



APPENDIX 4

Blast Management Plan

**OBERON QUARRY
BLAST MANAGEMENT PLAN**

DRAFT

OCTOBER 2014

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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Oberon Quarries Pty Ltd

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Report No. **1296/R36/V1**
Date: **October 2014**



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1.0 Introduction

1.1 Background

Oberon Quarries Pty Limited operates Oberon Quarry, an existing hard rock quarry located approximately 4 kilometres south of Oberon, New South Wales (NSW) (refer to **Figure 1.1**). The original Oberon Quarries Development Consent (DA92/164) (Development Consent) was granted on 1 October 1993 by the NSW Minister for Planning. Oberon Quarries has been operating at the site since 1995.

The existing Modification 5 Consolidated Development Consent allows for continued operations of the existing Oberon Quarry and enables the extraction of additional hard rock resources within the approved extraction area (refer to **Figure 1.1**).

1.2 Purpose and Scope

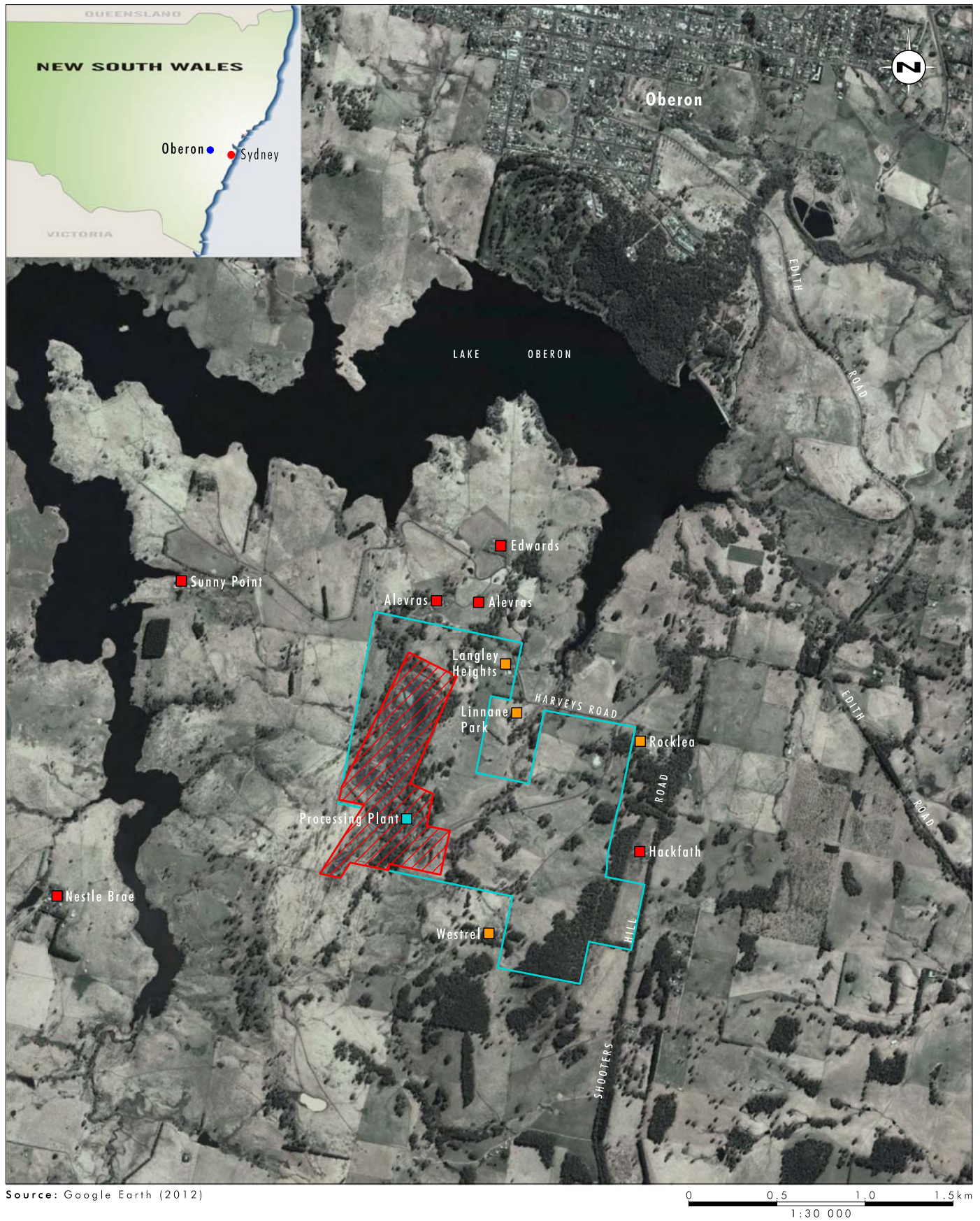
The purpose of this Blast Management Plan (BMP) is to provide a description of the measures currently implemented and those proposed to be implemented to manage blasting operations at Oberon Quarry. The requirements for this Plan have been outlined in Condition 22 of the Oberon Quarries Modification 5 Consolidated Development Consent. The scope of this document extends to the management of all blasting events undertaken by or on behalf of Oberon Quarries.

This BMP outlines the control measures to be implemented as part of the continued operations at Oberon Quarry to minimise the potential blast related impacts on the local community.

1.3 Objectives

The objectives of this BMP include:

- detail the controls currently implemented at the site and the controls to be implemented to minimise blasting impacts from the site;
- provide a blast protocol to assess monitoring results against blast impact assessment criteria to evaluate compliance;
- manage blast-related community complaints in a timely and effective manner; and
- detail the procedure for reporting blast criteria exceedances to relevant stakeholders.



Legend

- Project Area
- Langley Heights Property
- Private Residence
- Residence Owned by Oberon Quarries or Associated with Quarry
- Processing Plant

FIGURE 1.1
Locality Map

2.0 Regulatory Requirements

2.1 Development Consent

Oberon Quarries is required to operate in accordance with the Oberon Quarries Consolidated Consent (MOD5 – 27 September 2013). This BMP has been prepared to guide the management of blasting at the quarry and has been prepared in accordance with Condition 22 of the Direction, which states:

'22. Blasting

- ix) by 31 December 2013, the Applicant shall commission a suitably qualified person, whose appointment has been endorsed by the Director-General, to:
 - a) undertake a review of existing blast procedures and practices on site;
 - b) determine whether any additional management or mitigation measures are necessary to ensure compliance with air blast overpressure and ground vibration limits in this consent; and
 - c) prepare a report detailing the outcomes and recommendations of the review, to the satisfaction of the Director-General.

Within 2 months of receiving the review report, or as otherwise agreed by the Director-General, the Applicant shall submit a copy of the report to the Director-General, with a response to any of the recommendations contained in the report, including a timetable for the implementation of any reasonable and feasible measures proposed to address the recommendations in the report. The Applicant shall then implement the measures identified by the Director-General, to the satisfaction of the Director-General.'

Management controls for potential blast impacts associated with quarrying and ancillary activities are provided in **Section 4.0**.

2.2 Blasting Criteria

Oberon Quarries undertakes blast monitoring to verify that the limits for airblast overpressure levels and ground vibration peak particle velocity are not exceeded at any point within 1 metre of any affected residential boundary or other noise sensitive area. Blast criteria arise from Condition L4 of the Oberon Quarries EPL (EPL No. 4442).

The airblast overpressure level from blasting operations must not exceed^[1]:

- 115 dB (Lin Peak) for more than 5 per cent of the total number of blasts during each reporting period; and
- 120 dB (Lin Peak) at any time.

^[1] For assessment of annoyance due to blasting, the EPA adopts guidelines produced by the Australian and New Zealand Environment and Conservation Council (ANZECC, 1990)

The ground vibration peak particle velocity from blasting operations must not exceed:

- 5 mm/s (millimetres per second) for more than 5 per cent of the total number of blasts carried out on the premises during each reporting period; and
- 10 mm/s at any time;
- at any point within one metre of any affected residential boundary or other noise sensitive area in the vicinity of the plant.

3.0 Blast Methods at Oberon Quarry

Explosives are used to fracture the high quality basalt to enable the extraction of the resource by earth moving equipment. To achieve this, holes are drilled in a pre determined pattern giving attention to their angle, depth and spacing. These holes are then filled with an explosive and the charge is initiated with the aid of primers and detonators. The detonation of each hole is delayed in a pre-designed sequence to ensure that each hole is fired individually in close succession. This delayed firing technique improves the efficiency of the blast and also reduces its environmental impacts.

The design of a blast depends on its location, geological structures in that area, volume of resource in the target area, end product requirements and any limiting factors in relation to potentially sensitive locations (including residences and infrastructure). Blast design is therefore completed on a blast by blast basis, ensuring that all these factors are considered to achieve blast levels within acceptable limits.

4.0 Blasting Assessment

A blasting assessment has been completed for the quarry. The information presented below provides further detail on the response to blast exceedance events during 2012.

Blasts at Oberon Quarry are monitored (i.e. overpressure and vibration) in accordance with DA 92/164. The blast monitoring results for the 2010 and 2011 calendar years shows that none of the blasts monitored were above 115 dB or 10 mm/s.

The blast monitoring results for the 2012 calendar year show that there had been two exceedances of 120 dB overpressure and no exceedances of the 5 mm/s vibration limit of the blasts that were monitored. The overpressure exceedances were due to irregularities along the blasting face, which when combined with the drill hole angle reduced the distance to face for some holes which has resulted in overpressure levels being recorded above 120 dB. Oberon Quarries is committed to ensuring that sufficient distance is maintained between the blast hole and the quarry face so that this situation does not occur in the future.

These exceedances occurred when blasting was being undertaken on the upper level at the very northern end of the extraction area approximately 360 metres from NM2 (Alevras cottage) where the blasts were monitored. In the future, blasting at the northern end of the extraction area will be at least 400 metres from Alevras cottage and will be undertaken on the lower bench which is approximately 10 metres below ground level.

Blast monitoring has been a requirement of the blasting contract for many years. There have been some problems with the implementation of component of the contract in the past and as a result of the November and December 2012 blast exceedances, Oberon Quarries has purchased its own blast monitoring equipment and has been undertaking blast monitoring in parallel with the blasting contractor to ensure that all blasts are accurately monitored.

In addition, the Quarry Manager has undertaken blasting training so that all blasts configurations and delays used can be thoroughly checked before the blasts are detonated. In conjunction with this Oberon Quarries has reduced the maximum number of holes to be detonated in a blast from 300 to 150.

Oberon Quarries has committed to ensuring that sufficient distance is maintained between the blast hole and the quarry face, that appropriate delays are used and that all blasts are monitored and recorded to avoid any further exceedances in the future.

Oberon Quarries has and will continue to manage its blasting impacts through ongoing monitoring and review of the blast design, so that the overpressure and vibration criteria are not exceeded at private residences unless agreed with the resident. With the ongoing adoption of appropriate controls and checks no adverse impacts from blasting are predicted to occur as a result of the proposed ongoing operations.

5.0 Blast Management

Oberon Quarries is committed to implementing reasonable and feasible best practice blast impact mitigation measures at the Quarry. The relevant blast controls for the operation are detailed in the sections below and will be reviewed to confirm their applicability on an ongoing basis through the process outlined in **Section 7.2.1**.

5.1 Existing Controls Utilised at Oberon Quarries

Oberon Quarries will continue to implement the following blast management measures:

- all relevant quarry personnel will be trained on the environmental obligations in relation to blasting controls;
- the surrounding landowners and Council will be notified prior to undertaking a blast;
- the date, location of blast holes and quantity of explosive used each day will be documented;
- blasts will be designed to comply with overpressure and vibration criteria;
- monitoring will be undertaken at the nearest private residence and/or other sensitive locations (as required) to verify compliance with the relevant criteria;
- the maximum number of holes to be detonated in a blast will be 150;
- sufficient distance is to be maintained between the blast hole and the quarry face;
- appropriate delays will be used;
- all blasts will be monitored and recorded;

- blast monitoring data will be used on an ongoing basis to further refine the blast design and management;
- review of blast design will be ongoing and blast management procedures will be periodically reviewed to evaluate performance and identify corrective action, if required;
- blasting will be undertaken between 9.00 am and 3.00 pm, Monday to Friday inclusive, except under apparent temperature inversions conditions when blasting shall only occur between 11.00 am and 1.00 pm Monday to Friday. No blasting is undertaken on weekends or public holidays, without approval of the Director-General.
- Oberon Quarries will undertake consultation with residents whose properties are adjacent to the development, with a view to determining the most appropriate blasting times for the development. The applicant shall, in accordance with the requirements of the council, give notice of proposed blasting times;
- not blast more than twice a week;
- design all blasts to minimise airblast overpressure and vibration using the NONEL system of equivalent;
- design all blasts based on the results of monitored blasts designed to minimise airblast overpressure and vibration using the NONEL system such that any one blast has less than a five (5) per cent probability of exceeding airblast overpressure and vibration goals as set by the EPA for affected property;
- obtain appropriate local weather observations or take indicative measurements, immediately prior to blasting and from that data shall predict whether noise levels outside the quarry area are likely to be increased above the levels expected under neutral meteorological conditions. The said observations shall be recorded by the Applicant as part of its monitoring data; and
- not blast if the predictions indicate that the EPA noise goals of 115dBL/120dBL are likely to be exceeded.

5.2 Proposed Additional Controls

Oberon Quarries will implement the following blast management practices over the life of the Oberon Quarries Project:

- detailed design will be undertaken for each blast in order to maximise the blast efficiency, minimise dust, fumes, ground vibration and airblast, the potential for flyrock and to ensure compliance with site specific blasting conditions.
- Oberon Quarries will undertake a pre-blast meteorological assessment in order to confirm the applicability of blasting during the proposed blasting times. The pre-blast meteorological assessment will inform the likelihood of potential blast impacts as a result of forecasted adverse wind inversion weather conditions;

- Oberon Quarries will monitor blasts as quarrying progresses utilising the adaptive management techniques described in **Section 7.2.1**, so that blast prediction site laws can be further refined and future blast designs can be optimised based on more detailed site information. By adopting this approach, in conjunction with the adoption of improved blasting products and methods, as they are introduced, it is anticipated that blast emissions criteria can be met without imposing any significant constraints on blast designs throughout the operation of Oberon Quarries. Oberon Quarries will design all blasts to comply with the project specific vibration and airblast criteria and to protect public and private infrastructure and property from any damage as a result of flyrock. Future updates of this plan will include any additional management requirements, taking into account the results of blast monitoring undertaken.
- the blasting site design will be constantly updated using site-specific blast monitoring data. This process will provide Oberon Quarries with flexibility to design blasts to best meet production requirements while complying with relevant criteria for residential receivers.
- In addition, and as outlined in **Section 4.2**, the Quarry Manager has undertaken blasting training so that all blasts configurations and delays used can be thoroughly checked before the blasts are detonated. In conjunction with this Oberon Quarries has reduced the maximum number of holes to be detonated in a blast from 300 to 150.

5.2.1 Blast Fume Management Protocol

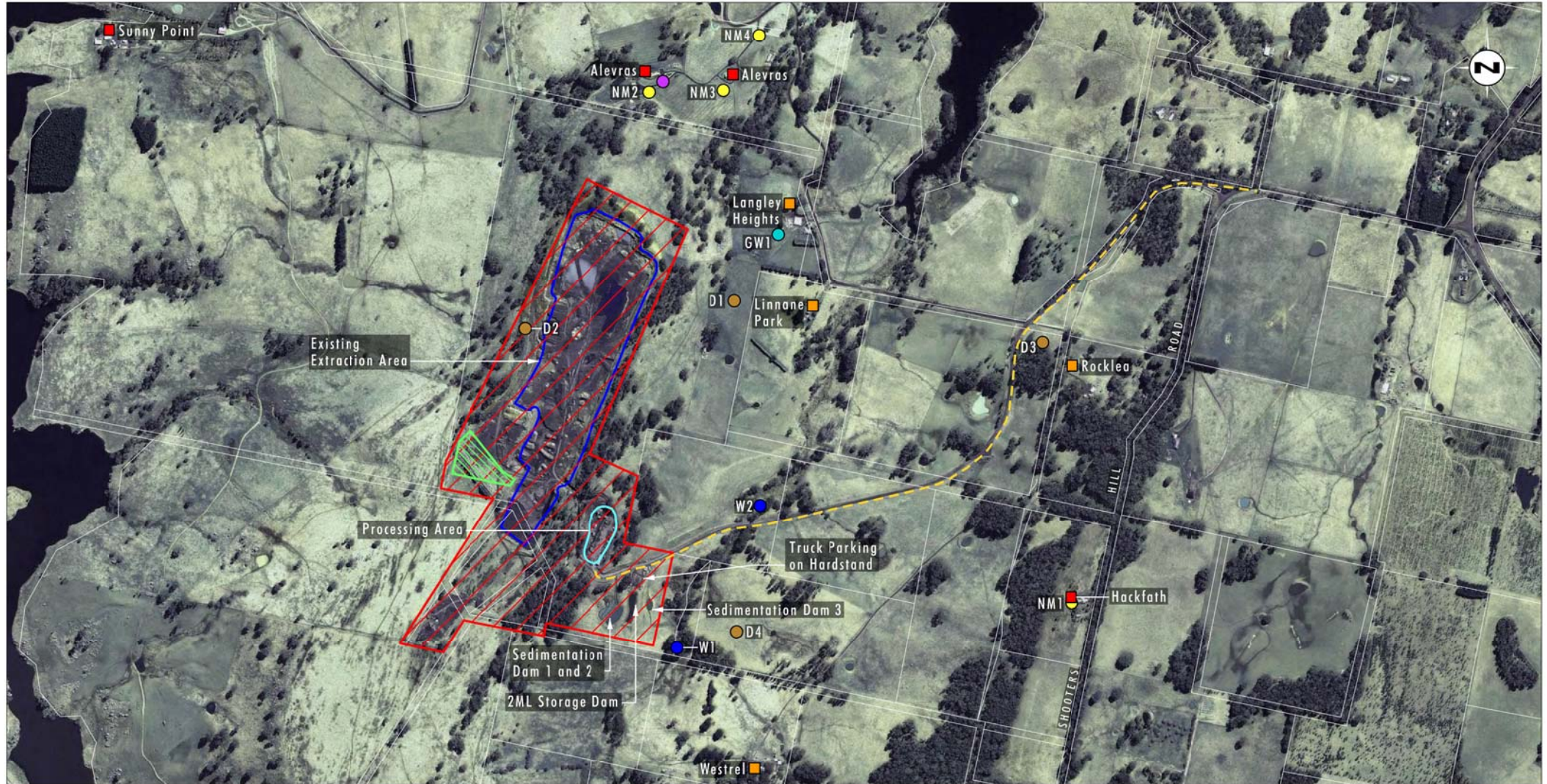
Blast fume development and migration is to be observed and managed. With regard to Blast Fume Management, the following management controls will be undertaken:

- use of appropriately qualified personnel. This includes an assessment of whether the contractor is appropriately trained to undertake the drill and blast works;
- use of appropriate blast design as approved by the site drill and blast coordinator or his or her delegate;
- appropriate dewatering of drill hole prior to loading;
- minimisation of 'sleep time' between loading and blasting, where practical;
- prior to blasting, a visual weather assessment of meteorological conditions will be undertaken by the Quarry Manager to confirm that weather conditions are not conducive to fume migration; and
- In the event that blast fume generated by the blast, an investigation into the causes of the blast fume will be undertaken (refer to **Section 6.2**).

6.0 Blast Monitoring

Oberon Quarry will monitor blasts as quarrying progresses in accordance with the existing blast monitoring system so that blast performance and design can be further refined and future blast designs can be optimised based on more detailed site information.

To ensure compliance with Development Consent and EPL conditions, monitoring of blasts will be undertaken. Blast monitoring for airblast and vibration will continue to be undertaken at the locations shown in **Figure 6.1**.



Source: Google Earth (2012)

0 250 500 750 m
1:15 000

Legend

- | | | |
|-----------------------------------|--|----------------------------|
| Project Area | Noise Monitoring Location | Existing Extraction Area |
| Right of Carriageway | Blast Monitoring Location | Proposed Extension (1.0ha) |
| Depositional Dust Gauge Location | Private Residence | |
| Surface Water Monitoring Location | Residence Owned by Oberon Quarries/Associated with Oberon Quarry | |
| Groundwater Monitoring Location | Processing Plant | |

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20141031 16.17

FIGURE 6.1

Environmental Monitoring Locations

6.1 Blast Data

Data collected for each blast will include:

- measured vibration;
- measured overpressure;
- maximum instantaneous charge;
- number of holes;
- blast type; and
- meteorological conditions.

6.2 Blast Fume Monitoring

Fume monitoring and post blasting investigation into fume events will be undertaken at Oberon Quarry. Fume monitoring requirements include:

- visual assessment and analysis of each blasting event to determine whether excessive fume was generated as a result of the blast. All blasts undertaken at Oberon Quarry are video recorded to provide a record of the blast;
- in the event that any blast at Oberon Quarry leads to the development of excessive fume an analysis of the blast will be undertaken to determine the cause of the blast fume development and whether the blast fume travelled off site; and
- analysis of meteorological conditions to determine the likely, if any, offsite impact of NOx fume events post blasting.

6.3 Standards Relevant to Blast Monitoring/Management

Oberon Quarries will undertake blast monitoring at Oberon Quarry in accordance with the policies, principles, regulation and guidelines contained within:

- *Protection of the Environment Operations Act 1997* (PoEO Act) administered by the OEH;
- EP&A Act administered by the Department of Planning and Environment (DP&E);
- AS 2187.2-2006 'Explosives – Storage and Use – Use of Explosives';
- *OHS Amendment (Dangerous Goods) Act 2005* and *Explosives Act 2003* administered by WorkCover;
- Prevention and Management of Blast Generated NOx Gases in Surface Blasting – Code of Good Practice (AEISG 2011); and
- ANZECC '*Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration*'.

7.0 Reporting

7.1 External Reporting

A summary of blast monitoring results will be provided in the Oberon Quarries Annual Environmental Management Report (AEMR). The following information will be reported in the Annual Review in accordance with Condition 27 of the Development Consent.

In addition, in accordance with *Protection of the Environment Legislation Amendment Act 2011* (Amendment Act), Oberon Quarries will provide contact details on the Oberon Quarries website so residents and stakeholders can obtain proposed blast dates and times from Oberon Quarries personnel. Blast monitoring results will also be provided on the Oberon Quarries website (<http://www.oberonquarries.com.au>).

7.2 Blast Criteria Exceedance Reporting Protocol

Exceedances of blast criteria will be classified as environmental incidents and will be managed and reported in accordance with the requirements of EPL 4442 and the Development Consent. All environmental incidents will be investigated to a level commensurate to their risk level, by Oberon Quarries Manager in consultation with the relevant specialists, as required. Additional controls will be implemented where required, based on the outcomes of the investigation. All environmental incidents/exceedances will be reported annually in the AEMR.

Incidents that have caused, or threaten to cause material harm to the environment will be reported to the Director-General of DP&E as soon as practicable after Oberon Quarries become aware of the incident. Incidents will also be reported in accordance with EPL 4442 conditions and in accordance with the Oberon Quarry Pollution and Incident Response Management Plan (PIRMP).

Additionally, in the event an exceedance of the blast impact assessment criteria is identified, Oberon Quarries will notify DP&E and any affected landowner(s) and provide regular monitoring results to each of these parties until the results show that the operation is complying with the relevant criteria.

7.2.1 Adaptive Management

Oberon Quarries will assess and manage blast related risks to ensure compliance with the criteria outlined in **Section 2.2**.

Where a non-compliance relating blast impact has occurred, Oberon Quarries will, to the satisfaction of the Director-General of DP&E:

- take all reasonable and feasible measures to ensure the exceedance ceases and does not recur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the DP&E describing those options and any preferred remediation measures or other course of action; and
- implement remediation measures as directed by the Director-General of DP&E.

7.3 Complaint Response

Complaints relating to blasting at Oberon Quarry will be included on a site register and will be investigated in accordance with site practices. A summary of complaints will be available to regulatory authorities on request and provided in the AEMR.

8.0 Definitions

The terminology utilised within this BMP is defined in **Table 8.1** below.

Table 8.1 – Terminology Utilised Within the BMP

Term	Definition
Airblast/ Overpressure	An airborne shock wave resulting from detonation of explosives. An airblast may be caused by blasted material movement or the release of expanding gas into the air.
Blasting	Any activity involving the use of explosives for the purpose of producing an explosion to fragment rock for mining.
Flyrock	Rock that is propelled outside of the blasting area through the air or along the ground as a result of the detonation of explosives.
Ground vibration	The movement of the ground caused by the blast wave emanating from the blast.
Particle Velocity	A measure of ground vibration. Particle velocity describes the velocity at which a particle of ground vibrates when excited by a seismic wave.
Blast Exclusion Window	The arc of prevailing wind direction calculated on an individual blast basis and designed to minimise the risk of adverse dust or fume impacts.
Sleep time	The time taken between the drill hole being loaded with explosive and detonation of the explosive

9.0 Accountabilities

Relevant roles and responsibilities associated with this BMP are presented in **Table 9.1** below.

Table 9.1 – Roles and Responsibilities

Role	Responsibilities
Oberon Quarries Manager	• provide adequate resources for the implementation of this BMP; • authorise the implementation of specific management measures to minimise blast impacts in accordance with this plan; • ensuring that the outcomes of monitoring are systematically evaluated as part of ongoing quarry planning; • authorise internal and external reporting requirements; • oversee the implementation of the BMP; • ensure the drill pattern is drilled in accordance with the blast design; • ensure that the blast is loaded with the correct quantity and quality of explosive and stemmed in accordance with the blast design; • record drill status, including hole depths, pattern and relevant information; • coordinate blast monitoring in accordance with this BMP; • regularly review blast design parameters on the basis of blast monitoring records; • notify regulatory authorities and affected landholders of any blasting related exceedance and undertake associated reporting; manage blasting related complaints; • ensure that the results of monitoring are systematically evaluated and reported to relevant personnel for consideration as part of ongoing quarry planning; and • undertake investigations into blasting exceedances, incidents or complaints.

10.0 References

AEISG 2011. *Prevention and Management of Blast Generated NOx Gases in Surface Blasting – Code of Good Practice.*

Australian and New Zealand Environment and Conservation Council ANZECC 1990. *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.*

EPA 2001. OEH's 'Approved methods for the sampling and analysis of air pollutants in NSW' which refers to Australian Standard AS 2923 -1987 (Guide for measurement of horizontal wind for air quality applications).

Standards Australia, AS 2187.2 1993 *Explosives – Storage, Transport and Use.*

Standards Australia, AS 2187.2-2006 *Explosives – Storage and Use – Use of Explosives.*