



# **ANNUAL REVIEW**

## **KARUAH EAST HARD ROCK QUARRY**

### **KARUAH, NSW**

***Review Period: 1 January, 2020 – 31 December 2020***

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**APPENDIX 6 - Water Quality Monitoring**

**APPENDIX 7 – *Tetratheca juncea* Monitoring**

**APPENDIX 8 – Audit Action Plan Status Update**

# ABBREVIATIONS

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|          |                                                                                      |
|----------|--------------------------------------------------------------------------------------|
| 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                                                             |
| POEO Act | <i>Protection of the Environment Operations Act 1997</i>                             |
| NPWS     | NSW National Parks and Wildlife Service, now part of Environment, Energy and Science |
| RFS      | NSW Rural Fire Service                                                               |
| SWMP     | Site Water Management Plan                                                           |
| tpa      | tonnes per annum                                                                     |

## **i      PURPOSE OF THE REPORT**

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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 2020 to 31 December 2020**.

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.

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>Name of Operation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Karuah East Quarry Pty Ltd                                                           |
| <b>Name of Operator</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Karuah East Quarry Pty Ltd                                                           |
| <b>Development Consent / Project Approval #</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | PA 09_0175                                                                           |
| <b>Name of holder of Development Consent / Project Approval</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Karuah East Quarry Pty Ltd                                                           |
| <b>Mining Lease #</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | None                                                                                 |
| <b>Water Licences</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | None                                                                                 |
| <b>Annual Review start date</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1 January 2020                                                                       |
| <b>Annual Review end date</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 31 December 2020                                                                     |
| <p>I, Michael Todd, 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 2020 to 31 December 2020 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: section 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> |                                                                                      |
| <b>Name of authorised reporting officer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Michael Todd                                                                         |
| <b>Title of authorised reporting officer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Quarry Manager                                                                       |
| <b>Signature of authorised reporting officer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| <b>Date</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9.4.21                                                                               |

## 1.0 STATEMENT OF COMPLIANCE

**Tables 1 - 3** outline the compliance status of the quarry operations at the end of the 2020 reporting period in accordance with relevant approval conditions. Most of these non – compliances were the result of the Independent Environmental Audit (IEA) which covers a longer period, compared to the Annual Review. Appendix 8 (Audit Action Plan) outlines the response and current status of actions. It should be noted that the Audit Action Plan also includes recommendations for compliant 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                                                                                                                                                                                                                              |
|-----------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High</b>     | Non – compliant | Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence                                                                                                                     |
| <b>Medium</b>   | Non – compliant | Non-compliance with: <ul style="list-style-type: none"> <li>potential for serious environmental consequences, but is unlikely to occur; or</li> <li>potential for moderate environmental consequences, but is likely to occur</li> </ul> |
| <b>Low</b>      | Non – compliant | Non-compliance with: <ul style="list-style-type: none"> <li>potential for moderate environmental consequences, but is unlikely to occur; or</li> <li>potential for low environmental consequences, but is likely to occur</li> </ul>     |
| <b>Admin NC</b> | 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 2 Condition 8  | Structural Adequacy             | Non-compliant     | Construction and Occupation Certificates were not available during the Independent Environmental Audit to confirm construction in accordance with relevant requirements. | Appendix 8                       |
| PA 09_0175        | Schedule 2 Condition 11 | Developer Contributions         | Non-compliant     | Records of one-off and annual council contributions were unavailable during the Independent Environmental Audit.                                                         | Appendix 8                       |

| Relevant Approval | Condition #            | Condition Description (Summary)          | Compliance Status                                          | Site Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Where Addressed in Annual Review |
|-------------------|------------------------|------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| PA 09_0175        | Schedule 3 Condition 3 | Noise Criteria                           | Non-compliant                                              | <p>See Audit Action Plan for full details of issue. Audit identified these issues:</p> <ol style="list-style-type: none"> <li>1. Instrument details and a copy of current instrument calibration certificates as required by relevant Australian Standards.</li> <li>2. Measurement results for a location representative of Residences A to E and calculated quarry noise levels to these residences, including calculation details and justification of the calculation method.</li> <li>3. Detailed assessment and reporting of modifying factors as required by relevant policies and conditions, at least including tonal and low frequency characteristics.</li> <li>4. Traffic noise measurements at the potentially most affected receptors as required by Schedule 3, Condition 4.</li> </ol> |                                  |
| PA 09_0175        | Schedule 3 Condition 4 | Road Noise Criteria                      | Non-compliant                                              | The auditor recommended that unattended monitoring charts are included in the monthly monitoring reports as required by Section 8.4 of the NMP, or revise the NMP to not require these charts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Appendix 8                       |
| PA 09_0175        | Schedule 3 Condition 6 | Noise Operating Conditions               | Non-compliant                                              | The auditor recommended carrying out a review of noise monitoring results upon receipt of each noise compliance report, to reduce response time in the event of non-compliance with criteria or other noise issues.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Appendix 8                       |
| PA 09_0175        | Schedule 3 Condition 7 | Noise Management Plan Monitoring Program | Non -compliance relating to frequency of monitoring events | The approved Noise Management Plan requires quarterly monitoring of noise, however only three monitoring events were undertaken in 2020 not four. No noise monitoring in Quarter 1, 2020.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Appendix 8                       |



| Relevant Approval | Condition #             | Condition Description (Summary)               | Compliance Status                                             | Site Comment                                                                                                                                                                                                                                                                                                                                  | Where Addressed in Annual Review |
|-------------------|-------------------------|-----------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| PA 09_0175        | Schedule 3 Condition 11 | Blast Monitoring Agreement                    | Non – Compliant                                               | The auditor recommended that Karuah East consult with relevant private landholders and seek to enter into written agreements to allow blasting within 500 m of their land.                                                                                                                                                                    | Appendix 8                       |
| PA 09_0175        | Schedule 3 Condition 13 | Depositional Dust Monitoring Frequency        | Non-compliant                                                 | Depositional dust gauge (DDG) 4 was found to be broken in early May 2020, resulting a missing monthly result for April 2020.                                                                                                                                                                                                                  | Appendix 8                       |
| PA 09_0175        | Schedule 3 Condition 19 | Surface Water Discharges                      | Non-compliance relating to exceedance of concentration limits | There were 11 TSS exceedances in 2020, five recorded at LDP001, three at LDP002 and three at LDP003, all during uncontrolled discharge. There was one exceedance of pH criteria during 2020, which occurred during uncontrolled discharge from LDP001.                                                                                        | Appendix 8                       |
| PA 09_0175        | Schedule 3 Condition 21 | Water Management Plan Monitoring Requirements | Non-compliant                                                 | It was identified during the Independent Environmental Audit that stream ecosystem health is not included in the surface water monitoring program as required by this condition.<br><br>It is recommended that Karuah East implement a program to monitor the health of local watercourses under the Water Management Plan.                   | Appendix 8                       |
| PA 09_0175        | Schedule 3 Condition 23 | Monitoring of Product Transport               | Non-compliant                                                 | It was identified during the Independent Environmental Audit that truck movements offsite are not reported quarterly on the website in accordance with this condition.<br><br>The auditor recommended that the information required under this condition is regularly reviewed and published on the Karuah East website on a quarterly basis. | Appendix 8                       |

| Relevant Approval | Condition #              | Condition Description (Summary)              | Compliance Status | Site Comment                                                                                                                                                                                                                                                                                                                                                                                 | Where Addressed in Annual Review |
|-------------------|--------------------------|----------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| PA 09_0175        | Schedule 3, Condition 27 | <i>Tetratheca Juncea</i> Translocation       | Non-compliant     | It was identified during the Independent Environmental Audit that the <i>Tetratheca Juncea</i> Translocation Management Plan does not include performance criteria or comments on general plant health, individual identification or photo point monitoring.<br><br>It is recommended that the TJTMP be updated to include performance criteria to measure the effectiveness of the program. | Appendix 8                       |
| PA 09_0175        | Schedule 3, Condition 28 | Biodiversity Offset Strategy                 | Non-compliant     | The Biodiversity Offset Strategy Finalisation letter and evidence of consultation with the former OEH and Council was not available for review at the time of Independent Environmental Audit.                                                                                                                                                                                               | Appendix 8                       |
| PA 09_0175        | Schedule 3, Condition 32 | Landscape and Rehabilitation Management Plan | Non-compliant     | It was identified during the Independent Environmental Audit that there was insufficient evidence to confirm some of the measure in the Landscape and Rehabilitation Management Plan were being implemented.                                                                                                                                                                                 | Appendix 8                       |
| PA 09_0175        | Schedule 3, Condition 33 | Biodiversity Offset Area Management Plan     | Non-compliant     | BOAMP be updated to include a three year management schedule for the period November 2018 – November 2021.                                                                                                                                                                                                                                                                                   | Appendix 8                       |
| PA 09_0175        | Schedule 3, Condition 35 | Conservation and Rehabilitation Bond         | Non-compliant     | No evidence was available at the time of audit to confirm that the Conservation and Rehabilitation Bond was reviewed within three months of the previous IEA. This is currently being completed                                                                                                                                                                                              | Appendix 8                       |
| PA 09_0175        | Schedule 4, Condition 1  | Notification of Landowners                   | Non-compliant     | It was identified during the Independent Environmental Audit that correspondence was not provided to affected landholders regarding exceedance.                                                                                                                                                                                                                                              | Appendix 8                       |

| Relevant Approval | Condition #            | Condition Description (Summary) | Compliance Status                                             | Site Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Where Addressed in Annual Review |
|-------------------|------------------------|---------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| PA 09_0175        | Schedule 5 Condition 2 | Exceedance Control Measures     | Non-compliant                                                 | <p>Evidence was not available at the time of the Independent Environmental Audit to confirm that reports were provided to DPIE which reviewed control measures and remedial actions required following identified exceedances.</p> <p>The auditor recommended that Karuah East Quarry update their communications and incident response procedures to ensure that any future exceedances of the Project Approval criteria and any implementation management controls / remediation measures are reported to DPIE at the earliest opportunity once they are identified.</p> | Appendix 8                       |
| PA 09_0175        | Schedule 5 Condition 5 | Reviews                         |                                                               | <p>No evidence was available at the time of the Independent Environmental Audit to confirm that Karuah East had reviewed strategies, plans and programs required under the approval following audit period Annual Reviews, incidents, audit reports and modifications.</p> <p>The auditor recommends that Karuah East document any reviews undertaken as required under this condition.</p>                                                                                                                                                                                | Appendix 8                       |
| EPL 20611         | Condition L1 and 2     | Surface Water Discharges        | Non-compliance relating to exceedance of concentration limits | As per Schedule 3 Condition 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Appendix 8                       |
| EPL 20611         | Condition L4.1         | Noise Monitoring                | Non-compliant                                                 | <p>Noise monitoring was not completed in Quarter 1, 2020, therefore it is not possible to determine compliance with EPL noise criteria.</p> <p>Monitoring at Locations A and B was completed in Quarter 3 and 4 in 2020, but not prior to this as there was a misunderstanding relating to noise monitoring locations.</p>                                                                                                                                                                                                                                                 | Appendix 8                       |

| Relevant Approval | Condition #    | Condition Description (Summary)                 | Compliance Status | Site Comment                                                                                                                                                                                                                                                                                                                                                                                                                    | Where Addressed in Annual Review     |
|-------------------|----------------|-------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| EPL 20611         | Condition R4.3 | Quarterly Noise Reports as per EPL requirement. | Non - compliant   | <p>The noise consultants reports and Karuah East monthly monitoring reports (prior to August 2020) include assessment of compliance with the noise limits, however they do not include:</p> <p>(a) description of the plant in operation and activities during each noise monitoring assessment; and</p> <p>(b) an outline of any management actions taken to address any exceedances."</p> <p>This has now been rectified.</p> | Covered in noise reports. Appendix 8 |
| EPL 20611         | Condition M2   | Depositional Dust Monitoring Frequency          | Non-compliant     | Depositional dust gauge (DDG) 4 was found to be broken in early May 2020, resulting a missing monthly result for April 2020.                                                                                                                                                                                                                                                                                                    | Section 6.4.3                        |

## 2.0 INTRODUCTION

This Annual Review covers the reporting period from the **1 January 2020** to **31 December 2020** for the Karuah East Quarry. **Figure 1** presents the Karuah East Quarry site plan and layout.

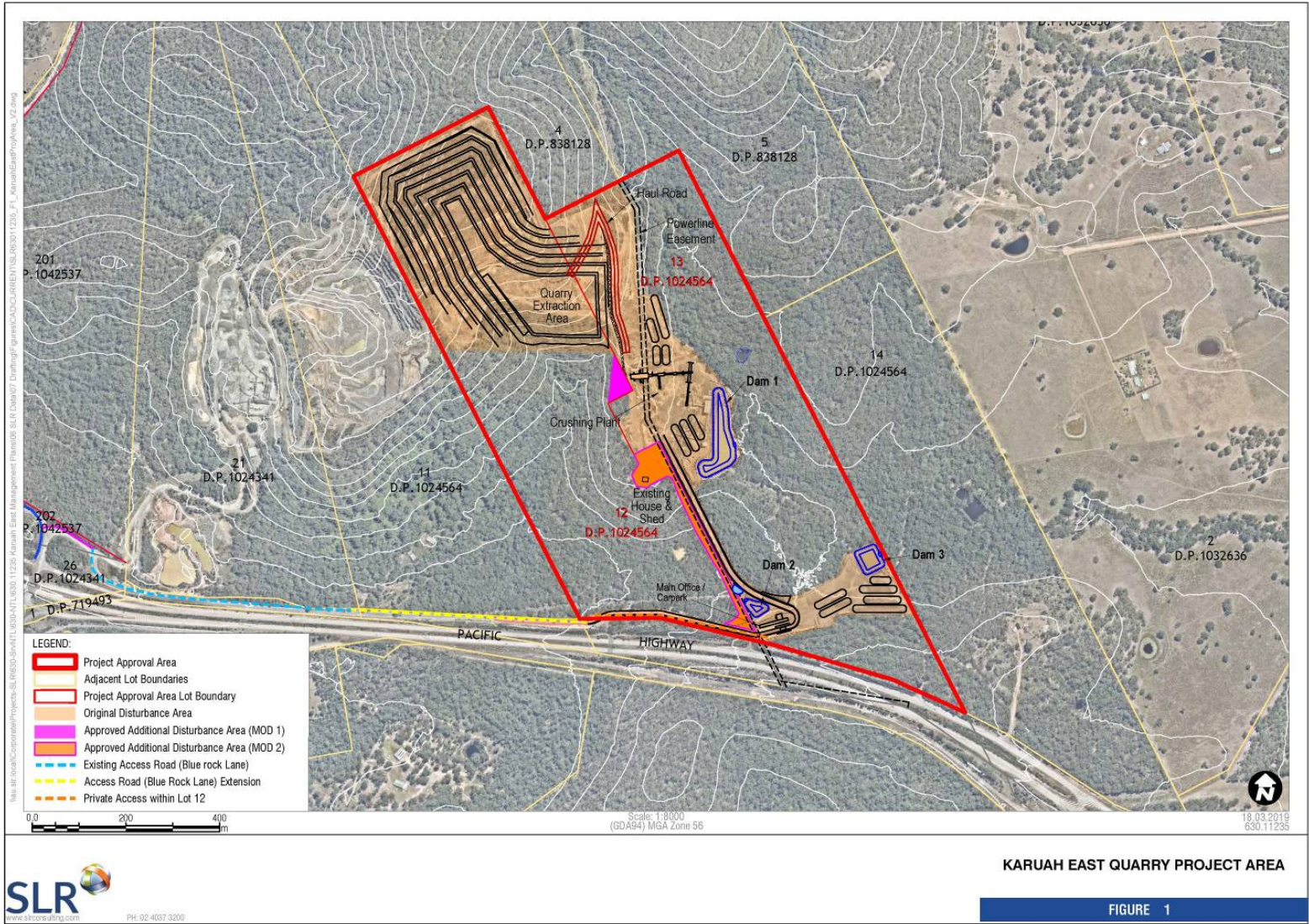
### 2.1 Project Overview

Karuah East Quarry is a hard rock quarry which contributes materials to construction industries in the Hunter Region. The site is located on Blue Rock Close, off the Pacific Highway, approximately 3 km north-east of Karuah, NSW. The Karuah East Quarry site covers approximately 33 hectares within Lots 12 and 13 of DP 1024564. 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 m<sup>3</sup> 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;
- Drilling and blasting activities;
- Loading and hauling of extracted material;
- Crushing and screening of extracted material;
- Stockpiling of material onsite; and
- Location of plant on Lot 13 comprised of office buildings, workshops, parking areas, crushing plant, wash plant, weigh bridge and product storage areas.



Figure 1 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 summarised in **Table 4**.

**Table 4 - 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>      |

### 3.1 PA 09\_0175

PA 09\_0175 has been modified three times, Modification 1, Modification 2 and Modification 8. A copy of the consolidated consent is attached as **Appendix 1**. Note that Modifications 3 to 7 proposed vegetation clearing and administrative changes, however these were not progressed and have been withdrawn.

#### 3.1.1 Modification 1

Modification 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 2,500m<sup>2</sup> as shown in **Figure 1**.

#### 3.1.2 Modification 2

Modification 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**.

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

Approval for MOD 8 was received on 22 December 2020. Further details around the changes to noise criteria and additional acoustic measures are included in **Section 6.2**.

### 3.2 EPBC 2014/7278

Federal Approval (EPBC 2014/7282) for the Karuah East Quarry was granted on 20 March 2015. A copy of this approval is attached in **Appendix 1**.

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/>.

### 3.3 EPL 20611

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.

**Table 5 - 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  |

No variations were made to EPL 20611 in 2020. EPL 20611 will be varied in 2021 to reflect the changes to noise criteria as a result of the approval of MOD 8.

### 3.4 Management Plans

The site operates under a series of approved environmental management plans, which are listed in **Table 6**.

**Table 6 – Karuah East Quarry Management Plan Status**

| Management Plan                                | Status                                                                                                                                  |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Management Strategy              | Originally approved in 2015.<br>Updated in 2019 for MOD 2.<br>Reviewed in 2020 and will be updated in 2021 following approval of MOD 8. |
| Air Quality and Greenhouse Gas Management Plan | Originally approved in 2015.<br>Updated in 2019 for MOD 2.                                                                              |
| Biodiversity Offset Management Plan            | Originally approved in March 2016<br>Latest update in October 2018                                                                      |
| Blast Management Plan                          | Originally approved in 2015<br>Updated in 2019 for MOD 2.                                                                               |
| Heritage Management Plan                       | Originally approved in 2015                                                                                                             |
| Landscape and Rehabilitation Management Plan   | Originally approved in 2015<br>Approved in March 2020.                                                                                  |
| Nosie Management Plan                          | Originally approved in 2015<br>Updated in 2019 for MOD 2                                                                                |
| Traffic Management Plan                        | Originally approved in 2015                                                                                                             |



| Management Plan                             | Status                                                   |
|---------------------------------------------|----------------------------------------------------------|
| Water Management Plan                       | Originally approved in 2015<br>Updated in 2019 for MOD 2 |
| <i>Tetratheca juncea</i> Translocation Plan | Originally approved in 2015                              |

### 3.5 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 former 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 Applicant must review the environmental performance of the development to the satisfaction of the Planning Secretary. This review must:</i><br><br><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>                                                                                                                                      | This document.<br>Annual Review |
| Schedule 5, Condition 4(b) | <i>(b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against:</i><br><br><ul style="list-style-type: none"> <li><i>the relevant statutory requirements, limits or performance measures/criteria;</i></li> <li><i>the monitoring results of previous years; and</i></li> <li><i>the relevant predictions in the documents referred to in condition 2(d) of Schedule 2 of this consent;</i></li> </ul> | Section 6                       |
| Schedule 5, Condition 4(c) | <i>(c) 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(d) | <i>(d) identify any trends in the monitoring data over the life of the development;</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Section 6                       |
| Schedule 5, Condition 4(e) | <i>(e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and</i>                                                                                                                                                                                                                                                                                                                                                                | Section 6                       |
| Schedule 5, Condition 4(f) | <i>(f) describe the measures that would be implemented over the current calendar year to improve the environmental performance of the development.</i>                                                                                                                                                                                                                                                                                                                                                                                  | Section 12                      |

## 4.0 OPERATIONS SUMMARY

The following section briefly describes the general operation and environmental performance of Karuah East Quarry during this 2020 reporting period.

### 4.1 Land Preparation

During the reporting period there was approximately no land clearing. Approximately 1.25 ha within the quarry footprint is scheduled for clearance in 2021.

### 4.2 Construction Activities

No construction activities were completed at Karuah East Quarry during the 2020 reporting period.

### 4.3 Quarry Operations

Operations during 2020 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 - Monthly Production Summary (tonnes)**

| Month         | Monthly total (tonnes) |
|---------------|------------------------|
| Jan           | 49,927                 |
| Feb           | 68,683                 |
| Mar           | 68,002                 |
| Apr           | 58,026                 |
| May           | 78,222                 |
| Jun           | 82,156                 |
| Jul           | 70,152                 |
| Aug           | 49,770                 |
| Sep           | 70,712                 |
| Oct           | 77,078                 |
| Nov           | 80,509                 |
| Dec           | 83,032                 |
| <b>Total:</b> | <b>836,269</b>         |

Project Approval 09\_0175 permits the extraction of up to 1.5 million tonnes per annum from Karuah East Quarry. Although the annual production is a significant increase from the 305,031 tonnes produced in 2019, the 2020 production total was still significantly below the annual limit.



**Photo 1 –Crushing Plant (January 2021)**



**Photo 2 –Dam 1 (January 2021)**





**Photo 3 –View from top of quarry (January 2021)**

#### **4.4 Operating Hours**

In accordance with Schedule 2, Condition 7 of the PA 09\_0175, Karuah East Quarry operates during the approved operating hours listed in **Table 9**:

**Table 9 - Approved Operating Hours**

| <b>Activity</b>         | <b>Operating Hours</b>                                                                                                                                                                                |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quarrying Operations    | 7.00 am to 6.00 pm, Monday to Friday; and<br>7.00 am to 1.00 pm, Saturdays.<br>No quarrying operations on Sundays or Public Holidays                                                                  |
| Construction activities | 7.00 am to 6.00 pm, Monday to Friday; and<br>8.00 am to 1.00 pm, Saturdays.<br>Unless noise from the activities does not exceed 40 dB(A) $L_{Aeq}(15\text{minute})$ 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.*

During the reporting period, Karuah East were contacted by Central Coast Council to supply material for emergency beach erosion works at Wamberal. The quarry operated outside of approved hours on 22 and 23 July 2020, as approved by DPIE's Matthew Sprott in a letter dated 22 July 2020. This out of hours operation was permitted by the note associated with Schedule 2 Condition 7 of PA 09\_0175 (see **Table 9**).

## 4.5 Operating Equipment

When operational during the 2020 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 2021. |

## 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 2019 Annual Review was resubmitted in June 2020 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 |
|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| <b>Karuah East Commitments from 2019 Annual Review</b>                                            |                                                                                                                                                                |                                  |
| Continue environmental monitoring in accordance with management plans and approval requirements   | Ongoing. To be continued in 2021                                                                                                                               | Section 6<br>Section 7           |
| Continue CCC and community support                                                                | Ongoing. To be continued in 2021.                                                                                                                              | Section 9                        |
| Continue to update the website with monitoring data and key environment and community information | Ongoing. To be continued in 2021.                                                                                                                              | Section 9                        |
| Complete Independent Environmental Audit                                                          | Complete. An Independent Environmental Audit was completed by Hansen Bailey in October 2020 and Karuah East have prepared a Response to Audit Recommendations. | Section 10<br>Appendix 8         |

## 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 development, the Applicant 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.*

A 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**.

**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-20 | 25.1         | 14.5          | 45.6          | 88.8       | 49.4           | 8                   | 49.7                 |
| Feb-20 | 23.0         | 12.5          | 43.8          | 286.6      | 105.2          | 12                  | 66.3                 |
| Mar-20 | 20.5         | 12.1          | 38.4          | 116.2      | 24.4           | 13                  | 49.7                 |
| Apr-20 | 18.0         | 7.3           | 30.3          | 38.8       | 10.0           | 7                   | 58.0                 |
| May-20 | 13.4         | 2.8           | 26.3          | 129.6      | 65.6           | 12                  | 66.3                 |
| Jun-20 | 12.2         | 4.0           | 24.1          | 74.8       | 23.4           | 6                   | 45.0                 |
| Jul-20 | 11.5         | 0.7           | 23.3          | 164.4      | 71.4           | 12                  | 53.3                 |
| Aug-20 | 12.0         | 0.9           | 27.2          | 36.4       | 21.0           | 5                   | 110.0                |
| Sep-20 | 16.0         | 4.0           | 31.8          | 35.4       | 15.8           | 6                   | 52.1                 |
| Oct-20 | 18.8         | 7.0           | 34.1          | 355.2      | 217.2          | 8                   | 54.4                 |
| Nov-20 | 21.0         | 8.5           | 42.1          | 39.2       | 26.2           | 5                   | 65.1                 |
| Dec-20 | 21.8         | 11.9          | 34.8          | 171.6      | 41.2           | 14                  | 49.7                 |

Average monthly temperatures during the reporting period ranged from 11.5 degrees Celsius (°C) to 25.1°C, with a maximum temperature of 45.6°C recorded in January 2020. Total monthly rainfall ranged from 35.4 mm to 355.2 mm per month, with the maximum daily rainfall recorded at 217.2 mm in October 2020. The total rainfall for 2020 was 1537 mm as compared with 775 mm in 2019. The maximum wind gust was recorded in August 2020 with a result of 110 km per hour.

## 6.2 Noise

### 6.2.1 EIS / Preferred Project Report Predictions

As part of the *Noise and Blasting Impact Assessment (SLR, 2012)*, noise levels were 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                                               |

### 6.2.2 Noise Criteria

#### PA 09\_0175

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

*The Applicant must ensure that the operational noise generated by the development does not exceed the criteria in **Table 14** at any residence on privately owned land. Noise generated by the development must be monitored and measured in accordance with the relevant procedures and modifications (including certain meteorological conditions) of the NSW Noise Policy for Industry 2017.*



**Table 14 - Operational Noise Criteria (dBA LAeq(15minute))**

| Location                              | Criteria (day) |
|---------------------------------------|----------------|
| <i>Residence on Lot 11 DP 1024564</i> | 43             |
| <i>A</i>                              | 40             |
| <i>B</i>                              | 37             |
| <i>G</i>                              | 38             |
| <i>All other residences</i>           | 35             |

Note 1: Day period defined as Monday to Saturday 7am to 6pm, Sunday and Public Holidays 8am to 6pm

From 22 December 2020, the criteria in **Table 15** applies to noise monitoring at Karuah East following the approval of MOD 8.

**Table 15 - Operational Noise Criteria (dBA LAeq(15minute) MOD 8 (from 22 December 2020))**

| Location                    | Criteria (day) |
|-----------------------------|----------------|
| <i>A</i>                    | 42             |
| <i>G</i>                    | 43             |
| <i>H</i>                    | 45             |
| <i>All other residences</i> | 40             |

Note 1: Day period defined as Monday to Saturday 7am to 6pm, Sunday and Public Holidays 8am to 6pm

The noise criteria in **Table 14** and **Table 15** does not apply if the Proponent has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

#### **EPL Condition L4**

The noise limits set out in Condition L4.1 of the EPL 20611 are reproduced in **Table 16** are generally consistent with the criteria detailed in PA 09\_0175.

**Table 16 - 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                                   |

EPL 20611 will be varied in 2021 to reflect the changes to noise criteria as a result of the approval of MOD 8. The criteria in **Table 16** continue to apply for the 2020 reporting period.

#### **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*”.

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.

### 6.2.3 Key Environmental Performance or Management Issues

Both attended and unattended noise monitoring has been conducted at the nearest residential receivers to the quarry during the 2020 reporting period. A summary of the results are provided in **Tables 17 to 22**, with full copies of the noise monitoring reports (Thearle Acoustics) appended to this Annual Review (**Appendix 4**).

The approved *Noise Management Plan* includes a noise monitoring program as required by Schedule 3, Condition 7 of PA 09\_0175. Quarterly monitoring is required, however only three monitoring events were undertaken in 2020 (April, June, and November) due to unfavourable weather and scheduling issues.

#### 6.2.3.1 Attended Noise Monitoring

##### April 2020 Operational Noise Monitoring

**Table 17 - Operator Attended Noise Survey Results (18 April 2020)**

| Date/Start Time<br>Weather                      | Primary Noise Descriptor<br>(dBA re 20 µPa) |                 |                  |                  |                  | Description of Noise Emission and Typical<br>Maximum Levels<br>L <sub>Amax</sub> – dBA                                          |
|-------------------------------------------------|---------------------------------------------|-----------------|------------------|------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------|
|                                                 | L <sub>Amax</sub>                           | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>Aeq</sub> |                                                                                                                                 |
| Location F<br>18/04/2020 11:35 PM<br>W = 10 kph | 78                                          | 59              | 46               | 40               | 51               | Pacific Highway 45-50<br>Insects 40-45<br>Birds 45-50<br>Airplane 45<br>Local Traffic 60<br><b>Karuah East Quarry Inaudible</b> |
| Location G<br>18/04/2020 10:15 PM<br>W = 10 kph | 64                                          | 49              | 45               | 41               | 44               | Reversing Alarm 35<br>Trucks 38-40<br>Pacific Highway 40<br>Birds 50<br><b>Karuah East Quarry Inaudible</b>                     |

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

Karuah East operational activities were found to be inaudible at Location F and G, therefore results were found to be within the relevant consent condition criteria during April 2020 noise monitoring.

### June 2020 Operational Noise Monitoring

**Table 18 - Operator Attended Noise Survey Results (June 2020)**

| Date/Start Time<br>Weather                    | Primary Noise Descriptor<br>(dBA re 20 µPa) |     |      |      |      | Description of Noise Emission and Typical<br>Maximum Levels<br>LAmax – dBA                               |
|-----------------------------------------------|---------------------------------------------|-----|------|------|------|----------------------------------------------------------------------------------------------------------|
|                                               | LAmax                                       | LA1 | LA10 | LA90 | LAeq |                                                                                                          |
| Location A<br>15/06/2020 1:15 PM<br>W = calm  | 72                                          | 69  | 65   | 57   | 63   | Pacific Highway 50-70<br><b>Karuah East Quarry Inaudible</b>                                             |
| Location B<br>15/06/2020 1:45 PM<br>W = calm  | 76                                          | 73  | 69   | 60   | 66   | Pacific Highway 45-52<br>Birds 45-50<br>Aeroplane 45<br><b>Karuah East Quarry Inaudible</b>              |
| Location F<br>15/06/2020 2:15 PM<br>W = calm  | 76                                          | 66  | 61   | 52   | 58   | Pacific Highway 50-60<br>Exhaust breaks 75<br>Local Traffic 60-70<br><b>Karuah East Quarry Inaudible</b> |
| Location G<br>15/06/2020 12:30 PM<br>W = Calm | 69                                          | 66  | 58   | 43   | 54   | Insects 35<br>Pacific Highway 45<br>Dogs barking 45-65<br><b>Karuah East Project Inaudible</b>           |

Karuah East operational activities were found to be inaudible at Location A, B, F and G, therefore, results were found to be within the relevant consent condition criteria during June 2020 noise monitoring.

### November 2020 Noise Monitoring

**Table 19 - Operator Attended Noise Survey Results (Nov 2020)**

| Date/Start Time<br>Weather                    | Primary Noise Descriptor<br>(dBA re 20 µPa) |     |      |      |      | Description of Noise Emission and Typical<br>Maximum Levels<br>LAmax – dBA  |
|-----------------------------------------------|---------------------------------------------|-----|------|------|------|-----------------------------------------------------------------------------|
|                                               | LAmax                                       | LA1 | LA10 | LA90 | LAeq |                                                                             |
| Location A<br>04/11/2020 10:40 AM<br>W = calm | 58                                          | 54  | 47   | 41   | 44   | Birds 35-40<br><b>Karuah East Quarry Inaudible</b>                          |
| Location B<br>04/11/2020 11:35 AM<br>W = calm | 75                                          | 70  | 66   | 57   | 63   | Pacific Highway 55-65<br>Birds 40-45<br><b>Karuah East Quarry Inaudible</b> |

|                                               |    |    |    |    |    |                                                                             |
|-----------------------------------------------|----|----|----|----|----|-----------------------------------------------------------------------------|
| Location F<br>04/11/2020 12:44 PM<br>W = Calm | 76 | 60 | 48 | 40 | 49 | Birds 40<br>Local Traffic 50-55<br><b>Karuah East Project Inaudible</b>     |
| Location G<br>04/11/2020 10:00 PM<br>W = Calm | 59 | 50 | 42 | 36 | 41 | Birds 30-35<br>Pacific Highway 35-40<br><b>Karuah East Quarry Inaudible</b> |

Karuah East operational activities were found to be inaudible at Location A, B, F and G, therefore, results were found to be within the relevant consent condition criteria during November 2020 noise monitoring.

### 6.2.3.2 Unattended Noise Monitoring

Unattended noise monitoring was conducted at location G during the reporting period. **Table 20** to **Table 22** outline unattended noise monitoring results.

**Table 20 - Unattended Continuous Monitoring Ambient Noise Levels (April 2020)**

| INP Period        | LA1 | LA10 | LA90 | LA <sub>eq</sub> |
|-------------------|-----|------|------|------------------|
| <b>Location G</b> |     |      |      |                  |
| Daytime           | 58  | 51   | 38   | 49               |
| Evening           | 60  | 55   | 44   | 51               |
| Night             | 56  | 48   | 38   | 49               |

**Table 21 - Unattended Continuous Monitoring Ambient Noise Levels – Operations (June 2020)**

| INP Period        | LA1 | LA10 | LA90 | LA <sub>eq</sub> |
|-------------------|-----|------|------|------------------|
| <b>Location G</b> |     |      |      |                  |
| Daytime           | 61  | 51   | 37   | 54               |
| Evening           | 55  | 51   | 37   | 48               |
| Night             | 52  | 48   | 34   | 45               |

**Table 22 - Unattended Continuous Monitoring Ambient Noise Levels – Operations (Nov 2020)**

| INP Period        | LA1 | LA10 | LA90 | LA <sub>eq</sub> |
|-------------------|-----|------|------|------------------|
| <b>Location G</b> |     |      |      |                  |
| Daytime           | 56  | 49   | 41   | 49               |
| Evening           | 57  | 50   | 41   | 48               |
| Night             | 52  | 48   | 37   | 46               |

Thearle Acoustics concluded that Karuah East was compliant during the reporting period.

### 6.2.3.3 Noise Summary 2020

Noise levels were within the consent condition criteria in **Table 14** at all locations during the monitoring period. Noise levels in 2021 will be monitored against the criteria in **Table 15**.

There however two issues relating to noise monitoring in 2020, with these being:

- Unfortunately there was no noise monitoring in Quarter 1 2020; and
- Monitoring at Locations A and B was completed in Quarter 3 and 4 in 2020, but not prior to this as there was a misunderstanding relating to noise monitoring locations. DPIE had approved monitoring not to be undertaken at locations A and B through approval of the Noise Management Plan with the reason being the heavy influence noise from the Pacific Highway. However, no EPL variation was sought to remove Locations A and B. as previously outlined noise monitoring is now completed at Locations A and B.

### 6.2.4 Management Measures

The following best practice noise control measures were implemented in 2020:

- 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.

### 6.2.5 Proposed Improvements to Management Measures

The *Noise Management Plan* will be updated in 2021 to reflect the approval of MOD 8.

## 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 23**.

**Table 23 - Project Approval Blasting Criteria**

| Location                                                            | Airblast overpressure<br>(dB (Lin Peak)) | Ground<br>Vibration<br>(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 28 blasts during the reporting period at Karuah East Quarry. The results of the blast monitoring undertaken are contained in **Table 24**. The location of monitoring undertaken at Location B is shown in **Appendix 3**.

**Table 24 - Blast Results 2020 at Monitor 2 (Location B)**

| Date                      | Time     | Overpressure dB(L) | Vibration |
|---------------------------|----------|--------------------|-----------|
| Thursday 16 January 2020  | 12:35 PM | n/t                | n/t       |
| Wednesday 5 February 2020 | 12:28 PM | 113.3              | 0.86      |
| Friday 14 February 2020   | 12:28 PM | 101.7              | 0.7       |
| Thursday 20 February 2020 | 12:55 PM | 114.8              | 0.72      |
| Tuesday 10 March 2020     | 12:32 PM | 112.0              | 0.59      |
| Friday 27 March 2020      | 12:31 PM | n/t                | n/t       |
| Thursday 9 April 2020     | 1:55 PM  | n/t                | n/t       |
| Friday 24 April 2020      | 1:30 PM  | 111.6              | 0.69      |
| Thursday 7 May 2020       | 12:30 PM | n/t                | n/t       |
| Friday 22 May 2020        | 12:26 PM | n/t                | n/t       |
| Thursday 4 June 2020      | 12:30 PM | n/t                | n/t       |
| Tuesday 16 June 2020      | 12:30 PM | 111.1              | 0.62      |

| Date                       | Time     | Overpressure dB(L) | Vibration |
|----------------------------|----------|--------------------|-----------|
| Monday 22 June 2020        | 12:30 PM | n/t                | n/t       |
| Tuesday 30 June 2020       | 12:30 PM | n/t                | n/t       |
| Friday 10 July 2020        | 2:01 PM  | 109.8              | 0.55      |
| Friday 31 July 2020        | 1:56 PM  | n/t                | n/t       |
| Friday 14 August 2020      | 12:28 PM | n/t                | n/t       |
| Wednesday 26 August 2020   | 12:29 PM | n/t                | n/t       |
| Friday 4 September 2020    | 12:29 PM | n/t                | n/t       |
| Monday 14 September 2020   | 12:23 PM | n/t                | n/t       |
| Friday 18 September 2020   | 12:30 PM | n/t                | n/t       |
| Friday 9 October 2020      | 12:27 PM | n/t                | n/t       |
| Tuesday 20 October 2020    | 12:27 PM | n/t                | n/t       |
| Monday 9 November 2020     | 12:28 PM | n/t                | n/t       |
| Wednesday 25 November 2020 | 11:28 PM | n/t                | n/t       |
| Tuesday 1 December 2020    | 12:28 PM | n/t                | n/t       |
| Friday 11 December 2020    | 12:27 PM | n/t                | n/t       |
| Friday 18 December 2020    | 11:53 AM | n/t                | n/t       |

n/t = Not triggered

During the 2020 Annual Review reporting period:

- No blasts exceeded 120 dBL;
- All blasts were below 115 dBL at the nearest residential dwelling or privately-owned land); 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 Location 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 7 to 9 of PA 09\_0175 and have been reproduced in **Table 25**, **Table 26**, and **Table 27**. 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 development do not exceed the criteria in **Table 25** to **Table 27** at any residence on privately owned land.

**Table 25 - Long-term impact assessment criteria for particulate matter**

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

**Table 26 - Short-term impact assessment criteria for particulate matter**

| Pollutant                                      | Averaging Period | <sup>d</sup> Criterion            |
|------------------------------------------------|------------------|-----------------------------------|
| Particulate matter < 10 µm (PM <sub>10</sub> ) | 24 hour          | <sup>a</sup> 50 µg/m <sup>3</sup> |

**Table 27 - Long-term impact assessment criteria for deposited dust**

| Pollutant                   | Averaging Period | Maximum increase in deposited dust level | Maximum total deposited dust level     |
|-----------------------------|------------------|------------------------------------------|----------------------------------------|
| <sup>c</sup> Deposited dust | Annual           | <sup>b</sup> 2 g/m <sup>2</sup> /month   | <sup>a</sup> 4 g/m <sup>2</sup> /month |

Notes to Table 25 to Table 27 above:

- Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).
- Incremental impacts (i.e. incremental increase in concentrations due to the development 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 Planning Secretary in consultation with EPA.

No specific limit conditions are specified for air quality emissions in EPL 20611.

### 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 28**. The location of the depositional dust gauges is shown in **Appendix 3**.

**Table 28 - Depositional Dust Monitoring Summary (g/m<sup>2</sup>/month)**

| Date                    | DDG 1      | DDG 2          | DDG 3          | DDG 4      | DDG 5          |
|-------------------------|------------|----------------|----------------|------------|----------------|
| 12/12/2019 – 3/01/2020  | 2.0        | 2.7            | 1.9            | 2.0        | 2.8            |
| 13/01/2020 – 13/02/2020 | 3.4        | 1.6            | 2.3            | 3.5        | 3.5            |
| 13/02/2020 – 12/03/2020 | 1.7        | 1.5            | 0.7            | 0.9        | 1.6            |
| 12/03/2020 – 9/04/2020  | 0.8        | 0.8            | 0.5            | 0.1        | 0.5            |
| 9/04/2020 – 7/05/2020   | 1.2        | 0.9            | 1.0            | -*         | 1.3            |
| 7/05/2020 – 4/06/2020   | 0.2        | 0.3            | 0.3            | 0.7        | 0.1            |
| 4/06/2020 – 2/07/2020   | 0.1        | 0.2            | 0.3            | 0.3        | 0.3            |
| 2/07/2020 – 31/07/2020  | 0.2        | <0.1           | 0.2            | 0.6        | <0.1           |
| 31/07/2020 – 1/09/2020  | 0.4        | 0.2            | 0.4            | 1          | <0.1           |
| 1/09/2020 – 1/10/2020   | 0.6        | 0.5            | 0.4            | 1.0        | 1.0            |
| 1/10/2020 – 2/11/2020   | 0.2        | <0.1           | 1.3            | 0.7        | 0.6            |
| 2/11/2020 – 3/12/2020   | 3.2        | 2.3            | 0.8            | 0.7        | <b>4.7</b>     |
| 3/12/2020 – 4/01/2021   | 0.3        | 0.5            | <0.1           | 0.4        | 1.5            |
| <b>Annual Average</b>   | <b>1.1</b> | <b>0.9</b>     | <b>0.8</b>     | <b>1.0</b> | <b>1.4</b>     |
| <b>Minimum</b>          | <b>0.1</b> | <b>&lt;0.1</b> | <b>&lt;0.1</b> | <b>0.1</b> | <b>&lt;0.1</b> |
| <b>Maximum</b>          | <b>3.4</b> | <b>2.7</b>     | <b>2.3</b>     | <b>3.5</b> | <b>4.7</b>     |

\* Broken dust gauge resulting in missing result

There was one elevated result at DDG 5 of 4.7 g/m<sup>2</sup>/month in November 2020, however all dust gauges were below the annual average for Karuah East Quarry during the reporting period.

DDG 4 was discovered broken in May 2020, resulting in no depositional dust result for the April 2020. As monthly monitoring is required by EPL 20611, Karuah East reported the missing result to the DPIE on 15 May 2020. DPIE did not require any further action. All other depositional dust gauges recorded a compliant result for April 2020.

#### High Volume Air Sampler

EPL 20611 Condition M2.2 and the *Air Quality Management Plan* (required by PA 09\_0175 Schedule 3 Condition 16) requires monitoring of TSP and PM<sub>10</sub> every 6 days. **Table 29** outlines the High Volume Air Sampler (HVAS) results during the 2020 reporting period.

Table 29 - High Volume Air Sampler Results ( $\mu\text{g}/\text{m}^3$ )

| Date             | TSP ( $\mu\text{g}/\text{m}^3$ ) | PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ ) | Comments |
|------------------|----------------------------------|-----------------------------------------------|----------|
| 3 January 2020   | 49                               | 26                                            |          |
| 9 January 2020   | 45                               | 30                                            |          |
| 15 January 2020  | 32                               | 14                                            |          |
| 21 January 2020  | 66                               | 32                                            |          |
| 27 January 2020  | 47                               | 25                                            |          |
| 2 February 2020  | 57                               | 29                                            |          |
| 8 February 2020  | 26                               | 16                                            |          |
| 14 February 2020 | 22                               | 15                                            |          |
| 20 February 2020 | 31                               | 16                                            |          |
| 26 February 2020 | 36                               | 16                                            |          |
| 3 March 2020     | 34                               | 14                                            |          |
| 9 March 2020     | 21                               | 7                                             |          |
| 15 March 2020    | 23                               | 10                                            |          |
| 21 March 2020    | 38                               | 18                                            |          |
| 27 March 2020    | 20                               | 9                                             |          |
| 2 April 2020     | 51                               | 17                                            |          |
| 8 April 2020     | 13                               | 10                                            |          |
| 14 April 2020    | 27                               | 12                                            |          |
| 20 April 2020    | 18                               | 11                                            |          |
| 26 April 2020    | 27                               | 15                                            |          |
| 2 May 2020       | 15                               | 7                                             |          |
| 8 May 2020       | 29                               | 16                                            |          |
| 14 May 2020      | 9                                | 4                                             |          |
| 20 May 2020      | 16                               | 8                                             |          |
| 26 May 2020      | 15                               | 8                                             |          |
| 1 June 2020      | 12                               | 6                                             |          |
| 7 June 2020      | 15                               | 11                                            |          |
| 13 June 2020     | 8                                | 3                                             |          |
| 19 June 2020     | 17                               | 8                                             |          |
| 25 June 2020     | 5                                | 1                                             |          |
| 1 July 2020      | 32                               | 21                                            |          |
| 7 July 2020      | 13                               | 7                                             |          |
| 13 July 2020     | 5                                | 4                                             |          |
| 19 July 2020     | 5                                | 3                                             |          |
| 25 July 2020     | 12                               | 6                                             |          |
| 31 July 2020     | 18                               | 12                                            |          |
| 6 August 2020    | 13                               | 5                                             |          |

| Date                  | TSP ( $\mu\text{g}/\text{m}^3$ ) | PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ ) | Comments |
|-----------------------|----------------------------------|-----------------------------------------------|----------|
| 12 August 2020        | 9                                | 4                                             |          |
| 18 August 2020        | 8                                | 2                                             |          |
| 24 August 2020        | 13                               | 4                                             |          |
| 30 August 2020        | 15                               | 14                                            |          |
| 5 September 2020      | 15                               | 10                                            |          |
| 11 September 2020     | 7                                | 3                                             |          |
| 17 September 2020     | 27                               | 17                                            |          |
| 23 September 2020     | 25                               | 13                                            |          |
| 29 September 2020     | 10                               | 8                                             |          |
| 5 October 2020        | 29                               | 16                                            |          |
| 11 October 2020       | 16                               | 9                                             |          |
| 17 October 2020       | 40                               | 20                                            |          |
| 23 October 2020       | 25                               | 13                                            |          |
| 29 October 2020       | 9                                | 7                                             |          |
| 4 November 2020       | 14                               | 10                                            |          |
| 10 November 2020      | 8                                | 7                                             |          |
| 16 November 2020      | 36                               | 21                                            |          |
| 22 November 2020      | 24                               | 19                                            |          |
| 28 November 2020      | 27                               | 16                                            |          |
| 4 December 2020       | 28                               | 16                                            |          |
| 10 December 2020      | 33                               | 17                                            |          |
| 16 December 2020      | 47                               | 16                                            |          |
| 22 December 2020      | 10                               | 8                                             |          |
| 28 December 2020      | 22                               | 15                                            |          |
| 3 January 2021        | 10                               | 10                                            |          |
| <b>Annual Average</b> | <b>23</b>                        | <b>12</b>                                     |          |
| <b>Minimum</b>        | <b>5</b>                         | <b>1</b>                                      |          |
| <b>Maximum</b>        | <b>66</b>                        | <b>32</b>                                     |          |

**Notes:**

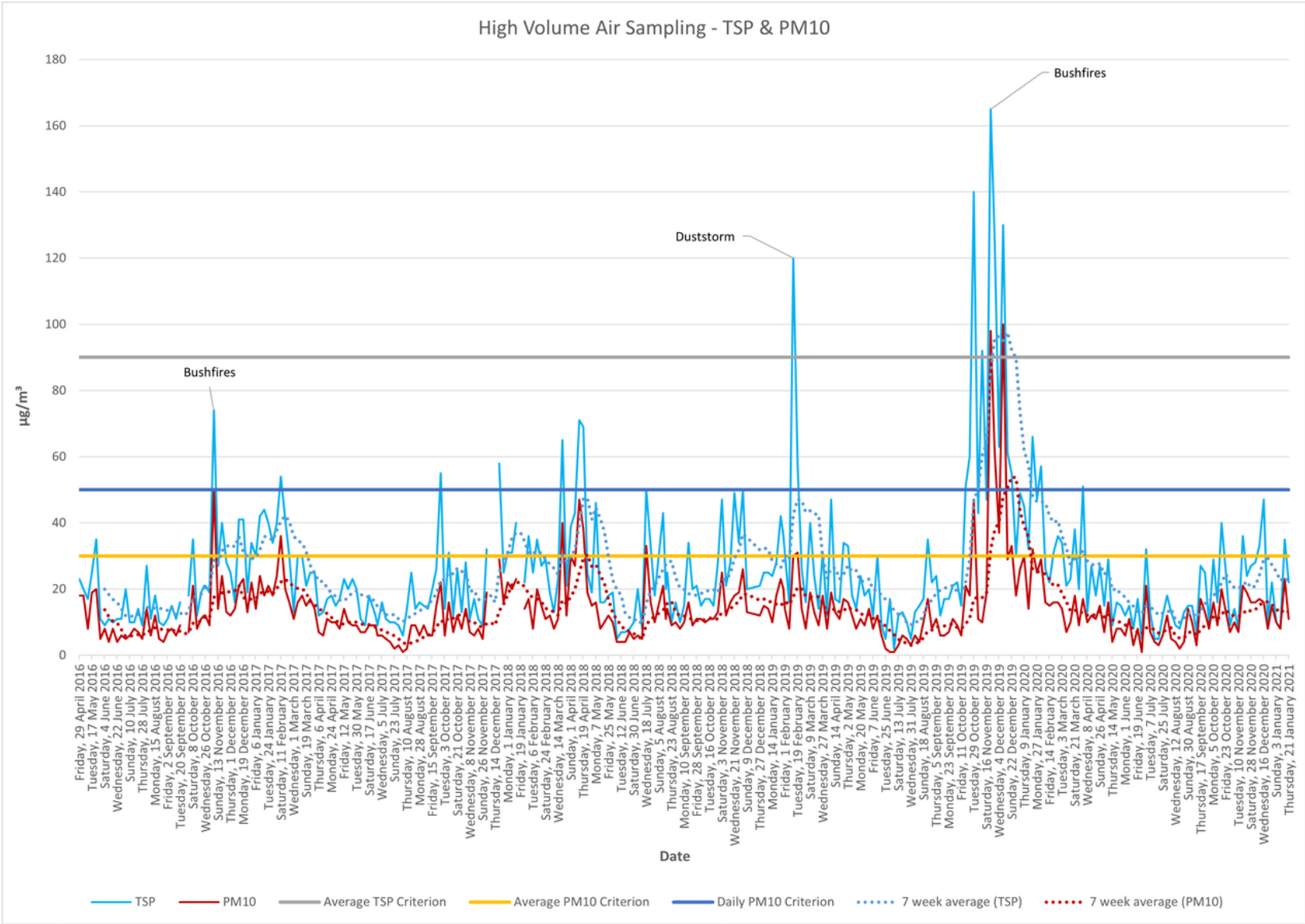
- <sup>1</sup>= Maximum criteria as specified in PA 09\_0175

The TSP average during 2019 was 23  $\mu\text{g}/\text{m}^3$ , well below the annual average criteria of 90  $\mu\text{g}/\text{m}^3$ . There was an decrease of 12.7  $\mu\text{g}/\text{m}^3$  from the 2019 TSP average. The highest short-term TSP result for the reporting period was 66  $\mu\text{g}/\text{m}^3$  which occurred in the 21 January 2020 sample. The highest TSP reading has decrease from a maximum reading of 165  $\mu\text{g}/\text{m}^3$  recorded in December 2019.

The annual average for PM<sub>10</sub> ( $\mu\text{g}/\text{m}^3$ ) was 12  $\mu\text{g}/\text{m}^3$  well below the long-term impact assessment criteria of 30  $\mu\text{g}/\text{m}^3$ . This was a decrease from the average PM<sub>10</sub> result of 17  $\mu\text{g}/\text{m}^3$  from 2019. The maximum PM<sub>10</sub> result recorded during 2020 was 32  $\mu\text{g}/\text{m}^3$  significantly less than the 100  $\mu\text{g}/\text{m}^3$  recorded during 2019.

The short-term impact assessment criteria of 50  $\mu\text{g}/\text{m}^3$  was not exceeded during 2020. Long term trends are shown on **Figure 2**.

Figure 2 High Volume Air Sampling – Long-term Trends



#### 6.4.4 Management Measures

During 2020, an additional Polo Citrus system (a concentrated citrus-based product) was installed at the secondary crusher of Karuah East Quarry to manage dust generated by the operation.

The following best practice air quality control measures will continue to be implemented in 2021:

- 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; 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

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

#### 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* (BOAMP) 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 2020. A copy of the 2020 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 have been surveyed annually in October since 2016, 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 2020 monitoring indicate that vegetation condition across monitoring sites remain relatively stable since the previous monitoring event in 2019, with almost all monitoring sites recording signs of regeneration across both canopy and mid-storey species.

Key results from the 2020 monitoring programme include:

- *Asperula asthenes*, *Tetratheca juncea* and *Grevillea parviflora subsp. parviflora* populations are in good condition and have increased in size since annual monitoring in 2019, likely due to recent favourable weather conditions;
- Minor sedimentation due to overtopping of a small number of sediment fences was observed, and the occurrence of dust on foliage within close proximity to quarry operations was noted;
- Weed coverage remained largely stable - management is required to reduce Lantana cover, especially within the northern portion of the site;
- Feral pigs were observed along the powerline easement in the northern portion of the site, along with signs of feral pig diggings near monitoring sites MP 3 and MP 4; and

- A total of 318 nest boxes have been installed to date across the BOA. Monitoring of nest boxes was undertaken in June 2020.

### **Tetradthea juncea Translocation**

In accordance with the Translocation Plan for *Tetradthea juncea* (*T.juncea*), monitoring of *T.juncea* was undertaken by Firebird ecoSultants (2021) 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 2,500m<sup>2</sup> and 3,000m<sup>2</sup>. 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.

In October 2020, monitoring of the *T. juncea* individuals was undertaken and involved the following:

- Flower Counts;
- Observe general plant health;
- Identify all plants within each Section; and
- Photo points.

Only six of the translocation rows were observed to have *T. juncea* that were in flower, otherwise the *T. juncea* within the translocation site were predominantly not in flower or have browned or died off completely. The translocation site was found to be extensively overgrown in some areas, particularly rows B1 to B7 which were covered in dense grass growing around 2 m in height. *T. juncea* are extremely difficult to find when not in flower, particularly in densely vegetated areas. Due to the extremely low number of *T. juncea* that were observed to be in flower at this time (seven individuals total), combined with the dense overgrown rows, it was decided that it was not viable to undertake the complete survey for 2020. It is possible that *T. juncea* may have begun flowering earlier in the year and subsequently stopped flowering earlier in the year which may explain the lack of flowering individuals observed in October 2020. However, it is more likely that the chosen translocation site is just not suitable habitat for *T. juncea*.

Firebird ecoSultants (2021) believe that the translocation project for *T. juncea* at the Karuah East Quarry has had a low level of success, with the survival rate steadily reducing each year. The low rate of success is primarily attributed to the selection of the translocation site, which does not adequately represent the habitat in which *T. juncea* are typically found. *T. juncea* are typically found on southern facing slopes with sufficient canopy cover. The chosen translocation site is located near the top of a hill with little to no canopy cover which has exposed the translocated *T. juncea* to too much direct sunlight. However it should be noted that there may have been other contributing factors to the low success rate, such as the lack of rainfall in past years and the increase in average temperature attributed to climate change.



A copy of the *T. juncea* Monitoring Report is attached as **Appendix 7**.

#### 6.5.4 Management Measures

During 2020, the following management measures were undertaken:

- Repair of erosion as required;
- Fence repair (as required);
- Installation and monitoring of nest boxes;
- Installation of an additional fauna crossing;
- Weed and pest control; and
- Undertook vertebrate pest monitoring in December 2020).

#### Long Term Security of the Conservation Offset Area

Condition 29 of Project Approval 09\_0175 requires long term security of the Biodiversity Offset Area. Karuah East previously drafted a Conservation Agreement and lodged with the Biodiversity Conservation Trust (BCT). Comments were received asking for the Conservation Agreement to be split into two separate agreements (to cover the differing land ownerships of Lot 13 and Lot 5 / Lot 14 (same ownership). Meetings were held with the BCT in late 2020 to discuss future modifications to PA 09\_0175. BCT advised that it is their preference that the long-term arrangements are finalised when future modifications to PA 09\_0175 are approved as it will result in a change to the long term agreements. DPIE have also agreed with BCT and will issue a letter in 2021 confirming that the long term agreements can be postponed pending the outcome of future modifications to PA 09\_0175.

#### 6.5.5 Proposed Improvements to Management Measures

The Karuah East Quarry will continue to implement the BOAMP and LRMP during 2021. As recommended by Kleinfelder (2020), the following actions will be undertaken in accordance with the relevant sections of the BOAMP:

- Ongoing weed management (targeting Lantana in the northern portion of the site);
- Repair of sediment fencing and removal of a fallen tree blocking access to a track in the south eastern corner of the site (Lot 13/Lot 14); and
- Ongoing vertebrate pest management to control destructive invasive wildlife (including wild dogs, feral pigs and foxes).

In addition, Karuah East Quarry proposes to undertake the following in 2021:

- Assess and if necessary, replace BOA “Keep out” signage and padlocks on gates;
- Determine a course of action for the TJ translocation area; and
- Review/revise the BOAMP with recommendations from the Karuah East 2020 IEA (see **Appendix 8**).

## 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 Heritage NSW 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 Heritage NSW and Heritage NSW 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 Heritage NSW confirms the remains are Aboriginal, Heritage NSW 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 m<sup>3</sup> 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 30** provides a summary of the environmental performance at the site for the reporting period.

**Table 30 - 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                | Non-compliant                           | Within criteria but only 3 of 4 required monitoring events undertaken within the calendar year. | Continued monitoring                      |
| Blasting     | See Section 6.3.1                | Compliant                               | Within criteria                                                                                 | Continued monitoring                      |
| Air Quality  | See Section 6.4.1                | Compliant                               | Within criteria                                                                                 | 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

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.

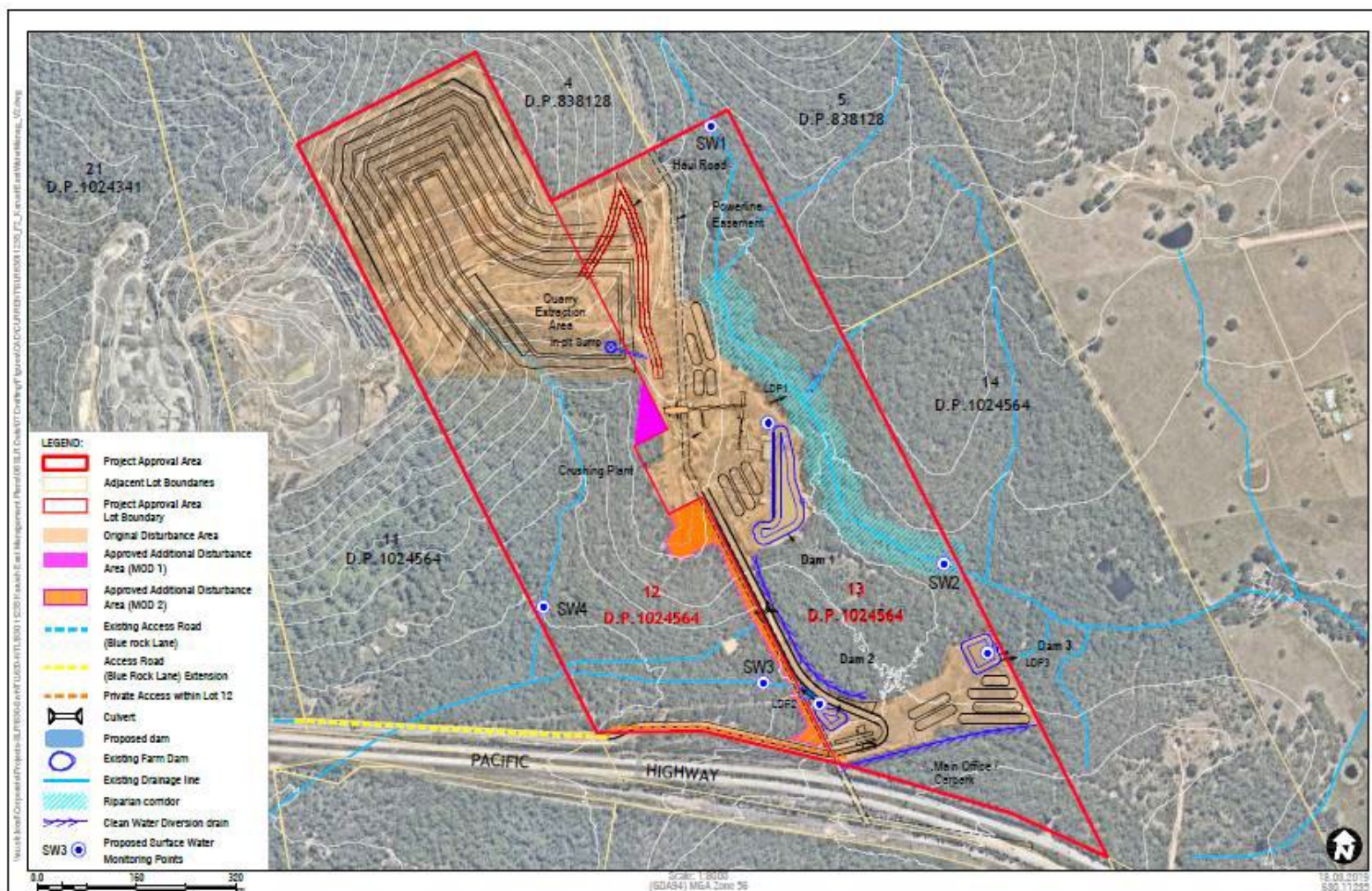
#### ***Water Storage and Use***

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).

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

**Figure 3**      **Current Water Management System (Prepared by SLR)**



## 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 31**. These pollutants will be tested during discharge events from LDP001, LDP002 and LDP003. Discharge events are discussed in **Section 7.3.3**.

**Table 31 - 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 32**.

**Table 32 - Water Quality Data - ANZECC Guidelines**

| Parameter                              | Unit  | ANZECC Guidelines <sup>1</sup> |
|----------------------------------------|-------|--------------------------------|
| 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 <sub>3</sub> ) | mg/L  | --                             |

| Parameter | Unit | ANZECC Guidelines <sup>1</sup> |
|-----------|------|--------------------------------|
| 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 mgCaCO<sub>3</sub>/L)

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

- Dam 1, Dam 2, and 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.

The WMP for Karuah East Quarry will be revised and updated in 2021.

### 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 during 2020. Dam 1 was sampled 10 times during 2020, with January and October monitoring not undertaken due to insufficient water;
- SW1 was not monitored in 2020, 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 has the requirement to monitor monthly if the creek is flowing and within 24 hours of any discharge as per the *Water Management Plan*. During 2020, the creek was flowing for 11 of the 12 monthly monitoring events;

- SW3 has a 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, however there were five occasions where monitoring was possible during 2020; and
- SW4 rarely flows and was not monitored during 2020. SW4 has a requirement to monitor monthly if the creek is flowing as per the *Water Management Plan*, but there was no flow at SW4 during monthly monitoring events.



Table 33 - 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 | 6.2     | 7.2     | 6.8     | 5.9     | 7.0   | 6.6     | 6.8     | 9.2    | 7.9     |
| TSS (mg/L)                             | 40        | 21      | 212     | 67.4    | 10      | 271   | 64.6    | 6       | 305    | 89.3    |
| TDS (mg/L)                             | -         | 422     | 598     | 487.3   | 238     | 1173  | 450.1   | 350     | 961    | 508.3   |
| Turbidity (NTU)                        | -         | 42      | 246     | 101.5   | 9       | 690   | 105.3   | 4       | 380    | 110.8   |
| EC (µS/cm)                             | 125-2200  | 554     | 844     | 732.6   | 190     | 1820  | 679.2   | 46      | 1588   | 838.8   |
| Nitrogen (Nitrate) (mg/L)              | 0.35      | 15.4    | 22.9    | 18.9    | 0.2     | 1.7   | 0.8     | <0.01   | 17.2   | 3.1     |
| Total Nitrogen (mg/L)                  | 0.02      | 18.4    | 24.5    | 21.5    | 0.6     | 2.6   | 1.3     | 0.04    | 20.1   | 3.7     |
| Total Phosphorous (mg/L)               | 0.025     | <0.01   | 0.3     | 0.08    | <0.01   | 0.13  | 0.04    | <0.01   | 0.2    | 0.06    |
| Ammonia (mg/L)                         | 0.02      | 0.02    | 0.23    | 0.08    | 0.01    | 0.2   | 0.07    | 0.01    | 0.2    | 0.06    |
| Oil and Grease (mg/L)                  | 5         | <5      | <5      | <5      | <5      | <5    | <5      | <5      | <5     | <5      |
| Calcium (mg/L)                         | -         | 2       | 5       | 3.9     | 5       | 179   | 55.9    | 4       | 62     | 29.6    |
| Magnesium (mg/L)                       | -         | 4       | 9       | 6.7     | 2       | 30    | 10.1    | 6       | 32     | 12.9    |
| Sodium (mg/L)                          | -         | 97      | 147     | 129.4   | 23      | 110   | 51.8    | 54      | 230    | 122.1   |
| Potassium (mg/L)                       |           | 1       | 3       | 2       | <1      | 3     | 1.6     | 2       | 3      | 2.2     |
| Total Hardness (as CaCO <sub>3</sub> ) |           | 21      | 74      | 40.6    | 21      | 645   | 187.3   | 43      | 316    | 129.5   |
| Arsenic (mg/L)                         | 0.024     | <0.001  | <0.001  | <0.001  | <0.001  | 0.001 | 0.001   | <0.001  | 0.01   | 0.004   |
| Cadmium (mg/L)                         | 0.0002    | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.001 | 0.0005  | <0.0001 | 0.0002 | 0.0002  |
| Chromium (mg/L)                        | 0.001     | <0.001  | 0.006   | 0.003   | <0.001  | 0.004 | 0.003   | <0.001  | 0.008  | 0.004   |
| Copper (mg/L)                          | 0.001     | <0.001  | 0.006   | 0.003   | <0.001  | 0.01  | 0.005   | <0.001  | 0.01   | 0.005   |
| Nickel (mg/L)                          | 0.011     | <0.001  | 0.004   | 0.002   | <0.001  | 0.2   | 0.02    | <0.001  | 0.006  | 0.003   |

| Parameter        | Criteria | Dam 1  |       |         | Dam 2  |       |         | Dam 3  |       |         |
|------------------|----------|--------|-------|---------|--------|-------|---------|--------|-------|---------|
|                  |          | Min    | Max   | Average | Min    | Max   | Average | Min    | Max   | Average |
| Lead (mg/L)      | 0.003    | <0.001 | 0.003 | 0.002   | <0.001 | 0.005 | 0.003   | <0.001 | 0.006 | 0.003   |
| Manganese (mg/L) | 1.9      | 0.1    | 0.2   | 0.17    | 0.01   | 0.25  | 0.13    | 0.01   | 0.3   | 0.1     |
| Vanadium (mg/L)  | -        | <0.01  | 0.02  | 0.015   | <0.01  | 0.02  | 0.02    | <0.01  | 0.03  | 0.02    |
| Zinc (mg/L)      | 0.021    | 0.013  | 0.035 | 0.022   | <0.005 | 0.12  | 0.04    | <0.005 | 0.05  | 0.02    |

Table 34 - Monthly Surface Water Quality Results for SW1-4

| Parameter                 | *Criteria | SW2   |      |         | SW3  |      |         |
|---------------------------|-----------|-------|------|---------|------|------|---------|
|                           |           | Min   | Max  | Average | Min  | Max  | Average |
| pH (pH unit)              | 6.5 - 8.5 | 3.2   | 7.9  | 6.5     | 6.0  | 6.5  | 6.4     |
| TSS (mg/L)                | 40        | 13    | 85   | 39.1    | 151  | 994  | 374.4   |
| TDS (mg/L)                | -         | 373   | 510  | 431.4   | 458  | 1270 | 787.4   |
| Turbidity (NTU)           | -         |       | 148  | 67.2    | 265  | 761  | 486.4   |
| EC ( $\mu$ S/cm)          | 125-2200  | 496   | 782  | 645.5   | 204  | 377  | 264.8   |
| Nitrogen (Nitrate) (mg/L) | 0.35      | 6.4   | 17.2 | 11.2    | <0.1 | 0.4  | 0.2     |
| Total Nitrogen (mg/L)     | 0.02      | 7.9   | 20.1 | 13.2    | 1.4  | 4    | 2.1     |
| Total Phosphorous (mg/L)  | 0.025     | <0.01 | 0.2  | 0.06    | <0.1 | 0.4  | 0.3     |
| Ammonia (mg/L)            | 0.02      | 0.04  | 0.2  | 0.096   | 0.02 | 0.04 | 0.03    |
| Oil and Grease (mg/L)     | 5         | <5    | <5   | <5      | <5   | <5   | <5      |
| Calcium (mg/L)            | -         | 3     | 4    | 3.9     | 2    | 3    | 2.2     |
| Magnesium (mg/L)          | -         | 4     | 8    | 5.8     | 2    | 4    | 2.8     |
| Sodium (mg/L)             | -         | 81    | 139  | 111.9   | 33   | 68   | 45.4    |
| Potassium (mg/L)          | -         | 2     | 3    | 2.3     | 1    | 2    | 1.6     |

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| Parameter                              | *Criteria | SW2     |         |         | SW3     |        |         |
|----------------------------------------|-----------|---------|---------|---------|---------|--------|---------|
|                                        |           | Min     | Max     | Average | Min     | Max    | Average |
| Total Hardness (as CaCO <sub>3</sub> ) | -         | 24      | 43      | 33.7    | 13      | 24     | 16.8    |
| Arsenic (mg/L)                         | 0.024     | <0.001  | <0.001  | <0.001  | <0.001  | 0.005  | 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  | 0.004   | 0.002   | 0.006   | 0.03   | 0.01    |
| Copper (mg/L)                          | 0.001     | <0.001  | 0.005   | 0.003   | 0.01    | 0.03   | 0.02    |
| Nickel (mg/L)                          | 0.011     | <0.001  | 0.002   | 0.002   | 0.004   | 0.02   | 0.01    |
| Lead (mg/L)                            | 0.003     | <0.001  | 0.002   | 0.002   | 0.006   | 0.02   | 0.01    |
| Manganese (mg/L)                       | 1.9       | 0.02    | 0.1     | 0.06    | 0.1     | 0.6    | 0.3     |
| Vanadium (mg/L)                        | -         | <0.01   | 0.01    | 0.01    | 0.02    | 0.1    | 0.05    |
| Zinc (mg/L)                            | 0.021     | 0.008   | 0.03    | 0.02    | 0.05    | 0.2    | 0.1     |

\*Criteria 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 35 - Comparison between Dam Averages**

| Parameter                 | Dam 1 2020 Average | Dam 1 2019 Average | Dam 1 2018 Average | Dam 2 2020 Average | Dam 2 2019 Average | Dam 2 2018 Average | Dam 3 2020 Average | Dam 3 2019 Average | Dam 3 2018 Average |
|---------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| pH (pH unit)              | 6.8                | 7.0                | 6.9                | 6.6                | 6.6                | 6.6                | 7.9                | 7.7                | 7.3                |
| TSS (mg/L)                | 67.4               | 119                | 36                 | 64.6               | 52                 | 108                | 89.3               | 34                 | 96                 |
| TDS (mg/L)                | 487.3              | 411                | 397                | 450.1              | 423                | 289                | 508.3              | 649                | 432                |
| Turbidity (NTU)           | 101.5              | 181                | 86                 | 105.3              | -                  | -                  | 110.8              | 46                 | 178                |
| EC (µS/cm)                | 732.6              | 655                | 609                | 679.2              | 603                | 417                | 838.8              | 1067               | 661                |
| Nitrogen (Nitrate) (mg/L) | 18.9               | 9.51               | 8.763              | 0.8                | 0.39               | 0.858              | 3.1                | 1.29               | 3.897              |
| Total Nitrogen (mg/L)     | 21.5               | 10.95              | 9.81               | 1.3                | 0.94               | 1.23               | 3.7                | 1.76               | 4.500              |
| Total Phosphorous (mg/L)  | 0.08               | 0.07               | 0.02               | 0.04               | 0.03               | 0.04               | 0.06               | 0.03               | 0.07               |
| Ammonia (mg/L)            | 0.08               | 0.04               | 0.08               | 0.07               | 0.04               | 0.05               | 0.06               | 0.06               | 0.08               |

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| Parameter                              | Dam 1 2020 Average | Dam 1 2019 Average | Dam 1 2018 Average | Dam 2 2020 Average | Dam 2 2019 Average | Dam 2 2018 Average | Dam 3 2020 Average | Dam 3 2019 Average | Dam 3 2018 Average |
|----------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Oil and Grease (mg/L)                  | <5                 | <5.0               | <5.0               | <5                 | <5.0               | <5.0               | <5                 | <5.0               | <5.0               |
| Calcium (mg/L)                         | 3.9                | 8.8                | 3.6                | 55.9               | 42.3               | 16.5               | 29.6               | 29.0               | 17                 |
| Magnesium (mg/L)                       | 6.7                | 5.0                | 4.9                | 10.1               | 8.0                | 5.0                | 12.9               | 20.0               | 9.3                |
| Sodium (mg/L)                          | 129.4              | 96.0               | 100.8              | 51.8               | 45.0               | 51.1               | 122.1              | 166.0              | 101.3              |
| Potassium (mg/L)                       | 2                  | 2.00               | 2.07               | 1.6                | 1.00               | 1.43               | 2.2                | 2.30               | 1.65               |
| Total Hardness (as CaCO <sub>3</sub> ) | 40.6               | 42.0               | 27.5               | 187.3              | 140.0              | 59.7               | 129.5              | 152.0              | 78.3               |
| Arsenic (mg/L)                         | <0.001             | 0.001              | 0.001              | 0.001              | 0.001              | 0.001              | 0.004              | 0.001              | 0.001              |
| Cadmium (mg/L)                         | <0.0001            | 0.0001             | 0.0006             | 0.0005             | 0.0001             | 0.0007             | 0.0002             | <0.0001            | 0.0001             |
| Chromium (mg/L)                        | 0.003              | 0.004              | 0.001              | 0.003              | 0.002              | 0.004              | 0.004              | 0.001              | 0.003              |
| Copper (mg/L)                          | 0.003              | 0.004              | 0.012              | 0.005              | 0.004              | 0.015              | 0.005              | 0.003              | 0.014              |
| Nickel (mg/L)                          | 0.002              | 0.003              | 0.004              | 0.02               | 0.002              | 0.004              | 0.003              | 0.002              | 0.003              |
| Lead (mg/L)                            | 0.002              | 0.003              | 0.001              | 0.003              | 0.002              | 0.003              | 0.003              | 0.0014             | 0.002              |
| Manganese (mg/L)                       | 0.17               | 0.1                | 0.1                | 0.13               | 0.1                | 0.1                | 0.1                | 0.1                | 0.1                |
| Vanadium (mg/L)                        | 0.015              | 0.02               | 0.01               | 0.02               | 0.02               | 0.01               | 0.02               | 0.01               | 0.02               |
| Zinc (mg/L)                            | 0.022              | 0.03               | 0.03               | 0.04               | 0.02               | 0.03               | 0.02               | 0.02               | 0.04               |

**Table 36 - Comparison between SW Averages**

| Parameter       | SW 1 2020 Average | SW 1 2019 Average | SW 1 2018 Average | SW 2 2020 Average | SW 2 2019 Average | SW 2 2018 Average | SW 3 2020 Average | SW 3 2019 Average | SW 3 2018 Average | SW4 2020 Average | SW 4 2019 Average | SW 4 2018 Average |
|-----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| pH (pH unit)    | -                 | -                 | -                 | 6.5               | 6.9               | 6.5               | 6.4               | 5.7               | 5.5               | -                | -                 | 6.5               |
| TSS (mg/L)      | -                 | -                 | -                 | 39.1              | 31                | 25                | 374.4             | 32                | 186               | -                | -                 | 61                |
| TDS (mg/L)      | -                 | -                 | -                 | 431.4             | 473               | 360               | 787.4             | 670               | 505               | -                | -                 | 224               |
| Turbidity (NTU) | -                 | -                 | -                 | 67.2              | 94                | 82                | 486.4             | 234               | 309               | -                | -                 | 105               |
| EC (µS/cm)      | -                 | -                 | -                 | 645.5             | 535               | 451               | 264.8             | 235               | 274               | -                | -                 | 259               |

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| Parameter                                    | SW 1 2020<br>Average | SW 1 2019<br>Average | SW 1 2018<br>Average | SW 2 2020<br>Average | SW 2 2019<br>Average | SW 2 2018<br>Average | SW 3 2020<br>Average | SW 3 2019<br>Average | SW 3 2018<br>Average | SW4 2020<br>Average | SW 4 2019<br>Average | SW 4 2018<br>Average |
|----------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| Nitrogen<br>(Nitrate)<br>(mg/L)              | -                    | -                    | -                    | 11.2                 | 3.6                  | 2.6                  | 0.2                  | 0.7                  | 0.2                  | -                   | -                    | 0.002                |
| Total<br>Nitrogen<br>(mg/L)                  | -                    | -                    | -                    | 13.2                 | 4.4                  | 3.9                  | 2.1                  | 1.9                  | 1.1                  | -                   | -                    | 0.8                  |
| Total<br>Phosphorous<br>(mg/L)               | -                    | -                    | -                    | 0.06                 | 0.07                 | 0.05                 | 0.3                  | 0.14                 | 0.12                 | -                   | -                    | 0.02                 |
| Ammonia<br>(mg/L)                            | -                    | -                    | -                    | 0.096                | 0.08                 | 0.05                 | 0.03                 | 0.03                 | 0.05                 | -                   | -                    | 0.15                 |
| Oil and<br>Grease<br>(mg/L)                  | -                    | -                    | -                    | <5                   | <5                   | <5                   | <5                   | <5                   | <5                   | -                   | -                    | <5                   |
| Calcium<br>(mg/L)                            | -                    | -                    | -                    | 3.9                  | 4.5                  | 3.3                  | 2.2                  | 3.0                  | 2.5                  | -                   | -                    | 4.0                  |
| Magnesium<br>(mg/L)                          | -                    | -                    | -                    | 5.8                  | 5.1                  | 4.5                  | 2.8                  | 3.5                  | 2.7                  | -                   | -                    | 6.0                  |
| Sodium<br>(mg/L)                             | -                    | -                    | -                    | 111.9                | 90.0                 | 75.9                 | 45.4                 | 37.5                 | 37.7                 | -                   | -                    | 39                   |
| Potassium<br>(mg/L)                          | -                    | -                    | -                    | 2.3                  | 2.1                  | 2.1                  | 1.6                  | 1.5                  | 1.2                  | -                   | -                    | 2.0                  |
| Total<br>Hardness<br>(as CaCO <sub>3</sub> ) | -                    | -                    | -                    | 33.7                 | 32.0                 | 25.3                 | 16.8                 | 21.5                 | 18                   | -                   | -                    | 35                   |
| Arsenic<br>(mg/L)                            | -                    | -                    | -                    | <0.001               | 0.001                | 0.001                | 0.003                | 0.003                | 0.001                | -                   | -                    | 0.001                |

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| Parameter        | SW 1 2020<br>Average | SW 1 2019<br>Average | SW 1 2018<br>Average | SW 2 2020<br>Average | SW 2 2019<br>Average | SW 2 2018<br>Average | SW 3 2020<br>Average | SW 3 2019<br>Average | SW 3 2018<br>Average | SW4 2020<br>Average | SW 4 2019<br>Average | SW 4 2018<br>Average |
|------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| Cadmium (mg/L)   | -                    | -                    | -                    | <0.0001              | <0.0001              | 0.0001               | 0.0001               | 0.0001               | 0.0001               | -                   | -                    | 0.0001               |
| Chromium (mg/L)  | -                    | -                    | -                    | 0.002                | 0.007                | 0.002                | 0.01                 | 0.01                 | 0.01                 | -                   | -                    | 0.001                |
| Copper (mg/L)    | -                    | -                    | -                    | 0.003                | 0.003                | 0.002                | 0.02                 | 0.01                 | 0.01                 | -                   | -                    | 0.001                |
| Nickel (mg/L)    | -                    | -                    | -                    | 0.002                | 0.003                | 0.001                | 0.01                 | 0.007                | 0.005                | -                   | -                    | 0.001                |
| Lead (mg/L)      | -                    | -                    | -                    | 0.002                | 0.002                | 0.001                | 0.01                 | 0.013                | 0.007                | -                   | -                    | 0.001                |
| Manganese (mg/L) | -                    | -                    | -                    | 0.06                 | 0.65                 | 0.06                 | 0.3                  | 0.12                 | 0.12                 | -                   | -                    | 0.04                 |
| Vanadium (mg/L)  | -                    | -                    | -                    | 0.01                 | 0.02                 | 0.009                | 0.05                 | 0.06                 | 0.035                | -                   | -                    | <0.01                |
| Zinc (mg/L)      | -                    | -                    | -                    | 0.02                 | 0.02                 | 0.014                | 0.1                  | 0.06                 | 0.054                | -                   | -                    | 0.005                |

### Summary of Creeks (2018-2020):

The following is a comparison of key surface water parameters over the past three reporting periods. Other parameters can be found in the tables above.

#### SW1 –

- No monitoring occurred during 2020 due to no flow in the creek at the monitoring location.

#### SW 2 –

- Average pH remained consistent with results of 6.5, 6.9 and 6.5 for 2018, 2019 and 2020 respectively.
- Average TSS has increased marginally from 25 mg/L in 2018 to 39 mg/L in 2020.
- Average EC has continued to increase, with results of 645 us/cm, 535 us/cm and 451 us/cm for 2020, 2019 and 2018 respectively.
- Average nitrate levels were above the criteria of 0.35 mg/L in 2020 at 11.2 mg/L which was an increase from 2019 (3.6 mg/L) and 2018 (2.6 mg/L).
- Average phosphorous levels were above the criteria of 0.025 mg/L in 2020 at 0.06 mg/L compared to 0.07 mg/L in 2019 and 0.5 mg/L in 2018.
- Average ammonia levels were above the criteria of 0.02 mg/L in 2020 at 0.096 mg/L which was an increase from 2019 (0.08 mg/L) and 2018 (0.05 mg/L).
- Average chromium levels were above the criteria of 0.001 mg/L in 2020 at 0.002 mg/L which was a decrease from 2019 (0.007 mg/L) and the same as 2018 (0.002 mg/L).
- Average copper levels were above the criteria of 0.001 mg/L in 2020 at 0.003 mg/L which was consistent with 2019 (0.003 mg/L) but higher than 2018 (0.002 mg/L).
- Average zinc levels were below the criteria of 0.021 mg/L in 2020 at 0.020 mg/L which was consistent with 2019 (0.020 mg/L) but higher than 2018 (0.014 mg/L).
- Average lead levels were below the criteria of 0.003 mg/L in 2020 at 0.002 mg/L which was consistent with 2019 (0.002 mg/L) and higher than 2018 (0.001 mg/L).

#### SW 3 –

- Average pH has increased with results of 6.4, 5.7 and 5.5 for 2018, 2019 and 2020 respectively.
- Average TSS has increased significantly in 2020 with a result of 374 mg/L, compared to 32 mg/L in 2019 and 186 mg/L in 2018.
- There has been an increase in average EC from 451 us/cm in 2018, 535 us/cm in 2019 and 646 us/cm in 2020.
- Average nitrate levels were above the criteria of 0.35 mg/L in 2020 at 0.2 mg/L which was a decrease from 2019 (0.7 mg/L) and consistent with 2018 (0.2 mg/L).

- Average phosphorous levels were above the criteria of 0.025 mg/L in 2020 at 0.3 mg/L which was a slight increase from 2019 (0.14 mg/L) and 2018 (0.12 mg/L).
- Average ammonia levels were above the criteria of 0.02 mg/L in 2020 at 0.03 mg/L which was consistent with 2019 (0.03 mg/L) and lower than to 2018 (0.05 mg/L).
- Average chromium levels have not changed since 2018 and were above the criteria of 0.001 mg/L in 2020 at 0.011 mg/L.
- Average copper levels were above the criteria of 0.001 mg/L in 2020 at 0.02 mg/L which was a slight increase from 2019 and 2018 (both 0.01 mg/L).
- Average zinc levels were above the criteria of 0.021 mg/L in 2020 at 0.1 mg/L which was higher than 2019 (0.06 mg/L) and 2018 (0.035 mg/L).
- Average lead levels were above the criteria of 0.003 mg/L in 2020 at 0.01 mg/L which was consistent with 2019 (0.013 mg/L) and higher than 2018 (0.007 mg/L).

#### SW4 –

- No monitoring occurred during 2020 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 are listed in **Table 37**.

There were 30 discharges from LDP001 during the 2020 reporting which, 5 of which were uncontrolled. The monitoring results show that all pH results were within criteria except for the uncontrolled discharge on 28 October 2020 which recorded a pH of 6.4. Oil and Grease was within criteria during all discharge events. TSS results exceeded criteria during the five uncontrolled discharges dates in October 2020 but were within criteria for all controlled discharges.

During 2020 there were 19 discharge events from LDP002, three of which were uncontrolled. The monitoring results show that both pH and Oil and Grease were within criteria during all controlled and uncontrolled discharges. TSS exceeded criteria during the three uncontrolled discharges.

There were 20 discharges from LDP003 in 2020, 17 of which were controlled and three uncontrolled. The monitoring results show that both pH and Oil and Grease were within criteria during all controlled and uncontrolled discharges. TSS exceeded criteria during the three uncontrolled discharges.

There was a total of one pH exceedance at LDP001 and 11 TSS exceedances from the combined LDP001, LDP002 and LDP003 discharges during 2020.

All 11 TSS exceedances occurred during the uncontrolled discharged in October 2020 with the largest exceedance recording 5380 mg/L on the 26 October 2020 from LDP001. The pH exceedance also occurred in October 2020. The uncontrolled discharge was related to a period of extreme rainfall in the Karuah region, which resulted in submerged roads and damaged access tracks. This uncontrolled discharge was reported as an incident to relevant authorities in accordance with the *Pollution Incident Response Management Plan*. Further details of this incident can be found in **Section 11.1**.



Table 37 - Discharge Monitoring Results 2020

| Discharge Point | Date                      | pH        | EC (µS/cm) | Turbidity (NTU) | TSS (mg/L) | Oil and Grease (mg/L) | Comment              |
|-----------------|---------------------------|-----------|------------|-----------------|------------|-----------------------|----------------------|
|                 | EPL Criteria              | 6.5 - 8.5 | -          | -               | 40         | 5                     |                      |
| LDP001          | Thursday, 5 March 2020    | 6.8       | 681        | 36              | 19         | <5                    | Controlled discharge |
|                 | Friday, 3 April 2020      | 6.9       | 781        | 75              | 36         | <5                    | Controlled discharge |
|                 | Monday, 20 April 2020     | 7.1       | 774        | 34              | 17         | <5                    | Controlled discharge |
|                 | Tuesday, 21 April 2020    | 7         | 755        | 40              | 18         | <5                    | Controlled discharge |
|                 | Wednesday, 22 April 2020  | 7.1       | 751        | 36              | 20         | <5                    | Controlled discharge |
|                 | Thursday, 21 May 2020     | 7.1       | 762        | 27              | 15         | NV                    | Controlled discharge |
|                 | Thursday, 28 May 2020     | 7         | 676        | 35              | 13         | NV                    | Controlled discharge |
|                 | Friday, 29 May 2020       | 6.8       | 737        | 21              | 10         | NV                    | Controlled discharge |
|                 | Monday, 1 June 2020       | 6.8       | 1430       | 45              | 23         | NV                    | Controlled discharge |
|                 | Tuesday, 2 June 2020      | 6.7       | 677        | 55              | 21         | NV                    | Controlled discharge |
|                 | Wednesday, 3 June 2020    | 7.2       | 701        | 55              | 26         | NV                    | Controlled discharge |
|                 | Wednesday, 17 June 2020   | 6.9       | 789        | 60              | 29         | NV                    | Controlled discharge |
|                 | Monday, 22 June 2020      | 6.9       | 794        | 28              | 13         | NV                    | Controlled discharge |
|                 | Tuesday, 23 June 2020     | 7         | 839        | 31              | 16         | NV                    | Controlled discharge |
|                 | Wednesday, 24 June 2020   | 7         | 773        | 35              | 18         | NV                    | Controlled discharge |
|                 | Thursday, 13 August 2020  | 7.2       | 693        | 75              | 37         | NV                    | Controlled discharge |
|                 | Friday, 14 August 2020    | 7         | 700        | 50              | 31         | NV                    | Controlled discharge |
|                 | Monday, 17 August 2020    | 7         | 704        | 55              | 31         | NV                    | Controlled discharge |
|                 | Tuesday, 18 August 2020   | 7.1       | 712        | 60              | 25         | NV                    | Controlled discharge |
|                 | Wednesday, 19 August 2020 | 6.9       | 714        | 60              | 27         | NV                    | Controlled discharge |

| Discharge Point | Date                       | pH         | EC (µS/cm) | Turbidity (NTU) | TSS (mg/L)  | Oil and Grease (mg/L) | Comment                |
|-----------------|----------------------------|------------|------------|-----------------|-------------|-----------------------|------------------------|
|                 | Thursday, 20 August 2020   | 6.8        | 690        | 70              | 35          | NV                    | Controlled discharge   |
|                 | Friday, 21 August 2020     | 6.8        | 689        | 75              | 36          | NV                    | Controlled discharge   |
|                 | Monday, 24 August 2020     | 6.8        | 689        | 75              | 40          | NV                    | Controlled discharge   |
|                 | Tuesday, 25 August 2020    | 7          | 753        | 75              | 37          | NV                    | Controlled discharge   |
|                 | Wednesday, 26 August 2020  | 6.9        | 715        | 75              | 33          | NV                    | Controlled discharge   |
|                 | Monday, 26 October 2020    | 6.5        | 241        | 8620            | <b>5380</b> | NV                    | Uncontrolled discharge |
|                 | Tuesday, 27 October 2020   | 6.7        | 598        | 905             | <b>412</b>  | NV                    | Uncontrolled discharge |
|                 | Wednesday, 28 October 2020 | <b>6.4</b> | 692        | 300             | <b>161</b>  | NV                    | Uncontrolled discharge |
|                 | Thursday, 29 October 2020  | 6.5        | 714        | 260             | <b>95</b>   | NV                    | Uncontrolled discharge |
|                 | Friday, 30 October 2020    | 6.9        | 737        | 160             | <b>71</b>   | NV                    | Uncontrolled discharge |
| LDP002          | Thursday, 5 March 2020     | 6.8        | 387        | 30              | 21          | <5                    | Controlled discharge   |
|                 | Wednesday, 1 April 2020    | 6.9        | 549        | 13              | 9           | <5                    | Controlled discharge   |
|                 | Thursday, 2 April 2020     | 6.8        | 545        | 13              | 8           | <5                    | Controlled discharge   |
|                 | Friday, 22 May 2020        | 7.2        | 597        | 80              | 40          | NV                    | Controlled discharge   |
|                 | Thursday, 28 May 2020      | 6.6        | 404        | 55              | 22          | NV                    | Controlled discharge   |
|                 | Friday, 29 May 2020        | 6.6        | 424        | 50              | 23          | NV                    | Controlled discharge   |
|                 | Monday, 1 June 2020        | 6.6        | 448        | 32              | 18          | NV                    | Controlled discharge   |
|                 | Friday, 12 June 2020       | 6.8        | 417        | 75              | 36          | NV                    | Controlled discharge   |
|                 | Tuesday, 21 July 2020      | 6.8        | 392        | 45              | 22          | NV                    | Controlled discharge   |
|                 | Wednesday, 22 July 2020    | 6.7        | 395        | 50              | 29          | NV                    | Controlled discharge   |
|                 | Tuesday, 11 August 2020    | 6.5        | 430        | 50              | 30          | NV                    | Controlled discharge   |
|                 | Wednesday, 12 August 2020  | 6.9        | 426        | 33              | 20          | NV                    | Controlled discharge   |

| Discharge Point | Date                        | pH  | EC (µS/cm) | Turbidity (NTU) | TSS (mg/L) | Oil and Grease (mg/L) | Comment                |
|-----------------|-----------------------------|-----|------------|-----------------|------------|-----------------------|------------------------|
|                 | Thursday, 13 August 2020    | 6.9 | 409        | 20              | 13         | NV                    | Controlled discharge   |
|                 | Friday, 14 August 2020      | 6.8 | 427        | 17              | 11         | NV                    | Controlled discharge   |
|                 | Monday, 17 August 2020      | 6.9 | 450        | 19              | 12         | NV                    | Controlled discharge   |
|                 | Monday, 26 October 2020     | 6.7 | 63         | 1872            | <b>915</b> | NV                    | Uncontrolled discharge |
|                 | Tuesday, 27 October 2020    | 6.8 | 146        | 660             | <b>296</b> | NV                    | Uncontrolled discharge |
|                 | Wednesday, 28 October 2020  | 6.6 | 137        | 970             | <b>413</b> | NV                    | Uncontrolled discharge |
|                 | Wednesday, 16 December 2020 | 6.8 | 840        | 17              | 14         | NV                    | Controlled discharge   |
| LDP003          | Thursday, 5 March 2020      | 7.6 | 999        | 60              | 35         | <5                    | Controlled discharge   |
|                 | Wednesday, 1 April 2020     | 8   | 987        | 45              | 21         | <5                    | Controlled discharge   |
|                 | Thursday, 2 April 2020      | 8.1 | 985        | 45              | 21         | <5                    | Controlled discharge   |
|                 | Tuesday, 21 April 2020      | 8.2 | 943        | 40              | 18         | <5                    | Controlled discharge   |
|                 | Wednesday, 22 April 2020    | 8.2 | 933        | 39              | 39         | <5                    | Controlled discharge   |
|                 | Monday, 1 June 2020         | 8.3 | 836        | 40              | 28         | NV                    | Controlled discharge   |
|                 | Tuesday, 2 June 2020        | 8.4 | 762        | 33              | 21         | NV                    | Controlled discharge   |
|                 | Wednesday, 3 June 2020      | 8.5 | 824        | 29              | 21         | NV                    | Controlled discharge   |
|                 | Monday, 15 June 2020        | 8   | 726        | 45              | 32         | NV                    | Controlled discharge   |
|                 | Tuesday, 16 June 2020       | 8.2 | 758        | 36              | 25         | NV                    | Controlled discharge   |
|                 | Wednesday, 17 June 2020     | 8.2 | 765        | 30              | 20         | NV                    | Controlled discharge   |
|                 | Tuesday, 21 July 2020       | 7.8 | 693        | 55              | 28         | NV                    | Controlled discharge   |
|                 | Wednesday, 22 July 2020     | 7.8 | 692        | 55              | 25         | NV                    | Controlled discharge   |
|                 | Thursday, 23 July 2020      | 7.7 | 688        | 50              | 23         | NV                    | Controlled discharge   |
|                 | Friday, 14 August 2020      | 7.6 | 646        | 75              | 36         | NV                    | Controlled discharge   |

| Discharge Point | Date                       | pH  | EC (µS/cm) | Turbidity (NTU) | TSS (mg/L)  | Oil and Grease (mg/L) | Comment                |
|-----------------|----------------------------|-----|------------|-----------------|-------------|-----------------------|------------------------|
|                 | Tuesday, 25 August 2020    | 8   | 756        | 29              | 17          | NV                    | Controlled discharge   |
|                 | Wednesday, 26 August 2020  | 8.1 | 727        | 28              | 18          | NV                    | Controlled discharge   |
|                 | Monday, 26 October 2020    | 7.1 | 271        | 1690            | <b>1250</b> | NV                    | Uncontrolled discharge |
|                 | Tuesday, 27 October 2020   | 6.9 | 248        | 985             | <b>507</b>  | NV                    | Uncontrolled discharge |
|                 | Wednesday, 28 October 2020 | 6.9 | 335        | 1444            | <b>715</b>  | NV                    | Uncontrolled discharge |

## Discharge Analysis

All 11 TSS exceedances occurred during October 2020 with the largest exceedance recording 5380 mg/L on the 26 October 2020 from LDP001. The pH exceedance also occurred in October 2020.

As evident from the data presented in **Section 6.1**, the Karuah East site experienced higher than average rainfall in 2020. October was the wettest month, with a maximum daily rainfall of 217.1 mm experienced on 27 October 2020. A total of 333.2 mm of rainfall was recorded between October 24 and October 29, which correlates to the dates of the uncontrolled discharge. Further details are provided in **Section 11.1**.

## 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, 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.

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 DoI Water.

## 7.4.2 Monitoring Results

### Groundwater Level

**Table 38** shows a comparison of groundwater levels since 2017. All groundwater locations were monitored four times during 2020 with a requirement for quarterly monitoring of groundwater levels as per the WMP. As evident, water levels have remained relatively consistent at BH208 and BH303, with BH205 showing a consistent decrease in water level since the start of monitoring. Water levels at BH207 were relatively consistent until 2020, where water level has declined slightly.

**Table 38 - Groundwater Level since 2017**

| 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  |
| January 2020 | 19.95                                         | 9.3   | 20.7  | 31.2  |
| April 2020   | 18.4                                          | 8.3   | 20.6  | 30.4  |
| July 2020    | 18.2                                          | 8.3   | 20.8  | 31.2  |
| October 2020 | 16.7                                          | 7.7   | 20.7  | 30.8  |

### Groundwater Quality

Sampling of groundwater monitoring locations occurred on 14 April 2020 and 1 October 2020 in accordance with the six-monthly requirement to monitor groundwater quality data as per the WMP. Note: BH 208 was unable to be sampled in 2020 due to insufficient water levels at both monitoring events. Results have been compared against data sampled from 2010 (pre-Karuah East Quarry) in **Table 39**.

**Table 39 - 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                             |     |            |             |                   |

| Monitoring Location  | pH   | TDS (mg/L) | EC (µS/cm) | Number of Samples |
|----------------------|------|------------|------------|-------------------|
| 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                 |
| 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                 |
| Average Results 2020 |      |            |            |                   |
| BH 205               | 7.1  | 1460       | 2735       | 2                 |
| BH 207               | 7.0  | 1548       | 2865       | 2                 |
| BH 208               | *    | *          | *          | 0                 |
| BH 303               | 5.9  | 1625       | 2985       | 2                 |

\* No data recorded due to insufficient water levels.

The pH in 2020 is lower than 2019 results at BH 205 and BH 303 and above the 2019 average at BH 207. Results are comparable to pre-Karuah East averages. TDS levels continued to be highly variable across the years. Average EC was higher at all locations in 2020 compared to 2020. EC was not sampled during 2010 monitoring.

Karuah East Quarry will continue to monitor groundwater quality during 2021.

## 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 40**.

**Table 40 - 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. |
| Key rehabilitation performance indicators                                                                                                                                                                                                              | No Rehabilitation.                                                                                                                     |
| Renovation or removal of buildings                                                                                                                                                                                                                     | No Rehabilitation.                                                                                                                     |
| Any other Rehabilitation Taken including: <ul style="list-style-type: none"> <li>• Exploration activities;</li> <li>• Infrastructure;</li> <li>• Dams; and</li> <li>• The installation or maintenance of fences, bunds and any other works.</li> </ul> | No Rehabilitation. Approximately 1.25 ha within the quarry footprint is scheduled for clearance in 2021.                               |
| 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 41 - 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) | 25.07 ha                           | 25.07 ha                       | 25.32 ha                         |
| Total Active Disturbance                          | 25.07 ha                           | 25.07 ha                       | 25.32 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 42**.

**Table 42 - 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:

- 9 March 2020; and
- 14 September 2020.

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 (if available). Meeting minutes are found on the website <http://hunterquarries.com.au/karuah-east-documents/>.

Key aspects discussed include:

- Site inspection;
- Discussion about MOD 8 (acoustics) approval timeline;
- Presentation of the Company Report;
- Monitoring and environmental performance, including non-compliance;
- Community complaints and response to complaints; and
- Discussion around future modifications that may be sought.

### 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](http://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 2020 Complaints**

In 2020 there was one complaint received.

Karuah East Quarry received a complaint by direct phone call on 30 January 2020 regarding vibration. The resident of The Branch Lane enquired if the Quarry had conducted any blasts on the day, as vibration was felt through the residents dwelling. It was advised that no blasts had been conducted on the day. The resident was alerted to the blast register used by Karuah East Quarry to notify community members of scheduled blasts and offered to be added to the register. This offer was accepted by the resident. No further action was required.

## 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.

In October 2020, Hansen Bailey completed the second Independent Environmental Audit of Karuah East Quarry. A copy of the Independent Environmental Audit is available on the website <http://hunterquarries.com.au/karuah-east-documents/>.

The following key documents reviewed during the audit included:

- PA 09\_0175 and Statement of Commitments (as modified);
- EPL 20611; and
- Karuah East Quarry environmental management plans and procedures.

The non-compliances identified in the 2020 Independent Environmental Audit were generally minor in nature, however there were some additional controls recommended by Hansen Bailey to ensure that the environmental management plans approved under PA 09\_0175 are consistently implemented.

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

#### Uncontrolled Discharge

After a relatively dry period (two consecutive months of less than 40mm of rainfall) all three dams at Karuah East were substantially low. On 23 October 2020, an inspection of the dams was undertaken to visually assess water level and quality. The primary water storage unit, Dam 1, was assessed to be at approximately 15 to 20% capacity.

The Karuah region experienced a period of extreme rainfall, receiving 333.2 mm between 24 October and 29 October 2020. On 26 October, uncontrolled discharge occurred from LDP001, LDP002 and LDP003 as a result of this extreme rainfall. Access roads were submerged and access tracks damaged. An incident report was completed by the Environmental Officer and maintenance work on erosion and sediment controls across the site were undertaken where safe to do so. The *Pollution Incident Response Management Plan* was activated, and relevant authorities contacted.

The EPA Pollution Hotline was contacted to self-report uncontrolled discharge from all dams. DPIE Compliance Officer (Jennifer Sage) and EPA Operations Officer (Rebecca Akhurst) were also both contacted and provided a summary of the extreme weather event and environmental incident that had occurred. A communication strategy was prepared in consultation with the DPIE and implemented as soon as practically possible, to notify nearby residents.

At the morning toolbox talk, all site workers and contractors were briefed that the PIRMP had been enacted and were advised to notify their supervisor if they noticed anything that may cause environmental concern.

#### Broken Depositional Dust Gauge

DDG 4 was discovered broken in May 2020, resulting in no depositional dust result for the April 2020. As monthly monitoring is required by EPL 20611, Karuah East reported the missing result to the DPIE on 15 May 2020. DPIE did not require any further action. All other depositional dust gauges recorded a compliant result for April 2020.

### 11.2 Summary of Non-compliance

A summary of non - compliances is outlined in **Table 2** in **Section 1**. These include the uncontrolled discharge incident in October 2020, the broken depositional dust gauge in April 2020, the frequency of noise monitoring and administrative non-compliances from the 2020 Independent Environmental Audit.

### 11.3 Environmental Training

Training of Karuah East Quarry employees and contractors was undertaken monthly through the year with a focus on environmental awareness and incidents.

## 12.0 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

**Table 49** outlines the proposed actions in the next reporting period.

**Table 43 - Proposed Actions in the Next Reporting Period**

| Proposed Action                                                                                     | Timeline   | Management Plan Requires Revision |
|-----------------------------------------------------------------------------------------------------|------------|-----------------------------------|
| Update Noise Management Plan (and other management plans if necessary) to reflect approval of MOD 8 | March 2021 | Yes                               |
| 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 recommendations listed in Audit Action Plan                | 2021       | Yes<br>(see Appendix 8)           |
| Continue to undertake pest and weed management as required                                          | Ongoing    | No                                |

## 13.0 REFERENCES

The following documents and reports have been used to assist in writing this 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 2018);
- Traffic Management Plan (Streetwise 2015); and
- Water Management Plan (SLR 2019).

### Monitoring Reports

- 2020 Annual Monitoring Report - Karuah East Quarry Biodiversity Offset Area and Lot 12 (Kleinfelder 2020);
- Karuah East Quarry Independent Environmental Audit (Hansen Bailey 2020);
- Karuah East Quarry-Quarterly Noise Monitoring April 2020 (Thearle Acoustics 2020a);
- Karuah East Quarry-Quarterly Noise Monitoring June 2020 (Thearle Acoustics 2020b);
- Karuah East Quarry-Quarterly Noise Monitoring November 2020 (Thearle Acoustics 2020c); and
- *Tetratheca Juncea* Monitoring Report for The Karuah East Quarry Site (Firebird ecoSultants 2021).

### Statutory Documents

- Section 2.55 (1A) Modification Report – Proposed Modification to Operational Noise Criteria and Implementation of Improved Acoustic Mitigation Measures, PA 09\_0175 (ADW Johnson 2019);
- 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 development.

Alan Coutts  
Member of the Commission

David Johnson  
Member of the Commission

Sydney

17 June 2014

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### SCHEDULE 1

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

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

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

**Note:** Modifications 3 – 7 – withdrawn

Purple text represents Mod 8 (Operational noise criteria) – December 2020

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## DEFINITIONS

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aboriginal object / place    | Has the same meaning as the definition of the term in section 5 of the NP&W Act.                                                                                                                                                                                                                                                                                                                                                                |
| Annual review                | The review required under condition 4 of Schedule 5                                                                                                                                                                                                                                                                                                                                                                                             |
| Applicant                    | Karuah East Quarry Pty Limited or any other person or company who rely on this consent to carry out the development that is the subject of this consent                                                                                                                                                                                                                                                                                         |
| BCA                          | Building Code of Australia                                                                                                                                                                                                                                                                                                                                                                                                                      |
| BCD                          | Biodiversity and Conservation Division within the Department                                                                                                                                                                                                                                                                                                                                                                                    |
| Biodiversity offset strategy | The conservation and enhancement strategy described in the EA, and depicted conceptually in the figure in Appendix 4                                                                                                                                                                                                                                                                                                                            |
| Calendar year                | A period of 12 months from 1 January to 31 December                                                                                                                                                                                                                                                                                                                                                                                             |
| CCC                          | Community Consultative Committee                                                                                                                                                                                                                                                                                                                                                                                                                |
| Conditions of this consent   | Conditions contained in Schedules 2 to 5 inclusive                                                                                                                                                                                                                                                                                                                                                                                              |
| Council                      | MidCoast Council                                                                                                                                                                                                                                                                                                                                                                                                                                |
| CPI                          | Australian Bureau of Statistics Consumer Price Index                                                                                                                                                                                                                                                                                                                                                                                            |
| Day                          | The period from 7 am to 6 pm on Monday to Saturday, and 8 am to 6 pm on Sundays and Public Holidays.                                                                                                                                                                                                                                                                                                                                            |
| Department                   | Department of Planning, Industry and Environment                                                                                                                                                                                                                                                                                                                                                                                                |
| DPIE Water                   | Water Group within the Department                                                                                                                                                                                                                                                                                                                                                                                                               |
| Development                  | The development as described in the EA, EA (MOD 1), EA (MOD 2) and SEE (MOD 8).                                                                                                                                                                                                                                                                                                                                                                 |
| Development layout           | The layout of the development as shown in the figures in Appendix 1                                                                                                                                                                                                                                                                                                                                                                             |
| 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>                                                                                                                                                                                                                                                                                                                                                                                    |
| EPBC Act                     | <i>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</i>                                                                                                                                                                                                                                                                                                                                                               |
| EPL                          | Environment Protection Licence under the POEO Act                                                                                                                                                                                                                                                                                                                                                                                               |
| Extraction Area              | Extraction Area shown in Figure 1 in Appendix 1                                                                                                                                                                                                                                                                                                                                                                                                 |
| Feasible                     | Feasible relates to engineering considerations and what is practical to build                                                                                                                                                                                                                                                                                                                                                                   |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heritage item                 | <p>An Aboriginal object, an Aboriginal place, or a place, building, work, relic, moveable object, tree, or precinct of heritage significance, that is listed under any of the following:</p> <ul style="list-style-type: none"> <li>the State Heritage Register under the <i>Heritage Act 1977</i>;</li> <li>a state agency heritage and conservation register under section 170 of the <i>Heritage Act 1977</i>;</li> <li>a Local Environmental Plan under the EP&amp;A Act;</li> <li>the World Heritage List;</li> <li>the National Heritage List or Commonwealth Heritage List under the EPBC Act; or</li> <li>anything identified as a heritage item under the conditions of this consent.</li> </ul> |
| 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                          | Has the same meaning as the definition of the term in in section 1.4 of the EP&A Act, except where the term is used in the noise and air quality conditions in Schedules 3 and 4 of this consent 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 NSW Land Registry Services at the date of this consent                                                                                                                                                                                                                                                                                                                   |
| Material harm                 | <p>Is harm to the environment that:</p> <ul style="list-style-type: none"> <li>involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial; or</li> <li>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).</li> </ul>                                                                                                                                                                   |
| MEG                           | Regional NSW – Mining, Exploration & Geoscience                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Minister                      | The Minister for Planning and Public Spaces, or delegate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Minor                         | Not very large, important or serious.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Mitigation                    | Activities associated with reducing the impacts of the development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Modification 1                | Modification 1 to the development, as described in EA (MOD 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Modification 2                | Modification 2 to the development, as described in EA (MOD 2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Modification 8                | Modification 8 to the development, as described in SEE (MOD 8)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| NP&W Act                      | <i>National Parks and Wildlife Act 1974</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| NPfl                          | <i>NSW Noise Policy for Industry 2017</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 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, Karuah East Quarry Pty Limited (or its subsidiary) or another quarry operator (or its subsidiary).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 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 is 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Registered Aboriginal Parties | As described in the <i>National Parks and Wildlife Regulation 2009</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|                          |                                                                                                                                                                                                                                                                         |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rehabilitation           | The restoration of land disturbed by the development to a good condition, to ensure it is safe, stable and non-polluting                                                                                                                                                |
| Residence                | Existing or approved dwelling at the date of approval of Modification 1                                                                                                                                                                                                 |
| RFS                      | NSW Rural Fire Service                                                                                                                                                                                                                                                  |
| SEE (MOD 8)              | The Statement of Environmental Effects titled <i>Karuah East Quarry S4.55 (1A) Modification Report Proposed Modification to Operational Noise Criteria and Implementation of Improved Acoustic Measures</i> prepared by ADW Johnson Pty Limited and dated 20 June 2019. |
| Site                     | The development land shown in Figure 1 of Appendix 1, with land Lot and DP numbers identified in Schedule 1.                                                                                                                                                            |
| Statement of commitments | The Applicant's commitments in Appendix 6                                                                                                                                                                                                                               |
| TfNSW                    | Transport for NSW                                                                                                                                                                                                                                                       |
| 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 measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the construction and operation of the development, and any rehabilitation required under this consent.

### TERMS OF APPROVAL

2. The Applicant must carry out the development:
  - (a) in compliance with the conditions of this consent;
  - (b) in accordance with the statement of commitments in Appendix 6;
  - (c) in accordance with all written directions of the Planning Secretary; and
  - (d) generally in accordance with the EA, EA (MOD1), EA (MOD 2) and SEE (MOD 8).
3. Consistent with the requirements in this consent, the Planning Secretary may make written directions to the Applicant 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 consent, 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 condition 3(a).
4. The conditions of this consent and directions of the Planning Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and a document/s listed in condition 2(d). In the event of an inconsistency, ambiguity or conflict between any of the document/s listed in condition 2(d), the most recent document prevails to the extent of the inconsistency, ambiguity or conflict.

### LIMITS ON APPROVAL

#### Quarrying Operations

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

*Note: Under this consent, the Applicant is required to rehabilitate the site and carry out additional undertakings to the satisfaction of the Planning Secretary. Consequently, this consent 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 Applicant 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 Applicant 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.<br>No quarrying operations on Sundays or Public Holidays. |



| Activity                | Operating Hours                                                                                                                                                                                    |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction activities | 7.00 am to 6.00 pm, Monday to Friday; and<br>8.00 am to 1.00 pm, Saturdays,<br>unless noise from these activities does not exceed 40 dB(A) $L_{Aeq(15\ min)}$<br>at any privately-owned residence. |
| Maintenance activities  | 24 hours a day, 7 days per week, providing maintenance activities are<br>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 Applicant 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 Applicant is required to obtain construction and occupation certificates for any proposed building works.
- Part 8 of the EP&A Regulation sets out the requirements for the certification of the development.

## DEMOLITION

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

## DEVELOPER CONTRIBUTIONS

11. The Applicant 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 development; 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: (i) 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 development 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. All plant and equipment used on site, or to monitor the performance of the development, must be:
- maintained in a proper and efficient condition; and
  - operated in a proper and efficient manner.

## STAGED SUBMISSION OF ANY STRATEGY, PLAN OR PROGRAM

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

*Notes:*

- While any strategy, plan or program may be submitted on a progressive basis, the **Applicant** 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 **Applicant** must:
- (a) provide annual quarry production data to **MEG** 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 **Applicant** must ensure that all employees, contractors and sub-contractors are made aware of, and instructed to comply with, the conditions of this **consent** relevant to activities they carry out in respect of the development.

## APPLICABILITY OF GUIDELINES

16. References in the conditions of this consent 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 **consent**.

However, consistent with the conditions of this consent and without altering any limits or criteria in this **consent**, the **Planning** Secretary may, when issuing directions under this consent 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 consent require consultation with an identified party, the **Applicant** must:
- (a) consult with the relevant party prior to submitting the subject document;
  - (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 **Applicant** and how the **Applicant** has addressed the matters not resolved.

### SCHEDULE 3 ENVIRONMENTAL PERFORMANCE CONDITIONS

#### IDENTIFICATION OF APPROVED LIMITS OF EXTRACTION

1. The Applicant 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 Applicant 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. Except for the carrying out of construction works, the Applicant must ensure that the operational noise generated by the development does not exceed the criteria in Table 2 at any residence<sup>a</sup> on privately-owned land.

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

| Residence (Noise Assessment Location) <sup>a</sup> | Criteria (Day) |
|----------------------------------------------------|----------------|
| A                                                  | 42             |
| G                                                  | 43             |
| H                                                  | 45             |
| All other residences                               | 40             |

<sup>a</sup> The Residences (Noise Assessment Locations) referred to in Table 2 are shown in Appendix 2.

Noise generated by the development must be monitored and measured in accordance with the relevant procedures and modifications (including certain meteorological conditions) of the NPfI.

- 3A. The noise criteria in Table 2 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

##### Road Traffic Noise Criteria

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

Table 3: Road traffic noise criteria

| Road            | Criteria (Day <sup>a</sup> )        |
|-----------------|-------------------------------------|
| Pacific Highway | 60 dB(A) L <sub>Aeq</sub> (15 hour) |
| Local roads     | 55 dB(A) L <sub>Aeq</sub> (1 hour)  |

<sup>a</sup> Day is the period from 7 am to 10 pm every day in accordance with the EPA's NSW Road Noise Policy (2011).

5. Deleted

### Noise Operating Conditions

6. The Applicant must:
- take all reasonable steps to minimise noise from construction and operational activities, including low frequency noise and other audible characteristics, associated with the development;
  - implement reasonable and feasible noise attenuation measures on all plant and equipment that will operate in noise sensitive areas;
  - operate a comprehensive noise management system commensurate with the risk of impact;
  - take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions when the noise criteria in this consent do not apply (see NPfI);
  - carry out quarterly attended noise monitoring (unless otherwise agreed by the Planning Secretary) to determine whether the development is complying with the relevant conditions of this consent; and
  - regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of this consent.

### Noise Management Plan

7. The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
- be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;
  - be prepared in consultation with the EPA;
  - describe the measures to be implemented to ensure:
    - compliance with the noise criteria and operating conditions in this consent;
    - best practice management is being employed;
    - noise impacts of the development are minimised during noise-enhancing meteorological conditions when the noise criteria in this consent do not apply (see NPfI);
  - describe the noise management system in detail; and
  - include a monitoring program that:
    - is capable of evaluating the performance of the development;
    - monitors noise at the nearest and/or most affected residences;
    - adequately supports the noise management system;
    - includes a protocol for distinguishing noise emissions of the development from any neighbouring developments; and
    - includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of any such event.

- 7A. The Applicant must implement the plan as approved by the Planning Secretary.

### BLASTING

#### Blasting Criteria

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

Table 4: Blasting criteria

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

However, the blasting criteria in Table 5 do not apply if the **Applicant** has a written agreement with the relevant landowner or infrastructure provider/owner, and the **Applicant** has advised the Department in writing of the terms of this agreement.

### Blasting Hours

9. The **Applicant 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 **Applicant 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 **Applicant 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 **Applicant**, unless:
      - the **Applicant** has a written agreement with the relevant landowner to allow blasting to be carried out closer to the land, and the **Applicant** has advised the Department in writing of the terms of this agreement, or
      - the **Applicant** 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 Applicant must prepare a Blast Management Plan for the development 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 to the Planning Secretary for approval prior to the commencement of construction activities;
  - describe the measures that would be implemented to ensure:
    - best management practice is being employed; and
    - compliance with the relevant conditions of this consent;
  - include a road closure protocol if blasting occurs within 500 metres of a public road;
  - include a specific blast fume management protocol, to demonstrate how emissions will be minimised including risk management strategies if blast fumes are generated; and
  - include a monitoring program for evaluating the performance of the development including:
    - compliance with the applicable criteria; and
    - minimising fume emissions from the site.

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

## AIR QUALITY

### Air Quality Criteria

13. The Applicant must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development 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 | <sup>d</sup> Criterion            |
|------------------------------------------------|------------------|-----------------------------------|
| Total suspended particulates (TSP)             | Annual           | <sup>a</sup> 90 µg/m <sup>3</sup> |
| Particulate matter < 10 µm (PM <sub>10</sub> ) | Annual           | <sup>a</sup> 30 µg/m <sup>3</sup> |

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

| Pollutant                                      | Averaging period | <sup>d</sup> Criterion            |
|------------------------------------------------|------------------|-----------------------------------|
| Particulate matter < 10 µm (PM <sub>10</sub> ) | 24 hour          | <sup>a</sup> 50 µg/m <sup>3</sup> |

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

| Pollutant                   | Averaging period | Maximum increase in deposited dust level | Maximum total deposited dust level     |
|-----------------------------|------------------|------------------------------------------|----------------------------------------|
| <sup>c</sup> Deposited dust | Annual           | <sup>b</sup> 2 g/m <sup>2</sup> /month   | <sup>a</sup> 4 g/m <sup>2</sup> /month |

Notes to Tables 7-9:

- <sup>a</sup> Total impact (ie incremental increase in concentrations due to the development plus background concentrations due to all other sources);
- <sup>b</sup> Incremental impact (ie incremental increase in concentrations due to the development on its own);
- <sup>c</sup> 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.
- <sup>d</sup> 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 Applicant must implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site.

## Operating Conditions

15. The **Applicant must**:
- (a) implement best management practice to minimise dust emissions by the **development**;
  - (b) 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 **consent**;
  - (c) minimise the air quality impacts of the **development** during adverse meteorological conditions and extraordinary events (see note d under Tables 7-9); and
  - (d) minimise surface disturbance of the site, other than as permitted under this **consent**.

## Air Quality Management Plan

16. The **Applicant must** prepare an Air Quality Management Plan for the **development** 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 for approval to the **Planning** Secretary prior to the commencement of construction activities;
  - (c) describe the measures that would be implemented to ensure:
    - compliance with the relevant air quality conditions of this **consent**;
    - best management practice is employed; and
    - the air quality impacts of the **development** are minimised during adverse meteorological conditions and extraordinary events;
  - (d) describe the proposed air quality management system; and (e) include a monitoring program that:
    - is capable of evaluating the performance of the **development**;
    - includes a protocol for determining any exceedances of the relevant conditions of **consent**;
    - effectively supports the air quality management system; and
    - evaluates and reports on the adequacy of the air quality management system.

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

## METEOROLOGICAL MONITORING

17. For the life of the **development**, the **Applicant 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

### Water Supply

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

### Surface Water Discharges

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

### Effluent Management

20. The **Applicant 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 Applicant must prepare a Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
- (a) be prepared in consultation with the EPA and DPIE Water 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 development;
      - 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 development 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 Applicant must implement the plan as approved by the Planning Secretary.

## TRANSPORT

### Roadworks

22. The Applicant 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 TfNSW;



- (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 Applicant must keep accurate records of all laden truck movements to and from the site (including time of arrival and dispatch) and publish a summary of records on its website every 6 months and in the Annual Review.

#### Parking

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

#### Operating Conditions

25. The Applicant must ensure that all development-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 Applicant must prepare a Transport Management Plan for the development 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 TfNSW 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 consent;
    - that drivers of development-related heavy vehicles are aware of potential safety issues along the haulage routes; and
    - that drivers of development-related heavy vehicles comply with the Driver Code of Conduct; and
  - (e) include a program to monitor the effectiveness of these measures.

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

#### LANDSCAPE

##### *Tetratheca Juncea* Translocation

27. The Applicant must develop a translocation program for *Tetratheca juncea* to the satisfaction of the Planning Secretary. This program must:
- (a) be prepared in consultation with BCD, by a suitably qualified and experienced ecologist 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 that involve clearing of or potential harm to *Tetratheca juncea*;
  - (c) 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;
  - (d) include a monitoring program to study the *Tetratheca juncea* stems before and after translocation;
  - (e) include short and long-term goals and performance criteria to measure the effectiveness of the program; and

- (f) provide for the transfer of information obtained as a result of implementing the program to BCD and the Department.

### Biodiversity Offset Strategy

28. The Applicant 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 BCD 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 Applicant must implement the strategy as approved by the Planning Secretary.

### Long Term Security of Offsets

29. The Applicant 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 BCD 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 **Applicant must** rehabilitate the site to the satisfaction of the **Planning** Secretary. This rehabilitation must:
- be 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 <b>Planning</b> 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 <b>development</b> | Restore ecosystem function, including maintaining or establishing self-sustaining eco-systems comprised of: <ul style="list-style-type: none"> <li>native endemic species; and</li> <li>a landform consistent with the surrounding environment.</li> </ul> |
| Community                                     | Ensure public safety.<br>Minimise the adverse socio-economic effects associated with quarry closure.                                                                                                                                                       |

## Progressive Rehabilitation

31. The **Applicant must**:
- rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance;
  - take all reasonable and feasible measures to minimise the total area of the site exposed at any time; and
  - 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 Applicant must** prepare a Landscape and Rehabilitation Management Plan for the **development** to the satisfaction of the **Planning** Secretary. This Plan would relate to the area of the quarry and all perimeter lands. This plan must:
- be prepared by a suitably qualified expert whose appointment has been approved by the **Planning** Secretary;
  - be prepared in consultation with BCD and Council, and submitted to the Planning Secretary for approval prior to the commencement of construction activities;
  - describe how the implementation of the Tetraheca juncea Translocation Program would be integrated with the overall rehabilitation of the site;
  - 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 **consent**.
  - include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the site, including triggers for any remedial action;
  - 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 consent;
    - 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 Applicant must implement the plan as approved by the Planning Secretary.

#### Biodiversity Offset Area Management Plan

33. The Applicant must prepare a Biodiversity Offset Area Management Plan for the development 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 BCD and Council;
  - (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.

#### Conservation & Rehabilitation Bond

34. The Applicant **must** lodge a Conservation and Rehabilitation Bond with the Department 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 Applicant and BCD 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 Applicant **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).

## HERITAGE

### Heritage Management Plan

36. The Applicant must prepare a Heritage Management Plan for the development 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 BCD, 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 Applicant must implement the plan as approved by the Planning Secretary.

## VISUAL

37. The Applicant 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 development 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 Applicant 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 Applicant 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 Applicant must secure the site to ensure public safety at all times, to the satisfaction of the Planning Secretary.

### Bushfire Management

41. The Applicant must:
- (a) ensure that the development 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 Applicant must:
- (a) minimise the waste generated by the development; and

- (b) ensure that the waste generated by the development 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 and no longer than 7 days after obtaining monitoring results showing an:
  - (a) exceedance of any noise, blasting and air quality criteria in Schedule 3, the Applicant must provide the details of the exceedance to any affected landowners and/or tenants; and
  - (b) an exceedance of the relevant air quality criteria in Schedule 3, the Applicant 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 a landowner considers the development to be exceeding any noise, blasting or air quality criterion in Schedule 3 of this consent, they may ask the Planning Secretary in writing for an independent review of the impacts of the development on their land.
3. If the Planning Secretary is not satisfied that an independent review is warranted, the Planning Secretary will notify the landowner in writing of that decision, and the reasons for that decision, within 21 days of the request for a review.
4. If the Planning Secretary is satisfied that an independent review is warranted, within 3 months, or as otherwise agreed by the Planning Secretary and the landowner, of the Planning Secretary's decision, the Applicant must:
  - (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Planning Secretary, to:
    - (i) consult with the landowner to determine their concerns;
    - (ii) conduct monitoring to determine whether the development is complying with the relevant criteria in Schedule 3 of this consent; and
    - (iii) if the development is not complying with that criteria, identify measures that could be implemented to ensure compliance with the relevant criteria;
  - (b) give the Planning Secretary and landowner a copy of the independent review; and
  - (c) comply with any written requests made by the Planning Secretary to implement any findings of the review.



## SCHEDULE 5 ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING

### ENVIRONMENTAL MANAGEMENT

#### Environmental Management Strategy

1. The **Applicant must** prepare an Environmental Management Strategy for the **development** 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 **development**;
  - (c) identify the statutory approvals that apply to the development;
  - (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the development;
  - (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 **development**;
    - receive, handle, respond to, and record complaints;
    - resolve any disputes that may arise during the course of the **development**;
    - 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 **consent**; and
      - a clear plan depicting all the monitoring required to be carried out under the conditions of this **consent**.

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

#### Adaptive Management

2. The **Applicant must** assess and manage **development**-related risks to ensure that there are no exceedances of the criteria and/or performance measures in this **consent**. 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 **Applicant 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.

#### Management Plan Requirements

3. The **Applicant must** ensure that the Management Plans required under this **consent** 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 commitments or recommendations identified in the documents listed in condition 2(d) of Schedule 2**;
    - 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 **development** 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 **development**; 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 development 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 **Applicant** must review the environmental performance of the **development** 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;
  - (b) include a comprehensive review of the monitoring results and complaints records of the **development** 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 **documents referred to in condition 2(d) of Schedule 2 of this consent**;
  - (c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
  - (d) identify any trends in the monitoring data over the life of the **development**;
  - (e) identify any discrepancies between the predicted and actual impacts of the **development**, and analyse the potential cause of any significant discrepancies; and
  - (f) describe the measures that would be implemented over the current calendar year to improve the environmental performance of the **development**.

;

### 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 **consent**, (unless the conditions require otherwise), the **Applicant must** review the strategies, plans, and programs required under this **consent**, 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 **development**.*

### Community Consultative Committee

6. The **Applicant must** establish and operate a Community Consultative Committee (CCC) for the **development**. 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 **Applicant** complies with this **consent**.
- In accordance with the guideline, the Committee should comprise an independent chair and appropriate representation from the **Applicant**, Council, recognised environmental groups and the local community.

## REPORTING

### Incident Notification

7. The **Applicant** 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](mailto:compliance@planning.nsw.gov.au) and identify the **development** (including the **development** 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 **Applicant** must notify the Department of the non-compliance. The notification must be in writing to [compliance@planning.nsw.gov.au](mailto:compliance@planning.nsw.gov.au) and identify the **development** (including the **development** application number and name), set out the condition of this **consent** that the **development** 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 **Applicant** **must** regularly report on the environmental performance of the **development** on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this **consent**.

## 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 **Applicant** **must** commission and pay the full cost of an Independent Environmental Audit of the **development**. This audit must:
- (a) be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the **Planning** Secretary;
  - (b) include consultation with the relevant agencies;
  - (c) assess the environmental performance of the **development** and whether it is complying with the relevant requirements in this **consent** and any relevant EPL and/or Water Licence (including any assessment, plan or program required under these approvals);
  - (d) review the adequacy of any approved strategy, plan or program required under these approvals; and
  - (e) recommend measures or actions to improve the environmental performance of the **development**, 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 **Applicant** 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.

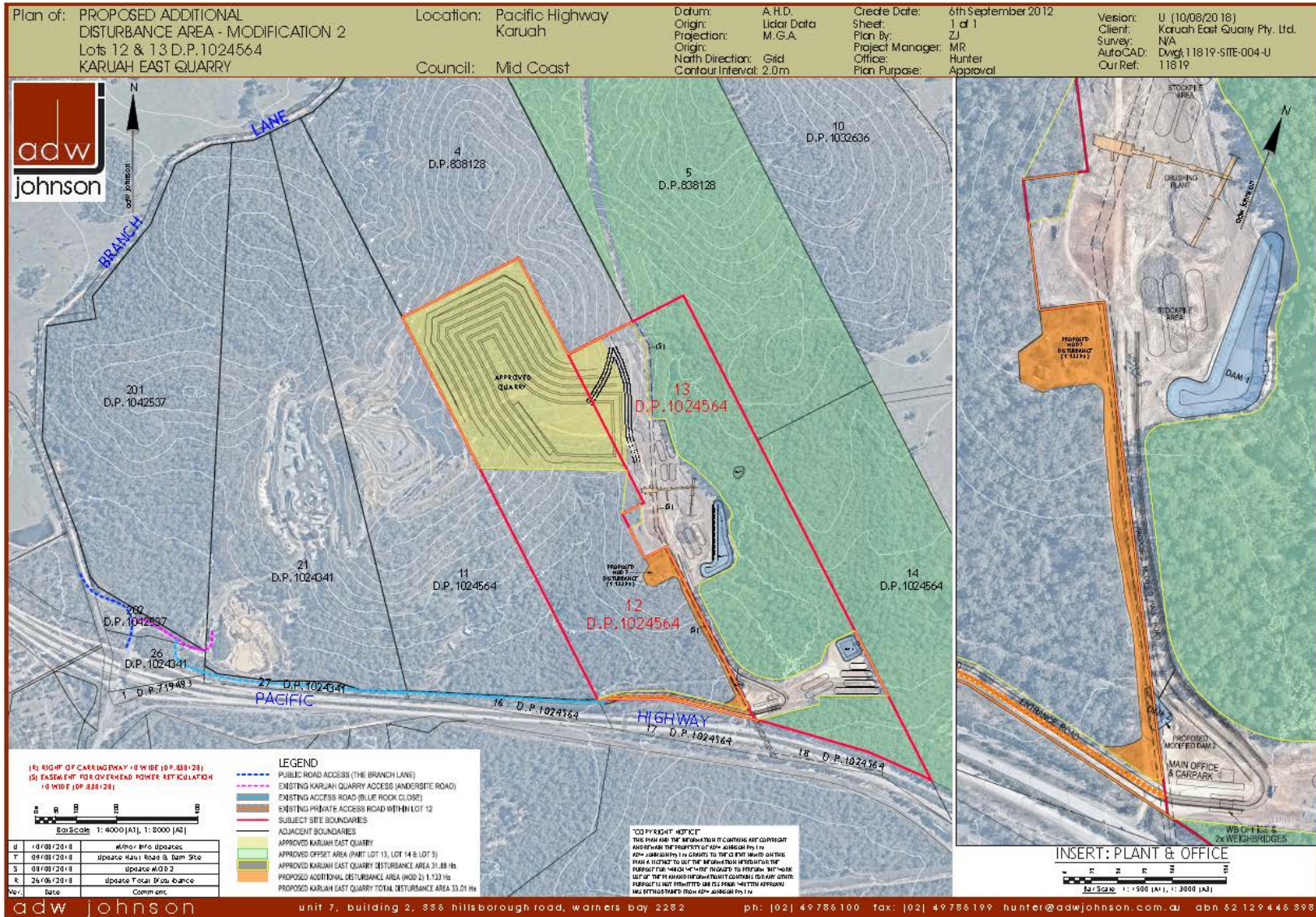
## ACCESS TO INFORMATION

11. The Applicant must:
- (a) make the following information publicly available on its website:
    - the documents referred to in condition 2(d) of Schedule 2 of this consent;
    - any statutory approvals for the development;
    - approved strategies, plans and/ programs;
    - a summary of the monitoring results of the development, which have been reported in accordance with the various plans and programs approved under the conditions of this consent;
    - a complaints register, updated quarterly;
    - minutes of CCC meetings;
    - annual reviews;
    - any independent environmental audit, and the Applicant'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

### DEVELOPMENT LAYOUT



**Figure 1: Development Layout**



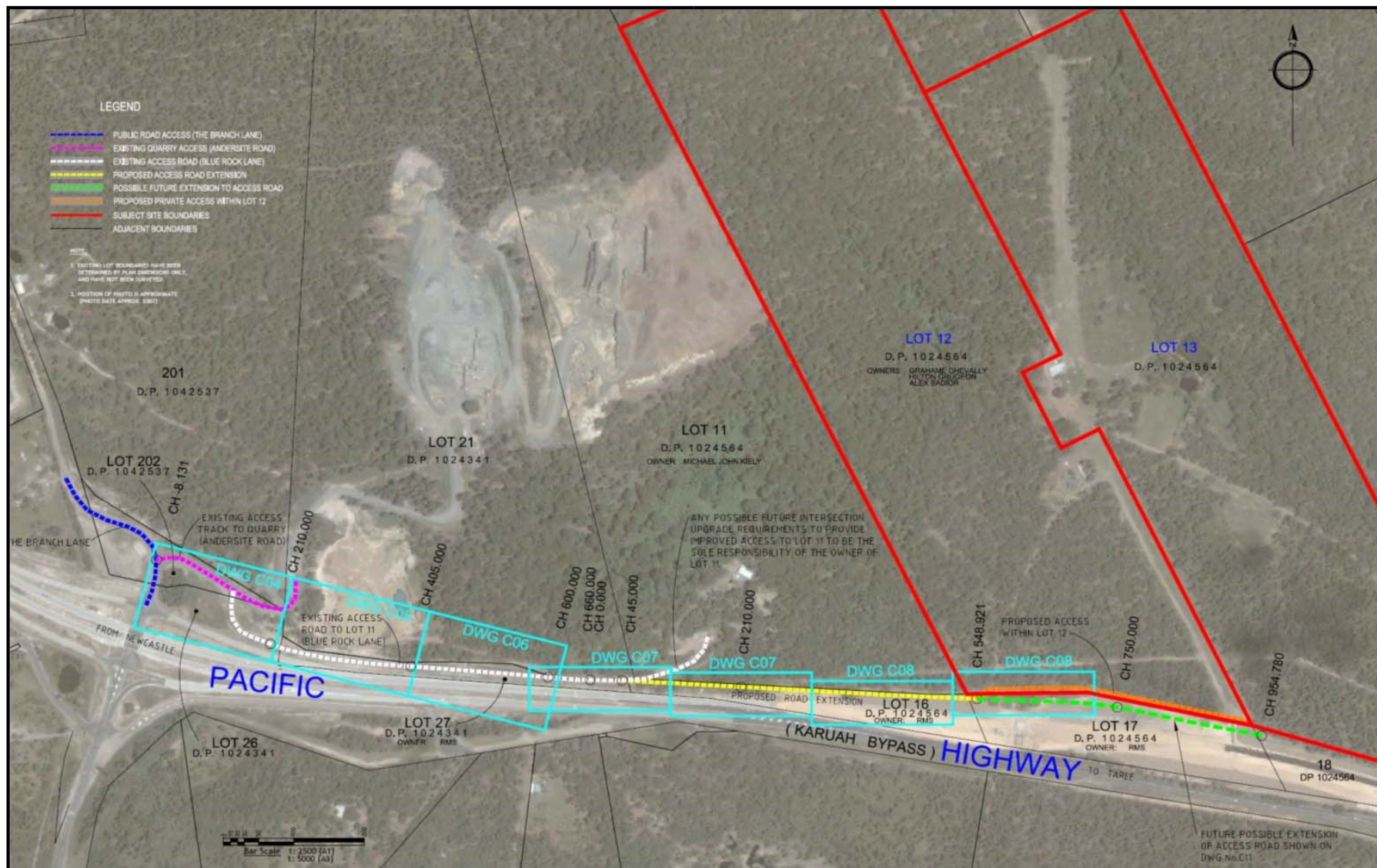
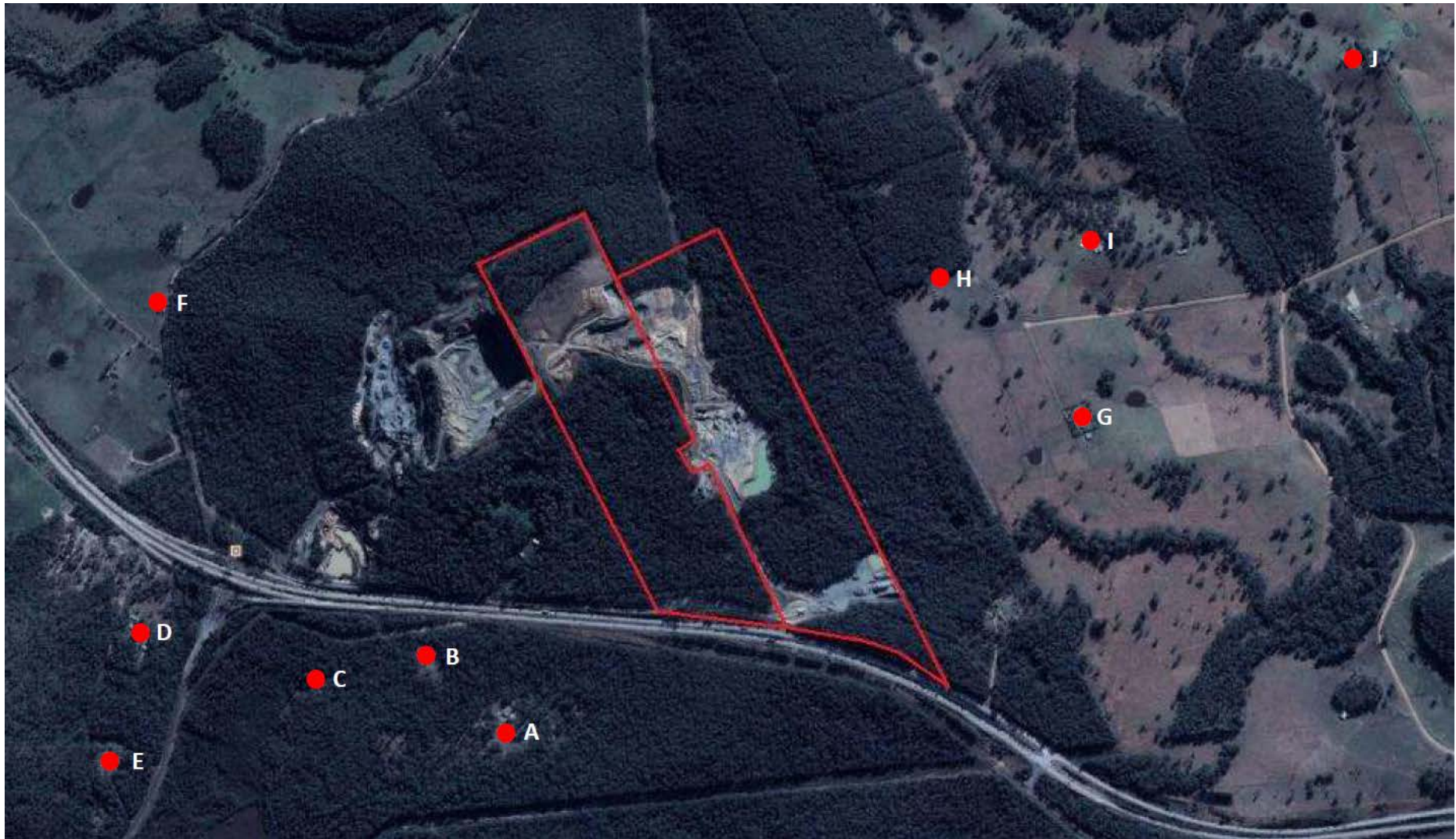


Figure 2: Proposed roadworks



APPENDIX 2  
RESIDENCES (NOISE ASSESSMENT LOCATIONS)



*Figure 1: Residences (Noise Assessment Locations)*

## APPENDIX 3

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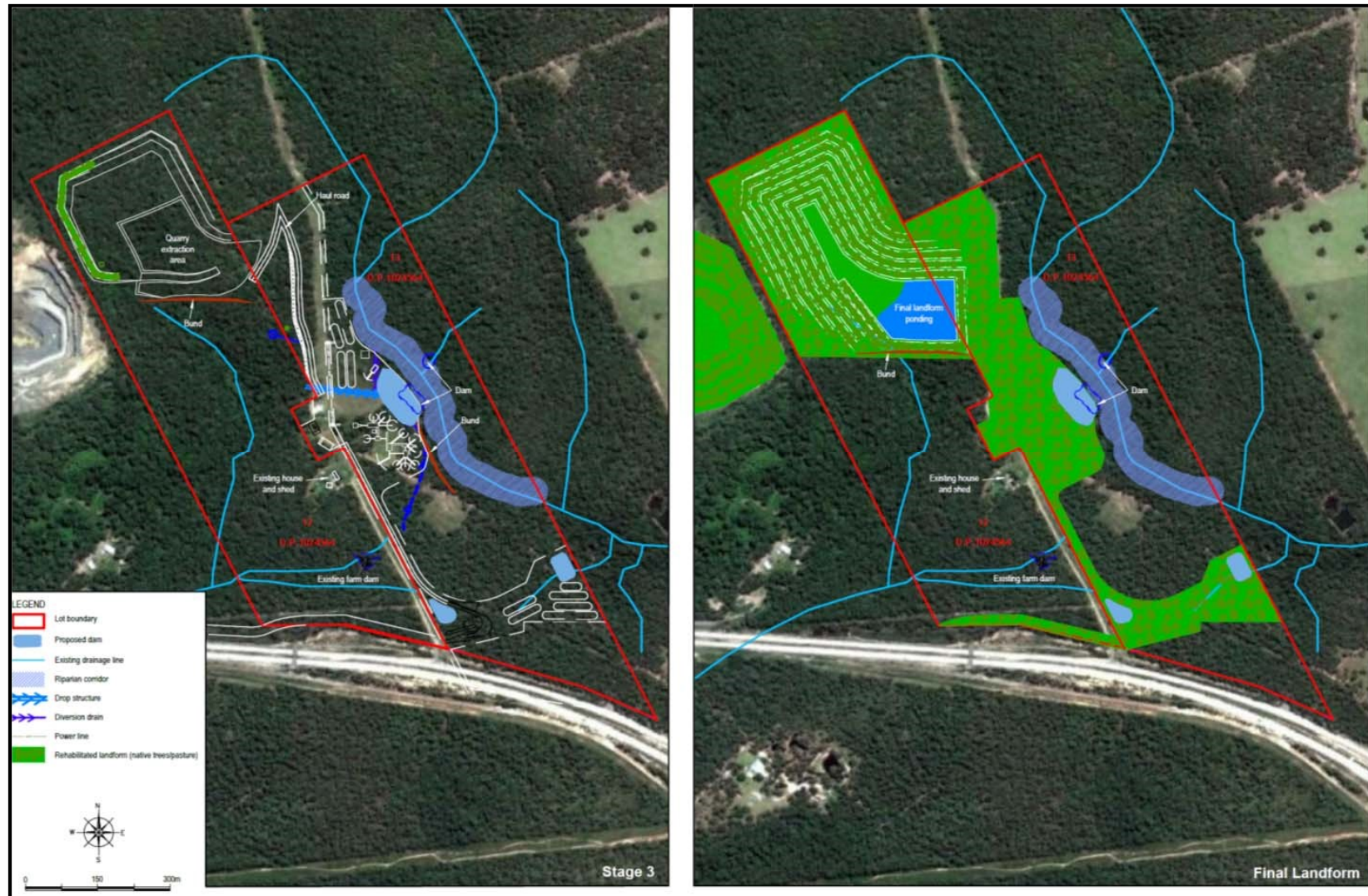
# APPENDIX 4 CONCEPTUAL BIODIVERSITY OFFSET AREA



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 **Applicant'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;
- 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.

**Table 1 - Recommended Stripping Depths**

| Soil Type                                  | Development Soil Name | Soil Layer | Recommended Stripping Depth (m) | Area (ha) | Volume (m³) |
|--------------------------------------------|-----------------------|------------|---------------------------------|-----------|-------------|
| 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     |

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 vehicles 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 development 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 development 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 development 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, 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.

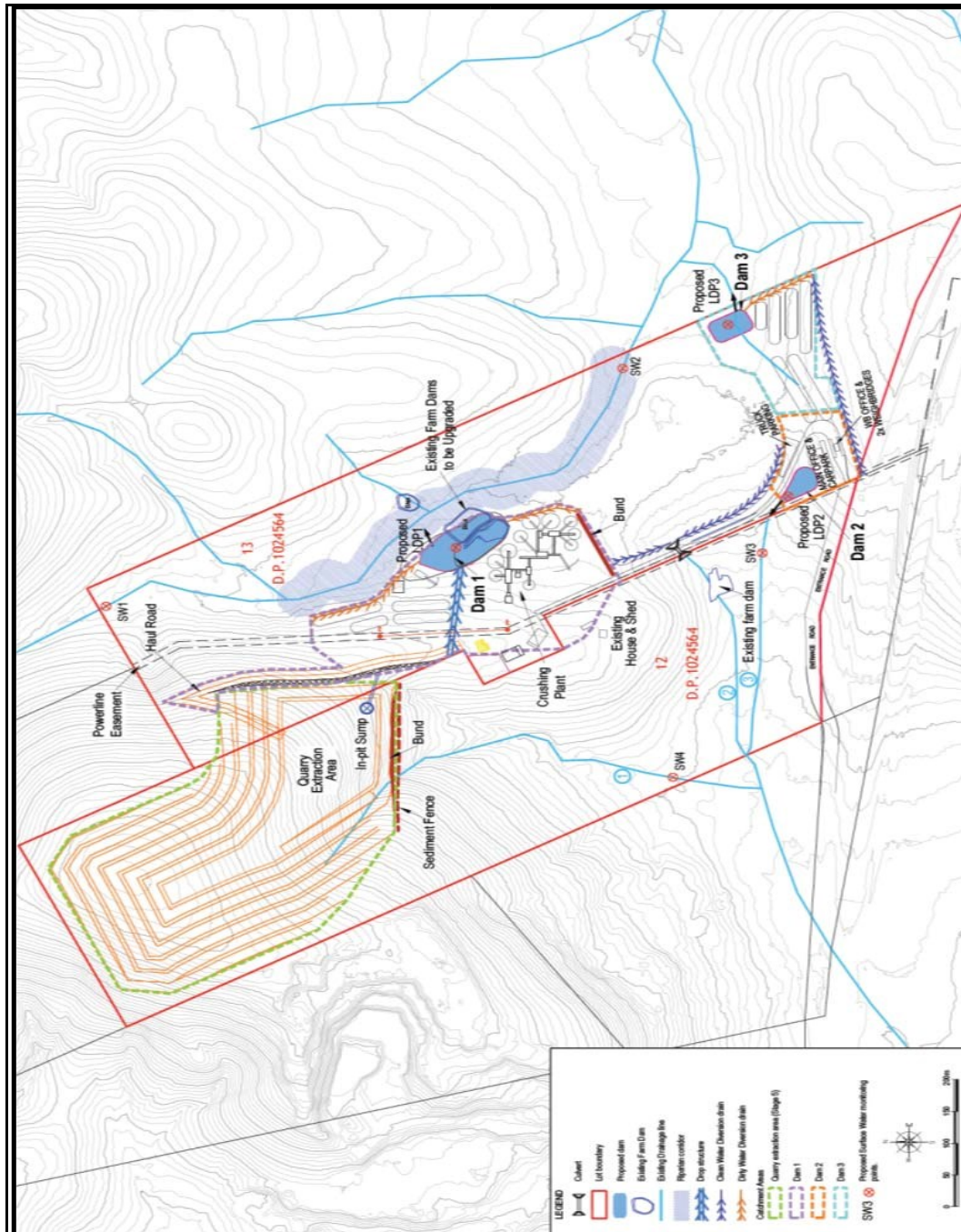
## **Reporting**

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:





**Figure 1:** Surface Water Management Plan.

### **Quarry Extraction Area**

- Runoff generated within the active quarry extraction area will be directed into an in-pit sump where it will be contained and pumped out as required so as not to impede quarrying activity;
- A bund and sediment fence will be maintained along the southern boundary of the quarry, to minimise the risk of sediment being washed downstream of the quarry;
- Construction of the quarry floor will be managed in such a way so as to direct all runoff to the in-pit sump. The location of this sump will change as quarrying progresses, however it will generally be located in the south east corner of the quarry;
- Water collected in the in-pit sump will be pumped out as required into a rock lined table drain adjacent to the main haul road. The water will flow down this drain to the main dirty water dam, Dam 1, via a rock lined drop structure; and
- Progressive rehabilitation of all formed surfaces, such as quarry benches and long-term soil stockpiles, will occur wherever possible to reduce the amount of total suspended solids (TSS) in runoff from disturbed areas.

### **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 storage (ML) | water capacity | 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 BCD 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 DPIE Water;
- 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 development consent 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:
  - Containment of dirty water runoff from the active quarry area by directing this water into in-pit sumps;
  - Directing sediment-laden runoff from disturbance areas and rehabilitated areas into designated sediment control dams;
  - Installing temporary erosion and sediment control devices as required (i.e. sediment fences sandbag 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);
  - topsoil/subsoil handling and stockpiling procedures; and



- 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 **Development**; and
  - 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 **BCD** 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**

| <b>Parameter</b>                       | <b>Unit</b> | <b>ANZECC Guidelines<sup>1</sup></b> |
|----------------------------------------|-------------|--------------------------------------|
| pH (Field)                             | --          | 6.5 – 8.5                            |
| Conductivity (Field)                   | uS/cm       | 125 – 2200                           |
| Conductivity (Lab)                     | uS/cm       | 125 – 2200                           |
| Total Dissolved Solids                 | mg/L        | -                                    |
| <b>Parameter</b>                       | <b>Unit</b> | <b>ANZECC Guidelines<sup>1</sup></b> |
| Total Phosphorus                       | mg/L        | 0.025                                |
| Ammonia                                | mg/L        | 0.02                                 |
| Nitrogen (Nitrate)                     | mg/L        | 0.350                                |
| Total Hardness (as CaCO <sub>3</sub> ) | 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                               |

<sup>1</sup> Key default trigger values presented in ANZECC 2000 for slightly disturbed upland rivers in NSW. Heavy metals based on hard water (120-179 mgCaCO<sub>3</sub>/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.

## **4.0 BIODIVERSITY & CONSERVATION OFFSET**

### **4.1 Flora and Fauna**

The following will be implemented by the **Applicant**:

## **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 [BCD](#) 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 to 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 [development consent](#).

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 BCD for the salvage program will be made and will be subject to a detailed Salvage Plan to be prepared by the Applicant (and endorsed by BCD 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 Applicant). In the event that Lot 5 DP 838128 is unable to be secured by the Applicant, the Applicant 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 BCD and be to the satisfaction of the Planning Secretary.

The following will be undertaken by the Applicant 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 BCD guidelines. In particular, seasonal survey for *tetratheca juncea* and *grevillea parviflora* ssp *parviflora* will be undertaken and reported to the BCD;
- Prior to establishment of the proposed quarry, the Applicant 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 Applicant, as noted above, the Applicant will purchase an alternate offset site (to be agreed to by BCD and be to the satisfaction of the Planning Secretary).
- Upon approval of the development, in consultation with the BCD, the Applicant 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 Applicant). 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:

- Enclosure of the Jaw Crusher with 100 mm 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;
- Purchase and use of generator sets which are acoustically treated including complete enclosure of the engine and generator, acoustically treated exhaust systems and cooling systems;
- Noise compliance monitoring will be undertaken in accordance with conditions of consent and Noise Management Plan by a suitably qualified acoustic expert. The monitoring will consider the performance of the quarry in relation to the development specific noise (as established in the Thearle Acoustics Noise Impact Assessment 10 June

2019) and vibration and blast criteria established in the SLR Noise and Blasting Impact Assessment (dated 2 November 2012);

- The Applicant will not fire blasts at the existing quarry and the proposed Karuah East quarry at the same time;
- The Applicant 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 Applicant 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 TfNSW 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/m<sup>2</sup>/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 development 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 development site will be considered to reduce transport distances for vehicles entering / exiting the development 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 adopted by the Applicant.

### **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 **Applicant** 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 **BCD** Enviroline 131 555 and relevant Aboriginal stakeholders in order to determine an action plan for the management of the skeletal remains prior to works recommencing 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 **BCD** 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 **Applicant** 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  |                          |                      |



|                            |                                                                                                                                                                                                                      |                                                      |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>General Description</b> | <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 |
| <b>2m x 2m quadrants</b>   | <ul style="list-style-type: none"> <li>Count the number of plants of all species, excluding grass.</li> <li>Measure live vegetation cover for understorey and grasses (separately) using a line intercept</li> </ul> | 12 months after establishment and then every 2 years |

| Aspect of Rehabilitation | Elements to be Monitored                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Monitoring Frequency                                 |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
|                          | method.<br><input type="checkbox"/> Record details of ground cover (litter, logs, rocks etc).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                      |
| <b>20m x 10m plots</b>   | <ul style="list-style-type: none"> <li>Count, by species, all trees &gt;1.6m tall.</li> <li>Tag and measure DBH of trees &gt;1.6m tall, to a maximum of 10 for any one species.</li> <li>Record canopy cover over the whole 20m centreline when trees are tall enough.</li> <li>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.</li> <li>Record any new plant species not present in the smaller plots, including any problem and declared noxious weeds.</li> <li>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.</li> </ul> | 12 months after establishment and then every 2 years |
| <b>50m transect</b>      | <ul style="list-style-type: none"> <li>Along the 50m erosion monitoring transect, record the location, number and dimension of all gullies &gt;30cm wide and/or 30cm deep.</li> <li>Erosion pins may be established in plots located in newer rehabilitation to record sheet erosion if present.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 12 months after establishment and then every 2 years |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                      |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Rehabilitation general</b> | <ul style="list-style-type: none"> <li>• 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).</li> <li>• Observation such as this can provide useful, broad scale information on rehabilitation success and problems.</li> </ul> | 12 months after establishment and then every 2 years |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|

| Aspect of Rehabilitation      | Elements to be Monitored                                                                                                                                                                                                                                                                                                                                                             | Monitoring Frequency                                                                                                                   |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Photographic record</b>    | <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                                                                                   |
| <b>Habitat</b>                | <ul style="list-style-type: none"> <li>• General observations relating to the availability and variety of food sources (e.g. flowering/ fruiting trees, presence of invertebrates etc).</li> <li>• Availability and variety of shelter (e.g. depth of leaf litter, presence of logs, hollows etc).</li> <li>• Presence/absence of free water in the rehabilitation areas.</li> </ul> | 12 months after establishment and then every 2 years                                                                                   |
| <b>Fauna</b>                  | <ul style="list-style-type: none"> <li>• General observations of vertebrate species (including species of conservation significance).</li> <li>• Detailed fauna surveys including presence and approximate abundance and distribution of vertebrate species (focusing on species of conservation significance).</li> </ul>                                                           | After rehabilitation is three years old undertake monitoring in every 2 years after establishment in both Autumn and Spring            |
| <b>Weeds and pests</b>        | <ul style="list-style-type: none"> <li>• Species identity.</li> <li>• Approximate numbers/level of infestation.</li> <li>• Observation of impact on rehabilitation (if any).</li> </ul>                                                                                                                                                                                              | Quarterly during the first two years and biannually after that. Inspections should be opportunistic after significant rainfall events. |
| <b>Geotechnical Stability</b> |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                        |

|                                | <ul style="list-style-type: none"> <li>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.</li> <li>Surface integrity of landform cover/capping (measurement of extent of integrity failure).</li> <li>Presence/ absence of landform slumping.</li> </ul> | Annually                                                                                                                   |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Aspect of Rehabilitation       | Elements to be Monitored                                                                                                                                                                                                                                                                                                                                                                                      | Monitoring Frequency                                                                                                       |
| <b>Surface and Groundwater</b> |                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                            |
|                                | Groundwater quality and depth<br>Efficiency of landform surface water drainage systems (integrity of banks and drains).<br>Water quality including pH, EC and total suspended solids of water in water storages, and pits, sedimentation dams.                                                                                                                                                                | Quarterly or following rainfall events.<br>Monitoring of receiving waters during a rainfall event which results in runoff. |

## 11.2 Final Void Managements

### 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 a 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.

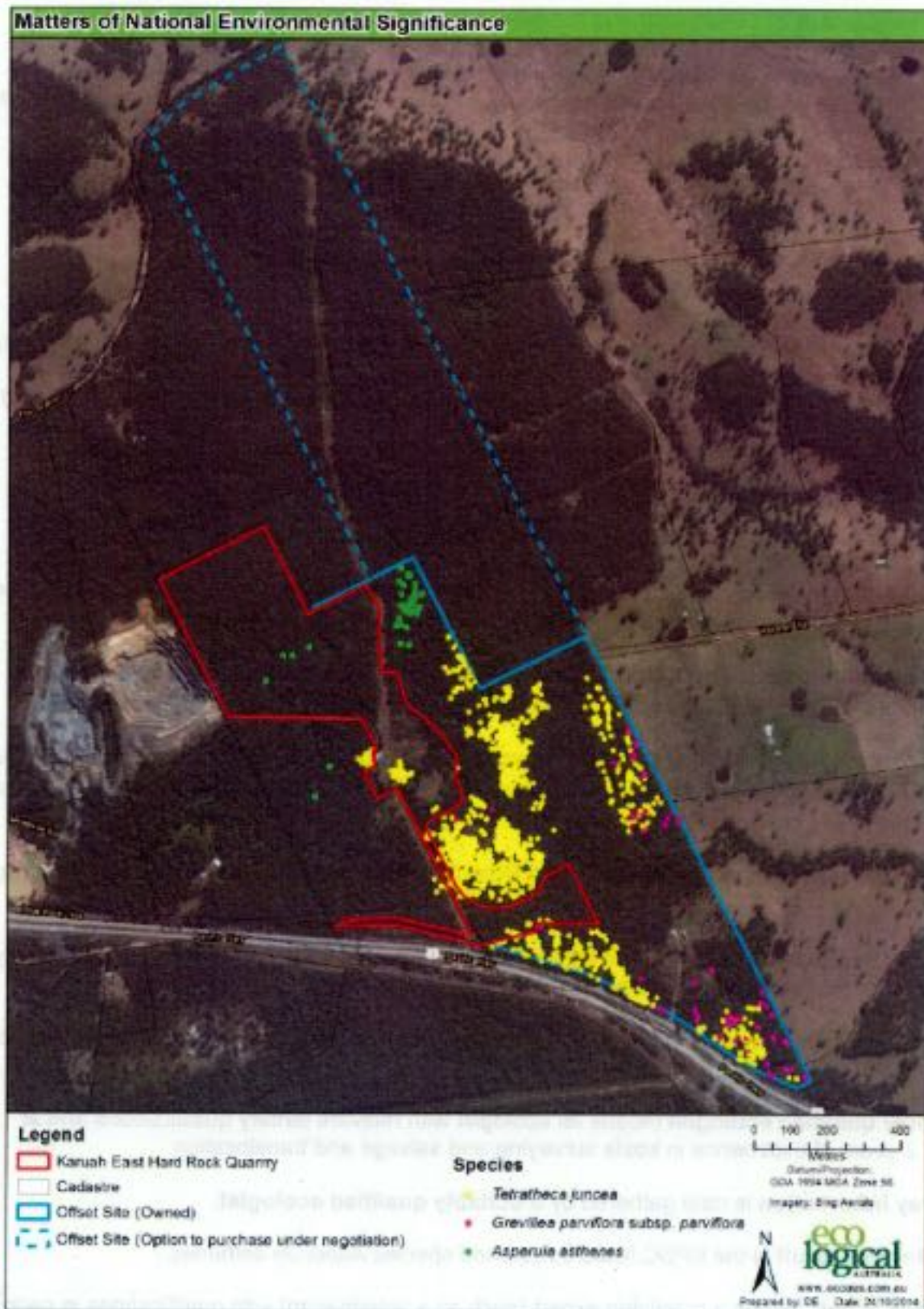
**Survey information** is data gathered by a **suitably qualified ecologist**.

**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**

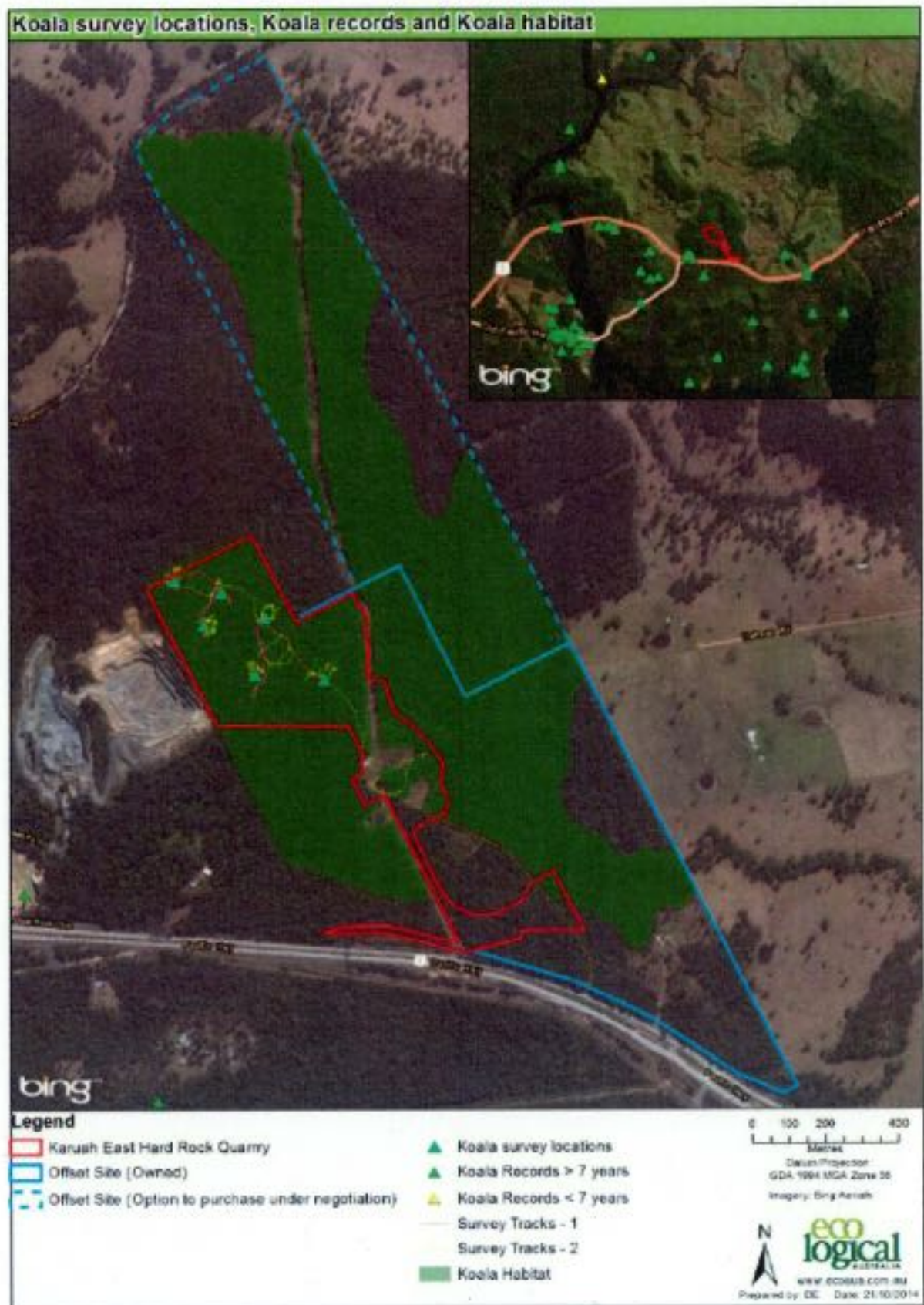


Figure 9 Koala habitat within both the quarry impact area and the adjacent offset areas

## **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

Licence - 20611

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# Environment Protection Licence

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Licence - 20611



## 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).

# Environment Protection Licence

Licence - 20611



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.



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## 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:
- a) in a legible form, or in a form that can readily be reduced to a legible form;
  - b) kept for at least 4 years after the monitoring or event to which they relate took place; and
  - c) 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:
- a) the date(s) on which the sample was taken;
  - b) the time(s) at which the sample was collected;
  - c) the point at which the sample was taken; and
  - d) 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/m2    | 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:

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

# Environment Protection Licence

Licence - 20611

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<br>1 - Design the Necessary<br>Noise Mitigation<br>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  |

# Environment Protection Licence

Licence - 20611

## Dictionary

### General Dictionary

|                                                    |                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3DGM [in relation to a concentration limit]</b> | 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 |
| <b>Act</b>                                         | Means the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                  |
| <b>activity</b>                                    | Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                      |
| <b>actual load</b>                                 | Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009                                                                                                                                                                                                                                                                            |
| <b>AM</b>                                          | 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> .                                                                                                                                                                                 |
| <b>AMG</b>                                         | Australian Map Grid                                                                                                                                                                                                                                                                                                                                                          |
| <b>anniversary date</b>                            | 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.                            |
| <b>annual return</b>                               | Is defined in R1.1                                                                                                                                                                                                                                                                                                                                                           |
| <b>Approved Methods Publication</b>                | Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009                                                                                                                                                                                                                                                                            |
| <b>assessable pollutants</b>                       | Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009                                                                                                                                                                                                                                                                            |
| <b>BOD</b>                                         | Means biochemical oxygen demand                                                                                                                                                                                                                                                                                                                                              |
| <b>CEM</b>                                         | 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> .                                                                                                                                                                          |
| <b>COD</b>                                         | Means chemical oxygen demand                                                                                                                                                                                                                                                                                                                                                 |
| <b>composite sample</b>                            | 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.                                                                                                                                                                                               |
| <b>cond.</b>                                       | Means conductivity                                                                                                                                                                                                                                                                                                                                                           |
| <b>environment</b>                                 | Has the same meaning as in the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                             |
| <b>environment protection legislation</b>          | Has the same meaning as in the Protection of the Environment Administration Act 1991                                                                                                                                                                                                                                                                                         |
| <b>EPA</b>                                         | Means Environment Protection Authority of New South Wales.                                                                                                                                                                                                                                                                                                                   |
| <b>fee-based activity classification</b>           | Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.                                                                                                                                                                                                                                               |
| <b>general solid waste (non-putrescible)</b>       | Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                     |

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|                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>flow weighted composite sample</b>                                | Means a sample whose composites are sized in proportion to the flow at each composites time of collection.                                                                                                                                                                                                                                                                                                               |
| <b>general solid waste (putrescible)</b>                             | Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                 |
| <b>grab sample</b>                                                   | Means a single sample taken at a point at a single time                                                                                                                                                                                                                                                                                                                                                                  |
| <b>hazardous waste</b>                                               | Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                 |
| <b>licensee</b>                                                      | Means the licence holder described at the front of this licence                                                                                                                                                                                                                                                                                                                                                          |
| <b>load calculation protocol</b>                                     | Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009                                                                                                                                                                                                                                                                                                                        |
| <b>local authority</b>                                               | Has the same meaning as in the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                                         |
| <b>material harm</b>                                                 | Has the same meaning as in section 147 Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                                 |
| <b>MBAS</b>                                                          | Means methylene blue active substances                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Minister</b>                                                      | Means the Minister administering the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                                   |
| <b>mobile plant</b>                                                  | Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                 |
| <b>motor vehicle</b>                                                 | Has the same meaning as in the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                                         |
| <b>O&amp;G</b>                                                       | Means oil and grease                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>percentile [in relation to a concentration limit of a sample]</b> | 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.                                                                                                                         |
| <b>plant</b>                                                         | Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.                                                                                                                                                                                                                                                                                                |
| <b>pollution of waters [or water pollution]</b>                      | Has the same meaning as in the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                                         |
| <b>premises</b>                                                      | Means the premises described in condition A2.1                                                                                                                                                                                                                                                                                                                                                                           |
| <b>public authority</b>                                              | Has the same meaning as in the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                                         |
| <b>regional office</b>                                               | Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence                                                                                                                                                                                                                                                                                                                   |
| <b>reporting period</b>                                              | 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. |
| <b>restricted solid waste</b>                                        | Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                 |
| <b>scheduled activity</b>                                            | Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                          |
| <b>special waste</b>                                                 | Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997                                                                                                                                                                                                                                                                                                                 |
| <b>TM</b>                                                            | 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> .                                                                                                                                                                                                                                                |



# Environment Protection Licence

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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

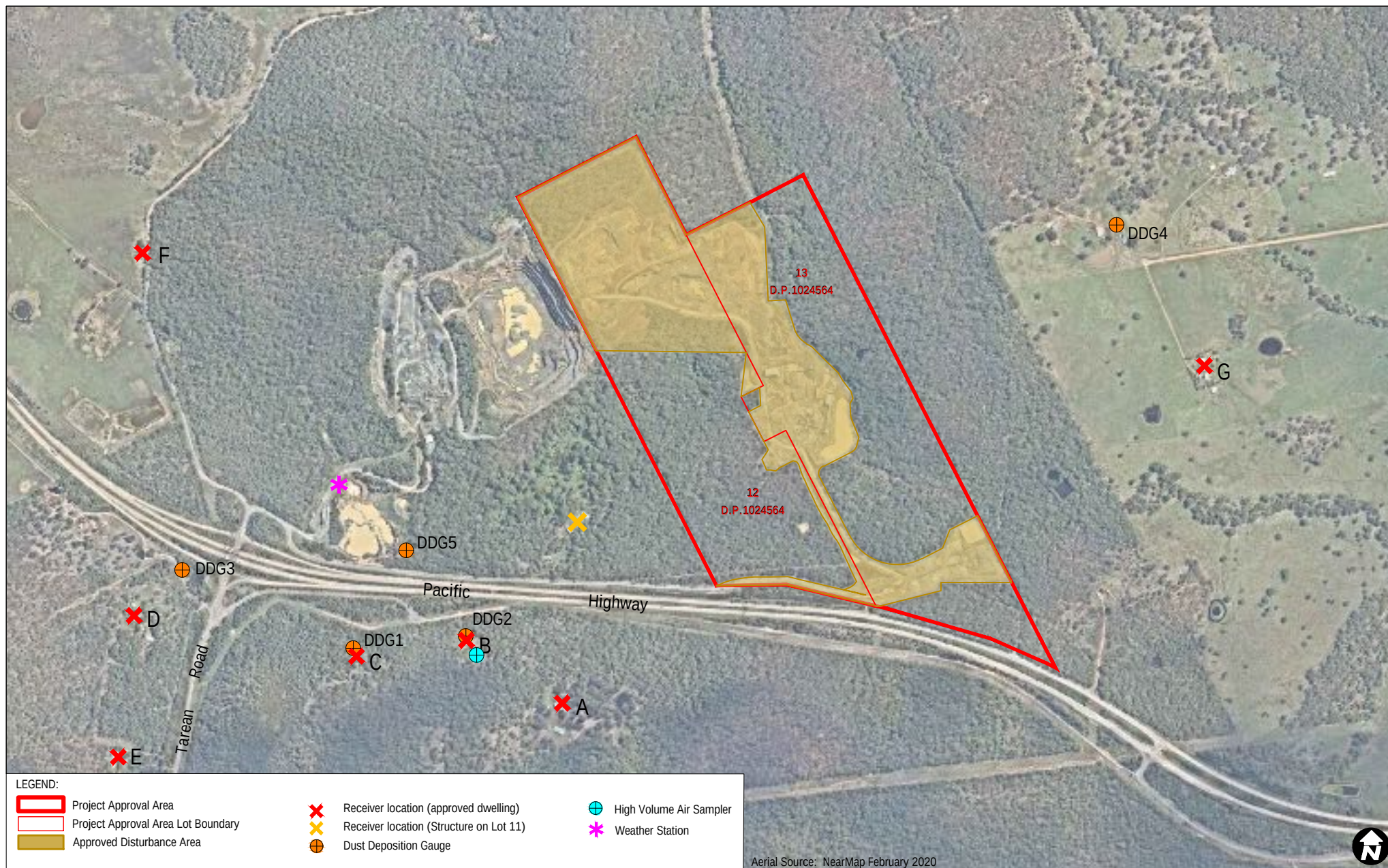
(By Delegation)

Date of this edition: 26-August-2015

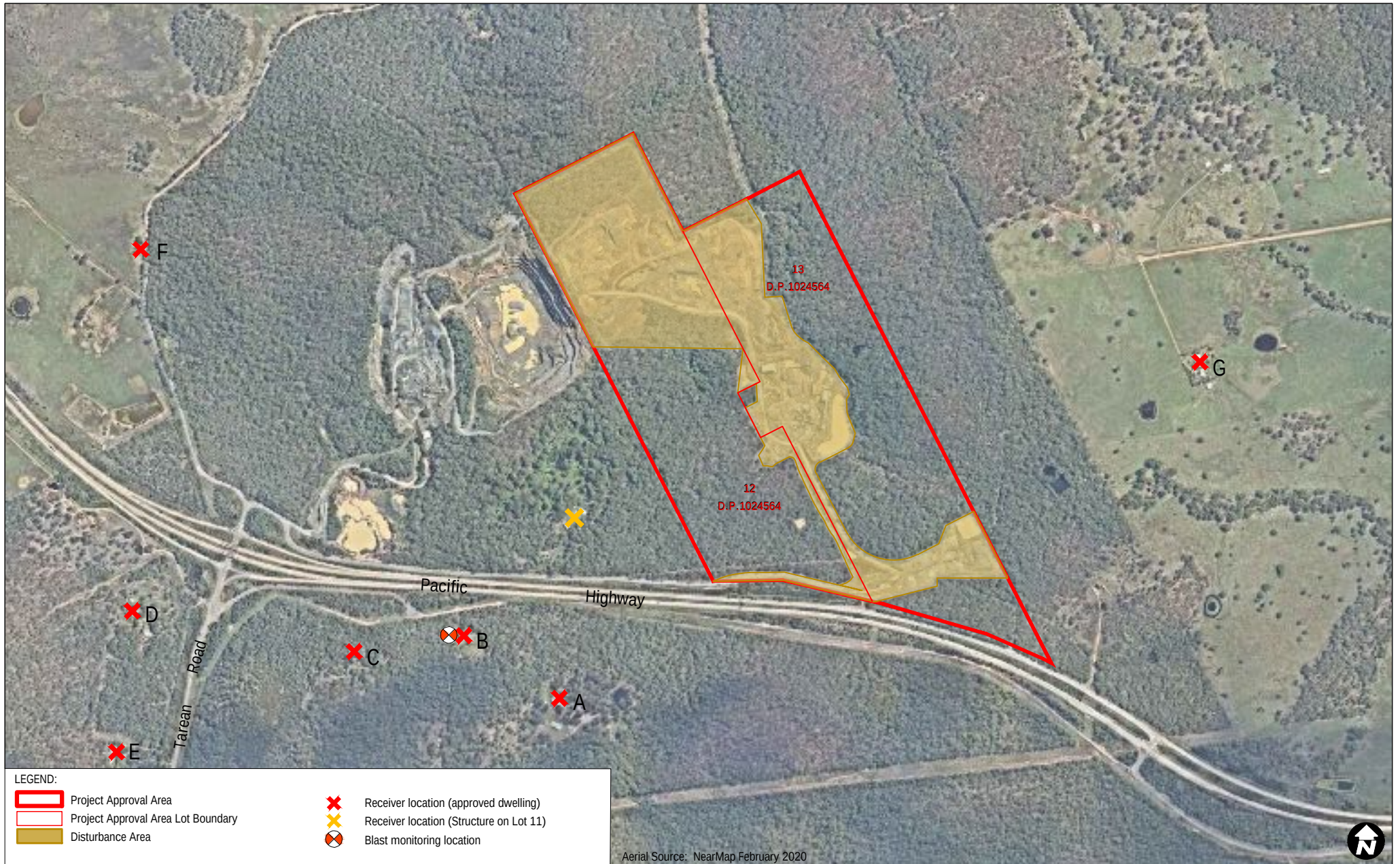
| End Notes |                           |                               |
|-----------|---------------------------|-------------------------------|
| 2         | Licence varied by notice  | 1533596 issued on 21-Sep-2015 |
| 3         | Licence varied by notice  | 1547416 issued on 06-Dec-2016 |
| 4         | 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**



## KARUAH EAST QUARRY

Quarterly Noise Monitoring

April 2020

## 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:<br>PO Box 3284<br>Thornton NSW 2322                        |
|                                         | Quarry Location:<br>Lot 12 DP1024564<br>Pacific Highway<br>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<sub>eq</sub>(15min))**

| LOCATION                        | CRITERIA (DAY <sup>1</sup> ) |
|---------------------------------|------------------------------|
| 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<br>START TIME<br>WEATHER        | L <sub>MAX</sub> | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>AEQ</sub> | DESCRIPTION OF NOISE<br>AND TYPICAL MAXIMUM<br>NOISE LEVELS (DBA)                                                                           |
|----------|--------------------------------------|------------------|-----------------|------------------|------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| F        | 18/04/2020<br>11:35 pm<br>W = 10 kph | 78               | 59              | 46               | 40               | 51               | Pacific Highway 45 - 50<br>Insects 40 - 45<br>Birds 45-50<br>Airplane 45<br>Local Traffic 60<br><br><b>Karuah East Quarry<br/>Inaudible</b> |
| G        | 18/04/2020<br>10:15 pm<br>W = 10 kph | 64               | 49              | 45               | 41               | 44               | Reversing Alarm 35<br>Trucks 38 - 40<br>Pacific Highway 40<br>Birds 50 dB<br><br><b>Karuah East Quarry Audible</b>                          |

### 3. UNATTENDED NOISE MONITORING

Table 5 - Unattended Noise Monitoring Results

| INP PERIOD | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>AEQ</sub> |
|------------|-----------------|------------------|------------------|------------------|
| DAY        | 58              | 51               | 38               | 49               |
| EVENING    | 60              | 55               | 44               | 51               |
| NIGHT      | 56              | 48               | 38               | 49               |

### 4. SUMMARY

The attended noise monitoring conducted during April 2020 identified that Karuah East Quarry was not audible at location F and audible at location G. Karuah East Quarry is determined to be compliant for the monitoring completed in April 2020.



## KARUAH EAST QUARRY

Quarterly Noise Monitoring

June 2020

## 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:<br>PO Box 3284<br>Thornton NSW 2322                        |
|                                         | Quarry Location:<br>Lot 12 DP1024564<br>Pacific Highway<br>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<sub>eq</sub>(15min))**

| LOCATION                        | CRITERIA (DAY <sup>1</sup> ) |
|---------------------------------|------------------------------|
| 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) and EPL 25611 Date 25 June 2019. A summary of requirements is presented in Table 3.



**Table 3 - Operational Noise Monitoring Program**

| MONITORING METHOD           | LOCATION | FREQUENCY | CRITERIA                                                                           |
|-----------------------------|----------|-----------|------------------------------------------------------------------------------------|
| Unattended Noise Monitoring | G        | Quarterly | As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015)<br>As Per EPL 20611 |
| Attended Noise Monitoring   | A        |           |                                                                                    |
| Attended Noise Monitoring   | B        |           | As Per EPL 20611                                                                   |
| Attended Noise Monitoring   | F        |           | As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015)                     |
| Attended Noise Monitoring   | G        |           | As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015) and EPL 20611       |



**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<br>START TIME<br>WEATHER  | L <sub>AMAX</sub> | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>AEQ</sub> | DESCRIPTION OF NOISE<br>AND TYPICAL MAXIMUM<br>NOISE LEVELS (DBA)                                                    |
|----------|--------------------------------|-------------------|-----------------|------------------|------------------|------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>A</b> | 15/06/2020<br>1:15 pm<br>Calm  | 72                | 69              | 65               | 57               | 63               | Pacific Highway 50 - 70<br><br><b>Karuah East Quarry<br/>Inaudible</b>                                               |
| <b>B</b> | 15/06/2020<br>1:45 pm<br>Calm  | 76                | 73              | 69               | 60               | 66               | Pacific Highway 55 - 75<br>Birds 45-50<br>Airplane 45<br><br><b>Karuah East Quarry<br/>Inaudible</b>                 |
| <b>F</b> | 15/06/2020<br>2:15 pm<br>Calm  | 76                | 66              | 61               | 52               | 58               | Pacific Highway 50 - 60<br>Exhaust Brakes 75<br>Local Traffic 60 - 70<br><br><b>Karuah East Quarry<br/>Inaudible</b> |
| <b>G</b> | 15/06/2020<br>12:30 pm<br>Calm | 69                | 66              | 58               | 43               | 54               | Insects 35<br>Pacific Highway 45<br>Dogs Barking 45 - 65<br><br><b>Karuah East Quarry Audible</b>                    |

### 3. UNATTENDED NOISE MONITORING

**Table 5 - Unattended Noise Monitoring Results**

| INP PERIOD | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>AEQ</sub> |
|------------|-----------------|------------------|------------------|------------------|
| DAY        | 61              | 51               | 37               | 54               |
| EVENING    | 55              | 51               | 37               | 48               |
| NIGHT      | 52              | 48               | 34               | 45               |

### 4. SUMMARY

The attended noise monitoring conducted during June 2020 identified that Karuah East Quarry was not audible at location A, B, F and G. Karuah East Quarry is determined to be compliant for the monitoring completed in June 2020.



# KARUAH EAST QUARRY

Quarterly Noise Monitoring

November 2020



# 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:<br>PO Box 3284<br>Thornton NSW 2322<br><br>Quarry Location:<br>Lot 12 DPI024564<br>Pacific Highway<br>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<sub>eq(15min)</sub>)**

| LOCATION                        | CRITERIA (DAY <sup>1</sup> ) |
|---------------------------------|------------------------------|
| 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) and EPL 20611 Date 25 June 2019. A summary of requirements is presented in Table 3.

**Table 3 – Operational Noise Monitoring Program**

| <b>MONITORING METHOD</b>    | <b>LOCATION</b> | <b>FREQUENCY</b> | <b>CRITERIA</b>                                                              |
|-----------------------------|-----------------|------------------|------------------------------------------------------------------------------|
| Unattended Noise Monitoring | G               | Quarterly        | As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015)               |
| Attended Noise Monitoring   | A               |                  | As Per EPL 20611                                                             |
| Attended Noise Monitoring   | B               |                  | As Per EPL 20611                                                             |
| Attended Noise Monitoring   | F               |                  | As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015)               |
| Attended Noise Monitoring   | G               |                  | As Per Table 10,12,13 of the Noise Management Plan (SLR, 2015) and EPL 20611 |



**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<br>START TIME<br>WEATHER  | L <sub>AMAX</sub> | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>Aeq</sub> | DESCRIPTION OF NOISE<br>AND TYPICAL MAXIMUM<br>NOISE LEVELS (DBA)                                           |
|----------|--------------------------------|-------------------|-----------------|------------------|------------------|------------------|-------------------------------------------------------------------------------------------------------------|
| <b>A</b> | 04/11/2020<br>10:40 am<br>Calm | 58                | 54              | 47               | 41               | 44               | Birds 35 - 40<br><b>Karuah East Quarry Inaudible</b>                                                        |
| <b>B</b> | 04/11/2020<br>11:35 am<br>Calm | 75                | 70              | 66               | 57               | 63               | Pacific Highway 55 - 65<br>Birds 40 – 45<br><b>Karuah East Quarry Inaudible</b>                             |
| <b>F</b> | 04/11/2020<br>12:44 pm<br>Calm | 76                | 60              | 48               | 40               | 49               | Birds 40<br>Local Traffic 50-55<br><b>Karuah East Quarry Inaudible</b>                                      |
| <b>G</b> | 04/11/2020<br>10:00 pm<br>Calm | 59                | 50              | 42               | 36               | 41               | Birds 30 - 35<br>Pacific Highway 35 – 40<br>Karuah East Quarry 30 – 36<br><b>Karuah East Quarry Audible</b> |

## 3. OPERATING EQUIPMENT

Equipment operating on the day of attended monitoring was noted as:

- Volvo Loader L180 #2
- Volvo Loader L220
- Komatsu Loader WA470 (hired)
- Volvo Excavator EC750
- Komatsu HM400 (1) – Dump truck (hired)
- Cat 740 B – Dump truck
- HD465 – Komatsu dump truck
- Volvo A40F – Dump truck
- Volvo A40F – Dump truck (hired)
- Isuzu watercart
- Gen set 1 (control room)
- Gen set 2 (secondary plant)
- Gen set 3 (secondary plant)
- Primary crushing plant
- Secondary crushing plant

## 4. UNATTENDED NOISE MONITORING

**Table 5 – Unattended Noise Monitoring Results**

| INP PERIOD | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>AEQ</sub> |
|------------|-----------------|------------------|------------------|------------------|
| DAY        | 56              | 49               | 41               | 49               |
| EVENING    | 57              | 50               | 41               | 48               |
| NIGHT      | 52              | 48               | 37               | 46               |

## 5. EQUIPMENT DETAILS

|                             | Serial Number | Microphone and Preamp Serial Number | Calibration Date | Calibration Expiry |
|-----------------------------|---------------|-------------------------------------|------------------|--------------------|
| NTI XL2-TA                  | A2A-14797-E0  | A15893 / 7656                       | 20/11/2019       | 19/11/2021         |
| Precision Calibrator CAL200 | 15642         |                                     | 20/11/2019       | 19/11/2021         |

## 6. SUMMARY

The attended noise monitoring conducted during November 2020 identified that Karuah East Quarry was not audible at location A, B, F and G. Karuah East Quarry is determined to be compliant for the monitoring completed in November 2020.

## **APPENDIX 5 – Ecological Monitoring Report**

# 2020 Annual Monitoring Report

Karuah East Quarry Biodiversity Offset Area and Lot 12

20212186

15 December 2020



95 Mitchell Road, Cardiff, NSW 2285  
Phone: +61 2 4949 5200





# 2020 Annual Monitoring Report

## Karuah East Quarry Biodiversity Offset Area and Lot 12

Kleinfelder Project: 20212186

Kleinfelder Document: NCA20R119674

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Prepared for:

Karuah East Quarry PTY LTD  
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| Prepared                             | Reviewed                              | Endorsed                              |
| David Martin<br>Ecologist (Botanist) | Dr Daniel O'Brien<br>Senior Ecologist | Dr Daniel O'Brien<br>Senior Ecologist |
|                                      |                                       |                                       |

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# 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). Subsequent modification was approved on 27 April 2018 (Modification 1) and 19 December 2018 (Modification 2) 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. The BOAMP has since been updated in consideration of Modification 1 (February 2019) and will be further updated following approval of Modification 2. Establishment of a Conservation Agreement for the BOA is currently in progress (with the Biodiversity Conservation Trust) as required under the project approval - Condition 29.

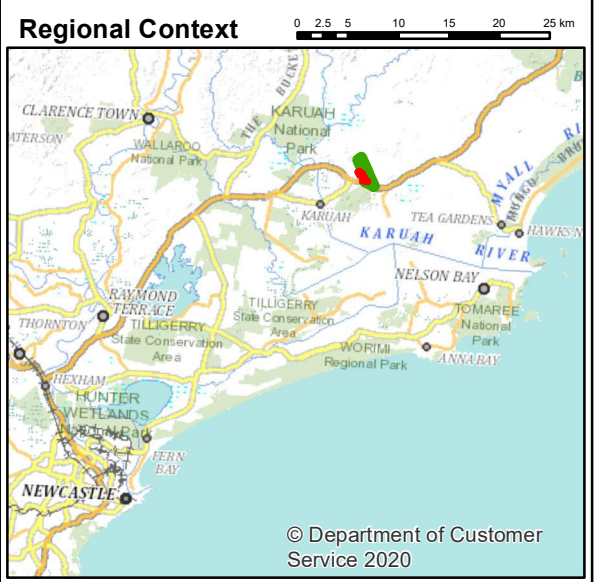
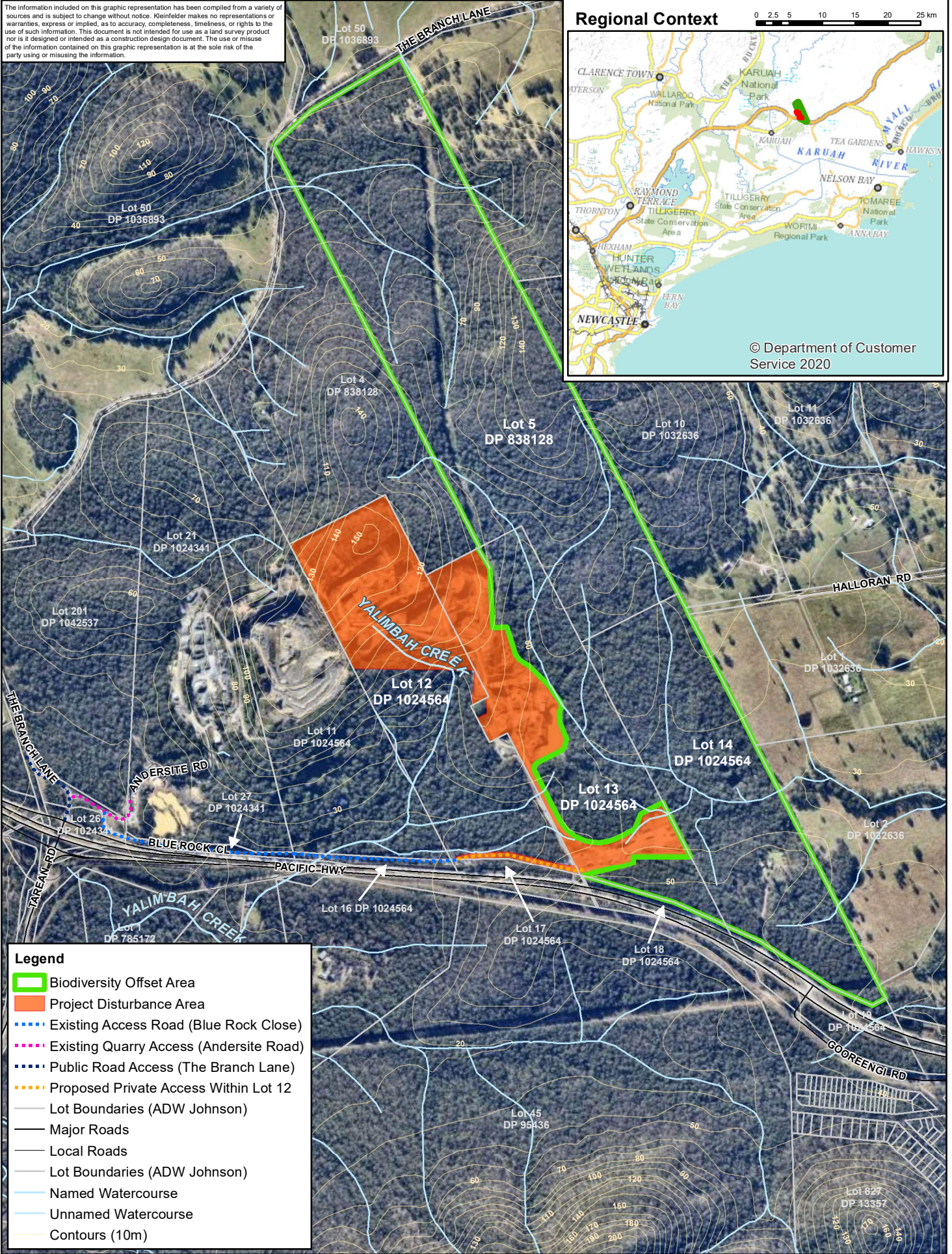
Baseline ecological surveys and monitoring were undertaken in October 2015 prior to commencement of clearing and construction as required under Section 3 of the BOAMP. The baseline monitoring surveys involved the establishment of 13 permanent monitoring sites within the Karuah East BOA in accordance 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/>).

The first year of annual monitoring of the BOA and Lot 12 was undertaken in October 2016. This report provides the results of the fifth annual monitoring event undertaken in October 2020. 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 6 of the BOAMP implementation to ensure compliance with relevant performance criteria.



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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

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DRAWN BY: G.Joyce  
DATA SOURCE:  
NSW DFSI - 2017  
ADW Johnson - 2015  
Nearmap - 2020

**Karuah East Quarry  
and Biodiversity Offset Area**

Karuah East Quarry Pty Ltd  
2020 Annual Monitoring Report  
Karuah East Quarry Project

FIGURE:  
**1**





## 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 Error! Reference source not found.. It is noted that not all monitoring activities listed in Error! Reference source not found. are required for the 2020 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 2020                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Vegetation and Threatened Flora Monitoring</b><br>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.<br><br>Monitoring is to be undertaken during spring to coincide with the flowering times of threatened flora species in the BOA.                                 | Section 3.13 of BOAMP<br><br>Section 12.1.3 of L&RMP | Annually for life of quarry (LOQ) | Completed                                                                                                                                                                                                                                                                               |
| <b>Fencing</b><br>Inspections of boundary fencing will be undertaken as part of annual monitoring to identify maintenance requirements and record fencing activities undertaken in previous year.<br><br>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. | Section 3.2 of BOAMP<br><br>Section 12.1.2 of L&RMP  | Annually for LOQ                  | Outstanding.<br><br>Boundary fencing around the BOA commenced prior to the 2018 monitoring round, and requires completion. Inaccessibility has largely limited fence installation.<br><br>To date, there has been no evidence of stock or unauthorised entry across the surveyed areas. |
| <b>Tracks</b><br>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.                                                                                                                                                                                                | Section 3.3 of BOAMP                                 | Annually for LOQ                  | Completed                                                                                                                                                                                                                                                                               |
| <b>Erosion</b><br>Inspections of erosion sites will be undertaken as part of annual monitoring to identify maintenance requirements and record maintenance activities undertaken in previous year.<br><br>Erosion and sediment control structures installed within the project disturbance area to protect retained vegetation will be inspected as part of annual ecological monitoring.                               | Section 3.4 of BOAMP<br><br>Section 12.1.2 of L&RMP  | Annually for LOQ                  | Completed                                                                                                                                                                                                                                                                               |
| <b>Existing Dwellings</b><br>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.                                                                                                                                | Section 3.5 of BOAMP                                 | Annually for LOQ                  | Completed                                                                                                                                                                                                                                                                               |



| Monitoring Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | BOAMP / L&RMP Section(s)                         | Timing / Frequency                                                                                 | Completed in 2020                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>Habitat Augmentation and Nest Boxes</b><br>Nest boxes will be inspected and maintained (or replaced) every two years following installation:<br>Nest boxes 1 – 30 installed in April 2016<br>Nest boxes 31 – 125 installed in February 2018<br>Nest boxes 126 – 318 installed in July-August 2020                                                                                                                                                                                                                                                                                                                                                                      | Section 3.8 of BOAMP                             | Boxes 1-30 and 31 – 125 monitoring required in 2020.                                               | Monitoring completed for nest boxes 1 – 30 in 2018.<br>Monitoring completed for nest boxes 1 – 125 in 2020. |
| <b>Weeds</b><br>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.<br>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. | Section 12.1.1 of L&RMP<br>Section 3.10 of BOAMP | Annually (KEQ, 50 m buffer and Yalimbah Creek)<br>Every 2 years from baseline survey for LOQ (BOA) | Completed (KEQ, 50 m buffer, Yalimbah Creek)<br>Weed mapping for BOA updated in 2020.                       |
| <b>Vertebrate Pest Assessment</b><br>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.                                                                                                                                                                                                                                                                                                                                                              | Section 3.11                                     | Every 2 years from baseline survey for LOQ (BOA)                                                   | Outstanding                                                                                                 |
| <b>Aerial Fauna Crossings</b><br>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.                                                                                                                                                                                                                                                                                                                                                                                                                              | Section 12.1.4 of L&RMP                          | 12 months from installation of the crossings                                                       | Aerial fauna crossings installed.<br>Monitoring commenced by quarry staff.                                  |
| <b>Threatened Flora Translocation – refer to Tetratheca juncea Translocation Management Plan (TjMP; Firebird 2015).</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Refer to TjMP                                    | Refer to TjMP                                                                                      | Completed – refer to Tj Translocation Monitoring Report (Firebird 2018)                                     |

### 1.3 KARUAH EAST QUARRY PROGRESS

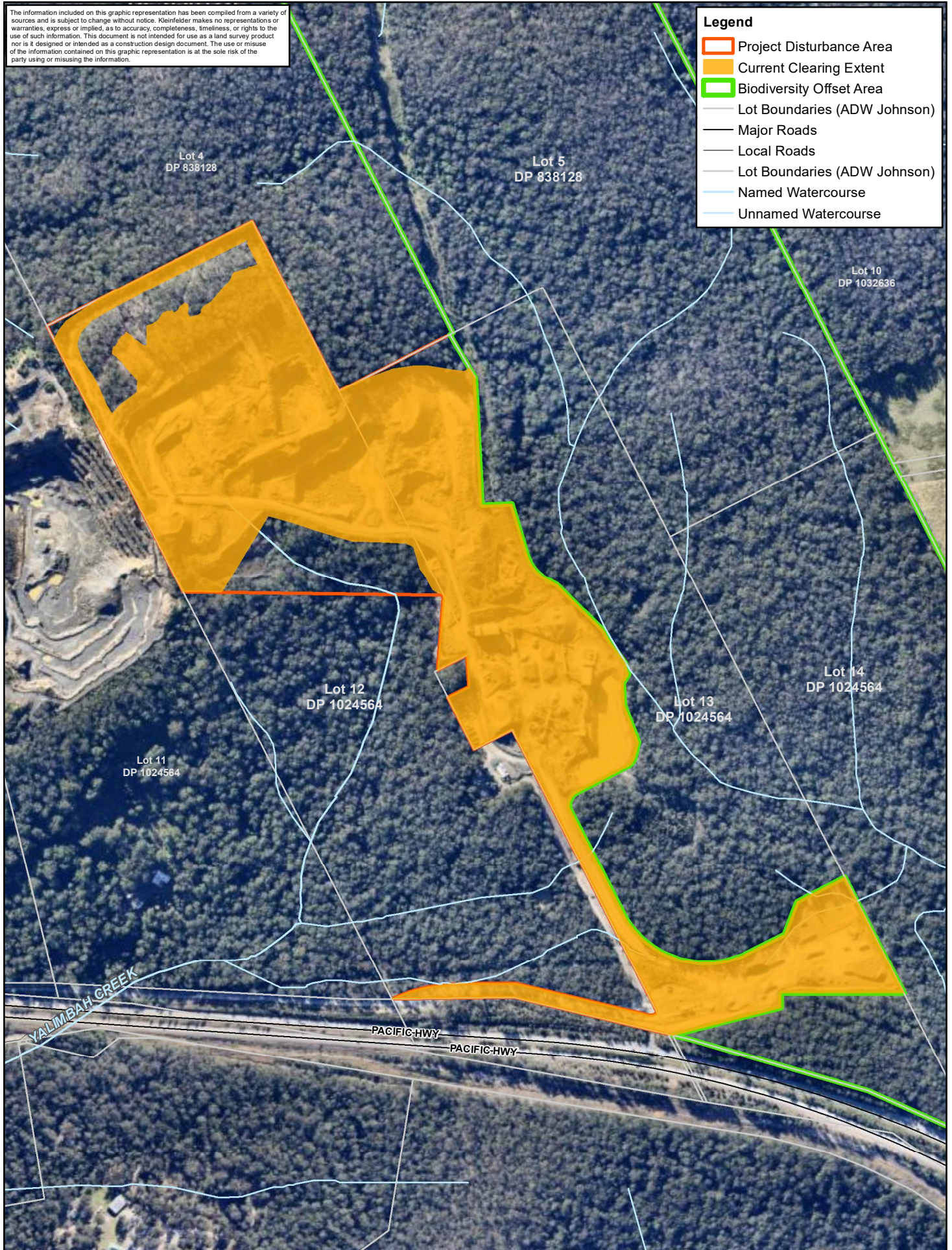
The Karuah East Quarry (KEQ) Project commenced operations in May 2019 after construction of the plant in 2018. Vegetation clearing commenced in April 2016 and the majority of the KEQ project area was primarily cleared between April and June 2016, with some additional clearing also occurring in November 2016, May 2018, July 2018, October 2019, November 2019 and September 2020. 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**.



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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



|                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                             |                                                                                                                                                                                                                                                        |                                                                            |
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| <div style="display: flex; justify-content: space-between; align-items: center;"> <div> <p>Metres</p> <p>0 25 50 100 150 200 250</p> </div> <div style="text-align: center;"> <p>N</p> </div> </div> <div style="text-align: center; margin-top: 10px;"> <p><b>KLEINFELDER</b><br/>Bright People. Right Solutions.<br/>www.kleinfelder.com</p> </div> | <p>PROJECT REFERENCE: 20212186</p> <p>DATE DRAWN: 2020/12/08 16:30 Version 1</p> <p>DRAWN BY: G.Joyce</p> <p>DATA SOURCE:<br/>NSW DFSI - 2017<br/>ADW Johnson - 2015<br/>Nearmap - 2020</p> | <p style="text-align: center;"><b>Current Extent of Clearing<br/>within the Karuah East<br/>Quarry Project Area</b></p> <p style="text-align: center;">Karuah East Quarry Pty Ltd<br/>2020 Annual Monitoring Report<br/>Karuah East Quarry Project</p> | <p>FIGURE:</p> <p style="text-align: center; font-size: 2em;"><b>2</b></p> |
|                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                             |                                                                                                                                                                                                                                                        |                                                                            |





## 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 Error! Reference source not found.. 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**

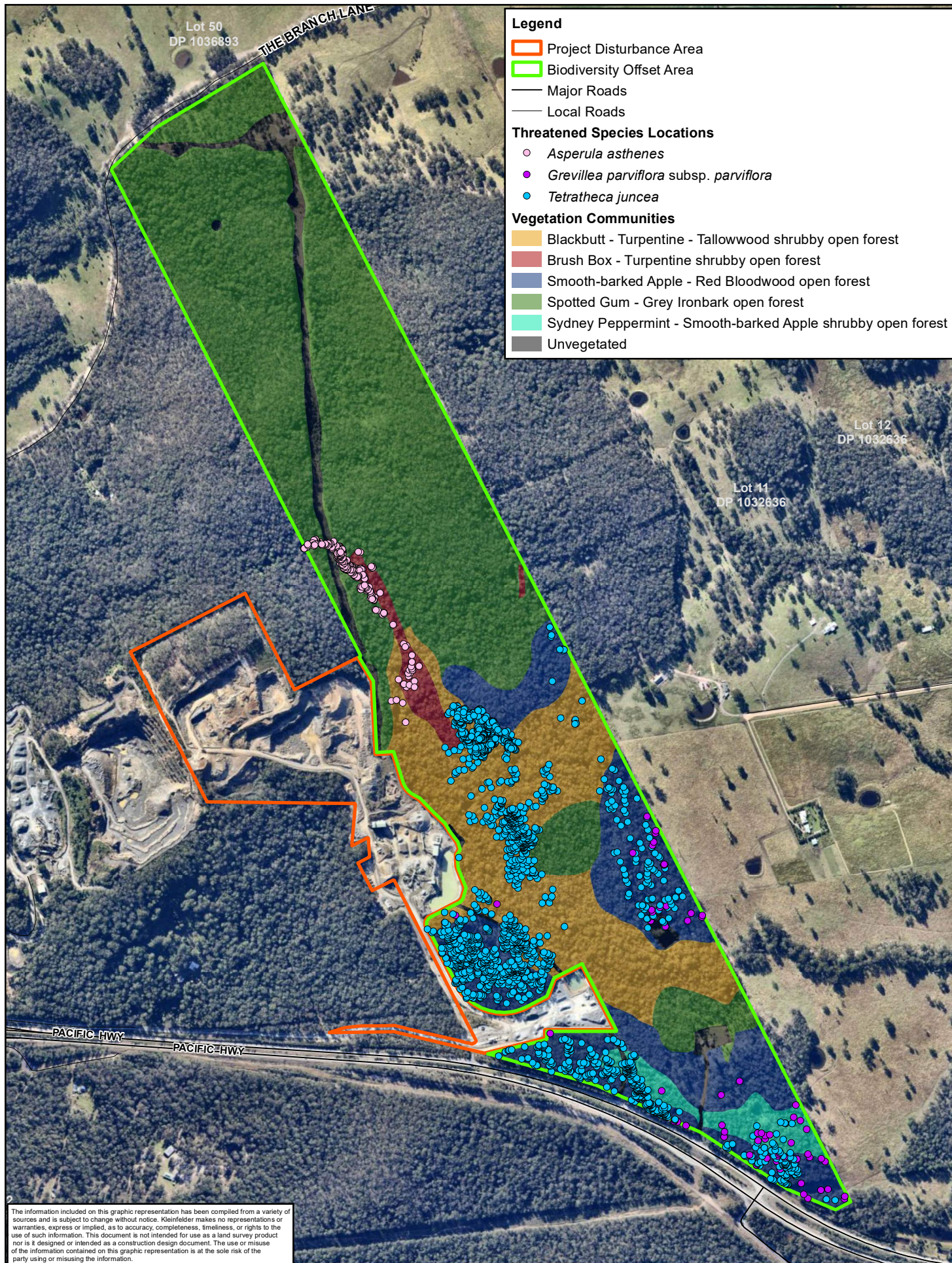
| Biodiversity Values                    |                                                                                                                                                | Area (ha) / No. of individuals |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 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               | *^Tetratheca juncea (Black-eyed Susan)                                                                                                         | 6,907                          |
|                                        | *^Grevillea parviflora subsp. parviflora (Small-flower Grevillea)                                                                              | 100+                           |
|                                        | *^Asperula asthenes (Trailing Woodruff)                                                                                                        | 399                            |
| Threatened and Migratory Fauna Species | *Eastern Falsistrelle (Falsistrellus tasmaniensis)                                                                                             | -                              |
|                                        | *Little Bent-winged Bat (Miniopterus australis)                                                                                                | -                              |
|                                        | *Eastern Bent-winged Bat (Miniopterus orianae oceanensis)                                                                                      | -                              |
|                                        | *Eastern Coastal Free-tailed Bat (Mormopterus norfolkensis)                                                                                    | -                              |
|                                        | *Southern Myotis (Myotis macropus)                                                                                                             | -                              |
|                                        | *Eastern Cave Bat (Vespadelus troughtoni)                                                                                                      | -                              |
|                                        | *Glossy Black-Cockatoo (Calyptorhynchus lathami)                                                                                               | -                              |
|                                        | *Varied Sittella (Daphoenositta chrysoptera)                                                                                                   | -                              |
|                                        | *Powerful Owl (Ninox strenua)                                                                                                                  | -                              |
|                                        | +Rufous Fantail (Rhipidura rufifrons)                                                                                                          | -                              |

\* = listed as Vulnerable under the BC Act 2016

^ = listed as Vulnerable under the EPBC Act 1999

+ = listed as Migratory under the EPBC Act 1999





|                                                                                                                                     |                                                                                                                                                                                            |                                                                                                                                                                  |                                |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <p>Metres</p> <p>0 50 100 200 300 400 500</p> <p><b>KLEINFELDER</b><br/>Bright People. Right Solutions.<br/>www.kleinfelder.com</p> | <p>PROJECT REFERENCE: 20212186</p> <p>DATE DRAWN: 2020/12/08 16:33Version 1</p> <p>DRAWN BY: G.Joyce</p> <p>DATA SOURCE:<br/>NSW DFSI - 2018<br/>ADW Johnson - 2015<br/>Nearmap - 2020</p> | <p><b>Vegetation Types and Threatened Flora Locations</b></p> <p>Karuah East Quarry Pty Ltd<br/>2020 Annual Monitoring Report<br/>Karuah East Quarry Project</p> | <p>FIGURE:</p> <p><b>3</b></p> |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|





## 2 METHODS

### 2.1 VEGETATION AND THREATENED FLORA MONITORING

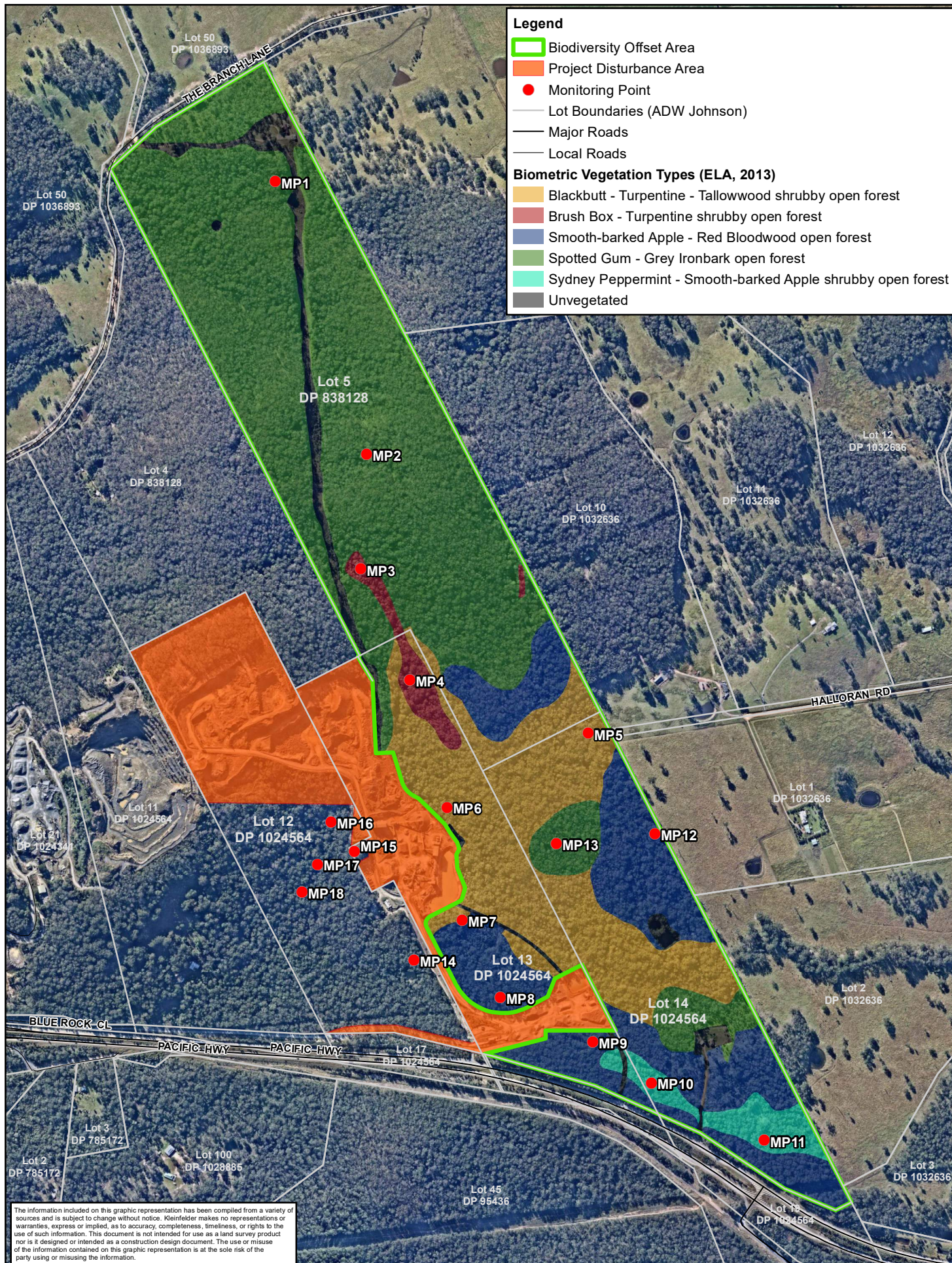
A total of 18 monitoring sites were established in October 2015 including 13 sites within the Biodiversity Offset Area (BOA), and five sites on Lot 12 DP 1024564 within 50 m of the project disturbance area and along Yalimbah Creek. The location of each monitoring site was recorded with a handheld GPS (Trimble™ Juno 5S unit) and permanently marked with a capped star picket (see **Figure 4**).

Baseline surveys were completed across the 18 monitoring sites in October 2015 and subsequently surveyed in October 2016, 2017, 2018, 2019, and 2020 (7<sup>th</sup> and 8<sup>th</sup> October 2020). Vegetation condition monitoring (**Section 0**) was conducted across all 18 monitoring sites. Threatened flora monitoring (**Section 2.1.2**) was completed at nine of the monitoring sites (see **Table 3**).

**Table 3 Summary of vegetation and threatened flora monitoring sites**

| Monitoring Site | Location     | Vegetation Community                                        | Threatened Flora Species Monitored                           |
|-----------------|--------------|-------------------------------------------------------------|--------------------------------------------------------------|
| MP 1            | BOA – Lot 5  | Spotted Gum - Grey Ironbark open forest                     | -                                                            |
| MP 2            | BOA – Lot 5  | Spotted Gum - Grey Ironbark open forest                     | -                                                            |
| MP 3            | BOA – Lot 5  | Brush Box - Turpentine shrubby open forest                  | Asperula asthenes                                            |
| MP 4            | BOA – Lot 13 | Brush Box - Turpentine shrubby open forest                  | Asperula asthenes                                            |
| MP 5            | BOA – Lot 14 | Blackbutt - Turpentine - Tallowwood shrubby open forest     | -                                                            |
| MP 6            | BOA – Lot 13 | Blackbutt - Turpentine - Tallowwood shrubby open forest     | -                                                            |
| MP 7            | BOA – Lot 13 | Smooth-barked Apple - Red Bloodwood open forest             | Tetratheca juncea                                            |
| MP 8            | BOA – Lot 13 | Smooth-barked Apple - Red Bloodwood open forest             | Tetratheca juncea and Grevillea parviflora subsp. parviflora |
| MP 9            | BOA – Lot 13 | Smooth-barked Apple - Red Bloodwood open forest             | -                                                            |
| MP 10           | BOA – Lot 14 | Sydney Peppermint - Smooth-barked Apple shrubby open forest | -                                                            |
| MP 11           | BOA – Lot 14 | Sydney Peppermint - Smooth-barked Apple shrubby open forest | Grevillea parviflora subsp. parviflora                       |
| MP 12           | BOA – Lot 14 | Smooth-barked Apple – Red Bloodwood open forest             | Grevillea parviflora subsp. parviflora                       |
| MP 13           | BOA – Lot 14 | Spotted Gum – Grey Ironbark open forest                     | -                                                            |
| MP 14           | Lot 12       | Smooth-barked Apple - Red Bloodwood open forest             | -                                                            |
| MP 15           | Lot 12       | Blackbutt - Turpentine - Tallowwood shrubby open forest     | Tetratheca juncea                                            |
| MP 16           | Lot 12       | Spotted Gum – Grey Ironbark open forest                     | -                                                            |
| MP 17           | Lot 12       | Brush Box - Turpentine shrubby open forest                  | Asperula asthenes                                            |
| MP 18           | Lot 12       | Brush Box - Turpentine shrubby open forest                  | Asperula asthenes                                            |









### 2.1.1 Vegetation Condition Assessment

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.
- Four photographs (north, south, east and west) were taken at each of the monitoring points.

### 2.1.2 Threatened Flora Monitoring

Monitoring of threatened flora species was 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. Note separate individual plants were delineated based on criteria described in **Table 4**.

**Table 4 Criteria for delineation of “individual” plants**

| Species                                              | Definition of “individual”                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Asperula asthenes</i>                             | Individual plants 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 <i>Asperula asthenes</i> occurring 40 cm or more apart are considered separate individuals. |
| <i>Tetratheca juncea</i>                             | 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.                                                                                                                |
| <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | Stems occurring 30 cm or more apart were considered separate individuals.                                                                                                                                                                                                                                                                            |

For each individual identified in the survey area, the following information was recorded:

- Clump/individual ID 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.





## 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 2020 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.

### 2.2.1 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:  $\leq 20\%$  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).



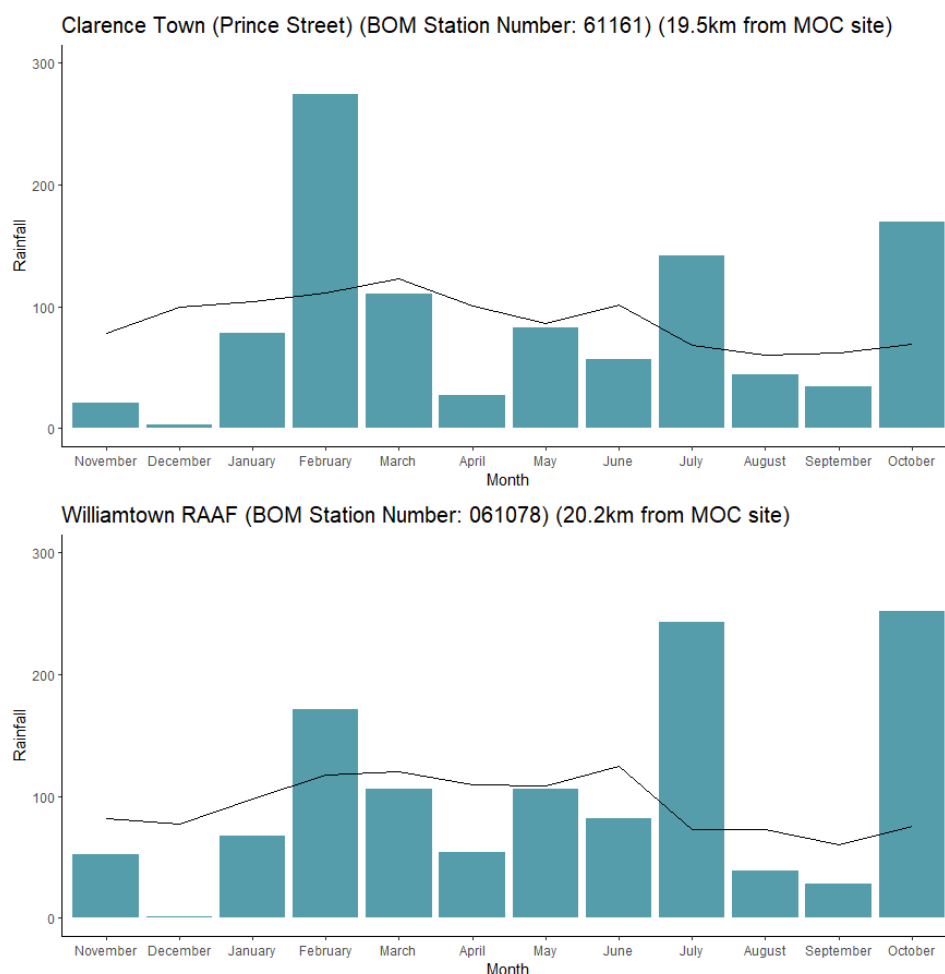
## 3 RESULTS AND DISCUSSION

### 3.1 ENVIRONMENTAL CONDITIONS

Field surveys were conducted on the 7<sup>th</sup> and 8<sup>th</sup> October 2020. Rainfall in the preceding months was variable with lower than average rainfall occurring in August and September and above average rainfall occurring in July (Table 5, Plate 1). Heavy rainfall totals experienced in October occurred after fieldwork was completed (25<sup>th</sup>-27<sup>th</sup> October). Rainfall was generally higher in 2020 when compared to the very dry conditions recorded throughout 2019, which recorded an annual rainfall total (597.8 mm) half of the annual long-term average (1063.7 mm) and was the driest year since baseline monitoring was completed in 2015.

**Table 5 Local Rainfall Data in mm (Clarence Town (Prince Street) Station – BOM Station 61161) (BOM 2020)**

| Year | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug  | Sep  | Oct   | Nov   | Dec   | Total  |
|------|-------|-------|-------|-------|-------|-------|-------|------|------|-------|-------|-------|--------|
| 2015 | 134.2 | 32.0  | 128.2 | 451.8 | 130.6 | 54.0  | 25.2  | 35.6 | 85.6 | 48.6  | 162.8 | 147.4 | 1436.0 |
| 2016 | 472.2 | 38.6  | 36.4  | 43.0  | 14.8  | 113.0 | 54.6  | 68.2 | 55.0 | 50.0  | 64.6  | 83.6  | 1094.0 |
| 2017 | 62.4  | 88.8  | 218.0 | 91.2  | 14.8  | 121.6 | 8.6   | 17.4 | 8.0  | 91.0  | 41.2  | 53.2  | 816.2  |
| 2018 | 16.2  | 79.2  | 149.2 | 83.4  | 15.4  | 153.6 | 1.0   | 28.4 | 49.8 | 143.2 | 90.2  | 87.0  | 896.6  |
| 2019 | 23.4  | 73.6  | 152.0 | 53.8  | 36.0  | 77.6  | 16.8  | 36.0 | 85.0 | 19.6  | 21.0  | 3.0   | 597.8  |
| 2020 | 78.0  | 274.0 | 110.0 | 26.8  | 82.4  | 56.6  | 141.8 | 44.0 | 34.6 | 169.2 |       |       |        |
| Mean | 104.3 | 111.5 | 122.9 | 100.4 | 86.6  | 101.6 | 68.3  | 60.3 | 61.9 | 68.9  | 78.2  | 99.3  | 1063.7 |



**Plate 1 Local Rainfall Data (BOM 2020) – Columns (2019/2020 rainfall data), Line (Long-term mean rainfall)**



## 3.2 VEGETATION AND THREATENED SPECIES MONITORING

### 3.2.1 Vegetation Condition

The 2020 KEQ vegetation condition assessment was completed over two days (7<sup>th</sup> and 8<sup>th</sup> October 2020) across all 18 monitoring sites and represents the fifth annual inspection of vegetation condition within the KEQ BOA and Lot 12, with baseline data collected in 2015.

Vegetation condition, exotic species cover and records of disturbance are summarised in the results below. Site specific results and photo monitoring results are detailed further in **Appendix A** and **Appendix B**.

#### **General health of vegetation**

Vegetation condition across KEQ BOA and Lot 12 monitoring sites remain relatively stable since the previous monitoring event in 2019, with almost all monitoring sites recording signs of regeneration across both canopy and mid-storey species.

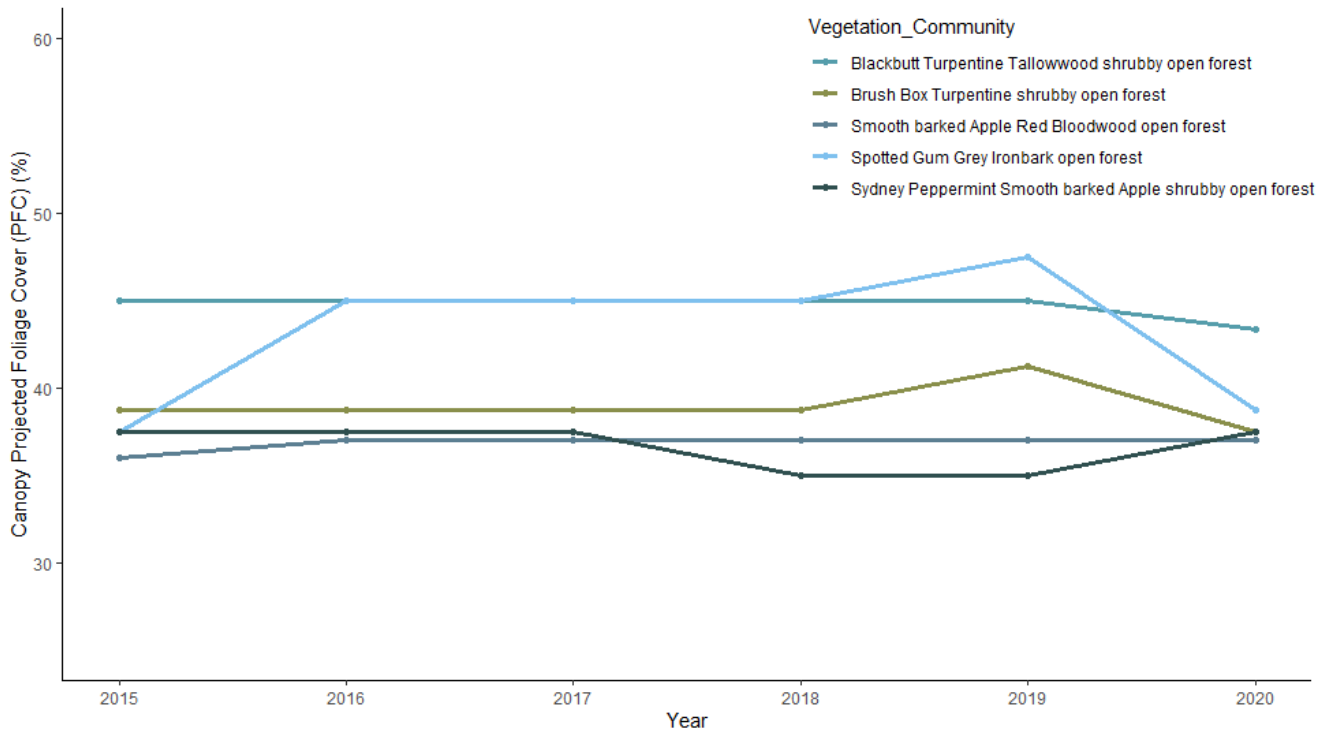
Canopy condition, measured as Projected Foliage Cover (PFC%) shows little change since 2019, or since baseline results collected in 2015 (see **Plate 2**), beyond natural variation likely in response to prevailing weather conditions (**Plate 1**). The only exception was a reduction in Canopy PFC within *Spotted Gum – Grey Ironbark open forest* sites which declined in mean PFC from 47% to 38%, much of this influenced by variation at MP 13 (from 50% to 25%). Canopy dieback was observed within the monitoring site, however the decline in condition is unlikely to be the result of impacts from the quarry, instead it is likely to be in response to last years dry conditions, exacerbated by the sites shallow soils, rocky surface and exposed landscape position. Whilst signs of minor dieback was observed at monitoring sites; MP 1, MP 2, MP 4, MP 5, MP 6, MP 7, MP 12, and MP 18 these trees also show signs of recovering, with new growth recorded in 2020. It is expected that recent improved conditions will likely lead to an improvement in canopy PFC over the next year and be recorded during the 2021 annual monitoring.

There has been no discernable change in PFC across mid-storey or shrub strata from baseline records in 2015 or between 2019 and 2020 (current survey)(see **Plate 3** and **Plate 4**). The only exception to this was an increase in shrub cover within *Brush Box – Turpentine shrubby open forest* sites (**Plate 4**), with MP 4 recording an increase from 3% to 20% since 2019. This increase in shrub PFC is largely attributed to a high cover of native shrub saplings (*Glochidion ferdinandi* var. *ferdinandi* and *Pittosporum multiflorum*) which have likely taken advantage of a recent opening in the dense canopy (greater access to light) and improved conditions since 2019 (**Plate 1**).

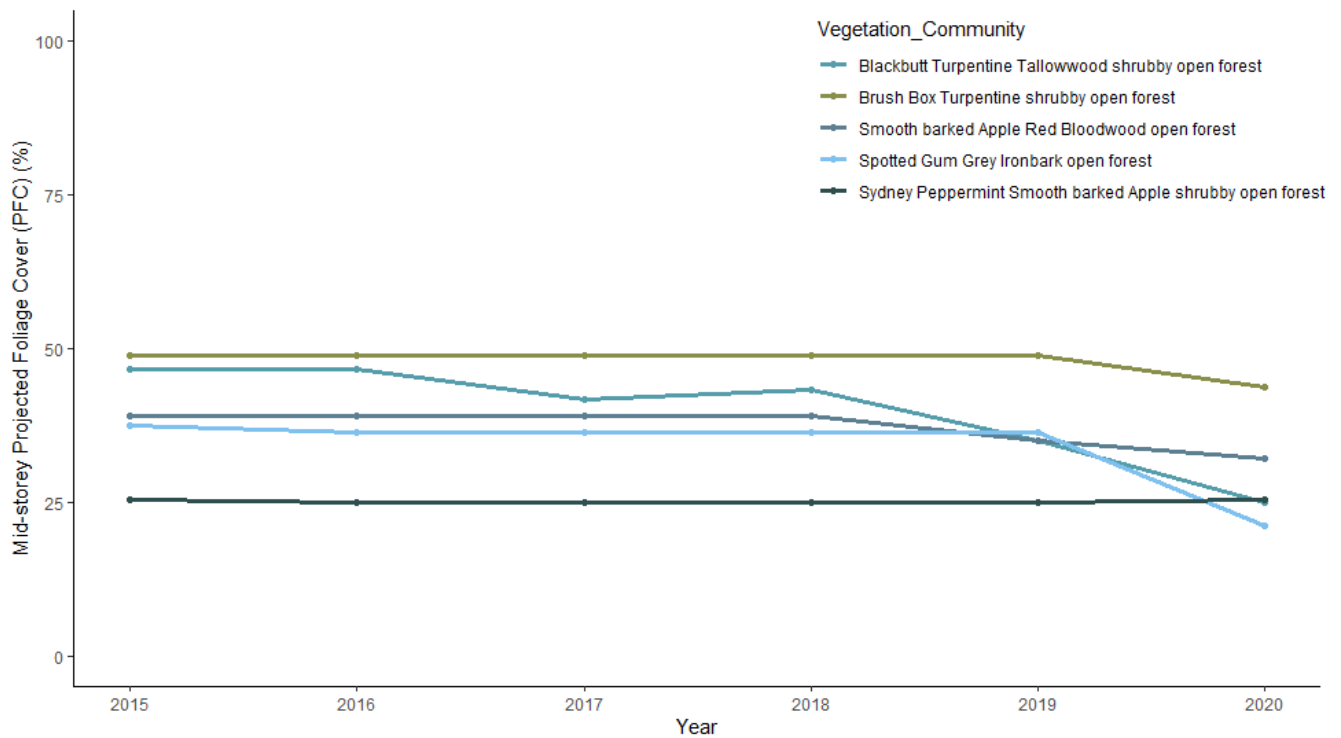
Groundcover PFC has remained relatively stable since baseline surveys in 2015, with only a small decline occurring across most vegetation communities since the 2019 annual monitoring (**Plate 5** and **Plate 6**). This is unlikely to be the result of any direct or indirect impacts of quarry operations, instead is more likely a combination of natural variability and increasing competition from shrub/mid-storey species, disturbance from heavy rain events, as well as small variability expected from changes in surveyors.

#### **Exotics**

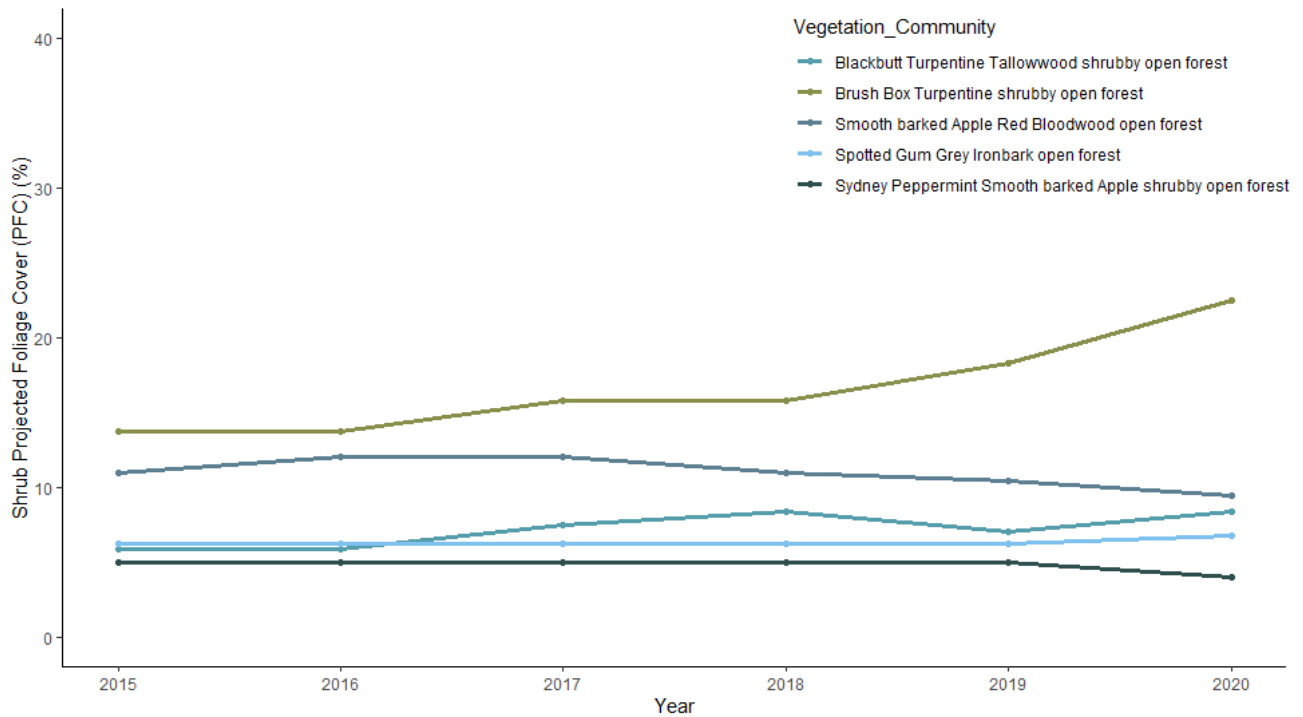
Exotic species cover has declined marginally across all five vegetation communities (**Plate 7**). The highest level of exotic species cover continues to occur within *Brush Box – Turpentine shrubby open forest* sites and includes large thickets of *Lantana camara* var. *camara*. Weed coverage across the BOA and Lot 12 is further discussed and mapped in **Section 3.3**.



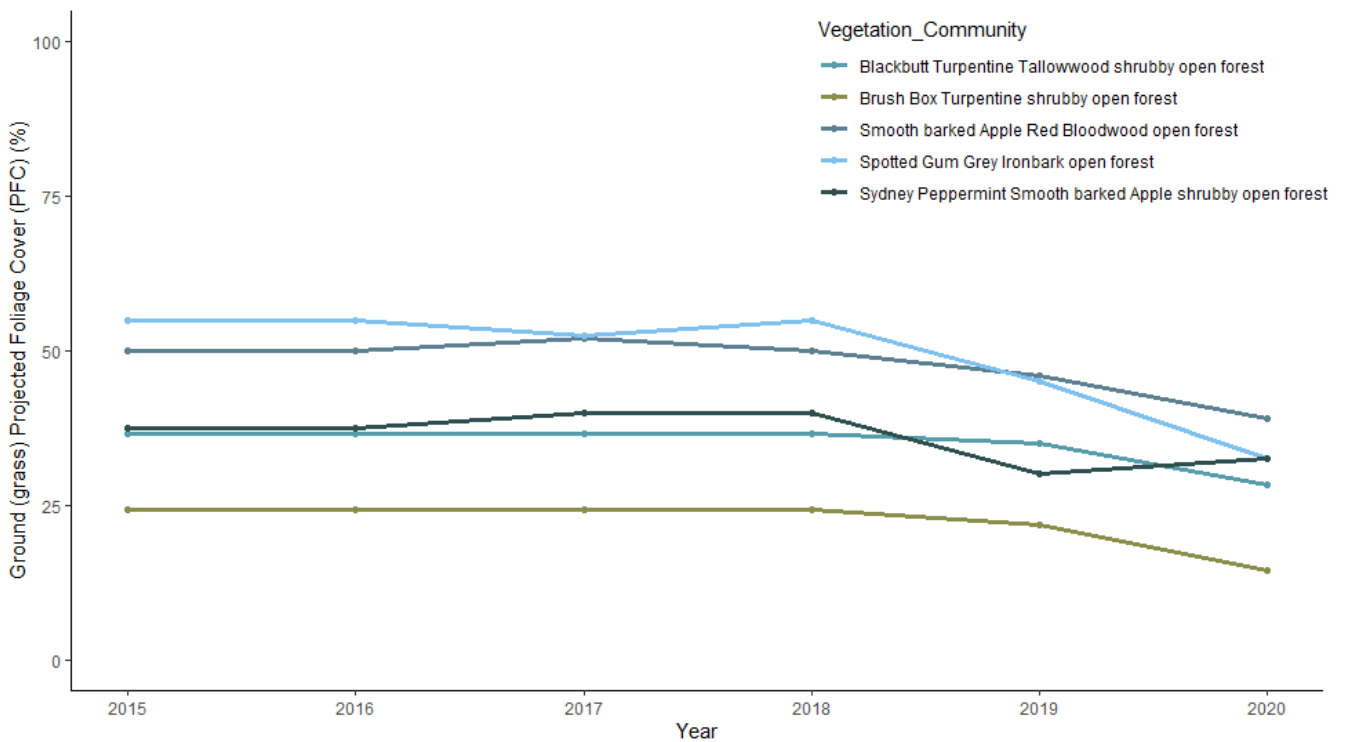
**Plate 2** Mean Canopy Projected Foliage Cover (%) by vegetation community (2015-2020)



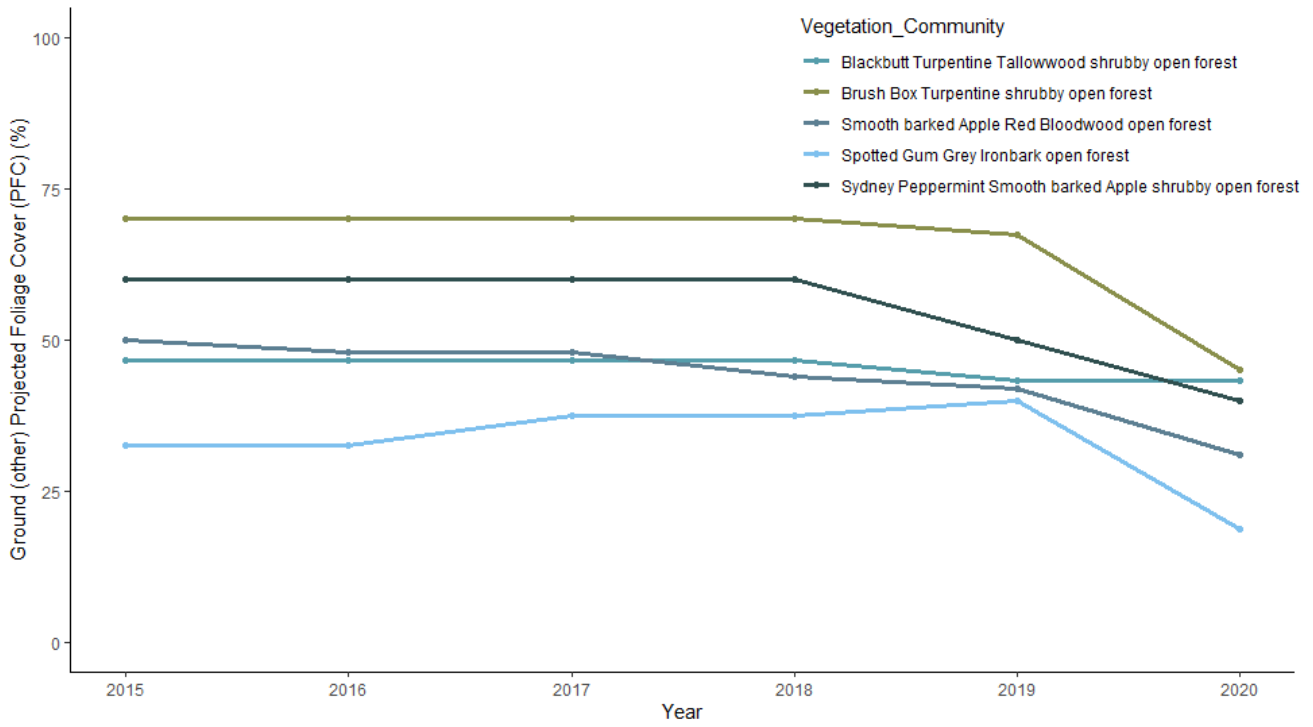
**Plate 3** Mean Mid-storey Projected Foliage Cover (%) by vegetation community (2015-2020)



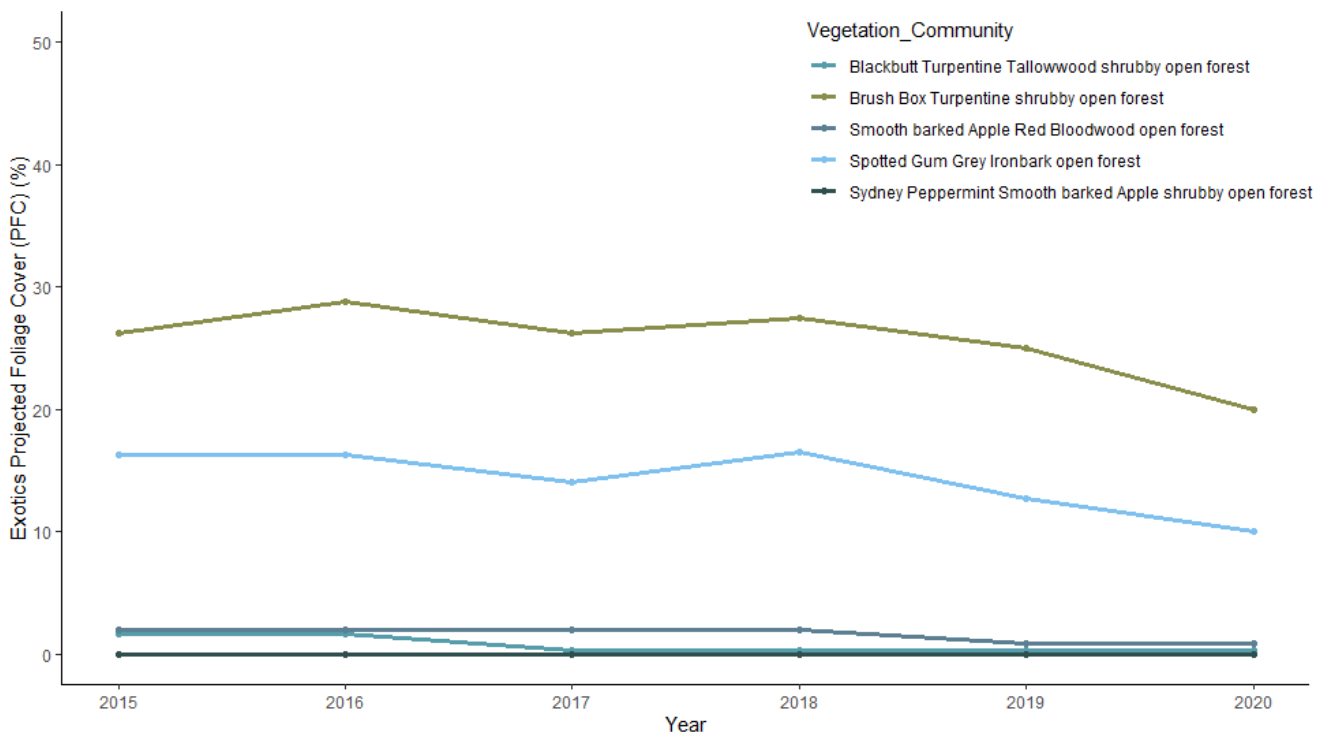
**Plate 4** Mean Shrub Projected Foliage Cover (%) by vegetation community (2015-2020)



**Plate 5** Mean Ground (grass) Projected Foliage Cover (%) by vegetation community (2015-2020)



**Plate 6** Mean Ground (other) Projected Foliage Cover (%) by vegetation community (2015-2020)



**Plate 7** Mean Exotics Projected Foliage Cover (%) by vegetation community (2015-2020)





## Disturbance

Minor disturbance was recorded at a number of monitoring sites. These are detailed in **Appendix A**, however, the following key observations are noted below:

- Minor scouring of creek bank was recorded at MP 18, MP 17 within a gully to the west of the quarry. This is likely the result of high rainfall events during the preceding months.
- Siltation is occurring along a drainage channel just outside of monitoring site MP 14, previously installed sediment fencing has collapsed requiring replacement (further discussed in **Section 3.3.2**)
- Wild pigs were observed within the vicinity of monitoring site MP 4. Recent erosion and disturbance to the groundcover within this area is likely the result of the pest species - Impacts of vertebrate pests are further discussed in **Section 3.3.4**.
- Past clearing at MP 12 is beginning to show signs of regeneration.
- High levels of dust were observed on foliage (see **Photo 1**) and on the ground at monitoring sites MP 6 and MP 7 along the eastern boundary of quarry operations. Minor dust cover was recorded at MP 18 and MP 15 along the quarry's western boundary. Whilst rainfall events following the 2020 monitoring event have likely reduced dust levels, monitoring of this disturbance should be continued in future years to assess any potential impacts to remnant vegetation.



**Photo 1**      **Dust cover on foliage recorded at MP 4**



### 3.2.2 Threatened Flora

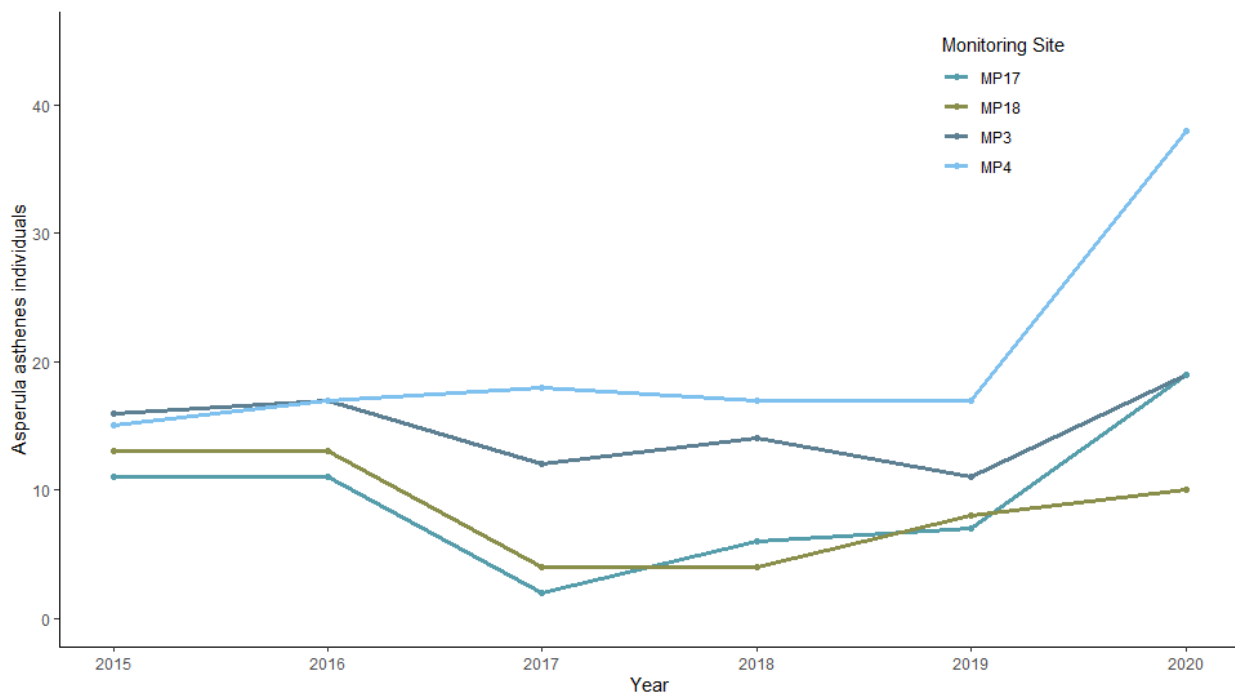
The 2020 threatened species monitoring identified a total of 86 individual *Asperula asthenes* plants, 34 clumps of *Tetradlea juncea*, and 24 *Grevillea parviflora* subsp. *parviflora* shrubs, representing an increase in threatened flora abundance for most species and at a majority of the monitoring locations.

Species specific results are discussed below, for more detailed threatened flora results including site specific observations on abundance and condition see **Appendix C**.

#### *Asperula asthenes*

Monitoring for *A.asthenes* was completed at four monitoring sites; MP 3, MP 4, MP 17, and MP 18, all of which recorded increases in *A.asthenes* abundance since 2019, with a mean increase of 98% within this period (**Plate 8**) and majority of plants recording flowers. The greatest increase within this period was recorded at MP 4 where abundance doubled from 17 plants in 2019 to 38 plants in 2020 (see **Plate 8**). It is important to note that many of the new individuals recorded at MP 4 were young seedlings establishing across areas of bare soil exposed from recent heavy rains. Whilst these are ideal conditions, the inevitable return of other groundcover species will likely begin to out compete the new *A.asthenes* returning abundance to pre-2020 levels.

The increase in abundance for the species across the monitoring sites continues a pattern of fluctuating abundance results for the species since 2015 and is likely due to improved conditions over winter, including higher rainfall (see **Plate 1**). There is no discernible pattern indicating impacts from quarry operations with *A.asthenes* abundance approximately 55% greater than the 2015 baseline.



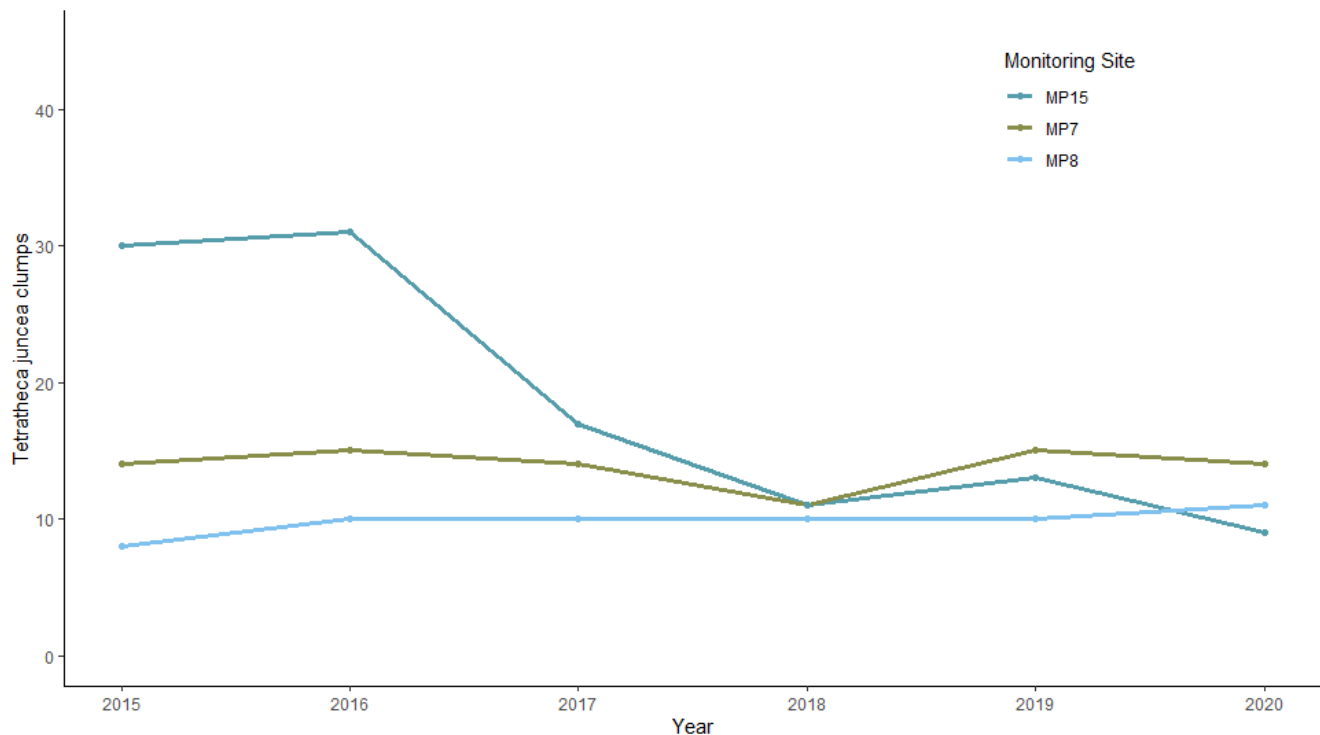
**Plate 8** *Asperula asthenes* abundance at monitoring sites (2015-2020)



## ***Tetratheca juncea***

Monitoring for *T. juncea* was completed at three monitoring sites; MP 7, MP 8, and MP 15. The population remains stable with only a small decline in abundance was recorded between 2019 and 2020 at MP 7 (15 to 14 plants) and at MP 15 (13 to 9 plants), whilst an increase was recorded at MP 8 (10 to 11 plants) (see **Plate 9**). *T. juncea* abundance has declined across the three monitoring sites by approximately 11% since the 2015 baseline monitoring event (**Plate 9**). The majority of this decline since 2015 has occurred within MP 15, which similar to MP 7 and MP 8 is in close proximity to quarry operations (see **Figure 4**). No major disturbances were recorded within MP 15 during the 2020 monitoring event, however dust was observed on foliage throughout the area.

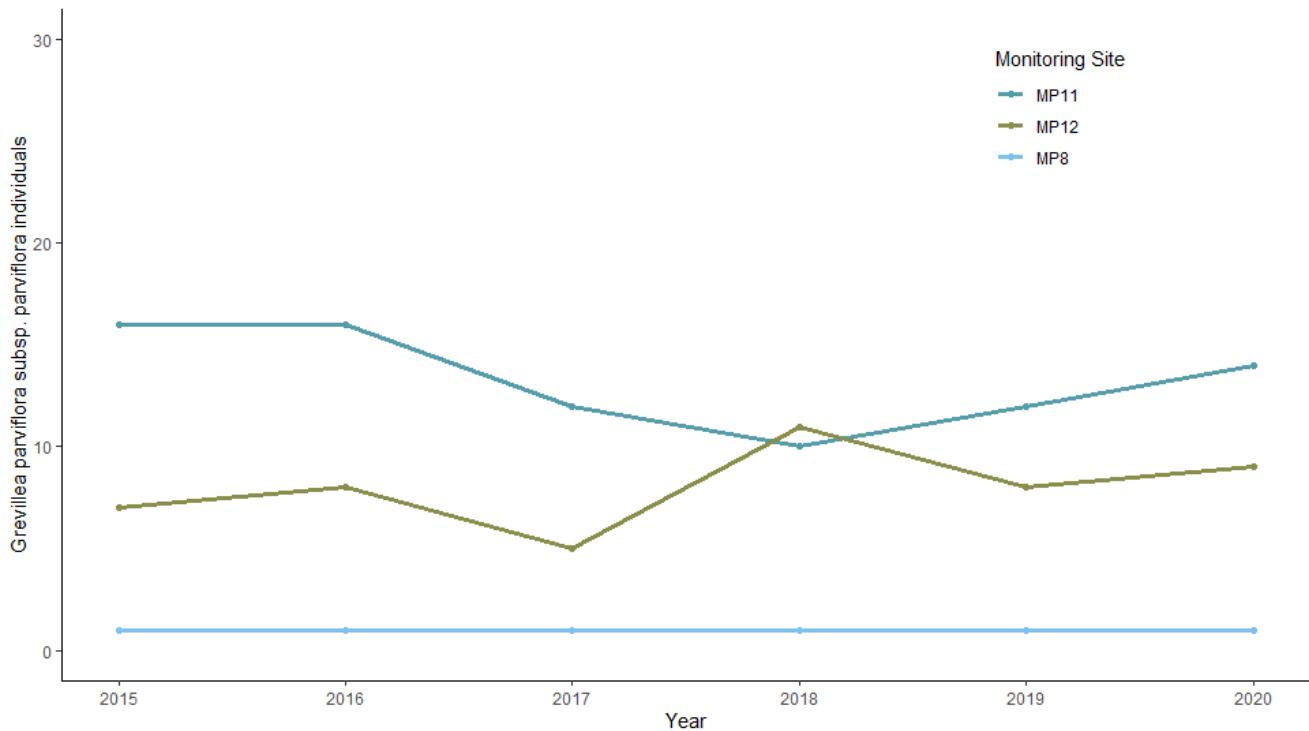
Flowering was recorded for the species across all three monitoring plots (MP 7, MP 8, and MP 15) during the 2020 monitoring event. Of the 15 plants recorded at MP 7, nine were in flower (60%) with a mean of 5.8 flowers, compared to 67% flowering and 5.2 flowers in 2019. MP 8 saw an increase from 60% flowering and 2.6 flowers to 92% flowering and 6.27 flowers. MP 15 also increased from only 54% flowering and 2.4 flowers in 2019 to 100% and 2.3 flowers in 2020. These results indicate the species is in good reproductive condition, likely due to favourable conditions (i.e. rainfall) over winter and into spring.



**Plate 9** *Tetratheca juncea* abundance at monitoring sites (2015-2020)

## ***Grevillea parviflora* subsp. *parviflora***

Monitoring for *G. parviflora* subsp. *parviflora* was completed at three monitoring sites; MP 8, MP 11 and MP 12. The population remains stable with a small increase in abundance recorded between 2019 and 2020 at MP 11 (12 to 14 plants) and at MP 12 (8 to 9 plants) (see **Plate 10**). However, despite the increase in abundance at MP 11 four plants were found to have died since 2019 with minor dieback recorded on three others. Overall, there is little change in abundance for the species since the 2015 baseline indicating minimal impact from quarry operations.



**Plate 10** *Grevillea parviflora* subsp. *parviflora* abundance at monitoring sites (2015-2020)

### 3.3 SITE WALKOVER AND INSPECTION

#### 3.3.1 Weed Infestations

Weed mapping was conducted across during field surveys on the 7<sup>th</sup> and 8<sup>th</sup> of October 2020 the BOA, within the project disturbance area, within 50 m of the project disturbance area, and along Yalimbah Creek on Lot 12. The resulting weed map (**Figure 5**) illustrates the cover of the most abundant weed species across the site, *Lantana camara* var. *camara* (Lantana) (Priority Weed within the Mid Coast LGA). As with previous monitoring events, major infestations occur throughout the site, with the majority of infestations occurring on the northern part of the BOA and localized within gullies and disturbed edges (**Figure 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 previously mapped along road and track sides were recorded again in 2020 and are mapped in **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.





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, especially within the vicinity of MP 3 and MP 4 to protect *Asperula asthenes* individuals. 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.

### 3.3.2 Fencing and Tracks

The layout of existing and required fencing, gates and tracks across the BOA is shown in **Figure 6**. 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 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.

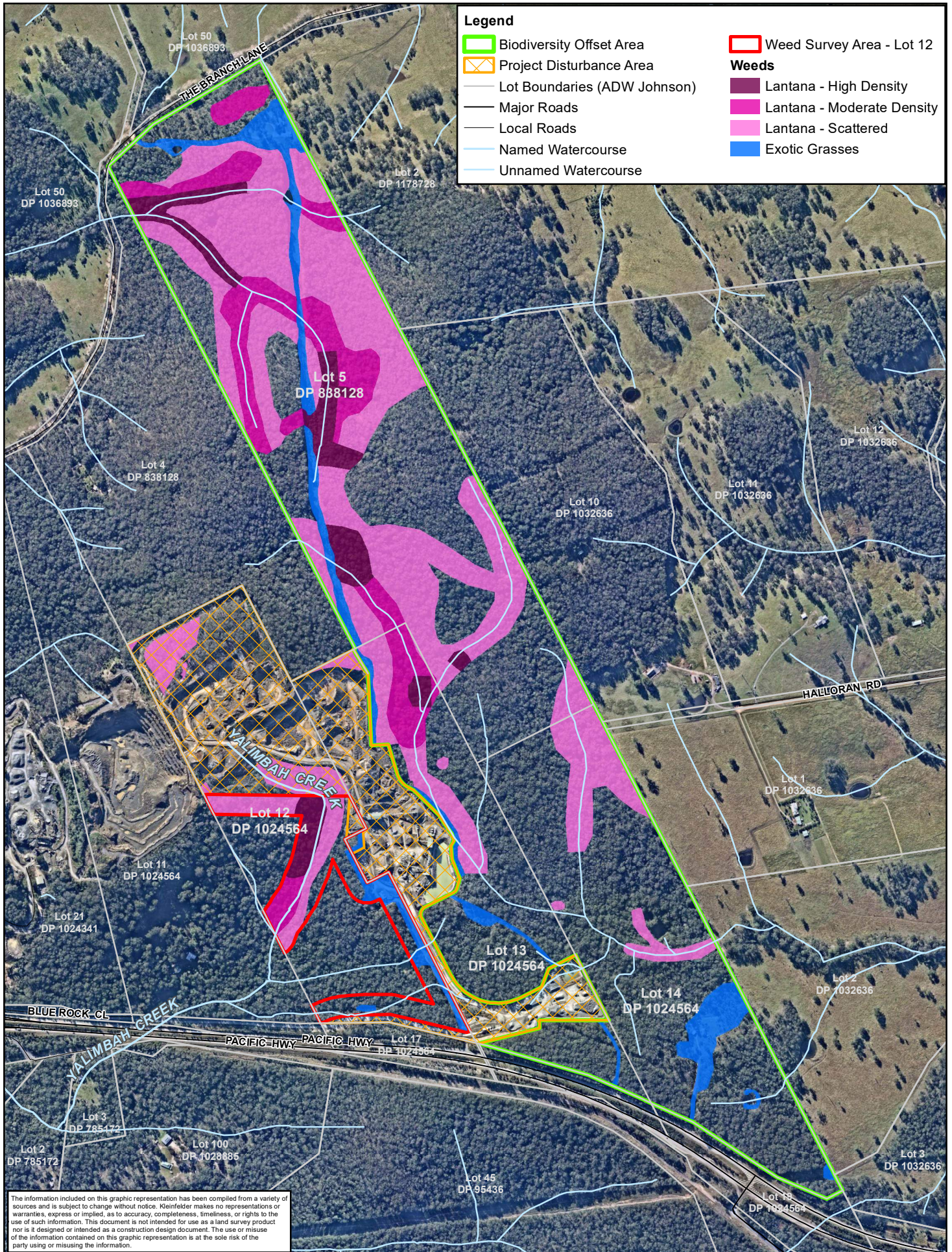
Several redundant sections of tracks within the southern part of the BOA are being successfully rehabilitated following the placement of branches, hollow logs / sections and other organic debris salvaged from the KEQ disturbance area during vegetation clearing.

Maintenance is recommended at the access track along the south-western boundary of Lot 14 to remove a small tree that has recently fallen over (see **Photo 2** and **Figure 6**). Works along the powerline easement track have improved accessibility and should continue to be maintained.



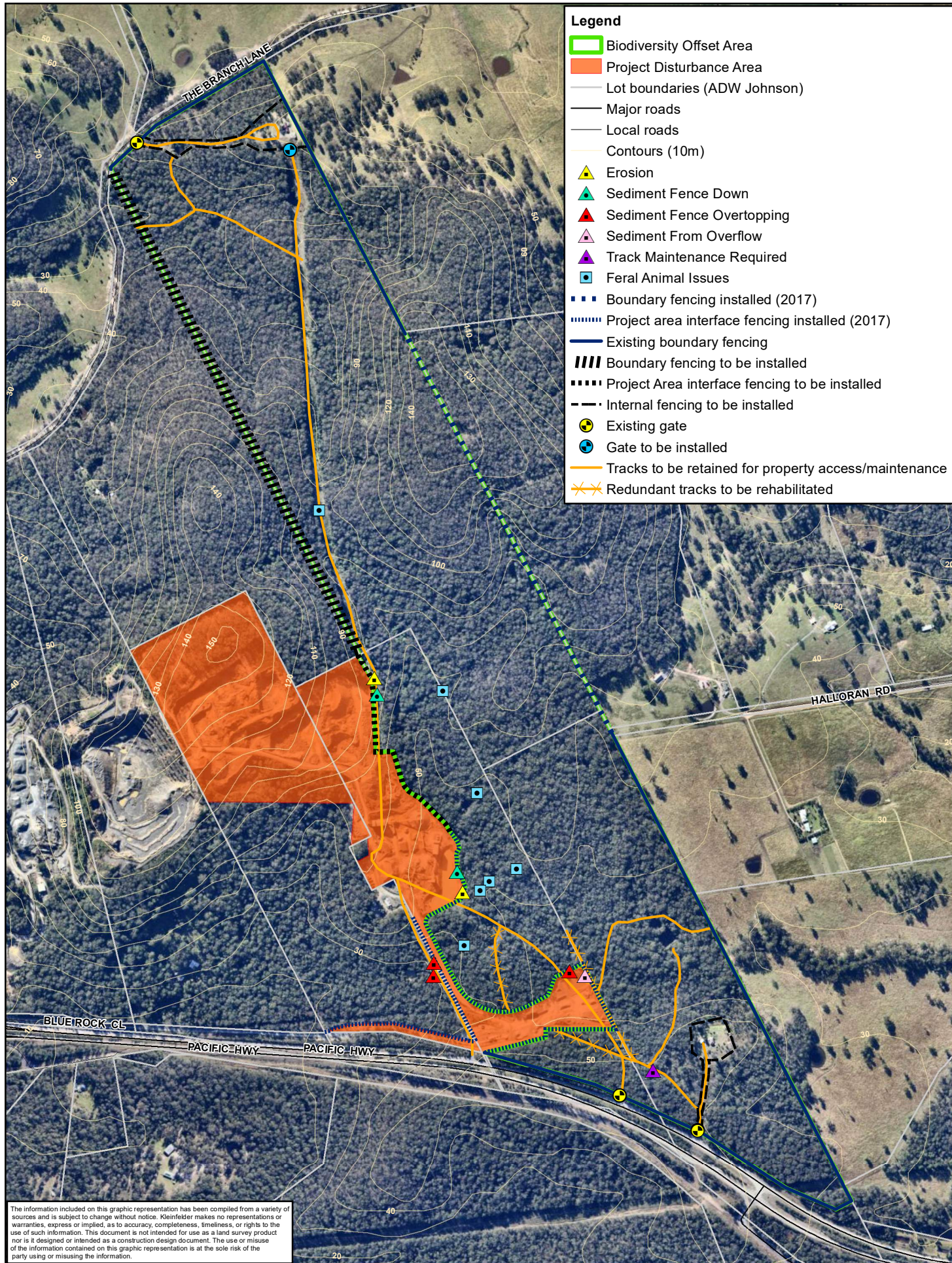
**Photo 2**      **Fallen Tree along access track in Lot 14**





|                                                                                                                                     |                                                                                                                                                                                            |                                                                                                                               |                                |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <p>0 50 100 200 300 400 500</p> <p>Metres</p> <p><b>KLEINFELDER</b><br/>Bright People. Right Solutions.<br/>www.kleinfelder.com</p> | <p>PROJECT REFERENCE: 20212186</p> <p>DATE DRAWN: 2020/12/08 16:41Version 1</p> <p>DRAWN BY: G.Joyce</p> <p>DATA SOURCE:<br/>NSW DFSI - 2017<br/>ADW Johnson - 2015<br/>Nearmap - 2020</p> | <p><b>Weed Mapping</b></p> <p>Karuah East Quarry Pty Ltd<br/>2020 Annual Monitoring Report<br/>Karuah East Quarry Project</p> | <p>FIGURE:</p> <p><b>5</b></p> |
|                                                                                                                                     |                                                                                                                                                                                            |                                                                                                                               |                                |





|                                                                                                                                     |                                                                                                                                                                                             |                                                                                                                                                               |                                |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <p>0 50 100 200 300 400 500</p> <p>Metres</p> <p><b>KLEINFELDER</b><br/>Bright People. Right Solutions.<br/>www.kleinfelder.com</p> | <p>PROJECT REFERENCE: 20212186</p> <p>DATE DRAWN: 2020/12/08 17:29/Version 1</p> <p>DRAWN BY: G.Joyce</p> <p>DATA SOURCE:<br/>NSW DFSI - 2017<br/>ADW Johnson - 2015<br/>Nearmap - 2020</p> | <p><b>Fencing, Track, Erosion,<br/>and Pest Issues</b></p> <p>Karuah East Quarry Pty Ltd<br/>2020 Annual Monitoring Report<br/>Karuah East Quarry Project</p> | <p>FIGURE:</p> <p><b>6</b></p> |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|





### 3.3.3 Erosion

No areas of major active erosion were identified within the BOA during the 2020 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 and within the vicinity of monitoring sites MP 17 and MP 18 in Lot 12. However, this scouring is considered to be natural stream bank erosion, likely exacerbated by recent heavy rainfall events, 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 the 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, 2019, and 2020 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.

Key erosion and sedimentation 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 2020) and, therefore, no longer provided active sediment control (**Figure 6**). It was observed in these locations that some sediment had been deposited within the surrounding environment. The overtopping sediment fencing along the western boundary of the quarry, within Lot 12, and adjacent to monitoring site MP 14 shows evidence of resulting sedimentation of the drainage channel and dam located to the immediate west of the fencing (see **Photo 3**).
- 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 or 2020. 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.



**Photo 3** Sediment fencing down and overtopping within Lot 12

### 3.3.4 Vertebrate Pests

Feral pigs were recorded during the 2020 site inspections along the powerline easement in Lot 5 and in close proximity to monitoring site MP 4, supporting previous observations of suspected Feral Pig diggings recorded in the southern half of the BOA area during previous site inspections (**Figure 6**). Karuah East Quarry conducted Feral Pig trapping in Lot 14 in March 2019 and is in the process of implementing a broader feral animal control programme in the BOA (December 2020).

### 3.3.5 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 were stockpiled on the boundaries of the KEQ project area (see **Figure 7**).

In addition to this, a total of 77 hollows and hollow log sections were previously salvaged and set aside for redistribution into the BOA. The location of the hollow logs to be redistributed throughout the BOA is shown on **Figure 7**. Recent inspections indicated that most hollows are unsuitable for reinstallation due to cracks in hollow walls or the requirement to substantially modify the hollow for reinstallation. As such, in July/August 2020, 193 nest boxes were installed to compensate for the loss of 116 hollows and also compensate for the need to reinstall 77 salvaged hollows. It is recommended that the 77 salvaged hollows be redistributed terrestrially within the BOA to provide habitat for terrestrial fauna species.



Tree hollows removed as part of clearing works completed on site in November 2016, May and August 2018, and October and November 2019, have now been sufficiently replaced as per the requirements of the BOAMP. Details on nest box installation are covered below.

### Nest Boxes

Since 2016 a total of 318 nest boxes have been installed within the Karuah East Quarry BOA. Details of nest boxes installed are outlined in **Table 6**.

**Table 6 Nest box installation details across KEQ BOA (2016-2020)**

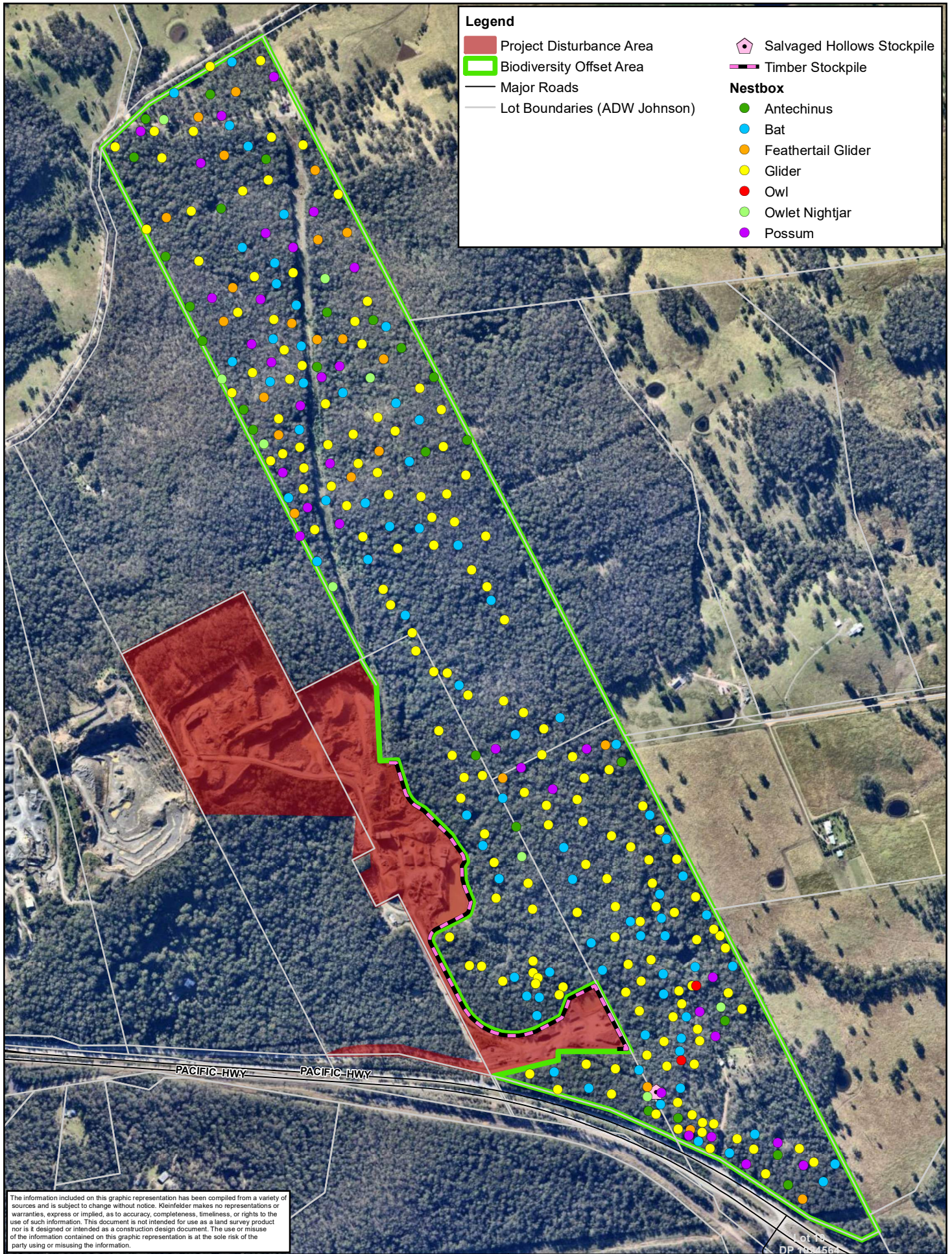
| Installation Date | Installation Details                                                                                                                                                                                                                                                                                           | Box Types Installed                                                                                                                                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| April 2016        | 30 nest boxes were installed within the BOA in April 2016 as per Section 3.8 of the BOAMP.                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>20 Glider boxes</li> <li>10 Microchiropteran bat boxes</li> </ul>                                                                                                                               |
| February 2018     | 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 (totaling 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. | <ul style="list-style-type: none"> <li>62 Glider boxes</li> <li>31 Microchiropteran bat boxes</li> <li>Two owl nest boxes</li> </ul>                                                                                                   |
| July-August 2020  | 193 nest boxes were installed within the BOA to replace hollows removed during clearing undertaken on site in May and August 2018 at a ratio 1:1 as per the requirements of the L&RP and the BOAMP.                                                                                                            | <ul style="list-style-type: none"> <li>70 Glider boxes</li> <li>33 Possum boxes</li> <li>25 Antechinus boxes</li> <li>33 Microchiropteran bat boxes</li> <li>23 Feathertail Glider boxes</li> <li>Nine Owlet Nightjar boxes</li> </ul> |

Biennial nest box monitoring was completed by Kleinfelder in 2018 and in 2020, results from these inspections are summarized below in **Table 7**. Nest box monitoring is due to be completed again in 2022.

**Table 7 Nest box monitoring results (2018-2020)**

| Installation Date | Usage Rate                                                                                                                                                                           | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2018 Inspection   | <ul style="list-style-type: none"> <li><b>2016 Install of 30 nest boxes (2yrs old) = 27% usage.</b></li> </ul>                                                                       | <ul style="list-style-type: none"> <li>30 boxes were deemed to be available for use</li> <li>No boxes recorded as damaged or unusable.</li> <li>Eight Glider boxes showed signs of use including one being actively occupied by two Sugar Gliders (<i>Petaurus breviceps</i>).</li> <li>None of the Microchiropteran bat exhibited signs of use during the survey.</li> </ul>                                                                                                                                                                                                                                                                                                                        |
| 2020 Inspection   | <ul style="list-style-type: none"> <li><b>2016 Install of 30 nest boxes (4yrs old) = 47% usage.</b></li> <li><b>2018 Install of 95 nest boxes (2yrs old) = 28% usage.</b></li> </ul> | <ul style="list-style-type: none"> <li>122 boxes were deemed to be available for use</li> <li>Two boxes were found to be damaged and one unusable box (termite infested).</li> <li>40 Glider boxes showed signs of occupation, this included, three boxes occupied by Sugar Gliders (<i>Petaurus breviceps</i>) and 37 other boxes showing signs of use either from Sugar Gliders, Brown Antechinus (<i>Antechinus stuartii</i>) and Feathertail Gliders (<i>Acrobates pygmaeus</i>).</li> <li>Almost half of all the glider nest boxes have either been utilised by or contain fauna species (usage rate of 49%).</li> <li>None of the Microchiropteran bat boxes exhibited signs of use</li> </ul> |





|                                                                                                                                     |                                                                                                                                                                                             |                                                                                                                                                          |                                |
|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <p>0 50 100 200 300 400 500</p> <p>Metres</p> <p><b>KLEINFELDER</b><br/>Bright People. Right Solutions.<br/>www.kleinfelder.com</p> | <p>PROJECT REFERENCE: 20212186</p> <p>DATE DRAWN: 2020/12/08 18:13 Version 1</p> <p>DRAWN BY: G.Joyce</p> <p>DATA SOURCE:<br/>NSW DFSI - 2017<br/>ADW Johnson - 2015<br/>Nearmap - 2020</p> | <p><b>Habitat Resources and NestBox Locations</b></p> <p>Karuah East Quarry Pty Ltd<br/>2020 Annual Monitoring Report<br/>Karuah East Quarry Project</p> | <p>FIGURE:</p> <p><b>7</b></p> |
|                                                                                                                                     |                                                                                                                                                                                             |                                                                                                                                                          |                                |





## 4 PERFORMANCE CRITERIA EVALUATION

BOAMP performance criteria and an evaluation of the current status, relevant management actions completed or further works required are detailed below in **Table 8**. 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 8 Current status of BOAMP performance criteria**

| Action                                                     | Performance Criteria                                                                                                | Current Status (2020)                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Fencing, Gates and Signage</i></b>                   |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                   |
| 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<br>Ongoing installation of boundary fencing, gates and signage required. Mostly restricted due to access (e.g. around uncleared areas of the extraction area).                                                                                                                                                                        |
| 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                                        | Maintain boundary fencing as direct by annual inspection                                                            | Repair of boundary fencing, gates and signage is undertaken as required. No Maintenance required following 2020 inspection.                                                                                                                                                                                                                       |
| <b><i>Access Tracks</i></b>                                |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                   |
| 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<br>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 2020 monitoring. The Lot 13/Lot 14 access track requires the removal of a fallen tree to ensure safe access.                                                                                                       |
| 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.                                                                                                                                                                                                                                                                                                                      |
| <b><i>Erosion, Sedimentation and Soil Management</i></b>   |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                   |
| Erosion and sedimentation mapping                          | Completed by end of year 1                                                                                          | Baseline assessment completed in October 2015.                                                                                                                                                                                                                                                                                                    |
| Erosion repair and management                              | Completed by end of year 3<br>Repair of erosion within BOA does not impact on ecological values                     | The 2020 survey identified areas requiring repair and/or management, these actions should be undertaken immediately.<br><br>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. |



| Action                                                      | Performance Criteria                                                                                                                                                  | Current Status (2020)                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Erosion inspections                                         | Completed annually                                                                                                                                                    | Annual inspection completed in October 2020.                                                                                                                                                                                                                                                                                                                                  |
| <b>Existing Dwellings</b>                                   |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                               |
| 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<br>Installation of fencing, gates and signage required.                                                                                                                                                                                                                                                                                                           |
| Inspections                                                 | Completed annually                                                                                                                                                    | Annual inspection completed in October 2020.                                                                                                                                                                                                                                                                                                                                  |
| Maintenance and weed control                                | No noxious weeds present within excised areas.<br>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 2020 monitoring.<br>No unauthorised disturbance observed outside of excised areas in the BOA during 2020 monitoring.                                                                                                                                                     |
| <b>Revegetation and Regeneration*</b>                       |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                               |
| 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, 2019 or 2020 monitoring events. The requirement for revegetation works within the BOA will be reassessed each year.                                                                                                                                        |
| <b>Habitat Augmentation</b>                                 |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                               |
| Salvage and redistribution of habitat resources             | Redistribution of salvaged resources by end of Year 3<br>Redistribution of salvaged resources does not impact on ecological values of BOA, including threatened flora | The 77 salvaged hollows were determined to be unsuitable for reinstallation. The installation of 193 nest boxes in July/August 2020 compensates for the loss of these hollows and recent clearing works undertaken on site.                                                                                                                                                   |
| Nest box installation                                       | 30 nest boxes installed in BOA prior to commencement of clearing.<br>Remaining nest boxes installed within three months following completion of clearing.             | Completed. A total of 318 nest boxes have been installed within the BOA. This includes Thirty nest boxes installed in the southern part of the BOA in April 2015 prior to commencement of clearing, an additional 95 were installed in February 2018, and the installation of 193 nest boxes in July-August 2020 which were required for clearing completed in November 2019. |
| Nest box monitoring and maintenance                         | Nest boxes inspected every two years.<br>Repairs / maintenance implemented within 6 months of biennial inspection.                                                    | Monitoring of nest box 1-30 was carried in April 2018.<br>Monitoring of boxes 1-125 was carried out in June 2020.                                                                                                                                                                                                                                                             |
| <b>Threatened Flora Translocation</b>                       |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                               |
| Tetratheca juncea translocation                             | Translocation completed by end of year 1<br>Maintenance and monitoring undertaken in accordance with the TjMP                                                         | Refer to Tj Translocation Monitoring Report (Firebird 2018).                                                                                                                                                                                                                                                                                                                  |
| <b>Weed Control</b>                                         |                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                               |
| Baseline weed mapping                                       | Completed by end of year 1                                                                                                                                            | Baseline assessment completed in October 2015 (Kleinfelder 2015).                                                                                                                                                                                                                                                                                                             |



| Action                                                      | Performance Criteria                                                                                                                                                                                                                                              | Current Status (2020)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                                | <p>20% reduction in extent or density (cover) of target weeds per year compared to baseline mapping by end of Year 3.</p> <p>Weed control activities do not impact on ecological values.</p>                                                                      | <p>Outstanding</p> <p>There has been little change in weed density over the Lot 5 area since the 2018 monitoring round.</p> <p>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.</p> <p>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.</p> <p>Further weed control is recommended to prevent the establishment of Lantana (low density areas) or control established patches (medium/high density areas).</p> |
| Weed monitoring                                             | <p>Completed biennially (every two years) (for BOA).</p> <p>Completed annually (KEQ, 50 m buffer and Yalimbah Creek).</p>                                                                                                                                         | 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) and BOA in October 2020.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Vertebrate Pest Management</b>                           |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Baseline vertebrate pest assessment                         | Completed by end of year 1                                                                                                                                                                                                                                        | Baseline assessment completed in October 2015 (Kleinfelder 2015).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Vertebrate pest control                                     | <p>No non-target species affected by control works.</p> <p>Reduction in abundance of target species across BOA compared to baseline assessment.</p>                                                                                                               | Feral animal control was undertaken in February 2019.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Monitoring                                                  | Completed biennially (every two years).                                                                                                                                                                                                                           | <p>Outstanding</p> <p>2017 biennially vertebrate pest monitoring required. 1080 baiting is planned to be undertaken within Lot 5 during December 2020.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Fire Management</b>                                      |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Fire management strategy                                    | Completed by end of year 1                                                                                                                                                                                                                                        | <p>Outstanding</p> <p>A fire management strategy is to be prepared for the BOA.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Bushfire mitigation                                         | Bushfire mitigation measures in the L&RMP adhered to at all times                                                                                                                                                                                                 | Refer to KEQ Annual Environmental Report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Aerial Fauna Crossing</b>                                |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 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> | <p>Completed</p> <p>Aerial fauna crossings installed at Karuah Hardrock Quarry in 2019, and KEQ in 2020. Remote Camera monitoring programmes for both crossings have commenced.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



| Action                                     | Performance Criteria                                                                                                                                                                                                                                                                                                                                                    | Current Status (2020)                                                                                                                                                                                                                                                                     |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Ecological Monitoring</i></b>        |                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                           |
| 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

Results from the 2020 KEQ BOA annual 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 stable since 2019 and the baseline surveys completed in 2015.

The 2020 monitoring programme has identified several key management actions that are required to be completed, which have been highlighted in **Section 4** of this report. Key results from the 2020 monitoring programme include:

- *Asperula asthenes*, *Tetralochea juncea* and *Grevillea parviflora subsp. parviflora* populations are in good condition and have increased in size since annual monitoring in 2019, likely due to recent favourable weather conditions.
- Key disturbances recorded within the KEQ BOA and Lot 12 include minor sedimentation due to overtopping of a small number of sediment fences, and the occurrence of dust on foliage within close proximity to quarry operations.
- Weed coverage across the KEQ BOA and Lot 12 have remained largely stable – management is required to reduce Lantana cover, especially within the northern portion of the site.
- Maintenance required to repair sediment fencing and remove fallen tree currently blocking access to a track in the south eastern corner of the site (Lot 13/Lot 14).
- Feral pigs were observed along the powerline easement in the northern portion of the site, along with signs of feral pig diggings near monitoring sites MP 3 and MP 4. Vertebrate pest management required, although it is understood that 1080 baiting is scheduled for December 2020.
- A total of 318 nest boxes have been installed to date across the KEQ BOA. Monitoring of nest boxes have been carried out in 2018 and 2020.





## 6 REFERENCES

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# APPENDIX A      VEGETATION CONDITION ASSESSMENT RESULTS





**Table A1 Vegetation condition and threatened flora monitoring results summary (2020)**

| 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"> <li>Minor evidence of canopy or mid-story foliage die-back.</li> <li>Observed reduction in ground cover since 2019 monitoring event, likely recovering from drier conditions over 2019-2020.</li> <li>Canopy and midstory regeneration present.</li> <li>Moderate cover of fallen logs / timber.</li> <li>Moderate to dense ground cover.</li> <li>Low rock cover.</li> </ul> <p><b>Conclusion:</b> No significant changes in vegetation and habitat condition since the previous survey (2019), reduction in groundcover likely to be reversed with the continuation of favourable weather conditions.</p> | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> No new disturbance or changes in existing disturbance severity were observed since the previous survey (2019).</p>                                                                                                                                          | N/A                         |
| MP2  | Spotted Gum – Grey Ironbark open forest | <ul style="list-style-type: none"> <li>Minor canopy and midstory foliage die-back observed.</li> <li>Moderate ground cover and recovery of grass cover within monitoring site.</li> <li>Canopy and midstorey regeneration present.</li> <li>Moderate cover of fallen logs / timber.</li> <li>Rocky areas present.</li> <li>Hollow-bearing trees and one stag present within vicinity of monitoring site.</li> </ul> <p><b>Conclusion:</b> No significant changes in vegetation and habitat condition since the previous survey (2019). Ground cover recovering from drier conditions experienced on site during 2019-2020.</p>                 | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li> <li>No signs of recent fire.</li> <li>Decline in weed cover within monitoring plot, however, heavy <i>Lantana</i> infestation in the gully south west of MP2 remains.</li> </ul> <p><b>Conclusion:</b> No new disturbance or changes in existing disturbance severity were observed since the previous survey (2019).</p> | N/A                         |



| Site | Vegetation Community                       | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Threatened Flora Monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MP3  | Brush Box – Turpentine shrubby open forest | <ul style="list-style-type: none"> <li>No evidence of foliage die-back.</li> <li>All vegetation strata in healthy condition.</li> <li>Canopy and midstory regeneration present.</li> <li>High structural complexity of vegetation.</li> <li>Light-Moderate cover of fallen timber.</li> <li>No ephemeral pools within stream.</li> <li>Reduction in <i>Lantana camara</i> cover within the monitoring site.</li> <li>Scattered <i>Ageratina riparia</i> (Mistflower) within creek</li> </ul> <p><b>Conclusion:</b> No significant or notable changes in vegetation and habitat condition since the previous survey (2019).</p>                                                                                                                              | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, or rock / timber removal.</li> <li>Dust cover on foliage observed (see <b>Section 3.2.1</b>)</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> No new disturbance or changes in existing disturbance severity were observed since the previous survey (2019).</p>                                                                                                                                             | <ul style="list-style-type: none"> <li>There was an increase in number of <i>Asperula asthenes</i> individuals within the monitoring site from 11 in 2019 to 19 in 2020.</li> <li>Three new <i>Asperula asthenes</i> plants were recorded in 2020.</li> <li>Seven <i>Asperula asthenes</i> plants were recorded flowering during monitoring.</li> <li>All <i>Asperula asthenes</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>The population at MP 3 remains relatively stable since 2015 baseline (16 individuals recorded) and has likely benefited from recent more favourable weather conditions.</li> </ul>                                 |
| MP4  | Brush Box – Turpentine shrubby open forest | <ul style="list-style-type: none"> <li>Evidence of minor dieback in <i>Eucalyptus microcorys</i> (Tallowwood)</li> <li>Apart from the minor Tallowwood dieback all vegetation strata within the monitoring site in healthy condition.</li> <li>Canopy and midstory regeneration present.</li> <li>High structural complexity of vegetation.</li> <li>Reduction in groundcover due to recent disturbance likely from heavy rain events and feral pig diggings,</li> <li>High fallen timber.</li> <li>Weed cover (<i>Lantana</i> and <i>Tradescantia</i>) within the monitoring site and surrounds remains high.</li> </ul> <p><b>Conclusion:</b> No significant or notable changes in vegetation and habitat condition since the previous survey (2019).</p> | <ul style="list-style-type: none"> <li>Feral pigs observed within the vicinity of the monitoring site.</li> <li>Evidence of ground disturbance likely from recent heavy rains and feral pig diggings. Some minor erosion and reduction of groundcover occurring.</li> <li>No recent evidence of disturbance from grazing, rubbish dumping, rock / timber removal, or dust.</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> Feral pigs and recent heavy rains have likely resulted in a reduction of groundcover and an increase in erosion on site. Feral pest control required.</p> | <ul style="list-style-type: none"> <li>There was an increase in number of <i>Asperula asthenes</i> individuals recorded within the monitoring site, from 17 in 2019 to 38 in 2020.</li> <li>23 new <i>Asperula asthenes</i> individuals were recorded in 2020.</li> <li>Five <i>Asperula asthenes</i> plants were recorded flowering during monitoring.</li> <li>All <i>Asperula asthenes</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>The population at MP 4 remains stable since 2015 baseline (15 individuals recorded) with recent large increase in population likely the result of recent more favourable weather conditions.</li> </ul> |





| Site | Vegetation Community                                    | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                           | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Threatened Flora Monitoring |
|------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| MP5  | Blackbutt – Turpentine – Tallowwood shrubby open forest | <ul style="list-style-type: none"><li>No evidence of foliage die-back was observed in the canopy or ground layer</li><li>Canopy and midstory regeneration present.</li><li>Moderate fallen logs / timber.</li><li>Moderate/dense ground cover.</li><li>Small reduction in mid-storey and groundcover PFC recorded within monitoring site.</li></ul> <p><b>Conclusion:</b> No significant changes in vegetation and habitat condition since the previous survey (2019).</p> | <ul style="list-style-type: none"><li>No evidence of erosion and sedimentation.</li><li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li><li>No signs of recent fire.</li></ul> <p><b>Conclusion:</b> No new disturbance or changes in existing disturbance severity were observed since the previous survey (2019).</p>                                                                                                                                  | N/A                         |
| MP6  | Blackbutt – Turpentine – Tallowwood shrubby open forest | <ul style="list-style-type: none"><li>Some evidence of foliage die-back in the mid-story.</li><li>Canopy in healthy condition.</li><li>Canopy and midstory regeneration present.</li><li>Moderate/High fallen logs / timber.</li><li>Moderate level of groundcover.</li><li>Standing pools within creek.</li></ul> <p><b>Conclusion:</b> No significant changes in vegetation and habitat condition since the previous survey (2019).</p>                                  | <ul style="list-style-type: none"><li>No evidence of erosion and sedimentation.</li><li>Disturbance from tree falling (<i>Glochidion ferdinandi</i>) within western half of MP6.</li><li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, or rock / timber removal was observed.</li><li>Dust cover observed on foliage.</li><li>No signs of recent fire.</li></ul> <p><b>Conclusion:</b> Dust cover on foliage was observed within the monitoring site in 2020, previously not recorded.</p> | N/A                         |



| Site | Vegetation Community                            | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                                                      | Threatened Flora Monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MP7  | Smooth-barked Apple - Red Bloodwood open forest | <ul style="list-style-type: none"> <li>Minor evidence of foliage die-back in canopy or midstory.</li> <li>All vegetation strata in healthy condition.</li> <li>Canopy and midstory regeneration present.</li> <li>Regrowth vegetation to the north and east (previously cleared).</li> <li>Moderate litter cover within monitoring site, fallen timber present.</li> <li>Decrease in groundcover recorded within the monitoring site since 2019 (see <b>Appendix B</b>).</li> </ul> <p><b>Conclusion:</b> There were only minor changes in vegetation and habitat condition since the previous survey (2019).</p> | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, or rock / timber removal.</li> <li>Dust cover observed on foliage.</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> Dust cover on foliage was observed within the monitoring site in 2020, previously not recorded.</p>           | <ul style="list-style-type: none"> <li>There was a small decrease in the number of <i>Tetratheca juncea</i> clumps recorded within the monitoring site, from 15 in 2019 to 14 in 2020.</li> <li>Two new <i>Tetratheca juncea</i> clumps were recorded in 2020.</li> <li>Nine <i>Tetratheca juncea</i> plants were recorded flowering during monitoring.</li> <li>Eight <i>Tetratheca juncea</i> plants were recorded with fruits during monitoring.</li> <li>All <i>Tetratheca juncea</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>The <i>Tetratheca juncea</i> population at MP 7 remains stable since 2015 baseline (14 individuals recorded) with decrease of one individual is likely a natural occurrence.</li> </ul>                                                                                                                               |
| MP8  | Smooth-barked Apple - Red Bloodwood open forest | <ul style="list-style-type: none"> <li>No dieback of canopy stratum was observed.</li> <li>Evidence of some die back in midstory stratum, especially <i>Allocasuarina littoralis</i> was observed.</li> <li>Canopy and midstorey regeneration present including regeneration of <i>Eucalyptus eugenioides</i>.</li> <li>Moderate fallen timber</li> <li>Dense ground cover and midstory</li> <li>Estimated foliage cover decreased for ground cover (<b>Appendix B</b>)</li> </ul> <p><b>Conclusion:</b> Minor changes in vegetation and habitat condition since the previous survey (2019).</p>                  | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust</li> <li>No signs of recent fire</li> <li>Old track to north-east</li> </ul> <p><b>Conclusion:</b> No new disturbance or changes in existing disturbance severity were observed since the previous survey (2019).</p> | <ul style="list-style-type: none"> <li>There was a small increase in the number of <i>Tetratheca juncea</i> clumps recorded within the monitoring site, from 10 in 2019 to 11 in 2020.</li> <li>Two new <i>Tetratheca juncea</i> clumps were recorded in 2020.</li> <li>11 <i>Tetratheca juncea</i> plants were recorded flowering during monitoring.</li> <li>One <i>Tetratheca juncea</i> plant was recorded with fruits during monitoring.</li> <li>All <i>Tetratheca juncea</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>The <i>Tetratheca juncea</i> population at MP 8 has increased slightly since 2015 baseline (eight individuals recorded).</li> <li>The one <i>Grevillea parviflora</i> subsp. <i>parviflora</i> individual occurring within MP 8 was recorded in 2020 to be in healthy condition and flowering during monitoring.</li> </ul> |



| Site | Vegetation Community                                        | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Threatened Flora Monitoring |
|------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| MP9  | Smooth-barked Apple - Red Bloodwood open forest             | <ul style="list-style-type: none"><li>There was no sign of foliage die-back in the understory.</li><li>Dead wood was observed throughout the canopy.</li><li>Canopy and midstory regeneration present.</li><li>Moderate/high fallen timber.</li><li>Moderate ground cover present.</li></ul>                                                                                                                                                                                         | <ul style="list-style-type: none"><li>No evidence of erosion and sedimentation.</li><li>No recent evidence of disturbance from grazing, pest animals, rock / timber removal, or dust.</li><li>No recent evidence of rubbish dumping was present; however, some rubbish was present in the area.</li><li>No signs of recent fire.</li><li>Old track to south.</li></ul> <p><b>Conclusion:</b> No new disturbance or changes in existing disturbance severity were observed since the previous survey (2019).</p> | N/A                         |
| MP10 | Sydney Peppermint - Smooth-barked Apple shrubby open forest | <ul style="list-style-type: none"><li>Two <i>Eucalyptus piperita</i> were observed to have some natural foliage die-back in canopy cover.</li><li>All vegetation strata in healthy condition.</li><li>Canopy and midstory regeneration present.</li><li>Low-moderate fallen timber and moderate litter coverage..</li><li>Moderate to dense ground cover.</li></ul> <p><b>Conclusion:</b> No major changes in vegetation and habitat condition since the previous survey (2019).</p> | <ul style="list-style-type: none"><li>No evidence of erosion and sedimentation.</li><li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li><li>No signs of recent fire.</li><li>Several old dead stags present.</li><li>Some canopy gaps (from past clearing/logging).</li></ul> <p><b>Conclusion:</b> No new disturbance or changes in existing disturbance severity were observed since the previous survey (2019).</p>                       | N/A                         |



| Site | Vegetation Community                                        | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Threatened Flora Monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MP11 | Sydney Peppermint - Smooth-barked Apple shrubby open forest | <ul style="list-style-type: none"> <li>No evidence of foliage die-back.</li> <li>All vegetation strata in healthy condition.</li> <li>Canopy and midstory regeneration present.</li> <li>Low fallen timber.</li> <li>Moderate Dense ground cover.</li> </ul> <p><b>Conclusion:</b> No significant or notable changes in vegetation and habitat condition since the previous survey (2019).</p>                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>Previous disturbance from tree falling along North-North/East 20 metre buffer boundary.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> No recent disturbance was observed since the previous survey (2019).</p>                                                                                                                                                                        | <ul style="list-style-type: none"> <li>There was a small increase in the number of <i>Grevillea parviflora</i> subsp. <i>parviflora</i> plants recorded within the monitoring site, from 12 in 2019 to 13 in 2020.</li> <li>Five new <i>Grevillea parviflora</i> subsp. <i>parviflora</i> plants were recorded in 2020.</li> <li>The majority of <i>Grevillea parviflora</i> subsp. <i>parviflora</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>Two <i>Grevillea parviflora</i> subsp. <i>parviflora</i> plants were recorded as having moderate dieback.</li> <li>The <i>Grevillea parviflora</i> subsp. <i>parviflora</i> population at MP 11 has declined slightly since 2015 baseline (16 individuals recorded).</li> <li>One new <i>Tetratheca juncea</i> clump was recorded in MP 11 during the 2020 monitoring event.</li> <li>The one <i>Tetratheca juncea</i> clump recorded at MP 11 was in a healthy condition with two flowers and 16 fruit.</li> </ul> |
| MP12 | Smooth-barked Apple – Red Bloodwood open forest             | <ul style="list-style-type: none"> <li>Evidence of minor canopy die-back.</li> <li>Canopy and midstorey regeneration present.</li> <li>Midstorey reduced compared to surroundings.</li> <li>Very high levels of fallen timber (from clearing).</li> <li>Moderate ground cover.</li> <li>There has been a decrease in estimated foliage cover for each vegetation stratum (<b>Appendix B</b>).</li> </ul> <p><b>Conclusion:</b> 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 (2019).</p> | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>No recent evidence of disturbance from pest animals, rubbish dumping, rock / timber removal or dust, however area has been previously subject to clearing due to fence line maintenance.</li> <li>Some evidence of herbivory on shrub and ground layer.</li> <li>No signs of recent fire.</li> <li>Cleared grazing land 20 m to east adjacent to BOA with exotic grasses, but no weeds within BOA in this area.</li> </ul> <p><b>Conclusion:</b> No evidence of new disturbance was observed since the previous survey (2019).</p> | <ul style="list-style-type: none"> <li>There was a small increase in the number of <i>Grevillea parviflora</i> subsp. <i>parviflora</i> plants recorded within the monitoring site, from 8 in 2019 to 9 in 2020.</li> <li>All <i>Grevillea parviflora</i> subsp. <i>parviflora</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>Five <i>Grevillea parviflora</i> subsp. <i>parviflora</i> plants were recorded with flowers in 2020.</li> <li>The <i>Grevillea parviflora</i> subsp. <i>parviflora</i> population at MP 11 has increased slightly since 2015 baseline (seven individuals recorded).</li> </ul>                                                                                                                                                                                                                                                                                                                                                         |



| Site | Vegetation Community                            | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                                                     | Threatened Flora Monitoring |
|------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| MP13 | Spotted Gum – Grey Ironbark open forest         | <ul style="list-style-type: none"> <li>Moderate to high level of dieback observed within the canopy and mid-storey.</li> <li>Canopy and midstorey regeneration present.</li> <li>Low-Moderate level of fallen logs / timber.</li> <li>Moderate to dense ground cover.</li> <li>Low rock cover.</li> <li>There has been a decrease in estimated foliage cover for each vegetation stratum (<b>Appendix B</b>).</li> </ul> <p><b>Conclusion:</b> No significant or notable changes in vegetation and habitat condition since the previous survey (2019).</p>                                       | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> No evidence of new disturbance was observed since the previous survey (2019).</p>                                                               | N/A                         |
| MP14 | Smooth-barked Apple - Red Bloodwood open forest | <ul style="list-style-type: none"> <li>Minor recovery observed to previous die-back of foliage in one <i>Eucalyptus eugenioides</i> and one <i>Eucalyptus paniculata</i>.</li> <li>All vegetation strata in healthy condition.</li> <li>Canopy and midstorey regeneration present.</li> <li>Low fallen/ timber.</li> <li>Dense ground cover.</li> <li>No changes in estimated foliage cover for any of the vegetation stratum. (<b>Appendix B</b>).</li> </ul> <p><b>Conclusion:</b> No significant or notable changes in vegetation and habitat condition since the previous survey (2019).</p> | <ul style="list-style-type: none"> <li>No evidence of erosion and sedimentation.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, or rock / timber removal.</li> <li>No signs of recent fire.</li> <li>Exotic grasses around dam to south and along access track.</li> </ul> <p><b>Conclusion:</b> No evidence of new disturbance was observed since the previous survey (2019).</p> | N/A                         |





| Site | Vegetation Community                                    | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                                                           | Threatened Flora Monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MP15 | Blackbutt - Turpentine - Tallowwood shrubby open forest | <ul style="list-style-type: none"><li>Foliage die-back previously observed in <i>Acacia irrorata</i> not observed during the 2020 monitoring event.</li><li>All vegetation strata in moderately healthy condition.</li><li>Canopy and midstorey regeneration present.</li><li>Regrowth vegetation to the north and east (previously cleared).</li><li>Moderate-High fallen timber.</li><li>Moderate ground cover and leaf litter.</li><li>Rocky areas present.</li><li>No changes in estimated foliage cover for any of the vegetation stratum. (<b>Appendix B</b>).</li></ul> <p><b>Conclusion:</b> Only minor changes in vegetation and habitat condition since the previous survey (2019).</p> | <ul style="list-style-type: none"><li>No evidence of erosion and sedimentation.</li><li>There are some edge effects from adjacent clearing.</li><li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, or rock / timber removal.</li><li>No signs of recent fire.</li></ul> <p><b>Conclusion:</b> Dust cover on foliage was observed within the monitoring site in 2020, previously not recorded.</p> | <ul style="list-style-type: none"><li>There was a small decrease in the number of <i>Tetratheca juncea</i> clumps recorded within the monitoring site, from 13 in 2019 to 9 in 2020.</li><li>One new <i>Tetratheca juncea</i> clump was recorded in 2020.</li><li>Nine <i>Tetratheca juncea</i> plants were recorded flowering during monitoring.</li><li>Eight <i>Tetratheca juncea</i> plants were recorded with fruits during monitoring.</li><li>All <i>Tetratheca juncea</i> plants within the monitoring site were observed to be in healthy condition.</li><li>The <i>Tetratheca juncea</i> population at MP 15 has declined since 2015 baseline (30 individuals recorded) with decrease of one individual is likely a natural occurrence. This decline in the <i>T. juncea</i> at MP 15 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.</li></ul> |
| MP16 | Spotted Gum – Grey Ironbark open forest                 | <ul style="list-style-type: none"><li>All vegetation strata in healthy condition.</li><li>Canopy and midstorey regeneration present.</li><li>Moderate fallen timber.</li><li>Dense leaf litter and moderate ground cover.</li><li>Low rock cover.</li><li>There has been minor declines in cover for mid-storey and ground cover strata (<b>Appendix B</b>).</li></ul> <p><b>Conclusion:</b> Some minor changes in vegetation and habitat condition since the previous survey (2019).</p>                                                                                                                                                                                                         | <ul style="list-style-type: none"><li>No evidence of erosion and sedimentation.</li><li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li><li>No signs of recent fire.</li><li>Several old dead stags present.</li></ul> <p><b>Conclusion:</b> No evidence of new disturbance was observed since the previous survey (2019).</p>                                 | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |



| Site | Vegetation Community                       | Vegetation and Habitat Condition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Evidence of Disturbance                                                                                                                                                                                                                                                                                                                                                                      | Threatened Flora Monitoring                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MP17 | Brush Box - Turpentine shrubby open forest | <ul style="list-style-type: none"> <li>No evidence of foliage die-back, evidence of midstorey and canopy regeneration.</li> <li>All vegetation strata in healthy condition.</li> <li>Canopy and midstorey regeneration present.</li> <li>High fallen timber.</li> <li>Dense ground cover.</li> <li>Rocky areas along ephemeral creek. No changes in estimated foliage cover for each vegetation stratum (<b>Appendix B</b>).</li> </ul> <p><b>Conclusion:</b> No significant or notable changes in vegetation and habitat condition since the previous survey (2019).</p>                                                                                                                                    | <ul style="list-style-type: none"> <li>Very minor scouring along creek bank.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, rock / timber removal, or dust.</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> No evidence of new disturbance was observed since the previous survey (2019).</p>                                    | <ul style="list-style-type: none"> <li>There was an increase in number of <i>Asperula asthenes</i> individuals within the monitoring site from 7 in 2019 to 19 in 2020.</li> <li>15 new <i>Asperula asthenes</i> plants were recorded in 2020.</li> <li>Five <i>Asperula asthenes</i> plants were recorded flowering during monitoring.</li> <li>All <i>Asperula asthenes</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>The population at MP 17 has increased since 2015 baseline (11 individuals recorded) likely as a result of recent more favourable weather conditions.</li> </ul>                                                                                                                                                                                |
| MP18 | Brush Box - Turpentine shrubby open forest | <ul style="list-style-type: none"> <li>Minor evidence of foliage die-back, however signs of recovery present.</li> <li>All vegetation strata in healthy condition</li> <li>Canopy and midstorey regeneration present</li> <li>Low fallen timber</li> <li>High level of leaf litter present.</li> <li>Moderate ground cover</li> <li>Rocky areas along ephemeral creek.</li> <li>There was a (10%) decrease from the previous year in ground cover.</li> <li>Decline in groundcover estimated foliage cover since the 2019 monitoring event (<b>Appendix B</b>).</li> </ul> <p><b>Conclusion:</b> No significant or notable changes in vegetation and habitat condition since the previous survey (2019).</p> | <ul style="list-style-type: none"> <li>Very minor scouring along creek bank.</li> <li>No recent evidence of disturbance from grazing, pest animals, rubbish dumping, or rock / timber removal.</li> <li>Minor dust coverage on foliage.</li> <li>No signs of recent fire.</li> </ul> <p><b>Conclusion:</b> No evidence of new disturbance was observed since the previous survey (2019).</p> | <ul style="list-style-type: none"> <li>There was an increase in number of <i>Asperula asthenes</i> individuals within the monitoring site from 8 in 2019 to 9 in 2020.</li> <li>Three new <i>Asperula asthenes</i> plants were recorded in 2020.</li> <li>One <i>Asperula asthenes</i> plant was recorded flowering during monitoring.</li> <li>All <i>Asperula asthenes</i> plants within the monitoring site were observed to be in healthy condition.</li> <li>The population at MP 18 has declined slightly since 2015 baseline (13 individuals recorded). Previous years of below average rainfall have likely 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.</li> </ul> |



## APPENDIX B      VEGETATION MONITORING DATA





**Table B1 Projected Foliage Cover results summary (2015-2020)**

| Monitoring Site | Dominant Floristics |                                                                                                                                                                                                 | Projected Foliage Cover (%) |      |      |      |      |      |
|-----------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|
|                 |                     |                                                                                                                                                                                                 | 2015                        | 2016 | 2017 | 2018 | 2019 | 2020 |
| MP 1            | 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%  | 40%  |
|                 | 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%  | 15%  |
|                 | 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%   | 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%  | 20%  |
|                 | Ground (other)      | <i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Carex longibrachiata</i> and <i>Adiantum aethiopicum</i> (Common Maidenhair)                                                             | 50%                         | 50%  | 50%  | 50%  | 50%  | 20%  |
|                 | Exotic              | <i>Lantana camara</i> (Lantana)                                                                                                                                                                 | 30%                         | 30%  | 25%  | 25%  | 20%  | 10%  |
| MP 2            | 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%  | 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%  | 30%  |
|                 | Shrub               | <i>Leucopogon juniperinus</i> (Prickly Beard-heath) and <i>Acacia ulicifolia</i> (Prickly Moses)                                                                                                | 5%                          | 5%   | 5%   | 5%   | 5%   | 10%  |
|                 | Ground (grass)      | <i>Themeda triandra</i> (Kangaroo Grass) and <i>Poa labillardierei</i> (Tussock)                                                                                                                | 50%                         | 50%  | 50%  | 50%  | 40%  | 25%  |
|                 | 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%  | 5%   |
|                 | Exotic              | <i>Lantana camara</i> (Lantana)                                                                                                                                                                 | 5%                          | 5%   | 1%   | 1%   | 1%   | 0%   |
| MP 3            | 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%  | 35%  |
|                 | 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%  | 40%  |
|                 | Shrub               | <i>Pittosporum multiflorum</i> (Orange Thorn), <i>Diospyros australis</i> (Black Plum) and <i>Bursaria spinosa</i> (Boxthorn)                                                                   | 40%                         | 40%  | 50%  | 50%  | 60%  | 60%  |
|                 | Ground (grass)      | <i>Oplismenus aemulus</i> (Australian Basket Grass)                                                                                                                                             | <5%                         | <5%  | <5%  | <5%  | <5%  | <5%  |



| Monitoring Site | Dominant Floristics |                                                                                                                                                                                         | Projected Foliage Cover (%) |      |      |      |      |      |
|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|
|                 |                     |                                                                                                                                                                                         | 2015                        | 2016 | 2017 | 2018 | 2019 | 2020 |
|                 | Ground (other)      | Doodia aspera (Prickly Rasp Fern), Carex longebrachiata, Adiantum hispidulum (Rough Maidenhair Fern) and Cissus antarctica (Kangaroo Vine)                                              | 90%                         | 90%  | 90%  | 90%  | 90%  | 65%  |
|                 | Exotic              | Lantana camara (Lantana) and Ageratina riparia (Mistflower)                                                                                                                             | 50%                         | 50%  | 50%  | 50%  | 40%  | 20%  |
| MP 4            | Canopy              | Lophostemon confertus (Brush Box), Syncarpia glomulifera (Turpentine), and Eucalyptus propinqua (Small-fruited Grey Gum)                                                                | 30%                         | 30%  | 30%  | 30%  | 40%  | 25%  |
|                 | Midstorey           | Glochidion ferdinandi var. ferdinandi (Cheese Tree), Melaleuca styphelioides (Prickly-leaved Tea Tree), Acmena smithii (Lilly Pilly) and Elaeocarpus obovatus (Hard Quandong)           | 60%                         | 60%  | 60%  | 60%  | 60%  | 60%  |
|                 | Shrub               | Pittosporum multiflorum (Orange Thorn)                                                                                                                                                  | 5%                          | 5%   | 3%   | 3%   | 3%   | 20%  |
|                 | Ground (grass)      | Oplismenus aemulus (Australian Basket Grass)                                                                                                                                            | 5%                          | 5%   | 5%   | 5%   | 5%   | 15%  |
|                 | Ground (other)      | Doodia aspera (Prickly Rasp Fern), Morinda jasminoides (Sweet Morinda) and Carex longebrachiata                                                                                         | 90%                         | 90%  | 90%  | 90%  | 90%  | 20%  |
|                 | Exotic              | Lantana camara (Lantana), Asparagus aethiopicus (Ground Asparagus) and Tradescantia fluminensis (Wandering Jew)                                                                         | 35%                         | 35%  | 25%  | 30%  | 30%  | 30%  |
| MP 5            | Canopy              | Eucalyptus pilularis (Blackbutt), E. microcorys (Tallowwood), Angophora costata (Smooth-barked Apple) and E. globoidea (White Stringybark)                                              | 40%                         | 40%  | 40%  | 40%  | 40%  | 40%  |
|                 | Midstorey           | Allocasuarina torulosa (Forest Oak), Glochidion ferdinandi var. ferdinandi (Cheese Tree), Persoonia linearis (Narrow-leaved Geebung) and Melaleuca linariifolia (Flax-leaved Paperbark) | 60%                         | 60%  | 60%  | 60%  | 60%  | 40%  |
|                 | Shrub               | Leptospermum polygalifolium (Tantoon), Breynia oblongifolia (Coffee Bush) and Phyllanthus hirtellus (Thyme Spurge)                                                                      | 5%                          | 5%   | 10%  | 10%  | 10%  | 10%  |
|                 | Ground (grass)      | Entolasia stricta (Wiry Panic) and Oplismenus imbecillis (Creeping Beard Grass)                                                                                                         | 60%                         | 60%  | 60%  | 60%  | 60%  | 40%  |
|                 | Ground (other)      | Doryanthes excelsa (Gynea Lily), Pteridium esculentum (Common Bracken) and Lomandra longifolia (Spiny-headed Mat-rush)                                                                  | 50%                         | 50%  | 50%  | 50%  | 50%  | 50%  |
|                 | Exotic              | Nil                                                                                                                                                                                     | -                           | -    | -    | -    | -    | -    |
| MP 6            | Canopy              | Eucalyptus microcorys (Tallowwood), E. propinqua (Small-fruited Grey Gum), Corymbia gummifera (Red Bloodwood) and Eucalyptus pilularis (Blackbutt)                                      | 50%                         | 50%  | 50%  | 50%  | 50%  | 45%  |





| Monitoring Site | Dominant Floristics |                                                                                                                                                                                                           | Projected Foliage Cover (%) |      |      |      |      |      |
|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|
|                 |                     |                                                                                                                                                                                                           | 2015                        | 2016 | 2017 | 2018 | 2019 | 2020 |
|                 | Midstorey           | Melaleuca styphelioides (Prickly-leaved Tea Tree), Allocasuarina torulosa (Forest Oak), Acmena smithii (Lilly Pilly), Zieria smithii (Sandfly Zieria) and Backhousia myrtifolia (Grey Myrtle), Acacia sp. | 60%                         | 60%  | 50%  | 55%  | 30%  | 20%  |
|                 | Shrub               | Hibbertia aspera (Rough Guinea Flower), Breynia oblongifolia (Coffee Bush)                                                                                                                                | <5%                         | <5%  | <5%  | 5%   | 1%   | 5%   |
|                 | Ground (grass)      | Imperata cylindrica (Blady Grass), Oplismenus imbecillis (Creeping Beard Grass) and Poa labillardierei (Tussock)                                                                                          | 20%                         | 20%  | 20%  | 20%  | 20%  | 20%  |
|                 | Ground (other)      | Lomandra longifolia (Spiny-headed Mat-rush), Doryanthes excelsa (Gynea Lily), Adiantum aethiopicum (Common Maidenhair) and Morinda jasminoides (Sweet Morinda)                                            | 30%                         | 30%  | 30%  | 30%  | 30%  | 30%  |
|                 | Exotic              | Lantana camara (Lantana)                                                                                                                                                                                  | -                           | -    | -    | -    | -    | -    |
| MP 7            | Canopy              | Angophora costata (Smooth-barked Apple), Eucalyptus eugenioides (Thin-leaved Stringybark) and Corymbia gummifera (Red Bloodwood)                                                                          | 35%                         | 35%  | 35%  | 35%  | 35%  | 40%  |
|                 | Midstorey           | Allocasuarina littoralis (Black She-oak), Leptospermum polygalifolium (Tantoon) and Allocasuarina torulosa (Forest Oak)                                                                                   | 40%                         | 40%  | 40%  | 40%  | 40%  | 40%  |
|                 | Shrub               | Pultenaea euchila (Orange Pultenaea)                                                                                                                                                                      | 5%                          | 5%   | 5%   | 5%   | 5%   | 5%   |
|                 | Ground (grass)      | Themeda triandra (Kangaroo Grass) and Entolasia stricta (Wiry Panic)                                                                                                                                      | 50%                         | 50%  | 50%  | 50%  | 40%  | 25%  |
|                 | Ground (other)      | Lomandra longifolia (Spiny-headed Mat-rush) and Gahnia radula                                                                                                                                             | 70%                         | 60%  | 60%  | 60%  | 60%  | 35%  |
|                 | Exotic              | Setaria sphacelata (South African Pigeon Grass)                                                                                                                                                           | 5%                          | 5%   | 5%   | 5%   | 2%   | 2%   |
| MP 8            | Canopy              | Angophora costata (Smooth-barked Apple), Eucalyptus eugenioides (Thin-leaved Stringybark) and Corymbia gummifera (Red Bloodwood)                                                                          | 30%                         | 30%  | 30%  | 30%  | 30%  | 30%  |
|                 | Midstorey           | Allocasuarina littoralis (Black She-oak), Leptospermum polygalifolium (Tantoon) and Acacia longifolia (Sydney Golden Wattle)                                                                              | 50%                         | 50%  | 50%  | 50%  | 30%  | 40%  |
|                 | Shrub               | Pultenaea paleacea (Chaffy Bush-pea), Pultenaea euchila (Orange Pultenaea), Phyllanthus hirtellus (Thyme Spurge), Hibbertia riparia (Erect Guinea-flower) and Hibbertia aspera (Rough Guinea Flower)      | 20%                         | 20%  | 20%  | 20%  | 15%  | 15%  |
|                 | Ground (grass)      | Entolasia stricta (Wiry Panic) and Themeda triandra (Kangaroo Grass)                                                                                                                                      | 50%                         | 50%  | 50%  | 50%  | 40%  | 40%  |
|                 | Ground (other)      | Lomandra longifolia (Spiny-headed Mat-rush), Ptilothrix deusta, Patersonia sericea (Silky Purple-flag) and Lomandra obliqua                                                                               | 50%                         | 50%  | 50%  | 50%  | 50%  | 40%  |
|                 | Exotic              | Nil                                                                                                                                                                                                       | -                           | -    | -    | -    | -    | -    |



| Monitoring Site | Dominant Floristics |                                                                                                                                                                                                                 | Projected Foliage Cover (%) |      |      |      |      |      |
|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|
|                 |                     |                                                                                                                                                                                                                 | 2015                        | 2016 | 2017 | 2018 | 2019 | 2020 |
| MP 9            | 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%  | 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), <i>Polyscias sambucifolia</i> (Elderberry Panax)        | 50%                         | 50%  | 50%  | 50%  | 50%  | 40%  |
|                 | 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%   | 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%  | 30%  |
|                 | 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%  | 40%  |
|                 | Exotic              | Nil                                                                                                                                                                                                             | -                           | -    | -    | -    | -    | -    |
| MP 10           | 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%  | 40%  |
|                 | 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%  | 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%   | 3%   |
|                 | 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%  | 40%  |
|                 | 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%  | 40%  |
|                 | Exotic              | Nil                                                                                                                                                                                                             | -                           | -    | -    | -    | -    | -    |
| MP 11           | 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%  | 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%  | 40%  |
|                 | Shrub               | <i>Pultenaea paleacea</i> (Chaffy Bush-pea) and <i>Boronia pinnata</i>                                                                                                                                          | 5%                          | 5%   | 5%   | 5%   | 5%   | 5%   |



| Monitoring Site | Dominant Floristics |                                                                                                                                                                                                                                                           | Projected Foliage Cover (%) |      |      |      |      |      |
|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|
|                 |                     |                                                                                                                                                                                                                                                           | 2015                        | 2016 | 2017 | 2018 | 2019 | 2020 |
|                 | 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%  | 25%  |
|                 | Ground (other)      | <i>Xanthorrhoea latifolia</i> , <i>Pteridium esculentum</i> (Common Bracken) and <i>Ptilothrix deusta</i> , <i>Doryanthes excelsa</i> (Gynea Lily)                                                                                                        | 60%                         | 60%  | 60%  | 60%  | 50%  | 40%  |
|                 | Exotic              | Nil                                                                                                                                                                                                                                                       | -                           | -    | -    | -    | -    | -    |
| MP 12           | 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%  | 35%  |
|                 | 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%  | 15%  |
|                 | Shrub               | <i>Pultenaea euchila</i> (Orange Pultenaea), <i>Boronia pinnata</i> and <i>Banksia spinulosa</i> (Hairpin Banksia)                                                                                                                                        | 10%                         | 10%  | 10%  | 5%   | 10%  | 5%   |
|                 | Ground (grass)      | <i>Themeda triandra</i> (Kangaroo Grass), <i>Entolasia stricta</i> (Wiry Panic), and <i>Austrostipa</i> sp.                                                                                                                                               | 40%                         | 40%  | 40%  | 30%  | 30%  | 20%  |
|                 | Ground (other)      | <i>Xanthorrhoea latifolia</i> and <i>Ptilothrix deusta</i>                                                                                                                                                                                                | 40%                         | 40%  | 40%  | 30%  | 30%  | 10%  |
|                 | Exotic              | Nil                                                                                                                                                                                                                                                       | -                           | -    | -    | -    | -    | -    |
|                 |                     |                                                                                                                                                                                                                                                           |                             |      |      |      |      |      |
| MP 13           | 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%  | 25%  |
|                 | Midstorey           | <i>Allocasuarina torulosa</i> (Forest Oak), <i>Syncarpia glomulifera</i> (Turpentine) and <i>Callistemon salignus</i> (Willow Bottlebrush)                                                                                                                | 40%                         | 40%  | 40%  | 40%  | 40%  | 10%  |
|                 | Shrub               | <i>Hibbertia aspera</i> (Rough Guinea Flower) and <i>Pultenaea euchila</i> (Orange Pultenaea), <i>Breynia oblongifolia</i> (Coffee Bush)                                                                                                                  | 5%                          | 5%   | 5%   | 5%   | 5%   | 2%   |
|                 | Ground (grass)      | <i>Imperata cylindrica</i> (Blady Grass), <i>Poa labillardierei</i> (Tussock), <i>Themeda triandra</i> (Kangaroo Grass) and <i>Opismenus imbecillis</i> (Creeping Beard Grass)                                                                            | 60%                         | 60%  | 60%  | 70%  | 70%  | 60%  |
|                 | 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> , <i>Lomandra multiflora</i> (Many-flowered Mat-rush)                                              | 30%                         | 30%  | 40%  | 40%  | 40%  | 30%  |
|                 | Exotic              | Nil                                                                                                                                                                                                                                                       | -                           | -    | -    | -    | -    | -    |



| Monitoring Site | Dominant Floristics |                                                                                                                                                                                                               | Projected Foliage Cover (%) |      |      |      |      |      |
|-----------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|
|                 |                     |                                                                                                                                                                                                               | 2015                        | 2016 | 2017 | 2018 | 2019 | 2020 |
| MP 14           | 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%  | 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%  | 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%  | 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%  | 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%  | 30%  |
|                 | Exotic              | <i>Setaria sphacelata</i> (South African Pigeon Grass)                                                                                                                                                        | 5%                          | 5%   | 5%   | 5%   | 2%   | 2%   |
| MP 15           | 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%  | 45%  |
|                 | Midstorey           | <i>Allocasuarina littoralis</i> (Black She-oak) and <i>Acacia irrorata</i> (Green Wattle)                                                                                                                     | 20%                         | 20%  | 15%  | 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%  | 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%  | 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%  | 50%  |
|                 | Exotic              | <i>Lantana camara</i> (Lantana)                                                                                                                                                                               | 5%                          | 5%   | 1%   | 1%   | 1%   | 1%   |
| MP 16           | 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%  | 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%  | 30%  |
|                 | Shrub               | <i>Leucopogon juniperinus</i> (Prickly Beard-heath) and <i>Acacia floribunda</i> (White Sally Wattle)                                                                                                         | 10%                         | 10%  | 10%  | 10%  | 10%  | 10%  |



| Monitoring Site | Dominant Floristics |                                                                                                                                                                                                                       | Projected Foliage Cover (%) |      |      |      |      |      |
|-----------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------|------|------|------|------|
|                 |                     |                                                                                                                                                                                                                       | 2015                        | 2016 | 2017 | 2018 | 2019 | 2020 |
|                 | 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%  | 25%  |
|                 | 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%  | 20%  |
|                 | Exotic              | <i>Lantana camara</i> (Lantana)                                                                                                                                                                                       | 30%                         | 30%  | 30%  | 40%  | 30%  | 30%  |
| MP 17           | 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%  | 45%  |
|                 | 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%  | 50%  |
|                 | 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%   | 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%  | 25%  |
|                 | 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%  | 65%  |
|                 | Exotic              | <i>Lantana camara</i> (Lantana)                                                                                                                                                                                       | 10%                         | 15%  | 15%  | 15%  | 15%  | 15%  |
|                 |                     |                                                                                                                                                                                                                       |                             |      |      |      |      |      |
| MP 18           | 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%  | 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%  | 25%  |
|                 | Shrub               | <i>Acacia maidenii</i> (Maiden's Wattle) and <i>Denhamia silvestris</i> (Narrow-leaved Orangebark), <i>Persoonia linearis</i> (Narrow-leaved Geebung)                                                                 | 5%                          | 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%  | 15%  |
|                 | 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%  | 30%  |
|                 | Exotic              | <i>Lantana camara</i> (Lantana)                                                                                                                                                                                       | 10%                         | 15%  | 15%  | 15%  | 15%  | 15%  |





# APPENDIX C RESULTS

## THREATENED FLORA MONITORING





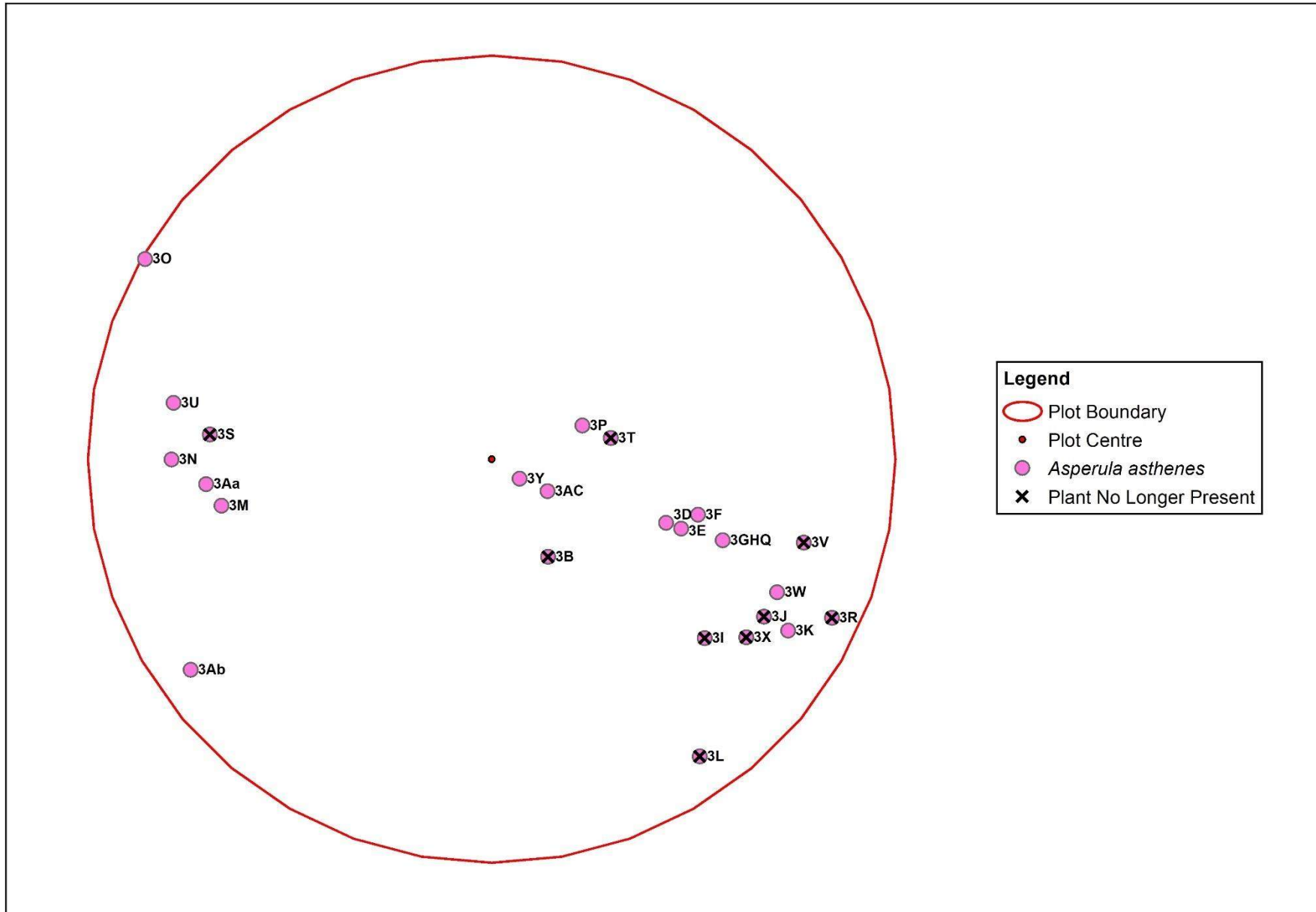
## Biodiversity Offset Area Monitoring Sites

### Monitoring Point 3 *Asperula asthenes* monitoring results

| ID | Distance | Bearing | Clump Size (cm) |         |          |           |           |         | Flowers/Fruit Present | Comments                    |
|----|----------|---------|-----------------|---------|----------|-----------|-----------|---------|-----------------------|-----------------------------|
|    |          |         | 2015            | 2016    | 2017     | 2018      | 2019      | 2020    |                       |                             |
| 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 | 110x110 | Flowers and Buds      | several large clumps        |
| 3D | 460      | 110     | 50 x 20         | 30 x 20 | -        | -         | -         | -       | -                     | Dense litter                |
| 3E | 500      | 110     | 55 x 30         | 30 x 30 | 45 x 40  | 5 x 5     | -         | -       | None                  | Found small                 |
| 3F | 530      | 105     | 50 x 10         | 30 x 30 | 60 x 20  | 60 x 20   | 80 x 60   | 100x60  | Fruit and Buds        |                             |
| 3G | 590      | 115     | 25 x 35         | 25 x 40 | 170 x 80 | -         | 10 x 5    | 10x5    | None                  | New shoots                  |
| 3H | 650      | 110     | 20 x 20         | 40 x 20 | -        | 100 x 100 | 60 x 40   | 20x40   | None                  | 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    | -       |                       | Overgrown                   |
| 3L | 900      | 145     | 35 x 45         | 20 x 10 | -        | -         | -         | 10x10   |                       | not found, dense litter     |
| 3M | 680      | 260     | 40 x 35         | 40 x 35 | 25 x 30  | 40 x 20   | 60 x 40   | 40x2    |                       | buds, new shoots            |
| 3N | 790      | 270     | 30 x 25         | 30 x 20 | -        | -         | 120 x 50  | 20x6    |                       | Two stems                   |
| 3O | 990      | 300     | 55 x 25         | -       | -        | 20 x 5    | -         | 50x30   |                       | -                           |
| 3P | 240      | 90      | 40 x 20         | 40 x 15 | 40 x 15  | 40 x 20   | 150 x 90  | -       |                       | -                           |
| 3Q | 590      | 105     | -               | 40 x 10 | -        | -         | -         | 50x30   | Flowers and Buds      | 12 Stems                    |
| 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              |



| ID  | Distance | Bearing | Clump Size (cm) |      |         |         |         |       | Flowers/Fruit Present | Comments                   |
|-----|----------|---------|-----------------|------|---------|---------|---------|-------|-----------------------|----------------------------|
|     |          |         | 2015            | 2016 | 2017    | 2018    | 2019    | 2020  |                       |                            |
| 3U  | 800      | 280     | -               | -    | 30 x 20 | 50 x 20 | 30 x 30 | 30x30 | Flowers               |                            |
| 3V  | 800      | 105     | -               | -    | -       | 5 x 5   | -       | -     |                       | not found, fallen branches |
| 3W  | 780      | 115     | -               | -    | -       | 80 x 50 | 80 x 30 | 40x30 |                       | 5 stems, new shoots        |
| 3X  | 770      | 125     | -               | -    | -       | 5 x 5   | -       | -     |                       | not found                  |
| 3Y  | 85       | 125     | -               | -    | -       | -       | 40 x 60 | 30x10 | Flowers and Buds      | new, multiple stems        |
| 3Z  | 780      | 280     | -               | -    | -       | -       | -       | 20x20 |                       |                            |
| 3AA | 710      | 265     | -               | -    | -       | -       | -       | 10x10 |                       |                            |
| 3AB | 910      | 235     | -               | -    | -       | -       | -       | 30x30 |                       | Large plant                |



**Monitoring Point 3     *Asperula asthenes* monitoring results**



## Monitoring Point 4 *Asperula asthenes* monitoring results

| ID | Distance | Bearing | Clump Size (cm) |          |          |         |          |       | Flowers/Fruit Present | Comments                             |
|----|----------|---------|-----------------|----------|----------|---------|----------|-------|-----------------------|--------------------------------------|
|    |          |         | 2015            | 2016     | 2017     | 2018    | 2019     | 2020  |                       |                                      |
| 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                            |
| 4C | 660      | 215     | 30 x 15         | 30 x 30  | -        | 5 x 5   | -        | 10x5  | None                  | not found, dense litter              |
| 4D | 630      | 220     | 20 x 20         | 20 x 20  | -        | 20 x 10 | 45 x 45  | 45x45 | None                  | -                                    |
| 4E | 760      | 220     | 65 x 20         | 40 x 20  | 10 x 5   | -       | 10 x 5   | 10x5  | Buds                  | -                                    |
| 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  | 40x40 | None                  | -                                    |
| 4H | 740      | 205     | 50 x 30         | 50 x 30  | 20 x 10  | 40 x 30 | 50 x 40  | 50x40 | Fruit                 | -                                    |
| 4I | 740      | 200     | 80 x 15         | 60 x 40  | -        | 5 x 10  | -        | -     | -                     | not found                            |
| 4J | 110      | 325     | 80 x 30         | 60 x 30  | 70 x 10  | 10 x 70 | 100 x 80 | 40x20 | -                     | Multiple Stems                       |
| 4K | 890      | 25      | 30 x 30         | 40 x 30  | 60 x 60  | -       | -        | -     | -                     | not found                            |
| 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  | 15x10 | none                  | one clump remaining                  |
| 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  | 5x5   | None                  | dieback, 1 stem                      |
| 4R | 155      | 270     | -               | -        | 20 x 5   | 50 x 10 | 100 x 40 | 20x10 | -                     | 2 clumps within 30 com, some dieback |
| 4S | 590      | 80      | -               | -        | 10 x 15  | -       | -        | -     | -                     | not found, dense litter              |
| 4T | 890      | 15      | -               | -        | 10 x 5   | -       | 10 x 5   | 10x5  | none                  | not found                            |

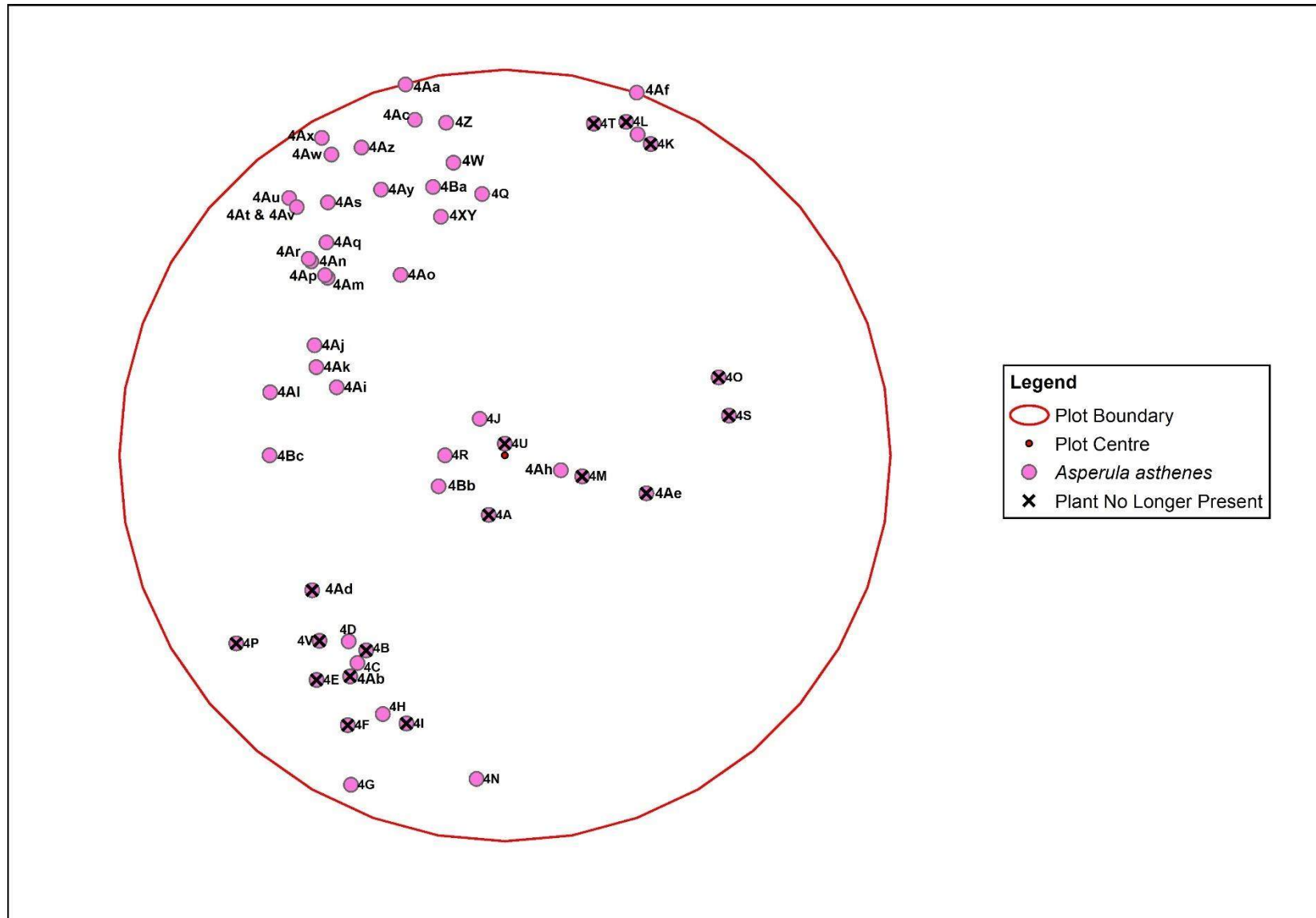




| ID  | Distance | Bearing | Clump Size (cm) |      |         |         |         |        | Flowers/Fruit Present | Comments                               |
|-----|----------|---------|-----------------|------|---------|---------|---------|--------|-----------------------|----------------------------------------|
|     |          |         | 2015            | 2016 | 2017    | 2018    | 2019    | 2020   |                       |                                        |
| 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 | 20x5   | -                     | -                                      |
| 4X  | 640      | 345     | -               | -    | -       | 50 x 20 | 80 x 60 | 15x5   | -                     | Good Condition                         |
| 4Y  | 600      | 345     | -               | -    | -       | 50 x 20 | -       | 30x15  | Buds and Flowers      | merged with 4X                         |
| 4Z  | 875      | 350     | -               | -    | -       | 30 x 5  | 70 x 30 | 30x10  | none                  | multiple shoots, 2 shoots within 30 cm |
| 4Aa | 995      | 345     | -               | -    | -       | 10 x 10 | 80 x 50 | 10x10  | none                  | some dieback                           |
| 4Ab | 700      | 215     | -               | -    | -       | 10 x 5  | -       | -      |                       | Not found                              |
| 4Ac | 900      | 345     | -               | -    | -       | -       | 10 x 5  | 10x5   | none                  | new. single shoot                      |
| 4Ad | 610      | 235     | -               | -    | -       | -       | 35 x 20 | -      | none                  | not found                              |
| 4Ae | 380      | 105     | -               | -    | -       | -       | 10 x 5  | -      | none                  | not found                              |
| 4Af | 1000     | 20      | -               | -    | -       | -       | 55 x 30 | 5x10   | none                  | new                                    |
| 4AG | 900      | 22.5    | -               | -    | -       | -       | -       | 20x5   | none                  | -                                      |
| 4AH | 150      | 105     | -               | -    | -       | -       | -       | 20x20  | none                  | -                                      |
| 4AI | 470      | 292     | -               | -    | -       | -       | -       | 55x30  | none                  | 10 new stems                           |
| 4AJ | 570      | 300     | -               | -    | -       | -       | -       | 20x20  | none                  | 5 stems                                |
| 4AK | 540      | 295     | -               | -    | -       | -       | -       | 45x45  | none                  | 5 stems                                |
| 4AL | 630      | 285     | -               | -    | -       | -       | -       | 50x30  | none                  | 15 stems                               |
| 4AM | 650      | 315     | -               | -    | -       | -       | -       | 45x15  | none                  | 5 stems                                |
| 4AN | 710      | 315     | -               | -    | -       | -       | -       | 210x15 | none                  | 4 stems                                |
| 4AO | 540      | 330     | -               | -    | -       | -       | -       | 5x5    | none                  | 1 stem                                 |
| 4AP | 660      | 315     | -               | -    | -       | -       | -       | 30x30  | none                  | 5 stems                                |



| ID  | Distance | Bearing | Clump Size (cm) |      |      |      |      |       | Flowers/Fruit Present | Comments                  |
|-----|----------|---------|-----------------|------|------|------|------|-------|-----------------------|---------------------------|
|     |          |         | 2015            | 2016 | 2017 | 2018 | 2019 | 2020  |                       |                           |
| 4AQ | 720      | 320     | -               | -    | -    | -    | -    | 10x5  | none                  | 2 stem                    |
| 4AR | 720      | 315     | -               | -    | -    | -    | -    | 15x10 | none                  | 1 stem                    |
| 4AS | 800      | 325     | -               | -    | -    | -    | -    | 5X10  | none                  | 1 stem                    |
| 4AT | 840      | 320     | -               | -    | -    | -    | -    | 50X30 | none                  | Big Clump - lots of stems |
| 4AU | 870      | 320     | -               | -    | -    | -    | -    | 30X45 | none                  | 5 stems                   |
| 4AV | 840      | 320     | -               | -    | -    | -    | -    | 60X60 | none                  | 10 stems                  |
| 4AW | 900      | 330     | -               | -    | -    | -    | -    | 5X5   | none                  | 3 stems                   |
| 4AX | 950      | 330     | -               | -    | -    | -    | -    | 30X10 | none                  | 3 stems                   |
| 4AY | 760      | 335     | -               | -    | -    | -    | -    | 40X30 | none                  | 1 stem                    |
| 4AZ | 880      | 335     | -               | -    | -    | -    | -    | 40x20 | none                  | 10 stems                  |
| 4BA | 720      | 345     | -               | -    | -    | -    | -    | 10X10 | none                  | 2 stems                   |
| 4BB | 190      | 245     | -               | -    | -    | -    | -    | 10X10 | none                  | 2 stems                   |
| 4BC | 610      | 270     | -               | -    | -    | -    | -    | 50X10 | none                  | 1 stem                    |

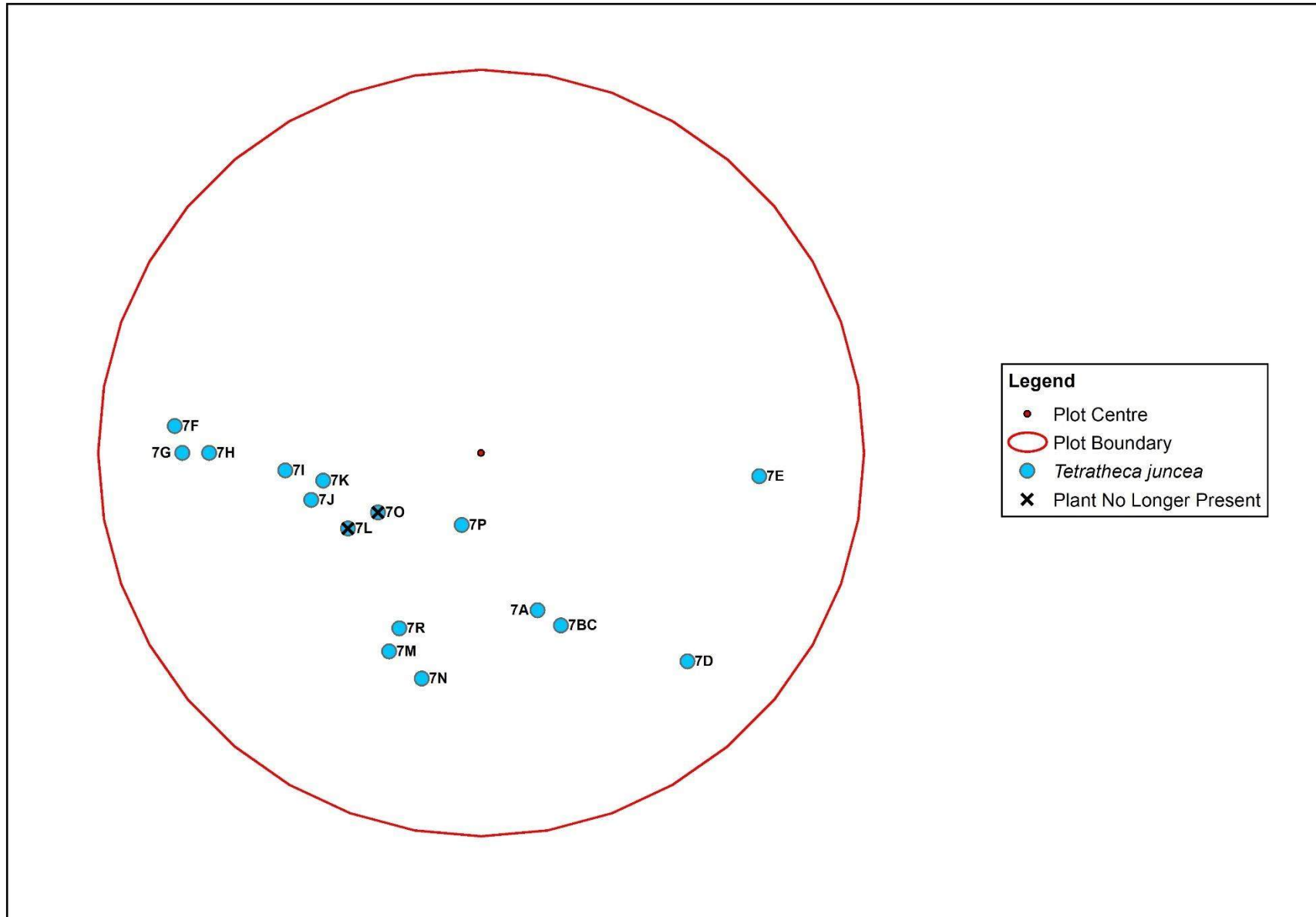


### *Asperula asthenes* monitoring results



### Monitoring Point 7 - *Tetraloche juncea* monitoring results

| ID | Distance | Bearing | Clump Size (cm) |        |        |        |        |        | Flowers/Fruit Present |        | Comments                    |
|----|----------|---------|-----------------|--------|--------|--------|--------|--------|-----------------------|--------|-----------------------------|
|    |          |         | 2015            | 2016   | 2017   | 2018   | 2019   | 2020   | Flowers               | Fruits |                             |
| 7A | 480      | 160     | 70x40           | 60x40  | 60x50  | 10x60  | 70x40  | 20x30  | 2                     | 0      | -                           |
| 7B | 470      | 155     | 5x 5            | 10x5   | -      | 10x10  | 30x20  | 30x20  | -                     | -      | B merged with C             |
| 7C | 500      | 155     | 35x15           | 40x15  | 70x30  | 60x30  | 50x20  | 70x40  | 18                    | 6      | 11 buds                     |
| 7D | 800      | 135     | 50x20           | 60x40  | 90x50  | 70x40  | 10x10  | 10x10  | 0                     | 0      | reshooting but with dieback |
| 7E | 730      | 95      | 60x50           | 90x40  | 100x70 | 100x50 | 110x80 | 30x60  | 1                     | 3      | dieback                     |
| 7F | 800      | 275     | 60x10           | 70x20  | 20x5   | -      | 40x30  | 40x20  | 1                     | 0      | -                           |
| 7G | 780      | 270     | 40x40           | 40x40  | 60x20  | -      | 130x80 | 100x65 | 10                    | 15     | -                           |
| 7H | 710      | 270     | 50x10           | 50x10  | 90x20  | 100x50 | 70x80  | 50x20  | 2                     | 4      | -                           |
| 7I | 510      | 265     | 30x10           | 30x10  | 20x5   | -      | 20x5   | 20x5   | 0                     | 1      | -                           |
| 7J | 460      | 255     | 40x20           | 40x30  | 90x30  | 100x50 | 90x60  | 80x60  | 1                     | 2      | dieback                     |
| 7K | 420      | 260     | 70x45           | 80x40  | 70x70  | 100x80 | 120x85 | 120x60 | 15                    | 20     | -                           |
| 7L | 400      | 240     | 45x10           | 50x10  | 55x10  | 20x10  | 25x10  | 25x10  | 0                     | 1      | not found                   |
| 7M | 570      | 205     | 110x70          | 110x70 | 110x80 | 60x20  | 80x130 | 30x10  | 0                     | 0      | dieback + reshooting        |
| 7N | 610      | 195     | 45x35           | 45x35  | 35x50  | 80x30  | 40x25  | 20x10  | 0                     | 0      | -                           |
| 7O | 310      | 240     | -               | 20x20  | 20x15  | -      | -      | -      | 0                     | 0      | not found                   |
| 7P | 700      | 195     | -               | -      | -      | -      | 80x60  | 60x20  | 0                     | 0      | -                           |
| 7R | 505      | 205     | -               | -      | -      | -      | 30x40  | 30x40  | 2                     | 0      | 2 spent flowers             |



### Monitoring Point 7 - *Tetratheca juncea* monitoring results



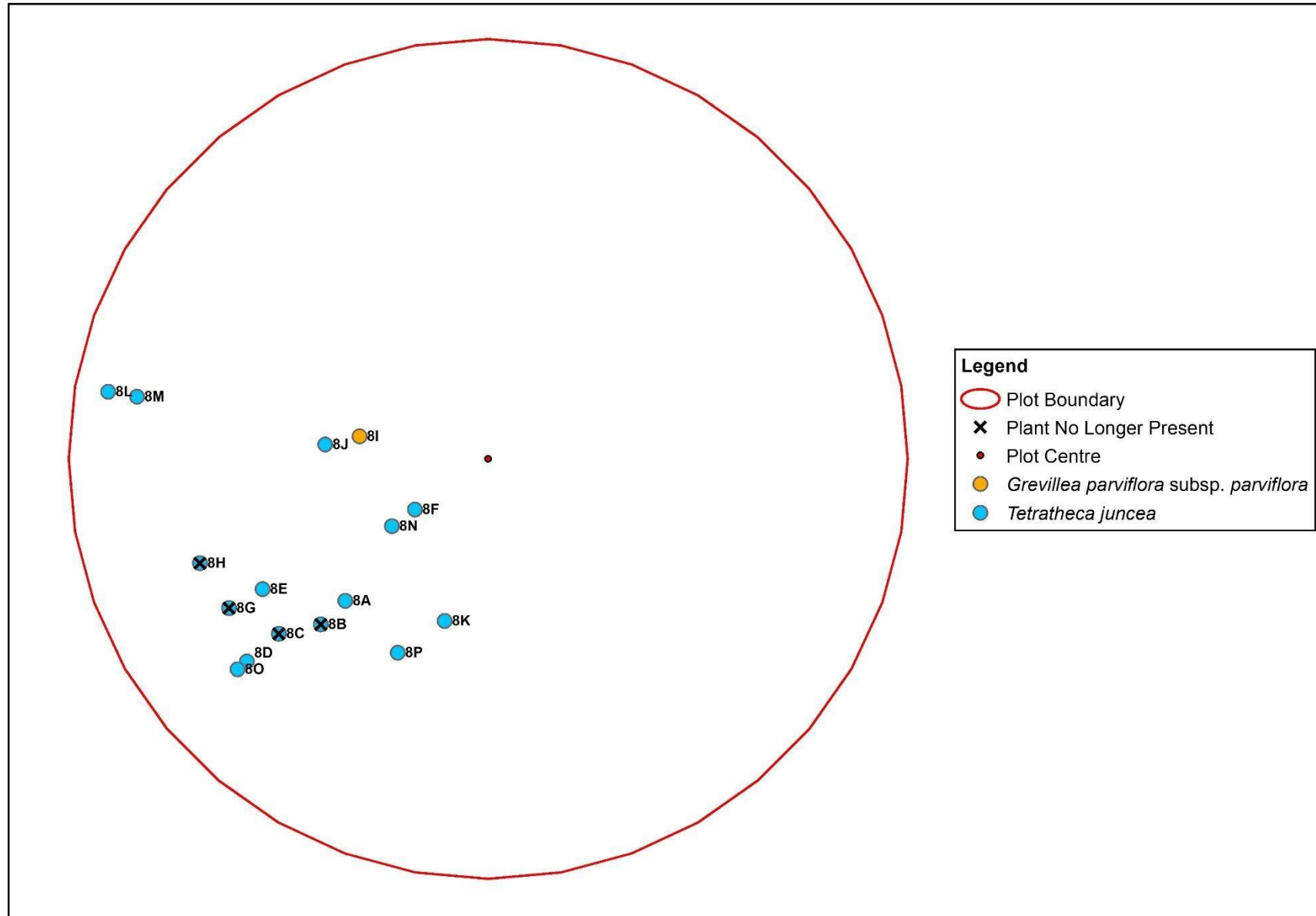


### Monitoring Point 8 – *Tetradleca juncea* and *Grevillea parviflora* monitoring results

| ID | Species                                                    | Distance | Bearing | Clump Size (cm) |         |        |        |        |         | Flowers/Fruit Present |        | Comments             |
|----|------------------------------------------------------------|----------|---------|-----------------|---------|--------|--------|--------|---------|-----------------------|--------|----------------------|
|    |                                                            |          |         | 2015            | 2016    | 2017   | 2018   | 2019   | 2020    | Flowers               | Fruits |                      |
| 8A | <i>Tetradleca juncea</i>                                   | 210      | 235     | 110x70          | 110x80  | 130x80 | 80x110 | 110x50 | 60x30   | 4                     | 0      | -                    |
| 8B | <i>Tetradleca juncea</i>                                   | 480      | 225     | 40x 30          | 60x 30  | 90x 20 | 80x 20 | 50x 50 | 60x60   | 7                     | 0      | not found            |
| 8C | <i>Tetradleca juncea</i>                                   | 560      | 225     | 120x110         | 120x100 | -      | -      | -      | -       | -                     | -      | not found            |
| 8D | <i>Tetradleca juncea</i>                                   | 650      | 230     | 110x110         | 110x110 | 120x60 | 45x 10 | 30x5   | 60x60   | 7                     | 0      | new growth           |
| 8E | <i>Tetradleca juncea</i>                                   | 750      | 230     | 65x30           | 65x30   | 40x80  | 60x30  | 50x 20 | 40x20   | 2                     | 0      | -                    |
| 8F | <i>Tetradleca juncea</i>                                   | 620      | 240     | 80x30           | 90x30   | 120x50 | 120x40 | 60x 30 | 20x10   | 2                     | 0      | -                    |
| 8G | <i>Tetradleca juncea</i>                                   | 710      | 240     | 100x50          | 100x50  | 80x50  | 100x50 | -      | -       | -                     | -      | not found            |
| 8H | <i>Tetradleca juncea</i>                                   | 730      | 250     | 60x50           | 60x50   | 100x40 | -      | 90x 30 | 90x30   | -                     | -      | not found            |
| 8I | <i>Grevillea parviflora</i><br>subsp.<br><i>parviflora</i> | 310      | 280     | 30              | 30      | 30     | 70     | 60     | 60x70   | 15                    | 0      | new shoots coming up |
| 8J | <i>Tetradleca juncea</i>                                   | 390      | 275     | 50x 10          | 50x 10  | 65x 10 | 60x 20 | 60x20  | 30x20   | 0                     | 0      | -                    |
| 8K | <i>Tetradleca juncea</i>                                   | 400      | 195     | 60x20           | 60x20   | 90x90  | 170x50 | 130x60 | 130x100 | 37                    | 34     | -                    |
| 8L | <i>Tetradleca juncea</i>                                   | 920      | 280     | -               | -       | 70x 70 | 70x 80 | 100x90 | 100x30  | 2                     | 0      | dieback              |



| ID | Species           | Distance | Bearing | Clump Size (cm) |      |      |       |        |        | Flowers/Fruit Present |        | Comments |
|----|-------------------|----------|---------|-----------------|------|------|-------|--------|--------|-----------------------|--------|----------|
|    |                   |          |         | 2015            | 2016 | 2017 | 2018  | 2019   | 2020   | Flowers               | Fruits |          |
| 8M | Tetratheca juncea | 850      | 280     | -               | -    | -    | 40x20 | -      | 20x10  | 2                     | 0      | -        |
| 8N | Tetratheca juncea | 280      | 235     | -               | -    | -    | -     | 50x 20 | 20x10  | 1                     | 0      | -        |
| 8O | Tetratheca juncea | 780      | 230     | -               | -    | -    | -     | -      | 50x40  | 3                     | 0      | -        |
| 8P | Tetratheca juncea | 510      | 205     | -               | -    | -    | -     | -      | 100x40 | 2                     | 0      | New      |



## Monitoring Point 8 – *Tetratheca juncea* and *Grevillea parviflora* monitoring results



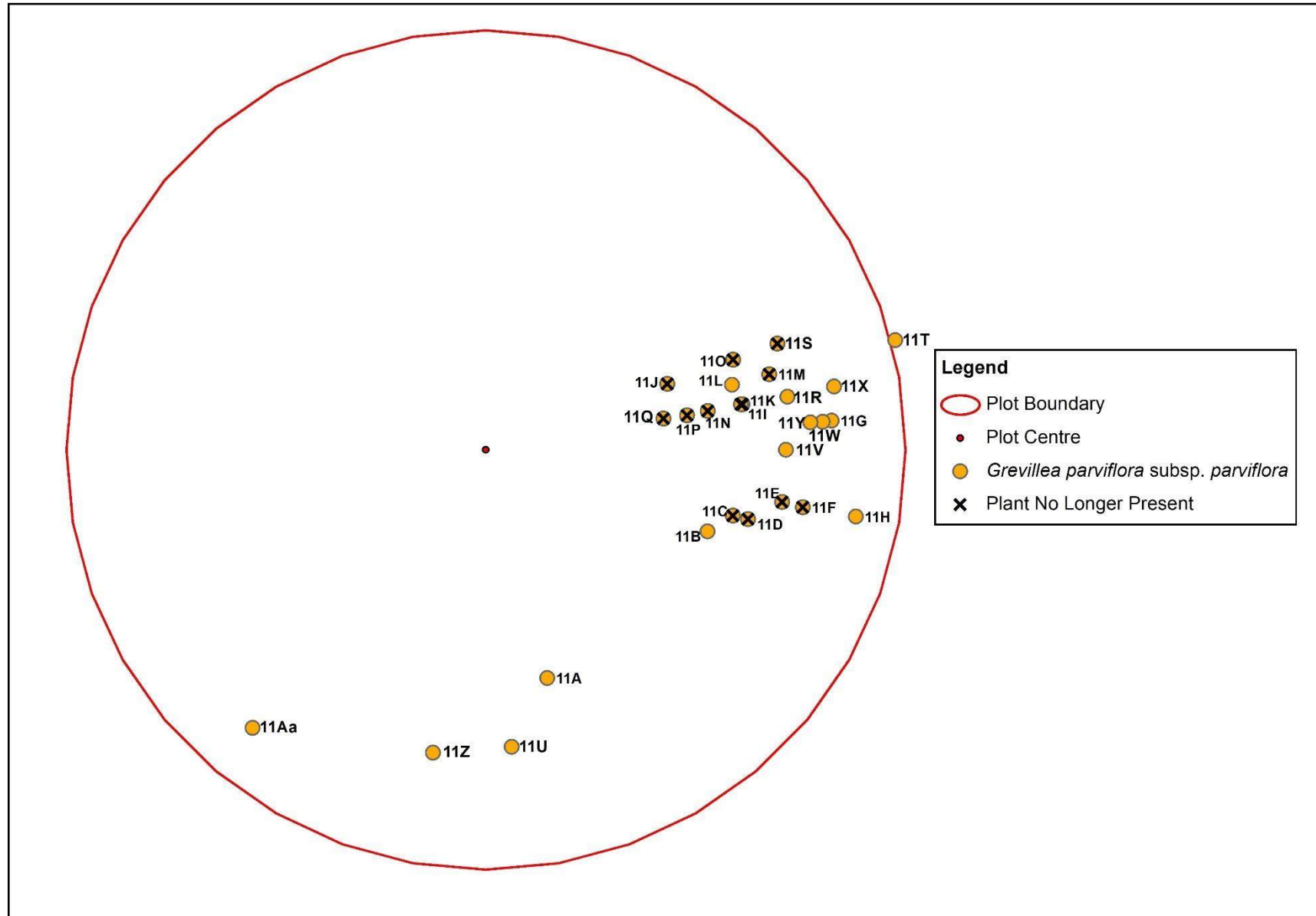
### Monitoring Point 11 - *Grevillea parviflora* monitoring results

| ID  | Species                                              | Distance | Bearing | Clump Size (cm) |      |      |      |      |      | Flowers/Fruit Present |        | Comments                             |
|-----|------------------------------------------------------|----------|---------|-----------------|------|------|------|------|------|-----------------------|--------|--------------------------------------|
|     |                                                      |          |         | 2015            | 2016 | 2017 | 2018 | 2019 | 2020 | Flowers               | Fruits |                                      |
| 11A | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 560      | 165     | 90              | 90   | 50   | 45   | 60   | 60   | 0                     | 0      | 4 stems 20cm apart, new growth       |
| 11B | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 565      | 110     | 20              | 45   | -    | -    | -    | 18   | 0                     | 0      | returned                             |
| 11C | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 610      | 105     | 55              | -    | -    | -    | -    | -    | 0                     | 0      | not found                            |
| 11D | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 650      | 105     | 100             | 65   | -    | -    | -    | -    | 0                     | 0      | not found                            |
| 11E | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 720      | 100     | 75              | 75   | 41   | -    | -    | -    | 0                     | 0      | not found                            |
| 11F | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 770      | 100     | 20              | 10   | -    | -    | -    | -    | 0                     | 0      | not found                            |
| 11G | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 830      | 85      | 110             | 110  | 80   | 100  | 90   | 95   | 0                     | 0      | dieback                              |
| 11H | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 900      | 100     | 60              | 60   | 30   | 65   | 70   | 80   | 0                     | 0      | dieback                              |
| 11I | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 620      | 80      | 50              | 50   | 60   | 60   | 55   | 55   | 0                     | 0      | dead                                 |
| 11J | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 460      | 70      | 45              | 35   | 40   | -    | -    | -    | 0                     | 0      | not found                            |
| 11K | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 620      | 80      | 40              | 40   | 40   | 40   | -    | -    | 0                     | 0      | not found                            |
| 11L | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 610      | 75      | 45              | 55   | 55   | 65   | 65   | 70   | 0                     | 0      | minor dieback                        |
| 11M | <i>Grevillea parviflora</i> subsp. <i>parviflora</i> | 700      | 75      | 65              | 70   | 65   | 75   | 80   | -    | 0                     | 0      | 2 clumps 10 cm apart, 1 with dieback |



| ID   | Species                                | Distance | Bearing | Clump Size (cm) |      |      |      |      |       | Flowers/Fruit Present |        | Comments                               |
|------|----------------------------------------|----------|---------|-----------------|------|------|------|------|-------|-----------------------|--------|----------------------------------------|
|      |                                        |          |         | 2015            | 2016 | 2017 | 2018 | 2019 | 2020  | Flowers               | Fruits |                                        |
| 11N  | Grevillea parviflora subsp. parviflora | 540      | 80      | 35              | 40   | 45   | 45   | 40   | -     | 0                     | 0      | dead                                   |
| 11O  | Grevillea parviflora subsp. parviflora | 630      | 70      | 20              | 30   | -    | -    | -    | -     | 0                     | 0      | not found                              |
| 11P  | Grevillea parviflora subsp. parviflora | 490      | 80      | 45              | 70   | 50   | 30   | 30   | 30    | 0                     | 0      | not found                              |
| 11Q  | Grevillea parviflora subsp. parviflora | 430      | 80      | -               | 20   | 60   | -    | -    | -     | 0                     | 0      | not found                              |
| 11R  | Grevillea parviflora subsp. parviflora | 730      | 80      | -               | -    | -    | 65   | 65   | 40    | 0                     | 0      | -                                      |
| 11S  | Grevillea parviflora subsp. parviflora | 740      | 70      | -               | -    | -    | -    | 20   | 20    | 0                     | 0      | not found                              |
| 11T  | Grevillea parviflora subsp. parviflora | 1010     | 75      | -               | -    | -    | -    | 80   | 95    | 0                     | 0      | -                                      |
| 11U  | Grevillea parviflora subsp. parviflora | 710      | 175     | -               | -    | -    | -    | 40   | 37    | 0                     | 0      | -                                      |
| 11V  | Grevillea parviflora subsp. parviflora | 715      | 90      | -               | -    | -    | -    | -    | 55    | 0                     | 0      | new 2 plants 20cm apart, dieback       |
| 11W  | Grevillea parviflora subsp. parviflora | 800      | 85      | -               | -    | -    | -    | -    | 65    | 0                     | 0      | new 2 stems 5cm apart                  |
| 11X  | Grevillea parviflora subsp. parviflora | 840      | 80      | -               | -    | -    | -    | -    | 60    | 0                     | 0      | new plant, new growth moderate dieback |
| 11Y  | Grevillea parviflora subsp. parviflora | 770      | 85      | -               | -    | -    | -    | -    | 25    | 0                     | 0      | new                                    |
| 11Z  | Grevillea parviflora subsp. parviflora | 720      | 190     | -               | -    | -    | -    | -    | 55    | 0                     | 0      | new                                    |
| 11AA | Tetradlea juncea                       | 865      | 220     | -               | -    | -    | -    | -    | 75x50 | 2                     | 16     |                                        |



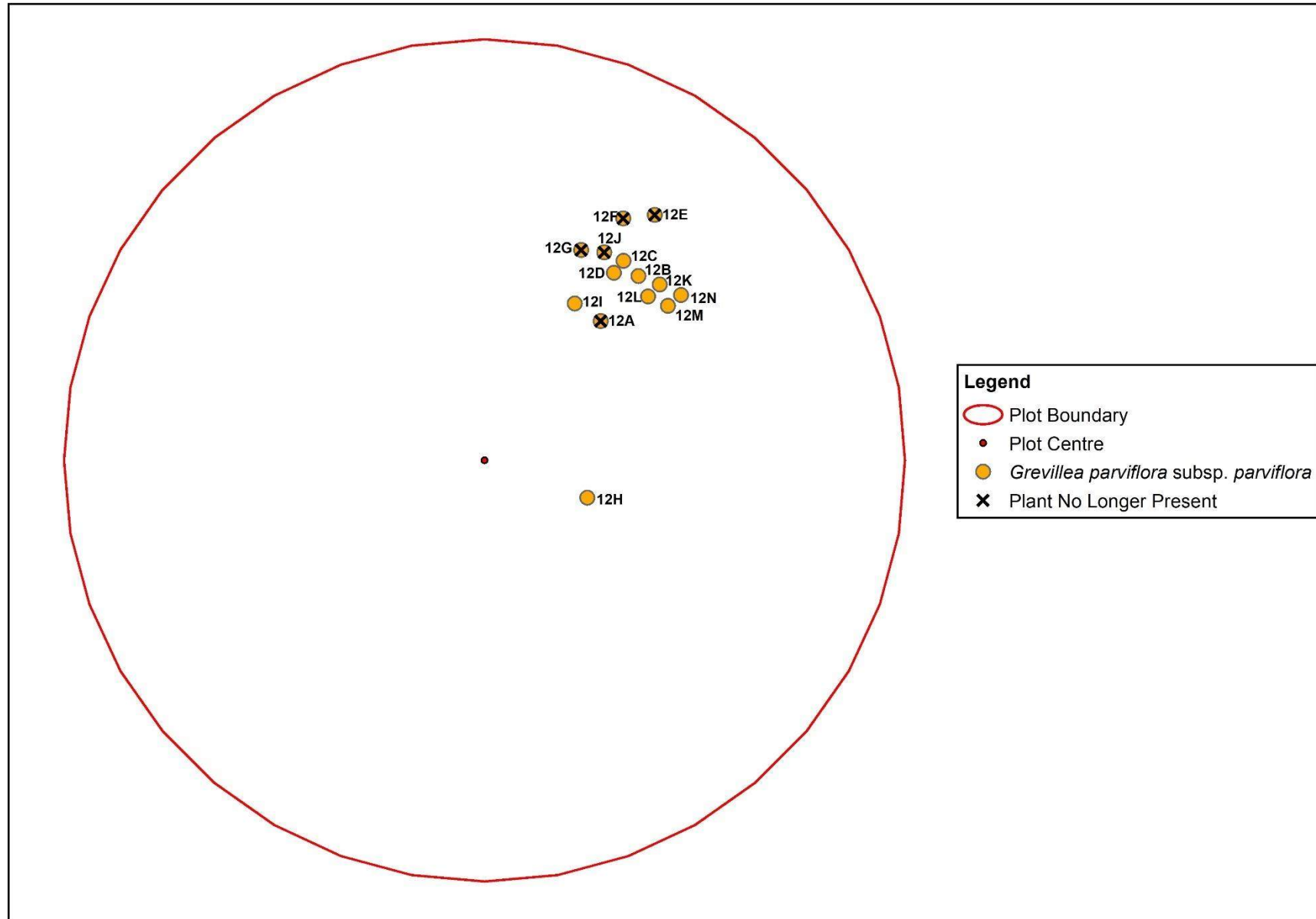


## Monitoring Point 11 - *Grevillea parviflora* monitoring results



### Monitoring Point 12 - *Grevillea parviflora* monitoring results

| ID  | Distance | Bearing | Clump Size (cm) |      |      |      |      |      | Flowers/Fruit Present | Comments     |
|-----|----------|---------|-----------------|------|------|------|------|------|-----------------------|--------------|
|     |          |         | 2015            | 2016 | 2017 | 2018 | 2019 | 2020 |                       |              |
| 12A | 430      | 40      | 80              | 80   | 80   | 50   | -    | -    | -                     | not found    |
| 12B | 570      | 40      | 80              | 90   | 60   | 25   | 50   | 55   | 1 flower              | -            |
| 12C | 580      | 35      | 65              | 70   | -    | 50   | 45   | 55   | none                  | -            |
| 12D | 540      | 35      | 20              | 25   | 40   | 30   | -    | 70   | 1 flower              | -            |
| 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   | 78   | 2 flowers             | -            |
| 12I | 430      | 30      | -               | -    | -    | 50   | 60   | 60   | 2 flowers. 3 buds     | healthy      |
| 12J | 570      | 30      | -               | -    | -    | 25   | -    | -    |                       | not found    |
| 12K | 590      | 45      | -               | -    | -    | 60   | 50   | 70   | 1 flower              | dead flowers |
| 12L | 550      | 45      | -               | -    | -    | 30   | 50   | 60   | none                  | -            |
| 12M | 570      | 50      | -               | -    | -    | 55   | 65   | 75   | 11 flowers, 2 buds    | -            |
| 12N | 610      | 50      | -               | -    | -    | -    | 40   | 60   | -                     | -            |



## Monitoring Point 12 - *Grevillea parviflora* monitoring results



Lot 12 Monitoring Sites

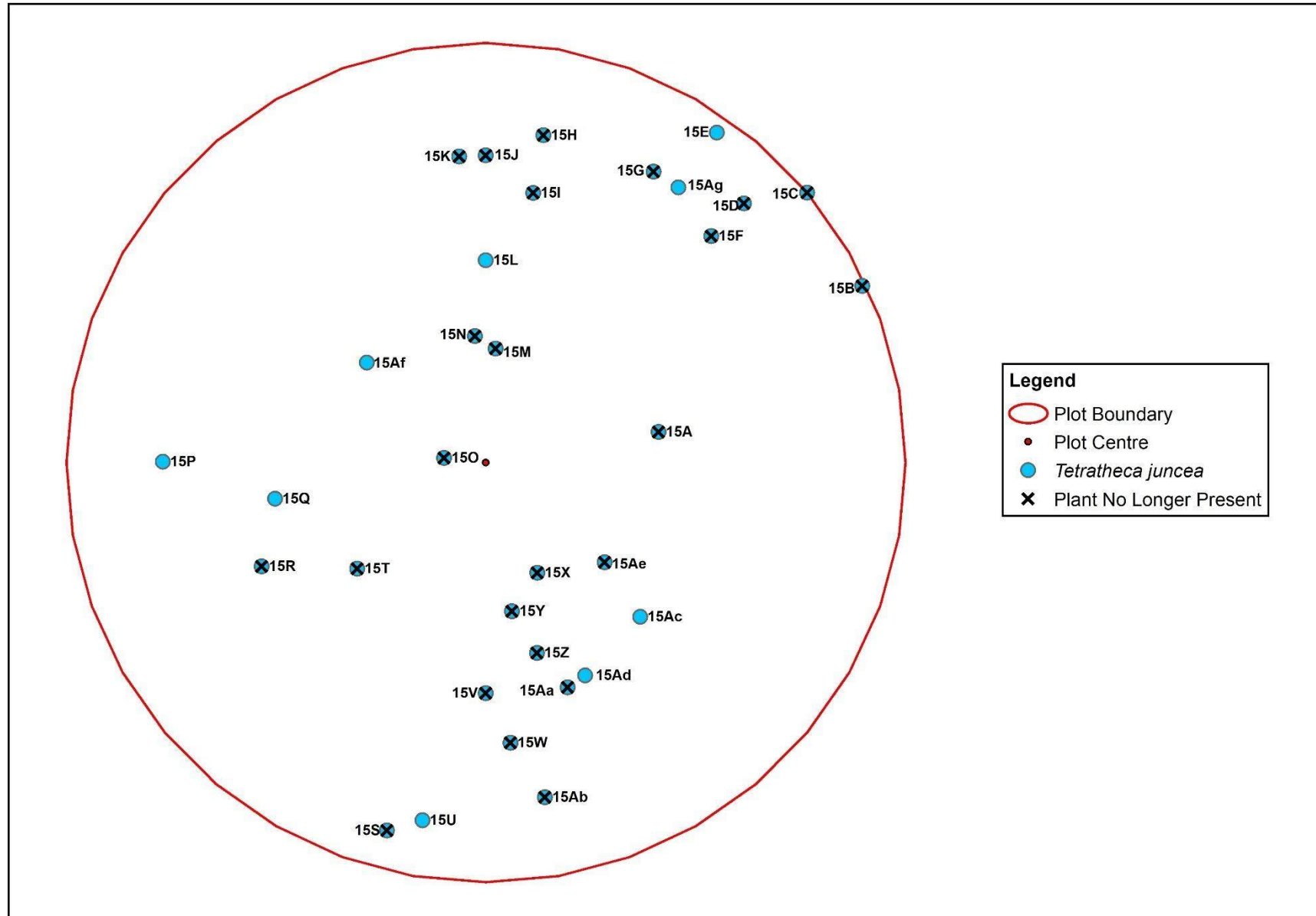
**Monitoring Point 15 - *Tetralochea juncea* monitoring results**

| ID  | Distance | Bearing | Clump Size (cm) |         |          |       |       |       | Flowers/Fruit Present |        | Comments |
|-----|----------|---------|-----------------|---------|----------|-------|-------|-------|-----------------------|--------|----------|
|     |          |         | 2015            | 2016    | 2017     | 2018  | 2019  | 2020  | Flowers               | Fruits |          |
| 15A | 420      | 80      | 20 x 10         | 30 x 10 | -        | -     | -     | -     | -                     |        |          |
| 15B | 990      | 65      | 5 x 5           | 10 x 5  | -        | -     | -     | -     | -                     |        |          |
| 15C | 1000     | 50      | 50 x 50         | 60 x 40 | 100 x 30 | -     | -     | -     | -                     |        |          |
| 15D | 870      | 45      | 40 x 40         | 40 x 40 | 65 x 20  | -     | -     | -     |                       |        |          |
| 15E | 960      | 40      | 75 x 20         | 80 x 20 | 90 x 20  | -     | 40x20 | 40x30 | 5                     | 2      |          |
| 15F | 780      | 45      | 30 x 15         | 40 x 15 | 40 x 15  | 30x40 | 30x20 | -     |                       |        |          |
| 15G | 800      | 35      | 40 x 25         | 50 x 25 | 40 x 20  | -     | -     | -     |                       |        |          |
| 15H | 790      | 10      | 5 x 5           | 10 x 5  | -        | -     | -     | -     |                       |        |          |
| 15I | 620      | 10      | 60 x 30         | 60 x 30 | -        | -     | -     | -     |                       |        |          |
| 15J | 730      | 0       | 20 x 30         | 40 x 20 | 40 x 10  | -     | -     | -     |                       |        |          |
| 15K | 730      | 355     | 50 x 20         | 40 x 20 | -        | -     | -     | -     |                       |        |          |
| 15L | 480      | 0       | 30 x 10         | 30 x 10 | 15 x 10  | 30x20 | 40x20 | 30x20 | 1                     | 4      |          |
| 15M | 270      | 5       | 40 x 10         | 50 x 10 | -        | 50x20 | 40x30 | -     |                       |        |          |
| 15N | 300      | 355     | 40 x 10         | 40 x 10 | 50 x 10  | -     | -     | -     |                       |        |          |
| 15O | 100      | 275     | 20 x 5          | 20 x 40 | -        | -     | -     | -     |                       |        |          |
| 15P | 770      | 270     | 60 x 20         | 50 x 30 | 50 x 30  | 40x10 | 40x10 | 40x20 | 1                     | 7      |          |
| 15Q | 510      | 260     | 60 x 50         | 70 x 50 | 90 x 50  | 90x30 | 50x40 | 80x50 | 1                     | 4      |          |
| 15R | 590      | 245     | 70 x 50         | 70 x 50 | 80 x 15  | -     | 10x10 | -     |                       |        |          |
| 15S | 910      | 195     | 20 x 10         | 20 x 10 | -        | -     | -     | -     |                       |        |          |
| 15T | 400      | 230     | 30 x 10         | 30 x 10 | -        | -     | -     | -     |                       |        |          |



| ID   | Distance | Bearing | Clump Size (cm) |         |         |       |        |       | Flowers/Fruit Present |        | Comments        |
|------|----------|---------|-----------------|---------|---------|-------|--------|-------|-----------------------|--------|-----------------|
|      |          |         | 2015            | 2016    | 2017    | 2018  | 2019   | 2020  | Flowers               | Fruits |                 |
| 15U  | 870      | 190     | 10 x 10         | 30 x 10 | 30 x 5  | 70x20 | 100x30 | 90x70 | 6                     | 11     |                 |
| 15V  | 550      | 180     | 30 x 15         | 40 x 20 | 40 x 10 | -     | -      | -     |                       |        |                 |
| 15W  | 670      | 175     | 5 x 5           | 10 x 5  | -       | -     | -      | -     |                       |        |                 |
| 15X  | 290      | 155     | 40 x 10         | 40 x 10 | 30 x 5  | -     | -      | -     |                       |        |                 |
| 15Y  | 360      | 170     | 5 x 5           | 30 x 5  | -       | 20x5  | -      | -     |                       |        |                 |
| 15Z  | 470      | 165     | 30 x 40         | 50 x 30 | 60 x 70 | 60x20 | 40x20  | -     |                       |        |                 |
| 15AA | 570      | 170     | 25 x 20         | 50 x 20 | 20 x 50 | 80x20 | 40x40  | -     |                       |        | Merge with 14AD |
| 15AB | 810      | 170     | 5 x 5           | 10 x 5  | -       | -     | -      | -     |                       |        |                 |
| 15AC | 520      | 135     | 40 x 10         | 50 x 15 | 15 x 50 | 40x30 | 60x10  | 50x30 | 3                     | 13     |                 |
| 15AD | 560      | 160     | 20 x 30         | 20 x 30 | -       | -     | 40x30  | 50x30 | 1                     | 5      |                 |
| 15AE | 370      | 130     | -               | 20 x 10 | -       | -     | -      | -     |                       | -      |                 |
| 15AF | 370      | 310     | -               | -       | -       | 10x10 | 50x30  | 60x40 | 2                     | 20     |                 |
| 15AG | 800      | 35      | -               | -       | -       | -     | -      | 20x20 | 1                     | 0      |                 |
| 15A  | 420      | 80      | 20 x 10         | 30 x 10 | -       | -     | -      | -     | -                     |        |                 |





## Monitoring Point 15 - *Tetratheca juncea* monitoring results

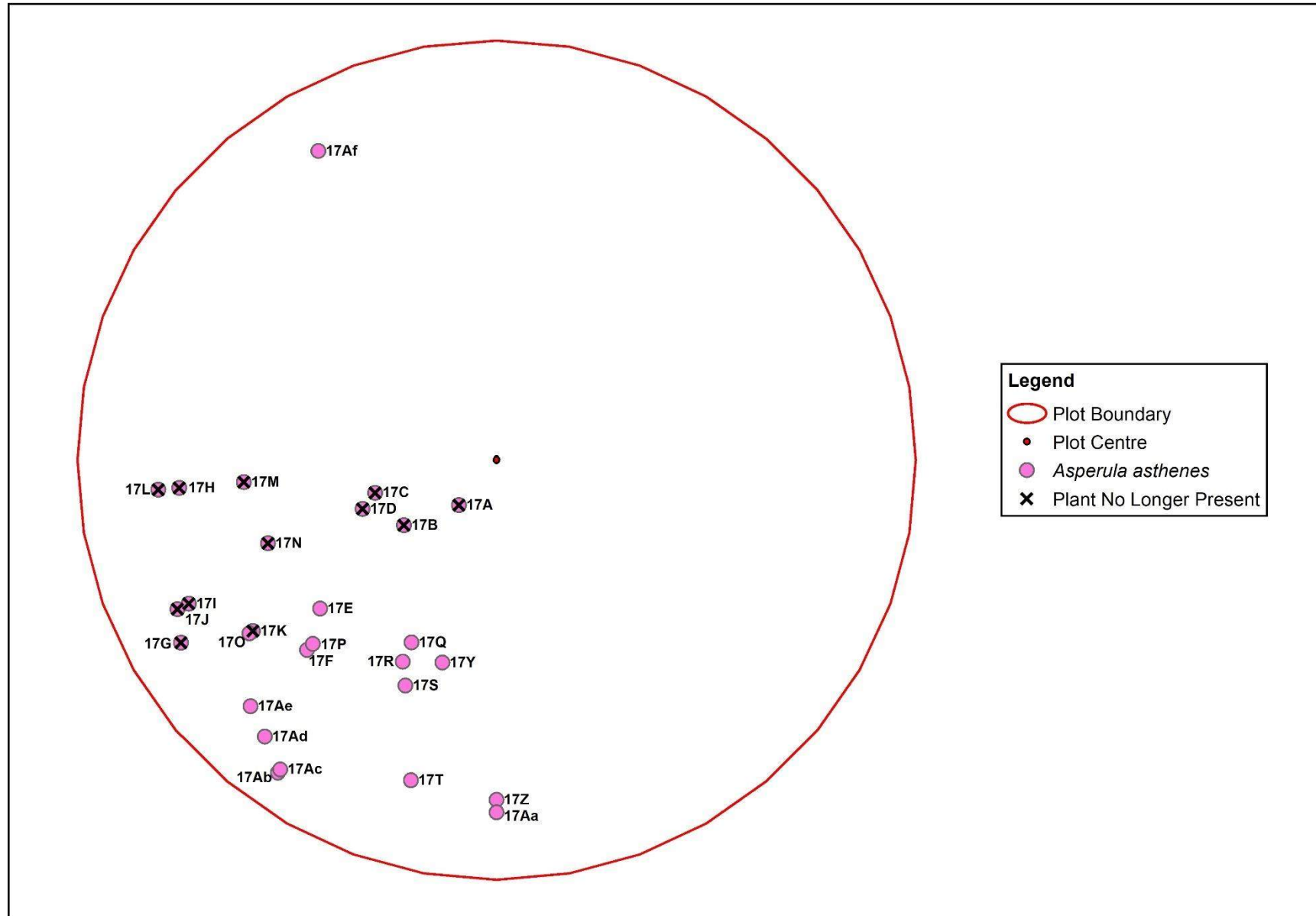


### Monitoring Point 17 - *Asperula asthenes* monitoring results

| ID  | Distance | Bearing | Clump Size (cm) |         |         |        |       |       | Flowers/Fruit Present          | Comments      |
|-----|----------|---------|-----------------|---------|---------|--------|-------|-------|--------------------------------|---------------|
|     |          |         | 2015            | 2016    | 2017    | 2018   | 2019  | 2020  |                                |               |
| 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 | 50x50 | buds and flowers               | minor dieback |
| 17F | 640      | 225     | 20 x 25         | 20 x 25 | 30 x 5  | 30x60  | 20x10 | 20x10 | none                           | healthy       |
| 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 | -     | -                              | not found     |
| 17L | 810      | 265     | -               | -       | -       | 10x5   | -     | -     | -                              | not found     |
| 17M | 605      | 265     | -               | -       | -       | 5x5    | 15x15 | -     | -                              | not found     |
| 17N | 580      | 250     | -               | -       | -       | 10x5   | 10x5  | -     | -                              | not found     |
| 17O | 720      | 235     | -               | -       | -       | -      | 10x5  | -     | -                              | -             |
| 17P | 620      | 225     | -               | -       | -       | -      | 20x10 | -     | -                              | not found     |
| 17Q | 480      | 205     | -               | -       | -       | -      | -     | 35x10 | buds and flowers               | -             |
| 17R | 530      | 205     | -               | -       | -       | -      | -     | 30x20 | buds and flowers               | -             |
| 17S | 580      | 220     | -               | -       | -       | -      | -     | 30x10 | buds and flowers               | -             |
| 17T | 490      | 195     | -               | -       | -       | -      | -     | 40x30 | Flowers / fruit present (2019) | -             |
| 17V | 500      | 195     | -               | -       | -       | -      | -     | 5x5   | -                              | -             |



| ID   | Distance | Bearing | Clump Size (cm) |      |      |      |      |       | Flowers/Fruit Present | Comments |
|------|----------|---------|-----------------|------|------|------|------|-------|-----------------------|----------|
|      |          |         | 2015            | 2016 | 2017 | 2018 | 2019 | 2020  |                       |          |
| 17W  | 760      | 215     | -               | -    | -    | -    | -    | 5x10  | buds                  | -        |
| 17X  | 740      | 210     | -               | -    | -    | -    | -    | 20x20 | -                     | -        |
| 17Y  | 740      | 195     | -               | -    | -    | -    | -    | 5x5   | -                     | -        |
| 17Z  | 810      | 180     | -               | -    | -    | -    | -    | 10x10 | -                     | -        |
| 17AA | 840      | 180     | -               | -    | -    | -    | -    | 20x10 | -                     | -        |
| 17AB | 910      | 215     | -               | -    | -    | -    | -    | 10x5  | buds                  | -        |
| 17AC | 215      | 900     | -               | -    | -    | -    | -    | 5x5   | -                     | -        |
| 17AD | 220      | 860     | -               | -    | -    | -    | -    | 10x5  | -                     | -        |
| 17AE | 225      | 830     | -               | -    | -    | -    | -    | 10x10 | -                     | -        |
| 17AF | 330      | 850     | -               | -    | -    | -    | -    | 10x5  | -                     | -        |

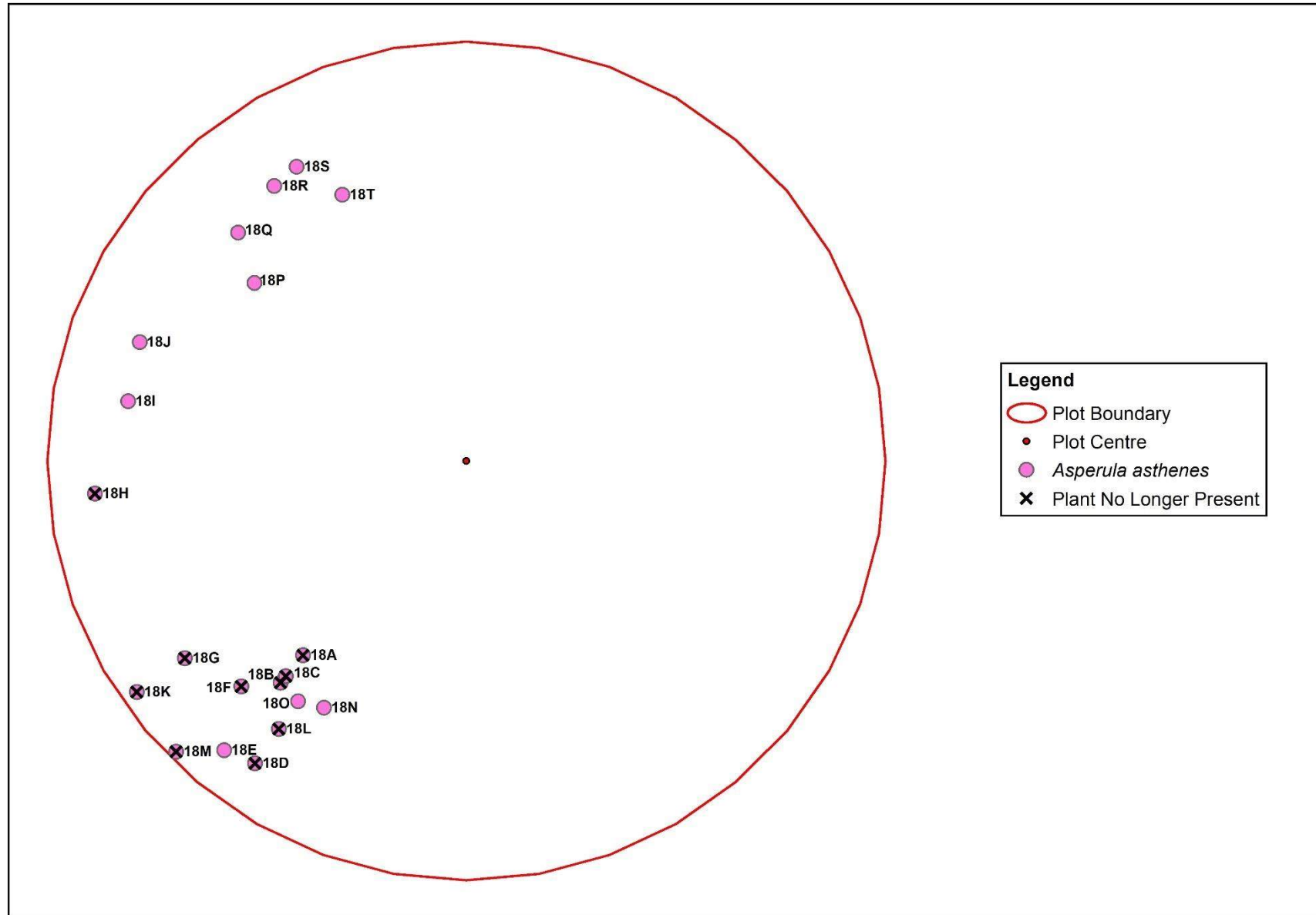


## Monitoring Point 17 - *Asperula asthenes* monitoring results



## Monitoring point 18 - *Asperula asthenes* monitoring results

| ID  | Distance | Bearing | Clump Size (cm) |          |         |       |       |       | Flowers/Fruit Present   | Comments  |
|-----|----------|---------|-----------------|----------|---------|-------|-------|-------|-------------------------|-----------|
|     |          |         | 2015            | 2016     | 2017    | 2018  | 2019  | 2020  |                         |           |
| 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  | 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  | -       | -     | -     |       |                         | not found |
| 18I | 820      | 280     | 30 x 40         | 30 x 30  | -       | -     | -     |       |                         |           |
| 18J | 830      | 290     | 55 x 30         | 50 x 30  | 5 x 5   | -     | 5x5   | 1x1   | none                    |           |
| 18K | 960      | 235     | 50 x 10         | 40 x 15  | -       | -     | -     | 5x5   |                         |           |
| 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 | 70x70 | 3 flowers, buds present |           |
| 18O | 700      | 215     | -               | -        | -       | 70x16 | 30x20 | 30x30 | -                       |           |
| 18P | 660      | 310     | -               | -        | -       | 10x26 | 45x15 | 10x10 | none                    |           |
| 18Q | 770      | 315     | -               | -        | -       | 60x21 | -     | 25x10 | none                    |           |
| 18R | 800      | 325     | -               | -        | -       | -     | -     | 10x10 | none                    |           |
| 18S | 810      | 330     | -               | -        | -       | -     | -     | 10x15 | none                    |           |
| 18T | 700      | 335     | -               | -        | -       | -     | -     | 10x10 | none                    |           |



## Monitoring point 18 - *Asperula asthenes* monitoring results





## APPENDIX D

## PHOTO MONITORING







## Appendix D.1 Biodiversity Offset Area Monitoring Sites

### Monitoring Point 1 (MP 1)

MP 1      2015



MP 1      2017







**MP 1      2018**



**MP 1      2019**







**MP 1      2020**



**Monitoring Point 2 (MP 2)**

**MP 2      2015**





**MP 2      2017**



**MP 2      2018**







**MP 2      2019**



**MP 2      2020**







## Monitoring Point 3 (MP 3)

MP 3      2015



MP 3      2017







**MP 3      2018**



**MP 3      2019**





2020



**Monitoring Point 4 (MP 4)**

**MP 4      2015**







**MP 4      2017**



**MP 4      2018**





**MP 4      2019**



**MP 4      2020**







## Monitoring Point 5 (MP 5)

MP 5      2015



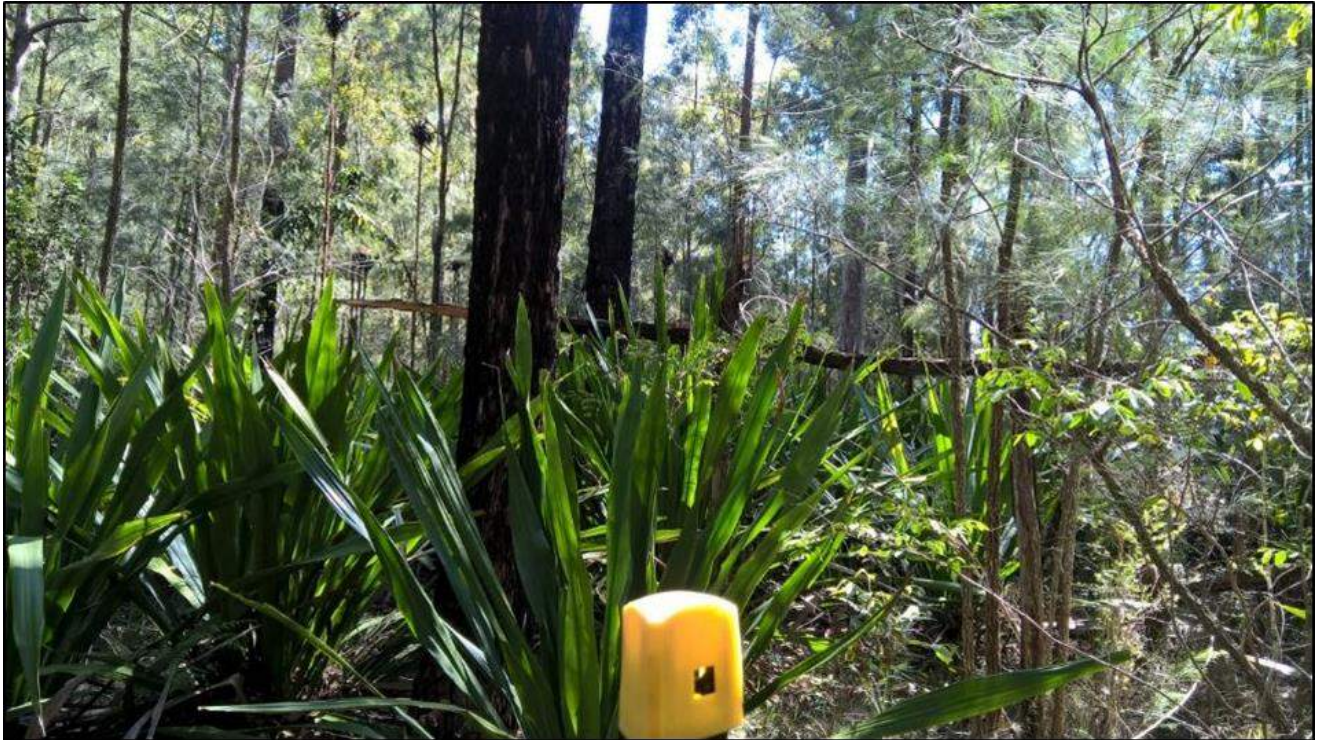
MP 5      2017







**MP 5      2018**



**MP 5      2019**





**MP 5      2020**



**Monitoring Point 6 (MP 6)**

**MP 6      2015**





**MP 6      2017**



**MP 6      2018**





**MP 6      2019**



**MP 6      2020**







## Monitoring Point 7 (MP 7)

MP 7      2015



MP 7      2017





**MP 7      2018**



**MP 7      2019**





**MP 7      2020**



**Monitoring Point 8 (MP 8)**

**MP 8      2015**



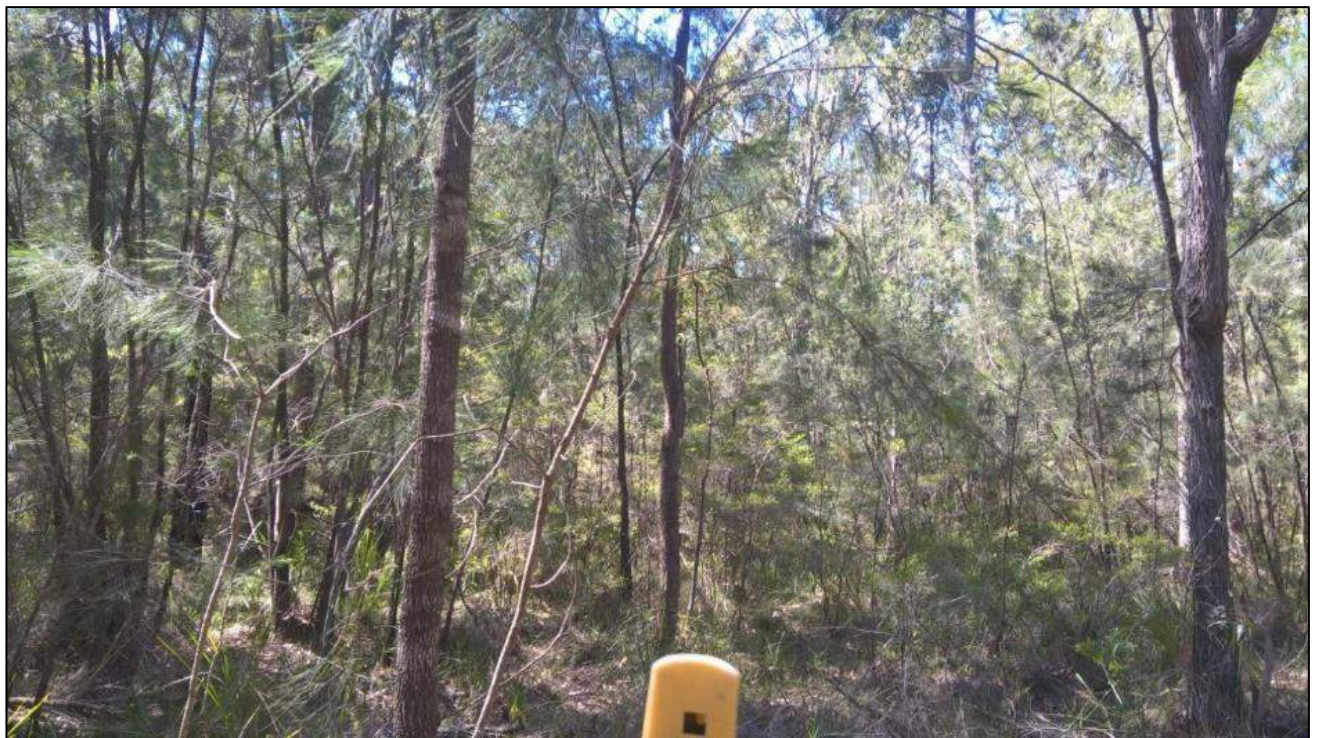




**MP 8      2017**



**MP 8      2018**

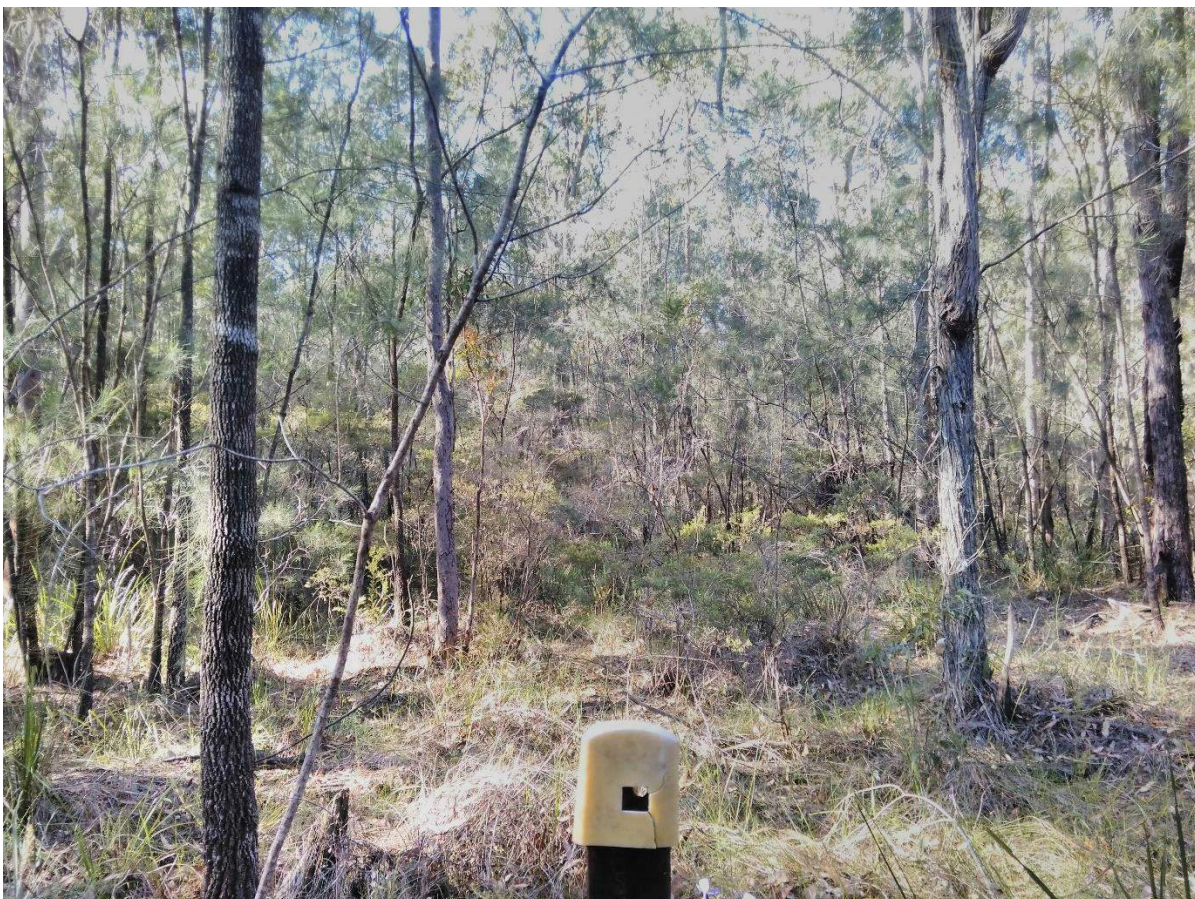




**MP 8      2019**



**MP 8      2020**







## Monitoring Point 9 (MP 9)

MP 9      2015



MP 9      2017







**MP 9      2018**



**MP 9      2019**





**MP 9      2020**



**Monitoring Point 10 (MP 10)**

**MP 10      2015**





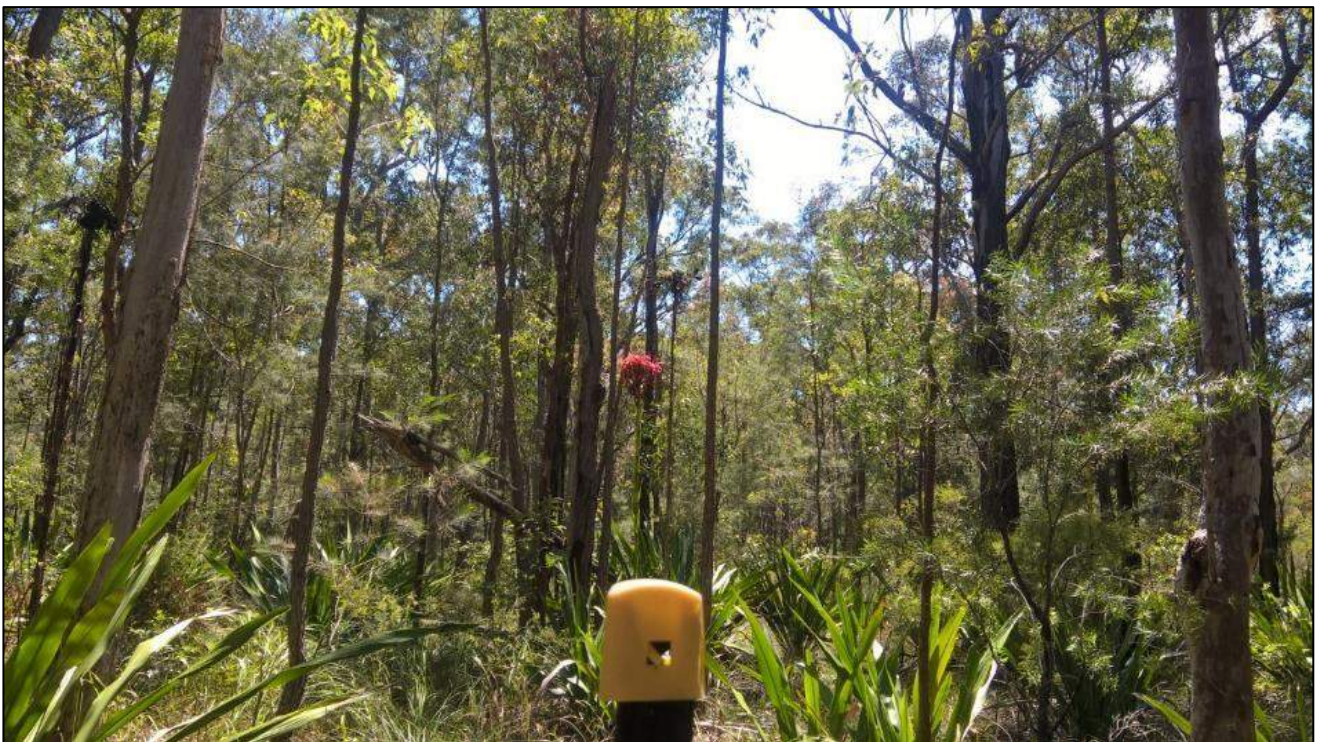
**MP 10**

**2017**



**MP 10**

**2018**





**MP 10**

**2019**



**MP 10**

**2020**







## Monitoring Point 11 (MP 11)

MP 11      2016



MP 11      2017







**MP 11**

**2018**



**MP 11**

**2019**







MP 11

2020







## APPENDIX E      EXOTIC SPECIES RECORDED WITHIN OFFSET AREA





**Table E1 Exotic species recorded on site (2015-2020)**

| Name                                      | Qualification              | Title/Experience        |
|-------------------------------------------|----------------------------|-------------------------|
| <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</i> var. <i>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 F      STAFF CONTRIBUTIONS

The following staff were involved in the compilation of this report.

| Name           | Qualification         | Title/Experience     | Contribution                  |
|----------------|-----------------------|----------------------|-------------------------------|
| David Martin   | MSc, BEnvSciMgnt      | Ecologist (Botanist) | Field surveys, Report Writing |
| Daniel O'Brien | BEnvSciMgnt           | Senor Ecologist      | Report Review                 |
| Emily Fittell  | BSc (Hons)            | Ecologist            | Field surveys                 |
| Nigel Fisher   | PhD                   | Senor Ecologist      | Field surveys                 |
| Gayle Joyce    | BSc (Forestry) (Hons) | GIS Specialist       | GIS and figure preparation    |





## APPENDIX G                      LICENSING

Kleinfelder employees involved in the current study are licensed or approved under the *Biodiversity Conservation Act 2016* (License Number: SL100730, Expiry: 31 March 2021) 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 (2020)

| Parameter                                                     | EPL & ANZECC Criteria | Date        |            |            |            |           |           |           |           |           |            |           |           | Min     | Max     | Average |
|---------------------------------------------------------------|-----------------------|-------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-----------|---------|---------|---------|
|                                                               |                       | 13/01/2020* | 13/02/2020 | 12/03/2020 | 14/04/2020 | 7/05/2020 | 4/06/2020 | 2/07/2020 | 3/08/2020 | 1/09/2020 | 1/10/2020* | 2/11/2020 | 3/12/2020 |         |         |         |
| pH (pH <sub>unit</sub> )                                      | 6.5 - 8.5             |             | 6.61       | 7.06       | 7.15       | 6.88      | 6.22      | 6.61      | 6.7       | 7.2       |            | 6.7       | 7.1       | 6.22    | 7.20    | 6.82    |
| TSS (mg/L)                                                    | 40                    |             | 48         | 50         | 35         | 43        | 21        | 21        | 144       | 36        |            | 64        | 212       | 21.00   | 212.00  | 67.40   |
| TDS (mg/L)                                                    | -                     |             | 422        | 422        | 480        | 490       | 450       | 468       | 529       | 485       |            | 598       | 529       | 422.00  | 598.00  | 487.30  |
| Turbidity (NTU)                                               | -                     |             | 148        | 62         | 42         | 62        | 50        | 53        | 246       | 58        |            | 99        | 195       | 42.00   | 246.00  | 101.50  |
| EC (µS/cm)                                                    | 125-2200              |             | 554        | 686        | 728        | 751       | 724       | 816       | 687       | 796       |            | 844       | 740       | 554.00  | 844.00  | 732.60  |
| Nitrogen (Nitrate) (mg/L)                                     | 0.35                  |             | 17.60      | 19.30      | 18.50      | 19.40     | 16.70     | 19.90     | 15.40     | 18.40     |            | 22.90     | 20.60     | 15.40   | 22.90   | 18.87   |
| Total Nitrogen (mg/L)                                         |                       |             | 19.4       | 20.5       | 21.1       | 24.2      | 19.5      | 24.5      | 18.4      | 21.4      |            | 23.4      | 22.4      | 18.40   | 24.50   | 21.48   |
| Total Phosphorus (mg/L)                                       | 0.025                 |             | <0.1       | 0.3        | 0.02       | <0.01     | 0.07      | 0.01      | 0.07      | 0.04      |            | 0.06      | 0.08      | 0.01    | 0.30    | 0.08    |
| Ammonia (mg/L)                                                | 0.02                  |             | 0.23       | 0.02       | 0.03       | 0.04      | 0.07      | 0.04      | 0.12      | 0.07      |            | 0.1       | <0.01     | 0.02    | 0.23    | 0.08    |
| Oil and Grease (mg/L)                                         | 5                     |             | <5         | <5         | <5         | <5        | <5        | <5        | <5        | <5        |            | <5        | <5        | <5      | <5      | <5      |
| Calcium (mg/L)                                                | -                     |             | 2.0        | 3.0        | 5.0        | 5.0       | 4.0       | 5         | 3         | 4         |            | 4         | 4         | 2.00    | 5.00    | 3.90    |
| Magnesium (mg/L)                                              | -                     |             | 4          | 5          | 7          | 7         | 7         | 9         | 6         | 7         |            | 8         | 7         | 4.00    | 9.00    | 6.70    |
| Sodium (mg/L)                                                 | -                     |             | 97         | 123        | 128        | 142       | 127       | 147       | 124       | 126       |            | 147       | 133       | 97.00   | 147.00  | 129.40  |
| Potassium (mg/L)                                              | -                     |             | 1          | 2          | 2          | 2         | 2         | 2         | 2         | 3         |            | 2         | 2         | 1.00    | 3.00    | 2.00    |
| Total Hardness (as CaCO <sub>3</sub> )                        | -                     |             | 21         | 28         | 74         | 41        | 39        | 50        | 32        | 39        |            | 43        | 39        | 21.00   | 74.00   | 40.60   |
| 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  |
| 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 |
| Chromium (mg/L)                                               | 0.001                 |             | 0.003      | 0.001      | <0.001     | <0.001    | <0.001    | <0.001    | 0.006     | <0.001    |            | <0.001    | <0.001    | <0.001  | 0.006   | 0.00    |
| Copper (mg/L)                                                 | 0.0014                |             | 0.004      | 0.001      | 0.002      | 0.002     | 0.002     | 0.001     | 0.005     | 0.006     |            | <0.001    | 0.004     | <0.001  | 0.006   | 0.00    |
| Nickel (mg/L)                                                 | 0.011                 |             | 0.003      | 0.002      | 0.001      | <0.001    | <0.001    | 0.001     | 0.004     | 0.001     |            | 0.001     | 0.002     | <0.001  | 0.004   | 0.00    |
| Lead (mg/L)                                                   | 0.0034                |             | 0.002      | <0.001     | <0.001     | <0.001    | <0.001    | <0.001    | 0.003     | <0.001    |            | <0.001    | 0.002     | <0.001  | 0.003   | 0.00    |
| Manganese (mg/L)                                              | 1.9                   |             | 0.172      | 0.158      | 0.14       | 0.121     | 0.17      | 0.198     | 0.221     | 0.123     |            | 0.186     | 0.2       | 0.121   | 0.221   | 0.17    |
| Vanadium (mg/L)                                               | -                     |             | 0.01       | <0.01      | <0.01      | <0.01     | <0.01     | <0.01     | 0.02      | <0.01     |            | <0.01     | <0.01     | <0.01   | 0.02    | 0.02    |
| Zinc (mg/L)                                                   | 0.0213                |             | 0.027      | 0.022      | 0.013      | 0.018     | 0.02      | 0.023     | 0.035     | 0.015     |            | 0.018     | 0.026     | 0.013   | 0.035   | 0.02    |
| *Monitoring unable to be undertaken due to insufficient water |                       |             |            |            |            |           |           |           |           |           |            |           |           |         |         |         |

Surface Water - DAM 2 (2020)

| Parameter                              | EPL & ANZECC Criteria | Date       |            |            |            |           |           |           |           |           |           |           |           | Min     | Max    | Average     |
|----------------------------------------|-----------------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|--------|-------------|
|                                        |                       | 13/01/2020 | 13/02/2020 | 12/03/2020 | 14/04/2020 | 7/05/2020 | 4/06/2020 | 2/07/2020 | 3/08/2020 | 1/09/2020 | 1/10/2020 | 2/11/2020 | 3/12/2020 |         |        |             |
| pH (pH <sub>unit</sub> )               | 6.5 - 8.5             | 6.78       | 6.52       | 7.02       | 6.95       | 6.62      | 5.92      | 6.28      | 6.5       | 6.6       | 6.93      | 6.5       | 6.78      | 5.92    | 7.02   | 6.616666667 |
| TSS (mg/L)                             | 40                    | 67         | 271        | 124        | 31         | 88        | 17        | 10        | 102       | 13        | 11        | 20        | 21        | 10      | 271    | 64.58333333 |
| TDS (mg/L)                             | -                     | 1173       | 368        | 248        | 273        | 319       | 296       | 312       | 238       | 448       | 447       | 499       | 780       | 238     | 1173   | 450.0833333 |
| Turbidity (NTU)                        |                       | 18         | 690        | 140        | 37         | 95        | 26        | 19        | 169       | 21        | 14        | 26        | 9         | 9       | 690    | 105.3333333 |
| EC (µS/cm)                             | 125-2200              | 1820       | 190        | 388        | 445        | 503       | 466       | 583       | 278       | 704       | 843       | 737       | 1193      | 190     | 1820   | 679.1666667 |
| Nitrogen (Nitrate) (mg/L)              | 0.35                  | 0.21       | 0.4        | 0.89       | 1.71       | 1.54      | 1.07      | 0.74      | 0.6       | 0.43      | 0.78      | 0.68      | 1.14      | 0.21    | 1.71   | 0.85        |
| Total Nitrogen (mg/L)                  |                       | 0.8        | 1.4        | 1.3        | 2.6        | 1.9       | 1.6       | 0.9       | 1.1       | 0.6       | 1.2       | 1.1       | 1.6       | 0.6     | 2.6    | 1.34        |
| Total Phosphorus (mg/L)                | 0.025                 | 0.05       | 0.13       | 0.11       | 0.02       | 0.03      | 0.01      | 0.01      | 0.04      | 0.02      | <0.01     | 0.01      | <0.01     | <0.01   | 0.13   | 0.04        |
| Ammonia (mg/L)                         | 0.02                  | 0.06       | 0.02       | 0.21       | 0.02       | 0.03      | 0.07      | 0.02      | 0.1       | 0.01      | 0.04      | 0.18      | 0.02      | 0.01    | 0.21   | 0.07        |
| Oil and Grease (mg/L)                  | 5                     | <5         | <5         | <5         | <5         | <5        | <5        | <5        | <5        | <5        | <5        | <5        | <5        | <5      | <5     | <5          |
| Calcium (mg/L)                         | -                     | 179        | 5          | 17         | 17         | 16        | 30        | 47        | 15        | 67        | 76        | 70        | 132       | 5       | 179    | 55.92       |
| Magnesium (mg/L)                       | -                     | 30         | 2          | 6          | 8          | 9         | 6         | 8         | 4         | 9         | 12        | 8         | 19        | 2       | 30     | 10.08       |
| Sodium (mg/L)                          | -                     | 110        | 23         | 43         | 54         | 64        | 42        | 42        | 30        | 43        | 56        | 47        | 68        | 23      | 110    | 51.83       |
| Potassium (mg/L)                       | -                     | 3          | 1          | 1          | 1          | 2         | 1         | <1        | <1        | 2         | 2         | 1         | 2         | <1      | 3      | 1.60        |
| Total Hardness (as CaCO <sub>3</sub> ) | -                     | 645        | 21         | 67         | 75         | 77        | 100       | 150       | 54        | 204       | 239       | 208       | 408       | 21      | 645    | 187.33      |
| 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  | 0.00        |
| Cadmium (mg/L)                         | 0.0002                | 0.0011     | 0.0001     | 0.0002     | <0.0001    | <0.0001   | <0.0001   | <0.0001   | <0.0001   | <0.0001   | <0.0001   | <0.0001   | <0.0001   | <0.0001 | 0.0011 | 0.00        |
| Chromium (mg/L)                        | 0.001                 | 0.002      | 0.004      | 0.003      | <0.001     | 0.003     | 0.002     | <0.001    | 0.003     | <0.001    | <0.001    | <0.001    | <0.001    | <0.001  | 0.004  | 0.00        |
| Copper (mg/L)                          | 0.0014                | 0.012      | 0.008      | 0.005      | 0.002      | 0.006     | 0.002     | <0.001    | 0.004     | 0.003     | 0.004     | <0.001    | 0.002     | <0.001  | 0.012  | 0.00        |
| Nickel (mg/L)                          | 0.011                 | 0.003      | 0.004      | 0.18       | 0.002      | 0.003     | <0.001    | <0.001    | 0.002     | <0.001    | <0.001    | 0.001     | 0.001     | <0.001  | 0.18   | 0.02        |
| Lead (mg/L)                            | 0.0034                | 0.003      | 0.005      | 0.002      | <0.001     | 0.002     | <0.001    | <0.001    | 0.002     | <0.001    | <0.001    | <0.001    | <0.001    | <0.001  | 0.005  | 0.00        |
| Manganese (mg/L)                       | 1.9                   | 0.047      | 0.175      | 0.18       | 0.161      | 0.138     | 0.105     | 0.0124    | 0.147     | 0.134     | 0.084     | 0.247     | 0.124     | 0.0124  | 0.247  | 0.13        |
| Vanadium (mg/L)                        | -                     | <0.01      | 0.02       | <0.01      | <0.01      | <0.01     | <0.01     | <0.01     | 0.01      | <0.01     | <0.01     | <0.01     | <0.01     | <0.01   | 0.02   | 0.02        |
| Zinc (mg/L)                            | 0.0213                | 0.118      | 0.046      | 0.036      | 0.016      | 0.023     | 0.04      | 0.022     | 0.034     | <0.005    | 0.01      | 0.021     | 0.04      | <0.005  | 0.118  | 0.04        |

Surface Water - DAM 3 (2020)

| Parameter                 | EPL & ANZECC Criteria | Date       |            |            |            |           |           |           |           |           |           |           |           | Min    | Max     | Average |
|---------------------------|-----------------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------|---------|---------|
|                           |                       | 13/01/2020 | 13/02/2020 | 12/03/2020 | 14/04/2020 | 7/05/2020 | 4/06/2020 | 2/07/2020 | 3/08/2020 | 1/09/2020 | 1/10/2020 | 2/11/2020 | 3/12/2020 |        |         |         |
| pH (pH <sub>unit</sub> )  | 6.5 - 8.5             | 7.78       | 8.08       | 7.76       | 7.74       | 8.74      | 8.42      | 8.37      | 6.81      | 7.63      | 9.16      | 7.04      | 7.40      | 6.81   | 9.16    | 7.91    |
| TSS (mg/L)                | 40                    | 6.00       | 27.00      | 77.00      | 287.00     | 38.00     | 16.00     | 16.00     | 177.00    | 27.00     | 13.00     | 305.00    | 83.00     | 6.00   | 305.00  | 89.33   |
| TDS (mg/L)                | -                     | 961.00     | 455.00     | 560.00     | 584.00     | 590.00    | 503.00    | 447.00    | 388.00    | 414.00    | 463.00    | 350.00    | 384.00    | 350.00 | 961.00  | 508.25  |
| Turbidity (NTU)           | -                     | 4.00       | 68.00      | 93.00      | 253.00     | 31.00     | 29.00     | 32.00     | 279.00    | 31.00     | 15.00     | 380.00    | 114.00    | 4.00   | 380.00  | 110.75  |
| EC (µS/cm)                | 125-2200              | 1588.00    | 740.00     | 943.00     | 904.00     | 945.00    | 836.00    | 782.00    | 577.00    | 812.00    | 861.00    | 469.00    | 609.00    | 469.00 | 1588.00 | 838.83  |
| Nitrogen (Nitrate) (mg/L) | 0.35                  | <0.01      | 1.29       | 1.22       | 1.05       | 0.44      | 1.48      | 17.20     | 3.00      | 2.79      | 1.20      | 1.84      | 1.98      | <0.01  | 17.20   | 3.04    |
| Total Nitrogen (mg/L)     |                       | 0.04       | 1.90       | 2.00       | 2.60       | 0.60      | 2.10      | 20.10     | 4.10      | 3.50      | 1.60      | 3.10      | 3.10      | 0.04   | 20.10   | 3.73    |

|                                        |        |         |         |        |         |         |         |         |       |         |         |         |         |         |        |        |
|----------------------------------------|--------|---------|---------|--------|---------|---------|---------|---------|-------|---------|---------|---------|---------|---------|--------|--------|
| Total Phosphorus (mg/L)                | 0.025  | 0.02    | 0.03    | 0.07   | 0.16    | 0.01    | 0.01    | 0.01    | 0.09  | 0.06    | <0.01   | 0.19    | 0.06    | <0.01   | 0.19   | 0.06   |
| Ammonia (mg/L)                         | 0.02   | 0.02    | 0.01    | 0.19   | 0.03    | 0.02    | 0.04    | 0.06    | 0.02  | 0.04    | 0.01    | 0.14    | 0.12    | 0.01    | 0.19   | 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)                         | -      | 62.00   | 21.00   | 29.00  | 26.00   | 25.00   | 28.00   | 4.00    | 20.00 | 46.00   | 46.00   | 22.00   | 26.00   | 4.00    | 62.00  | 29.58  |
| Magnesium (mg/L)                       | -      | 32.00   | 12.00   | 16.00  | 15.00   | 16.00   | 12.00   | 8.00    | 8.00  | 10.00   | 10.00   | 6.00    | 10.00   | 6.00    | 32.00  | 12.92  |
| Sodium (mg/L)                          | -      | 230.00  | 108.00  | 146.00 | 139.00  | 155.00  | 122.00  | 139.00  | 87.00 | 93.00   | 105.00  | 54.00   | 87.00   | 54.00   | 230.00 | 122.08 |
| Potassium (mg/L)                       | -      | 3.00    | 2.00    | 2.00   | 2.00    | 2.00    | 2.00    | 2.00    | 2.00  | 2.00    | 3.00    | 2.00    | 2.00    | 2.00    | 3.00   | 2.17   |
| Total Hardness (as CaCO <sub>3</sub> ) | -      | 316.00  | 102.00  | 138.00 | 127.00  | 128.00  | 119.00  | 43.00   | 83.00 | 156.00  | 156.00  | 80.00   | 106.00  | 43.00   | 316.00 | 129.50 |
| Arsenic (mg/L)                         | 0.024  | 0.00    | <0.001  | <0.001 | 0.01    | <0.001  | <0.001  | <0.001  | 0.00  | <0.001  | <0.001  | 0.00    | <0.001  | <0.001  | 0.01   | 0.00   |
| Cadmium (mg/L)                         | 0.0002 | <0.0001 | <0.0001 | 0.00   | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.00  | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.00   | 0.00   |
| Chromium (mg/L)                        | 0.001  | <0.001  | <0.001  | 0.00   | 0.00    | <0.001  | <0.001  | <0.001  | 0.01  | <0.001  | <0.001  | 0.01    | 0.00    | <0.001  | 0.01   | 0.00   |
| Copper (mg/L)                          | 0.0014 | 0.00    | 0.00    | 0.00   | 0.00    | 0.00    | 0.00    | <0.001  | 0.01  | 0.00    | 0.00    | 0.01    | 0.01    | <0.001  | 0.01   | 0.00   |
| Nickel (mg/L)                          | 0.011  | <0.001  | <0.001  | 0.00   | 0.00    | <0.001  | <0.001  | <0.001  | 0.00  | <0.001  | <0.001  | 0.01    | 0.00    | <0.001  | 0.01   | 0.00   |
| Lead (mg/L)                            | 0.0034 | <0.001  | <0.001  | 0.00   | 0.00    | <0.001  | <0.001  | <0.001  | 0.00  | <0.001  | <0.001  | 0.01    | 0.00    | <0.001  | 0.01   | 0.00   |
| Manganese (mg/L)                       | 1.9    | 0.02    | 0.09    | 0.32   | 0.17    | 0.03    | 0.03    | 0.02    | 0.20  | 0.05    | 0.01    | 0.32    | 0.14    | 0.01    | 0.32   | 0.12   |
| Vanadium (mg/L)                        | -      | <0.01   | <0.01   | <0.01  | 0.01    | <0.01   | <0.01   | <0.01   | 0.02  | <0.01   | <0.01   | 0.03    | <0.01   | <0.01   | 0.03   | 0.02   |
| Zinc (mg/L)                            | 0.0213 | 0.02    | 0.01    | 0.02   | 0.02    | 0.01    | 0.02    | 0.01    | 0.05  | 0.01    | <0.005  | 0.02    | 0.02    | <0.005  | 0.05   | 0.02   |

Surface Water - SW2 (2020)

| Parameter                              | EPL & ANZECC Criteria | Date        |            |            |            |           |           |           |           |           |           |           |           | Min     | Max     | Average |
|----------------------------------------|-----------------------|-------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|---------|---------|
|                                        |                       | 13/01/2020* | 13/02/2020 | 12/03/2020 | 14/04/2020 | 7/05/2020 | 4/06/2020 | 2/07/2020 | 3/08/2020 | 1/09/2020 | 1/10/2020 | 2/11/2020 | 1/12/2020 |         |         |         |
| pH (pH unit)                           | 6.5 - 8.5             |             | 5.93       | 6.41       | 6.91       | 7.12      | 6.69      | 7.86      | 6.46      | 7.49      | 6.63      | 3.23      | 6.46      | 3.23    | 7.86    | 6.47    |
| TSS (mg/L)                             | 40                    |             | 60.00      | 25.00      | 74.00      | 42.00     | 13.00     | 16.00     | 85.00     | 17.00     | 15.00     | 56.00     | 27.00     | 13.00   | 85.00   | 39.09   |
| TDS (mg/L)                             | -                     |             | 409.00     | 389.00     | 378.00     | 434.00    | 462.00    | 447.00    | 373.00    | 424.00    | 438.00    | 510.00    | 481.00    | 373.00  | 510.00  | 431.36  |
| Turbidity (NTU)                        |                       |             | 148.00     | 38.00      | 42.00      | 34.00     | 50.00     | 32.00     | 141.00    | 49.00     | 52.00     | 96.00     | 57.00     | 32.00   | 148.00  | 67.18   |
| EC (µS/cm)                             | 125-2200              |             | 496.00     | 610.00     | 554.00     | 674.00    | 703.00    | 782.00    | 509.00    | 735.00    | 707.00    | 633.00    | 697.00    | 496.00  | 782.00  | 645.45  |
| Nitrogen (Nitrate) (mg/L)              | 0.35                  |             | 10.60      | 10.40      | 6.38       | 10.40     | 15.90     | 17.20     | 7.90      | 14.20     | 9.07      | 14.20     | 6.49      | 6.38    | 17.20   | 11.16   |
| Total Nitrogen (mg/L)                  |                       |             | 12.90      | 11.50      | 8.40       | 12.50     | 19.00     | 20.10     | 9.90      | 17.00     | 10.00     | 16.00     | 7.90      | 7.90    | 20.10   | 13.20   |
| Total Phosphorus (mg/L)                | 0.025                 |             | <0.1       | 0.15       | 0.05       | <0.01     | 0.10      | 0.01      | 0.06      | 0.06      | <0.01     | 0.05      | 0.03      | <0.01   | 0.15    | 0.06    |
| Ammonia (mg/L)                         | 0.02                  |             | 0.15       | 0.17       | 0.08       | 0.09      | 0.05      | 0.06      | 0.04      | 0.15      | 0.13      | 0.09      | 0.05      | 0.04    | 0.17    | 0.10    |
| Oil and Grease (mg/L)                  | 5                     |             | <5         | <5         | <5         | <5        | <5        | <5        | <5        | <5        | <5        | <5        | <5        | <5      | <5      | <5      |
| Calcium (mg/L)                         | -                     |             | 3.00       | 4.00       | 4.00       | 4.00      | 4.00      | 4.00      | 4.00      | 4.00      | 4.00      | 4.00      | 4.00      | 3.00    | 4.00    | 3.91    |
| Magnesium (mg/L)                       | -                     |             | 4.00       | 5.00       | 5.00       | 5.00      | 6.00      | 8.00      | 6.00      | 7.00      | 6.00      | 6.00      | 6.00      | 4.00    | 8.00    | 5.82    |
| Sodium (mg/L)                          | -                     |             | 81.00      | 108.00     | 96.00      | 125.00    | 123.00    | 139.00    | 89.00     | 115.00    | 116.00    | 109.00    | 130.00    | 81.00   | 139.00  | 111.91  |
| Potassium (mg/L)                       | -                     |             | 2.00       | 2.00       | 2.00       | 3.00      | 2.00      | 2.00      | 2.00      | 3.00      | 3.00      | 2.00      | 2.00      | 2.00    | 3.00    | 2.27    |
| Total Hardness (as CaCO <sub>3</sub> ) | -                     |             | 24.00      | 30.00      | 30.00      | 30.00     | 35.00     | 43.00     | 35.00     | 39.00     | 35.00     | 35.00     | 35.00     | 24.00   | 43.00   | 33.73   |
| 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  |
| 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                 |             | 0.00       | 0.00       | 0.00       | 0.00      | <0.001    | <0.001    | 0.00      | 0.00      | 0.00      | 0.00      | <0.001    | <0.001  | 0.00    | 0.00    |
| Copper (mg/L)                          | 0.0014                |             | 0.00       | <0.001     | 0.00       | 0.00      | <0.001    | <0.001    | 0.00      | 0.01      | 0.00      | 0.00      | 0.00      | <0.001  | 0.01    | 0.00    |
| Nickel (mg/L)                          | 0.011                 |             | 0.00       | 0.00       | 0.00       | <0.001    | <0.001    | <0.001    | 0.00      | <0.001    | 0.00      | 0.00      | <0.001    | <0.001  | 0.00    | 0.00    |
| Lead (mg/L)                            | 0.0034                |             | 0.00       | <0.001     | <0.001     | <0.001    | <0.001    | <0.001    | 0.00      | <0.001    | 0.00      | 0.00      | 0.00      | <0.001  | 0.00    | 0.00    |
| Manganese (mg/L)                       | 1.9                   |             | 0.07       | 0.06       | 0.03       | 0.03      | 0.06      | 0.02      | 0.06      | 0.04      | 0.12      | 0.06      | 0.09      | 0.02    | 0.12    | 0.06    |
| Vanadium (mg/L)                        | -                     |             | 0.01       | <0.01      | <0.01      | <0.01     | <0.01     | <0.01     | 0.01      | <0.01     | <0.01     | <0.01     | <0.01     | <0.01   | 0.01    | 0.01    |
| Zinc (mg/L)                            | 0.0213                |             | 0.03       | 0.01       | 0.02       | 0.01      | 0.01      | 0.01      | 0.02      | 0.01      | 0.02      | 0.03      | 0.02      | 0.01    | 0.03    | 0.02    |

\*Monitoring unable to be undertaken due to insufficient flow

Surface Water - SW3 (2020)

| Parameter                              | EPL & ANZECC Criteria | Date        |            |            |             |           |            |            |           |            |            |           |            | Min    | Max     | Average |
|----------------------------------------|-----------------------|-------------|------------|------------|-------------|-----------|------------|------------|-----------|------------|------------|-----------|------------|--------|---------|---------|
|                                        |                       | 13/01/2020* | 13/02/2020 | 12/03/2020 | 13/04/2020* | 7/05/2020 | 4/06/2020* | 2/07/2020* | 3/08/2020 | 1/09/2020* | 1/10/2020* | 2/11/2020 | 3/12/2020* |        |         |         |
| pH (pH unit)                           | 6.5 - 8.5             |             | 6.52       | 6.34       |             | 6.52      |            |            | 6.45      |            |            | 6.04      |            | 6.04   | 6.52    | 6.37    |
| TSS (mg/L)                             | 40                    |             | 184.00     | 261.00     |             | 282.00    |            |            | 994.00    |            |            | 151.00    |            | 151.00 | 994.00  | 374.40  |
| TDS (mg/L)                             | -                     |             | 658.00     | 931.00     |             | 1270.00   |            |            | 458.00    |            |            | 620.00    |            | 458.00 | 1270.00 | 787.40  |
| Turbidity (NTU)                        | -                     |             | 467.00     | 394.00     |             | 545.00    |            |            | 761.00    |            |            | 265.00    |            | 265.00 | 761.00  | 486.40  |
| EC (µS/cm)                             | 125-2200              |             | 207.00     | 291.00     |             | 377.00    |            |            | 245.00    |            |            | 204.00    |            | 204.00 | 377.00  | 264.80  |
| Nitrogen (Nitrate) (mg/L)              | 0.35                  |             | 0.14       | <0.1       |             | <0.1      |            |            | 0.04      |            |            | 0.40      |            | <0.1   | 0.40    | 0.19    |
| Total Nitrogen (mg/L)                  |                       |             | 1.40       | 1.70       |             | 1.40      |            |            | 4.00      |            |            | 2.20      |            | 1.40   | 4.00    | 2.14    |
| Total Phosphorus (mg/L)                | 0.025                 |             | <0.1       | 0.29       |             | 0.44      |            |            | 0.22      |            |            | 0.18      |            | <0.1   | 0.44    | 0.28    |
| Ammonia (mg/L)                         | 0.02                  |             | 0.03       | 0.03       |             | 0.04      |            |            | 0.03      |            |            | 0.02      |            | 0.02   | 0.04    | 0.03    |
| Oil and Grease (mg/L)                  | 5                     |             | <5         | <5         |             | <5        |            |            | <5        |            |            | <5        |            | <5     | <5      | <5      |
| Calcium (mg/L)                         | -                     |             | 2.00       | 2.00       |             | 2.00      |            |            | 3.00      |            |            | 2.00      |            | 2.00   | 3.00    | 2.20    |
| Magnesium (mg/L)                       | -                     |             | 2.00       | 3.00       |             | 3.00      |            |            | 4.00      |            |            | 2.00      |            | 2.00   | 4.00    | 2.80    |
| Sodium (mg/L)                          | -                     |             | 34.00      | 50.00      |             | 68.00     |            |            | 42.00     |            |            | 33.00     |            | 33.00  | 68.00   | 45.40   |
| Potassium (mg/L)                       | -                     |             | 1.00       | 2.00       |             | 2.00      |            |            | 2.00      |            |            | 1.00      |            | 1.00   | 2.00    | 1.60    |
| Total Hardness (as CaCO <sub>3</sub> ) | -                     |             | 13.00      | 17.00      |             | 17.00     |            |            | 24.00     |            |            | 13.00     |            | 13.00  | 24.00   | 16.80   |



|                  |        |  |      |        |  |         |  |  |         |  |  |         |  |         |      |      |
|------------------|--------|--|------|--------|--|---------|--|--|---------|--|--|---------|--|---------|------|------|
| Arsenic (mg/L)   | 0.024  |  | 0.00 | 0.00   |  | 0.01    |  |  | 0.00    |  |  | <0.001  |  | <0.001  | 0.01 | 0.00 |
| Cadmium (mg/L)   | 0.0002 |  | 0.00 | <0.001 |  | <0.0001 |  |  | <0.0001 |  |  | <0.0001 |  | <0.0001 | 0.00 | 0.00 |
| Chromium (mg/L)  | 0.001  |  | 0.01 | 0.02   |  | 0.03    |  |  | 0.01    |  |  | 0.01    |  | 0.01    | 0.03 | 0.01 |
| Copper (mg/L)    | 0.0014 |  | 0.01 | 0.02   |  | 0.03    |  |  | 0.01    |  |  | 0.01    |  | 0.01    | 0.03 | 0.02 |
| Nickel (mg/L)    | 0.011  |  | 0.01 | 0.02   |  | 0.02    |  |  | 0.01    |  |  | 0.00    |  | 0.00    | 0.02 | 0.01 |
| Lead (mg/L)      | 0.0034 |  | 0.01 | 0.01   |  | 0.02    |  |  | 0.01    |  |  | 0.01    |  | 0.01    | 0.02 | 0.01 |
| Manganese (mg/L) | 1.9    |  | 0.18 | 0.39   |  | 0.62    |  |  | 0.21    |  |  | 0.14    |  | 0.14    | 0.62 | 0.31 |
| Vanadium (mg/L)  | -      |  | 0.03 | 0.07   |  | 0.10    |  |  | 0.02    |  |  | 0.02    |  | 0.02    | 0.10 | 0.05 |
| Zinc (mg/L)      | 0.0213 |  | 0.08 | 0.14   |  | 0.22    |  |  | 0.05    |  |  | 0.05    |  | 0.05    | 0.22 | 0.11 |

\*Monitoring unable to be undertaken due to insufficient flow

## **APPENDIX 7 – *Tetratheca juncea* Monitoring**



***TETRATHECA JUNCEA***  
**MONITORING REPORT**  
**FOR THE**  
**KARUAH EAST QUARRY SITE**  
**(PROJECT APPROVAL 09-0175)**

Prepared by:

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|                         |                                                                                                                                                                                                                                                                                                                                |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site Details:           | <i>Tetratheca juncea</i> Monitoring Report                                                                                                                                                                                                                                                                                     |
| Prepared by:            | <b><i>Sarah Jones B.Env.Sc., G.Dip.DBPA (Design in Bushfire Prone Areas)</i></b><br><b><i>Firebird ecoSultants Pty Ltd</i></b><br>ABN – 16 105 985 993<br>PO Box 354, Newcastle NSW 2300<br>M: 0414 465 990 Email: <a href="mailto:sarah@firebirdeco.com.au">sarah@firebirdeco.com.au</a><br>T: 02 4910 3939 Fax: 02 4929 2727 |
| Prepared for:           | Karuah East Quarry Pty Ltd                                                                                                                                                                                                                                                                                                     |
| Reference No.           | <i>Tetratheca juncea</i> Translocation - Karuah East                                                                                                                                                                                                                                                                           |
| Document Status & Date: | 1 February 2021                                                                                                                                                                                                                                                                                                                |





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## 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 Kaurah 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 23<sup>rd</sup> 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 2,500m<sup>2</sup> to 3,000m<sup>2</sup> 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.



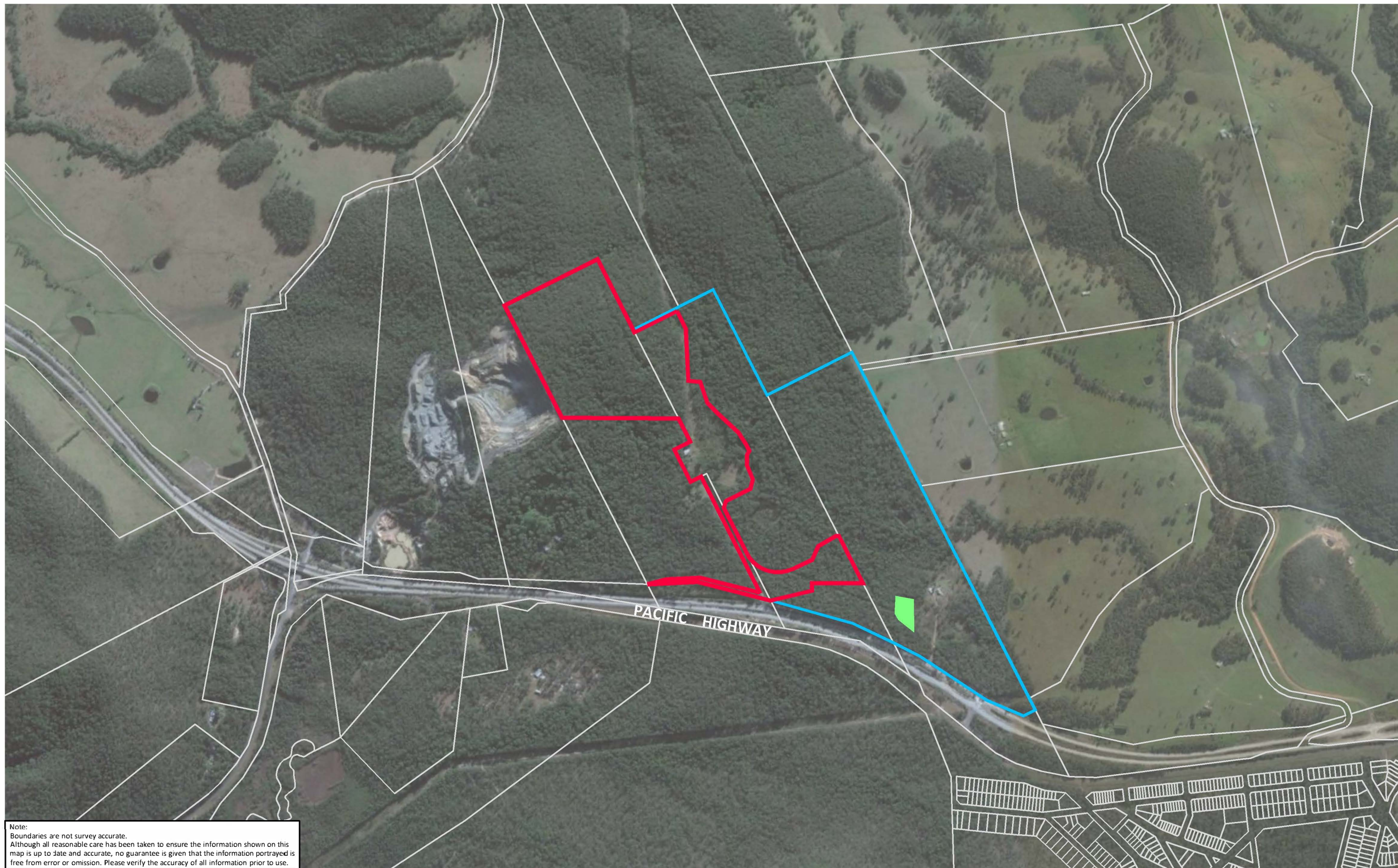
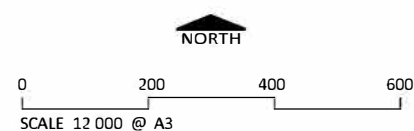


FIGURE 1-1: TRANSLOCATION AREA

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 *Tetralthea 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>Tetralthea 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                                 |
| <b>Total</b> | <b>367</b>                        |

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 MONITORING 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, September 2019 and October 2020. Monitoring involved the following:

- Flower Counts
- Observe general plant health
- Identify all plants within each Section
- Photo points

A site visit was undertaken on 12 October 2020, at this time only six of the translocation rows were observed to have *T. juncea* that were in flower, otherwise the *T. juncea* within the translocation site were predominantly not in flower or have browned or died off completely. The translocation site is also extensively overgrown in some areas, particularly rows B1 to B7 which are covered in dense grass growing around 2 m in height. *T. juncea* are extremely difficult to find when not in flower, particularly in densely vegetated areas. Due to the extremely low number of *T. juncea* that were observed to be in flower at this time (seven individuals total), combined with the dense overgrown rows, it was decided that it was not viable to undertake the complete survey for 2020. Instead, rows that contained no flowering individuals were recorded as NFP (no flowering plants) because the number of *T. juncea* existing in these rows cannot be accurately counted. In the rows that did contain flowering plants, only the flowering plants and the number of flowers on each were counted.

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%**. As discussed above, accurate results for 2020 were not viable. Refer to Appendix A for Photos.



**Table 3-1 Monitoring results of *T.juncea* plants recorded during the October 2020 survey**

| Row # | No Translocated in May 2016 | Monitoring Results October 2016 | Monitoring Results October 2017 | Monitoring Results September 2018 | Monitoring Results September 2019 | Monitoring Results October 2020 | Flower Count                                                                                      |
|-------|-----------------------------|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------|
| A1    | 6                           | 6                               | 5                               | 2                                 | 1                                 | NFP                             | Plant 1: 13 flowers.                                                                              |
| A2    | 5                           | 0                               | 0                               | 1                                 | 1                                 | NFP                             | Plant 1: Green, no flower                                                                         |
| A3    | 5                           | 5                               | 1                               | 1                                 | 3                                 | NFP                             | Plant 1: 0/BR, Plant 2: 0/BR, Plant 3: 3 flowers                                                  |
| A4    | 4                           | 5                               | 2                               | 1                                 | 5                                 | NFP                             | Plant 1: 12 flowers, Plant 2: 3 flowers, Plant 3: 1 flower, Plant 5: 2 flowers                    |
| A5    | 6                           | 3                               | 3                               | 2                                 | 3                                 | NFP                             | Plant 1: 0/BR, Plant 2: 1 flower, Plant 3: 0/BR                                                   |
| A6    | 8                           | 8                               | 4                               | 5                                 | 3                                 | NFP                             | Plant 1: 0/BR , Plant 2: 1 flower, Plant 3: 0/BR                                                  |
| A7    | 4                           | 4                               | 2                               | 3                                 | 2                                 | NFP                             | Plant 1: 7 flowers, Plant 2: 1 flower                                                             |
| A8    | 7                           | 9                               | 9                               | 5                                 | 5                                 | NFP                             | Plant 1: 4 flowers, Plant 2: 1 flower, Plant 3: 1 flower, Plant 4: 21 flowers, Plant 5: 3 flowers |
| A9    | 5                           | 5                               | 3                               | 2                                 | 3                                 | NFP                             | Plant 1: 4 flowers, Plant 2: 2 flowers, Plant 3: 0/BR                                             |





| Row # | No Translocated in May 2016 | Monitoring Results October 2016 | Monitoring Results October 2017 | Monitoring Results September 2018 | Monitoring Results September 2019 | Monitoring Results October 2020 | Flower Count |
|-------|-----------------------------|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|--------------|
| A10   | 5                           | 3                               | 1                               | 1                                 | 1                                 | NFP                             |              |
| A11   | 8                           | 7                               | 1                               | 2                                 | 2                                 | NFP                             |              |
| A12   | 7                           | 8                               | 4                               | 1                                 | 3                                 | NFP                             |              |
| A13   | 4                           | 4                               | 1                               | 2                                 | 2                                 | NFP                             |              |
| A14   | 6                           | 6                               | 0                               | 2                                 | 1                                 | NFP                             |              |
| A15   | 6                           | 6                               | 5                               | 5                                 | 3                                 | NFP                             |              |
| A16   | 6                           | 4                               | 4                               | 4                                 | 3                                 | NFP                             |              |
| A17   | 10                          | 4                               | 10                              | 2                                 | 3                                 | NFP                             |              |
| A18   | 11                          | 11                              | 8                               | 4                                 |                                   | NFP                             |              |



| Row # | No Translocated in May 2016 | Monitoring Results October 2016 | Monitoring Results October 2017 | Monitoring Results September 2018 | Monitoring Results September 2019 | Monitoring Results October 2020 | Flower Count        |
|-------|-----------------------------|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|---------------------|
|       |                             |                                 |                                 |                                   | 3                                 |                                 |                     |
| A19   | 10                          | 8                               | 5                               | 4                                 | 4                                 | NFP                             |                     |
| A20   | 10                          | 9                               | 5                               | 2                                 | 3                                 | NFP                             |                     |
| A21   | 8                           | 8                               | 2                               | 3                                 | 3                                 | NFP                             |                     |
| A22   | 9                           | 8                               | 7                               | 5                                 | 6                                 | 1                               | Plant 1: 1 flower   |
| A23   | 8                           | 13                              | 5                               | 6                                 | 6                                 | 1                               | Plant 1: 12 flowers |
| A24   | 8                           | 7                               | 4                               | 7                                 | 5                                 | NFP                             |                     |



| Row # | No Translocated in May 2016 | Monitoring Results October 2016 | Monitoring Results October 2017 | Monitoring Results September 2018 | Monitoring Results September 2019 | Monitoring Results October 2020 | Flower Count                          |
|-------|-----------------------------|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|---------------------------------------|
| A25   | 12                          | 6                               | 4                               | 4                                 | 5                                 | 2                               | Plant 1: 3 flowers, Plant 2: 1 flower |
| A26   | 16                          | 18                              | 7                               | 4                                 | 7                                 | 1                               | Plant 1: 4 flowers                    |
| A27   | 13                          | 7                               | 6                               | 3                                 | 4                                 | NFP                             |                                       |
| A28   | 11                          | 2                               | 2                               | 2                                 | 2                                 | 1                               | Plant 1: 3 flowers                    |
| A29   | 10                          | 7                               | 5                               | 5                                 | 2                                 | 1                               | Plant 1: 1 flower                     |
| A30   | 11                          | 10                              | 6                               | 3                                 | 4                                 | NFP                             |                                       |
| B1    | 11                          | 12                              | 4                               | 4                                 |                                   | NFP                             |                                       |



| Row # | No Translocated in May 2016 | Monitoring Results October 2016 | Monitoring Results October 2017 | Monitoring Results September 2018 | Monitoring Results September 2019 | Monitoring Results October 2020 | Flower Count |
|-------|-----------------------------|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|--------------|
|       |                             |                                 |                                 |                                   | 6                                 |                                 |              |
| B2    | 9                           | 8                               | 4                               | 3                                 | 4                                 | NFP                             |              |
| B3    | 11                          | 9                               | 6                               | 3                                 | 6                                 | NFP                             |              |
| B4    | 7                           | 5                               | 5                               | 3                                 | 4                                 | NFP                             |              |
| B5    | 6                           | 6                               | 5                               | 3                                 | 3                                 | NFP                             |              |
| B6    | 11                          | 7                               | 4                               | 1                                 | 4                                 | NFP                             |              |
| B7    | 9                           | 8                               | 7                               | 3                                 | 3                                 | NFP                             |              |
| B8    | 10                          | 7                               | 4                               | 5                                 |                                   | NFP                             |              |





| Row #        | No Translocated in May 2016 | Monitoring Results October 2016 | Monitoring Results October 2017 | Monitoring Results September 2018 | Monitoring Results September 2019 | Monitoring Results October 2020 | Flower Count |
|--------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------------|-----------------------------------|---------------------------------|--------------|
|              |                             |                                 |                                 |                                   | 3                                 |                                 |              |
| B9           | 9                           | 6                               | 5                               | 2                                 | 2                                 | NFP                             |              |
| B10          | 11                          | 11                              | 5                               | 2                                 | 2                                 | NFP                             |              |
| B11          | 10                          | 10                              | 6                               | 3                                 | 0                                 | NFP                             |              |
| B12          | 9                           | 10                              | 5                               | 3                                 | 2                                 | NFP                             |              |
| B13          | 12                          | 10                              | 5                               | 3                                 | 3                                 | NFP                             |              |
| B14          | 3                           | 9                               | 1                               | 4                                 | 2                                 | NFP                             |              |
| <b>Total</b> | <b>367</b>                  | <b>319</b>                      | <b>187</b>                      | <b>135</b>                        | <b>140</b>                        | <b>7</b>                        |              |

## 4 CONCLUSION

As discussed in previous section 3, a site visit was undertaken on 12 October 2020, at this time only six of the translocation rows were observed to have *T. juncea* that were in flower, otherwise the *T. juncea* within the translocation site were predominantly not in flower or have browned or died off completely. The translocation site is also extensively overgrown in some areas, particularly rows B1 to B7 which are covered in dense grass growing around 2 m in height. *T. juncea* are extremely difficult to find when not in flower, particularly in densely vegetated areas. Due to the extremely low number of *T. juncea* that were observed to be in flower at this time (seven individuals total), combined with the dense overgrown rows, it was decided that it was not viable to undertake the complete survey for 2020. Instead, rows that contained no flowering individuals were recorded as NFP (no flowering plants) because the number of *T. juncea* existing in these rows cannot be accurately counted. In the rows that did contain flowering plants, only the flowering plants and the number of flowers on each were counted. Refer to photos 1 to 5 in Appendix A for all individuals observed to be in flower as of 12 October 2020. Refer to photos 6 to 8 in Appendix A which show the densely overgrown translocation rows.

The year 2020 was to be the final year of monitoring of the translocation project. We have been unable to obtain sufficient data for the 2020 monitoring survey due to the low number of individuals in flower at the time. It is possible that *T. juncea* may have begun flowering earlier in the year and subsequently stopped flowering earlier in the year which may explain the lack of flowering individuals observed in October 2020. However, it is more likely that the chosen translocation site is just not suitable habitat for *T. juncea*. The chosen site is considered to be too structurally open with little to no canopy cover, with the exception of rows A20 to A30 which have some tree canopy cover. It has been observed in previous years that *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 trees and shrubs are planted adjacent to and within rows A1 to A19 to create more shade for the *T. juncea* within these rows, however the trees and shrubs should be representative of species that occur in areas where *T. juncea* grow naturally. It is also recommended that any future translocations are to be replanted in areas with canopy cover that is representative of typical habitat *T. juncea*.

Firebird ecoSultants also sought advice from Dr Colin Driscoll who is a biologist with extensive experience working with *T. juncea*, including translocation projects for this species in the surrounding local government areas. Dr Colin Driscoll agrees with Firebird ecoSultants that the chosen translocation site does not represent suitable habitat for *T. juncea*, he also stated that in his experience over the years he has found that *T. juncea* translocation projects tend not to be very successful.



Previous monitoring of the *T. juncea* translocation, as of September 2019, has shown a survival rate of less than 38% for the fourth year of monitoring. Kleinfelder (2021) have also observed a decline in the *T. juncea* numbers within the Biodiversity Offset for the past five 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 could potentially be related to the drier than normal conditions in past years, although the year 2020 has experienced more rainfall than previous years. The lack of rainfall may have been a contributing factor in the steadily declining survival rate; however, we believe that the primary factor is that the translocation site is simply not representative of the habitat that *T. juncea* typically occur in.

In conclusion, Firebird ecoSultants believe that the translocation project for *T. juncea* at the Kaurah East Quarry has had a low level of success, with the survival rate steadily reducing each year. We believe that the low rate of success is primarily attributed to the selection of the translocation site, which does not adequately represent the habitat in which *T. juncea* are typically found. *T. juncea* are typically found on southern facing slopes with sufficient canopy cover. The chosen translocation site is located near the top of a hill with little to no canopy cover which we believe has exposed the translocated *T. juncea* to too much direct sunlight. We also believe that there may have been other contributing factors to the low success rate, such as the lack of rainfall in past years and the increase in average temperature attributed to climate change.

For future translocation projects, we recommend that the translocation sites be more carefully selected to be more representative of the habitat in which *T. juncea* are typically found, including flora species and structure, canopy cover, soil composition, slope and topography.



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## 5 BIBLIOGRAPHY

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Lake Macquarie City Council, 2013, *Draft Lake Macquarie Tetratheca juncea Planning and management guidelines*, Prepared by: Lake Macquarie City Council.

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## APPENDIX A      PHOTOS

Photos 1 to 5: *T. juncea* in flower in October 2020

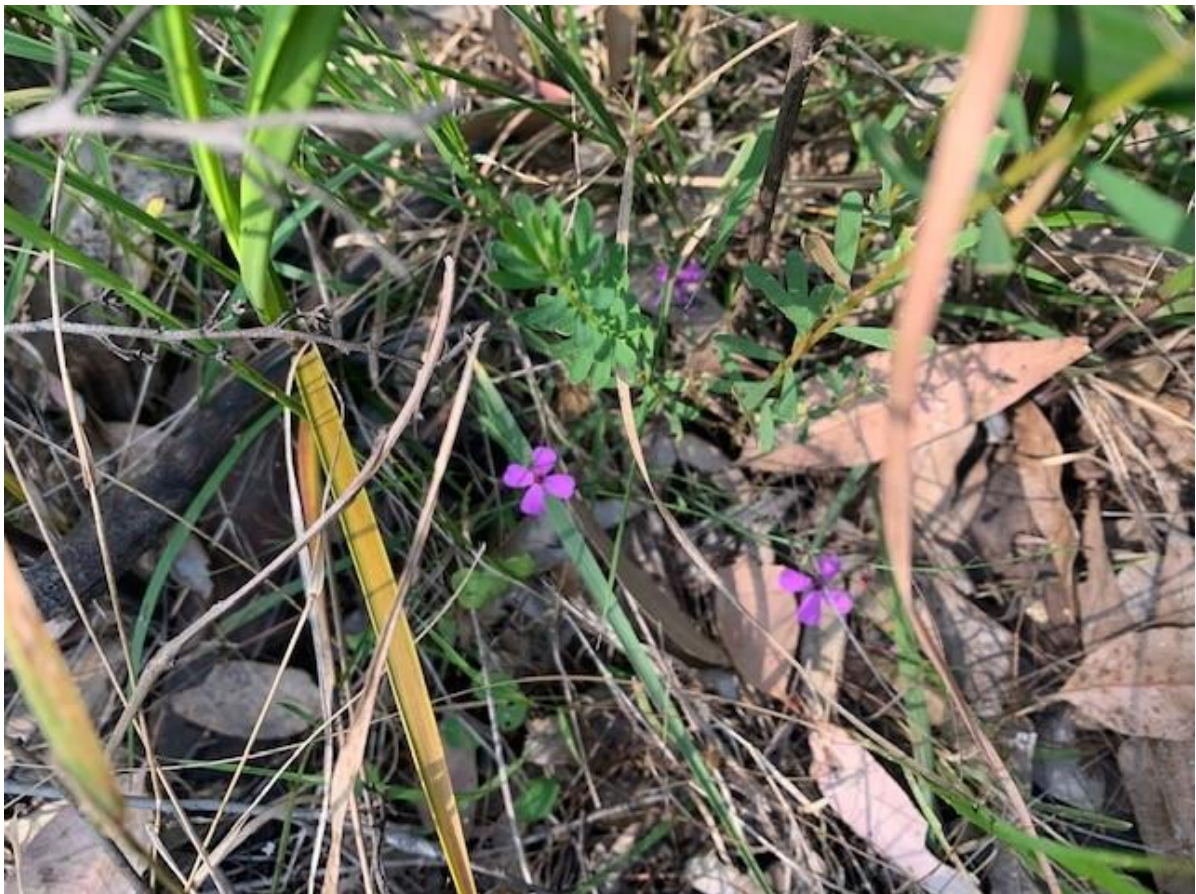










Photo 6 to 8: Considerable regrowth of native vegetation in translocation rows









## **APPENDIX 8 – Audit Action Plan**

| Ref                             | Recommendation Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | KEQPL Response/Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | KEQPL Action Timeframe | Annual Review 2020 Update                                                                                                                                           |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PA 09_0175 (as modified)</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        |                                                                                                                                                                     |
| Schedule 2, Condition 8         | It is recommended that KEQPL confirms that construction and occupation certificates for site infrastructure are in place.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | KEQPL have engaged BCA Certifiers Australia Pty Ltd to undertake an assessment of structures at Karuah East Quarry and associated design documents, with the ultimate goal to have all relevant structures certified.                                                                                                                                                                                                                                                                                                                 | 31/01/2021             | KEQ engaged BCA who have undertaken audit of construction and reported findings. This report is in the process of being reviewed and corrective actions undertaken. |
| Schedule 2, Condition 11        | It is recommended that KEQPL confirms that the developer contributions to Council required during the audit period have been made.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | KEQPL are investigating payments made to MidCoast Council to ensure that all required developer contribution payments have been made. If payments have not been made, KEQPL will consult with Council to establish a payment plan.                                                                                                                                                                                                                                                                                                    | 31/01/2020             | No further action required.                                                                                                                                         |
| Schedule 3, Condition 3         | <p>Pending any further directions from EPA and/or DPIE, it is recommended that noise consultant's monitoring reports are updated to include the following additional details:</p> <ol style="list-style-type: none"> <li>1. Instrument details and a copy of current instrument calibration certificates as required by relevant Australian Standards.</li> <li>2. Measurement results for a location representative of Residences A to E and calculated quarry noise levels to these residences, including calculation details and justification of the calculation method.</li> <li>3. Detailed assessment and reporting of modifying factors as required by relevant policies and conditions, at least including tonal and low frequency characteristics.</li> <li>4. Traffic noise measurements at the potentially most affected receptors as required by Schedule 3, Condition 4.</li> </ol> | KEQPL have been working in consultation with the Department and EPA towards a modification of the Project Approval. Draft conditions were issued 13/10/20. Upon approval of this acoustic modification, KEQPL will seek a variation of the EPL to ensure that commitments between the two documents (Project Approval and EPL) are aligned. At this stage, KEPLQ will additionally review and where necessary revise the NMP. This will include measures for noise monitoring reports to includes details recommended by the auditor. | 30/04/2021             | MOD 8 approved. NMP will be modified post EPL variation approval.                                                                                                   |
| Schedule 3, Condition 4         | It is recommended that unattended monitoring charts are included in the monthly monitoring reports as required by Section 8.4 of the NMP, or revise the NMP to not require these charts.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | As discussed above, following approval of the acoustic medication, KEQPL will review the NMP and revise where necessary to reflect changes in the Consent conditions and EPL (post variation).                                                                                                                                                                                                                                                                                                                                        | 30/04/2021             | Pending NMP revision and approval.                                                                                                                                  |

| Ref                      | Recommendation Description                                                                                                                                                                                                                                           | KEQPL Response/Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | KEQPL Action Timeframe | Annual Review 2020 Update                                |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------------------------------------------|
| Schedule 3, Condition 6  | Consider carrying out a review of noise monitoring results upon receipt of each noise compliance report, to reduce response time in the event of non-compliance with criteria or other noise issues.                                                                 | KEQPL are committed to operating in a compliant manner. When specialist/technical reports are prepared, they are reviewed as soon as practical then lodged with the ARA.<br><br>KEQPL will take this recommendation into consideration in the process of reviewing management plans and associated procedures.                                                                                                                                                                                                          | N/A                    | Pending NMP revision and approval.                       |
| Schedule 3, Condition 7  | It is recommended that the Noise Management Plan is revised to reflect the noise mitigation measures that were adopted by KEQ following completion of the Thearle Acoustics review that are in addition to or change the noise management commitments in the KEQ EA. | As discussed above, following approval of the acoustic medication, KEQPL will review the NMP and revise where necessary to reflect changes in the Consent conditions and EPL (post variation).                                                                                                                                                                                                                                                                                                                          | 30/04/2021             | Pending NMP revision and approval.                       |
| Schedule 3, Condition 11 | It is recommended that KEQ consult with relevant private landholders and seek to enter into written agreements to allow blasting within 500 m of their land.                                                                                                         | KEQPL have operated in accordance with the approved Blast Management Plan (2015) which identifies that there are no residents/receivers within 500 metres from the potentially nearest blasting areas. Refer to <i>Section 3.4 – Sensitive Receivers of the Karuah East Quarry Blast Management Plan</i> for further details.<br><br>KEQPL have never received a community complaint regarding blasting undertaken at the Quarry.<br><br>KEQPL will consult with the Department to determine if any action is required. | 31/01/2021             | KEQ are in consultation with DPIE regarding this matter. |
| Schedule 3, Condition 21 | It is recommended that written confirmation of approval is sought from DPIE during the next update of the WMP.                                                                                                                                                       | KEQPL agree with this recommendation and will consult with the Department during the next review of the WMP.                                                                                                                                                                                                                                                                                                                                                                                                            | 30/04/2021             | Pending WMP revision and approval.                       |



| Ref                                                         | Recommendation Description                                                                                                                                                         | KEQPL Response/Actions                                                                                                                                                                                                                                                                                                                                                                                                                                 | KEQPL Action Timeframe | Annual Review 2020 Update                                                                                                                                  |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                             | It is recommended that KEQ implement a program to monitor the health of local watercourses under the Water Management Plan.                                                        | KEQPL will consult with the Department during the next review of the WMP and BOAMP to determine whether additional monitoring is required to monitor the health of local watercourses.<br><br>However, let it be noted that local watercourses are monitored and reported on in the annual Biodiversity Offset Area Monitoring Report; this is in line with the approved BOAMP.                                                                        | 30/04/2021             | Ecologists have been consulted on this matter. Revision of BOAMP is underway. This recommendation will be further investigated during revision of the WMP. |
| Schedule 3,<br>Condition 23,<br>Schedule 5,<br>Condition 11 | It is recommended that the information required under this condition is regularly reviewed and published on the KEQ website on a quarterly basis.                                  | KEQPL agree with this recommendation. Future environmental monitoring reports will include information on the factors identified in mentioned conditions.                                                                                                                                                                                                                                                                                              | 31/01/2021             | Adopted. Action closed out.                                                                                                                                |
| Schedule 3,<br>Condition 27                                 | Cumberland Ecology recommends that the TJTMP be updated to include performance criteria to measure the effectiveness of the program.                                               | The TJTMP ceases after 2020. KEQPL will take this into consideration when reviewing the TJTMP.                                                                                                                                                                                                                                                                                                                                                         | 30/04/2021             | Review of this program and consultation with relevant government department to be undertaken at appropriate time.                                          |
|                                                             | Cumberland Ecology recommends that 2020 monitoring include all required monitoring methods, and if undertaken outside of October 2020 an explanation of the change in survey date. | Firebird ecoSultants Pty Ltd were engaged to conduct the TJ monitoring for 2020, however; after attending site and undertaking an inspection, the monitoring was postponed due to a lack of flowering.<br><br>Monitoring of the TJ has typically been done during it's flowering period, which varies dependant on climatic conditions.<br><br>The auditor's recommendation will be taken into consideration when a review of the TJTMP is undertaken. | 30/04/2021             | Review of this program and consultation with relevant government department to be undertaken at appropriate time.                                          |

| Ref                      | Recommendation Description                                                                                                                                                                                                            | KEQPL Response/Actions                                                                                                                                                                                                                                                                                                                                                          | KEQPL Action Timeframe | Annual Review 2020 Update               |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------|
| Schedule 3, Condition 28 | It is recommended that KEQ seek written confirmation from DPIE of an extension to the timeframe required to continue consultation and implement long-term security for the project Biodiversity Offset Strategy.                      | Officers of the Biodiversity Conservation Trust are attending site in November to assess the Biodiversity Area and consult on the progress of the Biodiversity Offset Strategy.<br><br>KEQPL will consult with the Department and seek extension to the timeframe required if required.                                                                                         | 31/01/2021             | Consultation with DPIE and BCT ongoing. |
| Schedule 3, Condition 32 | Cumberland Ecology recommends that the LRMP be updated to include a three year management schedule for the period November 2018 – November 2021.                                                                                      | KEQPL agree with the recommendation made by the auditor and will conduct a revision of the LRMP in the near future. The revisions describe here will be made.                                                                                                                                                                                                                   | 30/04/2021             | Pending LRMP revision and approval.     |
|                          | It is recommended that KEQ record and report all information required under implementation the LRMP.                                                                                                                                  | During the revision of the LRMP, KEQPL will ensure all procedures to record and report are examined and responsible employees are made aware of their obligations.                                                                                                                                                                                                              | 30/04/2021             | Pending LRMP revision and approval.     |
| Schedule 3, Condition 33 | Cumberland Ecology recommends that the BOAMP be updated to include a three year management schedule for the period November 2018 – November 2021.                                                                                     | KEQPL agree with this recommendation by the auditor. KEQPL have already engaged Kleinfelder to revise the BOAMP to reflect changes to the Project Approval. While this revision is taking place, KEQPL will request Kleinfelder to make these recommended changes.                                                                                                              | 30/04/2021             | Pending LRMP revision and approval.     |
| Schedule 3, Condition 35 | No evidence was available at the time of audit to confirm that the Conservation and Rehabilitation Bond was reviewed within three months of the previous IEA.                                                                         | This is proposed to be completed                                                                                                                                                                                                                                                                                                                                                | 30/06/2021             | Pending completion.                     |
| Schedule 3, Condition 37 | It is recommended that KEQ consult with DPIE over the progressive rehabilitation strategy for the visually prominent ridgeline identified in this condition and update the Landscape and Rehabilitation Management Plan, if required. | During the process outline above, KEQPL will consult with the Department over the progressive rehabilitation strategy of the ridgeline. This visual factor has been considered by KEQPL and it believed that as rehabilitation of the neighbouring quarry (Karuah Hard Rock Quarry) is established and finalised over the next few years, this visual impact will be mitigated. | 30/04/2021             | Pending LRMP revision and approval.     |

| Ref                     | Recommendation Description                                                                                                                                                                                                                                                                                  | KEQPL Response/Actions                                                                                                                                                                                                                                                                                                                                                                                                                                 | KEQPL Action Timeframe | Annual Review 2020 Update                                                                                                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Schedule 4, Condition 1 | It is recommended that KEQ update their notification procedures to ensure the relevant landholders are notified as soon as possible after receipt of monitoring results confirming that an exceedance has occurred.                                                                                         | KEQPL are committed to operating in a compliant manner and maintaining positive relations with community. Over recent years, this positive relationship can be demonstrated by the lack of complaints received from community and positive feedback received at Community Consultation Committee meetings.<br><br>KEQPL will review and where necessary revise the notification procedures followed when notifying landholders of pollution incidents. | 30/04/2021             | Pending PIRMP revision and approval.                                                                                                                                                                |
| Schedule 5, Condition 1 | It is recommended that KEQ undertake a review of the approved EMS to ensure that the document remains consistent with environmental monitoring requirements and approved site management plans. Consultation with DPIE should be undertaken if major updates to the 2015 version of the EMS are required.   | KEQPL will undertake a review of the EMS and revise if deemed necessary at the conclusion of this IEA.                                                                                                                                                                                                                                                                                                                                                 | 31/01/2021             | The KEQ EMS has been reviewed following the IEA, however, will require further revision and approval post revision of environmental management plans forecast for 2021/22 (LRMP, NMP, SWMP, BOAMP). |
| Schedule 5, Condition 2 | It is recommended that KEQ update their communications and incident response procedures to ensure that any future exceedances of the Project Approval criteria and any implementation management controls / remediation measures are reported to DPIE at the earliest opportunity once they are identified. | KEQPL are in the process of reviewing and where necessary revising the PIRMP. During this process KEQPL will review all communication and notification procedures for reporting of pollution exceedances to ARAs.                                                                                                                                                                                                                                      | 30/04/2021             | Pending PIRMP revision and approval.                                                                                                                                                                |
| Schedule 5, Condition 5 | It is recommended that KEQ document any reviews undertaken as required under this condition.                                                                                                                                                                                                                | KEQPL agree with this recommendation. A controlled template will be prepared for use when reviewing documents (such as procedures or management plans).                                                                                                                                                                                                                                                                                                | 30/04/2021             | Pending procedural revision.                                                                                                                                                                        |
| Schedule 5 Condition 7  | Evidence was not available at the time of audit to confirm that KEQ had notified DPIE and other relevant regulatory agencies of all environmental incidents.                                                                                                                                                | Complete notification as per this condition.                                                                                                                                                                                                                                                                                                                                                                                                           | 31/01/2021             | This has been completed. Closed off                                                                                                                                                                 |

| Ref                                   | Recommendation Description                                                                                                                                                                          | KEQPL Response/Actions                                                                                                                                                                                                                                                                                                                                                                      | KEQPL Action Timeframe                      | Annual Review 2020 Update           |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------|
| Schedule 5, Condition 10              | It is recommended that the KEQ response this IEA and implementation of actions are summarised in the next KEQ Annual Review.                                                                        | KEQPL agrees with this recommendation and will ensure that the KEQPL RAR and status of actions is reported in the next Annual Review.                                                                                                                                                                                                                                                       | 31/03/2021 (due date of next Annual Review) | This document.                      |
| Schedule 5 Condition 11               | The response to the previous IEA recommendations was not available on the KEQ website at the time of audit.                                                                                         | Add action plan.                                                                                                                                                                                                                                                                                                                                                                            | 31/01/2021                                  | Completed                           |
| <b>PA 09_0175 (as modified) SOC's</b> |                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                             |                                             |                                     |
| SoC 3.1                               | It is recommended that topsoil stripping depths and associated stockpile locations are recorded during future clearing works to assist with site rehabilitation.                                    | KEQPL agree with this recommendation. During revision of the LRMP, this recommendation will be taken into consideration and if necessary, a procedure will be prepared to ensure future stripping works record critical information (such as stripping depths and stockpile locations).                                                                                                     | 30/04/2021                                  | Pending LRMP revision and approval. |
|                                       | It is also recommended that KEQ develop an internal topsoil stripping and stockpiling procedure to ensure that the information under this SoC is retained on site to assist in site rehabilitation. | KEQPL agree with this recommendation. During revision of the LRMP, this recommendation will be taken into consideration and if necessary, a procedure will be prepared to ensure future stripping works record critical information (such as stripping depths and stockpile locations).                                                                                                     | 30/04/2021                                  | Pending LRMP revision and approval. |
| SoC 4.1                               | Recommend that KEQ review the process for salvage of large logs during clearing and whether any further emplacement of additional material would be beneficial in Lots 12 and 13.                   | KEQPL currently use fallen trees to create natural wooden bunding around the boundary of the disturbance area. Additionally, KEQPL have had approximately 300 nest boxes installed through the Biodiversity Offset area. These nest boxes are monitored and maintained yearly by trained ecologists. Albeit, KEPLQ will take this recommendation into consideration when revising the LRMP. | 30/04/2021                                  | Pending LRMP revision and approval. |
| <b>EPL 20611</b>                      |                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                             |                                             |                                     |



| Ref            | Recommendation Description                                                                                                                                                                                                                                    | KEQPL Response/Actions                                                                                                                                                                                                                                                                          | KEQPL Action Timeframe | Annual Review 2020 Update                                                                                                                                  |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Condition A1.2 | It is recommended that KEQPL consult with EPA over the approved use of soil and overburden material from KEQ to assist with the final rehabilitation of the adjacent Karuah Quarry site and confirm whether an associated variation to EPL 20611 is required. | KEPL agree with this recommendation and will consult with the EPA regarding this matter as soon as practical to ensure there are no compliance issues as a result of this process.                                                                                                              | 31/01/2021             | KEQ consulted with the EPA and resolved this matter.                                                                                                       |
| Condition L4.5 | Bridges Acoustics recommendation: Require consultants to specifically report assessment methods and results for tonal and low frequency modifying factors, as required by this condition, for all attended noise compliance surveys.                          | KEQPL will take this recommendation into consideration when undertaking revision of the NMP.                                                                                                                                                                                                    | 30/04/2021             | Pending NMP revision and approval.                                                                                                                         |
| Condition L5.7 | It is recommended that future Annual Reviews provide comment regarding the management of blast fume.                                                                                                                                                          | KEQPL agree with this recommendation. During review of the BMP, revision will be made to blast monitoring to direct blast technicians to report on blast fumes in the Post Blast Report. This detail will also be reported on in the Annual Review.                                             | 30/04/2021             | Pending BMP revision and approval.                                                                                                                         |
| Condition M5.1 | It is recommended that the Complaints Register available on the KEQ website is updated on a quarterly basis.                                                                                                                                                  | KEQPL agree with this recommendation. Fortunately, KEQPL have not received any complaints in recent times, however; understand the importance to keep the register up-to-date and published. Future environmental monitoring reports will include quarterly updates on the Complaints Register. | 31/01/2021             | Reporting of complaints has been added to the monthly environmental monitoring reports, which are published monthly on the <i>Hunter Quarries</i> website. |