Environmental Monitoring Program

Hard Rock Quarry, Karuah, NSW

Report Number HQP00-003

December 2014

Hunter Quarries Pty Ltd
PO Box 51
Thornton NSW 2322

Environmental Monitoring Program

Hard Rock Quarry, Karuah, NSW

PREPARED BY:

SLR Consulting Australia Pty
ABN 29 001 584 612
10 Kings Road
New Lambton NSW 2305 Australia
PO Box 447 New Lambton NSW 2305 Australia
61 2 4037 3200 61 2 4037 3201
newcastleau@slrconsulting.com www.slrconsulting.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked
HQP00-003	Draft EMP	May 2006	Klay Marchant	Craig Bagnall
HQP00-003	Draft EMP	June 2006	Klay Marchant	Nicole Reilly
HQP00-003	Revisions following HQPL, DEC & DOP comments	July 2006	Chrissie Eckersley	Andrew Hutton
HQP00-003	Draft Revisions following additional DOP comments	August 2006	Chrissie Eckersley	Andrew Hutton
HQP00-003	Final Report	August 2006	Chrissie Eckersley	Andrew Hutton
HQP00-003	Review of EMP	August 2008	Stephen Bragg	Andrew Hutton
HQP00-003	Revisions following audit & additional DOP comments	October 2008	Stephen Bragg	Andrew Hutton
HQP00-003	Revisions of EMS and EMP's	January 2012	Chris Jones	Andrew Hutton
HQP00-003	EMP Update to DP&E	June 2014	Chris Jones (SLR Consulting)	Andrew Hutton
HQP00-003	EMP Update to following Independent Environmental Audit	December 2014	Chris Jones (SLR Consulting)	Andrew Hutton

Environmental Monitoring Program – Hard Rock Quarry, Karuah, NSW

Report Prepared by:

Name: **Chris Jones (Associate Environmental Scientist)**
Qualifications: Bachelor Environmental Science
University of Newcastle, NSW, Australia

Company: **SLR Consulting Australia**
PO Box 447, New Lambton NSW 2305

Prepared for:

Client Name: **Hunter Quarries Pty Ltd**
PO Box 51, Thornton NSW 2322

Date of Issue: December 2014
SLR Reference: HQP00-003

Distribution List

Master:	SLR Consulting Australia Pty Ltd
Copy 1:	Hunter Quarries Pty Ltd
Copy 2:	NSW Department of Planning and Environment

TABLE OF CONTENTS

TABLES

APPENDICES

Appendix 1 – Monitoring Schedule

Appendix 2 – HQPL Karuah Site Plan: Location of Monitoring Points

1.0 INTRODUCTION

Hunter Quarries Pty Ltd (HQPL) received approval to operate a hard rock quarry in 1997 at a site located approximately 4km north of the township of Karuah (see **Figure 1**). The existing quarry operation consisted of an open cut excavation, crushing and processing facilities, stockpiles, loading facilities, workshop area and a weigh bridge. In October 2004, HQPL applied to the Department of Infrastructure, Planning and Natural Resources (DIPNR), now Department of Planning and Environment (DP&E) for approval to expand the quarry into adjoining land (i.e. the Stage 2 area) to allow the extraction of further hard rock resources.

Development Consent was granted by the then Minister for Infrastructure, Planning and Natural Resources on the 3 June 2005 (DA 265-10-2004), with the approved development including:

- Implementing the remainder of the approved Stage 1 quarry operation;
- Extending the quarry operations into the Stage 2 area;
- Upgrading and using existing infrastructure on site;
- Rehabilitating the site by re-contouring and revegetating exposed surfaces; and
- Producing up to 500,000 tonnes of product a year over the next 22 years.

The approval includes Lot 21 DP 1024341, Lot 11 DP 1024564 and part of Lot 12 DP 1024564. Quarrying activities will be undertaken on Lot 21 and Lot 11. Under Development Consent Condition 3, Schedule 4 of DA 265-10-2004 an **Environmental Monitoring Program** must be prepared to the satisfaction of the Director General (Now Secretary) and in consultation with other relevant agencies. GSS Environmental (GSSE) was engaged by HQPL to prepare the original 2006 *Environmental Monitoring Program* in accordance with the requirements of the Development Consent. A review of the *Environmental Monitoring Program* was completed in January 2012 as part of the review of the *Environmental Management Strategy* and associated environmental management plans. A review of the *Environmental Management Strategy* and associated management plans was again completed in June 2014, with change including figure updates (new aerial photo available) and changes to government department names. Following the Independent Environment Audit (submitted to DP&E in October 2014) the Environmental Monitoring Program was updated (this document) to address the comments from the auditor (MCW Environmental).

1.1 Actions Following Independent Environmental Audit

Following the completion of the Independent Environmental Audit in 2014 (MCW Environmental), HQPL sent the audit report to DP&E and responded to the recommended actions from the auditor. The recommendations relating to the Environmental Monitoring Program and where they addressed (letter sent to DP&E on 9 October 2014) are summarised in **Table 1**.

Table 1: Recommendations from the 2014 Independent Environmental Audit – Environmental Monitoring Program

Recommendation from Audit	Section
Air Quality • That the Air Quality Monitoring Program as defined in the Environmental Monitoring Program be augmented to include the existing monitoring being carried out (e.g. visual monitoring by control room; monitoring of water sprays; monitoring of dust on public roads etc); so that the implementation of air quality management controls can be better documented and assessed.	5.2.3
Water Quality • That the program be more specific for water monitoring as to how data will be obtained and recorded; who will be responsible for the monitoring and how will data be analysed and for what purpose. • That visual monitoring is conducted of drainage lines that are not directed to the Sediment Dam 2 to assess erosion and confirm drainage lines are clean or are directed to the Sediment Basin. • That the Plan include monitoring of water quality around the site entry on a regular basis during and after rain events to ensure erosion and sediment controls are effective.	5.3
Monitoring of Rehabilitation Works • That Hunter Quarries complete an annual rehabilitation inspection to assess the success or otherwise of rehabilitation; species diversity etc and to ensure ongoing health of these areas. This should be completed by a person competent in rehabilitation. • That the monitoring plan be amended to monitor all aspects of closure. This would be developed in line with the development of a Closure Plan as required of the Conditions of Consent.	5.7

Figure 1: Site Locality in relation to the township of Karuah, NSW.

2.0 OVERVIEW

In accordance with conditions of Development Consent, HQPL has established this *Environmental Monitoring* Program for the development to measure the **key environmental parameters for compliance during operation** of the Karuah Hard Rock Quarry.

Further, to integrate the plan with other site monitoring and management commitments, this *Environmental Monitoring Program* has been developed in accordance with the following related plans of the Karuah Hard Rock Quarry:

- *Hunter Quarries Pty Ltd Site Water Management Plan;*
- *Hunter Quarries Pty Ltd Rehabilitation Management Plan;*
- *Hunter Quarries Pty Ltd Flora and Fauna Management Plan; and*
- *Hunter Quarries Pty Ltd Environmental Management Strategy.*

Compliance evaluation and review of the environmental performance of various parameters will be carried out in accordance with the specific conditions of the Development Consent and Environment Protection Licence (EPL 11569). These include a range of environmental aspects with respect to the operation of the quarry. This Environmental Monitoring Program covers the Development Consent requirements to complete a Noise Monitoring Program (Schedule 3 Condition 3) and Air Quality Monitoring Program (Schedule 3 Condition 15).

3.0 SCOPE AND OBJECTIVES

The purpose of establishing and maintaining documented procedures to monitor key environmental characteristics of Hunter Quarries Pty Ltd (HQPL) Karuah Hard Rock Quarry is to enable HQPL to evaluate and continue to improve its environmental performance and ensure compliance with the EPL and Development Consent during the operational phase. This document satisfies part of Development Consent ***Schedule 4, Condition 3***, which requires that an *Environmental Monitoring Program* be developed and implemented for the quarry.

The relevant conditions of the Development Consent and the section(s) in this document where they are addressed is contained in **Table 2.**

Table 2: Relevant Conditions of Development Consent

Condition Number	Condition Requirement	Section
Sched 3, Cond. 3	*Within 6 months of the date of this consent, the Applicant shall prepare and implement a **Noise Monitoring Program** for the development to evaluate compliance with the noise impact assessment criteria in this consent, in consultation with the DEC, and to the satisfaction of the Director-General.*	This document covers the requirement to complete an Noise Monitoring Program Section 5.4.1
Sched 3, Cond. 15	*Within 6 months of the date of this consent, the Applicant shall prepare and implement an **Air Quality Monitoring Program** for the development to evaluate compliance with the air quality impact assessment criteria in this consent, in consultation with the DEC, and to the satisfaction of the Director-General.*	This document covers the requirement to complete an Air Quality Monitoring Program Section 5.2
16	*Within 6 months of this consent, the Applicant shall ensure that there is a suitable **meteorological station** operating in the vicinity of the development in accordance with the requirements in Approved Methods for Sampling of Air Pollutants in New South Wales, and to the satisfaction of the DEC and the Director-General.*	Section 5.5
26(b)	*Within 12 months of the date of this consent, the Applicant shall prepare, and subsequently implement, a Site Water Management Plan for the development, in consultation with the DEC, and to the satisfaction of the Director-General. The plan shall detail how site water management on site will be integrated with existing surface water management and erosion and sediment control systems and address surface water management and erosion and sediment control at both the construction and operation phases of the development. This plan must include:* ***Surface Water Monitoring Program***	Section 5.3
28	*The Applicant shall:* *a) measure:* • *the volume of water discharged from the site via licensed discharge points;* • *water use on the site;* • *water transfers across the site; and* • *dam and water structure storage levels.* *b) regularly monitor the quality of the surface water discharged from the licensed discharge points on the site;* *to the satisfaction of the DEC and the Director-General.*	Section 5.3

Condition Number	Condition Requirement	Section
34	*The Applicant shall:* *a) monitor the amount of waste generated by the development;* *b) investigate ways to minimise waste generated by the development;* *c) implement reasonable and feasible measures to minimise waste generated by the development; and* *d) report on waste management and minimisation in the AEMR.* *to the satisfaction of the Director-General.*	Section 5.8
Sched 4, Cond 3	***Within 6 months of the date of this consent, the Applicant shall prepare an Environmental Monitoring Program for the development, in consultation with the relevant agencies, and to the satisfaction of the Director-General. This program must consolidate the various monitoring requirements in Schedule 4 of this consent into a single document.***	**Whole document**
Sched 4, Cond. 4	*Within 3 months of the completion of the Independent Environmental Audit (see condition 6 below), the Applicant shall review, and if necessary revise, the Environmental Monitoring Program to the satisfaction of the Director-General.*	Section 6.0

The scope of environmental monitoring is directed towards key environmental aspects of quarry operations, as per the requirements of the conditions of Development Consent & undertakings made in the EIS (Asquith & deWitt, 2004).

This monitoring program has been developed entirely for ***"operational phase"*** monitoring. This is defined as the period of active quarrying including drilling, blasting, processing (crushing) and haulage of rock material from the site.

The nominated environmental aspects for monitoring & measurement at the quarry therefore include the following:

- **Air Quality;**
  - *Depositional Dust ; and*
  - *Total Suspended Solids and PM^{10} monitoring (as required).*
- **Water Quality;**
  - *Surface Water Quality (Sediment Dam No.2) ; and*
  - *Land Integrity & Stability (Erosion & Sediment Controls).*
- **Blast Monitoring;**
- **Noise Monitoring;**
- **Meteorological Conditions; and**
- **Flora & Fauna Surveys.**

Appendix 1 contains the monitoring schedule for the site, and **Appendix 2** contains a map showing the location of key environmental monitoring sites.

4.0 PERFORMANCE CRITERIA AND GUIDELINES

All monitoring is to be carried out in accordance with the Development Consent and/or the endorsed OEH Approved Methods as applicable. Where a standard or guideline is not specifically mentioned, HQPL will adopt the appropriate industry standard in liaison with appropriate regulatory authorities (e.g. OEH). Relevant standards and guidelines are detailed below.

Only NATA (or equivalent) accredited laboratories will be used for the analysis of the various parameters required as part of the environmental monitoring and measurement for the quarry.

4.1 Australian Standards

The following is a summary list of the Australian Standards (AS) relevant to monitoring and measurement at the quarry include:

- AS2923-1987 Ambient Air – Guide for siting of Sampling Units;
- AM-18 AS 3580.9.6-1990 “Particulate Matter – PM_{10} – high volume sampler with size selective inlet”;
- AS 3580.9.6:2004 “Methods for Sampling and Analysis of Ambient Air – Determination of suspended particulate matter – PM_{10} high volume air sampler with size selective inlet – gravimetric method”;
- As 2724.3 – 1984 “Ambient air – Particulate matter – Determination of total suspended particulates (TSP) – High Volume Sampler Gravimetric Method”;
- AS3580.10.1 Methods of Sampling and Analysis of Ambient Air; and
- AS2187.2-1993 Explosives – Storage, Transport and use - Use of Explosives.

4.2 Other Standards and Guidelines

The following is a summary list of other standards & guidelines relevant to monitoring and measurement at the quarry include:

- The NSW Environment Protection Authority (EPA) (1998) “Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales”;
- National Environmental Protection Council (NEPC) “National Environmental Protection Measure for Ambient Air Quality (1998)”;
- The NSW Environment Protection Authority (EPA) (1994) Environmental Noise Control Manual; and
- NSW Environment Protection Authority (EPA) (2000) Industrial Noise Policy (INP).

5.0 MONITORING PROCEDURES

The following specific procedures apply to all environmental monitoring and measurement at the quarry. These procedures will be implemented specifically in accordance with Schedule 3 of the Development Consent to ensure the safety of people, preservation and conservation of the environment, and to avoid and/or minimise any potential environmental impacts of the quarry on any privately owned land.

5.1 Monitoring Equipment

The monitoring equipment is to be installed, serviced and calibrated by a qualified consultant(s) given the responsibility of undertaking monitoring on the site. Where required by Development Consent and/or EPL, the equipment is to meet nominated standards and approved methods. The consultants are required to maintain records of instrument calibration and are to provide this information to the Quarry Manager on request.

In addition, any monitoring equipment controlled by HQPL that requires periodic calibration (e.g. weather station) is to be calibrated in the field and, when required, sent to the original equipment manufacturer (or equivalent) for full calibration tests and services.

5.2 Air Quality Monitoring Program

Schedule 3 Condition 13 of the Development Consent requires that dust emissions do not cause additional exceedances of the ambient air quality impact assessment criteria listed in **Tables 3, 4 and 5** below at any resident, or on more than 25 percent of any privately owned land.

Table 3: Long term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual	90 ug/m^3
Particulate Matter < 10um (PM_{10})	Annual	30 ug/m^3

Table 4: Short term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion
Particulate Matter < 10um (PM_{10})	24 hour	50 ug/m^3

Table 5: Long term Impact Assessment Criteria for Deposited Dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

The positioning of dust monitoring equipment (dust gauges for *depositional* dust fallout), is influenced by several factors, including the following:

- Prevailing seasonal wind regimes;
- The location of the nearest potential dust receptors;
- Practical limitations (including items such as clear siting as required by the Australian Standards, access, security, etc); and

- Previous dust management issues in the vicinity (e.g. complaints).

To ensure compliance with Schedule 3 Condition 13 of the Development Consent, HQPL have developed an *Air Quality Monitoring Program (AQMP)* to monitor the quarry's activities. The AQMP consists of monitoring for depositional dust, TSP and PM_{10} particulates (as required).

5.2.1 Depositional Dust Monitoring

Four (4) depositional dust gauges are located nearby to the site, and are monitored on a monthly basis by a suitably qualified contractor. The locations of the gauges are shown on the Environmental Monitoring Plan in **Appendix 2.** The results of air quality monitoring for the quarry shall be reported as per **Section 6.0** of this *Environmental Monitoring Program*.

5.2.2 HVAS Monitoring

To satisfy Schedule 3 Condition 15, an Air Quality Monitoring Program (AQMP) shall be implemented to assess compliance against the air quality impact assessment criteria as listed in Schedule 3 Condition 13. Following discussions the DECC (now OEH) in July 2006, it was agreed that the program would require the sampling of TSP and PM_{10} monitoring for a period of 12 months to determine compliance with the requirements of Development Consent Schedule 3 Condition 13 (air quality).

A High Volume Air Sampler (HVAS) had been operational at the site until March 2007, monitoring for both parameters at a residential property located directly opposite the quarry (see **Appendix 2**).

In April 2008, a review of the air quality monitoring program was undertaken in consultation with the then DECC and the then DoP after 12 months of HVAS monitoring. A report summarising the air quality monitoring undertaken by HQPL was completed by Heggies Pty Ltd in April 2008. The report reviewed the air quality monitoring program to determine compliance with Conditions of Development Consent for the following ambient air quality monitoring results.

- PM^{10} during April 2007 to March 2008; and
- TSP during April 2007 to March 2008.

The results findings of the air quality monitoring program demonstrated consistent compliance with the air quality criteria over the period from April 2007 to March 2008. The PM_{10} and TSP concentrations did not exceed the air quality criteria in Schedule 3 Condition 13. A letter from the then DECC dated 17 July 2008, acknowledged the annual ambient dust level averages were below the National Environmental Protection Council (NEPC) Standards for PM_{10} and TSP for the reporting period and were favourable to the removal of routine HVAS monitoring.

HVAS will not be completed unless otherwise directed by the DP&E or EPA. HQPL will continue dust depositional monitoring in accordance with the Development Consent and the EPL.

The results of the air quality monitoring for the quarry shall be reported as per **Section 6.0** of this *Environmental Monitoring Program*.

5.2.3 Inspections and Visual Monitoring

In addition to dust depositional monitoring the following is also completed:

- Visual monitoring by the control room;
- Monitoring of water sprays;

- Monitoring of dust from the highway;
- Daily inspections and drive around by the Quarry Manager; and
- Bi monthly inspection by specialist consultant.

5.3 Water Quality and Use

The nature of planned operational activities means that potential impacts on water quality are most likely to be related to erosion and sedimentation in the areas of progressive quarrying extraction and processing (including stockpiling and bulk material transfer) and also the continued use of the fuel storage area which may present potential oil and grease to waters**.**

An operational surface water monitoring program is currently in place at the quarry. Water from the site will report to Sediment Dam 2 for settlement of suspended solids prior to discharge (if required) from the site. Water quality management during quarry operations will be undertaken using water management controls in accordance with the *Site Water Management Plan*.

In order to measure the possible impact on water quality from the operation, the following monitoring will be undertaken:

- Surface water quality will be monitored every six months in Sediment Dam 2, with samples analysed for Total Suspended Solids (TSS), pH and Electrical Conductivity (EC). The collection and review of the water quality data over time will allow a good set of baseline data. Where sediment dam water quality exceeds this benchmark, flocculation may be required to assist sediment removal. In addition to the six monthly samples, more regular visual checks would be made to ensure that there is no noticeable increased discoloration or sediment build up in the sediment dams. The depth of the dams will be reviewed at least once a month to determine if the storage capacity of the dams has been reduced. Where the storage capacity has been reduced by thirty (30) percent or more the dam will be desilted.

In addition to the sampling, routine visual checks will be made of the dam during the bi-monthly (i.e. every two months) internal environmental inspections to ensure that there is no noticeable increased discoloration or sediment build up in the dams. The Quarry Manager completes a daily inspection of all components of the site. Water samples at Sediment Dam 2 are taken from the edge of the dam, adjacent to the pump. Water quality bottles are sent to a NATA accredited laboratory for testing.

- **Opportunistic Grab Samples** may also be taken during significant rainfall events. These samples will be analysed for Total Suspended Solids (TSS), pH and Electrical Conductivity (EC).
- **Bi-Monthly environmental inspections** will continue to be undertaken by the Quarry Manager to ensure mitigating controls and protocols are operating effectively. These cover all drainage lines, sediment fences and the main sediment dam.
- **Event-based Inspections** of the integrity of erosion and sediment controls and site drainage stability will be undertaken in accordance with the HQPL *SWMP*, including after runoff events (>20mm of rain) in addition to monthly routine environmental inspections (above). These cover drainage lines, sediment fences and the main sediment dam.
- **Water Use** – Water for dust suppression by water cart and sprays on the crushing facility is sourced from Sediment Dam 2. Water usage will therefore be measured via a flow metre to be installed on the pump in Sediment Dam 2. Flow metre readings will be recorded by the Quarry Manager during the bi-monthly environmental inspection.
- **Water Discharge** – The water volume in Sediment Dam 2 has been surveyed to determine the maximum capacity of the dam, which is approximately 18 mega litres. A height senor at Sediment Dam 2 monitors the water level to determine the capacity of the dam at any given time. In the event that water discharges from Sediment Dam 2, dam levels, along with rainfall and catchment

area will be used to calculate the volume of water discharged. Samples will be taken during the discharge of water from the site.

The results of the water quality monitoring program for the quarry shall be reported as per **Section 6.0** of this *Environmental Monitoring Program*.

5.4 Noise and Blast Monitoring

5.4.1 Operational Noise

Schedule 2 Condition 1 of the Development Consent requires HQPL to ensure noise generated by the development does not exceed the criteria specified in **Table 6** below at any residence, or any noise sensitive receptor on privately owned land.

Table 6: Noise Impact Assessment Criteria for the Development

Time Period	Noise Limits dB(A) $L_{Aeq\ (15\ min)}$
Day (7am to 6pm) Mon to Fri and 7am to 1pm Saturday	48
Evening (6pm to 10pm) Monday to Friday	47
At all other times	46

In order to measure the possible impact of noise resulting from quarry operations, the following monitoring will be undertaken at the two (2) nearest residences downwind and/or in line-of sight from the quarry and not owned or under agreement with HQPL:

- An unattended (continuous 24hr) noise monitor will be placed in the field to measure noise for at least four (4) full days of monitoring each six months;
- An attended survey (15-minutes meeting EPA standards) will be undertaken at the two nearest residences on a six monthly basis. This survey will be undertaken in conjunction with the unattended survey described above;
- A suitably qualified noise consultant will be engaged to undertake 15-minute attended noise surveys to investigate any complaints received by HQPL; and
- Onsite logged climatic data (particularly winds) will be utilised to assist with a timely management response to any noise issue that may arise. This is further discussed in Section 5.5.

During attended surveys, where the noise from operations is measured to be greater than approved criteria, a review of operational activities causing exceedances shall be undertaken and, where considered appropriate, the offending activity will cease until such times as the meteorological conditions improve (i.e. inversion lift) or other appropriate controls can be employed. In addition, the frequency of noise monitoring may be increased as appropriate, or until such time that it can be demonstrated that noise levels are well below required limits. Noise monitoring is completed by a trained external environmental consultancy.

5.4.2 Monitoring of Operational Blasting (Vibration and Overpressure)

In accordance with the Development Consent, blasts will only occur between 9am and 3pm Monday to Friday inclusive, once a week or at other times as approved by the OEH. In addition, blasting will only be undertaken in favourable weather conditions and by accredited specialist blasting contractors. Data from the site weather station will be checked prior to blasting. HQPL usually schedules blasts at 12:00pm on the day of blasting.

HQPL will ensure that the airblast overpressure level and peak particle velocity from blasting does not exceed the criteria below in **Table 7 and 8** respectively at any residence, or sensitive receiver on privately owned land.

Table 7: Airblast Overpressure Limits

Airblast overpressure level [dB(Lin Peak)]	Allowable exceedance
115	5% of the total number of blasts over a period of 12 months
120	0%

Table 8: Ground Vibration Limits

Peak Particle Velocity (mm/s)	Allowable exceedance
5	5% of the total number of blasts over a period of 12 months
10	0%

Blast monitoring will be undertaken at the nearest affected residence from the quarry (see **Appendix 2**) to ensure Schedule 3 Conditions 4 and 5 of the Development Consent are met.

In accordance with Schedule 3 Condition 7 of the Development Consent, a blasting notification register has been established at the quarry, with all registered individuals notified of upcoming blasting operations at the site.

The results of the noise and blasting monitoring program for the quarry shall be reported as per **Section 6.0** of this *Environmental Monitoring Program*.

5.5 Monitoring of Climatic Conditions

Schedule 3 Condition 16 of the Development Consent requires information on meteorological conditions to be provided for the site to specified OEH standards. The collation of this data will allow HQPL to respond to climatically influenced environmental issues such as noise and dust, and to assist in planning blasting activities to ensure that offsite impacts are minimised.

A meteorological monitoring station has been installed at the quarry, measuring a number of parameters including:

- Wind speed;
- Wind direction;
- Temperature;
- Humidity; and
- Rainfall.

Information from the meteorological station will be checked daily by the Quarry Manager (or nominated representative), downloaded by consultants for periodic environmental reporting, and accessed as required for complaint responses. Climatic information (eg winds) will also be checked prior to blasting. Information from the meteorological station will be reported in the AEMR.

5.6 Flora and Fauna Surveys

Flora and fauna surveys are undertaken at the site in accordance with the site *Flora and Fauna Management Plan.* This monitoring includes pre-clearing surveys, baseline surveys and performance monitoring of conservation/offset areas.

Karuah Hard Rock Quarries shall contract the services of a suitably qualified ecologist to complete the ecological monitoring program. The ecological monitoring program consists of monitoring:

- Ecological Communities;
- *Tetratheca juncea* Populations; and
- Threatened Fauna.

Following the Independent Environmental Audit, the auditors (MCW Environmental and Biosis) recommended that the frequency of ecological monitoring was every two years. HQPL have accepted this recommendation and are planning to recommence ecological monitoring every two years, commencing in Spring 2015. Details of the proposed ecological monitoring at the site and within the conservation offset area are outlined in *Flora and Fauna Management Plan*.

The results of the Ecological Monitoring Report for the quarry shall be reported as per **Section 6.0** of this *Environmental Monitoring Program*.

5.7 Monitoring of Rehabilitation Works

5.7.1 Annual Rehabilitation Inspection

The two small rehabilitation areas (Stage 1 and 2 Rehabilitation Areas) will be reviewed annually as part of the Annual Rehabilitation Inspection. The Annual Rehabilitation Inspection forms an appendix of the *Rehabilitation Management Plan*.

5.7.2 Detailed Rehabilitation Monitoring

Monitoring of the site's rehabilitation works will be undertaken in accordance with the site *Rehabilitation Management Plan.*

With minimal final rehabilitation to be completed until closure of the operation, no rehabilitation monitoring is planned until the site is closer to closure and additional rehabilitation has been completed. Analogue rehabilitation sites will be chosen to determine suitable final rehabilitation quality for the area.

When rehabilitation monitoring commences at the site it will include:

- Revegetated and landscaped areas will be monitored annually for 3 years, and then subsequently monitored every 2 years, and
- All rehabilitation works (i.e. fencing, weed control, erosion & sediment control) for the quarry's disturbed areas will be monitored as part of the site's bi-monthly (i.e. every two months) internal environmental inspections.

The monitoring also includes the following parameters outlined in **Table 9** below.

Table 9 : Rehabilitation Monitoring Program Parameters and their Descriptions

Rehabilitation Monitoring Program Parameters and their Descriptions	
Surface Erosion	General surface erosion observations made over entire 100m transect. Evidence of rill, gully or sheet erosion, areas of sedimentation/deposition, surface flow paths, and exposed surface soil texture (sandy, rocky, etc) recorded. If rill or gully erosion observed, representative erosion pins will be established along the gully and re-measured each monitoring visit to indicate erosion activity.
Groundcover	Depending on vegetation community type and accessibility, either stratified observations of groundcover percentage/type over twenty 1m x 1m quadrats, or 200 Point Intercept Observations, or both. Calculations will be made for proportion cover of native groundcover, weed groundcover, litter, deadfall, rock and exposed soil (per hectare).
Vegetation (tree & shrub)	Tree and shrub presence recorded for 100m x 5m transect (2.5m either side of transect tape). Tree/shrub species, height and location recorded. Calculations made for native species stems per ha and species richness. Mortality and premature senescence rates will be recorded in subsequent years. Observations will be noted on the development of community structure (canopy, understorey, groundcover, etc) will be observed as rehabilitation matures.
Weed presence	Significant weed infestations will be noted. Significant weed infestation includes: • the presence of any declared weeds or Weeds of National Significance (WONS), • infestations that appear to be interfering with the development of rehabilitated vegetation, or • weeds established near creeks or drainage lines that run offsite.
Comparisons with analogue site	Observations and trends noted for rehabilitation monitoring transect will be compared to information supplied from native vegetation monitoring.

The results of the site rehabilitation monitoring program for the quarry shall be reported as per **Section 6.0** of this *Environmental Monitoring Program*.

5.8 Waste Generation

In accordance with Schedule 3 Development Consent Condition 34, waste volumes and/or tonnages removed from site is to be recorded by the site's waste contractor and records regularly provided to HQPL.

Material recycled or reused offsite (volumes/tonnages, eg diverted from landfill) should also be recorded to illustrate waste minimisation and management performance of the site.

Waste minimisation strategies are included in annual environmental reporting (AEMR).

5.9 General Environmental Inspections

The Quarry Manager and Contract Environmental Officer will undertake **environmental inspections** every two months to ensure that mitigation controls, protected/conservation areas, and management procedures and protocols are functioning as required.

The **working order of mitigation controls** for surface drainage & storm water runoff, sediment controls, and potential dust sources are also to be inspected by the Quarry Manager as part of bi-monthly environmental inspections. The Quarry Manager will ensure that any contractors onsite are operating within the environmental controls as required for their activities. Additional water management inspections will be completed following greater than 20mm of rain.

6.0 REPORTING & REVIEWING

(i) Monitoring Results and Records:

To ensure that the *Environmental Monitoring Program* is effective and complying with specific statutory requirements and key objectives of this monitoring plan, the Quarry Manager (or nominated representative), will review monitoring results as required, particularly when activities change and an environmental impact is possible.

All monitoring records and reports are to be kept on site for a minimum period of four (4) years, in accordance with EPL and statutory requirements.

(ii) Reporting Environmental Incidents:

As required under environmental legislation and the Development Consent, HQPL is required to notify the OEH by phone *'immediately'* after becoming aware of any incident that may cause significant or adverse environmental harm, and to provide written details within seven (7) days. Incident management and reporting is completed in accordance with the sites *Pollution Incident Response Management Plan*.

(iii) Annual Reporting:

An annual report on environmental monitoring activities will be included within the AEMR to be submitted to the DP&E, OEH and Great Lakes Council annually.

(iv) Document Review:

This *Environmental Monitoring Program* will be reviewed at a minimum of every five (5) years to assess its effectiveness. The *Environmental Monitoring Program* will be revised to increase its effectiveness where any changes are recommended as a result of the review. This document is to be reviewed within three months of the completion of an Independent Environmental Audit as per Schedule 4 Condition 4 of the Development Consent.

6.1 Chain of Custody Documentation

All samples collected and sent from the HQPL Karuah site for further analysis must be accompanied by Chain of Custody (CoC) documentation.

Copies of all completed CoC documentation is kept on site in the Environmental Files.

7.0 RESPONSIBILITIES

The Quarry Manager (or their nominated representative) is responsible for the implementation of the *Environmental Monitoring Program*. The Quarry Manager will allocate responsibility for specific tasks where necessary. With respect to all aspects of environmental monitoring, the **Quarry Manager** (or his nominated representative) is responsible for the following:

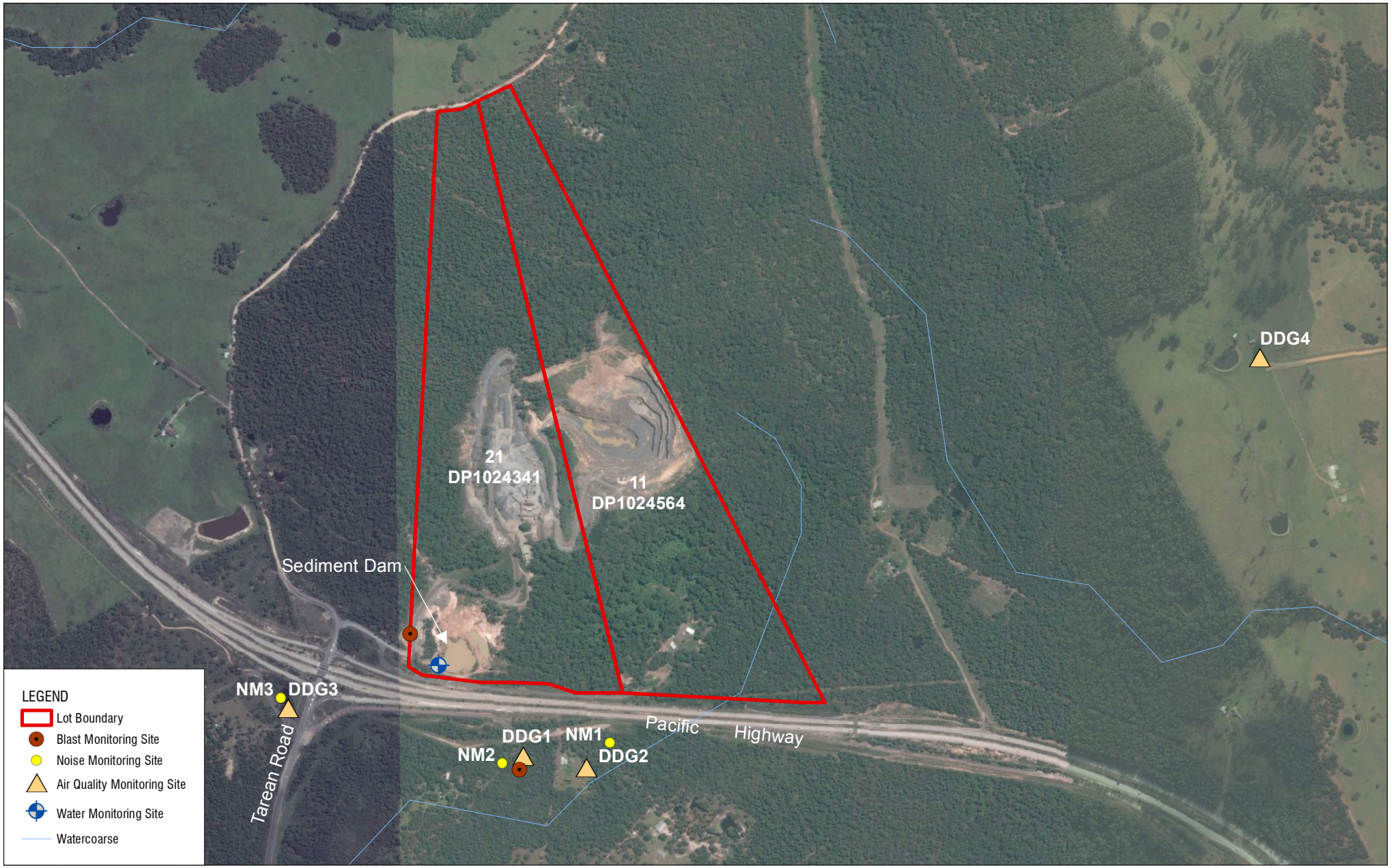
- Ensuring that all required monitoring programs required under this *Environmental Monitoring Program* are being undertaken;
- The management and co-ordination of specialist consultants and contractors related to the routine monitoring and measurement program for the quarry;
- Providing a primary point of contact for the various stakeholders in relation to the environmental performance of the operation;
- Receiving and responding to environmental complaints, and, being informed & available for public liaison to address any concerns arising from the operations;
- Taking reasonable steps to avoid or minimise unintended or adverse environmental impacts, and where such fails, directing the cessation of activities immediately where such impacts should be likely to occur;
- Undertaking additional monitoring (as required) that compliments the routine monitoring program;
- Collating and interpreting all monitoring & measurement data as provided by the specialist consultants and/or gathered on site and ensuring that it is made publicly available through the reporting process (i.e. AEMR);
- Ensuring access to all environmental monitoring sites is maintained and/or re-instated following any works associated with construction and operational activities; and
- Taking care to ensure all monitoring points are not damaged or destroyed by construction and operational activities where practical.

Appendix 1 – Monitoring Schedule

Environmental Monitoring Schedule

Environmental Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water Quality and Use												
- Sediment Dam Water Quality	■					■						
-Sediment Dam Water Use	■	■	■	■	■	■	■	■	■	■	■	■
- Sediment Dam Water Levels	■	■	■	■	■	■	■	■	■	■	■	■
Flora & Fauna Surveys												
- Surveys	As per site Flora and Fauna Management Plan – every two years											
Blast Monitoring												
- Overpressure Monitoring	Every blast											
- Vibration Monitoring												
Air Quality Monitoring												
- Depositional Dust Gauges (DG)	■	■	■	■	■	■	■	■	■	■	■	■
- TSP and PM10	As required under AQMP											
Climatic Monitoring												
-- Onsite Weather Station	■	■	■	■	■	■	■	■	■	■	■	■
Noise Monitoring												
- Unattended (logger) & Attended Survey					■						■	
Complaint-based Surveys	As required											
Waste Monitoring												
- Waste Removed (Volumes/Tonnages)	Every waste and/or recycling collection (contractor to record and provide to HQPL)											
- Offsite Recycling/Reuse (volumes/tonnages)												
Rehabilitation Works Monitoring												
-revegetated and landscaped areas	Monitoring to be undertaken in accordance with the Rehabilitation Management Plan. Currently Annual Rehabilitation Inspection											
- rehabilitation works (fencing, weed control, etc)												

Appendix 2 – HQPL Karuah Site Plan: Location of Monitoring Points



G:\Drafting\HQP00-003 - Karuah\Figures\ArcGIS\HQP00-003_Monitoring_01.mxd

SLR
10 KINGS ROAD
NEW LAMBTON
NEW SOUTH WALES 2305
AUSTRALIA
T: 61 2 4037 3200
F: 61 2 4037 3201
www.slrconsulting.com

Project No.:	633.HQP00.0030
Date:	23/06/2014
Drawn by:	LH
Scale:	1:12,000
Sheet Size:	A4
Projection:	GDA 1994 MGA Zone 56

N

0 100 200 300 m

Hunter Quarries Pty Ltd

Environmental Services and Support

Karuah Hard Rock Quarry
Environmental Monitoring Locations

FIGURE 1