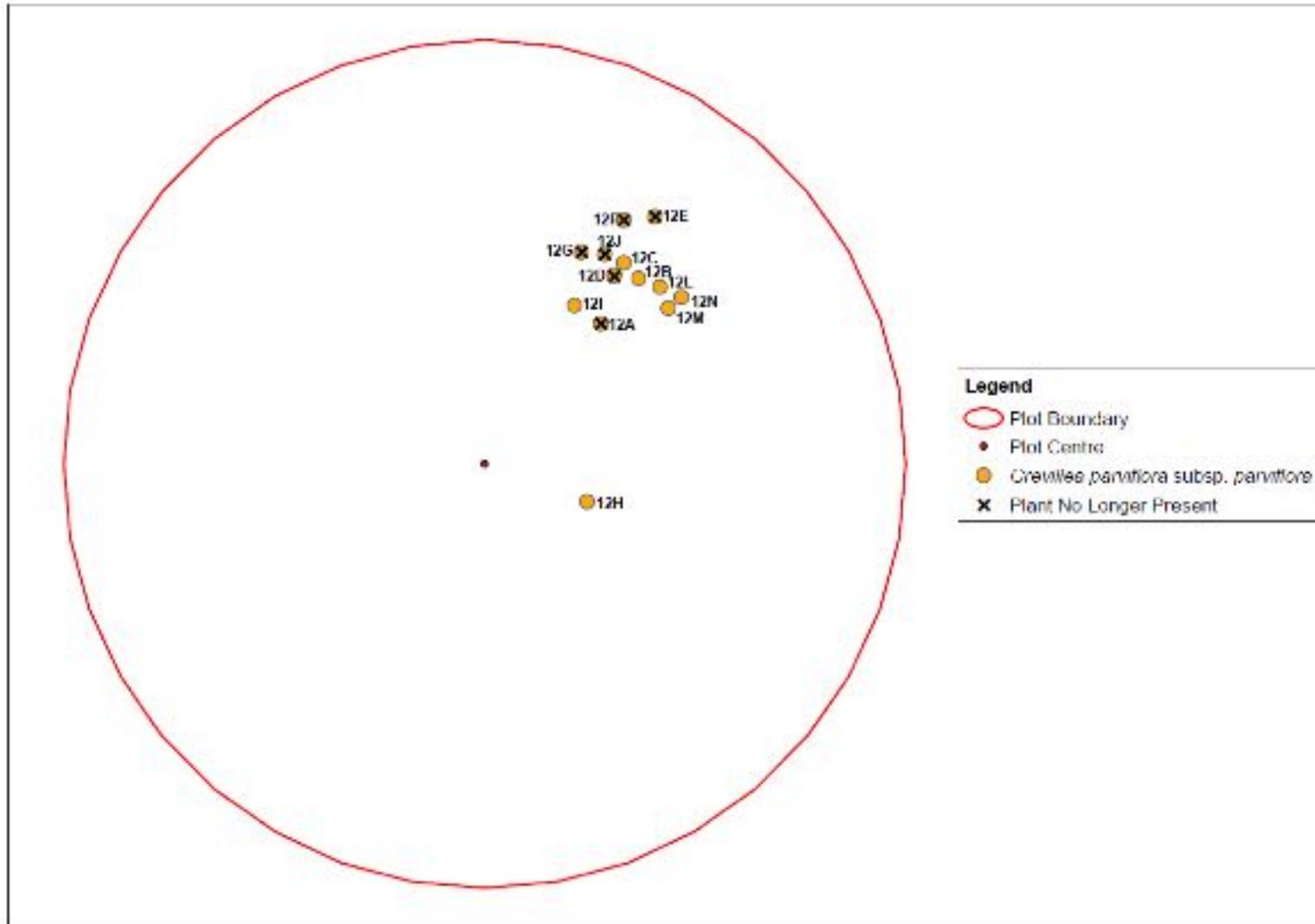


Figure A1-6 *Grevillea parviflora* locations – monitoring point 12

Appendix 1.2 – Lot 12 Monitoring Sites

Monitoring Point 15 - *Tetradlea juncea* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)					Flowers (2018)	Fruit (2018)	Comments
			2015	2016	2017	2018	2019			
15A	420	80	20 x 10	30 x 10	-	-	-			not found, dense litter
15B	990	65	5 x 5	10 x 5	-	-	-			not found, dense litter
15C	1000	50	50 x 50	60 x 40	100 x 30	-	-			not found, dense litter
15D	870	45	40 x 40	40 x 40	65 x 20	-	-			not found, dense litter
15E	960	40	75 x 20	80 x 20	90 x 20	-	40x20	4 buds	0	new shoots
15F	780	45	30 x 15	40 x 15	40 x 15	30x40	30x20	0	1	new shoots
15G	800	35	40 x 25	50 x 25	40 x 20	-	-			not found
15H	790	10	5 x 5	10 x 5	-	-	-			not found
15I	620	10	60 x 30	60 x 30	-	-	-			not found
15J	730	0	20 x 30	40 x 20	40 x 10	-	-			not found
15K	730	355	50 x 20	40 x 20	-	-	-			not found
15L	480	0	30 x 10	30 x 10	15 x 10	30x20	40x20	1 bud	3	new shoots
15M	270	5	40 x 10	50 x 10	-	50x20	40x30	1	6	
15N	300	355	40 x 10	40 x 10	50 x 10	-	-			not found
15O	100	275	20 x 5	20 x 40	-	-	-			not found
15P	770	270	60 x 20	50 x 30	50 x 30	40x10	40x10	0	2	
15Q	510	260	60 x 50	70 x 50	90 x 50	90x30	50x40	1	7	
15R	590	245	70 x 50	70 x 50	80 x 15	-	10x10	0	0	New shoots
15S	910	195	20 x 10	20 x 10	-	-	-			not found
15T	400	230	30 x 10	30 x 10	-	-	-			not found, high leaf litter
15U	870	190	10 x 10	30 x 10	30 x 5	70x20	100x30	5	1	
15V	550	180	30 x 15	40 x 20	40 x 10	-	-			not found
15W	670	175	5 x 5	10 x 5	-	-	-			not found
15X	290	155	40 x 10	40 x 10	30 x 5	-	-			not found
15Y	360	170	5 x 5	30 x 5	-	20x5	-			not found, high leaf litter
15Z	470	165	30 x 40	50 x 30	60 x 70	60x20	40x20	1	1	new shoots
15AA	570	170	25 x 20	50 x 20	20 x 50	80x20	40x40	0	3	new shoots
15AB	810	170	5 x 5	10 x 5	-	-	-			not found
15AC	520	135	40 x 10	50 x 15	15 x 50	40x30	60x10	4		new shoots
15AD	560	160	20 x 30	20 x 30	-	-	40x30	0	2	new shoots
15AE	370	130	-	20 x 10	-	-	-			not found, high leaf litter
15AF	370	310	-	-	-	10x10	50x30	0	6	New

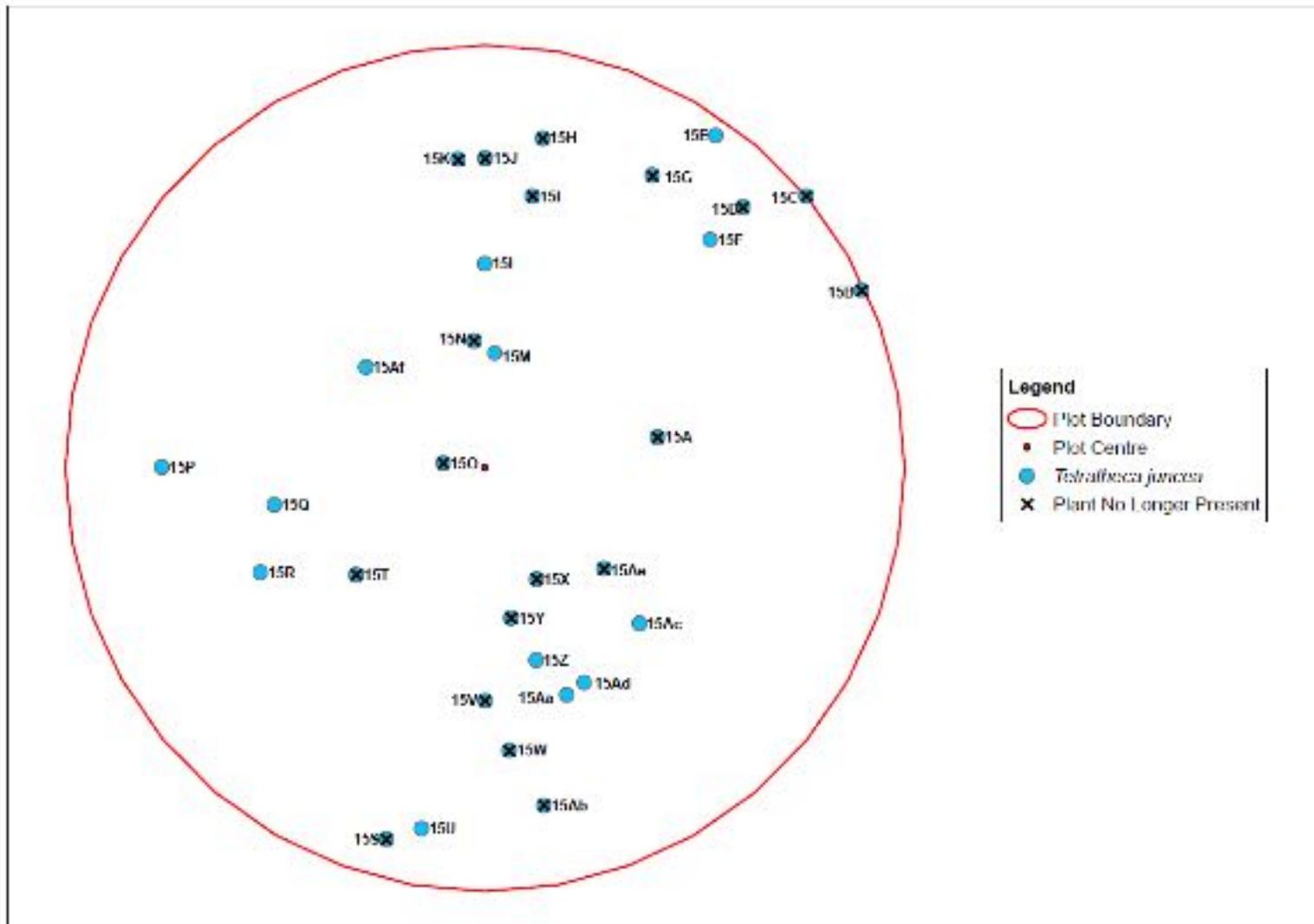


Figure A1-7 *Tetratheca juncea* locations – monitoring point 15

Monitoring Point 17 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)					Flowers / fruit present (2019)	Comments
			2015	2016	2017	2018	2019		
17A	140	220	20 x 5	20 x 5	-	-	-		
17B	270	235	35 x 15	20 x 10	-	-	-		
17C	300	255	40 x 5	30 x 5	-	-	-		
17D	340	250	5 x 5	10 x 5	-	-	-		
17E	550	230	80 x 80	80 x 80	-	70x90	70x30		
17F	640	225	20 x 25	20 x 25	30 x 5	30x60	20x10	fruit	
17G	870	240	20 x 10	20 x 10	-	-	-		
17H	760	265	90 x 35	90 x 35	-	-	-		
17I	810	245	35 x 20	25 x 10	-	-	-		
17J	840	245	40 x 60	40 x 50	-	-	-		
17K	710	235	20 x 5	20 x 10	30 x 10	130x55	20x10		some stems have died off
17L	810	265	-	-	-	10x5	-		not found
17M	605	265	-	-	-	5x5	15x15		
17N	580	250	-	-	-	10x5	10x5	1 bud	
17O	720	235					10x5		separated from 17K
17P	620	225					20x10		new

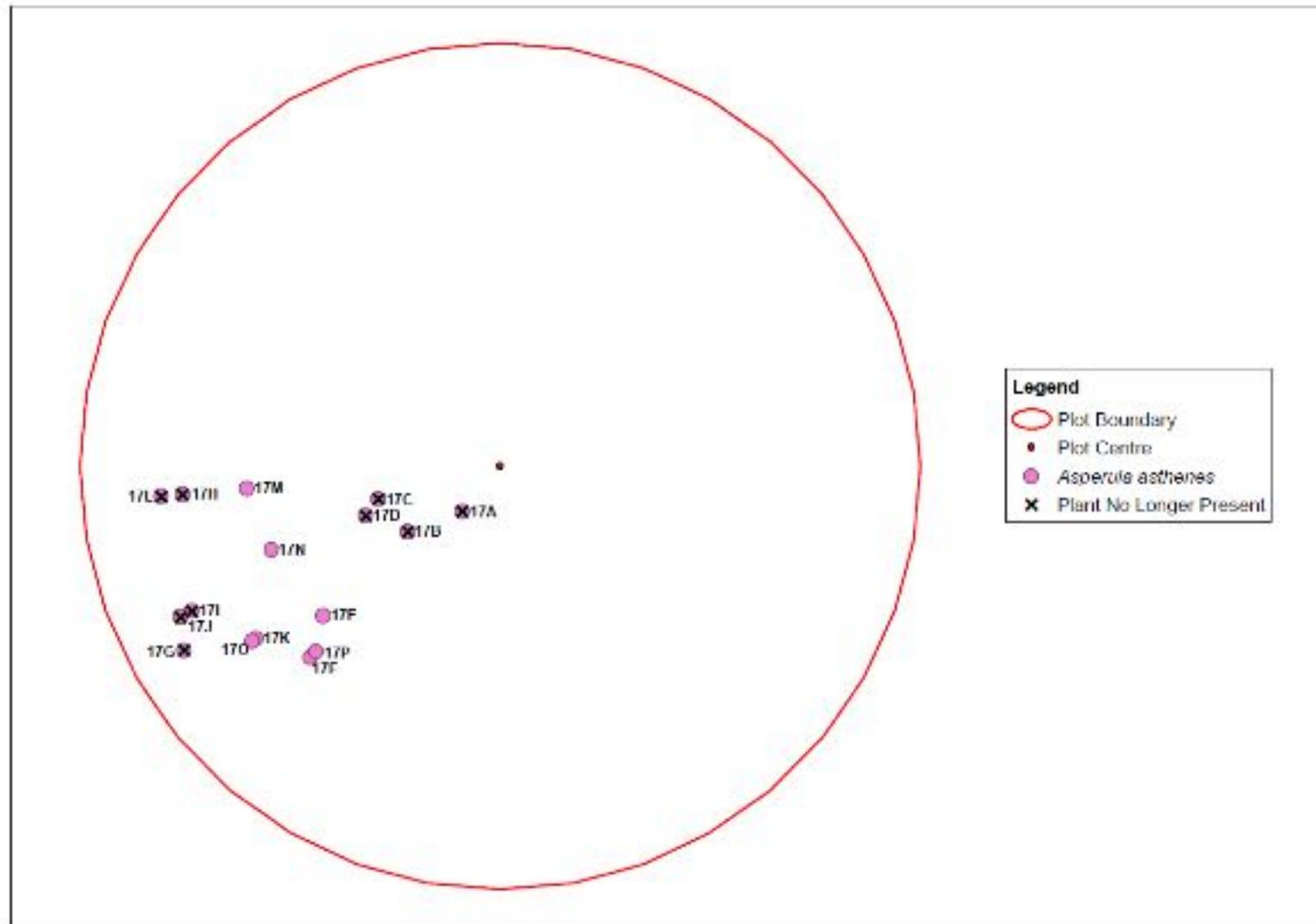


Figure A1-8: *Asperula asthenes* locations – monitoring point 17

Monitoring point 18 - *Asperula asthenes* monitoring results

Number	Distance (cm)	Bearing (degrees)	Clump Size (cm)					Flowers / fruit present (2019)	Comments
			2015	2016	2017	2018	2019		
18A	610	220	40 x 30	40 x 30	-	-	-		
18B	690	220	100 x 60	100 x 50	-	-	-		
18C	670	225	30 x 20	30 x 20	-	-	-		
18D	880	215	20 x 40	20 x 40	-	-	-		
18E	900	220	100 x 90	90 x 90	10 x 5	-	10x5	none	
18F	760	225	70 x 80	70 x 90	-	-	-		
18G	820	235	70 x 30	70 x 40	10 x 5	-	-		
18H	890	265	5 x 10	20 x 10	-	-	-		
18I	820	280	30 x 40	30 x 30	-	-	-		
18J	830	290	55 x 30	50 x 30	5 x 5	-	5x5	none	reshooting
18K	960	235	50 x 10	40 x 15	-	-	-		
18L	780	215	10 x 10	20 x 20	-	-	-		
18M	980	225	30 x 10	20 x 10	-	-	-		
18N	680	210	-	-	40 x 10	60x10	75x50		
18O	700	215	-	-	-	70x16	30x20		
18P	660	310	-	-	-	10x26	45x15	buds, flowers, fruit	Present on lower side of creek bank
18Q	770	315	-	-	-	60x21	-		not found - creek bed

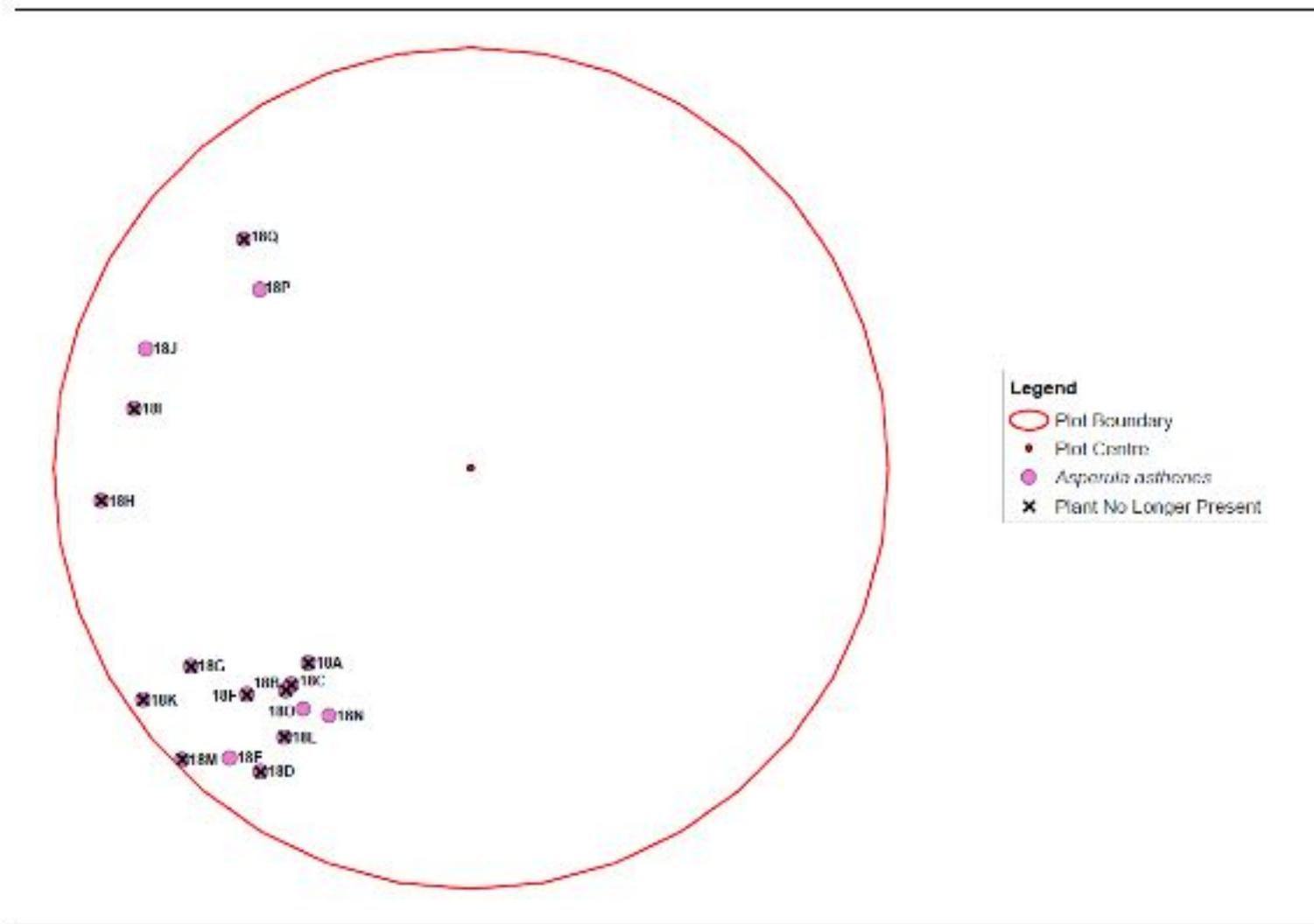


Figure A1-9: *Asperula asthenes* locations – monitoring point 18

APPENDIX 2. VEGETATION MONITORING DATA

Monitoring Site	Dominant species in each stratum		Estimated % cover				
			2015	2016	2017	2018	2019
MP1	Canopy	<i>Eucalyptus propinqua</i> (Small-fruited Grey Gum), <i>E. microcorys</i> (Tallowwood), <i>E. acmenoides</i> (White Mahogany) and <i>Corymbia maculata</i> (Spotted Gum)	50%	50%	50%	50%	50%
	Midstorey	<i>Allocasuarina torulosa</i> (Forest Oak), <i>Glochidion ferdinandi</i> var. <i>ferdinandi</i> (Cheese Tree) and <i>Breynia oblongifolia</i> (Coffee Bush)	40%	40%	40%	40%	40%
	Shrub	<i>Leucopogon juniperinus</i> (Prickly Beard-heath), <i>Hibbertia aspera</i> (Rough Guinea Flower) and <i>Breynia oblongifolia</i> (Coffee Bush)	5%	5%	5%	5%	5%
	Ground (grass)	<i>Imperata cylindrica</i> (Blady Grass), <i>Oplismenus aemulus</i> (Australian Basket Grass), <i>Poa labillardierei</i> (Tussock) and <i>Themeda triandra</i> (Kangaroo Grass)	60%	60%	60%	60%	40%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Carex longebrachiata</i> and <i>Adiantum aethiopicum</i> (Common Maidenhair)	50%	50%	50%	50%	50%
	Exotic	<i>Lantana camara</i> (Lantana)	30%	30%	25%	25%	20%
MP2	Canopy	<i>Corymbia maculata</i> (Spotted Gum), <i>Eucalyptus microcorys</i> (Tallowwood), <i>E. canaliculata</i> (Grey Gum) and <i>E. paniculata</i> subsp. <i>paniculata</i> (Grey Ironbark)	40%	40%	40%	40%	40%
	Midstorey	<i>Allocasuarina torulosa</i> (Forest Oak), <i>Bursaria spinosa</i> (Blackthorn) and <i>Exocarpos cupressiformis</i> (Cherry Ballart)	40%	35%	35%	35%	35%
	Shrub	<i>Leucopogon juniperinus</i> (Prickly Beard-heath) and <i>Acacia ulicifolia</i> (Prickly Moses)	5%	5%	5%	5%	5%
	Ground (grass)	<i>Themeda triandra</i> (Kangaroo Grass) and <i>Poa labillardierei</i> (Tussock)	50%	50%	50%	50%	40%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Gonocarpus tetragynus</i> and <i>Eustrephus latifolius</i> (Wombat Berry)	20%	20%	20%	20%	40%
	Exotic	<i>Lantana camara</i> (Lantana)	5%	5%	1%	1%	1%
MP3	Canopy	<i>Lophostemon confertus</i> (Brush Box), <i>Syncarpia glomulifera</i> (Turpentine), <i>Eucalyptus propinqua</i> (Small-fruited Grey Gum) and <i>E. microcorys</i> (Tallowwood)	40%	40%	40%	40%	40%
	Midstorey	<i>Melaleuca styphelioides</i> (Prickly-leaved Tea Tree), <i>Livistona australis</i> (Cabbage Palm), <i>Allocasuarina torulosa</i> (Forest Oak) and <i>Elaeocarpus obovatus</i> (Hard Quandong)	60%	60%	60%	60%	60%
	Shrub	<i>Pittosporum multiflorum</i> (Orange Thorn), <i>Diospyros australis</i> (Black Plum) and <i>Bursaria spinosa</i> (Boxthorn)	40%	40%	50%	50%	60%
	Ground (grass)	<i>Oplismenus aemulus</i> (Australian Basket Grass)	<5%	<5%	<5%	<5%	<5%
	Ground (other)	<i>Doodia aspera</i> (Prickly Rasp Fern), <i>Carex longebrachiata</i> , <i>Adiantum hispidulum</i> (Rough Maidenhair Fern) and <i>Cissus antarctica</i> (Kangaroo Vine)	90%	90%	90%	90%	90%
	Exotic	<i>Lantana camara</i> (Lantana) and <i>Ageratina riparia</i> (Mistflower)	50%	50%	50%	50%	40%

Monitoring Site	Dominant species in each stratum		Estimated % cover				
			2015	2016	2017	2018	2019
MP4	Canopy	<i>Lophostemon confertus</i> (Brush Box), <i>Syncarpia glomulifera</i> (Turpentine), and <i>Eucalyptus propinqua</i> (Small-fruited Grey Gum)	30%	30%	30%	30%	40%
	Midstorey	<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i> (Cheese Tree), <i>Melaleuca styphelioides</i> (Prickly-leaved Tea Tree), <i>Acmena smithii</i> (Lilly Pilly) and <i>Elaeocarpus obovatus</i> (Hard Quandong)	60%	60%	60%	60%	60%
	Shrub	<i>Pittosporum multiflorum</i> (Orange Thorn)	5%	5%	3%	3%	3%
	Ground (grass)	<i>Oplismenus aemulus</i> (Australian Basket Grass)	5%	5%	5%	5%	5%
	Ground (other)	<i>Doodia aspera</i> (Prickly Rasp Fern), <i>Morinda jasminoides</i> (Sweet Morinda) and <i>Carex longebrachiata</i>	90%	90%	90%	90%	90%
	Exotic	<i>Lantana camara</i> (Lantana), <i>Asparagus aethiopicus</i> (Ground Asparagus) and <i>Tradescantia fluminensis</i> (Wandering Jew)	35%	35%	25%	30%	30%
MP5	Canopy	<i>Eucalyptus pilularis</i> (Blackbutt), <i>E. microcorys</i> (Tallowwood), <i>Angophora costata</i> (Smooth-barked Apple) and <i>E. globoidea</i> (White Stringybark)	40%	40%	40%	40%	40%
	Midstorey	<i>Allocasuarina torulosa</i> (Forest Oak), <i>Glochidion ferdinandi</i> var. <i>ferdinandi</i> (Cheese Tree), <i>Persoonia linearis</i> (Narrow-leaved Geebung) and <i>Melaleuca linariifolia</i> (Flax-leaved Paperbark)	60%	60%	60%	60%	60%
	Shrub	<i>Leptospermum polygalifolium</i> (Tantoon), <i>Breynia oblongifolia</i> (Coffee Bush) and <i>Phyllanthus hirtellus</i> (Thyme Spurge)	5%	5%	10%	10%	10%
	Ground (grass)	<i>Entolasia stricta</i> (Wiry Panic) and <i>Oplismenus imbecillis</i> (Creeping Beard Grass)	60%	60%	60%	60%	60%
	Ground (other)	<i>Doryanthes excelsa</i> (Gynea Lily), <i>Pteridium esculentum</i> (Common Bracken) and <i>Lomandra longifolia</i> (Spiny-headed Mat-rush)	50%	50%	50%	50%	50%
	Exotic	Nil	-	-	-	-	-
MP6	Canopy	<i>Eucalyptus microcorys</i> (Tallowwood), <i>E. propinqua</i> (Small-fruited Grey Gum), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Eucalyptus pilularis</i> (Blackbutt)	50%	50%	50%	50%	50%
	Midstorey	<i>Callistemon salignus</i> (Willow Bottlebrush), <i>Melaleuca styphelioides</i> (Prickly-leaved Tea Tree), <i>Allocasuarina torulosa</i> (Forest Oak), <i>Acmena smithii</i> (Lilly Pilly), <i>Zieria smithii</i> (Sandfly Zieria) and <i>Backhousia myrtifolia</i> (Grey Myrtle)	60%	60%	50%	55%	30%
	Shrub	<i>Hibbertia aspera</i> (Rough Guinea Flower)	<5%	<5%	<5%	5%	1%
	Ground (grass)	<i>Imperata cylindrica</i> (Blady Grass), <i>Oplismenus imbecillis</i> (Creeping Beard Grass) and <i>Poa labillardierei</i> (Tussock)	20%	20%	20%	20%	20%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Doryanthes excelsa</i> (Gynea Lily), <i>Adiantum aethiopicum</i> (Common Maidenhair) and <i>Morinda jasminoides</i> (Sweet Morinda)	30%	30%	30%	30%	30%
	Exotic	Nil	-	-	-	-	-

Monitoring Site	Dominant species in each stratum		Estimated % cover				
			2015	2016	2017	2018	2019
MP7	Canopy	<i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus eugenioides</i> (Thin-leaved Stringybark) and <i>Corymbia gummifera</i> (Red Bloodwood)	35%	35%	35%	35%	35%
	Midstorey	<i>Allocasuarina littoralis</i> (Black She-oak), <i>Leptospermum polygalifolium</i> (Tantoon) and <i>Allocasuarina torulosa</i> (Forest Oak)	40%	40%	40%	40%	40%
	Shrub	<i>Pultenaea euchila</i> (Orange Pultenaea)	5%	5%	5%	5%	5%
	Ground (grass)	<i>Themeda triandra</i> (Kangaroo Grass) and <i>Entolasia stricta</i> (Wiry Panic)	50%	50%	50%	50%	40%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush) and <i>Gahnia radula</i>	70%	60%	60%	60%	60%
	Exotic	<i>Setaria sphacelata</i> (South African Pigeon Grass)	5%	5%	5%	5%	2%
MP8	Canopy	<i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus eugenioides</i> (Thin-leaved Stringybark) and <i>Corymbia gummifera</i> (Red Bloodwood)	30%	30%	30%	30%	30%
	Midstorey	<i>Allocasuarina littoralis</i> (Black She-oak), <i>Leptospermum polygalifolium</i> (Tantoon) and <i>Acacia longifolia</i> (Sydney Golden Wattle)	50%	50%	50%	50%	30%
	Shrub	<i>Pultenaea paleacea</i> (Chaffy Bush-pea), <i>Pultenaea euchila</i> (Orange Pultenaea), <i>Phyllanthus hirtellus</i> (Thyme Spurge), <i>Hibbertia riparia</i> (Erect Guinea-flower) and <i>Hibbertia aspera</i> (Rough Guinea Flower)	20%	20%	20%	20%	15%
	Ground (grass)	<i>Entolasia stricta</i> (Wiry Panic) and <i>Themeda triandra</i> (Kangaroo Grass)	50%	50%	50%	50%	40%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Ptilothrix deusta</i> , <i>Patersonia sericea</i> (Silky Purple-flag) and <i>Lomandra obliqua</i>	50%	50%	50%	50%	50%
	Exotic	Nil	-	-	-	-	-
MP9	Canopy	<i>Angophora costata</i> (Smooth-barked Apple), <i>Corymbia gummifera</i> (Red Bloodwood), <i>Eucalyptus microcorys</i> (Tallowwood) and <i>E. eugenioides</i> (Thin-leaved Stringybark)	40%	40%	40%	40%	40%
	Midstorey	<i>Allocasuarina littoralis</i> (Black She-oak), <i>Dodonaea triquetra</i> (Large-leaf Hop-bush) and <i>Persoonia linearis</i> (Narrow-leaved Geebung)	50%	50%	50%	50%	50%
	Shrub	<i>Leptospermum polygalifolium</i> (Tantoon), <i>Pultenaea euchila</i> (Orange Pultenaea), <i>Logania albiflora</i> and <i>Polyscias sambucifolia</i> (Elderberry Panax)	10%	10%	10%	10%	7%
	Ground (grass)	<i>Imperata cylindrica</i> (Blady Grass), <i>Entolasia stricta</i> (Wiry Panic) and <i>Themeda triandra</i> (Kangaroo Grass)	30%	30%	40%	40%	40%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Pteridium esculentum</i> (Common Bracken) and <i>Ptilothrix deusta</i>	60%	60%	60%	50%	40%
	Exotic	Nil	-	-	-	-	-
MP10	Canopy	<i>Eucalyptus piperita</i> (Sydney Peppermint), <i>Angophora costata</i> (Smooth-barked Apple), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Eucalyptus microcorys</i> (Tallowwood)	40%	40%	40%	35%	35%
	Midstorey	<i>Allocasuarina littoralis</i> (Black She-oak), <i>Persoonia linearis</i> (Narrow-leaved Geebung) and <i>A. torulosa</i> (Forest Oak)	10%	10%	10%	10%	10%
	Shrub	<i>Pultenaea euchila</i> (Orange Pultenaea), <i>Leptospermum polygalifolium</i> (Tantoon), <i>Pultenaea paleacea</i> (Chaffy Bush-pea) and <i>Acacia ulicifolia</i> (Prickly Moses)	5%	5%	5%	5%	5%
	Ground (grass)	<i>Entolasia stricta</i> (Wiry Panic), <i>Themeda triandra</i> (Kangaroo Grass) and <i>Imperata cylindrica</i> (Blady Grass)	40%	40%	40%	40%	30%

Monitoring Site	Dominant species in each stratum		Estimated % cover				
			2015	2016	2017	2018	2019
	Ground (other)	<i>Gahnia radula</i> , <i>Doryanthes excelsa</i> (Gynea Lily), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush) and <i>Ptilothrix deusta</i>	60%	60%	60%	60%	50%
	Exotic	Nil	-	-	-	-	-
MP11	Canopy	<i>Angophora costata</i> (Smooth-barked Apple), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Eucalyptus capitellata</i> (Brown Stringybark)	35%	35%	35%	35%	35%
	Midstorey	<i>Allocasuarina littoralis</i> (Black She-oak), <i>Glochidion ferdinandi</i> var. <i>ferdinandi</i> (Cheese Tree), <i>Leptospermum polygalifolium</i> (Tantoon) and <i>Banksia spinulosa</i> (Hairpin Banksia)	40%	40%	40%	40%	40%
	Shrub	<i>Pultenaea paleacea</i> (Chaffy Bush-pea) and <i>Boronia pinnata</i>	5%	5%	5%	5%	5%
	Ground (grass)	<i>Entolasia stricta</i> (Wiry Panic), <i>Imperata cylindrica</i> (Blady Grass) and <i>Themeda triandra</i> (Kangaroo Grass)	35%	35%	40%	40%	30%
	Ground (other)	<i>Xanthorrhoea latifolia</i> , <i>Pteridium esculentum</i> (Common Bracken) and <i>Ptilothrix deusta</i>	60%	60%	60%	60%	50%
	Exotic	Nil	-	-	-	-	-
MP12	Canopy	<i>Eucalyptus pilularis</i> (Blackbutt), <i>Angophora costata</i> (Smooth-barked Apple), <i>E. globoidea</i> (White Stringybark), <i>Corymbia gummifera</i> (Red Bloodwood), <i>E. microcorys</i> (Tallowwood) and <i>E. piperita</i> (Sydney Peppermint)	40%	40%	40%	40%	40%
	Midstorey	<i>Leptospermum polygalifolium</i> (Tantoon), <i>Allocasuarina littoralis</i> (Black She-oak), <i>Glochidion ferdinandi</i> var. <i>ferdinandi</i> (Cheese Tree) and <i>Exocarpos cupressiformis</i> (Cherry Ballart)	30%	30%	30%	30%	30%
	Shrub	<i>Pultenaea euchila</i> (Orange Pultenaea), <i>Boronia pinnata</i> and <i>Banksia spinulosa</i> (Hairpin Banksia)	10%	10%	10%	5%	10%
	Ground (grass)	<i>Themeda triandra</i> (Kangaroo Grass), <i>Entolasia stricta</i> (Wiry Panic), and <i>Austrostipa</i> sp.	40%	40%	40%	30%	30%
	Ground (other)	<i>Xanthorrhoea latifolia</i> and <i>Ptilothrix deusta</i>	40%	40%	40%	30%	30%
	Exotic	Nil	-	-	-	-	-
MP13	Canopy	<i>Eucalyptus sparsifolia</i> (Narrow-leaved Stringybark), <i>Corymbia maculata</i> (Spotted Gum), <i>E. paniculata</i> (Grey Ironbark) and <i>E. microcorys</i> (Tallowwood)	40%	40%	40%	40%	50%
	Midstorey	<i>Allocasuarina torulosa</i> (Forest Oak), <i>Syncarpia glomulifera</i> (Turpentine) and <i>Callistemon salignus</i> (Willow Bottlebrush)	40%	40%	40%	40%	40%
	Shrub	<i>Hibbertia aspera</i> (Rough Guinea Flower) and <i>Pultenaea euchila</i> (Orange Pultenaea)	5%	5%	5%	5%	5%
	Ground (grass)	<i>Imperata cylindrica</i> (Blady Grass), <i>Poa labillardierei</i> (Tussock), <i>Themeda triandra</i> (Kangaroo Grass) and <i>Oplismenus imbecillis</i> (Creeping Beard Grass)	60%	60%	60%	70%	70%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Doryanthes excelsa</i> (Gynea Lily), <i>Lepidosperma laterale</i> and <i>Patersonia sericea</i>	30%	30%	40%	40%	40%
	Exotic	Nil	-	-	-	-	-

Monitoring Site	Dominant species in each stratum		Estimated % cover				
			2015	2016	2017	2018	2019
MP14	Canopy	<i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus eugenioides</i> (Thin-leaved Stringybark), <i>E. microcorys</i> (Tallowwood), and <i>E. paniculata</i> subsp. <i>paniculata</i> (Grey Ironbark)	35%	40%	40%	40%	40%
	Midstorey	<i>Allocasuarina torulosa</i> (Forest Oak), <i>Callistemon salignus</i> (Willow Bottlebrush) and <i>Glochidion ferdinandi</i> (Cheese Tree)	25%	25%	25%	25%	25%
	Shrub	<i>Leucopogon juniperinus</i> (Prickly Beard-heath), <i>Pultenaea villosa</i> (Hairy Bush-pea), <i>Leptospermum polygalifolium</i> (Tantoon) and <i>Hibbertia aspera</i> (Rough Guinea Flower)	10%	15%	15%	15%	15%
	Ground (grass)	<i>Themeda triandra</i> (Kangaroo Grass), <i>Poa labillardierei</i> (Tussock) and <i>Entolasia stricta</i> (Wiry Panic)	80%	80%	80%	80%	80%
	Ground (other)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Doryanthes excelsa</i> (Gynea Lily) and <i>Brunoniella pumilio</i> (Dwarf Blue Trumpet)	30%	30%	30%	30%	30%
	Exotic	<i>Setaria sphacelata</i> (South African Pigeon Grass)	5%	5%	5%	5%	2%
MP15	Canopy	<i>Eucalyptus pilularis</i> (Blackbutt), <i>Angophora costata</i> (Smooth-barked Apple), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>E. microcorys</i> (Tallowwood)	45%	45%	45%	45%	45%
	Midstorey	<i>Allocasuarina littoralis</i> (Black She-oak) and <i>Acacia irrorata</i> (Green Wattle)	20%	20%	15%	15%	15%
	Shrub	<i>Hibbertia vestita</i> (Hairy Guinea Flower), <i>Breynia oblongifolia</i> (Coffee Bush) and <i>Phyllanthus gunnii</i> (Scrubby Spurge)	10%	10%	10%	10%	10%
	Ground (grass)	<i>Themeda triandra</i> (Kangaroo Grass), <i>Entolasia stricta</i> (Wiry Panic) and <i>Imperata cylindrica</i> (Blady Grass)	30%	30%	30%	30%	25%
	Ground (other)	<i>Doryanthes excelsa</i> (Gynea Lily), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Pteridium esculentum</i> (Common Bracken), <i>Lepidosperma laterale</i> and <i>Xanthorrhoea macronema</i>	60%	60%	60%	60%	50%
	Exotic	<i>Lantana camara</i> (Lantana)	5%	5%	1%	1%	1%
MP16	Canopy	<i>Eucalyptus pilularis</i> (Blackbutt), <i>E. propinqua</i> (Small-fruited Grey Gum), <i>E. microcorys</i> (Tallowwood) and <i>Angophora costata</i> (Smooth-barked Apple)	50%	50%	50%	50%	50%
	Midstorey	<i>Allocasuarina torulosa</i> (Forest Oak), <i>Syncarpia glomulifera</i> (Turpentine) and <i>Glochidion ferdinandi</i> var. <i>ferdinandi</i> (Cheese Tree)	30%	30%	30%	30%	30%
	Shrub	<i>Leucopogon juniperinus</i> (Prickly Beard-heath) and <i>Acacia floribunda</i> (White Sally Wattle)	10%	10%	10%	10%	10%
	Ground (grass)	<i>Poa labillardierei</i> (Tussock), <i>Imperata cylindrica</i> (Blady Grass), and <i>Oplismenus imbecillis</i> (Creeping Beard Grass)	50%	50%	40%	40%	30%
	Ground (other)	<i>Carex appressa</i> (Tall Sedge), <i>Doodia aspera</i> (Prickly Rasp Fern), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush) and <i>Calochlaena dubia</i> (Rainbow Fern)	30%	30%	40%	40%	30%
	Exotic	<i>Lantana camara</i> (Lantana)	30%	30%	30%	40%	30%
MP17	Canopy	<i>Eucalyptus pilularis</i> (Blackbutt), <i>E. microcorys</i> (Tallowwood), <i>Syncarpia glomulifera</i> (Turpentine), <i>E. acmenoides</i> (White Mahogany) and <i>E. propinqua</i> (Small-fruited Grey Gum)	40%	40%	40%	40%	40%
	Midstorey	<i>Backhousia myrtifolia</i> (Grey Myrtle), <i>Lophostemon confertus</i> (Brush Box), <i>Livistona australis</i> (Cabbage Palm), <i>Acmena smithii</i> (Lilly Pilly) and <i>Allocasuarina torulosa</i> (Forest Oak)	50%	50%	50%	50%	50%

Monitoring Site	Dominant species in each stratum		Estimated % cover				
			2015	2016	2017	2018	2019
	Shrub	<i>Wilkiea huegeliana</i> (Veiny Wilkiea), <i>Acacia maidenii</i> (Maiden's Wattle), <i>Eupomatia laurina</i> (Bolwarra) and <i>Pittosporum multiflorum</i> (Orange Thorn)	5%	5%	5%	5%	5%
	Ground (grass)	<i>Poa labillardierei</i> (Tussock), <i>Themeda triandra</i> (Kangaroo Grass) and <i>Entolasia marginata</i> (Bordered Panic)	40%	40%	40%	40%	40%
	Ground (other)	<i>Doodia aspera</i> (Prickly Rasp Fern), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush) and <i>Gymnostachys anceps</i> (Settlers' Twine)	50%	50%	50%	50%	50%
	Exotic	<i>Lantana camara</i> (Lantana)	10%	15%	15%	15%	15%
MP18	Canopy	<i>Eucalyptus saligna</i> (Sydney Blue Gum), <i>E. microcorys</i> (Tallowwood), <i>Syncarpia glomulifera</i> (Turpentine), and <i>E. acmenoides</i> (White Mahogany)	45%	45%	45%	45%	45%
	Midstorey	<i>Lophostemon confertus</i> (Brush Box), <i>Backhousia myrtifolia</i> (Grey Myrtle), <i>Cryptocarya glaucescens</i> (Jackwood), <i>Allocasuarina torulosa</i> (Forest Oak) and <i>Acacia irrorata</i> (Green Wattle)	25%	25%	25%	25%	25%
	Shrub	<i>Acacia maidenii</i> (Maiden's Wattle) and <i>Denhamia silvestris</i> (Narrow-leaved Orangebark)	5%	5%	5%	5%	5%
	Ground (grass)	<i>Poa labillardierei</i> (Tussock), <i>Imperata cylindrica</i> (Blady Grass), and <i>Oplismenus imbecillis</i> (Creeping Beard Grass)	50%	50%	50%	50%	40%
	Ground (other)	<i>Doodia aspera</i> (Prickly Rasp Fern), <i>Lomandra longifolia</i> (Spiny-headed Mat-rush) and <i>Gymnostachys anceps</i> (Settlers' Twine)	50%	50%	50%	50%	40%
	Exotic	<i>Lantana camara</i> (Lantana)	10%	15%	15%	15%	15%

APPENDIX 3. PHOTO MONITORING POINTS

Appendix 3.1 – Biodiversity Offset Area Monitoring Sites

Monitoring Point 1 (MP1)



Monitoring point 1 (north) – 2015



Monitoring point 1 (north) – 2017



Monitoring point 1 (north) – 2018



Monitoring point 1 (north) – 2019

Monitoring Point 2 (MP2)



Monitoring point 2 (north) – 2015



Monitoring point 2 (north) – 2017



Monitoring point 2 (north) – 2018



Monitoring point 2 (north) – 2019

Monitoring Point 3 (MP3)



Monitoring point 3 (north) – 2015



Monitoring point 3 (north) – 2017



Monitoring point 3 (north) – 2018



Monitoring point 3 (north) – 2018

Monitoring Point 4 (MP4)



Monitoring point 4 (north) – 2015



Monitoring point 4 (north) – 2017



Monitoring point 4 (north) – 2018



Monitoring point 4 (north) – 2019

Monitoring Point 5 (MP5)



Monitoring point 5 (north) – 2015



Monitoring point 5 (north) – 2017

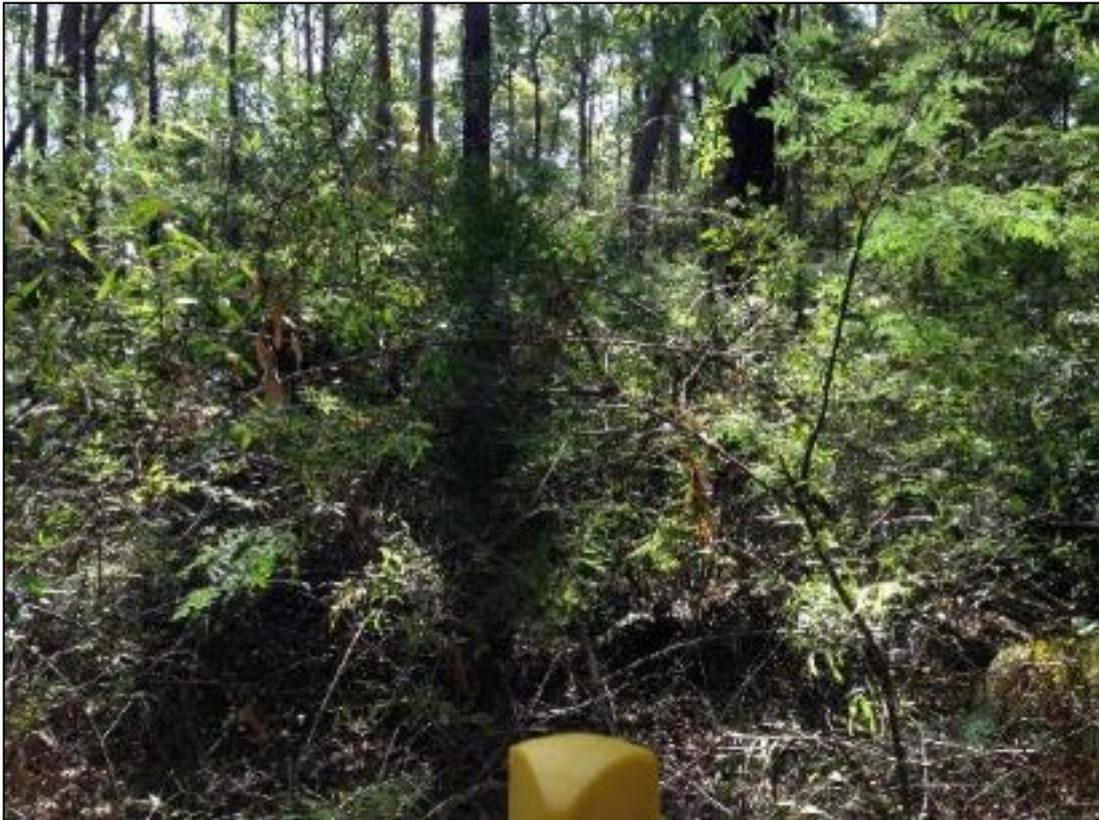


Monitoring point 5 (north) – 2018

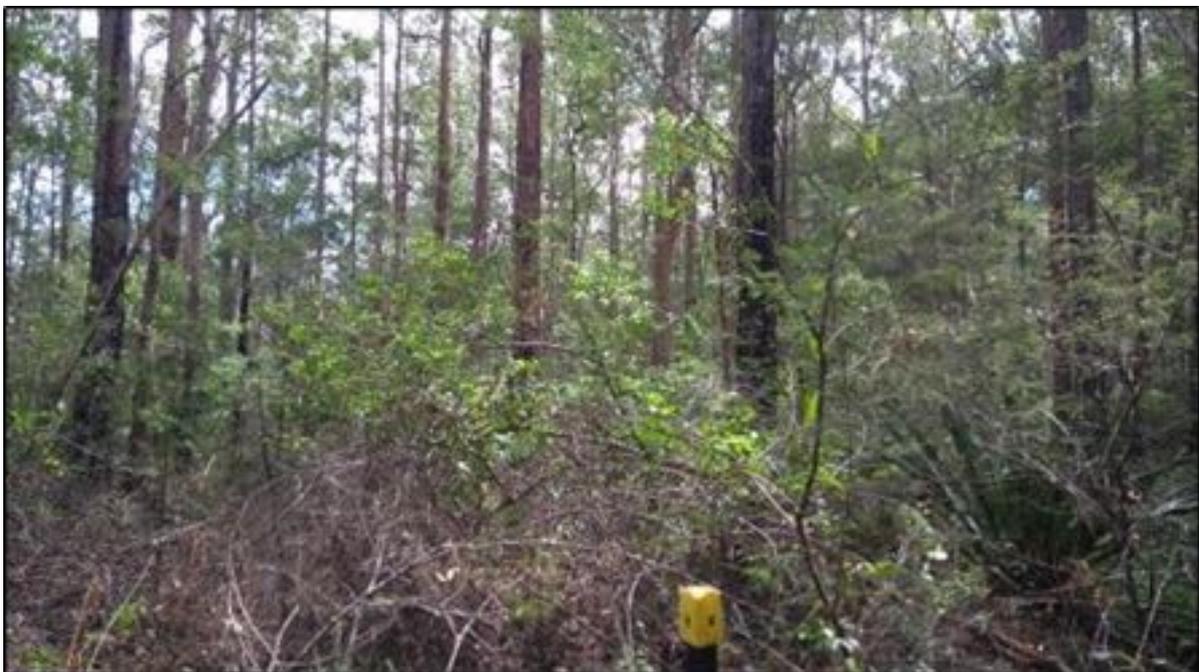


Monitoring point 5 (north) – 2019

Monitoring Point 6 (MP6)



Monitoring point 6 (north) – 2015



Monitoring point 6 (north) – 2017



Monitoring point 6 (north) – 2018



Monitoring point 6 (north) – 2019

Monitoring Point 7 (MP7)



Monitoring point 7 (north) – 2015



Monitoring point 7 (north) – 2017

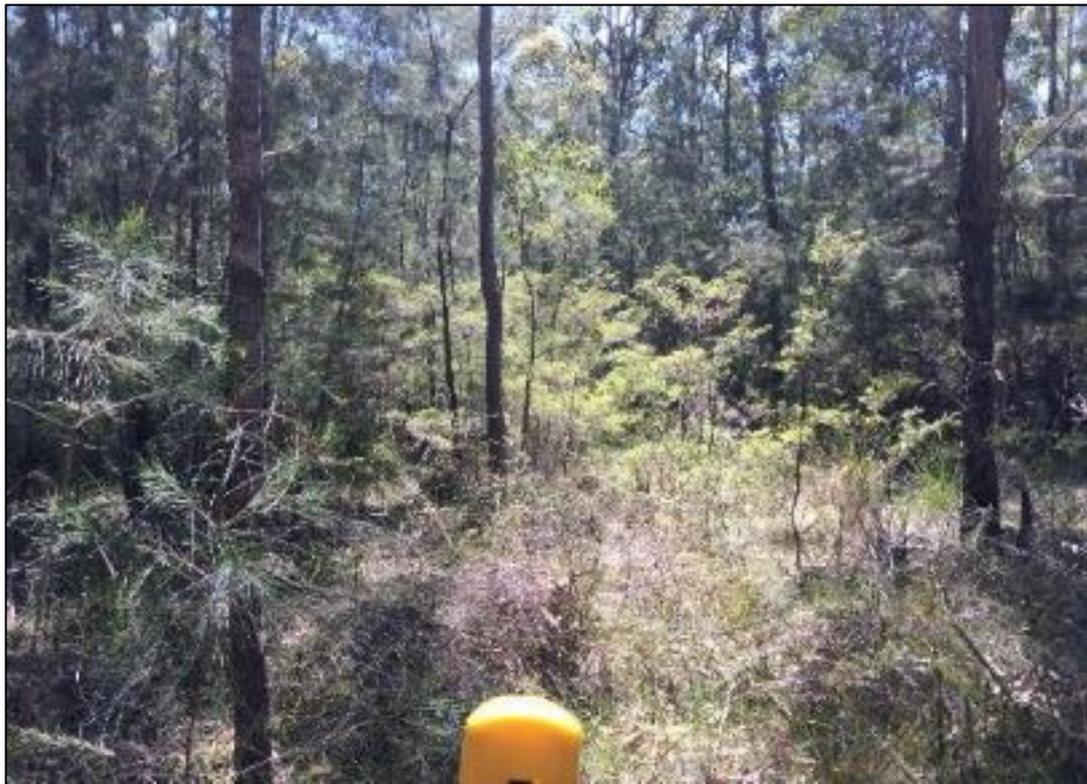


Monitoring point 7 (north) – 2018



Monitoring point 7 (north) – 2019

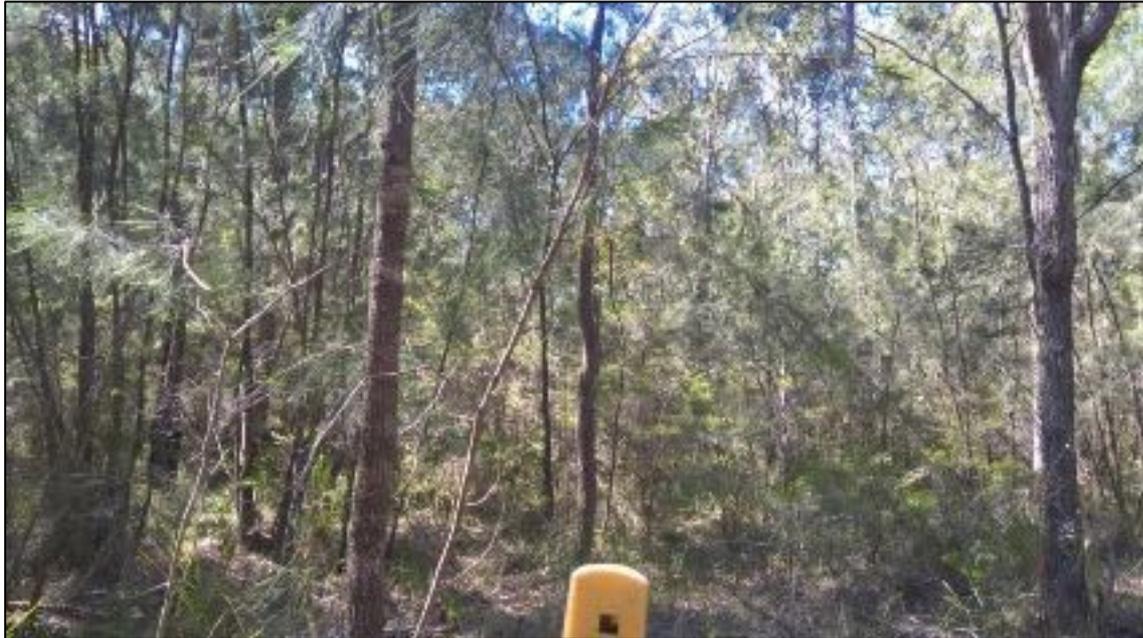
Monitoring Point 8 (MP8)



Monitoring point 8 (north) – 2015



Monitoring point 8 (north) – 2017



Monitoring point 8 (north) – 2018



Monitoring point 8 (north) – 2019

Monitoring Point 9 (MP9)



Monitoring point 9 (north) – 2015



Monitoring point 9 (north) – 2017



Monitoring point 9 (north) – 2018



Monitoring point 9 (north) – 2019

Monitoring Point 10 (MP10)



Monitoring point 10 (north) – 2015



Monitoring point 10 (north) – 2016



Monitoring point 10 (north) – 2018



Monitoring point 10 (north) – 2019

Monitoring Point 11 (MP11)



Monitoring point 11 (north) – 2015



Monitoring point 11 (north) – 2017



Monitoring point 11 (north) – 2018



Monitoring point 11 (north) – 2019

Monitoring Point 12 (MP12)



Monitoring point 12 (north) – 2015



Monitoring point 12 (north) – 2017



Monitoring point 12 (north) – 2018

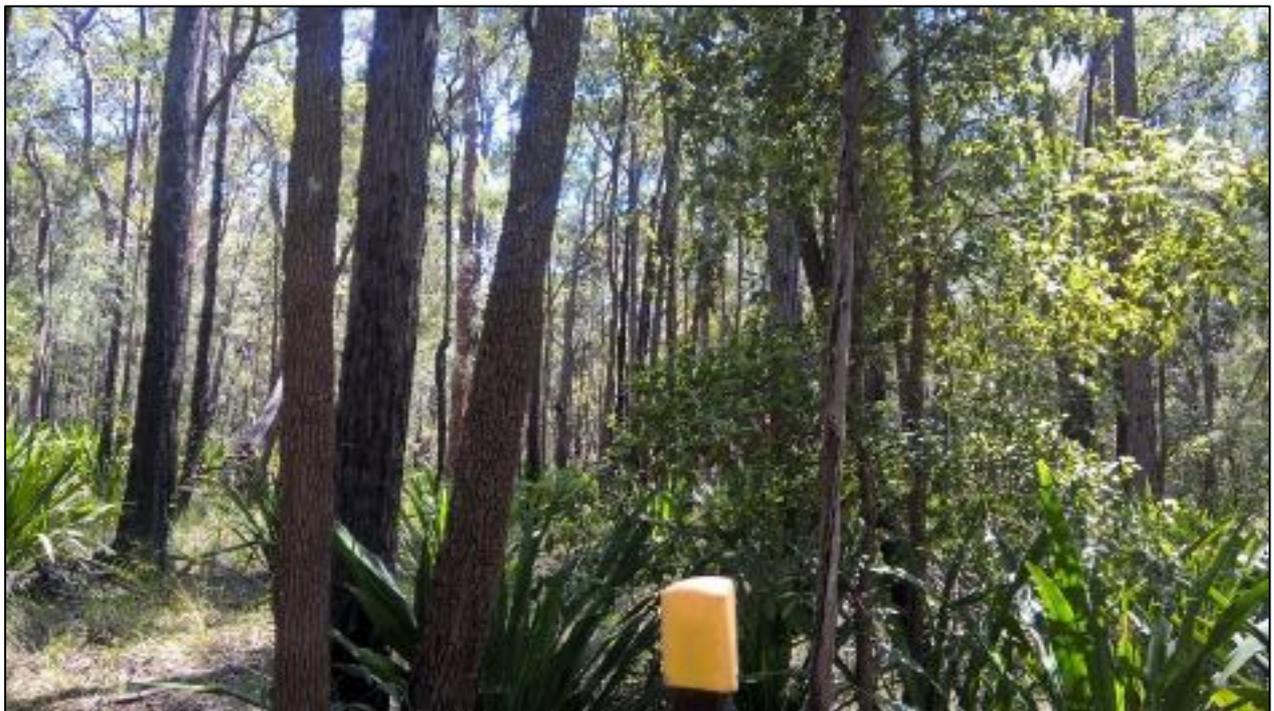


Monitoring point 12 (north) – 2019

Monitoring Point 13 (MP13)



Monitoring point 13 (north) – 2015



Monitoring point 13 (north) – 2017



Monitoring point 13 (north) – 2018



Monitoring point 13 (north) – 2019

Appendix 1.2 – Lot 12 Monitoring Sites

Monitoring Point 14 (MP14)



Monitoring point 14 (north) – 2015



Monitoring point 14 (north) – 2017



Monitoring point 14 (north) – 2018



Monitoring point 14 (north) – 2019

Monitoring Point 15 (MP15)



Monitoring point 15 (north) – 2015



Monitoring point 15 (north) – 2017



Monitoring point 15 (north) – 2018



Monitoring point 15 (north) – 2019

Monitoring Point 16 (MP16)



Monitoring point 16 (north) – 2015



Monitoring point 16 (north) – 2017



Monitoring point 16 (north) – 2018



Monitoring point 16 (north) – 2019

Monitoring Point 17 (MP17)



Monitoring point 17 (north) – 2015



Monitoring point 17 (north) – 2017



Monitoring point 17 (north) – 2018



Monitoring point 17 (north) – 2019

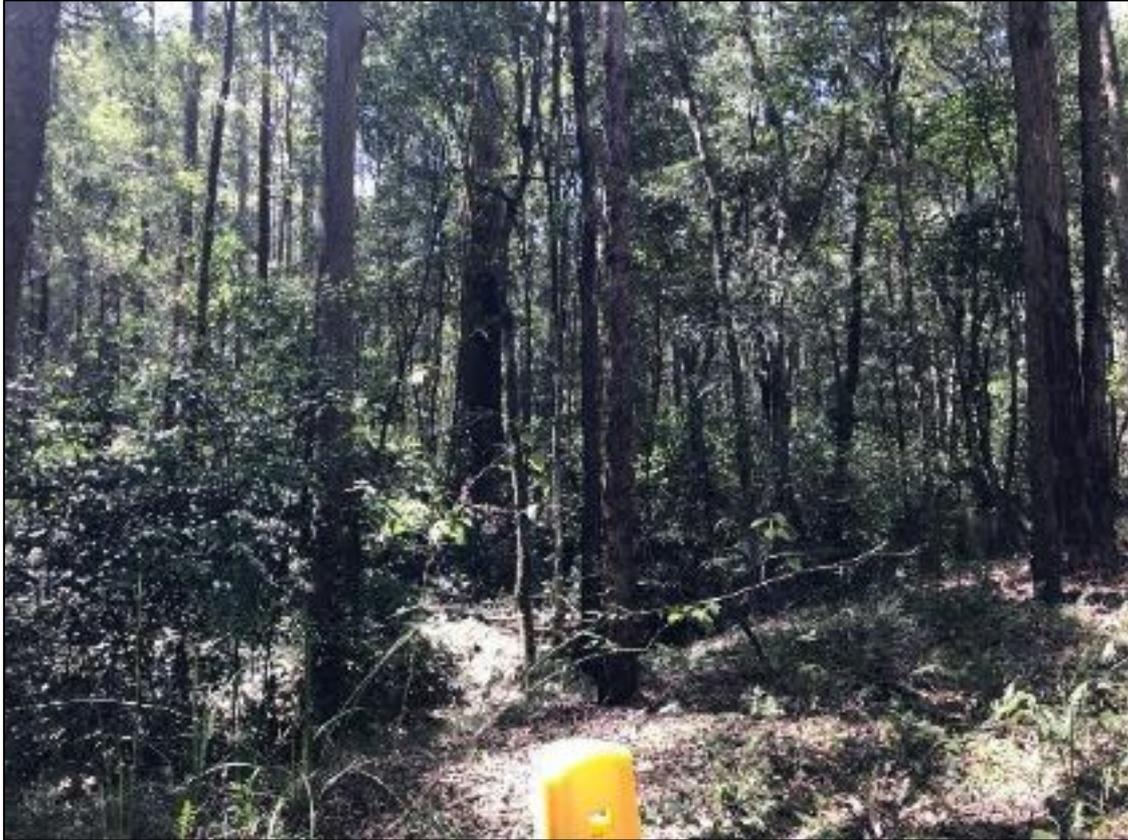
Monitoring Point 18 (MP18)



Monitoring point 18 (north) – 2015



Monitoring point 18 (north) – 2016



Monitoring point 18 (north) – 2017



Monitoring point 18 (north) – 2019

APPENDIX 4. EXOTIC SPECIES RECORDED IN THE OFFSET AREA

Scientific Name	Common Name	Priority Weeds (Biosecurity Act 2015) in Mid Coast Council control area
<i>Ageratina riparia</i>	Mistflower	-
<i>Anagallis arvensis</i>	Scarlet Pimpernel	-
<i>Andropogon virginicus</i>	Whisky Grass	-
<i>Asparagus aethiopicus</i>	Ground Asparagus	Prohibition on dealings
<i>Axonopus fissifolius</i>	Narrow-leafed Carpet Grass	-
<i>Bidens pilosa</i>	Cobblers Pegs	-
<i>Briza maxima</i>	Quaking Grass	-
<i>Chloris gayana</i>	Rhodes Grass	-
<i>Hypochaeris radicata</i>	Catsear	-
<i>Lantana camara</i>	Lantana	Prohibition on dealings
<i>Lolium perenne</i>	Perennial Ryegrass	-
<i>Melinis repens</i>	Red Natal Grass	-
<i>Paspalum dilatatum</i>	Paspalum	-
<i>Paspalum mandiocanum</i>	Broadleaf Paspalum	-
<i>Pennisetum clandestinum</i>	Kikuyu	-
<i>Plantago lanceolata</i>	Lamb's Tongues	-
<i>Senecio madagascariensis</i>	Fireweed	Prohibition on dealings
<i>Senna pendula var. glabrata</i>	Cassia	-
<i>Setaria sphacelata</i>	South African Pigeon Grass	-
<i>Solanum nigrum</i>	Black-berry Nightshade	-
<i>Stellaria media</i>	Common Chickweed	-
<i>Trifolium repens</i>	White Clover	-
<i>Tradescantia fluminensis</i>	Wandering Jew	-
<i>Verbena bonariensis</i>	Purpletop	-
<i>Vulpia myuros</i>	Rat's Tail Fescue	-

APPENDIX 5. STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution
Ashley Elise Owen	DipSc, BSc (in progress)	Ecologist	Field surveys and Report Writing
Emily Fittell	BSc (Hons)	Ecologist	Field surveys
Samara Schulz	BEnv Sc & Mgt (Hons)	Senior Ecologist	Report review
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation

APPENDIX 6. LICENSING

Kleinfelder employees involved in the current study are licensed or approved under the *National Parks and Wildlife Act 1974* (License Number: SL100730, Expiry: 31 March 2020) and the *Animal Research Act 1985* to harm/trap/release protected native fauna and to pick for identification purposes native flora and to undertake fauna surveys.

APPENDIX 6 – Water Monitoring Data

Surface Water - Dam 1 (2019)

Parameter	Criteria	Date											Min	Max	Average
		18-01-19	18-02-19	20-03-19	16-04-19	15-05-19	12-06-19	15-07-19	14-08-19	12-09-2019	16-10-2019	14-11-2019			
pH (pH unit)	6.5 - 8.5	7.1	7.1	6.9	8.0	6.8	6.5	6.8	6.8	6.5	7.1	7.0	6.5	8.0	7.0
TSS (mg/L)	40	10	19	44	415	406	13	19	17	15	187	164	10	415	119
TDS (mg/L)	-	402	408	461	436	646	420	455	103	461	343	383	103	646	411
Turbidity (NTU)	-	55	32	179	466	673	76	125	30	13	198	139	13	673	181
EC (µS/cm)	125-2200	975	862	494	538	520	631	524	780	706	561	616	494	975	655
Nitrogen (Nitrate) (mg/L)	0.35	9.95	10.70	9.85	8.50	8.50	11.7	10.2	10.1	8.8	8.46	7.8	7.80	11.70	9.51
Total Nitrogen (mg/L)	0.02	11.40	11.20	12.40	9.80	11.90	12.80	11.80	10.40	10.00	9.50	9.20	9.20	12.80	10.95
Total Phosphorous (mg/L)	0.025	<0.01	0.040	0.050	0.120	0.200	0.040	0.050	<0.05	0.080	0.050	0.050	0.010	0.200	0.07
Ammonia (mg/L)	0.02	0.04	<0.010	0.03	0.12	0.01	0.01	0.07	<0.05	0.04	<0.01	0.02	0.01	0.12	0.04
Oil and Grease (mg/L)	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Calcium (mg/L)	-	2	2	2	1	2	13	5	23	29	9	9	1.0	29.0	8.8
Magnesium (mg/L)	-	4	4	3	3	3	6	5	6	7	7	7	3	7	5.0
Sodium (mg/L)	-	120	125	107	93	92	88	86	87	85	85	89	85	125	96.0
Potassium (mg/L)	-	2	2	2	1	2	1	1	1	2	1	2	1	2	2.00
Total Hardness (as CaCO ₃)	-	21	21	17	15	17	57	33	82	101	51	51	15	101	42.0
Arsenic (mg/L)	0.024	0.001	0.001	0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.001
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001
Chromium (mg/L)	0.001	0.001	0.001	0.004	0.010	0.010	0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.001	0.010	0.004
Copper (mg/L)	0.001	0.001	0.002	0.005	0.011	0.011	0.002	0.003	<0.001	0.002	0.002	0.002	0.001	0.011	0.004
Nickel (mg/L)	0.011	0.001	0.001	0.002	0.005	0.006	0.002	0.002	<0.001	0.002	0.002	0.002	0.001	0.006	0.003
Lead (mg/L)	0.003	0.001	0.001	0.003	0.007	0.007	<0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.007	0.003
Manganese (mg/L)	1.9	0.0	0.0	0.1	0.3	0.3	0.1	0.2	0.1	0.1	0.2	0.1	0.02	0.29	0.1
Vanadium (mg/L)	-	<0.010	<0.010	<0.010	0.040	0.040	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.04	0.02
Zinc (mg/L)	0.021	0.016	0.015	0.024	0.049	0.050	0.032	0.016	0.008	0.034	0.017	0.018	0.01	0.05	0.03

Surface Water - Dam 2 (2019)

	Criteria	Date												Min	Max	Average
		18-01-19	18-02-19	20-03-19	16-04-19	15-05-19	12-06-2019	15-07-2019	14-08-2019	12-09-2019	16-10-2019	14-11-2019	12-12-2019			
pH (pH unit)	6.5 - 8.5	6.6	6.5	5.3	7.3	6.7	6.4	6.4	6.7	6.6	6.7	6.7	7.2	5.3	7.3	6.6
TSS (mg/L)	40	17	19	185	109	135	25	9	21	56	13	9	26	9	185	52
TDS (mg/L)	-	141	367	536	185	264	190	304	170	264	746	1047	862	141	1047	423
Turbidity (NTU)	-															
EC (µS/cm)	125-2200	533	563	182	265	327	288	468	472	414	1074	1235	1417	182	1417	603
Nitrogen (Nitrate) (mg/L)	0.35	0.10	0.10	0.47	0.40	0.76	1.3	0.55	0.31	0.22	0.46	0.02	0.04	0.02	1.30	0.39
Total Nitrogen (mg/L)	0.02	0.70	0.60	1.10	1.40	1.80	1.6	0.8	0.7	0.8	0.8	0.4	0.6	0.40	1.80	0.94
Total Phosphorous (mg/L)	0.025	<0.010	<0.010	<0.100	<0.040	<0.050	<0.020	<0.020	<0.05	<0.040	<0.01	<0.030	<0.020	0.010	0.100	0.03
Ammonia (mg/L)	0.02	0.02	0.02	0.01	0.07	0.01	<0.01	0.07	0.07	0.04	0.06	0.03	0.05	0.01	0.07	0.04
Oil and Grease (mg/L)	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Calcium (mg/L)	-	6	38	2	12	18	12	24	23	18	107	106	141	2.0	141.0	42.3
Magnesium (mg/L)	-	3	10	2	4	5	4	7	8	6	12	16	23	2	23	8.0
Sodium (mg/L)	-	29	43	31	29	34	34	44	44	38	62	68	86	29	86	45.0
Potassium (mg/L)	-	2	1	1	1	1	<1	1	1	1	2	2	2	1	2	1.00
Total Hardness (as CaCO3)	-	27	136	13	46	66	46	89	90	70	316	330	447	13	447	140.0
Arsenic (mg/L)	0.024	0.001	0.001	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.001
Cadmium (mg/L)	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001
Chromium (mg/L)	0.001	0.001	0.001	0.001	0.002	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.004	0.002
Copper (mg/L)	0.001	0.001	0.002	0.012	0.004	0.006	0.002	<0.001	0.002	0.003	0.002	0.003	0.002	0.001	0.012	0.004
Nickel (mg/L)	0.011	0.001	0.001	0.006	0.001	0.003	0.002	<0.001	0.001	0.004	0.002	0.002	0.001	0.001	0.006	0.002
Lead (mg/L)	0.003	0.001	0.001	0.007	0.001	0.003	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.007	0.002
Manganese (mg/L)	1.9	0.059	0.318	0.207	0.078	0.113	0.092	0.080	0.053	0.063	0.231	0.080	0.025	0.0	0.3	0.1
Vanadium (mg/L)	-	<0.010	<0.010	0.040	<0.010	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.04	0.02
Zinc (mg/L)	0.021	0.012	0.014	0.057	0.018	0.003	0.028	0.006	0.01	0.024	0.011	0.014	0.013	0.003	0.057	0.02

Surface Water – Dam 3 (2019)

Parameter	Criteria	Date												Min	Max	Average
		18-01-19	18-02-19	20-03-19	16-04-19	15-05-19	12-06-2019	15-07-2019	14-08-2019	12-09-2019	16-10-2019	14-11-2019	12-12-2019			
pH (pH unit)	6.5 - 8.5	8.2	8.4	7.6	7.5	7.7	7.6	7.0	8.0	8.0	7.0	8.6	7.5	7.0	8.6	7.7
TSS (mg/L)	40	43	23	30	164	19	12	6	<5	15	25	10	25	6	164	34
TDS (mg/L)	-	555	700	672	628	612	504	646	633	694	578	725	836	504	836	649
Turbidity (NTU)	-	50	43	108	157	25	38	38	21	19	30	12	12	12	157	46
EC (µS/cm)	125-2200	975	1140	915	998	1049	846	1036	1230	1144	993	1172	1309	846	1309	1067
Nitrogen (Nitrate) (mg/L)	0.35	1.99	0.49	0.43	0.81	1.16	1.56	2.77	3.00	2.15	1.06	0.06	0.04	0.0	3.00	1.29
Total Nitrogen (mg/L)	0.02	2.70	0.80	1.20	2.00	1.80	1.9	3.3	2.9	2.8	1.6	0.07	0.06	0.1	3.30	1.76
Total Phosphorous (mg/L)	0.025	<0.01	<0.01	0.02	0.06	0.01	<0.01	0.05	<0.05	0.05	<0.1	<0.01	0.02	0.010	0.060	0.029
Ammonia (mg/L)	0.02	0.02	0.02	0.19	0.23	0.01	<0.01	0.03	0.09	0.05	0.01	0.03	0.03	0.01	0.23	0.06
Oil and Grease (mg/L)	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Calcium (mg/L)	-	19	26	19	17	22	18	23	34	42	35	40	51	17	51	29.0
Magnesium (mg/L)	-	14	18	16	16	19	15	21	25	23	19	21	27	14.0	27	20.0
Sodium (mg/L)	-	165	211	185	158	162	134	152	172	165	138	161	192	134	211	166.0
Potassium (mg/L)	-	3.0	3.0	3.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	1.0	3.0	2.30
Total Hardness (as CaCO3)	-	105	139	113	108	133	107	144	188	200	166	186	238	105	238	152.-
Arsenic (mg/L)	0.024	0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001
Cadmium (mg/L)	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (mg/L)	0.001	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.002	0.001
Copper (mg/L)	0.001	0.001	0.0030	0.006	0.004	0.0020	0.002	0.002	0.002	0.002	0.002	0.0020	0.0020	0.001	0.006	0.003
Nickel (mg/L)	0.011	0.001	0.002	0.002	0.002	0.001	0.002	<0.001	<0.001	0.001	<0.001	0.001	<0.001	0.001	0.002	0.002
Lead (mg/L)	0.003	0.001	0.0010	0.002	0.002	0.0010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.0014
Manganese (mg/L)	1.9	0.026	0.0860	0.236	0.366	0.2340	0.104	0.134	0.069	0.020	0.041	0.0150	0.0350	0.02	0.37	0.1
Vanadium (mg/L)	-	<0.01	<0.010	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	0.01	0.01	0.01

Parameter	Criteria	Date											Min	Max	Average	
		18-01-19	18-02-19	20-03-19	16-04-19	15-05-19	12-06-2019	15-07-2019	14-08-2019	12-09-2019	16-10-2019	14-11-2019				12-12-2019
Zinc (mg/L)	0.021	0.0050	0.0080	0.0210	0.0160	0.0290	0.0150	<0.005	<0.005	0.008	0.0060	0.0110	0.0410	0.01	0.04	0.02

Surface Water - SW2 (2019)

Parameter	Criteria	Date											Min	Max	Average
		18-Jan-19	20-Mar-19	16-Apr-19	15-May-19	12-06-2019	15-07-2019	14-08-2019	12-09-2019	16-10-2019	14-11-2019	12-12-2019			
pH (pH unit)	6.5 - 8.5	6.9	6.5	7.1	7.8	6.2	7.0	6.5	6.9	6.7	6.9	7.2	6.2	7.8	6.9
TSS (mg/L)	40	24	16	121	45	11	<5	8	18	26	22	21	8	121	31
TDS (mg/L)	-	399	478	642	815	415	426	309	420	349	361	584	309	815	473
Turbidity		59	121	200	291	85	89	21	75	49	29	16	16	291	94
EC (µS/cm)	125-2200	533	496	506	510	531	526	501	563	570	562	584	496	584	535
Nitrogen (Nitrate) (mg/L)	0.35	<0.100	6.120	2.040	4.440	6.91	5.03	3.3	0.5	7.07	0.06	<0.05	0.06	7.07	3.6
Total Nitrogen	0.02	1.10	8.10	3.20	6.70	7.9	6.4	3.1	1.6	7.9	1.1	1.1	1.10	8.10	4.4
Total Phosphorous (mg/L)	0.025	<0.01	0.05	0.09	0.16	0.03	0.04	<0.05	0.12	0.12	0.04	0.02	0.01	0.16	0.07
Ammonia (mg/L)	0.02	0.040	0.060	0.070	0.040	<0.01	0.01	0.07	0.08	0.01	0.07	0.32	0.01	0.32	0.08
Oil and Grease (mg/L)	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Calcium (mg/L)	-	2.0	2.0	3.0	2.0	6.0	4.0	4.0	4.0	8.0	6.0	9.0	2.0	9.0	4.5
Magnesium (mg/L)	-	4.0	3.0	3.0	3.0	6.0	5.0	5.0	5.0	7.0	7.0	8.0	3.0	8.0	5.1
Sodium (mg/L)	-	103	108	98	91	89	77	81	80	86	82	97	77	108	90.0
Potassium (mg/L)	-	3.0	2.0	2.0	2.0	1.0	1.0	2.0	2.0	2.0	2.0	4.0	1.0	4.0	2.1
Total Hardness (as CaCO3)	-	21	17	20	17	40	30	30	30	49	44	55	17	55	32.0
Arsenic (mg/L)	0.024	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.002	0.001
Cadmium (mg/L)	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (mg/L)	0.001	0.002	0.021	0.008	0.010	0.001	0.002	<0.001	0.003	<0.001	<0.001	<0.001	0.001	0.021	0.007
Copper (mg/L)	0.001	0.001	0.003	0.007	0.008	0.002	0.002	0.002	0.003	<0.001	0.002	<0.001	0.001	0.008	0.003
Nickel (mg/L)	0.011	0.002	0.004	0.004	0.005	0.002	0.001	<0.001	0.003	<0.001	0.002	0.003	0.001	0.005	0.003

Parameter	Criteria	Date											Min	Max	Average	
		18-Jan-19	20-Mar-19	16-Apr-19	15-May-19	12-06-2019	15-07-2019	14-08-2019	12-09-2019	16-10-2019	14-11-2019	12-12-2019				
								1								
Lead (mg/L)	0.003	0.001	0.002	0.004	0.006	<0.001	0.001	0.001	0.002	<0.001	<0.001	<0.001	0.001	0.006	0.002	
Manganese (mg/L)	1.9	0.134	0.041	0.084	0.116	6	0.036	0.221	0.088	0.034	0.134	0.234	0.03	6.00	0.65	
Vanadium (mg/L)	-	<0.010	<0.010	0.030	0.030	<0.01	<0.01	<0.01	0.01	<0.1	<0.01	<0.01	0.01	0.03	0.02	
Zinc (mg/L)	0.021	0.011	0.026	0.039	0.052	0.031	0.018	0.016	0.03	0.01	0.015	0.013	0.01	0.05	0.02	

Surface Water – SW3 (2019)

Parameter	Criteria	Date		Min	Max	Average
		20-Mar-19	12-06-2019			
pH (pH unit)	6.5 - 8.5	5.6	5.8	5.6	5.8	5.7
TSS (mg/L)	40	51	12	12	51	32
TDS (mg/L)	-	1147	192	192	1147	670
Turbidity		403	64	64	403	234
EC (µS/cm)	125-2200	202	268	202	268	235
Nitrogen (Nitrate) (mg/L)	0.35	1.01	0.47	0.47	1.01	0.7
Total Nitrogen	0.02	2.70	1	1.00	2.70	1.9
Total Phosphorous (mg/L)	0.025	0.230	0.040	0.04	0.23	0.14
Ammonia (mg/L)	0.02	0.03	<0.01	0.03	0.03	0.03
Oil and Grease (mg/L)	5	<5	<5	<5	<5	<5
Calcium (mg/L)	-	2.0	4.0	2.0	4.0	3.0
Magnesium (mg/L)	-	2.0	5.0	2.0	5.0	3.5
Sodium (mg/L)	-	37	38	37.0	38.0	37.5
Potassium (mg/L)	-	2.0	1.0	1.0	2.0	1.5
Total Hardness (as CaCO ₃)	-	13	30	13.0	30.0	21.5
Arsenic (mg/L)	0.024	0.003	<0.001	0.003	0.003	0.003
Cadmium (mg/L)	0.0002	<0.0001	0.0001	0.0001	0.0001	0.0001

Parameter	Criteria	Date		Min	Max	Average
		20-Mar-19	12-06-2019			
Chromium (mg/L)	0.001	0.021	0.001	0.00	0.02	0.011
Copper (mg/L)	0.001	0.020	0.005	0.01	0.02	0.01
Nickel (mg/L)	0.011	0.012	0.001	0.001	0.012	0.007
Lead (mg/L)	0.003	0.0130	<0.001	0.013	0.013	0.013
Manganese (mg/L)	1.9	0.231	0.018	0.02	0.23	0.12
Vanadium (mg/L)	-	0.060	<0.01	0.06	0.06	0.06
Zinc (mg/L)	0.021	0.096	0.018	0.02	0.10	0.06

Surface Water – SW4 (2018)

Parameter	Criteria	Date				Min	Max	Average
		18 May	19 Jun	19 Oct	18 Dec			
pH (pH unit)	6.5 - 8.5	5.55	7.00	6.16	3.29	3.29	7	5.5
TSS (mg/L)	40	12	270	248	216	12.00	270	186.5
TDS (mg/L)	-	382	370	453	816	370	816	505.2
Turbidity		81	488	281	386	81	488	309
EC (µS/cm)	125-2200	331	112	243	412	112	412	274.5
Nitrogen (Nitrate) (mg/L)	0.35	0.460	0.280	<0.010	0.050	0.01	0.46	0.2
Total Nitrogen	0.02	0.80	0.90	1.20	1.40	0.80	1.4	1.075
Total Phosphorous (mg/L)	0.025	0.120	0.080	0.120	0.170	0.08	0.17	0.1
Ammonia (mg/L)	0.02	0.090	0.010	0.010	0.080	0.01	0.1	0.05
Oil and Grease (mg/L)	5	<5	<5	<5	<5	5	5	5
Calcium (mg/L)	-	3.0	2.0	3.0	2.0	2	3	2.5
Magnesium (mg/L)	-	5.0	1.0	3.0	2.0	1	5	2.7
Sodium (mg/L)	-	54	25	38	34	25	54	37.7
Potassium (mg/L)	-	2.0	1.0	1.0	1.0	1	2	1.25
Total Hardness (as CaCO ₃)	-	30	9	20	13	9	30	18
Arsenic (mg/L)	0.024	0.001	0.002	0.001	0.002	0.001	0.002	0.001
Cadmium (mg/L)	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (mg/L)	0.001	0.001	0.012	0.009	0.017	0.001	0.02	0.01

Parameter	Criteria	Date				Min	Max	Average
		18 May	19 Jun	19 Oct	18 Dec			
Copper (mg/L)	0.001	0.002	0.010	0.011	0.019	0.002	0.02	0.01
Nickel (mg/L)	0.011	0.001	0.006	0.006	0.009	0.001	0.009	0.005
Lead (mg/L)	0.003	0.001	0.0070	0.0080	0.0110	0.001	0.01	0.007
Manganese (mg/L)	1.9	0.028	0.139	0.123	0.178	0.03	0.18	0.1
Vanadium (mg/L)	-	<0.010	0.040	0.030	0.060	0.01	0.06	0.03
Zinc (mg/L)	0.021	0.015	0.052	0.057	0.092	0.02	0.09	0.05

Groundwater - BH 205 and BH 207 *(2018)

Parameter	BH 205					BH 207				
	Date		Min	Max	Average	Date		Min	Max	Average
	18 Apr 18	30 Oct 18				18 Apr 18	30 Oct 18			
Chloride (mg/L)	870	420	420.000	870.00	645	1100	140	140	1100	620
Conductivity (at 25Å°C) (µS/cm)	2400	2600	2400	2600	2500	3300	580	580	3300	1940
Nitrate & Nitrite (as N) (mg/L)	0.09	0.07	0.07	0.09	0.08	<0.05	<0.05	0.05	0.05	0.05
pH	7.8	9.8	7.8	9.8	8.8	7.3	7.0	7	7.3	7.15
Phosphate total (as P)	0.40	0.17	0.17	0.40	0.28	0.52	0.34	0.34	0.52	0.43
Sulphate (as S) (mg/L)	59	41	41	59	50	74	22	22	74	48
Total Dissolved Solids (mg/L)	1200	1100	1100	1200	1150	1700	340	340	1700	1020
Total Kjeldahl Nitrogen (as N) (mg/L)	2.7	0.4	0.4	2.7	1.5	0.3	0.5	0.3	0.5	0.4
Total Nitrogen (as N) (mg/L)	2.8	0.5	0.5	2.8	1.65	0.3	0.5	0.3	0.5	0.4
Calcium (mg/L)	46	180	46	180	113	37	6	6	37	21
Magnesium (mg/L)	22	<0.5	0.5	22	11.2	47	8	7.6	47	27.3
Potassium (mg/L)	3.2	9.1	3.2	9.1	6.1	2.5	0.9	0.9	2.5	1.7
Sodium (mg/L)	370	220	220	370	295	490	97	97	490	293.5
Bicarbonate Alkalinity (as CaCO3)	280	<20	20	280	150	200	40	40	200	120
Carbonate Alkalinity (as CaCO3)	<10	94	10	94	52	<10	<10	10	10	10
Total Alkalinity (as CaCO3)	280	420	280	420	350	200	40	40	200	120
Benzene (µg/L)	<0.001	<0.001	-	-	-	<0.001	<0.001	-	-	-
Ethylbenzene (µg/L)	<0.001	<0.001	-	-	-	<0.001	<0.001	-	-	-
m&p-Xylenes (µg/L)	<0.002	<0.002	-	-	-	<0.002	<0.002	-	-	-
o-Xylene (µg/L)	<0.001	<0.001	-	-	-	<0.001	<0.001	-	-	-
Toluene (µg/L)	<0.001	<0.001	-	-	-	<0.001	<0.001	-	-	-
Xylenes - Total (µg/L)	<0.003	<0.003	-	-	-	<0.003	<0.003	-	-	-
4-Bromofluorobenzene (surr)	101	82	82	101	91.5	99	93	93	99	96
TRH C10-36 (Total)	<0.1	<0.1	-	-	-	<0.1	<0.1	-	-	-

Parameter	BH 205					BH 207				
	Date		Min	Max	Average	Date		Min	Max	Average
	18 Apr 18	30 Oct 18				18 Apr 18	30 Oct 18			
TRH C10-C14 (µg/L)	<0.05	<0.05	-	-	-	<0.05	<0.05	-	-	-
TRH C15-C28 (µg/L)	<0.1	<0.1	-	-	-	<0.1	<0.1	-	-	-
TRH C29-C36 (µg/L)	<0.1	<0.1	-	-	-	<0.1	<0.1	-	-	-
TRH C6-C9 (µg/L)	<0.02	<0.02	-	-	-	<0.02	<0.02	-	-	-
Naphthalene	<0.01	<0.01	-	-	-	<0.01	<0.01	-	-	-
TRH >C10-C16	<0.05	<0.05	-	-	-	<0.05	<0.05	-	-	-
TRH >C10-C16 less Naphthalene (F2)	<0.05	<0.05	-	-	-	<0.05	<0.05	-	-	-
TRH >C16-C34	<0.1	<0.1	-	-	-	<0.1	<0.1	-	-	-
TRH >C34-C40	<0.1	<0.1	-	-	-	<0.1	<0.1	-	-	-
TRH C6-C10	<0.02	<0.02	-	-	-	<0.02	<0.02	-	-	-
TRH C6-C10 less BTEX (F1)	<0.02	<0.02	-	-	-	<0.02	<0.02	-	-	-

Groundwater – BH 208 and BH 303 (2018)

Parameter	BH 208					BH 303				
	Date		Min	Max	Average	Date		Min	Max	Average
	18 Apr 18	30 Oct 18				18 Apr 18	30 Oct 18			
Chloride (mg/L)	1000	-	1000	1000	1000	1000	520	520	1000	760
Conductivity (at 25Å°C) (µS/cm)	3000	-	3000	3000	3000	3200	1900	1900	3200	2550
Nitrate & Nitrite (as N) (mg/L)	3.6	-	3.6	3.6	3.6	<0.05	0.16	-	-	-
pH	7.10	-	7.10	7.10	7.10	6.8	8.2	6.8	8.2	7.5
Phosphate total (as P)	1.0	-	1.0	1.0	1.0	0.58	0.10	0.1	0.58	0.34
Sulphate (as S) (mg/L)	240	-	240	240	240	27	34	27	34	30.5
Total Dissolved Solids (mg/L)	3000	-	3000	3000	3000	1400	1100	1100	1400	1250
Total Kjeldahl Nitrogen (as N) (mg/L)	1.0	-	1.0	1.0	1.0	<0.2	1.0	0.2	1	0.6
Total Nitrogen (as N) (mg/L)	4.6	-	4.6	4.6	4.6	<0.2	1.2	0.2	1.2	0.7
Calcium (mg/L)	35	-	35	35	35	33	22	22	33	27.5
Magnesium (mg/L)	38	-	38	38	38	38	31	31	38	34.5
Potassium (mg/L)	3.0	-	3.0	3.0	3.0	5.4	7.0	5.4	7	6.2
Sodium (mg/L)	480	-	480	480	480	350	300	300	350	325
Bicarbonate Alkalinity (as CaCO3)	81	-	81	81	81	120	75	75	120	97
Carbonate Alkalinity (as CaCO3)	<10	-	<10	<10	<10	<10	<10	10	10	10
Total Alkalinity (as CaCO3)	81	-	81	81	81	120	75	75	120	97.5
Benzene (µg/L)	<0.001	-	-	-	-	<0.001	<0.001	-	-	-
Ethylbenzene (µg/L)	<0.001	-	-	-	-	<0.001	<0.001	-	-	-
m&p-Xylenes (µg/L)	<0.002	-	-	-	-	<0.002	<0.002	-	-	-

Parameter	BH 208					BH 303				
	Date		Min	Max	Average	Date		Min	Max	Average
	18 Apr 18	30 Oct 18				18 Apr 18	30 Oct 18			
o-Xylene (µg/L)	<0.001	-	-	-	-	<0.001	<0.001	-	-	-
Toluene (µg/L)	<0.001	-	-	-	-	<0.001	<0.001	-	-	-
Xylenes - Total (µg/L)	<0.003	-	-	-	-	<0.003	<0.003	-	-	-
4-Bromofluorobenzene (surr)	102	-	102	102	102	99	94	94	99	96.5
TRH C10-36 (Total)	1.81	-	-	-	-	0.2	0.2	-	-	-
TRH C10-C14 (µg/L)	0.41	-	-	-	-	<0.05	<0.05	-	-	-
TRH C15-C28 (µg/L)	1.0	-	-	-	-	0.2	0.2	-	-	-
TRH C29-C36 (µg/L)	0.4	-	-	-	-	<0.1	<0.1	-	-	-
TRH C6-C9 (µg/L)	<0.02	-	-	-	-	<0.02	<0.02	-	-	-
Naphthalene	<0.01	-	-	-	-	<0.01	<0.01	-	-	-
TRH >C10-C16	0.53	-	-	-	-	<0.05	0.27	-	-	-
TRH >C10-C16 less Naphthalene (F2)	0.53	-	-	-	-	<0.05	0.27	-	0.27	0.16
TRH >C16-C34	1.1	-	-	-	-	0.2	<0.1	-	0.2	0.15
TRH >C34-C40	<0.1	-	-	-	-	<0.1	<0.1	-	-	-
TRH C6-C10	<0.02	-	-	-	-	<0.02	<0.02	-	-	-
TRH C6-C10 less BTEX (F1)	<0.02	-	-	-	-	<0.02	<0.02	-	-	-

APPENDIX 7 – *Tetratheca juncea* Monitoring



TETRATHECA JUNCEA
MONITORING REPORT
FOR THE
KARUAH EAST QUARRY SITE
(PROJECT APPROVAL 09-0175)

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Prepared for:	Karuah East Quarry Pty Ltd
Reference No.	<i>Tetratheca juncea</i> Translocation - Karuah East
Document Status & Date:	March 2020



ABBREVIATIONS

DA	<i>Development Application</i>
EPA Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GPS	<i>Global Positioning System</i>
OEH	<i>NSW Office of Environment and Heritage</i>
PA	<i>Project Approval</i>
PPR	<i>Preferred Project Plan</i>
RMS	<i>NSW Roads and Maritime Service</i>
TJMP	<i>Tetratheca juncea Management Plan</i>



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I INTRODUCTION

Firebird ecoSultants has been engaged by Karuah East Pty Ltd to monitor the success of the translocation of the *Tetratheca juncea* in accordance with the Translocation Plan for *Tetratheca juncea* at Karuah East Quarry prepared by Firebird ecoSultants (July 2015) to satisfy the requirements of the Project Approval (PA 09_0175) granted on 17 June 2014 for the Karuah East Quarry Project (Karuah East).

The expansion area of the Karuah East Quarry Project required a translocation program to be implemented for the threatened flora species *Tetratheca juncea*. 243 clumps of *Tetratheca juncea* were originally found to be within the area of development. The approved quarry expansion includes a biodiversity offset conservation area adjacent to the existing quarry. This area was investigated during the approval process and found 6324 clumps of *Tetratheca juncea*. At the time of translocation (May 2016), a total of 367 individuals (clumps) of *Tetratheca juncea* were recorded and subsequently translocated. It is acknowledged that translocation is not a mitigation measure and is considered as a supplementary action due to low certainty of success. In this instance, translocation has been proposed as an additional measure to gain a better biodiversity outcome. Translocation of the individuals to be impacted from within the impact area to the offset site will assist in protecting the genetic diversity of the population. Translocation has been successfully undertaken for *Tetratheca juncea* previously at other sites with a moderate survival rate of 27% after 5 years (Lake Macquarie City Council, 2013).

Alex Picton (Firebird, ecologist) and Nicolas Alexander (Firebird, ecologist) aided in the removal of 367 *T.juncea* individuals during their excavation from the impact site on the 11 May 2016 till the 23rd May 2016. The 367 individuals were translocated into pre-prepared areas within the proposed offset site now referred to as the Translocation Site within this report. An area of 2,500m² to 3,000m² has been identified in Lot 14 as the Translocation Site. Refer to Figure 1-1 for the location of the Translocation Site. The Translocation Site was selected to ensure that an appropriate vegetation community and aspect would be provided. By replicating the source environment as much as possible, the chances of translocation success was as high as practically possible.

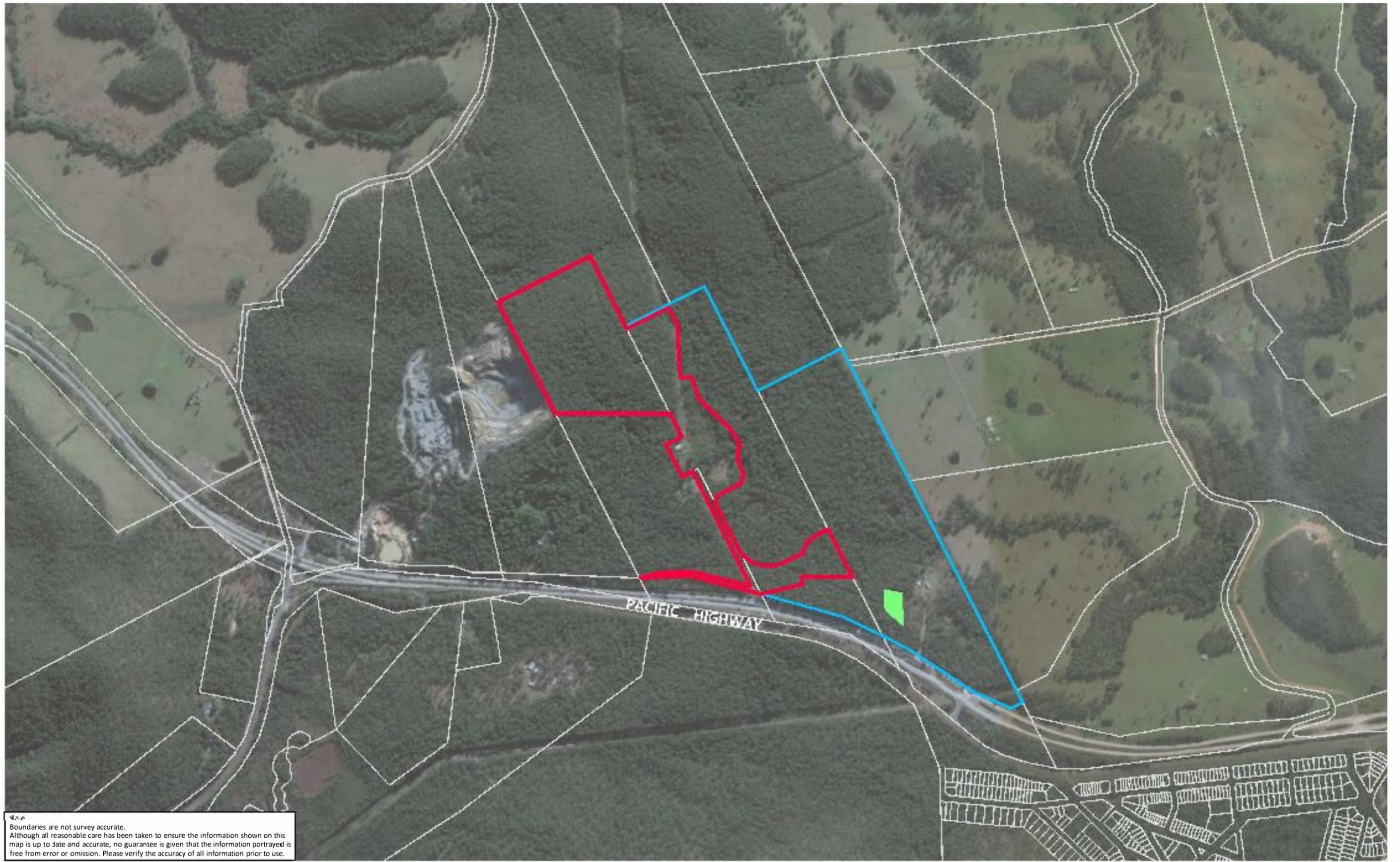
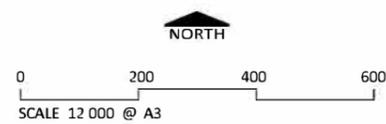


FIGURE 1-1: TRANSLOCATION AREA

CLIENT Karuah East Pty Ltd
 SITE DETAILS Pacific Highway Karuah
 DATE 19 July 2015

- Legend
- ▭ Karuah East Hard Rock Quarry
 - ▭ Offset Site (Owned)
 - ▭ Translocation Area



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2 TRANSLOCATION PREPARATION

2.1 Marking Plants

Three hundred and sixtyseven clumps of *Tetratheca juncea* were removed from the impact site that were translocated as part of the development approval. The collection method entailed digging within the Translocation Site before collecting a translocation section from the impact area and placing the section into the hole within the Translocation Site. Site preparation included the removal of threatening processes that may impact upon the success of plant survival. These include weed control, protection from herbivory and management of fire risks. An irrigation system was installed to ensure moisture levels remain adequate for plant survival.

Removal of the plants were undertaken in patches that included numerous clumps. Each of these patches are referred to as a translocation section with Rows A1-A30 and B1-B14 the number of individuals were recorded for each row. Refer to Table 2-1 for results of number of individuals plants in each row.

Table 2-1 Number of *T. juncea* translocated

Row	Count of <i>Tetratheca juncea</i>
A1	6
A2	5
A3	5
A4	4
A5	6
A6	8
A7	4
A8	7
A9	5
A10	5
A11	8
A12	7
A13	4
A14	6
A15	6
A16	6
A17	10
A18	11
A19	10
A20	10
A21	8
A22	9

Row	Count of <i>Tetratheca juncea</i>
A23	8
A24	8
A25	12
A26	16
A27	13
A28	11
A29	10
A30	11
B1	11
B2	9
B3	11
B4	7
B5	6
B6	11
B7	9
B8	10
B9	9
B10	11
B11	10
B12	9
B13	12
B14	3
Total	367

The following methods were employed for the translocation program:

- An excavator was used to dig the plants out of the ground in large scoops. This ensured the plant would be removed with large root balls and soil from the source area.
- The excavator operator would carefully slide the plants with the clump of soil from the excavator’s bucket onto the bucket of a front end loader.
- Once the front end loader was filled with approximately 6 excavator scoops, the driver would carefully transport the plants to the translocation area. The plants and soil from source area were carefully slid from the loader bucket by a labourer into the prepared holes.
- The area was watered immediately. The translocation sections received follow up watering to ensure establishment.

3 MONITOING RESULTS

Monitoring of the *T. juncea* individuals in accordance with the Translocation Plan for *T. juncea* (Firebird, 2015) has been undertaken by Firebird ecoSultants in October 2016, October 2017, September 2018 and September 2019. Monitoring involved the following:

- Flower Counts
- Observe general plant health
- Identify all plants within each Section
- Photo points

The results displayed in Table 3-1 show that of the 367 individuals translocated 118 have survived as of September 2019 and were showing signs of regrowth &/ or in flower. This presents an approximate survival rate of **38%**. Refer to Appendix A for Photos.

Table 3-1 Monitoring results of *T.juncea* plants recorded during the September 2019 survey

Row #	No Translocated in May 2016	Monitoring Results October 2016	Monitoring Results October 2017	Monitoring Results September 2018	Monitoring Results September 2019	Flower Count
A1	6	6	5	2	1	Plant 1: 13 flowers.
A2	5	0	0	1	1	Plant 1: Green, no flower
A3	5	5	1	1	3	Plant 1: 0/BR, Plant 2: 0/BR, Plant 3: 3 flowers
A4	4	5	2	1	5	Plant 1: 12 flowers, Plant 2: 3 flowers, Plant 3: 1 flower, Plant 5: 2 flowers
A5	6	3	3	2	3	Plant 1: 0/BR, Plant 2: 1 flower, Plant 3: 0/BR
A6	8	8	4	5	3	Plant 1: 0/BR , Plant 2: 1 flower, Plant 3: 0/BR
A7	4	4	2	3	2	Plant 1: 7 flowers, Plant 2: 1 flower
A8	7	9	9	5	5	Plant 1: 4 flowers, Plant 2: 1 flower, Plant 3: 1 flower, Plant 4: 21 flowers, Plant 5: 3

Row #	No Translocated in May 2016	Monitoring Results October 2016	Monitoring Results October 2017	Monitoring Results September 2018	Monitoring Results September 2019	Flower Count
						flowers
A9	5	5	3	2	3	Plant 1: 4 flowers, Plant 2: 2 flowers, Plant 3: 0/BR
A10	5	3	1	1	1	Plant 1: 0/BR
A11	8	7	1	2	2	Plant 1: budding, Plant 2: 0/BR
A12	7	8	4	1	3	Plant 1: 0/BR, Plant 2: 0/BR, Plant 3: 0/BR
A13	4	4	1	2	2	Plant 1: 6 flowers, Plant 2: 0/BR
A14	6	6	0	2	1	Plants 1: 0/BR
A15	6	6	5	5	3	Plant 1: 1 flower, Plant 2: 0/BR, Plant 3: 0/BR
A16	6	4	4	4	3	Plant 1: budding, Plant 2: 0/BR, Plant 3: 0/BR
A17	10	4	10	2	3	Plant 1: 5 flowers, Plant 2: 3 flowers, Plant 3: 0/BR
A18	11	11	8	4	3	Plant 1: 3 flowers, Plant 2: 20+ flowers, Plant 3: 10 flowers
A19	10	8	5	4	4	Plant 1: 2 flowers, Plant 2: 0/BR, Plant 3: 1 flower, Plant 4: 20+ flowers
A20	10	9	5	2	3	Plant 1: 0/Br, Plant 2: 20+ flowers, Plant3: 20+ flowers

Row #	No Translocated in May 2016	Monitoring Results October 2016	Monitoring Results October 2017	Monitoring Results September 2018	Monitoring Results September 2019	Flower Count
A21	8	8	2	3	3	Plants 1: 20+ flowers, Plant 2:0/BR, Plant 3:0/BR
A22	9	8	7	5	6	Plant 1: 20 + flowers, Plant 2: 20+ flowers, Plant 3: 7 flowers, Plant 4: 5 flowers, Plant 5: 4 flowers, Plant 6: 5 flowers
A23	8	13	5	6	6	Plant 1: 3 flowers, Plant 2: 11 flowers, Plant 3: 5 flowers, Plant 4: 3 flowers, Plant 5: 2 flowers, Plant 6: 5 flowers
A24	8	7	4	7	5	Plant 1: 1 flower, Plant 2: 4 flowers, Plant 3: 4 flowers, Plant 4: 0/BR, Plant 5: 7 flowers
A25	12	6	4	4	5	Plant 1: 20+ flowers, Plant 2: 1 flower, Plant 3: 3 flowers, Plant 4: 4 flower, Plant 5: 20 flowers
A26	16	18	7	4	7	Plant 1: 1 flower, Plant 2: 13 flowers, Plant 3: 15 flowers, Plant 4: 5 flowers, Plant 5: 1 flower, Plant 6: 3 flowers, Plant 7: 5 flowers
A27	13	7	6	3	4	Plant 1: 4 flowers, Plant 2: 2 flowers, Plant 3: 10 flowers, Plant 4: 1 flower
A28	11	2	2	2	2	Plant 1: 2 flowers, Plant 2: 0/BR
A29	10	7	5	5	2	Plant 1: 1 flower, Plant 2: 8 flowers
						Plant 1: 3 flowers, Plant 2: 1 flower, Plant 3: 8 flowers,

Row #	No Translocated in May 2016	Monitoring Results October 2016	Monitoring Results October 2017	Monitoring Results September 2018	Monitoring Results September 2019	Flower Count
A30	11	10	6	3	4	Plant 4: 2 flowers
B1	11	12	4	4	6	Plant 1: 7 flowers, Plant 2: 10 flowers, Plant 3: 8 flowers, Plant 4: 20+ flowers, Plant 5: 15 flowers, Plant 6: 7 flowers
B2	9	8	4	3	4	Plant 1: 10 flowers, Plant 2: 20+ flowers, Plant 3: 5 flowers, Plant 4: 0/BR
B3	11	9	6	3	6	Plant 1: 8 flowers, Plant 2: 5 flowers, Plant 3: 20+ flowers, Plant 4: 20+ flowers, Plant 5: 2 flowers, Plant 6: 8 flowers
B4	7	5	5	3	4	Plant 1: 3 flowers, Plant 2: 5 flowers, Plant 3: 12 flowers, Plant 4: 0/BR
B5	6	6	5	3	3	Plant 1: 14 flowers, Plant 2: 10 flowers, Plant 3: 3 flowers
B6	11	7	4	1	4	Plant 1: 3 flowers, Plant 2: 9, Plant 3: 0/Br, Plant 4: Green
B7	9	8	7	3	3	Plants 1: 1 flower, Plant 2: 0/BR, Plant 3: Green
B8	10	7	4	5	3	Plant 1,2: 0/BR, Plant 3 : Green
B9	9	6	5	2	2	Plant 1: 0 flowers, Plant 2: 0/BR
B10	11	11	5	2	2	Plant 1: 10 flowers, Plant 2: 0/BR
B11	10	10	6	3	0	-
B12	9	10	5	3	2	Plant 1: 2 flowers, Plant 2: Green



Row #	No Translocated in May 2016	Monitoring Results October 2016	Monitoring Results October 2017	Monitoring Results September 2018	Monitoring Results September 2019	Flower Count
B13	12	10	5	3	3	Plant 1: 4 flowers, Plant 2: Budding, Plant 3: 0/BR
B14	3	9	1	4	2	Plant 1: 5 flowers, Plant 2: 0/BR
Total	367	319	187	135	140	

0/BR = Plant has no flowers and is browned off
however there is fresh regrowth

D = Dead



4 CONCLUSION

The monitoring of the *T. juncea* translocation, as of September 2019, has shown a survival rate of 38% for the fourth year of monitoring. Kleinfelder (2020) have also observed a decline in the *T. juncea* numbers within the Biodiversity Offset for the past four years. It is noted that the yearly rainfall totals as recorded by the Bureau of Meteorology's official weather station at Nelson Bay has been below the long-term average in 2016, 2017, 2018 and 2019. This suggests that the natural decline in *T. juncea* population is potentially related to the drier than normal conditions.

T. juncea appear to be healthier and show a higher rate of survival in rows that have canopy cover or in rows that are considerably overgrown with grassy or shrubby vegetation. Rows A20 to A30 have a much higher number of surviving plants and have significantly more canopy cover than rows A1 to A19, which in contrast have significantly lower rates of survival and very little canopy cover. It is possible that *T. juncea* within rows A1 to A19 may be experiencing too much direct sunlight. As such, it is recommended that native shrubs are planted adjacent to and within rows A1 to A19 to create more shade for the *T. juncea* within these rows. It is also recommended that any future translocations are to be replanted in areas with canopy cover.

It should also be noted that the translocation site is considerably more overgrown with grassy native vegetation than the previous years. *T. juncea* are quite difficult to find when they are not in flower, particularly in heavily vegetated areas. Thus, it is considered that there was a chance of potentially missing individual *T. juncea* that were not in flower during the survey effort which would result in a lower predicted rate of survival.

A further one (1) year of monitoring will be able to show more certainty of the success of translocation of *T. juncea*.



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APPENDIX A PHOTOS

Photo 1: *T.junceca* in flower



Photo 2: Unhealthy/browning *T.junceca*



Photo 3: Considerable regrowth of native vegetation in translocation rows



APPENDIX 8 – Audit Action Plan



RESPONSE TO AUDIT RECOMMENDATIONS – Independent Environmental Audit (EMM, July 2017)

Update: March 2020

Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
Project Approval PA 09_0175			
Schedule 3 - Environmental Performance Conditions			
19	The Proponent shall comply with the discharge limits in any EPL, or with Section 120 of the POEO Act	<p>Non-compliant</p> <p>It is recommended that monitoring at SW5 is included in the routine monitoring program.</p> <p>It is recommend that oil and grease concentrations downstream and upstream of the quarry (and potentially in adjacent catchments) are investigated to determine the source of elevated oil and grease concentrations, and whether the quarry is contributing to downstream concentrations.</p> <p>It is recommended that any exceedances of water quality criteria during dam water discharges are reported, in accordance with the project approval conditions and the quarry's EPL.</p>	<p>TSS exceedances during discharge have been reported during 2018.</p> <p>Oil & grease has been closely monitored. There has been no elevated oil and grease concentrations during 2018 – 2020.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
21	<p>The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must:</p> <p>(c) include:</p> <p>..</p> <p>(iii) a Groundwater Monitoring Program that includes:</p> <ul style="list-style-type: none"> • baseline data of groundwater levels surrounding the site; • groundwater impact assessment criteria, to be developed following analysis of baseline data, including trigger levels for investigating any potentially adverse groundwater impacts; and • a program to monitor and/or validate the impacts of the project on groundwater resources. <p>..</p>	<p>Administrative non-compliance</p> <p>It is recommended that groundwater levels are monitored quarterly or that the monitoring frequency is modified in the WMP.</p>	<p>Action completed.</p> <p>Groundwater levels have been monitored every quarter and will continue in the future as per the approved Water MP.</p>
27	<p>The Proponent shall develop and implement a translocation program for <i>Tetratheca juncea</i> to the satisfaction of the Secretary. This program must:</p> <p>..</p> <p>(e) include short and long-term goals and performance criteria to measure the effectiveness of the program; and</p> <p>..</p>	<p>Administrative non-compliance</p> <p>It is recommended that the plan is updated to include performance criteria to ensure the effectiveness of the program can be reviewed and to identify ways to improve the success of future translocation programs.</p>	<p>Action completed.</p> <p>The TJTMP was updated in 2018, which received approval on 14 March 2019. The plan was again updated in 2020.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
29	<p>The Proponent shall, within 12 months of the finalisation of the Biodiversity Offset Strategy, make suitable arrangements to provide appropriate long-term security for the offset area, in consultation with OEH and Council, and to the satisfaction of the Secretary.</p> <p>..</p>	<p>Administrative non-compliance</p> <p>It is recommended that the conservation agreement is finalised in consultation with OEH and DPE.</p>	<p>Pending.</p> <p>A conservation agreement under Part 4 Division 12 of the National Parks & Wildlife Act 1974 was drafted in November 2016. In July 2017, KEQ lodged a Section 75(W) modification (Mod 1) with the DPE. In February 2018, another Section 75(W) modification (Mod 2) was lodged. Both these modifications were approved in 2018. The conservation agreement will be reviewed and modified accordingly.</p>
32	<p>The Proponent shall prepare and implement a Landscape and Rehabilitation Management Plan for the project to the satisfaction of the Secretary. This Plan would relate to the area of the quarry and all perimeter lands. This plan must:</p> <p>..</p> <p>d. describe the short, medium and long-term measures that would be implemented to:</p> <ul style="list-style-type: none"> • manage remnant vegetation and habitat on the site; and • ensure compliance with the rehabilitation objectives and progressive rehabilitation obligations of this approval. <p>..</p>	<p>Non-compliant</p> <p>It is recommended that soil is not stockpiled within the quarrying area or that it is stored within discrete stockpiles as opposed to forming parts of benches. This would allow the soil thickness to be verified to be less than 3 m and to ensure that it is easily recovered for use in rehabilitation.</p>	<p>Pending.</p> <p>Further topsoil from the extraction area has been stripped and temporarily stockpiled in the southern area of the extraction area. Topsoil stockpiles will be relocated once more room becomes available.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
34	<p>The Proponent shall lodge a Conservation and Rehabilitation Bond with P&I within 6 months of the approval of the Landscape and Rehabilitation Management Plan, to ensure that the Biodiversity Offset Strategy and the rehabilitation of the site is implemented in accordance with the performance and completion criteria set out in the Landscape and Rehabilitation Management Plan.</p> <p>..</p>	<p>Administrative non-compliance</p> <p>The Conservation and Rehabilitation Bond was lodged outside of 6 months of the approval of the Landscape and Rehabilitation Management Plan (14 December 2015).</p>	<p>The Conservation and Rehabilitation Bond was lodged with the DPE in July 2016. No further action is required to comply with this condition.</p>
Schedule 5 - Environmental Management, Reporting and Auditing			
3	<p>The Proponent shall ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include:</p> <p>...</p> <p>(f) a program to investigate and implement ways to improve the environmental performance of the project over time;</p> <p>(g) a protocol for managing and reporting any:</p> <ul style="list-style-type: none"> • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or 	<p>Compliant</p> <p>As noted within the EMS, the quarry's management team will discuss and review the status of all management plans on an annual basis, but unless required, all site environmental management plans (including the Environmental Management Strategy) will be reviewed and updated every three years. The EMS does not include a adequately detail the program to improve the environmental performance of the project, the reporting protocol or review protocol. It is recommended that a copy of the quarry's Environmental Incident Reporting Form be appended to each of the quarry's management</p>	<p>Management plans were reviewed and resubmitted to DPIE in 2019.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
	<ul style="list-style-type: none"> • performance criteria; and • a protocol for periodic review of the plan. 	<p>plans and the protocol for managing and reporting all environmental incidents be referenced in the text.</p>	
7	<p>The Proponent shall immediately notify the Secretary and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. For any other incident associated with the project, the Proponent shall notify the Secretary and any other relevant agencies as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Secretary any relevant agencies with a detailed report on the incident, and such further reports as may be requested.</p>	<p>Non-compliant</p> <p>It is recommended that any exceedances of water quality criteria during dam water discharges are reported, in accordance with the project approval conditions and the quarry's EPL.</p>	<p>All controlled and uncontrolled discharge events will be reported in the Annual Returns and Annual Review. Non - compliances are to be reported as per the consent and EPL requirements.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
EPL 20611			
2 Discharge to Air and Water and Applications to Land			
P1.3	The following points referred to in the table (refer to Appendix C) are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.	<p>Compliant</p> <p>As noted within the Annual Review and the environmental monitoring reports, there were no discharge events at Karuah East Quarry during the reporting period for these documents. The discharge points listed in the Water Management Plan are consistent with the licensed discharge points listed as part of this condition (refer to Figure 4 of the Water Management Plan).</p> <p>As noted regarding Schedule 2, Condition 2 of PA 09_0175, Dam 1 has been constructed about 100 m further south than shown on the plan.</p> <p>It is recommended that the proposed surface water management layout in the Water Management Plan (Figure 4) is updated accordingly and the plan is submitted to the EPA with a request to vary the EPL.</p>	Water MP has been revised.
3 Limit Conditions			
L1.1	Except as may be expressly provided in any other condition of this licence, the licensee must comply with Section 120 of the Protection of the Environment Operations Act 1997.	<p>Non-compliant</p> <p>It is recommended that any exceedances of water quality criteria during dam water discharges are reported, in accordance with the project approval conditions and the quarry's EPL.</p>	All controlled and uncontrolled discharge events will be reported in the Annual Returns and Annual Review. Non - compliances are to be reported as per the consent and EPL requirements.



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
L2.1	For each monitoring/discharge point or utilisation area specified in the table/s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.	<p>Non-compliant</p> <p>It is recommended that any exceedances of water quality criteria during dam water discharges are reported, in accordance with the project approval conditions and the quarry's EPL.</p>	All controlled and uncontrolled discharge events will be reported in the Annual Returns and Annual Review. Non - compliances are to be reported as per the consent and EPL requirements.
L2.2	Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.	<p>Non-compliant</p> <p>It is noted that the baseline pH of the area was 5.58–6.20 (refer to Table 4 in the Water Management Plan), while the EPL specifies a discharge range of pH 6.5–8.5. So any discharge is expected to be out of compliance unless it is treated to increase the pH above the natural range. The environmental benefit of such treatment is questionable given that it may result in a perturbation from the natural conditions of the receiving waters.</p>	All non - compliances discharge events will be reported in the Annual Returns and Annual Review. Non - compliances are to be reported as per the consent and EPL requirements.



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
L4.4	<p>To determine compliance:</p> <p>a) with the Leq(15 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located:</p> <p>i) approximately on the property boundary, where any dwelling is situated 30 metres or less from the property boundary closest to the premises; or</p> <p>ii) within 30 metres of a dwelling façade, but not closer than 3m, where any dwelling on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable;</p> <p>iii) within approximately 50 metres of the boundary of a National Park or a Nature Reserve.</p> <p>b) with the LA1(1 minute) noise limits in the Noise Limits table, the noise measurement equipment must be located within 1 metre of a dwelling façade.</p> <p>c) with the noise limits in the Noise Limits table, the noise measurement equipment must be located:</p> <p>i) at the most affected point at a location where there is no dwelling at the location; or</p> <p>ii) at the most affected point within an area at a location prescribed by part (a) or part (b) of this condition.</p> <p>Note: A non-compliance of the Noise Limits table will still occur where noise generated from the premises in excess of the appropriate limit is measured:</p>	<p>Compliant</p> <p>The Noise Management Plan specifies that all noise measurement procedures employed throughout the monitoring programme will be guided by the requirements of AS 1055 1997 Acoustics - Description and Measurement of Environmental Noise (refer to Section 8). In addition, all acoustic instrumentation employed throughout the monitoring programme will be designed to comply with the requirements of AS IEC 61672.1 2004 Electroacoustics Sound level meters - Specifications. As noted within the Noise Management Plan and the Annual Review, the noise monitoring locations are consistent with the locations listed as part of this EPL. The monitoring requirements specified as part of this condition are not explicitly addressed within the Noise Management Plan.</p> <p>It is recommended that the Noise Management Plan be revised to include reference to the specific measures listed in this condition.</p>	<p>KEQ will review the Noise MP in consultation with an acoustic specialist. Amendments will be made to the Noise MP if required.</p> <p>KEQ continues to liaise with the DPIE regarding noise and will update the Noise Management Plan if the EA modification is approved.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
	i) at a location other than an area prescribed in part (a) and part (b); and/or ii) at a point other than the most affected point at a location.		
5 Monitoring and Recording Conditions			
M3.1	... Note: The Protection of the Environment Operations (Clean Air) Regulation 2010 requires testing for certain purposes to be conducted in accordance with test methods contained in the publication " <i>Approved Methods for the Sampling and Analysis of Air Pollutants in NSW</i> ".	Compliant The general requirements of the air quality monitoring program are established in Section 8.1.1 of the Air Quality and Greenhouse Gas Management Plan. As noted within Section 8.1.1, all monitoring must be conducted in accordance with the Approved Methods for the Sampling and Analysis of Air Pollutants in NSW. It is recommended that a statement be included within the quarry's monthly environmental monitoring reports and future annual reviews that monitoring has been conducted in accordance with the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in NSW</i>.	Action completed.



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
M6.1	The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.	<p>Administrative non-compliance</p> <p>It is recommended that the Hunter Quarries website is updated to specify a number to call with complaints - this may be the same number as the general number provided.</p>	<p>Action completed.</p> <p>The Hunter Quarries website was updated on 14 July 2017. An environmental complaints contact phone number is now listed.</p>
M6.2	The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.	<p>Administrative non-compliance</p> <p>It is recommended that the Hunter Quarries website is updated to specify a number to call with complaints - this may be the same number as the general number provided.</p>	<p>Action completed.</p> <p>The Hunter Quarries website was updated on 14 July 2017. An environmental complaints contact phone number was added.</p>

Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
Statement of Commitments – Appendix 6, Project Approval 09_0175			
Schedule 3 - Environmental Performance Conditions			



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
2.0 SUMMARY OF MANAGEMET PLANS	<p>...</p> <p>The following management plans will be prepared prior to commencement of construction works:</p> <p>...</p> <p>- Waste Management Plan.</p> <p>...</p>	<p>Administrative non-compliant</p> <p>The quarry's EMS and management plans have been approved by DPE. However, a waste management plan has not been prepared to meet this commitment.</p> <p>It is recommended that a waste management plan is prepared, in accordance with the summary of environmental monitoring provided in Table 6 of the EMS.</p>	<p>Waste management is partially covered in the EMS.</p> <p>A separate Waste MP will be considered and developed if necessary before the end of Q2 2019.</p>
3.0 SOIL AND WATER / 3.2 Groundwater Management	<p>Refuelling will be undertaken in a designated non-permeable (compacted clay or concrete) area.</p>	<p>Administrative non-compliant</p> <p>The site is under construction and re-fuelling areas have not been constructed. Refuelling in the quarry and infrastructure area is currently performed by a mobile tanker. These are temporary arrangements during the project's construction period and will be addressed prior to the commencement of quarrying operations. Obviously, some earthworks need to be completed before a non-permeable refuelling area can be established. It would have been better to recognise this when writing this commitment.</p> <p>It is recommended that a non-permeable refuelling area (or areas) is constructed as soon as practicable.</p>	<p>Action completed.</p> <p>A permanent refuelling area was constructed at the end of 2017. A self-bundled "bladder" diesel tank was installed. Refuelling has been constructed in concrete and includes an oil/fuel catchment sump.</p>
3.0 SOIL AND WATER / 3.2 Groundwater Management	<p>Groundwater samples will be collected for laboratory analysis on a 6-monthly basis. The groundwater quality results will be laboratory analysed for the parameters below and compared to background water</p>	<p>Administrative non-compliant</p> <p>There is no evidence that the groundwater sampling was carried out by an experienced professional or environmental scientist in</p>	<p>Action completed.</p> <p>Groundwater monitoring reports are provided to KEQ by the groundwater specialists for every monitoring event.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
	<p>quality results. The groundwater sampling will be carried out by an experienced groundwater professional or environmental scientist in accordance with Australian sampling standards. The basic analyte and parameter suite applies to all samples. The additional extended analytic suite should apply annually together with the basic suite.</p>	<p>accordance with the Australian sampling standards. It is recommended that the qualifications and experience of the professional undertaking groundwater sampling are provided in monitoring reports. The laboratory results for March 2016 and April 2017 confirmed that the suite of analytes listed as part of this commitment were assessed (with the exception of total iron, which was not assessed as part of the April 2017 monitoring event). It is recommended that total iron concentrations be assessed as part of the 12 monthly suite of analytes or that the Water Management Plan is amended to remove this requirement.</p>	<p>All analytes are now included in the laboratory reports.</p>
<p>3.0 SOIL AND WATER / 3.2 Groundwater Management</p>	<p>Additional Analysis – 12 monthly (every second sample only): Nutrient suite: total nitrogen, nitrate, total Kjeldahl nitrogen, total phosphorus, phosphate; Metals (arsenic, cadmium, chromium, copper, lead, zinc, nickel, manganese, mercury, total iron, filterable iron); Polycyclic Aromatic Hydrocarbon (PAH); and Organophosphorus pesticides, phenoxy acid herbicides.</p>	<p>Administrative non-compliant The laboratory results for March 2016 and April 2017 confirmed that the suite of analytes listed as part of this commitment were assessed (with the exception of total iron, which was not assessed as part of the April 2017 monitoring event). It is recommended that total iron concentrations be assessed as part of the 12 monthly suite of analytes or that the Water Management Plan is amended to remove this requirement.</p>	<p>Action completed. All analytes are now included in the laboratory reports.</p>
<p>3.0 SOIL AND WATER / 3.3 Surface Water – Proposed Water</p>	<p>In the event that water is required to be discharged offsite, the water will be tested prior to discharge to ensure appropriate discharge criteria are met, such as Total Suspended Solids (TSS) below a</p>	<p>Non-compliant As described above (refer to Schedule 3, Condition 19 of PA 09_0175), the results of the TSS monitoring during the discharge events from Dam</p>	<p>All controlled and uncontrolled discharge events will be reported in the Annual Returns and Annual Review. Non - compliances are to be reported as per the consent and EPL requirements.</p>



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
Management System	concentration of 50 mg/L. Where this is not the case, water will be treated, for example through the use of chemical flocculation, to achieve a suitable water quality.	3 in March and April 2017 exceeded the concentration limits (40 mg/L) defined by Condition L2.4 of the quarry's EPL and 50 mg/L. It is recommended that water be treated during all future dam water discharges to achieve a suitable water quality.	KEQ will continue to monitor and treat the dam water in the future when required.
3.0 SOIL AND WATER / 3.3 Surface Water – Proposed Water Management System	In the event that an exceedance in surface water quality criteria is identified, the exceedance will need to be reported to the relevant agencies in accordance with the requirements of the EPL.	Non-compliant As described above (refer to Schedule 3, Condition 19 of PA 09_0175), the results of the water quality monitoring for pH, TSS and oil and grease during the discharge events from Dam 3 in March and April 2017 exceeded the concentration limits defined by Condition L2.4 of the quarry's EPL. These discharge events should have been reported due to the degraded water quality recorded. It is recommended that any exceedances of water quality criteria during dam water discharges are reported, in accordance with the project approval conditions and the quarry's EPL.	Noted. All controlled and uncontrolled discharge events will be reported in the Annual Returns and Annual Review. Non - compliances are to be reported as per the consent and EPL requirements.
3.0 SOIL AND WATER / 3.3 Surface Water – Proposed Water Management System	That controlled discharge of treated (e.g. flocculated) water be undertaken when total site storage levels are above 4.3 ML, which would provide the capacity to contain more rainfall events and reduce wet weather discharges (this assumes the dams are built to the capacities presented in Table 2 – refer to Appendix C).	<i>Not verified</i> It is noted that there was little free-board on Dam 1 and 3 during the site inspection. No water level gauges were observed. It is recommended that water level gauges are installed in the dams and the relationship between water levels and total volume stored is established.	KEQ is investigating options for water level gauges. It is likely that KEQ will install a water level gauge at Dam 1, Dam 2 and Dam 3 for long term monitoring.



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
4. BIODIVERSITY & CONSERVATION OFFSET / 4.1 Flora and Fauna	A report detailing the methods and results of the pre-clearing surveys will be prepared and submitted to OEH immediately prior to the commencement of the clearing operations.	<p>Administrative non-compliant</p> <p>Correspondence with T. Grugeon on 30 May 2017 confirmed that the pre-clearing surveys were undertaken as per Section 6.2 of the landscape and rehabilitation management plan, which was approved by DPE in accordance with Condition 32 of Schedule 3 of PA 09_0175. However, specific correspondence with OEH to address this commitment did not occur.</p> <p>It is recommended that the report detailing the methods and results of the pre-clearing surveys is submitted to OEH.</p>	Action completed. Reports submitted to OEH in 2017.
4. BIODIVERSITY & CONSERVATION OFFSET / 4.1 Flora and Fauna	<p><u>Site Survey and Exclusion Fencing</u></p> <p>The extraction area/forest interface will be delineated to protect retained bushland areas on Lot 12 and 13. To achieve this, the quarry footprint boundary will be surveyed and pegged by a Registered Surveyor prior to the conduct of clearing operations. Plastic mesh fencing or star pickets and flagging tape will be installed along the extraction boundary for use as exclusion fencing. The fencing will function as a clearly marked 'exclusion' boundary for the machinery operations.</p>	<p>Compliant</p> <p>During the site inspection, evidence of appropriate signage delineating the conservation offset areas from the extraction area/project area was observed. In addition, it was noted that boundary tape and plastic mesh fencing was used during the clearing process. Fencing has not yet been erected to the extent identified in this commitment, which is unclear as to whether it applies to construction as well as to operations. It was noted that long-term exclusion fencing cannot be erected until after construction has been completed.</p> <p>It is recommended that exclusion fencing be installed as soon as practicable after the completion of construction to meet this commitment.</p>	Noted. Partially completed. Exclusion chain wire fencing has been erected except along the boundary of the extraction area. The exclusion fencing will be installed as soon as it is practical in this area.



Condition Number	Condition	Compliance Status and Recommendations	KEQ Comment (March 2019)
4. BIODIVERSITY & CONSERVATION OFFSET / 4.1 Flora and Fauna	Where possible, vegetation clearing activity will be timed so as to avoid the following breeding periods for hollow dependent fauna: i) October – February (microbats); and ii) June – August (large forest owls and microbats in torpor).	Compliant Vegetation clearing for the project commenced in April 2016 and the majority of the project area was cleared between April and June 2016, with some clearing also occurring in July and November 2016. However, it is noted that the commitment is to avoid these periods "where possible" and that there will be ongoing clearing as part of the project. It is recommended that future clearing is scheduled well in advance to avoid breeding periods for hollow-dependent fauna.	Noted. KEQ has made all efforts to avoid clearing during these periods and will continue to do so in the future. Clearing and felling of identified habitat trees are supervised by ecologists.
4. BIODIVERSITY & CONSERVATION OFFSET / 4.2 Biodiversity Offset Strategy	Seasonal flora and fauna survey of the offset site will be undertaken in accordance with relevant OEH guidelines. In particular, seasonal survey for <i>Tetratheca juncea</i> and <i>Grevillea parviflora</i> ssp <i>parviflora</i> will be undertaken and reported to the NSW OEH.	Compliant No reduction in threatened flora populations was recorded at the monitoring sites in 2016. It is recommended that the results of all future seasonal surveys for <i>Tetratheca juncea</i> and <i>Grevillea parviflora</i> ssp <i>parviflora</i> be reported to OEH in accordance with this condition.	Noted. The 2018 BOA Annual Monitoring report and <i>Tetratheca juncea</i> were completed in 2019.
11.0 QUARRY CLOSURE & REHABILITATION / 11.1 Rehabilitation Management Plan	Stockpiles will be protected with sediment fencing and planted with a sterile cover crop (annual species) to ensure stabilisation. Surface drainage in the vicinity of the stockpiles will be configured so as to direct any runoff around the stockpile.	Non-compliant Stockpiles are generally protected by sediment fences. A sterile cover crop has not been planted. It is recommended that a sterile cover crop is planted on soil stockpiles in accordance with the Landscape and Rehabilitation Management Plan.	Noted. Partially completed. KEQ have seeded topsoil stockpiles with sterile crops (annual rye, millet and oats). All new topsoil stockpiles will continue to be seeded with sterile crops.