



# **Karuah East Quarry**

## **Monthly Environmental Monitoring Report**

**November 2020**

## Table of Contents

|                                                           |           |
|-----------------------------------------------------------|-----------|
| <b>1. INTRODUCTION .....</b>                              | <b>1</b>  |
| <b>2. DUST MONITORING.....</b>                            | <b>1</b>  |
| <b>2.1 Dust Deposition Results .....</b>                  | <b>2</b>  |
| <b>2.2 High Volume Air Sampling Results.....</b>          | <b>2</b>  |
| <b>2.3 Dust Monitoring Results Summary.....</b>           | <b>4</b>  |
| <b>3. BLAST MONITORING RESULTS .....</b>                  | <b>5</b>  |
| <b>4. NOISE MONITORING .....</b>                          | <b>6</b>  |
| <b>4.1 Operator Attended Monitoring Results .....</b>     | <b>6</b>  |
| <b>4.2 Unattended Continuous Monitoring Results .....</b> | <b>8</b>  |
| <b>4.3 Noise Monitoring Summary.....</b>                  | <b>8</b>  |
| <b>5. SURFACE WATER MONITORING .....</b>                  | <b>8</b>  |
| <b>5.1 Discharge Monitoring Results.....</b>              | <b>9</b>  |
| <b>5.2 Monthly Monitoring Results.....</b>                | <b>10</b> |
| <b>5.3 Surface Water Results Summary .....</b>            | <b>11</b> |
| <b>6. GROUNDWATER MONITORING .....</b>                    | <b>12</b> |
| <b>6.1 Groundwater Levels .....</b>                       | <b>12</b> |

## TABLES

|          |                                                                               |    |
|----------|-------------------------------------------------------------------------------|----|
| Table 1  | Licence Information .....                                                     | 1  |
| Table 2  | PA 09_0175 Long term impact assessment criteria for particulate matter .....  | 1  |
| Table 3  | PA 09_0175 Short term impact assessment criteria for particulate matter ..... | 1  |
| Table 4  | PA 09_0175 Long term impact assessment criteria for Deposited Dust .....      | 1  |
| Table 5  | Air Quality Monitoring Locations for Karuah East Quarry .....                 | 1  |
| Table 6  | Insoluble Solids (g/m <sup>2</sup> /month) for the Year to Date.....          | 2  |
| Table 7  | High Volume Air Sampling (µg/m <sup>3</sup> ) results .....                   | 2  |
| Table 8  | Blasting criteria .....                                                       | 5  |
| Table 9  | Blast Monitoring Results.....                                                 | 5  |
| Table 10 | Operational Noise Criteria (dB(A) LA <sub>eq</sub> (15min)) .....             | 6  |
| Table 11 | Noise Monitoring Program .....                                                | 6  |
| Table 12 | Operator Attended Noise Survey Results .....                                  | 8  |
| Table 13 | Unattended Continuous Noise Monitoring Results.....                           | 8  |
| Table 14 | Surface Water Discharge Monitoring Criteria.....                              | 9  |
| Table 15 | Surface Water Discharge Monitoring Results – Dam 1 .....                      | 9  |
| Table 16 | Surface Water Discharge Monitoring Results – Dam 2.....                       | 9  |
| Table 17 | Surface Water Discharge Monitoring Results – Dam 3.....                       | 9  |
| Table 18 | Surface Water Monthly Monitoring Results – Sediment Dams .....                | 10 |
| Table 19 | Surface Water Monthly Monitoring Results – Drain lines .....                  | 11 |
| Table 20 | Groundwater Monitoring Program.....                                           | 12 |
| Table 21 | Groundwater Levels.....                                                       | 12 |

## FIGURES

|          |                                                    |   |
|----------|----------------------------------------------------|---|
| Figure 1 | High Volume Air Sampling – Long term results ..... | 3 |
|----------|----------------------------------------------------|---|

## 1. INTRODUCTION

This report has been 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 (EPA) Requirements for Publishing Pollution Monitoring Data (October 2013). This report summarises the required monitoring data under Environmental Protection Licence (EPL) 20611 for the Karuah East Quarry. This report also includes some monitoring requirements under Project Approval 09\_0175 and the approved Statement of Commitments (SoC).

A summary of the environmental data for November 2020 is covered in this report.

A summary of the licence information is provided in **Table 1** below.

**Table 1 Licence Information**

|                                                |                                                                                                                                 |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental Protection Licence Number</b> | 20611                                                                                                                           |
| <b>Licensee's Name</b>                         | Karuah East Quarry Pty Ltd                                                                                                      |
| <b>Licensee's Address</b>                      | Postal Address: PO Box 3284 Thornton NSW 2322<br><br>Quarry Location:<br>Lot 13 DP1024564<br>Pacific Highway<br>Karuah NSW 2324 |
| <b>Link to full Licence on the EPA Website</b> | <a href="#">EPL 20611</a>                                                                                                       |

## 2. DUST MONITORING

There are no specific dust criteria listed in the EPL, but the dust criteria (Tables 2-4) are listed in Schedule 3 Condition 13 of *Project Approval 09\_0175*.

**Table 2 PA 09\_0175 Long term impact assessment criteria for particulate matter**

| Pollutant                                      | Averaging period | <sup>4</sup> Criterion            |
|------------------------------------------------|------------------|-----------------------------------|
| Total suspended particulates (TSP)             | Annual           | <sup>1</sup> 90 µg/m <sup>3</sup> |
| Particulate matter < 10 µm (PM <sub>10</sub> ) | Annual           | <sup>1</sup> 30 µg/m <sup>3</sup> |

**Table 3 PA 09\_0175 Short term impact assessment criteria for particulate matter**

| Pollutant                                      | Averaging period | <sup>4</sup> Criterion            |
|------------------------------------------------|------------------|-----------------------------------|
| Particulate matter < 10 µm (PM <sub>10</sub> ) | Daily            | <sup>1</sup> 50 µg/m <sup>3</sup> |

**Table 4 PA 09\_0175 Long term impact assessment criteria for Deposited Dust**

| Pollutant                   | Averaging period | Maximum increase in deposited dust level | Maximum total deposited dust level     |
|-----------------------------|------------------|------------------------------------------|----------------------------------------|
| <sup>3</sup> Deposited dust | Annual           | <sup>2</sup> 2 g/m <sup>2</sup> /month   | <sup>4</sup> 4 g/m <sup>2</sup> /month |

**Notes to Tables 2-4:**

<sup>1</sup> Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources).

<sup>2</sup> Incremental impact (ie incremental increase in concentrations due to the project on its own).

<sup>3</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>4</sup> Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire, incidents, illegal activities or any other activity agreed by the Secretary in consultation with EPA.

All dust monitoring is undertaken in accordance with the *Approved Methods of Sampling and Analysis of Air Pollutants in NSW* (EPA, 2007).

Dust deposition and TSP/PM<sub>10</sub> monitoring is undertaken at Karuah East Quarry at the locations listed in **Table 5**.

**Table 5 Air Quality Monitoring Locations for Karuah East Quarry**

| Site ID                      | EPL ID | Location                         | Address                                 | GPS Coordinates                   |
|------------------------------|--------|----------------------------------|-----------------------------------------|-----------------------------------|
| DDG 1                        | MP 4   | South-East of Karuah East Quarry | 5760 Pacific Hwy, Karuah NSW 2324       | 32°38'04"S<br>151°59'58"E         |
| DDG 2                        | MP 5   | South-East of Karuah East Quarry | 5770 Pacific Hwy, Karuah NSW 2324       | 32°38'02"S<br>152°00'09"E         |
| DDG 3                        | MP 6   | East of Karuah East Quarry       | DP 1024341, Karuah                      | 32°37'57"S<br>151°59'41"E         |
| DDG 4                        | MP 7   | West of Karuah East Quarry       | 21 Halloran Rd, North Arm Cove NSW 2324 | 32° 37' 30.87"S<br>152°01'10.18"E |
| DDG 5                        | MP 8   | West of Karuah East Quarry       | Lot 21/DP 1024341 Karuah NSW 2324       | 32° 37' 55.33"S<br>152°00'2.74"E  |
| HVAS (TSP/PM <sub>10</sub> ) | MP 9   | South-East of Karuah East Quarry | 5770 Pacific Hwy, Karuah NSW 2324       | 32°38'03"S<br>152°00'09"E         |

## 2.1 Dust Deposition Results

Dust deposition results for November 2020 and the year to date are shown in **Table 6**.

**Table 6 Insoluble Solids (g/m<sup>2</sup>/month) for the Year to Date**

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

Note <sup>1</sup>: Rolling Annual Average from the EPL 20611 anniversary date of 9 April.

## 2.2 High Volume Air Sampling Results

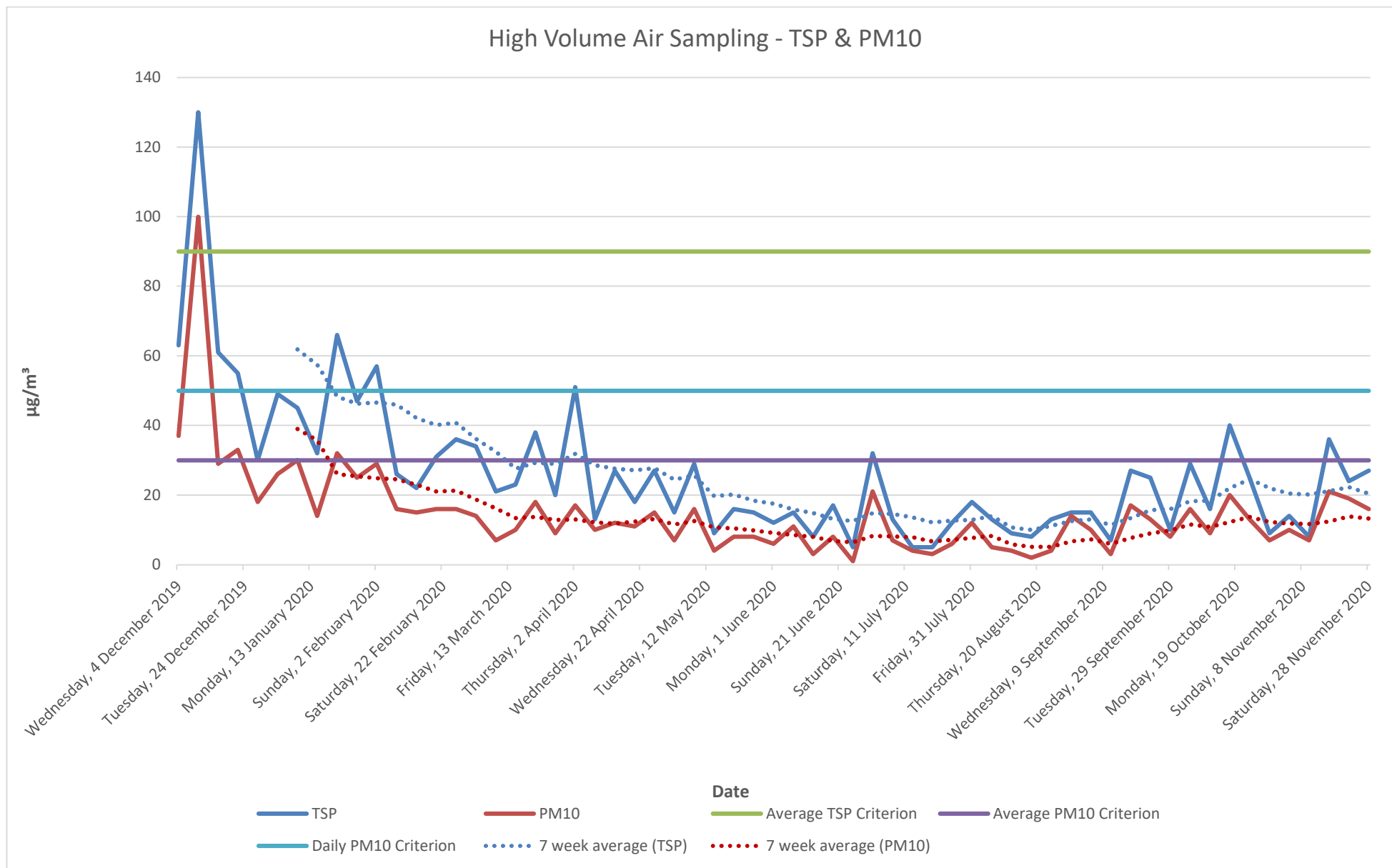
The TSP and PM<sub>10</sub> results for November 2020 are shown in **Table 7** with the long term monitoring results displayed in **Figure 1**.

**Table 7 High Volume Air Sampling (µg/m<sup>3</sup>) results**

| Date                                 | HVAS TSP (µg/m <sup>3</sup> ) | HVAS PM <sub>10</sub> (µg/m <sup>3</sup> ) |
|--------------------------------------|-------------------------------|--------------------------------------------|
| 4/11/2020                            | 14                            | 10                                         |
| 10/11/2020                           | 8                             | 7                                          |
| 16/11/2020                           | 36                            | 21                                         |
| 22/11/2020                           | 24                            | 19                                         |
| 28/11/2020                           | 27                            | 16                                         |
| <sup>1</sup> 24hr Max Criteria       | N/A                           | 50                                         |
| <sup>2</sup> Rolling Annual Average  | 23                            | 12                                         |
| <sup>1</sup> Annual Average Criteria | 90                            | 30                                         |

**Note:** 1. Maximum criteria as specified in PA 09\_0175  
2. Rolling Annual Average from the EPL 20611 anniversary date of 9 April.

**Figure 1 High Volume Air Sampling – Long term results**



### **2.3 Dust Monitoring Results Summary**

All dust monitoring results to the end of November 2020 indicate that the Dust Deposition (Insoluble Solids), TSP and PM10 levels recorded were below the project criterion.



### 3. BLAST MONITORING RESULTS

The conditions stipulated for blasting is referred to in Condition L5 and M7 of EPL 20611 and Schedule 3, Condition 8 of PA 09\_0175. Blast monitoring is undertaken at every blast. **Table 8** summarises the blast monitoring criteria.

**Table 8** Blasting criteria

| Location                                                            | Airblast overpressure<br>(dB(Lin Peak)) | Ground 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 |

Summary of blasting results are shown in **Table 9**.

**Table 9** Blast Monitoring Results

| Date and time                  | Overpressure and vibration | Location B<br>(Nearest Residence) |
|--------------------------------|----------------------------|-----------------------------------|
| <b>9/11/2020<br/>12:28 PM</b>  | Overpressure dB(L)         | n/t                               |
|                                | Vibration (mm/s)           | n/t                               |
| <b>25/11/2020<br/>11:28 AM</b> | Overpressure dB(L)         | n/t                               |
|                                | Vibration (mm/s)           | n/t                               |

## 4. NOISE MONITORING

Schedule 3 Condition 3 of the Project Approval and Condition L4.1 of the EPL requires Karuah East Quarry to ensure noise generated by Quarry operations does not exceed criteria outlined in **Table 10**.

**Table 10 Operational Noise Criteria (dB(A) LA<sub>eq(15min)</sub>)**

| Location                        | Criteria ( <sup>1</sup> day) |
|---------------------------------|------------------------------|
| Residence on Lot 11 DP 10244564 | 43                           |
| A                               | 40                           |
| B                               | 37                           |
| G                               | 38                           |
| All other residence             | 35                           |

**Note <sup>1</sup>:** A day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays.

The noise criteria shown in **Table 10** is not indicative of the construction noise criteria for the Karuah East Quarry project. Construction noise criteria has been developed based on the *NSW EPA Interim Construction Noise Guideline* for each location and is set out in Table 9 of the approved [Noise Management Plan \(SLR, 2015\)](#).

In accordance with Schedule 3 Condition 5 and Condition 7 of the Project Approval and the [Noise Management Plan \(SLR, 2015\)](#) a noise monitoring program has been implemented. Summary of this monitoring program is outlined in **Table 11**.

**Table 11 Noise Monitoring Program**

| Construction Noise Monitoring |                       |                                                                      |                                                                 |
|-------------------------------|-----------------------|----------------------------------------------------------------------|-----------------------------------------------------------------|
| Monitoring Method             | <sup>1</sup> Location | Frequency                                                            | <sup>2</sup> Criteria (dB(A) LA <sub>eq(15min)</sub> )          |
| Attended noise monitoring     | F                     | At the commencement of new activities and a min of once per quarter. | 54                                                              |
| Attended noise monitoring     | G                     | At the commencement of new activities and a min of once per quarter. | 44                                                              |
| Operational Noise Monitoring  |                       |                                                                      |                                                                 |
| Monitoring Method             | <sup>1</sup> Location | Frequency                                                            | <sup>2</sup> Criteria                                           |
| Attended noise monitoring     | F, G                  | Quarterly                                                            | As per Table 10, 12 and 13 <a href="#">Noise MP (SLR, 2015)</a> |
| Unattended noise monitoring   | G                     | Quarterly                                                            | As per Table 10, 12 and 13 <a href="#">Noise MP (SLR, 2015)</a> |

**Note:**

- Monitoring locations are shown in Appendix 1.
- Criteria is for daytime limits. Daytime is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays.

### 4.1 Operator Attended Monitoring Results

The results of the operator attended noise surveys are presented in **Table 12**. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, adjacent quarry and Karuah East Quarry. The table provides the following information:

a) Monitoring location and serial number of the noise logger;

- b) Date, start time, and wind conditions at the measurement location; and
- c) Typical maximum (LAmax) and contributed noise levels.

Quarry contributions listed in the tables are from Karuah East Quarry and are stated only when a contribution could be quantified.

**Table 12 Operator Attended Noise Survey Results**

| Location | Date/Start Time/<br>Weather | Primary Noise Descriptor<br>(dBA re 20 µPa) |                  |                   |                   |                   | Description of Noise Emissions and<br>Typical Maximum Noise Levels (dBA) |
|----------|-----------------------------|---------------------------------------------|------------------|-------------------|-------------------|-------------------|--------------------------------------------------------------------------|
|          |                             | L <sub>A</sub> max                          | L <sub>A</sub> 1 | L <sub>A</sub> 10 | L <sub>A</sub> 90 | L <sub>A</sub> eq |                                                                          |
| A        | 04/11/2020                  | 58                                          | 54               | 47                | 41                | 44                | Birds 35 - 40                                                            |
|          | 10:40 am                    |                                             |                  |                   |                   |                   |                                                                          |
|          | Calm                        | Karuah East Quarry inaudible                |                  |                   |                   |                   |                                                                          |
| B        | 04/11/2020                  | 75                                          | 70               | 66                | 57                | 63                | Pacific Highway 55 - 65                                                  |
|          | 11:35 am                    |                                             |                  |                   |                   |                   | Birds 40-45                                                              |
|          | Calm                        | Karuah East Quarry inaudible                |                  |                   |                   |                   |                                                                          |
| F        | 04/11/2020                  | 76                                          | 60               | 48                | 40                | 49                | Birds 40                                                                 |
|          | 12:44 pm                    |                                             |                  |                   |                   |                   | Local Traffic 50 – 55                                                    |
|          | Calm                        | Karuah East Quarry inaudible                |                  |                   |                   |                   |                                                                          |
| G        | 04/11/2020                  | 59                                          | 50               | 42                | 36                | 41                | Birds 30 - 35                                                            |
|          | 10:00 am                    |                                             |                  |                   |                   |                   | Pacific Highway 35 - 40                                                  |
|          | Calm                        | Karuah East Quarry audible                  |                  |                   |                   |                   | Karuah East Quarry 30 - 36                                               |

## 4.2 Unattended Continuous Monitoring Results

**Table 13 Unattended Continuous Noise Monitoring Results**

| INP Period         | Units | L <sub>A1</sub> | L <sub>A10</sub> | L <sub>A90</sub> | L <sub>Aeq</sub> |
|--------------------|-------|-----------------|------------------|------------------|------------------|
| Daytime            | dBA   | 56              | 49               | 41               | 49               |
| Evening            | dBA   | 57              | 50               | 41               | 48               |
| Night <sup>3</sup> | dBA   | 52              | 48               | 37               | 46               |

## 4.3 Noise Monitoring Summary

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

## 6. SURFACE WATER MONITORING

Condition M2 of the EPL outlines the requirement to monitor surface water discharges from Karuah East Quarry via the three licensed discharge points (LDP001, LDP002, LDP003). The *Statement of Commitments* (Appendix 6, PA 09\_0175) requires additional surface water monitoring to be undertaken for the first twelve months of operations. This additional water monitoring requires monthly sampling to be undertaken at the three licensed discharge points and at four locations on Yalimbah and Bulga Creeks when in flow.

All discharged water from the three licensed discharge points are required to meet the water quality concentration limits as stipulated in Condition L2.4 of the EPL. This criterion is shown in **Table 14** below.

**Table 14 Surface Water Discharge Monitoring Criteria**

| Sampling Points | Pollutant    | Unit     | EPL Limit             |
|-----------------|--------------|----------|-----------------------|
| LDP001 (Dam 1)  | pH           | pH units | 6.5 – 8.5             |
| LDP002 (Dam 2)  | TSS          | mg/L     | 40                    |
| LDP003 (Dam 3)  | Oil & Grease | mg/L     | 5 and/or none visible |

### 6.1 Discharge Monitoring Results

No controlled discharge occurred throughout November.

**Table 15 Surface Water Discharge Monitoring Results – Dam 1**

| Date                 | LDP001 (Dam 1) |           |              |
|----------------------|----------------|-----------|--------------|
|                      | pH (Lab)       | TSS       | Oil & Grease |
| <b>EPL Criterion</b> | <b>6.5-8.5</b> | <b>40</b> | <b>5</b>     |
| -                    | -              | -         | -            |

**Units:** pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L

**Table 16 Surface Water Discharge Monitoring Results – Dam 2**

| Date                 | LDP002 (Dam 2) |           |              |
|----------------------|----------------|-----------|--------------|
|                      | pH (Lab)       | TSS       | Oil & Grease |
| <b>EPL Criterion</b> | <b>6.5-8.5</b> | <b>40</b> | <b>5</b>     |
| -                    | -              | -         | -            |

**Units:** pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L

**Table 17 Surface Water Discharge Monitoring Results – Dam 3**

| Date                 | LDP003 (Dam 3) |           |              |
|----------------------|----------------|-----------|--------------|
|                      | pH (Lab)       | TSS       | Oil & Grease |
| <b>EPL Criterion</b> | <b>6.5-8.5</b> | <b>40</b> | <b>5</b>     |
| -                    | -              | -         | -            |

**Units:** pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L

## 6.2 Monthly Monitoring Results

Monthly water sampling was undertaken on the 2 November 2020.

Summary of monthly monitoring results is shown in **Table 18** and **Table 19**.

**Table 18 Surface Water Monthly Monitoring Results – Sediment Dams**

| Date       | LDP001 (Dam 1) |     |              |      | LDP002 (Dam 2) |     |              |      | LDP003 (Dam 3) |     |              |      |
|------------|----------------|-----|--------------|------|----------------|-----|--------------|------|----------------|-----|--------------|------|
|            | pH (Lab)       | TSS | Oil & Grease | EC   | pH (Lab)       | TSS | Oil & Grease | EC   | pH (Lab)       | TSS | Oil & Grease | EC   |
| 19/01/2018 | 7.29           | 9   | <5           | 665  | 7.29           | 37  | <5           | 434  | 7.08           | 10  | 6            | 925  |
| 16/02/2018 | 7.71           | 9   | <5           | 662  | 6.48           | 22  | <5           | 548  | 7.21           | 16  | <5           | 1075 |
| 20/03/2018 | 6.95           | 19  | <5           | 574  | 6.81           | 6   | <5           | 535  | 7.37           | 27  | <5           | 788  |
| 18/04/2018 | 6.40           | 5   | <5           | 529  | 7.70           | 17  | <5           | 490  | 7.10           | 17  | <5           | 830  |
| 18/05/2018 | 5.86           | 12  | <5           | 555  | 5.80           | 4   | <5           | 345  | 6.48           | 21  | <5           | 654  |
| 19/06/2018 | 7.33           | 76  | <5           | 496  | 7.51           | 828 | <5           | 171  | 7.28           | 418 | <5           | 347  |
| 20/07/2018 | 6.50           | 12  | <5           | 600  | 6.80           | 5   | <5           | 540  | 7.40           | 63  | <5           | 570  |
| 17/08/2018 | 6.71           | 12  | <5           | 553  | 6.64           | 5   | <5           | 604  | 7.16           | 14  | <5           | 622  |
| 14/09/2018 | 7.09           | 33  | <5           | 508  | 6.37           | 7   | <5           | 405  | 6.94           | 6   | <5           | 520  |
| 19/10/2018 | 6.78           | 81  | <5           | 593  | 6.77           | 191 | <5           | 268  | 8.07           | 38  | <5           | 688  |
| 15/11/2018 | 7.42           | 76  | <5           | 1035 | 6.76           | 14  | <5           | 470  | 8.01           | 23  | <5           | 833  |
| 18/12/2018 | 7.20           | 98  | <5           | 430  | 4.62           | 162 | <5           | 193  | 7.57           | 341 | <5           | 758  |
| 18/01/2019 | 7.13           | 10  | <5           | 975  | 6.55           | 17  | <5           | 533  | 8.15           | 43  | <5           | 975  |
| 18/02/2019 | 7.12           | 19  | <5           | 616  | 6.53           | 19  | <5           | 563  | 8.35           | 23  | <5           | 1140 |
| 20/03/2019 | 6.89           | 44  | <5           | 494  | 5.29           | 185 | <5           | 182  | 7.57           | 30  | <5           | 915  |
| 16/04/2019 | 8.03           | 415 | <5           | 538  | 7.30           | 109 | <5           | 265  | 7.49           | 164 | <5           | 998  |
| 15/05/2019 | 6.78           | 406 | <5           | 520  | 6.71           | 135 | <5           | 327  | 7.69           | 19  | <5           | 1049 |
| 12/06/2019 | 6.5            | 13  | <5           | 631  | 6.37           | 25  | <5           | 288  | 7.63           | 12  | <5           | 846  |
| 15/07/2019 | 6.79           | 19  | <5           | 524  | 6.37           | 9   | <5           | 468  | 6.96           | 6   | <5           | 1036 |
| 14/08/2019 | 6.8            | 17  | <5           | 780  | 6.67           | 21  | <5           | 472  | 7.97           | <5  | <5           | 1230 |
| 12/09/2019 | 6.47           | 15  | <5           | 706  | 6.56           | 56  | <5           | 414  | 8.03           | 15  | <5           | 1144 |
| 16/10/2019 | 7.11           | 187 | <5           | 561  | 6.73           | 13  | <5           | 1074 | 6.98           | 25  | <5           | 993  |
| 14/11/2019 | 6.95           | 164 | <5           | 616  | 6.72           | 9   | <5           | 1235 | 8.58           | 10  | <5           | 1172 |
| 12/12/2019 | -              | -   | -            | -    | 7.2            | 26  | <5           | 1417 | 7.51           | 25  | <5           | 1309 |
| 13/01/2020 | -              | -   | -            | -    | 6.78           | 67  | <5           | 1820 | 7.78           | 6   | <5           | 1588 |
| 13/02/2020 | 6.61           | 48  | <5           | 554  | 6.52           | 271 | <5           | 190  | 8.08           | 27  | <5           | 740  |
| 12/03/2020 | 7.06           | 50  | <5           | 686  | 7.02           | 124 | <5           | 388  | 7.76           | 77  | <5           | 943  |
| 14/04/2020 | 7.15           | 35  | <5           | 728  | 6.95           | 31  | <5           | 445  | 7.74           | 287 | <5           | 904  |
| 7/05/2020  | 6.88           | 43  | <5           | 751  | 6.62           | 88  | <5           | 503  | 8.78           | 38  | <5           | 945  |
| 4/06/2020  | 6.22           | 21  | <5           | 724  | 5.92           | 17  | <5           | 466  | 8.42           | 16  | <5           | 836  |
| 2/07/2020  | 6.61           | 21  | <5           | 816  | 6.28           | 10  | <5           | 583  | 8.37           | 16  | <5           | 782  |
| 3/08/2020  | 6.7            | 144 | <5           | 687  | 6.5            | 102 | <5           | 278  | 6.81           | 177 | <5           | 577  |
| 1/09/2020  | 7.2            | 36  | <5           | 796  | 6.6            | 13  | <5           | 704  | 7.63           | 27  | <5           | 612  |
| 1/10/2020  | -              | -   | -            | -    | 6.9            | 11  | <5           | 843  | 9.16           | 13  | <5           | 861  |
| 2/11/2020  | 6.7            | 64  | <5           | 844  | 6.5            | 20  | <5           | 737  | 7.04           | 305 | <5           | 469  |

**Units:** pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L, Electrical Conductivity (EC) in  $\mu\text{S}/\text{cm}$

**Table 19 Surface Water Monthly Monitoring Results – Drain lines**

| Date       | SW1 (Bulga Creek) |     |              |    | SW2 (Bulga Creek) |     |              |     | SW4 (Yalimbah Creek) |     |              |     |
|------------|-------------------|-----|--------------|----|-------------------|-----|--------------|-----|----------------------|-----|--------------|-----|
|            | pH (Lab)          | TSS | Oil & Grease | EC | pH (Lab)          | TSS | Oil & Grease | EC  | pH (Lab)             | TSS | Oil & Grease | EC  |
| 19/01/2018 | -                 | -   | -            | -  | -                 | -   | -            | -   | -                    | -   | -            | -   |
| 16/02/2018 | -                 | -   | -            | -  | -                 | -   | -            | -   | -                    | -   | -            | -   |
| 20/03/2018 | -                 | -   | -            | -  | -                 | -   | -            | -   | -                    | -   | -            | -   |
| 18/04/2018 | -                 | -   | -            | -  | 6.60              | 9   | <5           | 550 | -                    | -   | -            | -   |
| 18/05/2018 | -                 | -   | -            | -  | 5.75              | 5   | <5           | 536 | -                    | -   | -            | -   |
| 19/06/2018 | -                 | -   | -            | -  | 7.10              | 72  | <5           | 255 | 6.55                 | 61  | <5           | 259 |
| 20/07/2018 | -                 | -   | -            | -  | 6.50              | 14  | <5           | 410 | -                    | -   | -            | -   |
| 17/08/2018 | -                 | -   | -            | -  | 6.52              | 16  | <5           | 385 | -                    | -   | -            | -   |
| 14/09/2018 | -                 | -   | -            | -  | 6.72              | 10  | <5           | 304 | -                    | -   | -            | -   |
| 19/10/2018 | -                 | -   | -            | -  | 6.34              | 20  | <5           | 533 | -                    | -   | -            | -   |
| 15/11/2018 | -                 | -   | -            | -  | 6.57              | 19  | <5           | 426 | -                    | -   | -            | -   |
| 18/12/2018 | -                 | -   | -            | -  | 6.45              | 63  | <5           | 520 | -                    | -   | -            | -   |
| 18/01/2019 | -                 | -   | -            | -  | 6.86              | 24  | <5           | 533 | -                    | -   | -            | -   |
| 1/06/2019  | -                 | -   | -            | -  | 6.17              | 11  | <5           | 531 | -                    | -   | -            | -   |
| 15/07/2019 | -                 | -   | -            | -  | 6.99              | <5  | <5           | 526 | -                    | -   | -            | -   |
| 14/08/2019 | -                 | -   | -            | -  | 6.45              | 8   | <5           | 501 | -                    | -   | -            | -   |
| 12/09/2019 | -                 | -   | -            | -  | 6.86              | 18  | <5           | 563 | -                    | -   | -            | -   |
| 16/10/2019 | -                 | -   | -            | -  | 6.7               | 26  | <5           | 570 | -                    | -   | -            | -   |
| 14/11/2019 | -                 | -   | -            | -  | 6.92              | 22  | <5           | 562 | -                    | -   | -            | -   |
| 12/12/2019 | -                 | -   | -            | -  | 7.24              | 21  | <5           | 584 | -                    | -   | -            | -   |
| 13/01/2020 | -                 | -   | -            | -  | -                 | -   | -            | -   | -                    | -   | -            | -   |
| 13/02/2020 | -                 | -   | -            | -  | 5.93              | 60  | <5           | 496 | -                    | -   | -            | -   |
| 12/03/2020 | -                 | -   | -            | -  | 6.41              | 25  | <5           | 610 | -                    | -   | -            | -   |
| 14/04/2020 | -                 | -   | -            | -  | 6.91              | 74  | <5           | 554 | -                    | -   | -            | -   |
| 7/05/2020  | -                 | -   | -            | -  | 7.12              | 42  | <5           | 674 | -                    | -   | -            | -   |
| 4/06/2020  | -                 | -   | -            | -  | 6.69              | 13  | <5           | 703 | -                    | -   | -            | -   |
| 2/07/2020  | -                 | -   | -            | -  | 7.86              | 16  | <5           | 782 | -                    | -   | -            | -   |
| 3/08/2020  | -                 | -   | -            | -  | 6.46              | 85  | <5           | 509 | -                    | -   | -            | -   |
| 1/09/2020  | -                 | -   | -            | -  | 7.49              | 17  | <5           | 735 | -                    | -   | -            | -   |
| 1/10/2020  | -                 | -   | -            | -  | 6.63              | 15  | <5           | 707 | -                    | -   | -            | -   |
| 2/11/2020  | -                 | -   | -            | -  | 3.23              | 56  | <5           | 633 | -                    | -   | -            | -   |

Units: pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L, Electrical Conductivity (EC) in  $\mu\text{S}/\text{cm}$

### 6.3 Surface Water Results Summary

No controlled discharge occurred during the month of November.

The monthly water monitoring was conducted on the 2 November.

## 7. GROUNDWATER MONITORING

Groundwater monitoring is undertaken to meet the *EA Statement of Commitments* (Appendix 6, PA 09\_0175) and Section 8.2 [Water Management Plan \(SLR, 2015\)](#). Groundwater levels are monitored quarterly and water quality biannually at four groundwater monitoring bores (piezometers). Details of this monitoring program is shown in **Table 20**. Refer to Appendix 1 for piezometer locations.

**Table 20 Groundwater Monitoring Program**

| Piezometer         | Location         | Water Level<br>monitoring frequency | Water Quality<br>monitoring frequency |
|--------------------|------------------|-------------------------------------|---------------------------------------|
| <sup>1</sup> BH205 | Lot 13/DP1024564 | Quarterly                           | Biannually                            |
| <sup>2</sup> BH207 | Lot 13/DP1024564 | Quarterly                           | Biannually                            |
| BH208              | Lot 21/DP1024341 | Quarterly                           | Biannually                            |
| BH303              | Lot 21/DP1024341 | Quarterly                           | Biannually                            |

**Note:** 1. Piezometer BH205 was relocated approximately 30m to the west on 13 March 2017  
2. Piezometer BH207 was relocated approximately 60m to the north on 26 September 2016.

### 7.1 Groundwater Levels

**Table 21 Groundwater Levels**

| Date       | Unit                | <sup>2</sup> BH205 | <sup>3</sup> BH207 | BH208 | BH303 |
|------------|---------------------|--------------------|--------------------|-------|-------|
| 17/01/2018 | <sup>1</sup> metres | 21.98              | 9.12               | 20.27 | 30.67 |
| 18/04/2018 | <sup>1</sup> metres | 21.69              | 9.20               | 20.47 | 30.80 |
| 26/07/2018 | <sup>1</sup> metres | 20.46              | 8.89               | 20.49 | 30.86 |
| 31/10/2018 | <sup>1</sup> metres | 20.40              | 9.30               | 19.98 | 30.80 |
| 18/01/2019 | <sup>1</sup> metres | 20.11              | 9.21               | 20.44 | 30.96 |
| 30/04/2019 | <sup>1</sup> metres | 20.30              | 9.20               | 20.45 | 30.61 |
| 23/07/2019 | <sup>1</sup> metres | 19.68              | 9.08               | 20.57 | 31.09 |
| 30/10/2019 | <sup>1</sup> metres | 18.6               | 8.23               | 20.55 | 30.70 |
| 14/01/2020 | <sup>1</sup> metres | 19.95              | 9.25               | 20.71 | 31.20 |
| 14/04/2020 | <sup>1</sup> metres | 18.37              | 8.3                | 20.59 | 30.40 |
| 27/07/2020 | <sup>1</sup> metres | 18.18              | 8.34               | 20.74 | 31.21 |
| 1/10/2020  | <sup>1</sup> metres | 16.66              | 7.7                | 20.7  | 30.87 |

**Note:** 1. Groundwater levels are measured in metres below ground level.



# **APPENDIX 1**

## **Monitoring Locations**

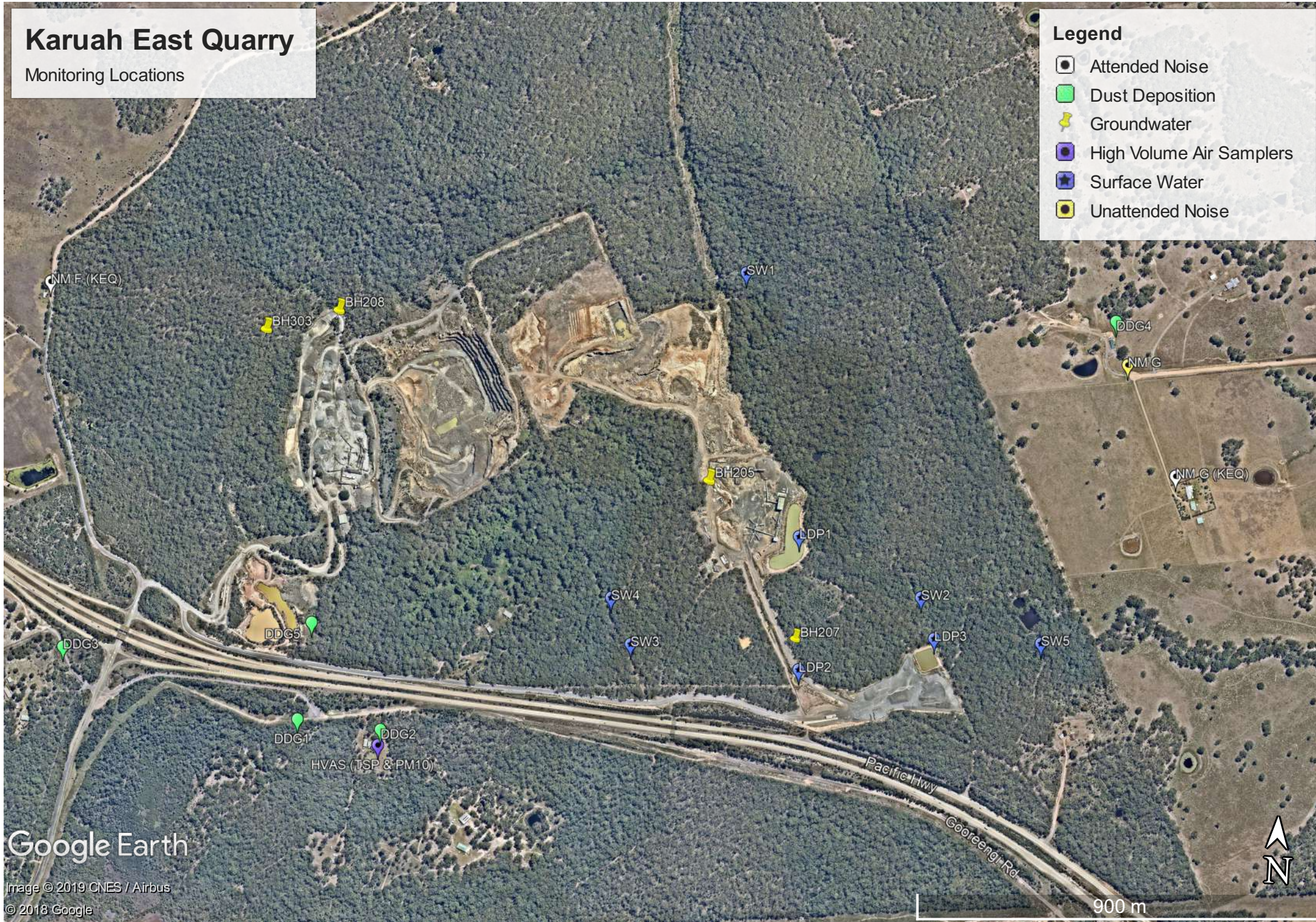


# Karuah East Quarry

Monitoring Locations

## Legend

- Attended Noise
- Dust Deposition
- Groundwater
- High Volume Air Samplers
- Surface Water
- Unattended Noise



Google Earth

Image © 2019 CNES / Airbus  
© 2018 Google