



**TOMINGLEY**  
GOLD OPERATIONS PTY LTD  
(A wholly owned subsidiary of Alkane Resources Ltd)

# Tomingley Gold Operations

## Blast Management Plan



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### TABLE OF REVISIONS

Revision Number	Revision Date	Prepared by	Approved by	Comments
Revision 1	28 October 2013	Kym Mosey	Sean Buxton	Submitted for Consultation
Revision 2	3 February 2014	Kym Mosey	Sean Buxton	Submission for approval following consultation
Revision 3	25 February 2015	Mark Williams	Sean Buxton	Annual review
Revision 4	24 February 2015	Mark Williams	Sean Buxton	Annual review
Revision 5	11 May 2016	Mark Williams	Sean Buxton	Update to including WY1 Blasting
Revision 6	15 September 2016	Mark Williams	Sean Buxton	Update following MOD 3 approval

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## 1 Context

This management plan has been prepared to manage blasting during the operation of the Tomingley Gold Mine (TGM). It will be used by Tomingley Gold Operations (TGO) personnel as the first point of reference for blast management during the project.

Tomingley Gold Operations is run using an Integrated Management System. This system comprises a number of management strategies and plans of which this plan is one.

The Blast Management Plan sits under the overarching Environmental Management Strategy for the project.

The other Environmental Management Plans include:

- Hazardous Materials Management Plan,
- Noise Management Plan,
- Air Quality and Greenhouse Gas Management Plan,
- Cultural Heritage Management Plan,
- Traffic Management Plan,
- Rehabilitation Management Plan,
- Water Management Plan,
- Pollution Incident Response Management Plan and,
- Biodiversity Management Plan.

## 2 Purpose

The aim of this document is to provide guidance to all personnel associated with blasting operations on site. It is intended to be used as an overall framework to plan works and mitigate the risks associated with blasting on the TGM, including those risks of an environmental nature.

## 3 Scope

This management plan applies to:

- All personnel working on the Tomingley Gold Project Mining Lease (ML),
- All personnel with a pit permit and open pit mining area specific induction,
- Technical and operational personnel involved in blasting operations, and
- The general public in latent capacity.

## 4 Definitions

Term	Definition
Action Limit	A limit set by TGO to assist in the management of noise levels and provide an opportunity to take action to prevent the level exceeding regulated benchmarks.
Person in Charge	The most senior TGO person at the Tomingley Gold Mine at the time.
ALARP	As low as reasonably practical
Blast Exclusion	Distance of clearance from the blast area to minimize risk of injury or damage from flyrock.
BMP	Blast Management Plan
dBL <sub>peak</sub>	Noise is measured in units called decibels (dB). There are several scales for describing noise, the appropriate scale for blast overpressure being the „Linear“ scale (L). This is the raw or un-weighted noise level across the whole frequency spectrum. The peak noise level is reported against criteria and is the time weighting function
Council	Narromine Shire Council
DPE	Department of Planning and Environment
OEH	Office of Environment and Heritage
DIR&E	Department of Industry Resources and Energy, NSW
EPA	Environmental Protection Authority, NSW.
Flyrock	Rock including stemming aggregate that is propelled outside of the blast area through the air or along the ground as a result of blasting.
Overpressure	The air blast pressure wave associated with blasting. It is measured in dBL <sub>peak</sub> .
Peak Particle Velocity (PPV)	The peak particle velocity (PPV) is the measure of ground vibration in mm/s.
Vibration	The oscillating movement of the ground due to blasting.
RMS	Roads & Maritime Services
SI	SI (“Still Isothermal”) refers to calm weather conditions (i.e. The absence of any wind or temperature gradients).
SSDS	Security Sensitive Dangerous Substance
TGO	Tomingley Gold Operations
TGM	Tomingley Gold Mine
Temperature Inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude.
(σθ) sigma-theta	The standard deviation of horizontal wind fluctuation. This is often used to estimate atmospheric stability classes, which in turn provides an estimate of the temperature gradients.

## 5 Key Objectives and Targets

The objectives of this BMP are to:

- Detail the controls implemented to minimise blasting impacts on site;
- Establish a blast monitoring system to assess the blast and vibration impact on surrounding receivers;
- Provide a blast protocol that assists with compliance to consent conditions;
- Manage any community concerns in a timely and effective manner; and
- Detail the procedure for reporting exceedances of the blast criteria to relevant stakeholders.



## 6 Consultation

This plan has been developed in consultation with the government agencies and companies listed in Appendix 1

The revision and distribution of this plan has occurred as follows:

- Narromine Shire Council - Revision 1 of this plan was submitted to NSC on 29<sup>th</sup> October 2013.
- NSW Office of Environment and Heritage – Revision 1 of this plan was submitted to OEH on 29<sup>th</sup> October 2013.
- NSW Roads and Maritime Services – Revision 1 of this plan was submitted to RMS on 29<sup>th</sup> October 2013. Further correspondence was issued to RMS on the 17<sup>th</sup> December 2013. Telephone discussions were had with RMS on 24 January 2014 and 28<sup>th</sup> January 2014. Revision 2 was created following confirmation RMS is agreeable to temporary road closures whilst blast trials are conducted or if a risk assessment can be carried out to demonstrate road closures are unnecessary, rather than locking in temporary road closures for the life of mine. Note: Revision 2 relates to RMS matters only no changes were made in relation to any other matter.

In accordance with the Project Approval condition number 14, the Blast Management Plan will be submitted to the Secretary of the Department of Planning and Infrastructure following consultation with other stakeholders.

This plan has been developed in consultation with the following TGO Personnel

- Sean Buxton – Operations Manager
- Simon Parsons – Mining Manager
- Mark Williams – Environment and Community Manager;
- Kym Mosey – Mining Superintendent
- Chris Aitchison - Drill and Blast Superintendent
- Simon Kelly – Blasting Supervisor

## 7 Risk Assessment

TGO has developed the blast management process after firstly considering the likely risks associated with blasting in Tomingley. Table 1 below shows the risk assessment undertaken from which subsequent management processes have been developed.

Table 1 – Primary Risks Associated with TGO Blasting Operations

<i>PRIMARY RISKS ASSOCIATED WITH TGO BLASTING OPERATIONS</i>							
<b>Hazard Type</b>	<b>Likelihood</b>	<b>Consequence</b>	<b>Risk Rating</b>	<b>Controls</b>	<b>Likelihood</b>	<b>Consequence</b>	<b>Risk Rating</b>
Blast Overpressure affecting nearby residents and Livestock	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>• TGO Explosives and Blast Management Plan – Site</li> <li>• Blast design standards</li> <li>• Weather forecast monitoring</li> <li>• Noise monitoring</li> <li>• Base line studies</li> <li>• Community Involvement</li> <li>• Blast design standards</li> </ul>	Unlikely	Major	Medium
Blast Vibration exceeding limits at nearby residences and Livestock	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>• TGO Explosives and Blast Management Plan – Site</li> <li>• Blast design standards</li> <li>• Weather forecast monitoring</li> <li>• Noise monitoring</li> <li>• Base line studies.</li> <li>• Community involvement</li> <li>• Blast design standards</li> </ul>	Unlikely	Major	Medium
Dust impact on nearby residents and livestock	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>• TGO Explosives and Blast Management Plan – Site</li> <li>• Blast design standards</li> <li>• Weather forecast monitoring</li> <li>• Dust monitoring</li> <li>• Base line studies</li> <li>• Community involvement</li> </ul>	Unlikely	Major	Medium
Dust impact on highway users	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>• TGO Explosives and Blast Management Plan – Site</li> <li>• Weather forecast monitoring</li> <li>• Dust monitoring</li> <li>• Base line studies</li> <li>• Temporary Highway closures during blast periods in Caloma and Wyoming 1 pits.</li> <li>• Warning signs and notifications.</li> </ul>	Unlikely	Major	Medium

Fume impact on nearby residents and livestock	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>TGO Explosives and Blast Management Plan – Site</li> <li>Weather forecast monitoring</li> <li>Visual monitoring for fumes.</li> <li>Community involvement</li> </ul>	Unlikely	Major	Medium
Fume impact on highway users	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>TGO Explosives and Blast Management Plan – Site</li> <li>Weather forecast monitoring</li> <li>Visual monitoring for fumes.</li> <li>Community involvement</li> <li>Temporary Highway closures</li> <li>Warning signs and notifications.</li> </ul>	Unlikely	Major	Medium

<i>PRIMARY RISKS ASSOCIATED WITH TGO BLASTING OPERATIONS</i>							
Hazard Type	Likelihood	Consequence	Risk Rating	Controls	Likelihood	Consequence	Risk Rating
Fly Rock impact on Highway Users	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>TGO Explosives and Blast Management Plan – Site</li> <li>Blast design standards</li> <li>Exclusion zones</li> <li>Quality Stemming Systems</li> <li>Base line studies from temporary road closure test blasting.</li> <li>Blast design optimisation</li> <li>Temporary Highway Closures</li> <li>Controlled exclusion zones</li> <li>Blast guards/Sentries</li> <li>Warning signs and notifications.</li> </ul>	Unlikely	Major	Medium
Fly Rock impact on Livestock in Surrounding Areas	Almost Certain	Major	Very High (Wyoming 1)	<ul style="list-style-type: none"> <li>TGO Explosives and Blast Management Plan – Site</li> <li>Exclusion zones</li> <li>Quality Stemming Systems</li> <li>Base line studies from temporary road closure test blasting.</li> <li>Blast design optimisation</li> <li>Controlled exclusion zones</li> <li>Blast guards/Sentries</li> <li>Warning signs and notifications.</li> </ul>	Unlikely	Major	Medium
Theft, un-authorized access to Explosives and SSDS	Almost Certain	Major	Very High	<ul style="list-style-type: none"> <li>TGO Explosives and Blast Management Plan – Site</li> <li>TGO SSDS Security Plan</li> <li>Licensed Authorisations</li> <li>Secured licenced Storage</li> </ul>	Unlikely	Major	Medium

## 8 Operational Management of Blasting Activities

All blasting activities conducted by TGO at the TGM are guided by the following principles;

1. Safety and community first; and
2. Most practical blast strategy.

All blasting activities shall be performed with strict adherence to this Blast Management Plan.

Mitigation measures derived from the risk assessment and in line with the “safety first” principle aim to protect personnel on site as well as external mine site stakeholders and members of the public. These mitigation measures include:

### 8.1.1 Blast Notification Systems in sensitive locations (Responsibility - Blast Supervisor/Shot Firer)

- A site blast notification board will be in place to inform all site personnel of blast activity on site.
- Blast notifications include blast time, location and contact information.
- Blast notifications will be issued 24 hours prior to any blasting activities. The Mining Manager is to ensure Road and Maritime Services (RMS) is notified 24 hours prior to each blast. Contact Details for are RMS – Luke Hodges (contact mine site for mobile number) or Traffic Management Centre on 131700.
- Two RMS installed blasting notification boards will be provided for the community. One in the truck parking bay in the village of Tomingley and one in the parking bay on the Newell Highway at the south end of the mining lease notifying motorists and the public of blast operations in the area.
- For blasting in the Wyoming 1 and Caloma 2 pits, a weekly schedule is to be prepared and provided to the land owner/leaseholders to the south of the Wyoming 1/Caloma 2 pit alerting them to blasting days and times.
- A red flashing light located adjacent to the magazine yard is to be turned on the night prior to the blast alerting the land owner south of the Wyoming 1 pit or leaseholder south of Caloma 2 pit that a blast is planned for the following day.
- A red flag is to be raised the morning before the blast on a pole adjacent to the magazine yard to alert the adjoining land owner south of the Wyoming 1 pit or leaseholder south of Caloma 2 pit that blasting is to occur on that day.

### 8.1.2 Blasting Times & Frequency (Responsibility – Drill and Blast Superintendent/ Blast Supervisor)

- Blasting at TGM will only occur on Monday-Saturday between 9am and 5pm. No blasting will be undertaken on Sundays, public holidays or at any other time, unless written approval is obtained from the Secretary of the Department of Planning and Environment.
- Blasting will be undertaken at a maximum of three blasts per day (unless an additional blast is required following a blast misfire resulting in a safety issue).

### 8.1.3 Public Works Security (Responsibility - Mine Manager/Drill and Blast Superintendent)

- A risk assessment will be undertaken prior to blasting activities to determine the likely impact to Public Infrastructure (including the Newell Highway) and the necessary mitigation measures will be put in place prior to blasting occurring.
- In accordance with the Project Approval issued by DPE, public infrastructure is not to be exposed to ground vibration exceeding 50mm/s. TGO will place appropriate blast monitoring equipment adjacent to the highway underpass bridge to ensure this is monitored.
- TGO will also ensure that the bridge is inspected by a suitable qualified and RMS approved engineer annually.
- In the event a vibration incident occurs and the approved threshold of 50mm/s is exceeded, the bridge will be inspected immediately by TGO staff. RMS and the EPA will be notified immediately and arrangements will be made to have the engineer inspect the bridge within 48 Hrs. A report will be provided to the RTA within 14 days.

#### 8.1.4 Blast Area Security (Responsibility - Blast Supervisor/Shot Firer)

- Adequately located Blast Guards/Sentries will be located in designated positions to restrict all access during firing.
- Pre-blast security clearance system will be in place including blast zone clearance checks, staff ID tag board check and access areas blocked by guards/sentries.
- All Blast Guards will have completed the Blast Guard internal training.

#### 8.1.5 Dust and Fume Emissions.

- The pre blast risk assessment will include consideration of likely dust and fume emissions from blasting activities.
- Generation of dust from blasting will be continually reviewed and if necessary dust suppression systems may be trialled.
- Weather forecast monitoring for excessive wind conditions and adverse wind direction will be undertaken prior to each blast. If risk of elevated dust contamination are determined blasting will be postponed to a time with favourable weather conditions.
- Monitoring and calibration of the explosive manufacturing unit to ensure explosive mixing is in the correct proportions. This will ensure that noxious fuming is kept to a minimum.
- Emulsion based explosive products will be used predominantly which will minimise the effects of wet holes on Ammonium Nitrate hence reducing the potential for fuming.

#### 8.1.6 Management of Flyrock

The generation of flyrock is managed by incorporating the appropriate controls in blast designs. These controls include considered design of stemming lengths and use of appropriate stemming materials to minimise the potential for generating fly rock and stemming ejection. Adequate burden, which is the distance from a charge to a free face, is maintained to minimise the risk of generating flyrock due to face bursting.

Appropriate aggregate graded stemming will be used to improve stemming confinement and hence reduce the chance of flyrock and elevated blast overpressure.

An appropriate exclusion zone for people, equipment, vehicles and livestock will be established around each blast site prior to firing a blast. The exclusion zone will be established beyond the expected range of any fly rock with an additional safety margin.

Any unusual level of fly rock generated by blasting, with the potential to cause a safety risk, will be noted for each blast. This information will be used to continually re-access the adequacy of blast design controls in reducing the generation of fly rock. The information will also be used to reassess the size of the safety exclusion zone in the vicinity of a blast.

A blasting trial was carried out (see. 8.2) to assess the risk of flyrock on the Newell Highway. During this blasting trial arrangements were made to close the Newell Highway temporarily. Road closures will remain in place during blasting in fresh rock zones in the Caloma Pits and Wyoming 1.

#### 8.1.7 Explosives Security

All explosives and SSDS at TGM will be handled, transported and stored in appropriately licensed equipment and by competent personnel as required by legislation and the relevant governing bodies.

All explosives and SSDS's are stored in specialised storage facilities within a compounded area that is restricted to access by authorised personnel only.

### 8.1.8 Summary of Blast Impact Mitigation Measures

TGO will implement the following additional blast impact mitigation measures to ensure the safety of people, equipment, vehicles and livestock in the surrounding areas:

- A “closed loop” blast design process will enable continuous improvement and quality control, resulting in continual development of optimum blast parameters. By adopting this approach in conjunction with the adoption of improved blasting products and methods, it is anticipated that blast emissions criteria can be met without imposing any significant constraints on the blast design throughout the operations of TGM.
- Road Closures will be implemented during blasting in accordance with RMS requirements.
- Adequate exclusion / clearance zones are to be maintained to ensure that the safety of people, equipment, vehicles or livestock on nearby land will not be affected by blasting. Trialling of increased flyrock containment products will also be implemented by TGO an additional control measure.
- Licenced compounded secure storage systems have been constructed for all explosives and SSDS;
- Best practice methodology is used to ensure fly-rock and fumes are ALARP;
- Blasts are only fired in favourable weather conditions. A meteorological assessments prior to blasting to ensure weather conditions are acceptable. In the event of unfavourable meteorological conditions are observed prior to the blast the shot-firer will liaise with the Drill and Blast Superintendent to determine whether to delay or postpone a blast;
- Good quality stemming products are used.
- Quality control practices are implemented on the ground to ensure blasts are kept within design tolerances
- Adequate burden is maintained on all faces to prevent blowouts and blast anomalies;
- Blast energies are minimised as far as possible;
- Continuous monitoring of blast performance is facilitated by the use of video recording and desktop analysis; and
- Training will be provided to all relevant personnel on environmental obligations in relation to blasting controls.

TGO will implement the following quality control measures to minimise dust generated from blasting;

- Continuous improvement in blast design by monitoring of blast performance
- Restricting blast firing to times of optimal weather conditions.
- Use of high quality stemming products.
- Minimising blast energies.

TGO will implement the following measures to minimise fume emissions generated from blasting;

- Monitoring and calibration of the explosive manufacturing unit to ensure explosive mixing is in the correct proportions. This will ensure that noxious fuming is kept to a minimum.
- Predominantly using emulsion based explosive products. Minimising the effects of wet holes on Ammonium Nitrate and thus reducing the potential for fuming.

## 8.2 Trial Blasting

Overburden removal will commence from the surface of each pit without blasting to a depth of approximately 10-12m below ground (depending on ground conditions in each pit). Following overburden removal, trial blasts will be undertaken in each pit. These initial blasts are considered “trials” as they are used to test ground conditions and refine the blast design.

TGO will ensure the road closure requirements of RMS are carried during this trial blast period. A Traffic Control Plan will be submitted to RMS prior to trial blasting commencing and appropriate approvals will be obtained from RMS prior to works being carried within the road reserve. All road closures will be performed by RMS approved traffic controllers in accordance with RMS approved procedures. This will ensure the safety of traffic and passengers while ground conditions are being tested and the blast design refined.

Following each of the trial blasts TGO will undertake the following;



- Review the monitoring results for blast overpressure and ground vibration and compare them to the limit criteria.
- Use results to modify design parameters for the next blast.

Trial blasting will only be undertaken when weather and site conditions are favorable. Favorable conditions will be determined predominantly by wind direction and wind speed. Favorable conditions would be considered as conditions where wind is blowing away from the road and nearby residences or onto site.

## 9 Legislative Requirements

The Tomingley Gold Project was granted project approval by the Department of Planning and Environment on 24<sup>th</sup> July 2012.

Schedule 3, Condition 14, of the Project Approval calls for the preparation of a Blast Management Plan (this plan) and stipulates criteria with respect to Blasting, these are reproduced below.

### **Blasting Criteria (Schedule 3, Condition 7)**

*The Proponent shall ensure that blasting on the site does not cause exceedances of the criteria in Table 4.*

**Table 4- Blasting Criteria**

<b>Location</b>	<b>Airblast Overpressure (dB(Lin Peak))</b>	<b>Ground Vibration (mm/s)</b>	<b>Allowable Exceedance</b>
<i>Residence on privately-owned land</i>	<i>120</i>	<i>10</i>	<i>0%</i>
	<i>115</i>	<i>5</i>	<i>5% of total blasts over any 12 month period</i>
<i>All Public Infrastructure</i>	<i>-</i>	<i>50, or alternatively, a specific limit determined to the satisfaction of the Secretary by the structural design methodology in AS 2187.2-2006, or its latest version</i>	<i>0%</i>

*However, these criteria do not apply if the Proponent has a written agreement with the relevant landowner, and has advised the Department in writing of the terms of this agreement.*

### **Blasting Hours (Schedule 3, Condition 8)**

*The Proponent shall only carry out blasting on site between 9:00am and 5:00pm Monday to Saturday, inclusive. No blasting is allowed on Sundays, public holidays or at any other time without the written approval of the Secretary.*

### **Blasting Frequency (Schedule 3, Condition 9)**

*The Proponent may carry out a maximum of three blasts per day for mining operations on the site, unless an additional blast is required following a blast misfire.*

*This condition does not apply to blasts that generate ground vibration of 0.5 mm/s or less at any residence on privately-owned land, or blasts required to ensure the safety of the site or its workers.*

*Note: for the purpose of this condition, a blast refers to a single blast event, which may involve a number of individual blasts fired in quick succession in a discrete area of the site.*

**Property Inspections (Schedule 3, Condition 10-11)**

*The Proponent shall advise the owners of privately-owned land within 2 kilometers of blasting operations at least 2 months prior to blasting that they are entitled to a structural property inspection to establish the baseline condition of buildings and other structures on the property.*

*If the Proponent receives a written request from any such landowner, then within one month of receiving the request, and where possible prior to blasting, the Proponent shall:*

*(a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties to:*

*(i) establish the baseline condition of any buildings and other structures on the land, or update the previous property inspection report; and*

*(ii) identify measures that should be implemented to minimise the potential blasting impacts of the project on these buildings and/or structures; and*

*(b) Give the landowner a copy of the new or updated property inspection report.*

*If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Proponent or the landowner disagrees with the findings of the property inspection report, either party may refer the matter to the Secretary for resolution.*

**Property Investigations (Schedule 3, Condition 12)**

*If the owner of any privately-owned land claims that buildings and/or structures on his/ her land have been damaged as a result of blasting on the site, then within one month of receiving this claim the Proponent shall:*

*(a) commission a suitably qualified, experienced and independent person, whose appointment is acceptable to both parties to investigate the claim; and*

*(b) Give the landowner a copy of the property investigation report.*

*If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damage to the satisfaction of the Secretary.*

*If there is a dispute over the selection of the suitably qualified, experienced and independent person, or the Proponent or the landowner disagrees with the findings of the independent property investigation, either party may refer the matter to the Secretary for resolution.*

**Operating Conditions (Schedule 3, Condition 13)**

*During operation of the project, the Proponent shall:*

*(a) implement best management practice to:*

*(i) protect the safety of people and livestock in the surrounding area;*

*(ii) protect public or private infrastructure/ property in the surrounding area from any damage, including the Newell Highway; and*

*(iii) minimise the dust and fume emissions from any blasting;*

*(b) minimise the frequency and duration of any road closures, and avoid road closures during peak traffic periods; and*

*(c) operate a suitable system to enable the public to get up-to-date information on the proposed blasting schedule on site, to the satisfaction of the Secretary.*

**9.1.1 Environmental Protection Licence**

The Tomingley Gold Project operates under an Environment Protection Licence (EPL 20169) issued by the NSW Environment Protection Authority, this licence is available on the Alkane website as well as the EPA Website.



### 9.1.2 Dangerous Goods

Following recent legislative amendments, dangerous goods are now regulated under the Work Health & Safety Act 2011 (NSW), the NSW Explosives Act 2003 and the NSW Explosives Regulation 2013. TGO will ensure that all regulatory requirements in relation to dangerous goods management are met. The storage of explosives or explosives precursors, are to be managed in accordance with the following TGO Management Plans, Hazardous Materials Management Plan, Operational Blast Management Plan, SSDS Security Plan.

### 9.1.3 Codes of practice and compliance with the codes

Blast monitoring at TGM will be undertaken in accordance with all relevant Australian Standards and OEH policies. At the time of writing this document these include:

- Australian Standard AS 2187.2: Storage, Transport and use – Use of explosives; and
- Australian and New Zealand Environment and Conservation Council (ANZECC) – Technical Basis for Guidelines to minimise Annoyance due to Blasting Overpressure and Ground Vibration.

Blasting operations will be conducted in accordance with the DIR&E and EPA legislation as well as all TGO's operational and safe work procedures for blasting, shot firing and explosives. The Environment Protection Licence and Project Approval set maximum limits for overpressure and vibration at locations adjacent to the mine, which includes private residences and public works. The exposure limits at any noise sensitive location are described in Table 1 and 2.

## 10 Monitoring

### 10.1.1 Vibration & Overpressure Monitoring

TGO will undertake ground vibration and air blast overpressure monitoring to determine if the levels are within the limits outlined in the Project Approval and the Environmental Protection Licence.

Monitoring shall be undertaken as follows:

- Air blast overpressure and ground vibration monitoring will be undertaken at the receiver locations shown in Figure 1;
- Location V1 will be located as appropriate such that it is always at the closest residential point (or representative thereof) to the Wyoming 1 & 3 Pits;
- Location V2 will be located as appropriate such that it is always at the closest residential point (or representative thereof) to Caloma 1 & Caloma 2 Pits;
- Location V3 will be relocated as appropriate such that it is always at the closest public works point (or representative thereof- Newell Highway) to any operating pit;
- Location V4 will be located on the RSF embankment between the Wyoming 1 and Wyoming 3 Pits
- Monitoring instrumentation and procedures will be in accordance with AS 2187.2-2006.;
- Monitoring shall capture all blast events; and
- Electronic records shall be filed in the Blasting Vibration and Overpressure Log and summarised on the Blasting Vibration and Overpressure Record Sheet – these are included in Appendix 2 of this plan.

### 10.1.2 Monitoring Records

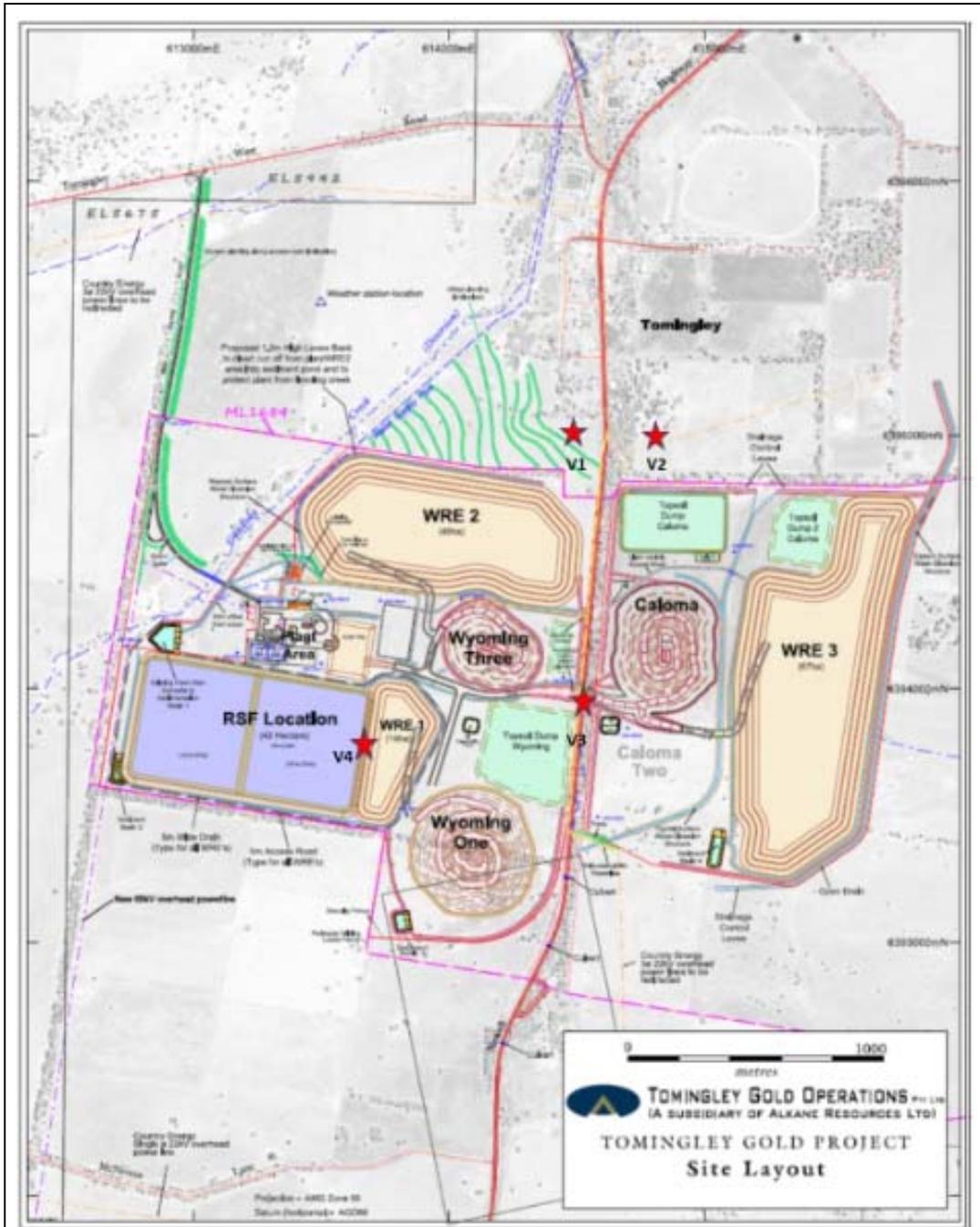
The Drill and Blast Superintendent shall record the following information during monitoring

- The type of instrumentation used (microphones used for airblast overpressure monitoring must have a lower cut-off frequency of 2Hz or less)
- Blast noise overpressure (dBL<sub>peak</sub>) and peak particle velocity (ppv, mm/s) in a radial, vertical and transverse direction.
- The time and duration of monitoring for each location.
- License limits, where appropriate
- Wind speed and direction.
- The type of monitoring being undertaken.

- The monitoring location.

In with EPL and as per document procedures, records will maintained at least four

accordance conditions TGO control monitoring be on site for years.



★	<b>Sensitive Receiver Monitoring Locations</b>
—	<b>Approximate Project Area</b>
Created Author Revision	31/01/2014 Kym Mosey

**Figure 1 – Blast/Vibration Monitoring Locations**

## 11 Roles and Responsibilities

Table 2 details the Roles and Responsibilities of TGO personnel with respect to the implementation of this plan.

Table 2 – Roles and Responsibilities

Role	Responsibilities
TGO Operations Manager	<ul style="list-style-type: none"> <li>• Provide adequate resources for the implementation of the BMP</li> </ul>
TGO Environment and Community Manager	<ul style="list-style-type: none"> <li>• Review data and determine management actions as appropriate.</li> <li>• Ensure actions are taken to prevent exceedance of Project Approval conditions and actions are implemented following an investigation.</li> <li>• Fixed monitoring equipment is correctly installed and operational.</li> <li>• Mobile monitoring equipment is operational.</li> <li>• Maintenance and calibration of equipment occurs as required to ensure equipment reliability.</li> <li>• Deliver weekly Wyoming 1 blasting schedule to land owner and leaseholder to the south of Wyoming 1 and Caloma 2 pits.</li> </ul> <p>Assist the Drill and Blast Superintendent with investigations of blasting exceedances, incidents or complaints;</p> <ul style="list-style-type: none"> <li>• Provide adequate and timely response to community complaints and that requirement of the Complaints Procedure are completed.</li> <li>• Make reports as per the TGO Standard: Corporate Incidents as required.</li> <li>• Ensure all internal and external reporting requirements are met.</li> <li>• Make reports to the EPA as required.</li> <li>• Co-ordinate and manage records and reporting of blast monitoring results.</li> </ul>
TGO Mining Manager	<ul style="list-style-type: none"> <li>• Requests in advance to RMS for temporary road closures</li> <li>• Notify Operations Manager and Environment and Community Manager in advance of any temporary road closures</li> <li>• Authorise the implementation of specific management measures to minimise blast impacts in accordance with this BMP</li> </ul>
TGO Drill and Blast Superintendent	<ul style="list-style-type: none"> <li>• Undertake noise monitoring and record results in the Blast Vibration and Overpressure Monitoring Log.</li> <li>• File all electronic results from development blasting vibration and overpressure monitoring in the Blasting Vibration and Overpressure Log and maintain this information on file for a period of not less than 7 years.</li> <li>• Report monitoring results to the Mining Superintendent/Manager.</li> <li>• Regularly review blast design parameters on the basis of blast monitoring records</li> <li>• Advise the relevant personnel of weekly blasting schedule.</li> </ul>

Role	Responsibilities
	<ul style="list-style-type: none"> <li>• Liaise with the blast supervisors/shot-firers to ensure blasting is being conducted under favourable weather/meteorological conditions.</li> <li>• Design and undertake blasts to comply with the requirements of this BMP.</li> <li>• Maintain records for blasts initiated.</li> <li>• Assist the Environmental Manager with investigations into blast exceedances, incidents or complaints.</li> <li>• Prepare weekly blasting schedule for Wyoming 1 to be provided to the land owner to the south of Wyoming 1 pit.</li> </ul>
TGO Mining Superintendent	<ul style="list-style-type: none"> <li>• Sign-off on all pre-blast risk assessments and blast site specific procedures (SSPs)</li> </ul>
Blasting Supervisor/Shot-Firer	<ul style="list-style-type: none"> <li>• Ensure the blast is loaded with the correct quantity and quality of explosive and stemmed in accordance with the blast design</li> <li>• Advise relevant personnel of daily blasting schedule.</li> <li>• Notify the Mining Engineer/Superintendent of any factors that may lead to non-compliance with this BMP.</li> <li>• Load and fire blasts in accordance with design supplied by the Mining Engineer.</li> <li>• Assess meteorological/weather conditions prior to blasting to determine whether conditions are appropriate for blasting.</li> <li>• Placing all required blast guards (sentries) in designated positions as per pre-blast risk assessments and SSPs</li> <li>• Turn on red flashing light at magazine yard before 6pm the night prior to blasting in Wyoming 1 or Caloma 2 pits.</li> <li>• Raise red flag on pole adjacent to magazine yard before 9am the day of blasting in Wyoming 1 or Caloma 2 pits.</li> </ul>

## 12 Recording and Reporting

### 12.1 Internal reporting

The Drill and Blast Superintendent shall report the monitoring results to the Environment and Community Manager in the event of an exceedance. The report is to identify whether it was a routine or trial blast.

The Environment and Community Manager will report to the Operations Manager the results and investigations of any complaints and/or any exceedances of the blast overpressure or vibration assessment criteria.

If a non-compliance with the blast impact assessment criteria is identified an internal report detailing the circumstances of the non-compliance and resulting actions will be submitted to the Operations Manager.

### 12.2 External reporting

Any non-compliance with the limits listed in Table 4 (PA 09\_0155) shall be recorded to the EPA pollution line on 131555 by the Blast Supervisor/Blast Superintendent following discussion with Environment and Community Manager and reported in the Statement of Compliance for submittal to the EPA as part of the Annual Return.

The Blasting Vibration and Overpressure Log shall be made available to an Officer of the EPA or DPE upon request.

Any non-compliance recorded at the vehicular underpass on the Newell Highway shall be reported to RMS in accordance with 8.1.3



Monthly monitoring and in particular any non-compliance recorded at the RSF shall be reported to the NSW Dam Safety Committee in accordance with the RSF Monitoring Management Plan.

The Annual Environmental Review will be prepared by the end of March each year. This document will discuss the environmental performance and associated actions of the project for the previous year. The annual review will include an assessment of the blast monitoring impact data, present any complaints received as well as the complaint response/outcome.

## 12.3 Evaluation of Compliance

If monitoring records show levels above the nominated Blasting Criteria the following action will be undertaken.

### 12.3.1 Investigation

Where the blast limit has been reached or exceeded the Drill and Blast Superintendent shall:

- Check wind conditions and monitoring records 15 minutes prior and post blasting and determine if the elevated result was due to wind activity.
- Where it is determined that wind conditions caused the elevated result, record this information in the Blasting Vibration and Overpressure Log and provide a report to the Mine Manager.

Where it is determined that wind or weather conditions did not cause the elevated result the Mine Engineer in consultation with the Drill and Blast Superintendent and Blast Supervisor shall:

- Undertake an investigation immediately into the firing and blast conditions.
- Check blasting pattern and adherence to Blasting Procedure. Identify and document any non-compliance or deviations authorized or not.
- Check that all mitigation measures were employed and identify and document any non-compliance or deviations authorised or not.
- In consultation with the Mine Manager, determine and implement action to prevent a recurrence.

### 12.3.2 Actions

The following actions, or their combination, shall be undertaken to prevent exceedance of blasting criteria:

- (i) The use of blast noise overpressure absorption barriers (Sound Bund) to minimise noise and blast overpressure at mining lease boundaries, situated along the northern perimeter of Waste Rock Emplacement Two Area.
- (ii) Appropriate stemming depth of blast holes to minimise blast overpressure.
- (iii) Quality aggregate stemming product to minimise blast overpressure.
- (iv) Adoption of smaller blast hole diameter on upper pit benches to minimise vibration and overpressure.
- (v) Adoption of conservative powder factors to minimise vibration and overpressure.
- (vi) Mindful blast firing sequence with offset control line delays to reduce maximum instantaneous charge and minimise vibration.

## 13 Complaints Response

Where there has been a complaint with respect to blasting the following action will be taken:



- Record the complaint, in the complaints register;
- Notify the Environment and Community Manager;
- Take immediate action to address the issue, firstly by investigating the nature and validity of the complaint.  
Depending on the seriousness of the issue this may include:
  - Modifying procedures,
  - Installing mitigation, and/or
  - Stopping related activities.

The Environment and Community Manager shall monitor the implementation of these actions until their completion and then close out the Complaints Register.

The Environment and Community Manager shall notify the DPE and any other relevant agencies of any incident associated with the Project in accordance with Schedule 5, Condition 7 of the Project Approval.



## 14 Property Inspections

TGO wrote to all land owners within a 2km radius of the mining pits (where blasting will be undertaken) and invited them to have a Pre-Blasting Structural Survey of their home and any structures located within their property.

20 landowners responded, taking up the opportunity to have their property surveyed.

Over 19<sup>th</sup> and 20<sup>th</sup> September 2013 Calare Civil Consulting Engineers of Bathurst undertook the Pre-Blasting Structural Surveys of the properties.

Calare Civil Consulting Engineers produced Property Condition Reports and these were provided to the land owner as well as TGO.

## 15 Property Investigations

If during mining activity a private land owner makes a claim that damage has resulted to their buildings and/or structures as a direct result from blasting operations at the mine TGO will investigate the matter in accordance with Schedule 3, Condition 12 of the project approval;

## 16 Review

This plan will be reviewed after the first 6 months of blasting activity and annually thereafter to ensure the currency and adequacy of the plan.



# Appendix 1

## Consultation in the preparation of this plan

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- Narromine Shire Council;
- NSW Roads and Maritime Services,
- NSW Environment Protection Authority;
- NSW Office of Water;
- WorkCover NSW; and
- NSW Department of Resources and Energy on the preparation of this plan
- Johnex Explosives Australia
- TREAD International (Mobile Manufacturing Unit supplier)
- NSW Department of Trade and Investment (Mine Safety Division)
- NSW Parkes, EMEA Pty Ltd (Mechanical Engineers)
- Mine Resilience Pty Ltd (Explosives Consultants and Trainers)

# Appendix 2

## TGO Blast Logging Template

*Blast Monitoring Made Easy*  Past Events ▾ Capture Events ▾ System Status ▾ Settings ▾

### Captured Events - Table View

Event Search

1 2 3 4 5 (Page 1 of 64)

#### Events

<input checked="" type="checkbox"/>	Event Code ▾	Category	Description	Date/Time	Trigger Source
<input type="checkbox"/>	TMG08U	Valid Shot		2016-01-09 12:57:49	Underpass
<input type="checkbox"/>	TMG08T	Valid Shot	CL1-200-303	2015-12-23 13:09:44	Underpass
<input type="checkbox"/>	TMG08S	Valid Shot	CL1-185-004/008/010	2015-12-23 12:58:43	Underpass
<input type="checkbox"/>	TMG08R	Valid Shot	CL1-185-007/009	2015-12-14 12:59:33	Underpass
<input type="checkbox"/>	TMG08Q	Valid Shot	CL1-205-304	2015-12-10 12:58:43	Underpass

1 2 3 4 5 (Page 1 of 64)

#### Captures for TMG08S

Station Name	Status	Max AB (dBL)	Max R (mm/s)
Underpass 	Full Wave		0.84
Harper	Full Wave	96.1	0.41
Tomingley Village	Full Wave	97.5	0.65
Harts Cottage	Full Wave	103.3	0.42
Residue Dam	Full Wave		0.15

# Appendix 3

## Risk Matrix

Severity level	Consequence Types						
	Financial	Health & Safety	Natural Environment	Social/Cultural Heritage	Community/govt./reputation/media	Legal	Variance from Business Performance
<b>Severe:</b>	>\$5M	Fatality	Long-term impairment of ecosystem	On-going serious social issues, major permanent impact to cultural and heritage sites	Serious public or media outcry (national coverage)/ major reputation impact	Significant prosecution and fines, litigation including class action	>30% variance from business plan with complete loss of productivity
<b>Major:</b>	\$1M - \$5M	Hospitalisation required leading to permanent injury	Medium term impairment of an ecosystem	Significant social issues, significant damage to structures/items of cultural significance	Major public embarrassment/ adverse media coverage	Serious breach of regulation leading to litigation	15% - 30% variance from business plan leading to major loss of productivity
<b>Moderate:</b>	\$100,000 - \$1M	Medical treatment leading to , lost time or restricted duties	Short term impairment of ecosystem affecting function	On-going social issues, damage to items of cultural significance	Adverse media/public/NGO attention	Significant level of complaints / incidents with a high threat of legal action	5% - 15% variance from business plan leading to; disruption to productivity
<b>Minor:</b>	\$10,000 - \$100,000	First aid treatment required but no lost time or restricted duties.	Short-term impact not affecting ecosystem functions	Minor medium-term social impacts on local population. Mostly repairable	Attention from media and/or heightened concern by local community,	Isolated complaint / incident with a threat of legal action	2% - 5% variance from business plan, minimal loss of productivity
<b>Insignificant:</b>	<\$10 000	No injury or review required	Minor impact on biological or physical environment	Minor social issues, repairable damage	Minor adverse local public or media attention or complaints	Minor complaint / incident.	<2% variance from business plan. Nil or negligible loss of productivity

LIKELIHOOD			
	DESCRIPTION	FREQUENCY	PROBABILITY
<b>Almost certain:</b>	The event will occur on an annual basis	More than once per year	> 95%
<b>Likely:</b>	The event has occurred several times or more in your career	At least once per 1 year	60% - 95%
<b>Possible:</b>	The event might occur once in your career	At least once in 3 years	30% - 60%
<b>Unlikely:</b>	The event does occur somewhere from time to time	At least once in 10 years	5% - 30%
<b>Rare:</b>	Heard of something like the event occurring elsewhere	Less than once in 30 years	<5%

RISK MATRIX					
	INSIGNIFICANT	MINOR	MODERATE	MAJOR	SEVERE
<b>Almost certain:</b>	MEDIUM	HIGH	HIGH	VERY HIGH	VERY HIGH
<b>Likely:</b>	MEDIUM	MEDIUM	HIGH	HIGH	VERY HIGH
<b>Possible:</b>	LOW	MEDIUM	HIGH	HIGH	HIGH
<b>Unlikely:</b>	LOW	LOW	MEDIUM	MEDIUM	HIGH
<b>Rare:</b>	LOW	LOW	MEDIUM	MEDIUM	HIGH



## Document Information

### Summary Information

Document Name	Blast Management Plan		
Document Reference	As per Document Control Procedure		
Document Owner	Environment and Community Manager		
Release Date	17 November 2016		
Classification			
Stakeholder Approvals	Sean Buxton	Approved by email	Operations Manager

### Revision History

Revision	Date	Changes	Changed By	Pages Affected
2.0	3/2/14	Policy complete	Kym Mosey	All
3.0	25/2/15	TGO employees list, RMS contact information, Management of Fly Rock and road closures	Mark Williams	Pages 5, 8,9
4.0	24/2/16	TGO employee list, RMS contact Information, management of fly rock and road closures, responsible persons.	Mark Williams	Pages 3,5,8,9,15,16,20.
5.0	11/5/16	Update WY 1 alert system and table of responsibility Wy1 Schedule preparation and distribution	Mark Williams	Pages 8 and15
6.0	15/9/16	Update to suit MOD 3 – Caloma 2	Mark Williams	Numerous

### Related Documents

Related Document	Location
Australian Standard AS 2187.2: Storage, Transport and use – Use of explosives	
Australian and New Zealand Environment and Conservation Council (ANZECC) – Technical Basis for Guidelines to minimise Annoyance due to Blasting Overpressure and Ground Vibration.	
TGO Environment Protection Licence	
TGO Project Approval	



**Distribution List**

<b>Name</b>	<b>Name</b>
<input type="checkbox"/> ALK Corporate	<input type="checkbox"/> ALL TGO Personnel
<input type="checkbox"/> TGO Managers	<input type="checkbox"/> TGO Seniors (Supervisors & Mine Engineer)
<input type="checkbox"/> TGO Superintendents	<input type="checkbox"/> TGO Suppliers