Karuah East Quarry

Monthly Environmental Monitoring Report

October 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 and the approved Statement of Commitments (SoC).

A summary of the environmental data for October 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 Quarry Location: Lot 13 DP1024564 Pacific Highway 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.

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_{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	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 151°59'58''E
DDG 2	MP 5	South-East of Karuah East Quarry	5770 Pacific Hwy, Karuah NSW 2324	32°38'02''S 152°00'09''E
DDG 3	MP 6	East of Karuah East Quarry	DP 1024341, Karuah	32°37'57''S 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 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 152°00'2.74"E
HVAS (TSP/PM10)	MP 9	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 October 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	-

Date	DDG 1	DDG 2	DDG 3	DDG 4	DDG 5
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
23/05/2017 to 20/06/2017	0.5	1.3	0.9	1.6	0.5
20/06/2017 to 18/07/2017	0.4	0.2	0.5	1.2	0.4
18/07/2017 to 17/08/2017	0.6	0.5	0.6	0.5	0.8
17/08/2017 to 14/09/2017	1.4	0.2	1.4	1.5	0.7
14/09/2017 to 12/10/2017	**1.1**	**0.1**	**1.2**	**1.8**	**1.5**
[1]Rolling Annual Average	1.3	0.2	1.3	1.7	1.1

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)
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

Date	HVAS TSP (µg/m³)	HVAS PM10 (µg/m³)
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
05/06/2017	11	7
11/06/2017	9	7
17/06/2017[3]	18	9
26/06/2017[4]	12	9
29/06/2017	9	6
05/07/2017	16	6
11/07/2017	11	5
17/07/2017	10	4
23/07/2017	10	2
29/07/2017	9	3
04/08/2017	6	1
10/08/2017	14	2
16/08/2017	25	9
22/08/2017	14	9
28/08/2017	16	6
03/09/2017	15	9
09/09/2017	14	6
15/09/2017	20	6
21/09/2017	26	15
27/09/2017	55	22
3/10/2017	14	6
9/10/2017	31	16
15/10/2017	12	7
21/10/2017	26	12
27/10/2017	13	8

Date	HVAS TSP (µg/m³)	HVAS PM10 (µg/m³)
[1]24hr Max Criteria	N/A	50
Report Average	19.2	9.8
[2]Rolling Annual Average	22.0	10.3
[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.
3. Value is a 48 hour average for two scheduled run dates (17/6/17 and 23/6/17).
4. An unscheduled "catch up" sample day for the 23/6/17.

2.3 Dust Monitoring Results Summary

All dust monitoring results to the end of October 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)
26/10/2017 12:33 PM	Overpressure dB(L)	110.4	111.4
	Vibration (mm/s)	1.44	1.34

As shown in Table 9, one blast was undertaken on 26 October 2017. Monitoring results were below the EPL criterion for overpressure and 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 Lot 50 DP 103	*Attended noise monitoring was not conducted during October 2017*						
G Lot 3 DP 1032636							

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 October 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.

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

Discharge did not occur in October 2017.

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

Sampling Points	Pollutant	Unit	EPL Limit
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

Date	LDP001 (Dam 1)				LDP002 (Dam 2)				LDP003 (Dam 3)			
	pH (Lab)	TSS	Oil & Grease	Turbidity	pH (Lab)	TSS	Oil & Grease	Turbidity	pH (Lab)	TSS	Oil & Grease	Turbidity
No discharge during October 2017												

Values outside of EPL limits highlighted in red.

5.2 Monthly Monitoring Results

Yalimbah and Bulga Creek drain lines were not flowing during October 2017 but water was pooled along the Bulga Creek drain line.

Surface water sampling was undertaken on 23 October 2017 at Dam 1, Dam 2, Dam 3 and monitoring point SW2. Water was pooled and not flowing at monitoring point SW2 at time 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
16/06/2017	5.94	220	22	457	-	-	-	-	5.95	1180	25	482
14/07/2017	6.50	82	<5	462	-	-	-	-	6.51	228	<5	452
18/08/2017	6.81	47	8	515	-	-	-	-	6.73	190	12	487
22/09/2017	6.98	18	10	492	6.61	26	8	444	6.80	122	10	520
23/10/2017	6.78	90	<5	438	6.73	336	15	382	6.63	164	10	475

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 – 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
19/01/2016	5.60	<5	9	204	4.66	<5	<5	173	5.70	13	<5	201

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
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	-	-	-	-
16/06/2017	5.47	6	<5	329	5.54	65	8	313	5.29	6	24	259
14/07/2017	-	-	-	-	5.81	47	<5	348	-	-	-	-
18/08/2017	-	-	-	-	6.04	22	<5	385	-	-	-	-
22/09/2017	-	-	-	-	6.34	10	<5	406	-	-	-	-
23/10/2017	-	-	-	-	6.42	29	6	323	-	-	-	-

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

The total oil and grease were found to be above the EPL criterion for discharge in Dam 2 and Dam 3 in the samples collected on 23 October 2017. The total suspended solids (TSS) were also found to be above the EPL criterion for discharge at Dam 1, Dam 2 and Dam 3. 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
05/10/2017	[1]metres	22.87	8.88	19.90	30.60

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.

6.2 Groundwater Quality

The biannual groundwater quality monitoring was undertaken in October 2017.

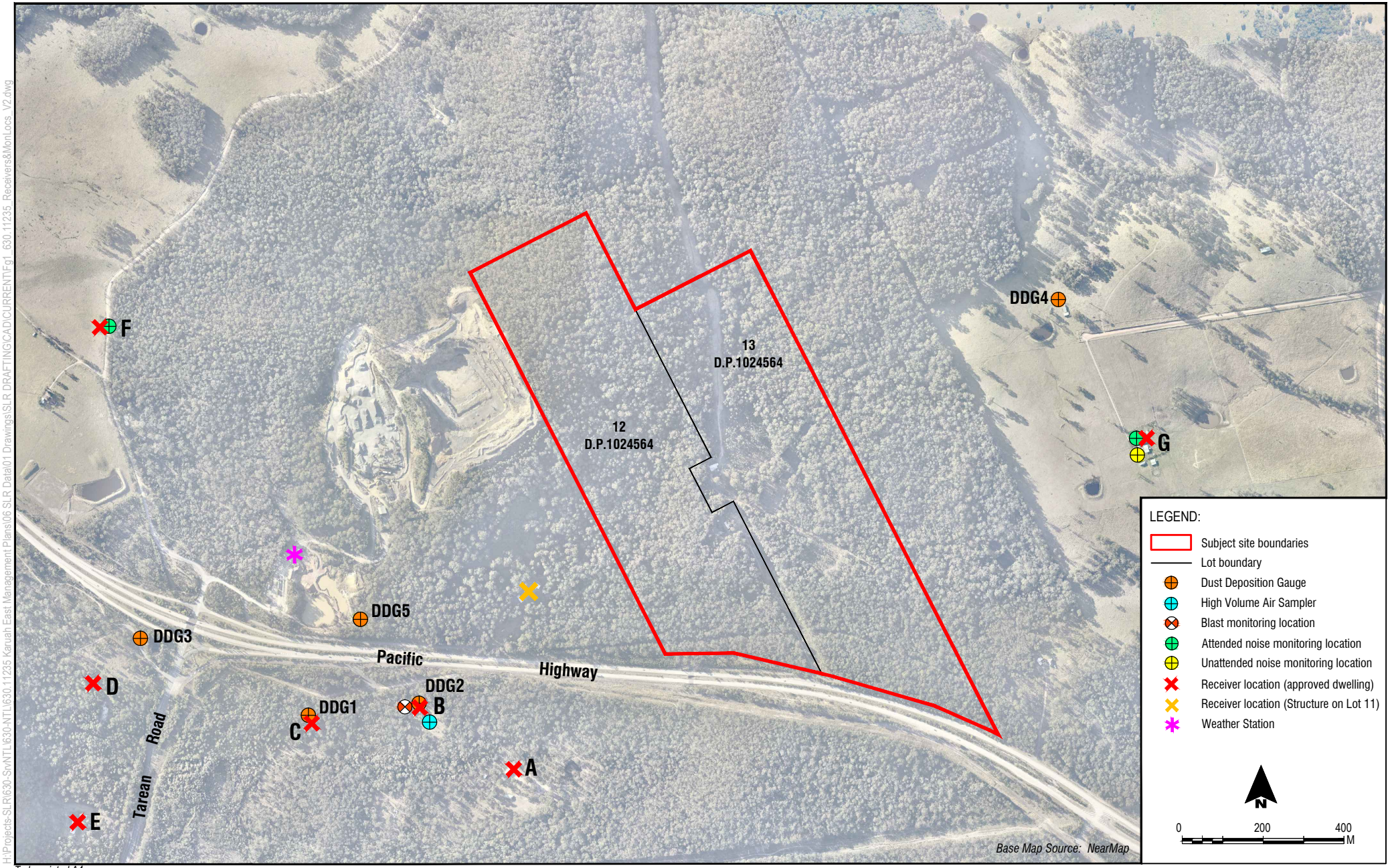
Table 20 Groundwater Quality

ANALYSIS	UNITS	BH205	BH207	BH208	BH303
Date Sampled	-				
pH Value (field)	pH unit	6.32	6.19	6.51	5.78
Conductivity (field)	µS/cm	1481	2053	1210	1497
Total Dissolved Solids	mg/L	1200	1900	1900	1600
BTEX					
Benzene	mg/L	<0.001	<0.001	<0.001	<0.001
Toluene	mg/L	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	mg/L	<0.001	<0.001	<0.001	<0.001
m/p-xylene	mg/L	<0.002	<0.002	<0.002	<0.002
o-xylene	mg/L	<0.001	<0.001	<0.001	<0.001
Total Xylenes	mg/L	<0.003	<0.003	<0.003	<0.003
Total Recoverable Hydrocarbons – 1999 NEPM Fractions					
TRH C6-C9	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C10-C14	mg/L	<0.05	<0.05	<0.05	<0.05
TRH C15-C28	mg/L	<0.1	<0.1	<0.1	0.3
TRH C29-C36	mg/L	<0.1	<0.1	<0.1	<0.1
TRH C10-C36 (Total)	mg/L	<0.1	<0.1	<0.1	0.3
Total Recoverable Hydrocarbons – 2013 NEPM Fractions					
Naphthalene[N02]	mg/L	<0.01	<0.01	<0.01	<0.01
TRH >C10-C16 less Naphthalene (F2)[N01]	mg/L	<0.05	<0.05	<0.05	<0.05
TRH C6-C10	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C6-C10 less BTEX(F1)[N04]	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C10-C16	mg/L	<0.05	<0.05	<0.05	<0.05
TRH C16-C34	mg/L	<0.1	<0.1	<0.1	0.4
TRH C34-C40	mg/L	<0.1	<0.1	<0.1	<0.1

ANALYSIS	UNITS	BH205	BH207	BH208	BH303
Polynuclear Aromatic Hydrocarbons					
Naphthalene	mg/L	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	mg/L	<0.001	<0.001	<0.001	<0.001
Acenaphthene	mg/L	<0.001	<0.001	<0.001	<0.001
Fluorene	mg/L	<0.001	<0.001	<0.001	<0.001
Phenanthrene	mg/L	<0.001	<0.001	<0.001	<0.001
Anthracene	mg/L	<0.001	<0.001	<0.001	<0.001
Fluoranthene	mg/L	<0.001	<0.001	<0.001	<0.001
Pyrene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(a)anthracene	mg/L	<0.001	<0.001	<0.001	<0.001
Chrysene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(b&j)fluoranthene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	mg/L	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-cd)pyrene	mg/L	<0.001	<0.001	<0.001	<0.001
Dibenzo(ah)anthracene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(ghi)perylene	mg/L	<0.001	<0.001	<0.001	<0.001
Total PAH (18)	mg/L	<0.001	<0.001	<0.001	<0.001
Anions					
Chloride	mg/L	490	900	880	900
Sulphate, SO4	mg/L	62	75	250	28
Nitrogen					
Nitrate & Nitrite (as N)	mg/L	0.95	<0.05	3.8	<0.05
Total Kjeldahl Nitrogen	mg/L	0.8	0.6	4.8	1.2
Total Nitrogen (calc)	mg/L	1.8	0.6	8.6	1.2
Alkalinity					
Bicarbonate Alkalinity as CaCO3	mg/L	320	200	64	79
Carbonate Alkalinity as CaCO3	mg/L	<10	<10	<10	<10
Total Alkalinity as CaCO3	mg/L	320	200	64	79
Metals					
Calcium, Ca	mg/L	71	58	40	61
Magnesium, Mg	mg/L	26	59	41	60
Sodium, Na	mg/L	420	630	570	570
Potassium, K	mg/L	6.8	<5	<5	16

APPENDIX 1

Monitoring Locations



H:\Projects-SLR\630-SvNTL\630-NTL\630.11235 Karuah East Management Plans\06 SLR Data\01 Drawings\SLR DRAFTING\CAD\CURRENT\Fg1 630.11235 Receivers&MonLocs V2.dwg

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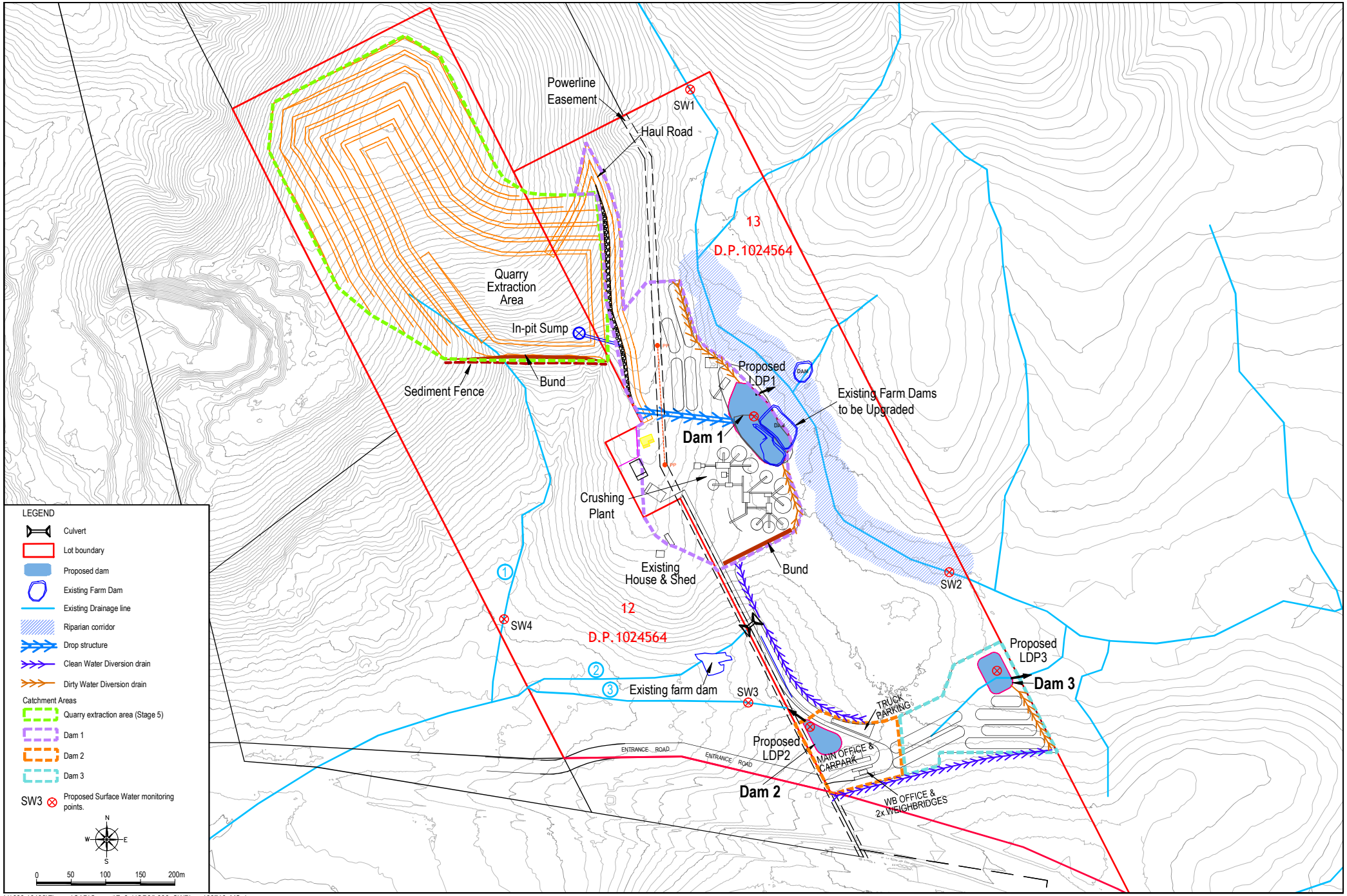
Karuah East Quarry - Sensitive Receivers and Monitoring Locations

FIGURE 1



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Proposed Surface Water Management Plan

FIGURE 4

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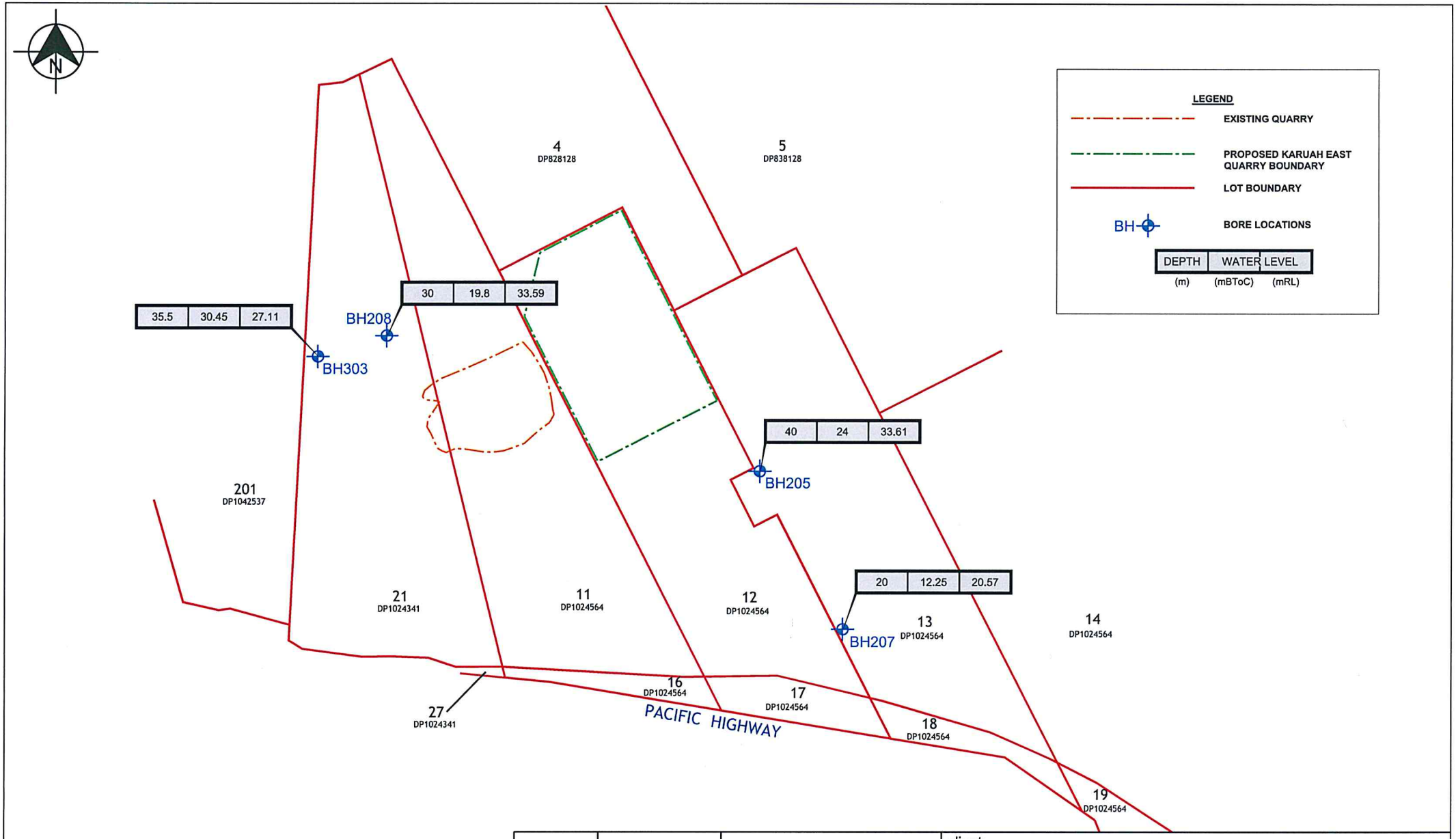

drawn	LZ
approved	MB
date	18.08.11
scale	1:12,000
original size	A4

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