Document Control & Title Block

Document Title	Environmental Management Annual Review – Calga Quarry			
Document Number				
Document Owner	Hanson Construction Materials Pty Ltd			
Revision	Issue Date	Originator	Reviewed	Approved
Draft	30 March 2018	B. Pignone	S. Pescud	A. Driver
Final	1 April 2018	B. Pignone		A. Driver

Name of operation	Calga Quarry
Name of operator	Hanson Construction Materials Pty Ltd
Development consent / project approval #	Project Approval 94-4-2004
Name of holder of development consent / project approval	Hanson Construction Materials
Water licence #	
Name of holder of water licence	
Annual Review start date	1 January 2017
Annual Review end date	31 December 2017
Name of authorised reporting officer	Belinda Pignone
Title of authorised reporting officer	Graduate Environmental Planning and Compliance Coordinator
Signature of authorised reporting officer	
Date	1 May 2018

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List of Acronyms

ANZECC	Australian and New Zealand Environment Conservation Council
CCC	Community Consultative Committee
DPE	Department of Planning and Environment
DRE	Department of Resources and Energy
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority
EPL	Environmental Protection Licence
GDE	Groundwater Dependent Ecosystem
SWL	Standing water level
SWMP	Site Water Management Plan
TSS	Total Suspended Solids
TSP	Total Suspended Particulates

1. STATEMENT OF COMPLIANCE

Table 1: STATEMENT OF COMPLIANCE

Were all conditions of the relevant approval(s) complied with?	
94-4-2004	YES

Table 2: NON-COMPLIANCES

Relevant Approval	**Condition #**	**Condition description (summary)**	**Compliance status**	**Comment**	**Where addressed in Annual Review**
N/A	N/A	N/A	N/A	N/A	N/A

Table 3: COMPLIANCE STATUS FOR TABLE 2

Risk Level	**Colour code**	**Description**
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with: Potential for serious environmental consequences, but is unlikely to occur, or Potential for moderate environmental consequences, but is likely to occur
Low	Non-Compliant	Non-compliance with: Potential for moderate environmental consequences, but is unlikely to occur, or Potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-Compliant	Only 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)

2. INTRODUCTION

The Quarry is owned and operated by Hanson Construction Materials Pty Ltd. The Quarry is located on the Somersby Plateau, approximately 1.0km northwest of the Calga Interchange on the M1 Freeway (**Figure 1**). **Figure 2** displays the existing layout including the boundary of Stage 3 extraction operations and designated sub-stages.

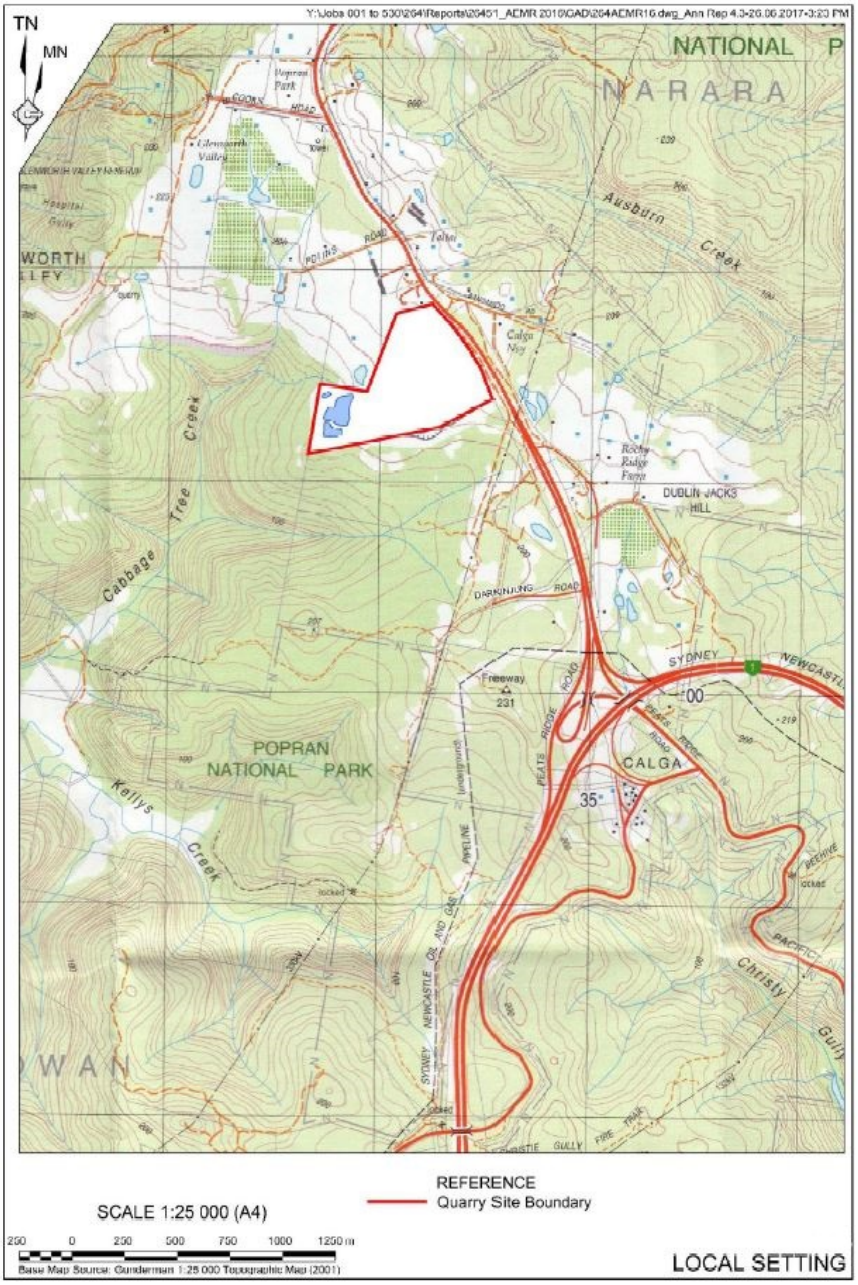


Figure 1: LOCAL SETTING

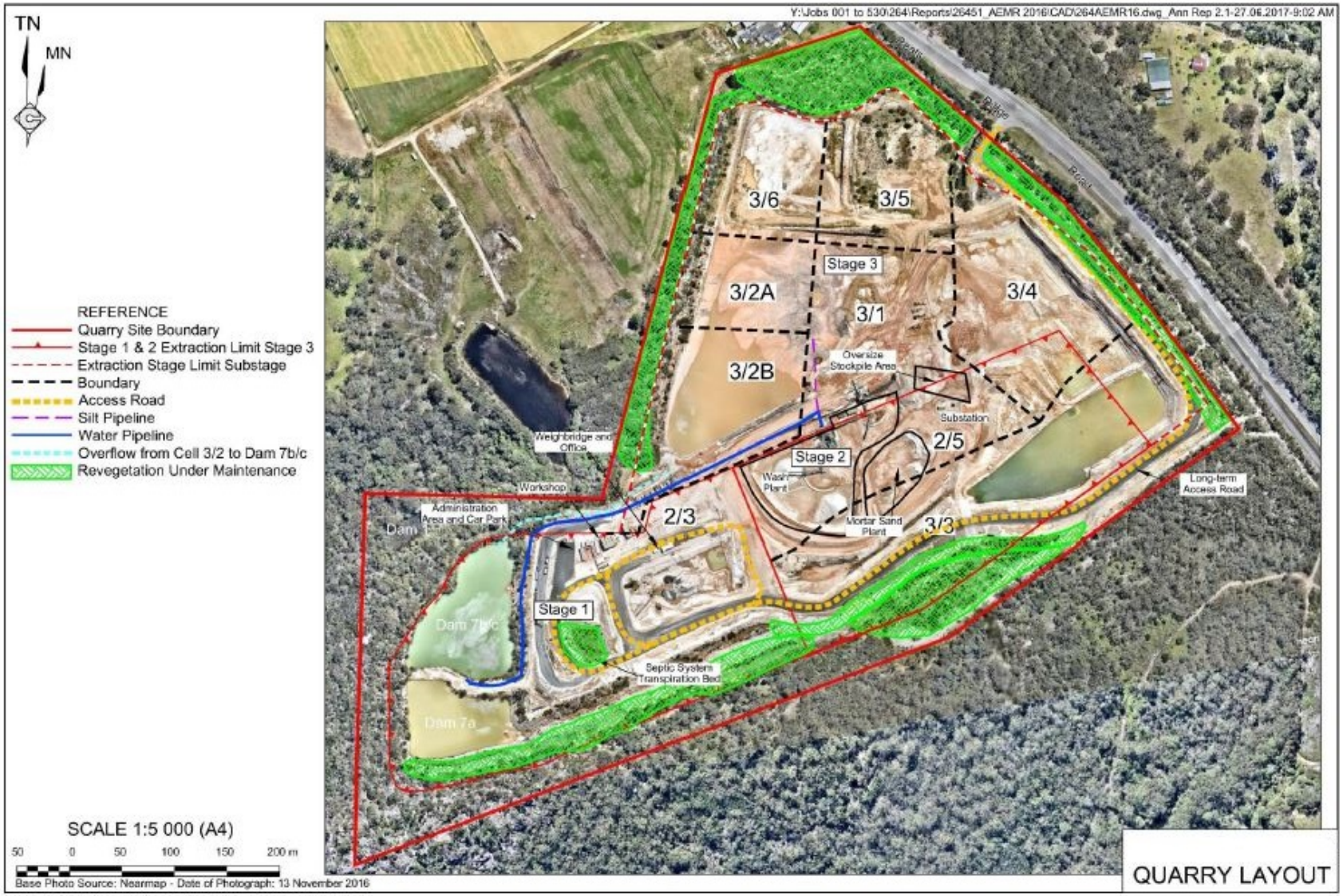


Figure 2: QUARRY LAYOUT

The following personnel are responsible for the ongoing management of the Calga Sand Quarry.

Table 4: QUARRY SITE PERSONNEL ROLES AND RESPONSIBILITIES

Position	Name	Phone	Email
Operations Manager	Chris Dolden	0457738811	chris.dolden@hanson.com.au
Quarry Manager	Paul Slough Shane Pescud	0418 166 212 0425 290 692	paul.slough@hanson.com.au shane.pescud@hanson.com.au
Risk Manager	Ian Bradbury	0417 423 467	ian.bradbury@hanson.com.au
Development Manager	Andrew Driver	0417 234 774	andrew.driver@hanson.com.au
Graduate Environmental Planning and Compliance Coordinator	Belinda Pignone	0439 131 941	belinda.pignone@hanson.com.au

Other persons involved with site management and compilation of quarry-related documentation and monitoring data include:

- Mr. James Dutton – an experienced horticulturist and contracted to undertake ongoing weed management and revegetation throughout the Quarry Site; and
- Mr. Colin Davies – Carbon Based Environmental Pty Ltd – Mr Davies is contracted to undertake the monthly collection of water samples, recording of groundwater levels and collection/assembly of deposited dust and meteorological data.

3. APPROVALS

This Annual Environmental Management Report (AEMR) has been prepared in accordance with *Condition 5(4)* of Development Consent DA 94-4-2004 (**Appendix 1**) to record the activities and environmental monitoring undertaken within and surrounding the Calga Sand Quarry during the period 1 January to 31 December 2017 (the reporting period) and to outline the activities and environmental monitoring planned throughout 2018. This condition requires the preparation of a report that:

- Identifies the standards and performance measures that apply to the development (see Section 4);
- Describes the works carried out throughout the last 12 months (see Section 6);
- Describes the works that will be carried out throughout the next 12 months (see Section 12);
- Includes a summary of the complaints received during the past year, and compares this to the complaints received in previous years (see Section 9.2);

- Includes a summary of the monitoring results for the development during the past year (see Section 7);
- Includes an analysis of these monitoring results against the relevant:
  - Impact assessment criteria;
  - Monitoring results from previous years; and
  - Predictions in the EIS and Amendment Report (See Sections 7.1.1, 7.2.3, 7.4.3 and 7.5.3)
- Identifies any trends in the monitoring results over the life of the development (see Section 7.1.1, 7.2.3, 7.5.3 and 7.6.2);
- Identifies any non-compliance during the previous year (see Section 11); and
- Describes what actions were, or are being taken to ensure compliance (see Section 11)

In addition, the following conditions specifically request that the subject information incorporated in this document.

- 3(18) The results of the yearly Water Management Plan review including:
  - Details of the review for each sub-plan (see Sections 7.4, 7.4.1 and 7.5)
  - The results of monitoring (Appendices 2 and 3);
  - The results of the Independent Groundwater Audit (including a copy of the report) (Appendix 3); and
  - Details of the measures undertaken/proposed to address any identified issues (see Sections 7.5, 7.6 and Appendix 3).
- 3(32c) A progress report on the re-vegetation and maintenance of the acoustic barrier (Section 7.6 and Appendix 6).
- 3(35d) A report on waste management and minimisation (Section 6.5)
- 3(39b) Annual production data (Section 6.1)

Within one month of the completion of each AEMR, Condition 5(10) requests that the Applicant:

- Provide a copy of the AEMR to the Council, relevant agencies and the CCC;
- Ensure that a copy of the AEMR is made publically available at the quarry; and
- A copy of the document is placed on the Applicant's website;

to the satisfaction of the Director-General (now Secretary).

Throughout this document, the land on which the Calga Sand Quarry is located (Lot 1, DP229889) is referred to as the "Quarry Site".

4. STANDARDS AND PERFORMANCE MEASURES

Hanson Construction Materials Pty Ltd (Hanson) is required to operate the approved activities at the Calga Sand Quarry in accordance with the development consent and licences listed in **Table 5**.

Table 5: PROJECT SUMMARY

Consent / Licence		Issue Date	Expiry Date
Development Consent 94-4-2004		28 October 2005	1 July 2030
Environmental Protection Licence No 11295		16 December 2002	24 July
Water Supply Works Approval 20WA211660		5 July 2011	5 July 2021
Water Access Licence 17384	10 ML	27 February 2012	No Expiry
Water Access Licence 27185	51 ML	4 February 2014	No Expiry
Water Access Licence 20019	46 ML	4 February 2014	No Expiry
Water Access Licence 2541	6 ML	14 January 2010	No Expiry

Relevant conditions within DA 94-4-2004 which nominate specific environmental criteria are as follows.

- Condition 3(2): noise emissions (day, evening and night).
  - Each of the relevant criteria are presented in Section 7.1.1 in conjunction with the assembled monitoring results
- Condition 3(8): dust emissions (suspended and deposited).
  - Each of the relevant criteria are presented in Section 7.2.1 in conjunction with the assembled monitoring results

In addition, Condition 3(20) requires Hanson to establish and subsequently maintain a meteorological station in the vicinity of the Quarry, to the satisfaction of the then DEC (now EPA) and the Director-General of the Department of Planning (now Secretary of the NSW Department of Planning and Environment – DPE). The station is required as a minimum, unless otherwise authorised by the Director-General (now Secretary), to monitor daily rainfall and evaporation in accordance with the requirements in Approved Methods for the Sampling and analysis of Air Pollutants in NSW.

Environment Protection Licence (EPL) 11295 also nominates specific environmental criteria as follows, (as noted above, details of the relevant criteria are presented in Sections 7.1.1 and 7.2.1).

- Noise.
  - Condition L3.1 – noise emission limits (day, evening and night).
  - Condition L3.2 and L3.4 specify the monitoring locations, adjustments due to tonal noise and relevant meteorological conditions for compliance.
- Dust

- EPL 11295 does not nominate any dust criteria; hence reliance is placed on the criteria nominated in Condition 3(8) within DA 9-4-2004.

The performance criteria relevant to assessing groundwater impacts are nominated either in the Site Water Management Plan (Section 8.6) or from the Freshwater Ecosystem Protection Guideline drawn from ANZECC (2000).

All surface water monitoring was undertaken pursuant to the Site Water Management Plan and, for the purposes of assessing compliance; reliance is placed upon the water quality limits nominated within this Plan.

Cumberland Ecology has established five monitoring plots within identified Groundwater Dependent Ecosystems (GDEs) approximately 500m south of the Quarry Site (see Section 8.7). Vegetation type and condition was recorded to establish a baseline for ongoing monitoring of these ecosystems and potential impacts as a result of quarrying activities. The baseline data recorded that the DGEs are in good condition with all species consisting of natives and no sign of nutrient enrichment or invasive species. Groundwater Dependent Ecosystem monitoring is discussed further in Section 8.7.

5. DOCUMENT PREPARATION

The information and data for this report has been drawn for the following documents commissioned or held by Hanson.

- Carbon Based Environmental Pty Limited – 2017 Monthly Dust Deposition, Surface and Ground Waters and Meteorological Station Monitoring Results Summaries (Appendix 2).
- Dundon Consulting Pty Limited – Calga Sand Quarry 2017 Annual Independent Groundwater Audit (Appendix 3).
- Wilkinson Murray Pty Limited – Compliance Noise Monitoring (Appendix 2).
- Cumberland Ecology Pty Limited – Calga Sand Quarry, Rehabilitation Monitoring Report (Appendix 6).

This document has been assembled by Ms. Belinda Pignone (B.Env.Sc.Mgmt) (Graduate Environmental Planning and Compliance Coordinator, Hanson). Mr Paul Slough (Quarry Manager) and Mr Shane Pescud (Quarry Manager) provided technical input and information on Quarry operations and environmental performance during the reporting period.

6. OPERATIONS SUMMARY

Table 6 lists the principle activities / milestones that occurred at the Calga Sand Quarry throughout 2017. Figure presents the location(s) of the activities described reference to operational areas within the Calga Sand Quarry are to either “stages” for extraction areas, i.e. consistent with the terminology in the 2004 EIS, or “cells” for the completed extraction stages

used for silt storage. Figure to display the condition and active areas of the Quarry Site as at April 2018.

Table 6: PRINCIPAL ACTIVITIES / MILESTONES DURING 2017

Month	Activity
January	– Extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Stripping overburden Cell 3/5 & placement within Silt Cells 3/1 and 3/2.
February	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Stripping overburden Cell 3/5 &placement within Silt Cells 3/1 and 3/2.. – Progressive rehabilitation of Silt Cells 3/1 and 3/2.
March	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Conducted attended noise monitoring. – Stripping overburden Cell 3/5 &placement within Silt Cells 3/1 and 3/2.Progressive rehabilitation of Silt Cells 3/1 and 3/2.
April	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Stripping overburden Cell 3/5 &placement within Silt Cells 3/1 and 3/2. – Progressive rehabilitation of Silt Cells 3/1 and 3/2.
May	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Stripping overburden Cell 3/5 &placement within Silt Cells 3/1 and 3/2. – Progressive rehabilitation of Silt Cells 3/1 and 3/2.
June	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Overburden placement within Silt Cells 3/1 and 3/2. – Progressive rehabilitation of Silt Cells 3/1 and 3/2. – Held Community Consultative Committee meeting at the Quarry on 7 June 2017.
July	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3.

	– Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Conducted attended and unattended noise monitoring. – Overburden placement within Silt Cells 3/1 and 3/2. – Progressive rehabilitation of Silt Cells 3/1 and 3/2.
August	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Progressive rehabilitation of Silt Cells 3/1 and 3/2. – Overburden placement within Silt Cells 3/1 and 3/2.
September	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Conducted attended noise monitoring. – Overburden placement within Silt Cells 3/1 and 3/2. – Progressive rehabilitation of Silt Cells 3/1 and 3/2.
October	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/1, 3/2 & 3/3. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Progressive rehabilitation of Silt Cells 3/1 and 3/2. – Overburden placement within Silt Cells 3/1 and 3/2.
November	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2, 3/3 & 3/4. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Progressive rehabilitation of Silt Cells 3/1 and 3/2. – Held Community Consultative Committee meeting at the Quarry on 7 June 2017.
December	– Continued extraction within Stage 3/4, with all silt deposited within Cells 3/2, 3/3 & 3/4. – Conducted monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. – Horticulturist continued weekly weed spraying and re-vegetation activities. – Conducted attended noise monitoring. – Progressive rehabilitation of Silt Cells 3/1 and 3/2. – Commissioned suitably qualified ecologist to conduct an annual rehabilitation and threatened species monitoring, including feral animal survey and noxious weed survey. Surveys completed January and March 2018.

6.1 EXTRACTION OPERATIONS

During the reporting period, extraction was conducted in Stage 3/4. Extraction operations involved ripping and pushing up friable sandstone.

Table 7 records the monthly/annual sales of the various products produced at the Quarry during 2017. This data was provided to the Division of Resources & Energy (DRE) in accordance with the requirements of Condition 3(39b).

Table 7: CALGA SAND QUARRY – 2017 SALES

2017	Monthly Sand Sales (tonnes)
January	28399.16
February	35965.93
March	38850.75
April	29459.29
May	41962.60
June	28820.45
July	31722.12
August	33418.19
September	32476.36
October	28791.89
November	32929.67
December	21893.05
Total	384,689

Table 8: CALGA SAND QUARRY – SUMMARY OF MATERIALS

Material	Approved production limit (specify source)	Previous reporting period (actual)	This reporting period (actual)	Next reporting period (forecast)
Friable Sandstone	4000,000 tonnes (DA 94-4-2004)	387,258 tonnes	384,689 tonnes	391,398 tonnes

6.2 PROCESSING AND PRODUCT STOCKPILING

During the reporting period, sand processing was undertaken using the wash plant. All of the sand extracted was washed to produce a range of concrete sand products.

6.3 OVERBURDEN AND SILT MANAGEMENT

All silt produced from the sand washing process was placed in Cell 3/1, Cell 3/2a, and 3/2b and Cell 3/3 & Cell 3/4 throughout the reporting period. All oversize material was stockpiled within the Quarry Site.

6.4 INFRASTRUCTURE DEVELOPMENT/UPGRADES

Minor alterations will be completed during the 2017 reporting period. This included minor landscaping activities.

6.5 WASTE MANAGEMENT

All wastes from the site office and amenities were collected in waste skips and removed from site by a waste contractor, as required. During 2017, the following waste was removed from the quarry.

- Approximately 3700 litres of oily waste and 10 tonnes of steel were removed for recycling.
- All waste batteries were removed for recycling.
- All oil and fuel filters and oil rags were removed to a licenced waste facility.

7. ENVIRONMENTAL PERFORMANCE

Hanson benchmarks environmental performance against the conditional requirements of DA 94-4-2004 and EPL 11295 as well as the approved environmental management plans. Generally environmental performance complies with expectations.

The Quarry is operated in accordance with an Environmental Management System and the following environmental management plans and monitoring programs.

- Noise Management Plan
- Air Quality Management Plan
- Transport Management Plan
- Surface Water Management Plan
- Groundwater Management Plan
- Landscape Management Plan

In addition, **Table 9** provides a summary of environmental monitoring at the Quarry.

Table 9: ENVIRONMENTAL MONITORING

Monitoring Parameter	Frequency
Meteorological Data	Continuous
Laden truck movements	Daily
Quarry products transported	Daily
Noise levels at closest residential receivers (attended)	Quarterly

Noise levels at closest residential receivers (unattended)	Yearly
Deposited dust	Monthly
Surface water monitoring (pH, EC, TDS, TSS and Oil & Grease)	Monthly
Surface water discharge (pH, EC, TSC, TSS, Oil & Grease)	Discharge
Groundwater quality (major anions and cations).	Quarterly
Groundwater level, pH and electrical conductivity	Bi-monthly
Water use	Daily

7.1 NOISE

Noise monitoring was undertaken by Wilkinson Murray (Sydney) Pty Ltd during the reporting period generally in accordance with the approved Noise Monitoring Program prepared in accordance with *Condition 3(7)* of the Development Consent 94-4-2004. Four periods of attended monitoring were conducted on 10 March, 29 July, 12 September and 19 December, which yielded valid measurements for inclusion in this report. A period of unattended monitoring was undertaken between 1 July and 19 July 2016. Monitoring was conducted at four surrounding residences, the locations of which are displayed on **Figure 3**.

7.1.1 Noise Criteria and Results

Table 11 displays the noise criteria for the Calga Sand Quarry together with the noise levels predicted at Residence 4 (CN-2), Residence 5 (CN-3) and Residence 6 (CN-4) in 2004 and the measured noise levels throughout 2011. It is noted in the Industrial Noise Policy that:

> *"A development will be deemed to be in non-compliance with a noise consent or licence condition if the monitored noise level is more than 2dB above statutory noise limit specified in the consent or licence condition."*

A summary of the noise results is included in **Appendix 2** and full copies of all reports are included on Hanson's website. The range of measured noise levels between 2006 and 2016 are also provided for comparative purposes. **Table 10** identifies the applicable noise impact criterion for four residential locations, which have been adopted for the noise monitoring surveys (**Appendix 2**).

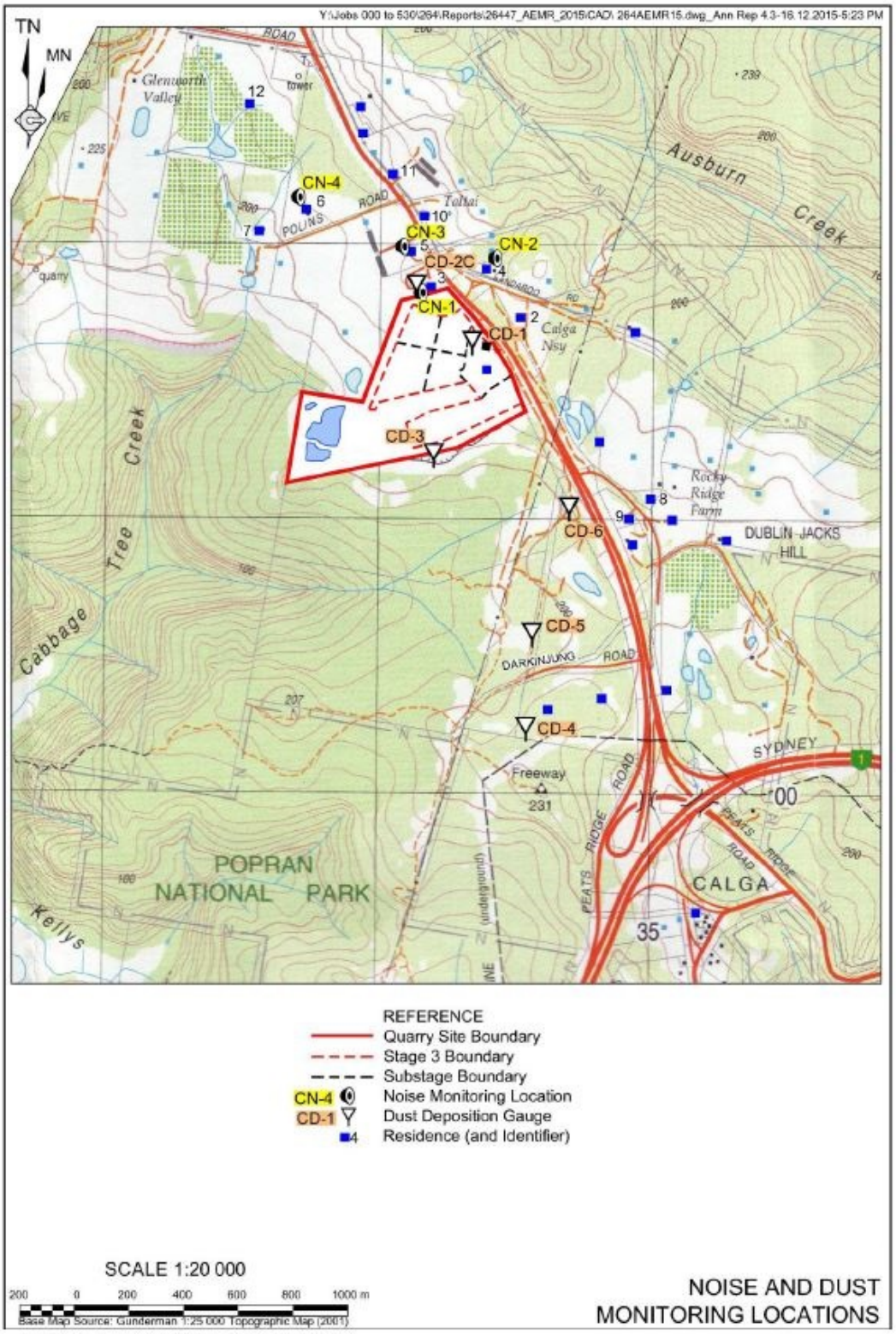


Figure 3: NOISE AND DUST MONITORING LOCATIONS

The noise monitoring conducted by Wilkinson Murray over 2017 has indicated that the Quarry's noise emissions comply with the acceptable noise levels prescribed in Project Approval 94-4-2004. The results are summarised in **Table 10** below.

Table 10: NOISE LIMIT CRITERIA AND 2017 RESULTS

	Time Period		
	5:00am-7:00am	**7:00am-6:00pm**	**6:00pm-10:00pm**
Residence 3 (CN-1): Power			
Criterion			
Extraction, Processing and transportation @	44	41	38
Product Transportation only @	41	40	37
Predicted Noise Levels +			
Extraction, Processing and transportation	NP	NP	NP
Product Transportation only	NP	NP	NP
Monitoring Results			
2007	-	36-39	-
2008	-	38-**42**	-
2009	-	30-37	-
2010	-	37-41	-
2011	-	37-**44**	-
2012	-	35-**44**	-
2013	-	27-**43**	-
2014	-	30-38	-
2015	-	31-35	-
10/03/16 Attended	-	36	-
19/07/16 Attended	-	33	-
01/07/16 to 19/07/16 Unattended	**60-68**	**50-62**	**45-56**
12/09/16 Attended	-	34	-
19/12/16 Attended	-	35	-
12/04/17 Attended	-	39	-
30/07/17 Attended	-	37	-
23//07/17 to 30/07/17 Unattended	**47-54**	38-**51**	**58-71**
19/12/17 Attended	-	40	-
Residence 4 (CN-2): King			
Criterion			
Extraction, Processing and transportation	45	40	40
Product Transportation only	43	40	39
Predicted Noise Levels +			

Extraction, Processing and transportation	39	39	39
Product Transportation only	28	28	28
Monitoring Results			
2007	-	24-34	-
2008	-	35-40	-
2009	-	33-40	-
2010	-	36-40	-
2011	-	31-**46**	-
2012	-	31-**47**	-
2013	-	29-**42**	-
2014	-	27-35	**43-53**
2015	-	Inaudible <20	-
10/03/16 Attended	-	37	-
19/07/16 Attended	-	Inaudible	-
01/07/16 to 19/07/16 Unattended	**58-67**	**48-59**	**45-55**
12/09/16 Attended	-	31	-
19/12/16 Attended	-	30	-
12/04/17 Attended	-	33	-
30/07/17 Attended	-	37	-
23//07/17 to 30/07/17 Unattended	**49-57**	**47-64**	**55-73**
19/12/17 Attended	-	Inaudible	-
Residence 5 (CN-3): Kashouli			
Criterion			
Extraction, Processing and transportation	44	39	38
Product Transportation only	41	40	37
Predicted Noise Levels +			
Extraction, Processing and transportation	37	37	38
Product Transportation only	27	27	28
Monitoring Results			
2007	-	28-29	-
2008	-	31-37	-
2009	-	26-39	-
2010	-	32-39	-
2011	-	28-**40**	-
2012	-	35-**40**	-
2013	-	25-36	-
2014	-	30-35	**43-55**
2015	-	Inaudible – 30	-
10/03/16 Attended	-	32	-

19/07/16 Attended	-	Inaudible	-
01/07/16 to 19/07/16 Unattended	**58-67**	**48-61**	**43-52**
12/09/16 Attended	-	32	-
19/12/16 Attended	-	<30	-
12/04/17 Attended	-	35	-
30/07/17 Attended	-	33	-
23//07/17 to 30/07/17 Unattended	**45-55**	34-**50**	**53-66**
19/12/17 Attended	-	Inaudible	-
Residence 6 (CN-4): Townsend			
Criterion			
Extraction, Processing and transportation	35*	35*	35*
Product Transportation only	35*	35*	35*
Predicted Noise Levels +			
Extraction, Processing and transportation	33	32	35
Product Transportation only	27	27	28
Monitoring Results			
2007	-	33-34	-
2008	-	35-36	-
2009	-	NA	-
2010	-	35	-
2011	-	24-36	-
2012	-	30-33	-
2013	-	34	-
2014	-	34-35	-
2015	-	Inaudible – 35	-
10/03/16 Attended	-	Inaudible	-
19/07/16 Attended	-	Inaudible	-
01/07/16 to 19/07/16 Unattended	**36-65**	31-**60**	30-**46**
12/09/16 Attended	-	32	-
19/12/2016 Attended	-	Inaudible	-
12/04/2017 Attended	-	Inaudible	-
30/07/17 Attended	-	31	-
23//07/17 to 30/07/17 Unattended	**38-82**	28-**44**	**40-80**
19/12/17 Attended	-	Inaudible	-

Note: Bold results identify an exceedance of the nominated criterion – see Section 4.3.3 for discussion of results

@ Criterion proposed are consistent with those determined for Residence 5 (CN-3). It is noted these are not specified in either Development Consent 94-4-2004 or EPL 11295

NA: Not Audible. NM: Non-measurable NP: Not Predicted

* Condition 3(2) specifies that the noise criterion at non specified residences should be 35 dB(A)

** Unattended results include all noise sources including traffic on Peats Ridge Road.

+ Source: Tables4.3 and 4-4 Noise Assessment by Wilkinson Murray (May 2004)

7.1.2 Analysis of Results

Measured noise levels were within the set noise limits indicated in the Noise Monitoring Program. As such, Calga Quarry noise emissions were compliant with the Quarry's Project Approval Conditions of Consent at all nominated noise sensitive monitoring locations that were assessed during all noise surveys.

In Comparison with Noise Impact Assessment Criteria

Attended noise monitoring was generally undertaken during the day time period at each receptor location between the hours of approximately 10:00am and 3:30pm. All measurements were carried out in accordance with Australian Standard AS 1055-1997 *"Acoustics - Description and measurement of environmental noise"*.

There were no noise exceedances in 2017 during the three periods of noise monitoring attributing to the operations at Calga Quarry. However, as during previous years, the unattended monitoring established that LAeq,15min noise levels recorded at all assessment locations were substantially higher than that recorded during the attended noise monitoring, as the unattended monitoring did not distinguish between Quarry-related noise and other noise sources. The recorded elevated noise levels were attributed largely to traffic on Peats Ridge Road. Wilkinson Murray noted that the graphical presentation of the unattended measured noise data show that the measured noise levels do not fluctuate at the starting and finishing hours of the Quarry operations which would be expected if they were dominated by noise associated with quarry activities. The trend in noise levels at each location was for a steady increase between 4:00am and 6:00am and gradual decrease between 6:00pm and 8:00pm; consistent with peak hour traffic noise.

In Comparison with Previous Years Results

Table 10 records the range of recorded noise levels during the years 2006 to 2016 at the four residences (Residence 3 to 6). In general, the noise levels recorded by attended monitoring during 2017 were within the range of results recorded between 2007 and 2016.

In Comparison with EIS Predictions

The measured noise levels at all monitoring locations were at, or immediately below, the predicted noise levels in the 2004 EIS for the four attended monitoring assessments. It is difficult to accurately assess the contribution of Quarry-related noise in the allotted 15 minute period of noise monitoring due to the local noise environment dominated by traffic noise generated from Peats Ridge Road.

7.1.3 Conclusion

Compliance with noise criteria continued throughout 2017 with noise levels comparable to monitored levels from previous years.

7.2 AIR QUALITY

Monitoring of air quality around the Calga Sand Quarry is currently confined to monitoring deposited dust. The Air Quality Monitoring Program nominates that in the event of a sustained annual average dust deposition level of >3.7g/m2/month at a non-project related residence; a program of PM10 monitoring would be introduced at the relevant location(s). Due to the update of the EPA Environmental Protection Licence the Quarry is required to have on-site PM_{10} monitoring to occur with the monitor to be installed in the second quarter of 2018.

Since 2001, three dust deposition gauges (CD-1, CD-2a/2b, and CD-3), located at representative locations within and around the Calga Quarry, have been monitoring deposited dust levels attributable to the activities within the Calga Sand Quarry and other local sources. A further three gauges (CD-4, CD-5 and CD-6) were installed in 2006. Dust deposition gauge CD-2 was relocated in late January 2010 to avoid interference with results from a nearby access road on the adjoining property. The new site is referred to as "CD-2c". **Figure 2** displays the locations of all gauges.

All samples are collected monthly by Carbon Based Environmental Pty Ltd and analysed by the ALS Laboratory Group.

7.2.1 Air Quality Criteria and Predicted Dust Levels

The full set of air quality goals for the Calga Sand Quarry are summarised in **Table 11**.

Table 11: AIR QUALITY GOALS

Pollutant	Averaging Period	Criteria
Total Solid Particulates (TSP)	Annual mean	90 µg/m^3
Particulate matter <10 µm (PM_{10})	Annual mean	30 µg/m^3
Particulate matter <10 µm (PM_{10})	24 hour maximum	50 µg/m^3
Particulate matter <10 µm (PM_{10})	(24-hour average, 5 exceedances permitted per year)	50 µg/m^3
Particulate matter <2.5 µm ($PM_{2.5}$)	Annual mean	8 µg/m^3
Particulate matter <2.5 µm ($PM_{2.5}$)	24 hour maximum	25 µg/m^3
Deposited Dust	Annual mean	4g/m^2/month

The only current applicable criterion is for deposited dust which is 2g/m^2/month above the background level of 1.7 g/m2/month or a total of 3.7 g/m^2/month.

Extraction within Stages 3/1 and 3/5 was considered to produce "worst-case" scenarios and modelled to predict the likely deposition levels of particulate material. **Table 12** presents a summary of the model predictions at each of the Residences 1 to 14 for Stage 3/1. The level of activity within Stage 3/3 and 3/4 during the reporting period is considered to remain appropriate for the comparative assessment for the activities during the reporting period.

7.2.2 Results

Table 13 displays the monthly monitoring results at each monitoring site for 2017 and the annual average deposited dusts results from 2015 to 2017. Deposited dust monitoring at CD-2b ceased in January 2010, after samples were consistently contaminated by motorcycle activity on a nearby trail. A new monitoring location CD-2c replaced CD-2b in February 2010.

Table 12: SUMMARY DISPERSION MODEL PREDICTIONS DUE TO QUARRY OPERATIONS

	PM10 (µg/m^3)		TSP (µg/m^3)	Dust deposition (g/m^2/month)
Averaging period	**24-hour**	**Annual**	**Annual**	**Month**
Air quality goal	50	30	90	3.7
Residence ID	**Stage 3/1**			
1	15.8	5.1	10.9	0.63
2	21.6	4.1	8.4	0.44
3	11.8	2.2	4.2	0.21
4	14.2	2.1	4.2	0.21
5	5.0	0.9	1.7	0.08
6	6.3	0.8	1.7	0.08
7	8.4	1.3	2.6	0.14
8	4.4	0.6	1.1	0.06
9	9.4	1.4	2.6	0.13
10	4.8	0.6	1.1	0.06
11	2.9	0.4	0.8	0.04
12	1.9	0.3	0.5	0.02
13	2.2	0.3	0.6	0.03
14	1.4	0.2	0.4	0.02

Table 13: DEPOSITED DUST MONITORING RESULTS

	CD-1	CD-2c	CD-3	CD-4	CD-5	CD-6
Residence ID	1	3	5	13	NA	NA
2015 Average	1.2	1.3	0.8	0.6	0.6	0.6
2016 Average	1.4	0.9	1.2	0.6	0.5	0.9
Jan-17	11.9	0.7	1.4	0.9	0.9	0.7
Feb-17	9.0	2.7	1.7	0.7	1.0	0.8
Mar-17	0.8	0.5	0.4	0.7	0.2	0.4
Apr-17	2.3	0.5	1.0	0.6	1.3	0.4
May-17	1.5	1.5	0.6	0.7	0.6	0.6
Jun-17	0.2	0.2	0.3	0.4	0.3	0.2
Jul-17	0.3	0.3	0.8	0.5	0.3	0.8

Aug-17	1.2	0.9	1.6	0.8	0.3	0.9
Sep-17	0.6	0.5	1.6	0.9	0.8	1.2
Oct-17	2.4	1.2	1.7	0.2	0.5	1.0
Nov-17	1.6	4.6*	0.9	0.6	0.9	1.6
Dec-17	2.8	1.3	7.5*	0.5	0.6	0.8
2017 Average	2.9	0.9	1.1	0.6	0.6	0.8

Results marked with an * indicate an excessively contaminated gauge. Contamination calculation can include bird droppings, vegetation (such as plant matter, algae, pollen and seeds) and insects.

NS = Not sampled- bottle/funnel burnt out. Gauge fixed and replaced.

7.2.3 Analysis of Results

In Comparison with Air Quality Goals

The yearly averages for all monitoring locations were within the nominated goals for deposited dust. There were no occurrences when the monthly deposited dust level was in excess of the 4g/m^2/month annual average criteria.

The relatively high samples recorded at monitoring location CD-1 in January and February 2017 is almost 2.5 times the annual average for this location. However, the dust gauge is placed very close to the operations and conditions are not considered to be indicative of ambient conditions. The generally hot and dry period from November 2016 to February 2017 further contributed to the slightly elevated dust levels.

In Comparison with Previous Years Results

Average deposited dust levels for all six locations were similar or lower than those recorded in 2016, excluding CD-1.

In Comparison with EIS Predictions

The measured deposited dust levels outlined in **Table 13** are comparatively low and within the nominated goals, hence air quality issues are within predicted limits.

7.3 TRANSPORT

Calga Quarry has remained compliant with stipulated limits regarding transportation of product and has hence remained compliant with the conditions of consent.

7.3.1 Transport Criteria and Results

Schedule 2, Condition 7 states the proponent shall limit product transport to 400,000 tonnes of product per year from the site. **Table 14** provides a summary of the accumulated number of loads of products that were despatched on each week day during the remainder of the report period for the periods 5:00am to 7:00am, 7:00am to 12:00 noon, 12:00 noon to 5:00pm and 5:00pm to 10:00pm.

Table 14: RECORDED TRUCK LOADS THROUGHOUT 2017

Days	Mon	Tue	Wed	Thu	Fri	Sat	Total
5:00am to 7:00am	454	417	397	405	379	313	2365
7:00am to 12:00 noon	971	871	826	819	847	599	4933
12:00 noon to 5:00pm	442	534	498	544	457	70	2545
5:00pm to 10:00pm	412	424	439	441	408	3	2127
Total	2279	2246	2160	2209	2091	985	11970
* Based on an average load of 31.5t				# One load generates two truck movements			

The data in **Table 14** reveals that 65.7% of the products were despatched between 5:00am and 12:00 noon and only 6.2% of products were despatched after 5:00pm. Approximately 8.3% of the products were despatched on Saturdays. During the reporting period, an additional afternoon shift was added from approximately 12pm to 10pm for loading and despatch of trucks. This remains within the approved operating hours and no complaints were received regarding this activity.

Table 15: TRUCK DISPATCH YEARLY COMPARISON

Year (total)	Mon	Tue	Wed	Thu	Fri	Sat	Total
2016	2182	2297	2208	2207	2152	993	12009
2017	2279	2246	2160	2209	2091	985	11970

There were no traffic incidents in the 2017 reporting period, as seen in **Table 16**.

Table 16: TRAFFIC INCIDENTS

Reporting period	Number of incidents	Details of Incident
2015	0	n/a
2016	0	n/a
2017	0	n/a

7.3.2 Conclusion

The Quarry continued to operate the SAP counting system to monitor and manage truck dispatch numbers. New rules incorporated into the SAP reporting software have reduced the number of false positives such as split loads and internal deliveries.

7.4 GROUNDWATER

7.4.1 2016 Groundwater Monitoring

Groundwater monitoring throughout the reporting period was undertaken by Carbon Based Environmental Pty Ltd (CBE) and an audit of the results was undertaken by Dundon Consulting Pty Limited (Dundon, 2018) in accordance with the requirements of *Condition 3(18)*. The audit reporting is provided in full as **Appendix 3**, with a summary of the results provided as follows.

The approved monitoring network for the Quarry consists of 22 groundwater bores, both within the Quarry Site and on neighbouring properties. Bores CQ1 and CQ2 are no longer being monitored as they have been removed due to advancing extraction activities and bores CP3 and CQ6 have been removed by the respective landowners. Bore CQ9 remains accessible but the casing of the bore has been damaged and water level measurements are not possible. Monitoring during the reporting period involved collection of data on groundwater levels and quality and monitoring for any potential impacts from sand extraction on water supply bores on the neighbouring properties. The locations of the monitoring bores are shown on **Figure 2**. A recent groundwater bore census has identified three additional water supply bores within 500m of the Quarry site that are not included in the groundwater monitoring network. These are not reviewed in this report as monitoring remains subject to landowner approval.

Access to bores, MW10, MW13, MW16 and MW17 is no longer possible due to heavy erosion of the access track and these bores were not monitored during 2017. These bores are located within the property to the south and southwest of the Quarry site (see **Figure 4**). Bore CP4 located on the Kashouli property to the north of the Quarry was monitored for water level only, as the installed pump is reportedly not working. Monitoring from CP4 ceased after February 2017, as access has been blocked by landowners and is no longer accessible.

In accordance with the Site Water Management Plan, standing water level (SWL) was measured manually on a bi-monthly basis, in all accessible bores, or automatically using automatic water level recorders installed in fourteen of the bores and set to record the water level every 6 hours.

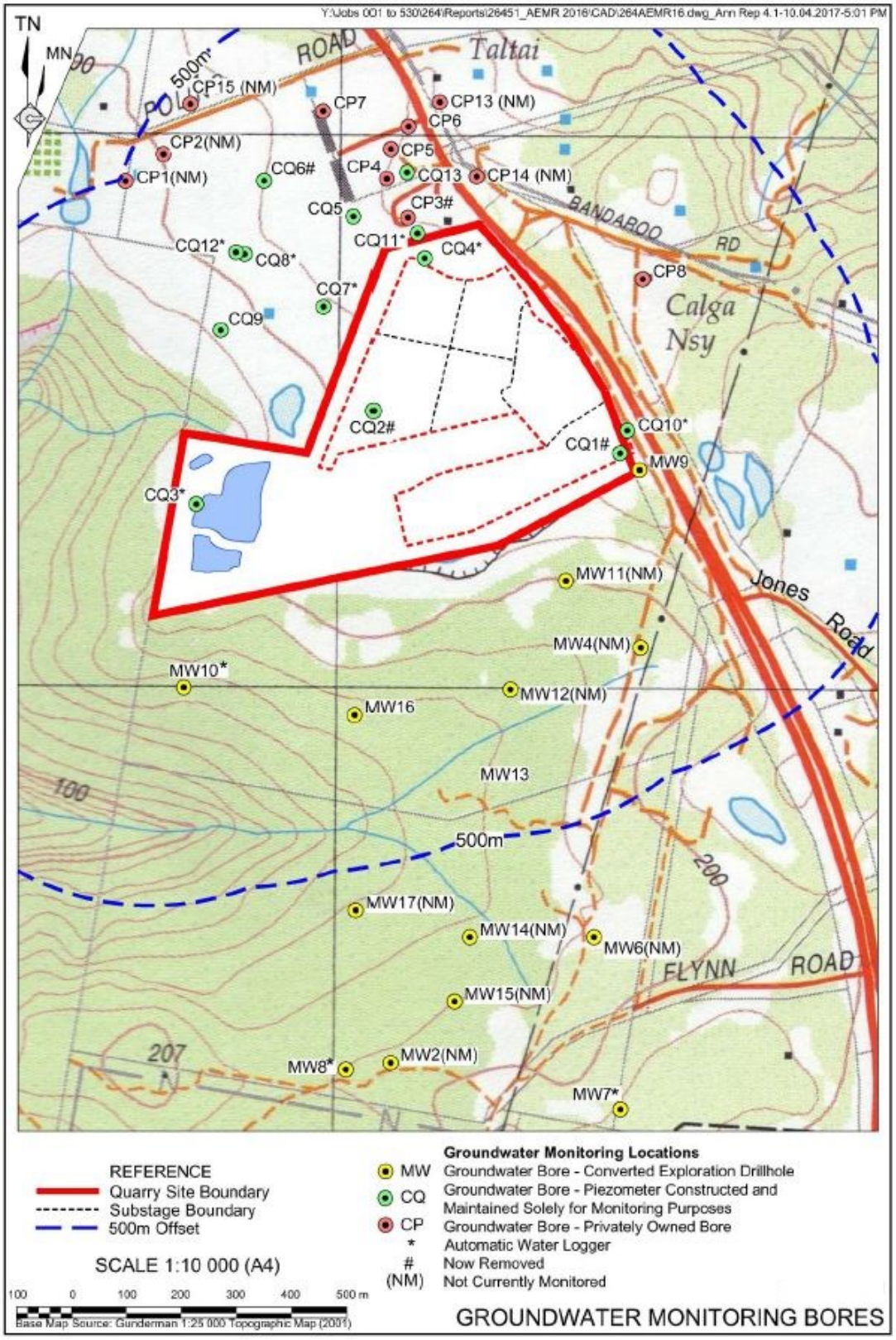


Figure 4: GROUNDWATER MONITORING BORES LOCATED WITHIN 500M OF QUARRY SITE.

Each monitoring bore was sampled bi-monthly (where possible) to determine the electrical conductivity (EC) and pH, and six-monthly for comprehensive laboratory analysis of a full suite of anions, cations and metals. The monitoring results were compiled into monthly Environmental Monitoring Reports by CBE and posted on the Hanson website.

7.4.2 Groundwater Criteria and Results

Groundwater Levels

The criteria relevant to groundwater quality and levels are drawn from the approved Site Water Management Plan (SWMP), dated February 2006 (Section 7.4.1).

It is a requirement to establish that any recorded declining trend in groundwater levels is attributable to climatic conditions or other factors not related to sand extraction activities on the Quarry site. In the event groundwater levels at monitoring bores CQ10 and CQ11 experience drawdowns of >1.0m attributable to sand extraction activities on the Quarry site, then a range of response actions need to be undertaken.

If any private bore on adjoining properties within 500m of the extraction area experiences a loss of yield >10% attributable to the extraction operation on the Quarry site, a range of response actions are also applicable. Monitored groundwater levels are represented in **Appendix 2** and shown graphically as hydrographs, together with rainfall and evaporation data, in **Appendix 3**.

Groundwater Quality

The criteria relevant to groundwater quality are drawn from the site Water Management Plan, dated February 2006 (Section). It is nominated that if any private production bore within 500m of the approved extraction area experiences a sustained salinity increase of >20% measured in either EC or total dissolved solids, a range of response actions will be implemented. Field measurements of EC and pH were recorded bi-monthly from all accessible bores. The results of these measurements are tabulated in **Appendix 2**. Samples for comprehensive laboratory analysis were collected 3 April 2017 and 3 October 2017. The results of the laboratory analyses are presented in **Appendix 3**.

7.4.3 Analysis of Results

Groundwater Levels

Groundwater levels are presented graphically as hydrographs, together with rainfall and evaporation data, in **Appendix 3**.

Bores CQ3, CQ4, CQ7, CQ8, CD10, CQ11S and CQ110, CQ12, CQ13, MW7, MW8, MW9 and MW10 are equipped with automatic dataloggers. For these bores, both datalogger and manual water levels are recorded, the dataloggers reading at 6 hourly intervals and the manual measurements taken every two months. All other bores are read manually every two months.

The 2017 Groundwater Audit (Dundon, 2018) has confirmed that the Quarry operations continue to have only a limited impact on the groundwater system. Water levels in most bores fluctuated throughout the year, consistent with rainfall patterns over 2017. Monitoring bores CQ10 and MW9 have showed a small magnitude divergence between the water levels and the Rainfall Residual Mass Curve in previous monitoring, suggesting that there has been some drawdown around the south eastern corner of the Quarry site. The magnitude of the recorded drawdown effect is much smaller than the normal seasonal fluctuation in groundwater levels in those bores due to climatic variability. Furthermore, there is no evidence that a drawdown effect in that location has extended off site. Dundon (2018) considered the predictions included in the assessment of groundwater conditions for the 2004 EIS (Jewell, 2004) and concluded that the recorded drawdown at these bores was consistent or below those predicted by Jewell (2004) in analytical modelling for the Quarry site. Further to this, the drawdown evident at this location is also below the predicted drawdown in the modelling completed in 2013 b Heritage Computing for the proposed southern extension project (Heritage Computing, 2013).

The audit confirmed that a small area of drawdown has developed off site in response to the extraction of friable sandstone from Cell 3/6 between April 2011 and February 2012. The area of drawdown extends less than 100m beyond the northern boundary of the Quarry site, and has been identified within three monitoring bores CQ4, CQ11S, CQ11D. The magnitude of the drawdown effect is relatively small compared to the long-term natural fluctuation in groundwater levels. The maximum drawdown attributable to the Quarry operations was observed at monitoring bore CQ4 which is located within the Quarry site. The drawdown effect was measured to be lower in CQ11S and CQ11D. Drawdown at this location is more likely to impact bore CP3, however this bore has since been removed by the landowner. The component of drawdown attributable to the Quarry has reduced significantly between 2013 and 2017, through recharge and inflows to the affected area drawdown, and is now less than half the magnitude reached by the end of 2012. Since 2012, groundwater levels at bores CQ4, CQ11S and CQ11D have fluctuated in accordance with the Residual mass Rainfall Curve. This suggests that drawdown at this location is no location occurring; however, the divergence in water level has not been restored. The monitored drawdown is much less than the predictions made in the 2004 EIS (RWC, 2004) and Groundwater Assessment Report (Jewell, 2004).

Apart from the localised impacts north of the Quarry site, no other off-site bore shos any impact attributable to the Quarry activities. The water level data trends continue to show a close correlation with the trends on the Rainfall Residual Mass Curve, indicating that rainfall recharge and natural discharge are the primary influences on groundwater levels.

Apart from the positive reversal in trend at CQ10 and MW9, water levels continue to rend in a manner consistent with trends observed in previous years.

Groundwater Quality

A number of exceedances of the ANZECC (2000) guideline values for freshwater ecosystem protection were recorded in 2017; however this remains consistent with records from previous years. These exceedances mostly relate to dissolved metals concentrations, with some

exceedances of the nitrate guideline value. A full list of recorded exceedances in shown in **Table 17**. The results confirm that the operation of the Quarry has not affected groundwater quality at any neighbouring groundwater bores.

The ongoing exceedances for dissolved metals are considered to reflect the natural groundwater quality and are not related to the Quarry operations. Exceedances of nitrate, which ranged up to a maximum recorded value of 9.19mg/L in 2017, are believed to be due to the agricultural activities on the neighbouring properties and result either from fertilizer application or possibly from chicken farming. The highest values were detected in off-site monitoring bores or private water supply bores north of the Quarry site. As such, these exceedances are considered not to be related to the Quarry operations (Dundon, 2018).

Table 17: EXCEEDANCES OF ANZECC (2000) FRESHWATER ECOSYSTEM PROTECTION GUIDELINES

Parameter	ANZECC (2000) Freshwater Ecosystem Protection Guideline (mg/L)	Reported Range (mg/L)	Exceedances*
Aluminium	0.055	0.03 – 2.57 (max CQ5)	All bores, except April 2017 from CQ3.
Cadmium	0.0002	<0.0001 – 0.0006	CQ3 (April 2017) only.
Copper	0.0014	<0.001 – 0.038 (max CQ10)	CQ3, CQ4 (April), CQ5, CQ7, CQ8 (April), CQ10, CQ11S (October), CQ11D (April), MW8 (October), MW9 (October), CP5, CP6 and CP7 (April).
Lead	0.0034	<0.001 – 0.009 (max CQ11D)	CQ7 (October), CQ10 (April), CQ11D, MW9 (October) and CP6 (April).
Nickel	0.011	<0.001 – 0.017 (max CQ3)	CQ3 (October).
Zinc	0.008	0.010 – 0.156 (max CQ5)	All bores except CP5 (April) and CP8 (April).
Nitrate	0.7	<0.01 – 9.19 (max CP6)	CQ4, CQ5, CQ7, CQ8, CQ10, CQ13, CP5, CP6, CP7 and CP8 (April).

* Dissolved metal and nitrate exceedances are considered to be reflective of natural groundwater quality and not a result of quarrying activities. Source: Dundon (2018) – Table 4

The Annual Groundwater Audit (see Section 7.2 of Dundon, 2018) recommends modifications to the Site Water Management Plan to exclude arsenic, selenium, boron and mercury from ongoing analytical suite of tests of groundwater quality given the historical lack of exceedances of the ANZECC (2000) guidelines values for these parameters. This recommendation has been made over six previous audit reports.

7.4.4 Recommendations

The Annual Groundwater Audit (Dundon, 2018) has reiterated several of the recommendations from previous years regarding the monitoring network and the groundwater monitoring program. These recommendations are summarised as follows.

- Monitoring should be discontinued at bores MW7, MW8, MW16 and MW17. These bores were established as monitoring bores for the formerly proposed southern quarry extension, and are no longer required.
- The access track should be re-instated and maintained to bores MW10 and MW13. These two bores should be equipped with dataloggers, in the even that access becomes lost at times in the future. Currently, MW10 has a datalogger. It is suggested that one of the dataloggers currently installed in MW7 or MW8 be used in MW13. As MW13 and MW16 water levels respond almost identically on a seasonal and short-term basis, it is not necessary to monitor both MW13 and MW16.
- CQ6 no longer exists. It is not considered necessary to replace the bore, as the other bores in the network provide adequate coverage. CQ7, CQ8 and CQ9 are screened at similar depth intervals to CQ6, and are located closer to the quarry than CQ6 was. Past monitoring has shown that CQ6 and CQ8 respond in almost identical ways to seasonal recharge, while CQ7 has a broadly similar response pattern.
- Subject to landowner approval, a monitoring bore should be installed at a site between Stage ¾ of the quarry and the Rozmanec bore CP8, as recommended in previous annual groundwater audit reports. This bore should be located near the site marked 'A' on Figure 1. It is also recommended that the new monitoring bore be equipped with an automatic datalogger to record water levels at 6 hourly intervals.
- Detailed laboratory analysis for groundwater quality should be reduced from six-monthly to annually, as first recommended in the 2011 annual groundwater audit, due to the lack of any seasonal trend in exceedances of metals and nitrates. The metal concentrations are considered to be natural and unrelated to the quarry. High nitrate concentrations which have been detected only in bores off the quarry site due to the land use practices on neighbouring properties, and are unrelated to the quarry.
- The laboratory water quality analysis does not need to include arsenic, boron, selenium and mercury, as there have been no reported detections of these analytes during the entire period of record.
- In order to comply with the Consent Conditions, CP13 and CP15 should be added to the monitoring network, subject to landowner agreement, as has been

recommended in previous annual audit reports. No water level measurements are possible in CP14, as the bore is sealed.

7.4.5 Conclusion

Localised drawdown has been recorded in 2017 in bores located within the Quarry Site to the north; however these results are consistent with monitored trends over recent years and are also consistent with predictions made in the 2004 EIS and Groundwater Assessment. Previously identified drawdown in the southeast of the Quarry was observed to recover slightly during 2017. These impacts are limited to bores within the Quarry Site and do not impact privately-owned bores.

During 2017, there were no significant changes in water quality in any of the surrounding private bores relative to the range and trends in prior years. No water quality issues were raised by any of the neighbours during 2017. No off-site water quality impacts attributable to the Quarry operations were recorded.

There have been no reports of loss of yield in any neighbouring production bore within 500m of the Quarry Site during 2017 which can be attributed to declining groundwater levels. Therefore this criterion was not affected.

7.5 SURFACE WATER

Monitoring of surface water quality was undertaken monthly by Carbon Based Environmental Pty Ltd. Samples collected were analysed by Australian Laboratory Services for pH, EC, total suspended solids (TSS) and total oil and grease at Site A (Dam 1), Site F (Dam 7b/c – at the overflow) and at Sites B to D when they were flowing (**Figure 5**). Samples are no longer taken at Site E following a request to discontinue sampling by the landowner of "Glenworth Valley". In June 2016, two new sampling sites were introduced to the northwest of the Quarry Site at the end of Polins Road (**Figure 5**). C1 was placed at the northern end of the dam to measure upstream results, and C2 was placed at the southern end to measure downstream results. These results have been reported in this document, however, it is noted that these results are upstream of the Quarry and therefore the results are indicative of background conditions only.

7.5.1 Water Quality Limits and Results

Table 18 presents a compilation of the routine monthly surface water monitoring results collected throughout 2017, together with the water quality limits drawn from the approved Site Water Management Plan. Water monitoring was undertaken following significant rainfall events in March 2017, the results of which are outlined in **Table 19**.

Table 18: ROUTINE SURFACE WATER RESULTS - 2017

	pH	EC	TDS	TSS	O&G
Units	-	uS/cm	mg/L	mg/L	mg/L

Water Quality Limits	+- unit	<1500	NA	<50	<10
A (Dam 1)					
No. of Samples	12	12	12	12	12
Minimum	5.86	60	43	<5	<5
Maximum	7.1	105	90	29	<5
Average #	6.40	82.00	65.67	17.75	<5
Standard Deviation #	0.42	15.01	16.12	7.36	0
B (Upstream from Dam 1 Overflow)					
No. of Samples	5	5	5	5	5
Minimum	5.87	96	135	6	<5
Maximum	6.67	135	198	98	8
Average #	6.45	111.00	170.60	41.00	6.50
Standard Deviation #	0.34	14.92	22.61	42.06	2.12
C (Upstream – Background Site)					
C1 (Upstream – Polins Road)					
No. of Samples	12	12	12	12	12
Minimum	6.38	90	52	<5	<5
Maximum	7.36	107	105	18	<5
Average #	6.87	99.25	69.17	12.33	<5
Standard Deviation #	0.30	6.08	14.07	3.77	0
C2 (Downstream – Polins Road)					
No. of Samples	12	12	12	12	12
Minimum	5.99	95	48	<5	<5
Maximum	7.02	132	103	34	<5
Average #	6.51	104.08	71.67	12.57	<5
Standard Deviation #	0.32	9.75	15.07	10.36	0
D (Upstream – Background Site)					
No. of Samples	2	2	2	2	2
Minimum	5.26	68	48	<5	<5
Maximum	5.48	93	73	<5	<5
Average #	5.37	80.5	60.5	<5	<5
Standard Deviation #	0.16	17.68	17.68	0	0
F (Dam7 b/c)					

No. of Samples	12	12	12	12	12
Minimum	4.81	60	54	<5	<5
Maximum	6.49	113	118	115	<5
Average #	5.80	86.50	77.08	27.60	<5
Standard Deviation #	0.49	17.52	18.03	31.69	0

EC = Electrical Conductivity TSS = Total Suspended Solids

TDS = Total Dissolved Solids O&G = Oil and Grease

Samples in **bold** exceed the nominated for the Quarry Site (though may not necessarily relate to the Quarry Site)

[1] Where levels were below the measurable threshold (i.e. <5mg/L), the maximum value of 5mg/L has been assumed for the purpose of preparing a statistical analysis.

Rounded value

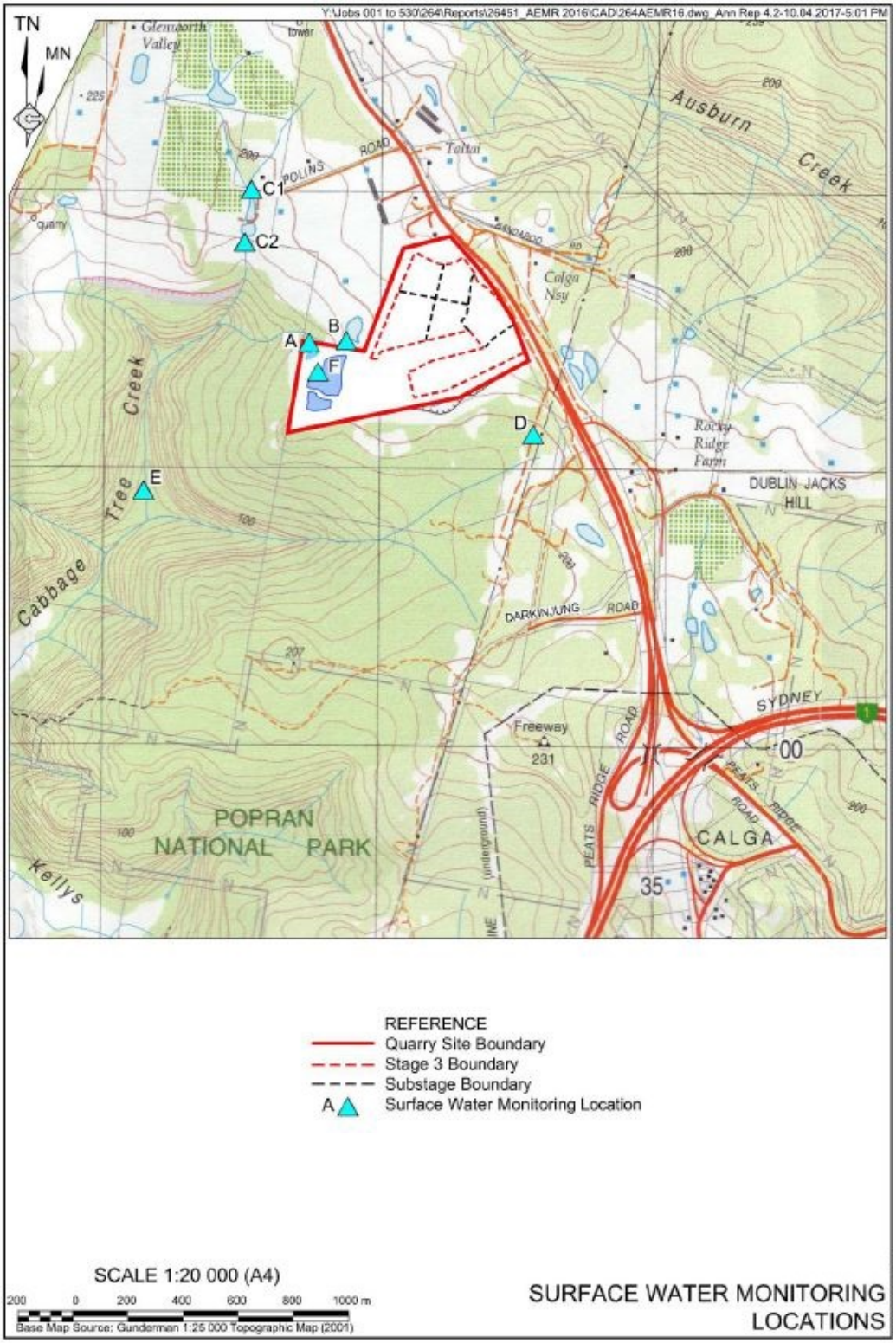


Figure 5: SURFACE WATER MONITORING LOCATIONS

Table 19: SURFACE WATER MONITORING RESULTS – SIGNIFICANT RAINFALL EVENTS 2017

	pH	EC	TDS	TSS	O&G
Units	-	uS/cm	mg/L	mg/L	mg/L
Water Quality Limits	+- unit	<1500	N/A	<50	<10
A (Dam 1)					
14/03/2017	6.89	86	79	**98**	<5
16/03/2017	6.49	70	165	**220**	<5
B (Upstream from Dam 1 Overflow)					
14/03/2017	6.33	106	110	42	<5
16/03/2017	6.66	100	267	**86**	<5
D (Upstream – Background Site)					
14/03/2017	6.35	60	59	<5	<5
16/03/2017	6.27	63	75	<5	<5
F (Dam 7b/c)					
14/03/2017	6.26	23	12	**78**	<5
16/03/2017	6.55	74	208	**208**	<5

EC = Electrical Conductivity
TSS = Total Suspended Solids
TDS = Total Dissolved Solids
O&G = Oil and Grease
NR = Not Recorded
Samples is bold exceed the nominated criteria for the Quarry Site (though may not necessarily relate to the Quarry site)

7.5.2 Analysis of Results

In Comparison with Water Quality Limits

When compared to the water quality limits nominated at the top of **Table 18**, the following comments are relevant.

- pH values in Dam 1 range from 5.86 and 7.1. These values have a range of approximately +- 1.0 pH units, which is consistent with pH levels recorded elsewhere in the catchment, including at upstream locations not influenced by the quarrying operations. These results are within +- pH units of the baseline pH range established at the upstream background Site D.
- EC values were always well below the 1 500uS/c limit. Average EC values at Site A and F were slightly lower than at Site B.
- TSS values were <50mg/L at all sampling sites with the exception of Site B (March 74 mg/L, April 98 mg/L) and Site F (March 118 mg/L).
- No oil and grease concentrations were above the 10mg/L limit in 2017 and were generally below the limit of detection.

In Comparison with Previous Years Results

Appendix 2 lists the recorded surface water quality since 2006.

- pH and EC values were comparable throughout the period 2006 to 2017.
- TSS values recorded in 2018 were comparable to those recorded between 2008 and 2014 and generally slightly lower than 2015 and 2017.
- Oil and grease concentrations were generally low, and regularly below the detection limit throughout the period 2006 to 2017. The only elevated record above the 10mg/L limit was at Monitoring Point D which is located upstream of Cabbage Tree Creek and monitored as a background site.

Significant Rainfall Events

The monitoring results recorded following significant rainfall events (**Table 19**) were consistent with the monthly monitoring results recorded during 2016. The elevated levels for Total Suspended Solids recorded in Dam A, Dam B and Dam F following the rainfall event in March 2017 most likely occurred due to significant disturbance within the catchment as a result of heavy rainfall during the three day period over 14, 15 and 16 March. Rainfall was recorded at 412.2mm for the month of March 2017, which is 3 times the average monthly rainfall recorded at the Bureau of Meteorology Lower Mangrove Monitoring Station between 1999 and the present.

In Comparison with EIS Predictions

The 2004 EIS included predictions that, with the adoption of the proposed design and operational safeguards, any discharge from the Quarry Site should satisfy the EIS predictions. Water Quality at Dam 1 during significant rainfall events was generally consistent with EIS predictions.

7.5.3 Conclusion

The monthly water monitoring undertaken during 2017 established that surface water quality was within the criteria established in the Site and Water Management Plan except for the oil and grease level recorded at Dam D for March 2016. This location is upstream of Cabbage Tree Creek and monitored as a background location and therefore this result was not influenced by quarrying activities. Records for oil and grease were below the limit of recorded for the remainder of the year which is consistent with previous trends at this location and this result is therefore considered to be anomalous.

7.6 REHABILITATION AND LANDSCAPE

7.6.1 Introduction

The 2017 rehabilitation program involved weekly work undertaken by an experienced horticulturalist on the areas identified in **Figure 6**. Activities include weed management, planting of native plant species using purchased tubestock or plants grown from seed, vegetation management and progressive maintenance of the existing visual and acoustic bund, as required. As part of this rehabilitation program, a seed bank, containing seeds collected from the existing Quarry Site as well as the immediately surrounding area, was established to aid in re-vegetation activities in the future. **Table 20** provides a summary of the rehabilitation undertaken in each of the areas defined in **Figure 6**. A list of all activities completed during 2017 is included in **Appendix 2**. During the reporting period revegetation activities continued within an area designated for the operation of the Envirocycle septic system. A transpiration bed developed for this system has been designated as Revegetation Area 8 for the purposes of reporting on ongoing revegetation and management of this area of the Quarry Site.

Table 20: 2017 REHABILITATION ACTIVITIES

Revegetation Area	Rehabilitation Undertaken During 2017
1	Spot and broad spraying, hand weeding, removal of dead vegetation, isolated mowing using a 'whipper snipper' to remove seed heads from weeds.
2	Spot spraying and hand weeding.
3	Spot spraying and hand weeding.
4	Spot spraying and hand weeding.
5	Spot and broad spraying, hand weeding. Planting of a number of native plant species grown from seed collected from the Quarry site.
6	Spot spraying and hand weeding.
7	Spot spraying and hand weeding.
8	Spot spraying and hand weeding within the area for Envirocycle System.
9	Spot spraying and hand weeding.
General Site Area	Raking mulch and spreading cuttings of local species containing seeds. Spot spraying along roadways, within car park and between dams, hand weeding.

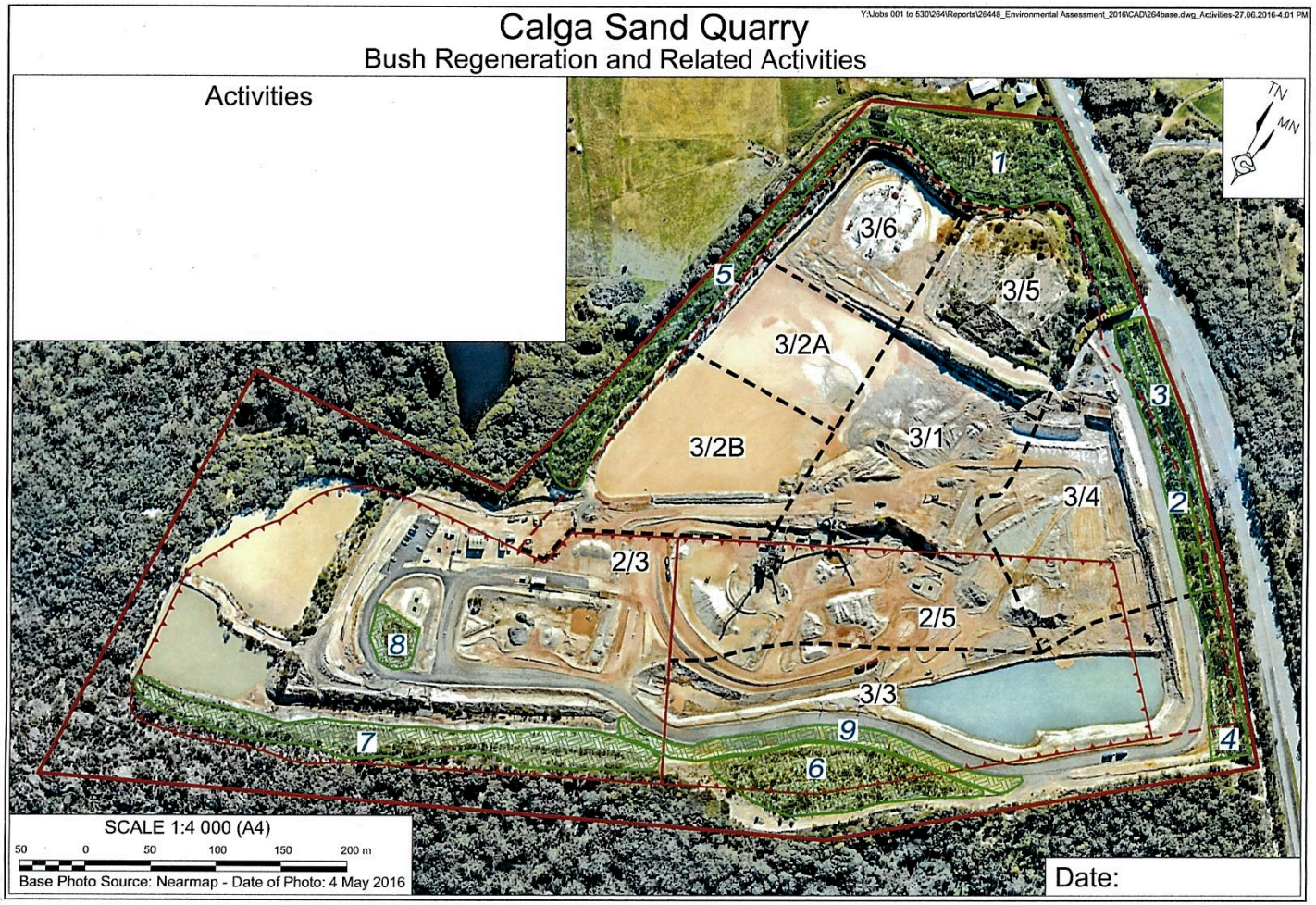


Figure 6: BUSH REGENERATION AND RELATED ACTIVITIES

Figure 7: GROUNDWATER DEPENDENT ECOSYSTEM MONITORING PLOTS

7.6.1 Criteria and Results

The weed species targeted by the horticulturalist during the reporting period included Kikuyu, Tagets, African Love Grass, Paspalum, Coreopsis, Cynodon, Sida, Verbena, Setaria and Bidens. Revegetation activities were focused on Revegetation Area 5 with tubestock of mixed plantings planted in the area.

A report prepared by Cumberland Ecology outlining the results of field surveys undertaken on 4 and 5 December 2017 is presented in **Appendix 6**. During the surveys, the re-vegetation status of previous rehabilitation/maintenance was assessed and annual vegetation monitoring within the Quarry Site undertaken. This report noted the following:

- Rehabilitation is generally being implemented in accordance with the performance criteria and the species required to be represented in the final landform are well represented.
- Apparent thinning of the revegetated native species *Acacia longifolia* subsp. *longifolia* has occurred through both active bush regeneration activities and through natural dieback senescing of the plants. This allows for greater diversity of revegetation, however, the increased light penetration is allowing exotic weed species to flourish. This has resulted in shading and out-competing native species in the ground layer throughout Revegetation Areas 1, 2, 3 and 5.
- Plantings of woody vegetation have been removed along the length of the fence line above Revegetation Area 5 due to repair of the fence as well as the removal of several large *Aracia* spp. individuals which were growing into and damaging the fence. Ongoing, any planting along the flat area containing the fence should be of native herbaceous species only.
- A continuing high standard and diversity of revegetation achieved in Revegetation Areas 4 and 6 and evidence of plant development with some plants over a metre high.
- Weed control has been carried out with a mixed degree of success compared to previous years. Weed coverage in Revegetation Area 7 was improved, while Revegetation Areas 2 and 3 exhibited increased weed coverage. It is noted that weed eradication activities should continue to target noxious weed species (where present) and prolific seeding weed species.
- The presence of Priority Weeds (declared under NSW *Biosecurity Act 2016*) within the Quarry Site is much improved since 2012, with only a few individuals observed within rehabilitation areas in December 2017.
- Recent threatened species surveys found the populations of *D. glauccophylla* and *H. procumbens* within the Quarry Site to be healthy and unaffected by extraction and associated activities. New occurrences of both species continue to be recorded.

Threatened Flora Species

The report prepared by Cumberland Ecology (Appendix 6) provides the results of monitoring at previously identified locations for the threatened flora species *Darwinia glaucophylla* and *Hibbertia procumbens.* In summary, the population of *D. glaucophylla* was found to be healthy and flowering with this species remaining unaffected by quarrying activities. The condition and number of plants identified has improved since 2015. *H. procumbens* was not located in areas where it has been previously identified during field survey. Cumberland Ecology has not located this species in these locations in the previous five years of monitoring studies (surveys conducted between 2013 and 2017) and concludes that the species is either not present within these locations or not able to be located. The report notes that other Hibbertia species were identified and have consistently been identified within the Quarry Site and identified approximately 50 individuals of *H. procumbens*. There is likely to be more species in this area given the nature of the survey method. All plants observed to be healthy and at various ages with some individuals observed to have recently flowered. The operations of the Quarry were not impacting on these individuals.

Groundwater Dependent Ecosystems

In January 2016 Cumberland Ecology were commissioned to survey the area to the south of the Quarry for the presence of GDEs and to establish monitoring plots that would be added to the annual vegetation monitoring undertaken within the Quarry Site. A total of five 20m square monitoring quadrats were established approximately 500m south of the Quarry Site (see Section 4 of Cumberland, 2017). Three plots were established within Sandstone Hanging Swamps (Groundwater Dependent Wetlands) and two plots were established in Sandstone Ranges Gully Rainforest (baseflow stream). **Figure 7** displays the location of the GDE monitoring plots.

The five monitoring quadrats were surveyed in December 2017 and the condition and composition of vegetation identified compared to the baseline and previous conditions recorded in January and December 2016. A detailed assessment of vegetation is included as Section 4 of Cumberland (2017) and a complete list of flora species recorded is available as Appendix C of the document. Cumberland Ecology concluded that all quadrats have similar species compositions and coverages compared to the baseline surveys. No dieback of vegetation was occurring and no impacts as a result of extraction activities were observed.

It should be noted that the Calga Sand Quarry has been operating since 2004 and the baseline monitoring and the current monitoring has indicated that there have been no impacts to GDEs to date from quarrying activities.

8. COMMUNITY

8.1 STAKEHOLDER AND COMMUNITY CONSULTATION

8.1.1 Local Community

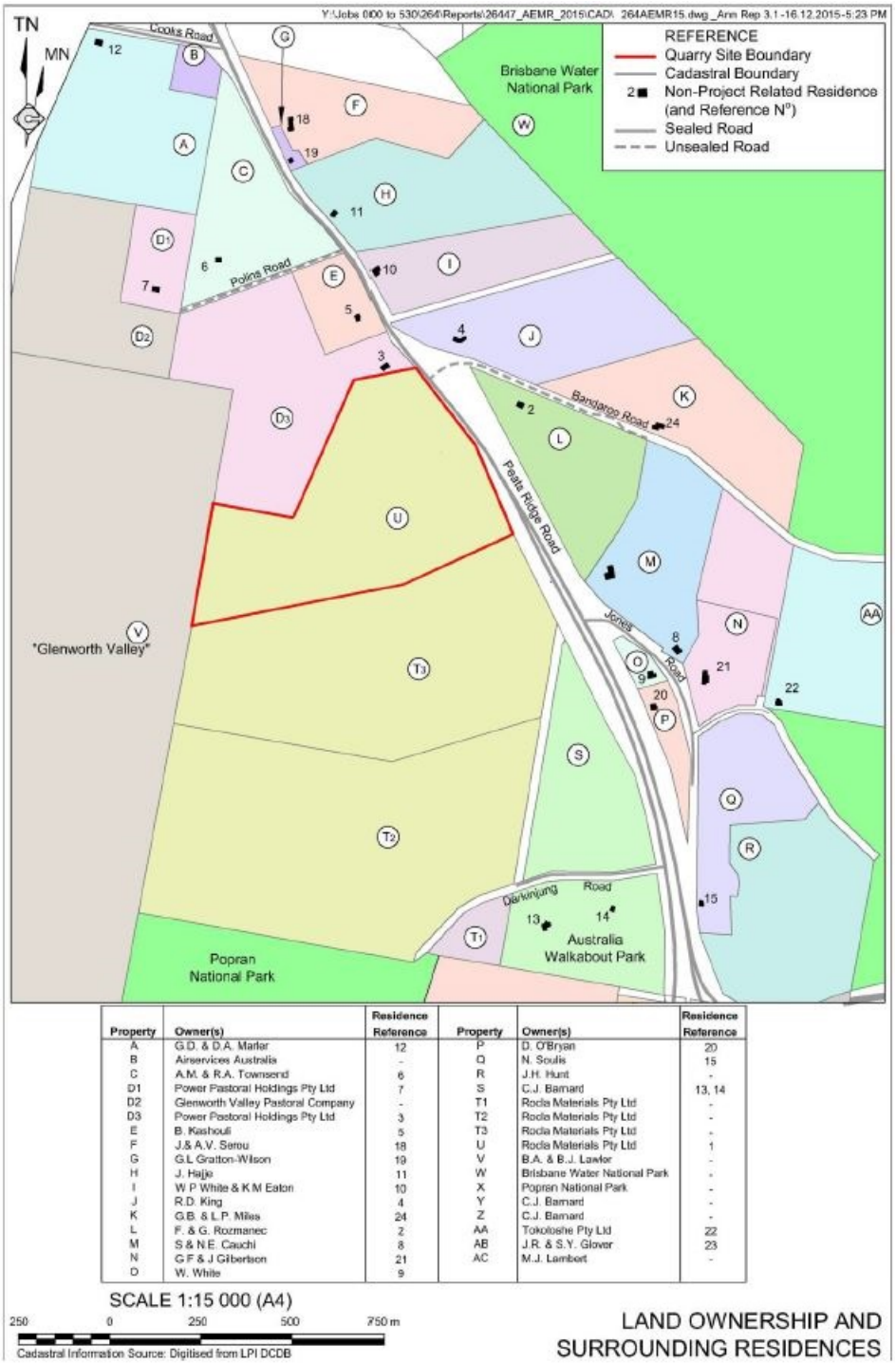
Figure 8 displays the land ownership and residences around the Calga Sand Quarry. The Quarry Manager, Mr Paul Slough & Mr Shane Pescud, maintained contact with neighbours throughout 2017 principally through direct one-to-one contact, occasional phone contact (call and SMS) and involvement in the Community Consultative Committee.

Two scheduled Community Consultative Committee (CCC) meetings were held at the Calga Sand Quarry on 1 May and 27 November 2017 to provide the committee with an update on the operation and discuss various issues raised by community members and Hanson personnel. The number of meetings held is consistent with the requirements on Condition 5(8)(c) for at least two meetings each year. The minutes of both meetings are reproduced as **Appendix 4**.

During the November 2017 CCC meeting, concerns were raised regarding the annual review of groundwater at the quarry site and Hanson's responsibility on monitoring groundwater. It was explained that the pump out of bores to gauge the recharge rate is generally utilised in the development of predicative monitoring with depth monitoring used as a comparative tool to the developed predicative model; as is required under the Calga Conditions of Consent.

8.1.2 Community Involvement

During the reporting period, two visits from local community representatives and neighbours were hosted at the Quarry as part of the Community Consultative Committee Meetings (as discussed in 8.1.1).



Property	Owner(s)	Residence Reference	Property	Owner(s)	Residence Reference
A	G.D. & D.A. Marler	12	P	D. O'Bryan	20
B	Airservices Australia	-	Q	N. Soulis	15
C	A.M. & R.A. Townsend	6	R	J.H. Hunt	-
D1	Power Pastoral Holdings Pty Ltd	7	S	C.J. Barnard	13, 14
D2	Glenworth Valley Pastoral Company	-	T1	Roda Materials Pty Ltd	-
D3	Power Pastoral Holdings Pty Ltd	3	T2	Roda Materials Pty Ltd	-
E	B. Kashouli	5	T3	Roda Materials Pty Ltd	-
F	J.& A.V. Serou	18	U	Roda Materials Pty Ltd	1
G	G.L Gratton-Wilson	19	V	B.A. & B.J. Lawler	-
H	J. Heijie	11	W	Brisbane Water National Park	-
I	W.P. White & K.M Eaton	10	X	Popran National Park	-
J	R.D. King	4	Y	C.J. Barnard	-
K	G.B. & L.P. Miles	24	Z	C.J. Barnard	-
L	F. & G. Rozmanec	2	AA	Tokoloshe Pty Ltd	22
M	S & N.E. Cauchi	8	AB	J.R. & S.Y. Glover	23
N	G.F & J Gilbertson	21	AC	M.J. Lambert	-
O	W. White	9			

Figure 8: LAND OWNERSHIP AND SURROUNDING RESIDENCES

8.2 ENVIRONMENTAL COMPLAINTS

Complaints are addressed in accordance with Section 3.3.3 of the Environmental Management System. Complaints management includes the following procedures.

- Complaints may be received by phone, email or mail.
- The complaints phone line number is displayed on the signage at the Quarry entrance, in the Yellow Pages and on the Hanson website.
- Phone calls are connected to a call centre from where the caller is directed to a Regional Risk Manager for NSW or other suitable person.
- All complaints are recorded and referred to the Quarry Manager.
- The Quarry Manager responds immediately by identifying the area of concern and an investigation is commenced by the Quarry Manager or an appropriate delegate.
- If necessary, additional environmental monitoring will be commissioned to confirm compliance or investigate the source of the complaint.
- A summary of the investigation, results and actions taken is recorded in the complaints register and made available on the Hanson website. A copy of the results is also provided to the complainant.

One complaint was received during the reporting period for nearby residences. The complaint was related to noise emissions from the Quarry Site and was investigated following the complaint. No extraneous noise requiring adjustment of operations were evident during the reporting period. A summary of the complaints is reproduced in **Table 21**.

Table 21: LIST OF COMPLAINTS RECEIVED IN 2017

Date	Time	Mode of Complaint	Nature of Complaint	Action Taken
24.11.2017	09:00am	SMS	Text message reads: Aside from the usual loud and disruptive noise that regularly emanates from the quarry, lately we are hearing new noises that sound like a giant magnified jackhammer. I assume this is the noise from your equipment trying to access hard rock.	Quarry manager drove over to listen and identify the alleged offending noise. The quarry was inaudible over the M1 and Peats Ridge Road traffic. The noise appears to be coming from somewhere else other than the quarry. Quarry manager tried to call the complainant, but received no return call. An SMS was sent asking if they could return the call to discuss the complaint. No response was received.

9. INDEPENDENT AUDIT

The first Independent Environmental Audit of Hanson operations under PA 08_0143 will occur in July 2018.

10. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

Hanson shall notify the relevant government authorities of any incident associated with the Quarry immediately after Hanson becomes aware of the incident, as per the Calga Sand Quarry Pollution Incident Response Management Plan. Within 7 days of the date of the incident, Hanson will provide the relevant agencies with a detailed report of the incident. There have been no reportable incidents in the last reporting period.

11. ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

11.1 INTRODUCTION

The following section provides a brief summary of the operational activities planned throughout 2018 (**Table 22**).

Table 22: SUMMARY OF PROPOSED QUARRY ACTIVITIES

Quarter	Activity
January – March	Continue extraction within Stage 3/4, with all slit deposited within Cells 3/1, 3/2 and 3/3 Conduct attended noise monitoring Conduct monthly dust deposition samples, surface water sampling s and bi-monthly bore water level monitoring as part of the environmental monitoring. Horticulturist to continue weeds spraying and planting in Revegetation Area 5 and revegetation maintenance activities. Overburden placement within Slit Cells 3/1 and 3/2
April – June	Continue extraction within Stage 3/4, with all slit deposited within Cells 3/2 and 3/3 Conduct monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring and bi-annual groundwater quality sampling as part of the environmental monitoring. Conduct attended noise monitoring Hold Community Consultative Committee meeting Horticulturist to continue weeds spraying and revegetation activities Overburden placement within Slit Cells 3/1 and 3/2
July – September	Continue extraction within Stage 3/4, with all slit deposited within Cells 3/3 Conduct attended and unattended noise monitoring Horticulturist to continue weeds spraying and revegetation activities

	Conduct monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring as part of the environmental monitoring. Overburden placement within Slit Cells 3/1 and 3/2
October – December	Continue extraction within Stage 3/4, with all slit deposited within Cells 3/3 & 3/4 Commence preparation and extraction in Stage 3/5 Conduct attended noise monitoring Suitably qualified ecologist to conduct annual rehabilitation and threatened species monitoring, including feral animal survey and noxious weed survey. Conduct monthly dust deposition samples, surface water sampling and bi-monthly bore water level monitoring and bi-annual groundwater quality sampling as part of the environmental monitoring. Hold Community Consultative Committee meeting. Horticulturist to continue weed spraying and revegetation activities. Overburden placement within Slit Cells 3/1 and 3/2

11.2 EXTRACTION OPERATIONS

Extraction of friable sandstone using mobile machinery will continue to be undertaken by standard rip and tear procedure and load and haul activities. No blasting is required or used at the Quarry.

Extraction operations will be undertaken in Stage 3/4 and is expected to possibly commence in Stage 3/5 towards the end of the year.

11.3 PROCESSING AND PRODUCT STOCKPILING

Processing activities will continue to occur at the plant during 2018. Material is transported by mobile machines to the sand processing plant where the material is processed and moved into stockpiles where it is stored on site for both internal and external sales by road registered trucks. The processed sand resource is primarily used for the manufacture of concrete for the construction industry. A small proportion of sand is used for other purposes, including landscaping and filling.

11.4 OVERBURDEN MANAGEMENT

Overburden material will continue to be placed in Cells 3/1, 3/2A, 3/2B throughout the reporting period.

11.5 SITE INFRASTRUCTURE

It is anticipated that minor alterations will be completed during the 2018 reporting period. This includes minor landscaping activities.

11.6 COMMUNITY INVOLVEMENT

During the reporting period, Hanson personnel intend to again host various visits from local community representatives and neighbours, principally through the Community Consultative Committee meetings.

11.7 WATER MANAGEMENT

Water quality monitoring with be continue in accordance with the EPL, Project Approval Conditions and Water Management Plans. The existing water transfer/recovery system involving Dams 7a and 7b/c will be maintained. Silts will be pumped to Stages 3/1, 3/2A and 3/2B in the first quarter of the year with placement moved to Cell 3/3 during the second quarter of 2018 and alternate between the two to manage silt storage capacity. Return water will continue to be directed to Dam 7b/c where it will settle before being pumped to the new wash plant using an electric pump.

The Site Water Management Plan is expected to be updated during the reporting period and water management will continue in accordance with this plan. Until that time, surface water sampling will continue on a monthly basis. Should there be any significant flows off site or rainfall is expected to be >50mm in a day, additional water sampling will also be undertaken.

11.8 AIR QUALITY MANAGEMENT

Hanson will continue to incorporate a range of design and operational safeguards, and operational procedures for the Quarry to ensure that the effectiveness of the air quality controls is optimised throughout all components of the quarry's operations. The Air Quality Monitoring Program requires the installation of a PM10 monitor, which will occur in the second quarter of 2018.

11.9 PRODUCT TRANSPORTATION

All product trucks will use the internal haul access road through the site. No changes to how the Quarry is accessed from Peats Ridge Road are proposed during the 2018 reporting period.

11.10 REHABILITATION

During 2018, Hanson will continue with the rehabilitation activities in the areas defined in **Figure 2**. These activities will largely involve planting of some additional native species on the existing acoustic bund and maintenance of previously revegetated areas. During 2018, emphasis will be placed upon continued thinning out the *Acacia longifolia*, additional planting in Revegetation Area 9 and spot spraying and hand weeding across all accessible Revegetation Areas.

11.11 MONITORING

Throughout 2018, the environmental monitoring programs will be continued in the same manner as those conducted throughout 2017.