
# Karuah East Quarry

## Monthly Environmental Monitoring Report

**May 2017**

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## TABLES

# 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.

A summary of the environmental data for May 2017 is covered in this report.

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

**Table 1 Licence Information**

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

# 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 | [4]Criterion |
|---|---|---|
| Total suspended particulates (TSP) | Annual | [1]90 µg/m³ |
| Particulate matter < 10 µm (PM10) | Annual | [1]30 µg/m³ |

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

| Pollutant | Averaging period | [4]Criterion |
|---|---|---|
| Particulate matter < 10 µm (PM10) | Daily | [1]50 µg/m³ |

**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 |
|---|---|---|---|
| [3]Deposited dust | Annual | [2]2 g/m²/month | [1]4 g/m²/month |

***Notes to Tables 2-4:***

*[1] Total impact (ie incremental increase in concentrations due to the project plus background concentrations due*

*to all other sources).*
*[2] Incremental impact (ie incremental increase in concentrations due to the project on its own).*
*[3] **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.*
*[4] 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.*

Dust deposition and TSP/$PM_{10}$ 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 | Location | Address | GPS Coordinates |
|---|---|---|---|
| DDG 1 | South-East of Karuah East Quarry | 5760 Pacific Hwy, Karuah NSW 2324 | 32°38'04''S 151°59'58''E |
| DDG 2 | South-East of Karuah East Quarry | 5770 Pacific Hwy, Karuah NSW 2324 | 32°38'02''S 152°00'09''E |
| DDG 3 | East of Karuah East Quarry | DP 1024341, Karuah | 32°37'57''S 151°59'41''E |
| DDG 4 | West of Karuah East Quarry | 21 Halloran Rd, North Arm Cove NSW 2324 | 32° 37' 30.87"S 152°01'10.18"E |
| DDG 5 | West of Karuah East Quarry | Lot 21/DP 1024341 Karuah NSW 2324 | 32° 37' 55.33"S 152°00'2.74"E |
| HVAS (TSP/PM10) | South-East of Karuah East Quarry | 5770 Pacific Hwy, Karuah NSW 2324 | 32°38'03''S 152°00'09''E |

## 2.1 Dust Deposition Results

Dust deposition results for May 2017 and the year to date are shown in **Table 6**.

**Table 6 Insoluble Solids (g/m²/month) for the Year to Date**

| Date | DDG 1 | DDG 2 | DDG 3 | DDG 4 | DDG 5 |
|---|---|---|---|---|---|
| **7/9/2015 to 8/10/2015** | 0.8 | 0.4 | 0.3 | 0.3 | - |
| **8/10/2015 to 6/11/2015** | 1.3 | 1.2 | 0.6 | 0.5 | - |
| **6/11/2015 to 8/12/2015** | 2.1 | 0.8 | 0.8 | 4.1 | - |
| **8/12/2015 to 8/1/2016** | 6.4 | 0.9 | 0.6 | 1.2 | - |
| **8/1/2016 to 8/2/2016** | 1.4 | 0.9 | 1.1 | 1.2 | - |
| **8/2/2016 to 3/3/2016** | 4.0 | 0.7 | 0.6 | 0.9 | - |
| **3/3/2016 to 4/4/2016** | 3.1 | 0.3 | 1.0 | 2.0 | - |
| **4/4/2016 to 6/5/2016** | 1.5 | 1.1 | 0.4 | 3.2 | - |
| **6/5/2016 to 3/6/2016** | 1.0 | 0.9 | 0.7 | 0.4 | - |
| **3/6/2016 to 4/7/2016** | 0.4 | 1.6 | 0.5 | 0.3 | - |
| **4/7/2016 to 1/8/2016** | 1.4 | 0.7 | 0.3 | 0.5 | - |
| **1/8/2016 to 31/8/2016** | 2.7 | 3.0 | 0.8 | 0.7 | - |
| **31/8/2016 to 28/9/2016** | 2.1 | 1.6 | 0.8 | 0.8 | 0.9 |
| **28/9/2016 to 26/10/2016** | 0.8 | 0.6 | 0.8 | 0.5 | 0.7 |
| **26/10/2016 to 23/11/2016** | 0.7 | 1.0 | 1.3 | 2.3 | 1.9 |
| **23/11/2016 to 21/12/2016** | 1.3 | 0.5 | 0.9 | 1.0 | 4.2 |

| | | | | | |
|---|---|---|---|---|---|
| **21/12/2016 to 18/01/2017** | 0.4 | 0.8 | 0.7 | 2.5 | 3.1 |
| **18/01/2017 to 16/02/2017** | 1.3 | 0.9 | 1.2 | 1.2 | 1.9 |
| **16/02/2017 to 20/03/2017** | 0.4 | 1.4 | 0.5 | 3.8 | 1.3 |
| **20/03/2017 to 21/04/2017** | 0.6 | 0.7 | 0.5 | 0.8 | 1.3 |
| **21/04/2017 to 23/05/2017** | **0.6** | **0.6** | **1.1** | **0.8** | **0.8** |
| **[1]Rolling Annual Average** | 0.9 | 0.9 | 0.9 | 1.5 | 1.8 |

**Note [1]:** Rolling Annual Average from the EPL 20611 anniversary date of 26 August.

## 2.2 High Volume Air Sampling Results

The monthly results for TSP and PM10 are shown in **Table 7**.

**Table 7 High Volume Air Sampling (µg/m³) results**

| Date | HVAS TSP (µg/m³) | HVAS PM10 (µg/m³) |
|---|---|---|
| 29/04/2016 | 23 | 18 |
| 05/05/2016 | 20 | 18 |
| 11/05/2016 | 17 | 8 |
| 17/05/2016 | 25 | 19 |
| 23/05/2016 | 35 | 20 |
| 29/05/2016 | 11 | 5 |
| 04/06/2016 | 9 | 8 |
| 10/06/2016 | 11 | 4 |
| 16/06/2016 | 10 | 8 |
| 22/06/2016 | 11 | 4 |
| 28/06/2016 | 11 | 6 |
| 04/07/2016 | 20 | 5 |
| 10/07/2016 | 10 | 6 |
| 16/07/2016 | 10 | 8 |
| 22/07/2016 | 14 | 7 |
| 28/07/2016 | 9 | 5 |
| 03/08/2016 | 27 | 14 |
| 09/08/2016 | 11 | 6 |
| 15/08/2016 | 18 | 12 |
| 21/08/2016 | 10 | 5 |
| 27/08/2016 | 9 | 4 |
| 02/09/2016 | 11 | 7 |
| 08/09/2016 | 15 | 8 |
| 14/09/2016 | 11 | 6 |
| 20/09/2016 | 16 | 9 |
| 26/09/2016 | *Breakdown* | *Breakdown* |
| 02/10/2016 | 18 | 7 |
| 08/10/2016 | 35 | 21 |
| 14/10/2016 | 12 | 8 |
| 20/10/2016 | 19 | 11 |
| 26/10/2016 | 21 | 12 |
| 01/11/2016 | 19 | 9 |
| 07/11/2016 | 74 | 50 |

| | | |
|---|---|---|
| 13/11/2016 | 27 | 14 |
| 19/11/2016 | 40 | 14 |
| 25/11/2016 | 28 | 13 |
| 01/12/2016 | 25 | 12 |
| 07/12/2016 | 16 | 14 |
| 13/12/2016 | 41 | 21 |
| 19/12/2016 | 41 | 23 |
| 25/12/2016 | 19 | 13 |
| 31/12/2016 | 34 | 22 |
| 06/01/2017 | 30 | 14 |
| 12/01/2017 | 42 | 24 |
| 18/01/2017 | 44 | 18 |
| 24/01/2017 | 40 | 21 |
| 30/01/2017 | 34 | 18 |
| 05/02/2017 | 40 | 24 |
| 11/02/2017 | 54 | 36 |
| 17/02/2017 | 41 | 20 |
| 23/02/2017 | 30 | 16 |
| 01/03/2017 | 13 | 11 |
| 07/03/2017 | 30 | 16 |
| 13/03/2017 | 30 | 18 |
| 19/03/2017 | 21 | 15 |
| 25/03/2017 | 25 | 17 |
| 31/03/2017 | 25 | 14 |
| 06/04/2017 | 12 | 7 |
| 12/04/2017 | 13 | 6 |
| 18/04/2017 | 17 | 11 |
| 24/04/2017 | 18 | 10 |
| 30/04/2017 | 18 | 10 |
| 06/05/2017 | 17 | 5 |
| 12/05/2017 | 23 | 14 |
| 18/05/2017 | 20 | 10 |
| 24/05/2017 | 23 | 9 |
| 30/05/2017 | 20 | 9 |
| **[1]24hr Max Criteria** | **N/A** | **50** |
| **Report Average** | 20.6 | 10.0 |
| **[2]Rolling Annual Average** | 26.1 | 13.2 |
| **[1]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 26 August.

## 2.3 Dust Monitoring Results Summary

All monitoring results to the end of May 2017 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 (dB(Lin Peak) | Ground vibration (mm/s) | Allowable exceedance |
|---|---|---|---|
| Any residence on privately-owned land, or any public infrastructure | 120 | 10 | 0% |
| | 115 | 5 | 5% of the total number of blasts over a period of 12 months |

Summary of the blasting results is shown in **Table 9**.

**Table 9 Blast Monitoring Results**

| Date and time | Overpressure and vibration | Monitor 1 (Front Gate) | Monitor 2 (Nearest Residence) |
|---|---|---|---|
| 15/05/2017 12:05 PM | Overpressure dB(L) | Below detection limits | Below detection limits |
| | Vibration (mm/s) | Below detection limits | Below detection limits |

As shown in Table 9, one blast was undertaken on 16 May 2017 and was below the EPL limits for overpressure and ground vibration. This was a small blasting event and as such, it was below the set minimum trigger levels at Monitor 1 and Monitor 2. Blast monitoring triggers at Karuah East Quarry are set at 88 dB(L) for overpressure and 0.37mm/s for ground vibration.

# 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) $LA_{eq(15min)}$)**

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

**Note [1]:** 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** | **[1]Location** | **Frequency** | **[2]Criteria (dB(A) $LA_{eq(15min)}$)** |
| 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** | **[1]Location** | **Frequency** | **[2]Criteria** |
| Attended noise monitoring | F, G | Quarterly | As per Table 10, 12 and 13 Noise MP (SLR, 2015) |
| Unattended noise monitoring | G | Quarterly | As per Table 10, 12 and 13 Noise MP (SLR, 2015) |

**Note:** 1. Appendix 1 illustrates the monitoring locations.

2. 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, Wind velocity (m/s) and Temperature (°C) 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/ Weather | Primary Noise Descriptor (dBA re 20 ?Pa) | | | | | Description of Noise Emissions and Typical Maximum Noise Levels (dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| F<br>Lot 50 DP 103 | 04/05/2017<br>12:59 pm<br>W = Calm<br>Temp = 19°C | 79 | 65 | 50 | 44 | 54 | Local road traffic 75 to 79 dBA<br>Pacific Highway 43 to 53 dBA<br>Karuah Quarry audible in lulls ~ 45dBA<br>**Karuah East Project construction audible**<br>Rock hammer 42 to 46 |
| | | Estimated LAeq(15 minute) noise contribution 41 dBA | | | | | |
| G<br>Lot 3 DP 1032636 | 04/05/2017<br>1:41 pm<br>W = 1.5 m/s S<br>Temp = 19°C | 56 | 44 | 41 | 35 | 39 | Pacific Highway 43 to 50 dBA<br>Frogs/Insects 35 to 38 dBA<br>Birds 43 to 53 dBA<br>Aircraft 44 dBA<br>**Karuah East Quarry construction audible**<br>Reversing beeper 35 dBA |
| | | Estimated LAeq(15 minute) noise contribution <30 dBA | | | | | |

## 4.2 Unattended Continuous Monitoring Results

**Table 13 Unattended Continuous Noise Monitoring Results**

| INP Period | Units | LA1 | LA10 | LA90 | LAeq |
|---|---|---|---|---|---|
| **Location G** | | | | | |
| Daytime during Operational Hours[1] | dBA | *Unattended noise monitoring was not conducted during May 2017* | | | |
| Daytime outside Operational Hours[2] | dBA | | | | |
| Evening[3] | dBA | | | | |
| Night[4] | dBA | | | | |

**Note:** 1. Daytime - 7.00 am to 5.00 pm Monday to Friday, 8.00 am to 12.00 pm Saturday, not operational on Sunday.

2. Daytime - 5.00 pm to 6.00 pm Monday to Friday, 12.00 pm to 6.00 pm Saturday, 8.00 am to 6.00 pm Sunday.

3. Evening - 6.00 pm 10.00 pm.

4. Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

## 4.3 Noise Result Summary

Operator-attended noise monitoring was conducted on Thursday, 4th of May 2017. As the Karuah East Quarry is still under construction, unattended monitoring was not required in May 2017.

Contributed noise relating to the Karuah East Quarry construction activities were estimated to be 41 and less than 30 dBA LAeq(15 minute) at location F and G respectively. The estimated noise level relating to the Karuah East Quarry project at location F was above the EPL criterion for operational noise levels, but was below the construction noise goal as outlined in the Noise Management Plan. It

is noted that the main noise contributor to the measured LAeq(15 minute) construction noise levels at location F was from a rock breaker operating on the Blue Rock Close construction site.

# 5. 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.

## 5.1 Discharge Monitoring Results

**Table 14** summarises the discharge criteria as per EPL.

**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 |
| | Turbidity | NTU | - |

**Table 15 Surface Water Discharge Monitoring Results**

| Sampling Point | Date | Time | pH (pH units) | TSS (mg/L) | Oil & Grease (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|
| LDP001 (Dam 1) | *No discharge during May 2017* | | | | | |
| LDP002 (Dam 2) | | | | | | |
| LDP002 (Dam 3) | | | | | | |

## 5.2 Monthly Monitoring Results

Surface water was sampled from Dam 1 (LDP1), Dam 3 (LDP3) and SW2 (Bulga Creek) in May 2017. The monitoring points were dry at SW1 (Bulga Creek), SW3 and SW4 (Yalimbah Creek) on the date of sampling. No flow was recorded at SW2 on the date of sampling.
Summary of monthly monitoring results is shown in **Table 16** and **Table 17**.

**Table 16 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 |
| **19/01/2016** | - | - | - | - | - | - | - | - | - | - | - | - |
| **25/07/2016** | 6.60 | <5 | <5 | 107 | - | - | - | - | - | - | - | - |
| **30/08/2016** | 6.07 | <5 | <5 | 74 | - | - | - | - | - | - | - | - |
| **19/10/2016** | 5.57 | 96 | <5 | 317 | - | - | - | - | - | - | - | - |
| **29/11/2016** | 5.89 | 63 | <5 | 305 | 5.39 | 72 | <5 | 520 | 5.22 | <5 | 34 | 260 |
| **19/12/2016** | 4.97 | 570 | <5 | 335 | 4.75 | 119 | <5 | 559 | 4.75 | 58 | <5 | 284 |
| **22/02/2017** | 5.90 | 145 | 8 | 349 | - | - | - | - | 5.28 | 8 | <5 | 323 |
| **01/03/2017** | 5.28 | 40 | <5 | 533 | - | - | - | - | 5.32 | 883 | <5 | 216 |
| **21/03/2017** | 5.97 | 383 | 18 | 612 | - | - | - | - | 4.78 | 890 | 16 | 286 |
| **21/04/2017** | 6.48 | 21 | <5 | 586 | - | - | - | - | 7.09 | 54 | 8 | 431 |
| **19/05/2017** | 6.81 | 11 | <5 | 907 | - | - | - | - | 6.97 | 169 | 14 | 500 |

**Units:** pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L, Electrical Conductivity (EC) in µS/cm

**Table 17 Surface Water Monthly Monitoring Results – Drainage 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 |
| **19/01/2016** | 5.60 | <5 | 9 | 204 | 4.66 | <5 | <5 | 173 | 5.70 | 13 | <5 | 201 |
| **25/07/2016** | - | - | - | - | 5.97 | 7 | <5 | 158 | - | - | - | - |
| **30/08/2016** | - | - | - | - | 5.70 | <5 | <5 | 207 | - | - | - | - |
| **19/10/2016** | - | - | - | - | 5.84 | 7 | <5 | 172 | - | - | - | - |
| **29/11/2016** | - | - | - | - | - | - | - | - | - | - | - | - |
| **19/12/2016** | - | - | - | - | - | - | - | - | - | - | - | - |
| **21/03/2017** | 4.90 | <5 | <5 | 313 | 4.76 | 12 | <5 | 309 | - | - | - | - |
| **31/03/2017** | - | - | - | - | 5.70 | 86 | 34 | 319 | 5.79 | 9 | 97 | 263 |
| **21/04/2017** | - | - | - | - | 5.76 | 12 | <5 | 369 | - | - | - | - |
| **19/05/2017** | - | - | - | - | 5.89 | 7 | <5 | 414 | - | - | - | - |

**Units:** pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L, Electrical Conductivity (EC) in µS/cm

### 5.3 Surface Water Results Summary

Water quality at Dam 1 (LDP001) were within the EPL criterion for discharge for all parameters. The TSS and oil & grease at Dam 3 (LDP003) were above the EPL criterion for discharge. As there were no discharges during the month, non-compliance under the EPL was not triggered.

## 6. 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 18**. Refer to Appendix 1 for piezometer locations.

**Table 18 Groundwater Monitoring Program**

| Piezometer | Location | Water Level monitoring frequency | Water Quality monitoring frequency |
|---|---|---|---|
| [1]BH205 | Lot 13/DP1024564 | Quarterly | Biannually |
| [2]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.

## 6.1 Groundwater Levels

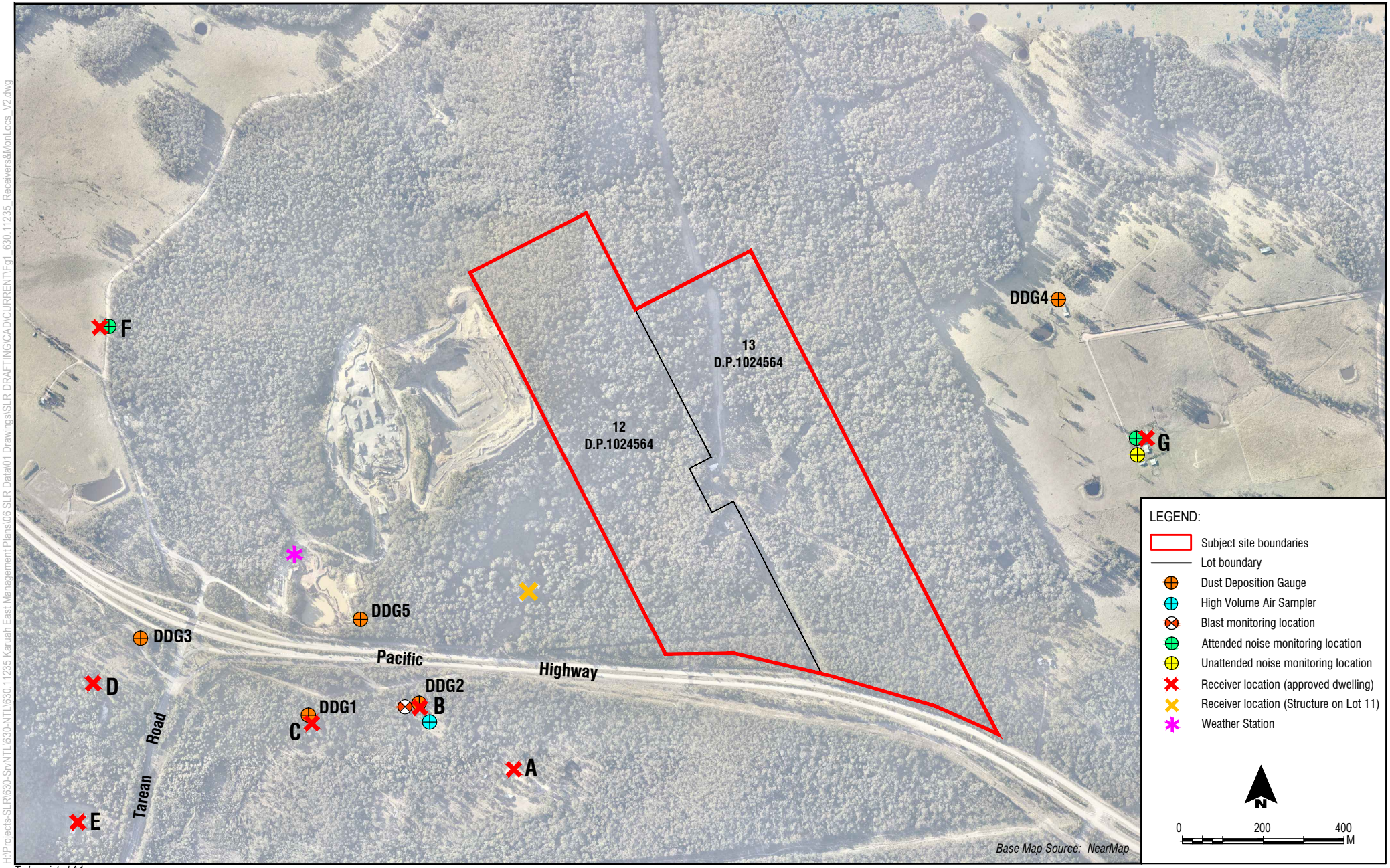
**Table 19 Groundwater Levels**

| Date | Unit | [2]BH205 | [3]BH207 | BH208 | BH303 |
|---|---|---|---|---|---|
| 30/03/2016 | [1]metres | 22.83 | 12.38 | 19.54 | 29.93 |
| 04/10/2016 | [1]metres | 24.00 | 9.61 | 19.77 | 30.45 |
| 04/04/2017 | [1]metres | 25.30 | 9.39 | 19.99 | 30.66 |

**Note:** 1. Groundwater levels are measured in metres below ground level.
2. Piezometer BH205 was relocated approximately 30m to the west on 13 March 2017.
3. Piezometer BH207 was relocated approximately 60m to the north on 26 September 2016.

# APPENDIX 1

# Monitoring Locations

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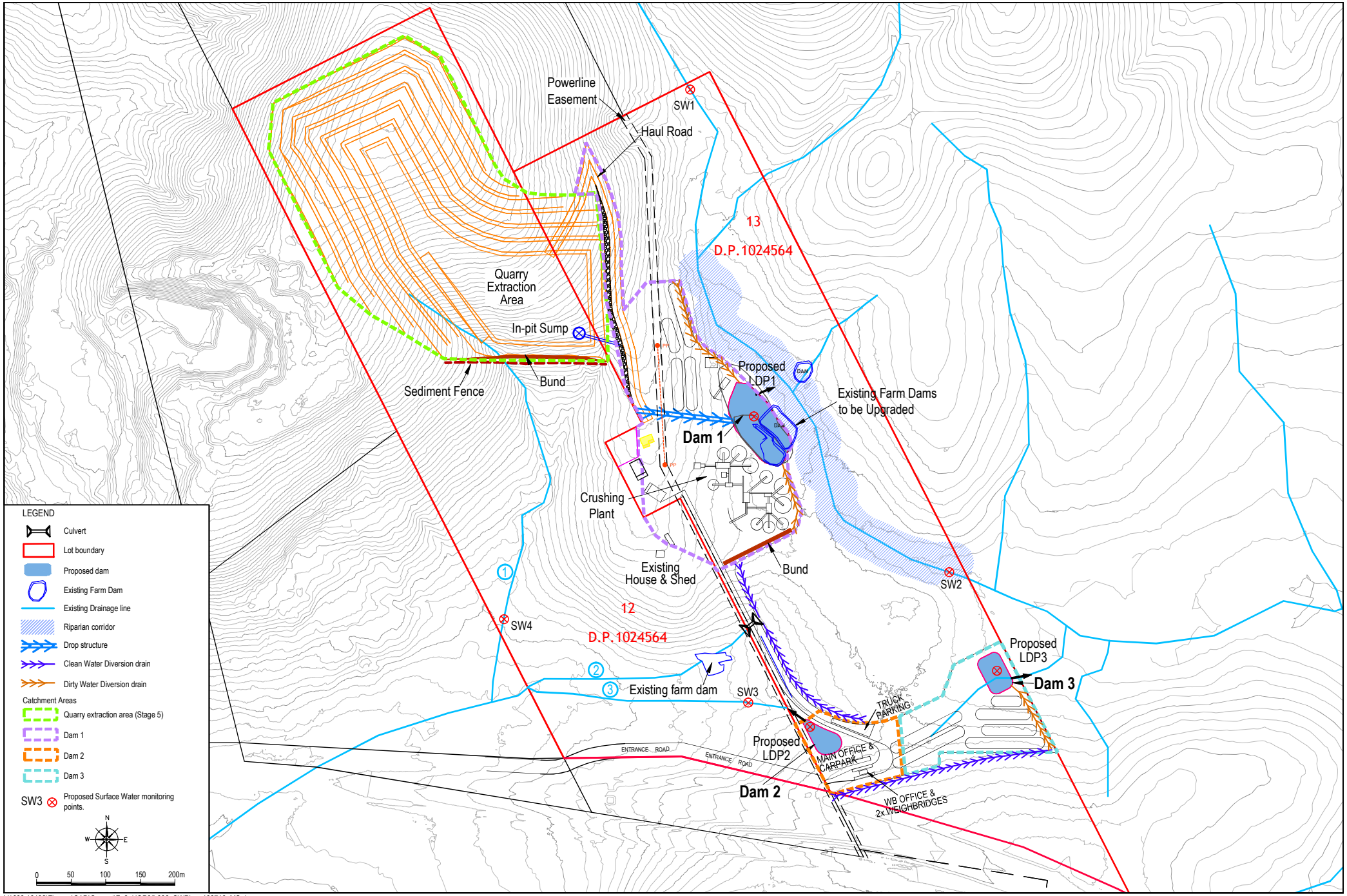
*To be printed A4*

Karuah East Quarry - Sensitive Receivers and Monitoring Locations

**FIGURE 1**

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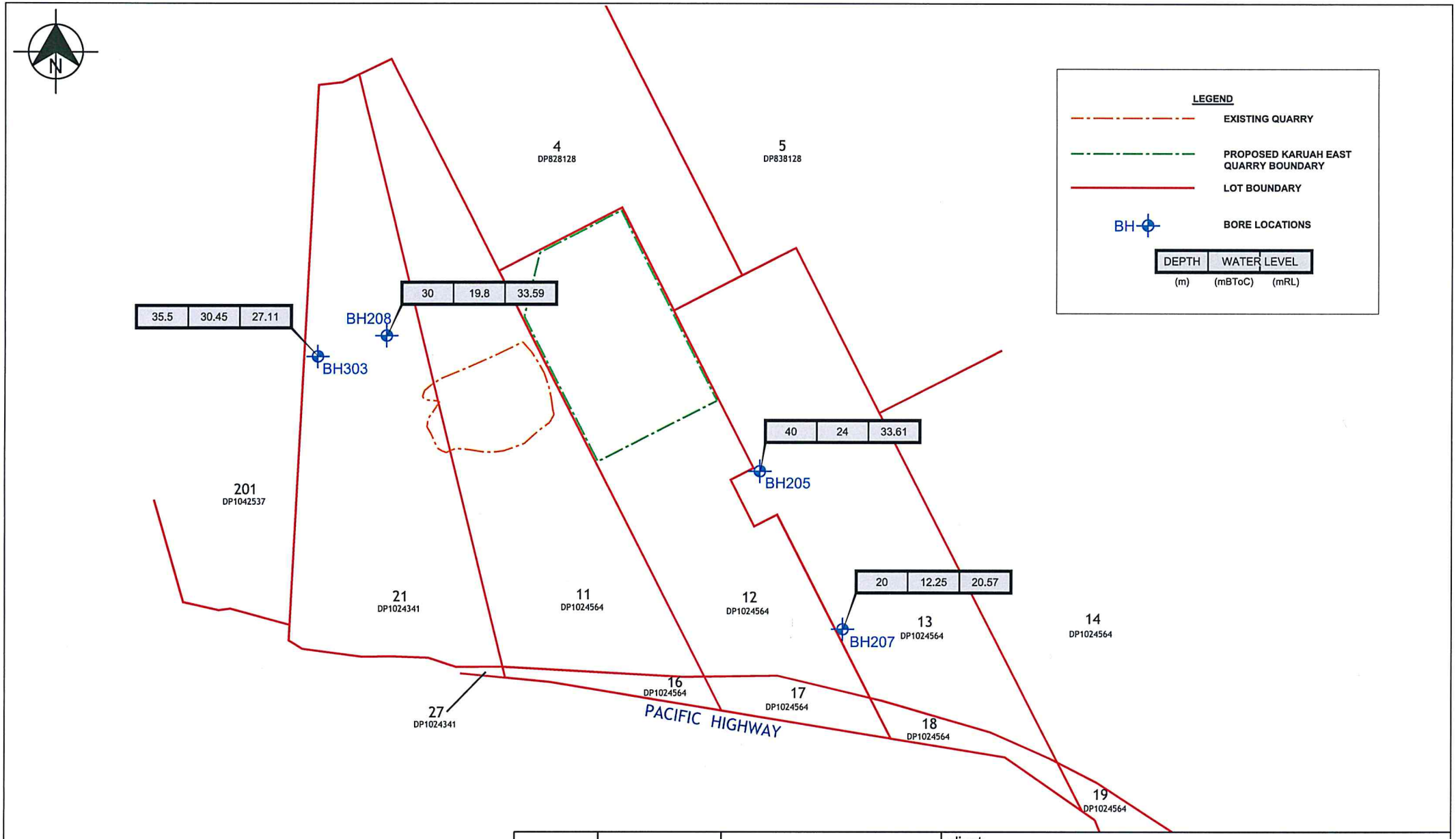
Proposed Surface Water Management Plan

**FIGURE 4**

A3EALandscape, 10/07/2013 5:01:46 PM, MarinSkoljarev




| | |
|---|---|
| drawn | LZ |
| approved | MB |
| date | 18.08.11 |
| scale | 1:12,000 |
| original size | A4 |

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: KARUAH EAST QUARRY PTY LTD

project: PROPOSED KARUAH EAST HARD ROCK QUARRY GROUNDWATER STUDY

title: GROUNDWATER BORE LOCATIONS AND MONITORING DATA

project no: GEOTWARA21232AA-AG

figure no: FIGURE 3.1