

# **KALGOORLIE CONSOLIDATED GOLD MINES PTY LTD**



## **NOISE AND VIBRATION MONITORING AND MANAGEMENT PLAN**

AUGUST 2018

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# 1. SUMMARY

## 1.1 Purpose of Document

This Condition Environmental Management Plan (Condition EMP), generally referred to as the Fimiston Noise and Vibration Monitoring and Management Plan (NVMMP), has been developed and implemented in accordance with conditions of Ministerial Statement No. 782 *Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning* (782:M) and the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016* (2016 Fimiston Noise Approval).

KCGM believes this Condition EMP incorporates best practice to minimise noise and vibration impacts to nearby residents of the City of Kalgoorlie-Boulder as a result of the Fimiston Operations.

## 1.2 Management Plan Summary

The table below presents the environmental criteria to measure achievement of the conditioned environmental outcome that must be met through implementation of this Condition EMP.

<b>Title of proposal</b>	Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning
<b>Proponent</b>	Kalgoorlie Consolidated Gold Mines Pty Ltd
<b>Ministerial Statement number</b>	782
<b>Purpose of the Condition EMP</b>	The NVMMP is submitted to fulfil the requirements of condition/s 9-6, 9-7, 9-8 and 9-9 of the above Statement.
	The NVMMP is submitted to fulfil the requirements of condition 9 of the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.
<b>Condition environmental objective</b>	To manage noise emissions from the Fimiston Operations to minimise potential impacts to the residents of the City of Kalgoorlie-Boulder.
<b>Environmental criteria</b>	Criterion 1: Environmental Noise Levels Criterion 2: Airblast Levels Criterion 3: Blast Vibration Levels

## 1.3 Document History

**Table 1: Document History**

Version	Date	Document Changes
1	JAN 1993	New Document. Submitted to the EPA to meet requirements of Condition 5 of Ministerial Statement No.188.
2	JUN 2004	Revised to meet requirements of the Southern Landform Extension Project Section 45C Approval.
3	AUG 2009	Revised to meet requirements of Ministerial Statement No.782 and the <i>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009</i> .
4	APR 2010	Revised to include the recommendations of the Appeals Committee regarding an appeal against the <i>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009</i> .
5	OCT 2010	Finalised in response to feedback from the OEPA and the DEC in regards to the April 2010 Provisional Noise and Vibration Monitoring and Management Plan.
	JUN 2013	Changes to the environmental noise monitoring programme approved by the DEC via email dated 21 June 2013.
6	JUN 2016	Revised to meet requirements of the <i>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016</i> .
7	JAN 2018	Changes were made to the blast monitoring network following a recommendation that the Echo blast monitoring site be relocated to a point further south of the current site. The recommendation was made following a blast assessment conducted in 2017 by George Boucher Consulting for then proposed Morrison mining project, located at the southern end of the Fimiston Open Pit.  A revised NVMMMP, showing the proposed new location for the Echo blast monitoring site was submitted with the Change to Proposal to Ministerial Statement No.782 application in February 2018 and subsequently approved under Section 45C of the <i>Environmental Protection Act 1986</i> 26 June 2018.
	AUG 2018	This revision is submitted to the CEO of the DWER to approve the relocation.

## 1.4 Corporate Endorsement

I hereby certify that to the best of my knowledge, the Condition EMP provisions within this Condition EMP are true and correct and address the legal requirements of Ministerial Statement No. 782 and the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016*.

[Signature of duly authorised proponent representative]

Name:

Signed:

Designation:

Date:

## 2. CONTEXT, SCOPE AND RATIONALE

### 2.1 Overview of the Fimiston Operations

KCGM manages and operates the following mining and processing operations for Joint Venture Owners Barrick Australia (Australia Pacific) Pty Limited and Newmont Asia Pacific Pty Ltd:

- Fimiston Open Pit (Super Pit): open pit mining and waste rock disposal
- Mt Charlotte Underground Mine: underground mining
- Fimiston Processing Plant: crushing, mineral processing, refining and tailings disposal
- Gidji Processing Plant: mineral processing and tailings disposal
- Exploration: mineral resource definition drilling and core processing

The Fimiston Operations are comprised of the Fimiston Open Pit and the Fimiston Processing Plant which are located adjacent to the City of Kalgoorlie-Boulder approximately 600 kilometres (km) east of Perth, Western Australia. KCGM produces around 700,000 ounces of gold each year and has a current open pit mine life until 2021 and mineral processing life until 2031.

KCGM proposes to mine the Morrison and Brownhill areas of the existing Fimiston Open Pit. Together the Morrison and Brownhill reserves add approximately 1.8 million gold ounces to the Fimiston Open Pit. The Project allows for continued mining of the Fimiston Open Pit as identified in KCGM's life of mine Plan. These reserves will extend the estimated life of mine for KCGM's open pit operations by five years to around 2026 and by three years to around 2034 for mineral processing operations.

Approximately 85 million tonnes (Mt) of ore and waste rock material are mined from the Fimiston Open Pit each year. Up to 13 Mt of ore is processed at the Fimiston Processing Plant annually, whilst the waste rock material is transported to various waste rock dumps or marginal ore stockpiles adjacent to the open pit operations.

The current footprint of the Fimiston Open Pit extends approximately 1.5 km in width, 3.5 km in length and to a depth of approximately 600 m and is currently one of the largest open pit gold mines in Australia.

### 2.2 History of Fimiston Noise Approvals

KCGM's Fimiston Operations commenced prior to the development of the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) and historically operated in accordance with Ministerial Statement No.188 Fimiston Project Stage II – Mine and Waste Dumps (188:M) granted on 24 October 1991.

Condition 4 of 188:M required the Minister to set noise level standards for the Fimiston Operations. On 19 November 1992 the "Noise Level Standards for Operations at Kalgoorlie" were established within which the Minister recognised the unique situation of the KCGM operations:

*"The residential areas of Kalgoorlie-Boulder affected by noise from mining activities have existed for many years and are located very much closer to the mine sites than the standards today would permit. Mining and ore processing activities have occurred very close to these residential areas for almost one hundred years. Thus the residential and mineral processing land uses impact adversely on each other. This makes it impracticable and unreasonable for KCGM to achieve fully desirable noise levels at all residences as it is not feasible to move either the ore body or all the closer residences."*



*Additionally, some locations in Kalgoorlie-Boulder currently have ambient noise levels which exceed fully desirable levels in the absence of noise from the proponent's mining and mineral processing activities."*

Under the Fimiston Project Stage II approval, mining of the Fimiston Open Pit would have ceased in around 2012. To enable the Fimiston Operations to continue approval was sought from the Environmental Protection Authority (EPA) for the Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning; commonly referred to as the Golden Pike Project, extending the life of the Fimiston Open Pit to around 2019.

The Golden Pike Project underwent a Public Environmental Review (PER), released in September 2006, during which time it was highlighted that the applicability and enforceability of the "Noise Level Standards for Operations at Kalgoorlie" set by the Minister in 1992 was unclear and required clarification. It was identified that the existing Fimiston Operations may not comply with the night time assigned noise levels under the Noise Regulations even with controls in place (e.g. the environmental noise bund). However, it was also noted that the ambient noise levels in Kalgoorlie-Boulder with no mining activity occurring are also above the night time assigned noise levels.

In February 2007, KCGM applied to the Minister for Environment in accordance with Regulation 17 of the Noise Regulations for approval to allow noise emissions to vary from the assigned levels. In December 2007, The EPA released its report and recommendations to the Minister and subsequently the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009 was published in the Government Gazette on 14 July 2009.

One appeal against this approval was received and an Appeals Committee was appointed by the Minister. The Appeals Committee Report was reviewed by the Minister and while the appeal was dismissed in March 2010, two recommendations made by the committee required further investigation and implementation by KCGM (refer to Sections 4.2.1 and 5.2.4).

The 2009 Approval was valid for 5 years until 13 July 2014 unless KCGM applied for further approval within the first four years. Accordingly, on 21 June 2013 KCGM re-applied for a Noise Regulation 17 Variation which the Minister referred to the Department of Environment Regulation (DER) on the 22 July 2013 for assessment.

On 5 December 2013 the Noise Regulations were amended, notably the levels for airblast were lowered. Consequently KCGM applied for another Noise Regulation 17 Variation, this time for approval to allow airblast levels to vary from those prescribed under regulation 11. The DER assessed this application in conjunction with KCGM's initial application over a two year period. A final assessment report was prepared 01 July 2015 and following approval by the Minister, the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016* was published in the Government Gazette on the 22 March 2016. No appeals were lodged against the approval.

## 2.3 Key Environmental Factors

This Condition EMP specifically addresses the noise and vibration environmental factor.

Noise and vibration are a key environmental factor for this proposal due to the proximity of the Fimiston Operations to the City of Kalgoorlie-Boulder (CKB), it is therefore essential that KCGM manages environmental noise and vibration aspects which may impact on nearby residents. KCGM's management approach is detailed in Section 4.



## 2.4 Requirements of the Condition

Specifically, this Condition EMP is submitted in accordance with 782:M (Conditions 8-1 to 9-9), and the 2016 Fimiston Noise Approval (Conditions 9(1) and 9(2)). Table 2 provides a summary of where the requirements of these conditions are addressed in the Condition EMP.

**Table 2: Summary of Conditions**

Condition		Section in Condition EMP
<b>Ministerial Statement No.782</b>		
<b>8 Noise</b>		2.2 History OF Fimiston Noise Approvals
8-1	The proponent shall not conduct any mining activities forming part of the expanded and revised proposal unless and until approval has been granted under regulation 17(7) of the <i>Environmental Protection (Noise) Regulations 1997</i> .  Note: In this condition "mining activities" does not include construction work within the meaning of regulation 13 of the <i>Environmental Protection (Noise) Regulations 1997</i> .	
8-2	The proponent shall undertake noise modelling to determine whether a special control area is required in accordance with the Goldfields-Esperance Regional Planning Strategy.	3 Noise Modelling and Verification
8-3	The proponent shall consult with the Western Australian Planning Commission, Department of Planning and Infrastructure, and the City of Kalgoorlie-Boulder in the implementation of Condition 8-2.	9 Stakeholder Consultation
<b>9 Airblast Overpressure and Vibration from Blasting</b>		4.4.1 Blasting Times
9-1	The proponent shall only detonate explosives on the premises between the hours of 0700 hours and 1800 hours unless undertaken in accordance with regulation 8.28 (4) of the <i>Mines Safety and Inspection Regulations 1995</i> .	
9-2	Where explosives are detonated on the premises outside the requirements specified in conditions 7-4 and 9-1, the circumstances which led to such detonation being necessary shall be reported by the proponent to the CEO within 36 hours following detonation.	7.4 Blasting Outside Daylight Hours (36-Hour Report)
9-3	The proponent shall ensure that all airblast overpressure levels due to blasting comply with Regulation 11 of the <i>Environmental Protection (Noise) Regulations 1997</i> .	5.1.2 Airblast Levels
9-4	The proponent shall make all reasonable effort to avoid blasting on Sundays.	4.4.1 Blasting Times
9-5	For all blasting, the proponent shall comply with the following vibration limits, measured or calculated in accordance with section J4.2 of Australian Standard 2187 .2 - 2006, for the protection of human comfort at any houses and low rise buildings, theatres, schools and other similar buildings occupied by people and not owned by the proponent:  1. the peak particle velocity shall not exceed 5 millimetres per second for 90% of blasts per year;  2. the peak particle velocity shall not exceed 10 millimetres per second for any blast; and  3. no more than one in ten consecutive blasts shall exceed 5 millimetres per second peak particle velocity.	5.1.3 Blast Vibration

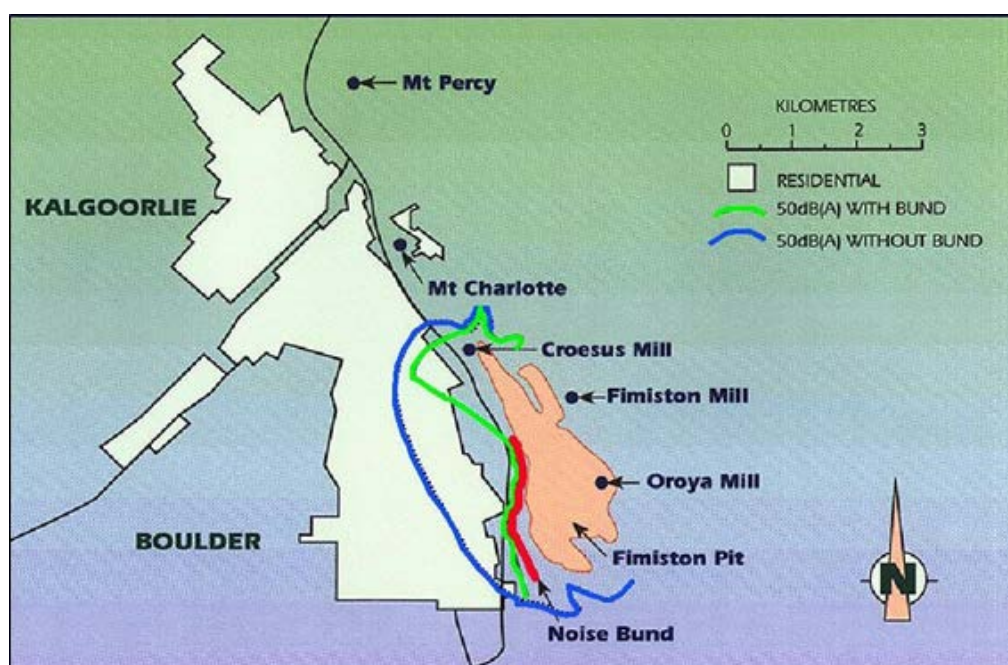
Condition	Section in Condition EMP
<p>9-6 Within six months following the issuing of the notice to the decision-making authorities under section 45(7) of the Environmental Protection Act 1986, the proponent shall revise the Revised Noise and Vibration Monitoring and Management Programme, dated June 2004, to the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation.</p> <p>This Programme shall include:</p> <ol style="list-style-type: none"> <li>1. Locations of the air blast overpressure and ground vibration monitors and demonstration that these locations meet the requirements of regulation 21 of the <i>Environmental Protection (Noise) Regulations 1997</i> and section J3.2.2 of Australian Standard 2187.2 - 2006;</li> <li>2. Description of the monitoring equipment and demonstration that the equipment complies with the requirements of schedule 4 of the <i>Environmental Protection (Noise) Regulations 1997</i> and section J3.2.1 of Australian Standard 2187.2 - 2006;</li> <li>3. Calibration by an approved calibration laboratory and field checks of the monitoring equipment in accordance with schedule 4 of the <i>Environmental Protection (Noise) Regulations 1997</i> and the manufacturer's specifications and section J3.1.2 of Australian Standard 2187.2 - 2006 (or any subsequent amendment) and recording of calibration;</li> <li>4. Procedures for the recording of blast information in accordance with section J3.4 of Australian Standard 2187.2 - 2006;</li> <li>5. Procedures for the reporting of air blast and vibration monitoring to the Department of Environment and Conservation; and</li> <li>6. Details of a complaints procedure and recording of complaints and action undertaken to resolve complaints.</li> </ol>	<p>5.2.5 Vibration and Airblast Monitoring</p> <p>5.2.5 Vibration and Airblast Monitoring</p> <p>5.2.5 Vibration and Airblast Monitoring</p> <p>10.3 Blast Monitoring Records</p> <p>7 Reporting Provisions</p> <p>6 Complaint Management</p>
<p>9-7 The proponent shall implement the Revised Noise and Vibration Monitoring and Management Programme required by condition 9-6.</p>	<p>1.3 Document History (Version 3)</p>
<p>9-8 The proponent shall review the Revised Noise and Vibration Monitoring and Management Programme as required by the Environmental Protection Authority, and shall amend the Programme to the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation.</p>	<p>1.3 Document History (Version 5)</p>
<p>9-9 The proponent shall implement the amended Revised Noise and Vibration Monitoring and Management Programme required by condition 9-8.</p>	<p>1.3 Document History (Version 5)</p>
<p><b>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009 Appeals Committee Recommendations</b></p>	
<p>(i) outline the steps required to develop and implement a noise amelioration program that will benefit the community most affected by noise from KCGM operations and that this would be over and above the commitments that KCGM have already made to other community projects.</p>	<p>4.2.1 UWA Research Project</p>
<p>(ii) detail, where practicable, the work required for the future installation and maintenance of a real-time noise monitoring site that is accessible by the public via the internet and preferably through the KCGM website.</p>	<p>5.2.4 Real-Time Noise Monitoring</p>
<p><b>Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016</b></p>	
<p>9(1) KCGM is to submit a noise management plan for the Fimiston Gold Mine to the CEO within 3 months after the start day.</p>	<p>1.3 Document History (Version 6)</p>

Condition	Section in Condition EMP
<p>9(2) The noise management plan is to include the following —</p> <ul style="list-style-type: none"> <li>(a) details of a noise and airblast level monitoring programme;</li> <li>(b) details of a programme to monitor weather conditions relevant to the assessment of noise and airblast levels from mining operations;</li> <li>(c) details of a programme for the provision of information to the community regarding noise and airblast levels from mining operations;</li> <li>(d) procedures to be adopted by KCGM to respond to complaints about noise emissions;</li> <li>(e) procedures to be adopted by KCGM to identify major noise emission sources;</li> <li>(f) procedures to be adopted by KCGM to adjust mining operations to reduce noise emissions — <ul style="list-style-type: none"> <li>(i) based on the noise and airblast level monitoring programme specified in paragraph (a); and</li> <li>(ii) based on responses to complaints about noise emissions;</li> </ul> </li> <li>(g) procedures to be adopted by KCGM to eliminate tonality, modulation and impulsiveness in noise emissions from mining operations;</li> <li>(h) procedures to be adopted by KCGM to minimise noise emissions from equipment used for mining operations;</li> <li>(i) procedures to be adopted by KCGM to minimise airblast levels;</li> <li>(j) procedures to be adopted by KCGM for recording details of blasting practices used for any blast that exceeds the airblast level set out in regulation 11;</li> <li>(k) any other matter that the CEO may require.</li> </ul>	<p>5.2 Monitoring Programmes 5.2.3 Weather Monitoring</p> <p>7.5 KCGM Website</p> <p>6 Complaint Management</p> <p>4 Management Approach</p> <p>8 Adaptive Management and Review of the Condition EMP</p> <p>4.1.3 Reversing Alarms 4.2.1UWA Research Project</p> <p>4.1 Management of Mining Activities</p> <p>4.4 Management of Blast Vibration and Airblast</p> <p>7.6 Reporting on Exceedance of Environmental Criteria</p> <p>8 Adaptive Management and Review of the Condition EMP</p>

### 3. NOISE MODELLING AND VERIFICATION

Since the early 1990s KCGM has consulted with noise consultants Herring Storer Acoustics to undertake noise modelling and assessments of the Fimiston Operations. A baseline environmental noise study was undertaken by Herring Storer Acoustics in September 1991 to quantify the noise environment and establish a model for planning purposes. Results of this modelling identified the following major noise emission sources: haul trucks, reversing signals (including that used on the front end loader at the primary crusher), and the Croesus Plant<sup>1</sup>.

To verify the noise modelling results, direct noise measurements were carried out during the night period (in order to minimise the effects of other noise sources). These measurements were taken at fixed sites in residential areas and involved a complete shutdown of the mining operation (All Plants “Off”) in order to achieve assessment of background noise levels (Herring Storer Acoustics, 1992). Supplementary noise modelling was undertaken by Herring Storer Acoustics with regards to the proposed Environmental Noise Bund in June 1992, which indicated significant noise reduction could be achieved by constructing a 20 m high bund extending the full length of the Fimiston Operations (Figure 1).



**Figure 1: Impact of Environmental Noise Bund on the 50 dB(A) Contour**

Based on the recommendations from this work, KCGM adopted management practices to minimise noise emissions from its mining and mineral processing activities, which are outlined in Section 4 (Management Approach).

As part of the ongoing life of mine planning process, KCGM undertakes additional modelling to evaluate any proposed changes to the mining activities. For example, in 2005, noise modelling was carried out to assess the impact of the Golden Pike Cutback. This modelling was reviewed as part of the PER undertaken for the Golden Pike Project where it was identified that the existing Fimiston Operations may not comply with the night time assigned noise levels under the Noise Regulations, even with controls in place (i.e. the environmental noise bund).

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<sup>1</sup> The Croesus Plant was decommissioned in 1997 eliminating this as a major noise emission source.

As a result, KCGM sought approval under Regulation 17 of the Noise Regulations for approval to allow noise emissions to vary from the standards specified and subsequently the *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009* was published in the Government Gazette on 14 July 2009.

Modelling is primarily undertaken using the SoundPlan software programme to predict, assess and map noise. Equipment used for modelling is taken from KCGM's equipment inventories and sound power levels used are calculated from measurements of actual or representative equipment at the Fimiston Operations.



## 4. MANAGEMENT APPROACH

KCGM's approach to managing noise emissions is based on the identification of major noise emission sources using conventional risk assessment methodologies, noise modelling and noise monitoring results and experience drawn from community feedback and complaints. The management measures implemented to address the major noise emission sources identified by KCGM are detailed in Section 4.1.

### 4.1 Management of Mining Activities

#### 4.1.1 Environmental Noise Bund

A key noise management feature at KCGM has been the establishment of the environmental noise bund. Prior to the commencement of the Fimiston Operations, results of modelling work (Herring Storer Acoustics, 1992) indicated that an earthen bund between the Fimiston Open Pit and City of Kalgoorlie-Boulder would significantly reduce noise emissions resulting from open pit mining activities (Figure 1).

The first stage of the environmental noise bund was constructed in 1992. Subsequent modifications and extensions have been undertaken as the Fimiston Open Pit has evolved over time (Figure 2). Most recently works undertaken to realign the environmental noise bund for the Golden Pike Cutback commenced in mid-June 2007 and were completed in July 2010.

Life of Mine planning and changes to the pit design take into consideration the location of the environmental noise bund. Noise modelling is undertaken for any major changes (e.g. cutbacks) and where noise modelling identifies modifications are required to the environmental noise bund these are incorporated back into the pit design.



Figure 2: KCGM Environmental Noise Bund Construction History

#### 4.1.2 Surface Activities

Certain activities when undertaken at surface have been identified as a major source of noise emissions with the potential to impact the community. These noise sources are associated with equipment which can emit annoying characteristics i.e. tonality, modulation and impulsiveness (as defined within the Noise Regulations) and activities which occur within close proximity to residential areas.

Examples of such equipment include: long hole percussion drilling, rock breaking, tracked loaders and dozers, and reversing alarms. To prevent noise impacts, the use of certain equipment in certain areas is restricted to daytime<sup>2</sup> only.

Mining operations are also adjusted to reduce noise emissions where practicable. This includes limiting surface mining activities (e.g. the Golden Pike Cutback) to daytime only until a level of 20 m below the undisturbed ground surface level is reached. Figure 3 shows a schematic of the restricted surface mining activities. Ground surface level is defined as the RL at the pit crest adjacent to the Environmental Noise Bund.

Construction of the environmental noise bund and waste rock dumps which occur within close proximity to residential areas are managed through predictive noise modelling to determine potential noise impacts, and where necessary construction activities are restricted to daytime only.

During construction of the Northern Waste Rock Dump, KCGM implemented the following noise management strategy whereby construction was undertaken in two stages:

- 1) Construction of the outer wall to act as a noise bund (daytime only); and
- 2) Dumping of waste rock behind the outer wall. This methodology was successful and a similar approach will be adopted for future waste rock dumps constructed within close proximity to residential areas.

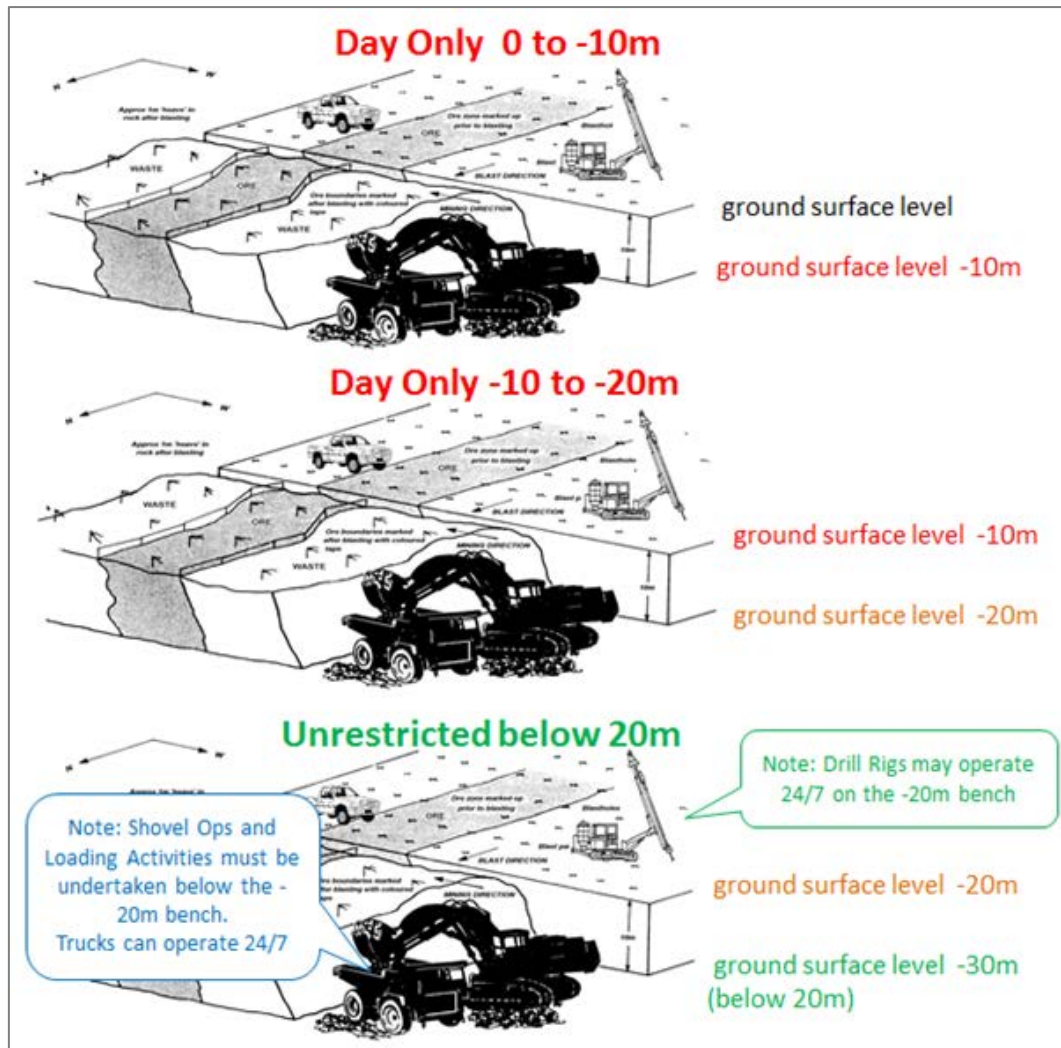
Additional noise controls which can be applied to surface activities include:

- Ensuring the quietest equipment available is used.
- Ensuring that all employees and contractors involved are made aware of the potential environmental impacts on the community and the importance of noise control measures.
- Ensuring action is taken (as appropriate) in response to feedback from stakeholders regarding noise management practices.

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<sup>2</sup> Daytime hours are defined as: 0700 to 1900 hours Monday to Saturday and 0900 to 1900 hours Sundays and public holidays





**Figure 3: Schematic showing the restricted surface mining activities**

#### 4.1.3 Reversing Alarms

Results of the environmental noise study undertaken in 1991 identified reversing signals as a major noise emission source. Reversing warning alarms are required for safety purposes on mobile equipment operating on any mining or mineral processing site in accordance with Regulation 13.3(1) of the *Mines Safety and Inspection Regulations 1995*. The signals from these audible alarms are by design intrusive in nature (containing annoying characteristics) and therefore KCGM has continually investigated ways to minimise this noise.

Initially “smart alarms” were utilised on mobile mining equipment; these alarms were able to adjust their output so that the signal is adjusted to 5dB(A) above background noise levels. Thus the emitted signal (reversing alarm) is reduced during quiet periods (i.e. at night). The use of visual high intensity magenta strobe lights was also used on night shift on the ROM Pad as an alternative to the tonal reversing alarm.

In 2006 KCGM became aware of a new type of reversing alarm which produces a broadband frequency noise as opposed to tonal noise as the warning signal. After successfully trialing the broadband reversing alarms during 2007, KCGM commenced installing broadband reversing alarms on all mobile equipment permanently located onsite at the Fimiston Operation<sup>3</sup>. Since completing the roll out in late 2010, the use of broadband reversing alarms has been applied to all new mining equipment permanently located onsite.

In order to eliminate tonality, modulation and impulsiveness in noise emissions from mining operations, KCGM will continue to research the feasibility of mechanisms other than audible signals for use as reversing alarms on other equipment used at the Fimiston Operations.

#### 4.1.4 Mt Charlotte Waste Rock Conveyor

Since the early 1990s, waste rock has been transported to the Mt Charlotte Glory Hole to provide backfill for the underground mining operation, which is important to ensure the safety and stability of the mine. Initially this was achieved by using haul trucks, however an increase in complaints received from nearby residents during 2000 identified this activity as a major noise emission source. In response, the number of trucks was reduced to a maximum of 12 per hour and operators were made aware of the environmental issues and improvements made to their driving techniques.

It became necessary to investigate alternative methods of transporting the waste rock which resulted in utilising the decommissioned conveyor equipment (previously used to transport ore from Mt Charlotte to the Oroya Mill). The conveyor eliminated the need for haul trucks which significantly reduced the noise emission levels associated with the transportation of waste rock to the Mt Charlotte Glory Hole.

However, the use of the conveyor introduced new noise emission sources, such as squeaky rollers and the noise from rocks falling off the belt and at designated transfer points. To reduce noise emissions, the conveyor design included fully enclosed sections internally lined with insulation and an enclosure (noise barrier) constructed around the transfer chute on the western side of the conveyor at the Glory Hole.

In 2009, it was identified through several complaints that metal clips (used to repair tears in the conveyor belt) travelling over the rollers was also a contributing noise source. KCGM replaced the conveyor belt during the first quarter of 2010 eliminating this noise source. The use of rubber clips in place of the metal clips has been trialled, however they were not suitable for repairing parallel rips or major tears. To mitigate the noise associated with the metal clips, a rubber strip is placed over the clips as required.

KCGM continues to manage noise emissions from the Mt Charlotte Waste Rock Conveyor via routine inspections and maintenance of the conveyor belt, the rollers and related infrastructure. Any feedback received regarding noise from the conveyor is responded to with a sense of urgency to ensure the source is identified and rectified.

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<sup>3</sup> Note: the PC 8000 Shovels and the CAT 994 Loader could not be fitted as the alarm could not be adequately heard above the idling of the equipment.

## 4.2 Management of Haul Truck Noise

Initial noise assessment and modelling of the Fimiston Operations identified haul trucks as a major noise emission source (Herring Storer Acoustics, 1991); recommendations from this assessment included investigating exhaust silencers and fitting panels to further enclose engines.

Consequently noise management regarding the haul trucks has continually been pursued by KCGM to address noise reduction opportunities, including the following:

- In 2002, KCGM undertook an improvement programme to retrofit existing haul trucks with quieter engines. New trucks purchased since this time have quieter engines and fans as a standard.
- KCGM purchased a Cat 793C “XQ” (eXtra Quiet) haul truck (226) in 2003 to trial on site; as the name suggests this truck model has additional noise control features. This was the first truck of its type to be used in the Goldfields and underwent an extensive trial period in order to measure its operational performance. The truck did not perform as expected, primarily due to the additional weight of the noise control features which meant the truck was less efficient in both the amount of material it could move and overall fuel consumption. It was also proven to be harder to maintain. For these reasons KCGM did not purchase any additional XQ models.
- In 2009, KCGM investigated the use of sound suppressant mufflers on a CAT 793C haul truck (213). Follow up noise testing undertaken indicated the newly installed muffler provided a 2 to 4 dB(A) sound pressure level reduction. However, there had been no significant change in the overall noise emission from the truck; for this reason it was not considered beneficial to install the mufflers on the rest of the fleet.
- From October 2008 to March 2016, KCGM has undertaken biannual sound power level testing on individual haul trucks to enable analysis of noise performance trends and identify if additional maintenance is required. Monitoring conducted during this time has demonstrated that haul truck noise levels have not increased over time. Given the stable nature and low variability of haul truck noise monitoring results the testing programme is considered completed. The request to cease the testing programme was formally presented in KCGM's 2013 Noise Regulation 17 Variation application.

### 4.2.1 UWA Research Project

In June 2010, KCGM commenced a Noise Amelioration Programme to satisfy a recommendation<sup>4</sup> made by the Appeals Committee in relation to an appeal against the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009.

After comprehensive community consultation a Research Project entitled “Integrated Passive and Active Control of Humming Noise from KCGM's Haul Trucks” put forward by the University of Western Australia (UWA) was selected at KCGM's Community Reference Group (CRG) meeting held in March 2012 as the preferred Noise Amelioration Programme for KCGM to pursue.

This project was considered to satisfy the intent of the Appeals Committee recommendation to benefit the community most affected by noise from KCGM's Fimiston Operations (i.e. haul truck noise) and to be over and above the commitments that KCGM has already made to other community projects regarding noise amelioration.

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<sup>4</sup> “(i) outline the steps required to develop and implement a noise amelioration program that will benefit the community most affected by noise from KCGM operations and that this would be over and above the commitments that KCGM have already made to other community projects.”

The parameters of the research project were developed in conjunction with UWA. To finance the project, KCGM and UWA pursued a government funded Australian Research Council (ARC) linkage grant. The project is aimed at achieving total sound power attenuation through development of a prototype engine enclosure as well as examining ways to reduce noise associated with the haul trucks as described below:

- The noise attenuation design incorporates both passive and active noise control to achieve total sound power attenuation; passive control gives good attenuation above 200 Hz whilst the active control will be applied for frequencies below 200 Hz; and
- Improvements to the existing muffler design were investigated to further reduce noise associated with haul trucks.

Whilst the ARC linkage grant expired in December 2017, KCGM is considering its continued support of the noise amelioration project subject to receipt and review of the final report for the project.

### 4.3 Management of Resource Definition Drilling

KCGM's resource definition drilling programmes often occur in close proximity to the CKB and have therefore been identified as a major noise emission source. Due to their transient nature and differentiation from general mining activities, noise emissions associated with resource definition drilling programmes are managed to comply with the Noise Regulations.

In June 2002 a detailed noise management plan was developed by Herring Storer Acoustics for a drilling programme on the western side of the Fimiston Open Pit that was in close proximity to residential areas and Noise Sensitive Premises.

The 2002 Noise Management Plan included the design and construction of trailer mounted acoustic screens to act as a noise barrier. Noise contours were derived from computer modelling to depict predicted noise levels 'on the ground'. The modelling evaluated noise levels from the drill rig with the acoustic screens in position, to ensure compliance with the Noise Regulations.

KCGM continued to implement the noise control principles and practices detailed in the 2002 noise management plan, including the use of the acoustic screens, to manage potential noise impacts for drilling programmes within close proximity to residential areas.

In 2011, a noise assessment was undertaken for a drilling programme within close proximity of residential properties in Williamstown. The assessment determined that the acoustic screens could not provide sufficient noise attenuation to comply with the Noise Regulations. An alternative noise barrier was investigated which resulted in the decision to trial the use of sea containers.

Noise modelling was conducted by Herring Storer Acoustics (2011) with the sea containers in place which indicated that the sea containers provided a significant improvement in noise reduction when compared to the use of the acoustic screens. Noise contours were derived from computer modelling to depict predicted noise levels 'on the ground'. The modelling evaluated noise levels from the drill rig with the sea containers in position, to ensure compliance with the Noise Regulations.

Following this successful trial, the use of sea containers to manage potential noise emissions from drill rigs has been implemented for all drilling programmes within close proximity to residential areas.

A desktop assessment is undertaken for each drilling programme prior to commencement to verify compliance with the Noise Regulations; this process generally includes the following:

- Review of nearby land use to identify potential impacts on noise sensitive premises (industrial, rural or residential).

- Review of 'on ground' noise contours with sea containers in place for each planned drilling location to determine compliance with the Noise Regulations at the nearest noise sensitive premises.
- Undertaking additional noise modelling as required.

For drilling programmes located within close proximity to residential areas the following noise control measures are considered:

- Drilling personnel provided with information to improve awareness of environmental impacts.
- Restricting times of operation.
- Utilisation of sea containers. Generally the cab will face the premises and the sea containers positioned in an "L" shape around the cab. The sea containers are to be assembled so as to maximise disrupting the line-of-sight between the drilling operations and the community. There should be no gaps either in the containers or at the junctions.
- Any ancillary pumps should be located behind tanks or the sea containers. In addition, the pumps should be placed on tyres as this provides an effective vibration isolation medium from the ground.
- Any tanks should be located together. There should be no gaps between the tanks if they are to act as an additional noise barrier.
- Thick rubber matting should be laid between the drill rods as they are stacked.
- Lighting towers should be directed away from residential areas.
- Noisy activities e.g. pulling of rods should be avoided during the night time period (between the hours of 2200 and 0700 or 0900 on Sunday and public holidays).

Follow up noise monitoring is usually undertaken once the drilling programme has commenced to verify the predicted noise levels obtained from the desktop assessment. The measurements are used to calibrate the model to improve predictions made for subsequent drilling programmes. Additional control measures are implemented as required.

## 4.4 Management of Blast Vibration and Airblast

Careful management of blasting impacts, vibration and airblast, is critical due to KCGM's close proximity to the CKB. Since the commencement of the Fimiston Open Pit in 1989, KCGM has achieved a high success rate of blasting within approved regulatory levels and therefore minimised the impacts of vibration and airblast on the community.

The Fimiston Open Pit presents some unique challenges for blast management including: numerous faults which intersect the pit, a vast network of underground voids remnant from historic mining operations, and the close proximity of the Fimiston Open Pit to the City of Kalgoorlie-Boulder. Through extensive research and development projects coupled with learnings from both favourable and unfavourable blast events, KCGM's management of blasting is continually improving. Key management approaches undertaken by KCGM to minimise the impacts of blasting on the community are outlined below.

### 4.4.1 Blasting Times

Condition 9-1 of 782:M stipulates that KCGM shall only detonate explosives on the premises between the hours of 0700 hours and 1800 hours; which is also in accordance with regulation 8.28(3) of the *Mines Safety and Inspection Regulations 1995* (i.e. "...a person must not fire a charge at night").



Where possible, KCGM blasts at around 1pm or 5pm. A daily blast notification is sent to a distribution list (which includes community organisations) advising of the planned blast time and location. Daily blast times are also made available through KCGM's Public Interaction Line (9022 1100).

Blasts may be scheduled with "one hour" notice when unfavourable weather is predicted or blast preparation is pending. Whilst every effort is made to notify the public of blast times, unexpected changes in weather and wind direction may cause a blast to be cancelled or rescheduled.

Additionally, in accordance with Condition 9-4 of 782:M, all reasonable effort is taken to avoid blasting on Sundays.

#### 4.4.2 Blast Design and Modelling

Each blast is carefully designed to meet internal design criteria and takes into account external factors which may potentially increase the vibration and/or airblast levels. A blast plan is developed for each bench to identify fault structures and underground workings within the blast areas to determine the risk profile with regards to vibration and airblast. Criteria for blast design to minimise vibration and airblast includes the following:

- Blast size is generally less than 450,000 tonnes. Blasts carried out at KCGM are much smaller than those undertaken by remote mine sites, using less than ten percent of the amount of explosive used in standard production blasting.
- Blasthole diameter is determined based on the type of blast and from the vibration modelling results. Generally 165 mm is used for production blasts, however 115 mm is used to reduce vibration in certain areas and to preserve wall integrity as required.
- Blast modelling is undertaken for all blasts to predict vibration and airblast levels. The model includes a vibration constant (K-factor) which is created for each known fault; this K-factor is continually updated based on blast results. Blast modelling also takes into account the location of the blast within the pit (i.e. distance of blast from the monitoring sites).
- The type of initiation system (Nonel or Ikon) is determined based on the type of blast and from the blast modelling results.
  - Nonel is a nonelectric shock tube detonation system which requires manual tie-in using various period delay detonators to achieve the required blast pattern. Experience has shown that inter-hole (IH) and inter-row (IR) timing combinations for Nonel can effectively manage vibration.
  - Ikon is an electronic detonation system which is used to achieve single hole firing to minimise the Maximum Instantaneous Charge (MIC). Because of the electronic programming of each individual hole, the use of Ikon can achieve a very precise blast pattern with reduced risk of misfire and timing errors. The electronic initiation system is able to separate the timing between holes to 12 milliseconds.
- A minimum stemming height is required for each blasthole to optimise containment and reduce airblast. There is a strict QA process in place whilst loading holes to ensure the required stemming height is achieved.
- Atmospheric conditions (e.g. cloud cover) are taken into consideration to minimise airblast levels. Blasting schedules are modified where atmospheric conditions are conducive to reflection of blast noise and potential to produce erroneous data due to high wind speeds.
- Firing of blastholes adjacent to known voids and simultaneous detonation of adjacent blastholes is avoided to minimise airblast levels.

## 5. CONDITION EMP PROVISIONS

### 5.1 Environmental Criteria

#### 5.1.1 Environmental Noise Levels

Environmental noise levels for KCGM's Fimiston Operations are stipulated in Condition 4 of the 2016 Fimiston Noise Approval.

For noise emissions other than those resulting from blasting, KCGM is granted approval to allow the level of noise emitted from the Fimiston Gold Mine to exceed the standards prescribed under regulation 7 of the *Environmental Protection (Noise) Regulations 1997* if the level of noise when received at a location at the time specified does not exceed the approved level as outlined in Table 3. The  $L_{A10}$  and  $L_{Amax}$  approved levels for specific reference locations are calculated by adding a Weather Influencing Factor (WIF) for that location which is determined according to the wind speed and direction at the time measurement is taken as outlined in Table 4.

**Table 3: Fimiston Gold Mine Approved Noise Levels**

Reference Location	Time of Day <sup>5</sup>	Approved Level (dB)	
		$L_{A10}$	$L_{Amax}$
Barton Street, Williamstown (BSW)	Day	50 + WIF	65 + WIF
	Evening	45 + WIF	55 + WIF
	Night	45 + WIF	55 + WIF
Kalgoorlie Technical School (KTS)	Day	50 + WIF	62 + WIF
	Evening	45 + WIF	52 + WIF
	Night	45 + WIF	52 + WIF
Boulder Primary School (BPS)	Day	50 + WIF	62 + WIF
	Evening	45 + WIF	52 + WIF
	Night	45 + WIF	52 + WIF
Outram Street, Boulder (OSB)	Day	52 + WIF	65 + WIF
	Evening	49 + WIF	60 + WIF
	Night	49 + WIF	60 + WIF
York Street, Boulder (YSB)	Day	52 + WIF	65 + WIF
	Evening	49 + WIF	60 + WIF
	Night	49 + WIF	60 + WIF

Source: Schedule 2 Table 1 - Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

<sup>5</sup> Day: 0700 to 1900 hours Monday to Saturday and 0900 to 1900 hours Sunday and public holidays

Evening: 1900 to 2200 hours all days

Night: 2200 on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays



**Table 4: Weather Influencing Factor**

Weather Conditions		Weather Influencing Factor				
Wind Direction	Wind Speed (km/hr)	Reference Location				
		BSW	BPS	KTS	OSB	YSB
Calm	<2	3	6	6	5	4
Northerly	≥2	-2	6	6	5	5
North Easterly	≥2	2	6	6	4	5
Easterly	≥2	4	6	6	4	5
South Easterly	≥2	4	6	6	3	5
Southerly	≥2	4	4	6	2	5
South Westerly	≥2	3	2	5	2	4
Westerly	2-7	0	2	3	3	2
Westerly	>7	-4	-3	-2	3	-3
North Westerly	2-7	-4	4	3	4	2
North Westerly	>7	-6	3	-1	3	-1

Source: Schedule 2 Table 1 - Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

### 5.1.2 Airblast Levels

Airblast levels for KCGM's Fimiston Operations are stipulated in Condition 4 of the 2016 Fimiston Noise Approval.

For noise emissions resulting from blasting, KCGM is granted approval to allow the level of noise emitted from the Fimiston Gold Mine to exceed the standards prescribed under regulations 11(4)(a)(i) and (6)(a)(i) of the *Environmental Protection (Noise) Regulations 1997* if the level of noise when received at a sensitive site on a residential property owned by KCGM at the time of day specified does not exceed the approved airblast level as outlined in Table 5.

**Table 5: Fimiston Gold Mine Approved Airblast Levels**

Time of Day / Location	Approved Airblast Level (dB L <sub>Z</sub> peak)	
	Not to be Exceeded Anytime (Limit)	Not to be Exceeded for any 9 in 20 Consecutive Blasts <sup>6</sup>
0700 to 1800 hours Monday to Saturday (excluding public holidays). When received at a sensitive site on a residential property owned by KCGM.	125	120
0700 to 1800 hours Sunday and public holidays. When received at a sensitive site on a residential property owned by KCGM.	120	115

Source: Schedule 3 Table 1 - *Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016*.

In accordance with Condition 9-3 of 782:M, all other sites are required to comply with the airblast levels prescribed in Noise Regulations as outlined in Table 6.

**Table 6: Regulation 11 Airblast Levels**

Time of Day / Location	Approved Airblast Level (dB L <sub>Z</sub> peak)	
	Not to be Exceeded Anytime (Limit)	Not to be Exceeded for any 9 in 20 Consecutive Blasts <sup>7</sup>
0700 to 1800 hours on any day. When received at a sensitive site	120	115
0700 to 1800 hours on any day. When received at a location other than a sensitive site	125	120

Source: *Regulations 11(4) and (6) - Environmental Protection (Noise) Regulations 1997*.

<sup>6</sup> When received at the same monitoring site

<sup>7</sup> When received at the same monitoring site

### 5.1.3 Blast Vibration Levels

Vibration levels for KCGM's Fimiston Operations are stipulated in Condition 9-5 of 782:M, as outlined in Table 7.

**Table 7: KCGM Fimiston Operations Blast Vibration Levels**

	No Blast Greater Than (Limit)	Not to be Exceeded for any 9 in 10 Consecutive Blasts <sup>8</sup>	90% of Blasts Per Year Less Than
Vibration Level (PPV) <sup>9</sup>	10 mm/s	5 mm/s	5 mm/s

Source: Condition 9-5 of Ministerial Statement 782 and specified in AS2187.2

## 5.2 Monitoring Programmes

### 5.2.1 Continuous Environmental Noise Monitoring

Condition 8(1) of the 2016 Noise Approval, requires KCGM to continuously record levels of noise received at BPS and Metal Exploration Premises (MEP).

KCGM's "Continuous Environmental Noise Monitoring Programme" has been implemented to meet the above requirement, as detailed below.

- Continuous noise monitoring is undertaken at BPS and MEP (Figure 4) using Bruel and Kjaer 2250 Sound Level Meter (SLM) equipment.
- Noise data at BPS is recorded in decibels as L10, L50, and L90 which are averaged over 1 hour.
- The SLM at BPS also records trigger events. The noise trigger function is set to operate between 1900 hours and 0700 hours. A noise trigger event is recorded when the noise level exceeds 60 dB(A) between 1900 and 2200 hours and 55 dB(A) between 2200 pm and 0700 hours for greater than 2 minutes. The digital recorder stamps all triggers with the date and time of the event. Trigger recordings are reviewed on an as need basis, usually in response to a noise complaint, to identify if the source of the noise was attributable to the Fimiston Operations.
- Noise data at MEP is recorded in decibels as Leq which are averaged over 5 minutes. The MEP site is used to record real-time noise monitoring data for the KCGM website (refer to Section 5.2.4) and therefore requires a different configuration to the SLM at BPS, which does not allow triggers to be recorded.
- The SLMs are NATA calibrated every two years in accordance with the manufacturer's recommendations.

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<sup>8</sup> When received at the same monitoring site

<sup>9</sup> Vibration limits can be measured or calculated in accordance with section J4.2 of Australian Standard 2187.2-2006, for the protection of human comfort at any houses and low rise buildings, theatres, schools and other similar buildings occupied by people and not owned by the proponent.

It should be noted that the continuous noise monitoring data is influenced by other noise sources such as traffic, animals (e.g. birds and barking dogs) and social activity (e.g. music) and is not considered to be representative of noise emitted from KCGM's Fimiston Operations. Consequently the continuous noise monitoring data is not used to measure compliance against the approved noise levels for the Fimiston Gold Mine; rather this is achieved via KCGM's Compliance Environmental Noise Monitoring Programme (Section 5.2.2).



**Figure 4: Continuous Noise Monitoring Sites**

### 5.2.2 Compliance Environmental Noise Monitoring

In accordance with Condition 8(2) of the 2016 Fimiston Noise Approval, KCGM is required to record levels of noise received at each reference location. This monitoring data is used to determine compliance against the approved noise levels for the Fimiston Gold Mine (Table 3).

KCGM's "Compliance Environmental Noise Monitoring Programme" has been implemented to meet the above requirement, as detailed below.

- Compliance environmental noise monitoring is completed each quarter by specialist noise consultants using a manned sound level meter. Contributing noise (other than mining noise attributable to the Fimiston Operations) is excluded from the sound pressure level logs.
- Noise is measured at the five reference locations (as defined in Table 8 and shown in Figure 5) during the evening and/or night periods. This time period has been selected to minimise noise from other contributing sources (e.g. traffic).
- Noise data is recorded as  $L_{A10}$  and  $L_{Amax}$  which are averaged over the measurement period (minimum of 15 minutes).

- Weather data recorded at the time of the monitoring (refer to Section 5.2.3) is used to determine the WIF (Table 4) for calculation of the approved noise level (Table 3).

**Table 8: Compliance Noise Monitoring Sites**

Name	Abbreviation	Description
Barton Street Williamstown	BSW	Means any place at or adjacent to the intersection of Barton Street and Baden Street, Williamstown.
Boulder Primary School	BPS	Means any place within the boundary of the premises known as Boulder Primary School at 200 Lane Street, Boulder.
Kalgoorlie Technical School	KTS	Means any place within the boundary of the premises known as Kalgoorlie Technical School at 13 Davidson Street, South Kalgoorlie.
Outram Street Boulder	OSB	Means any place at or adjacent to the intersection of Outram Street and Shannon Street, Boulder.
York Street Boulder	YSB	Means any place on York Street, between the intersections of York Street with Lane Street and Hamilton Street, Boulder.

Source: Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

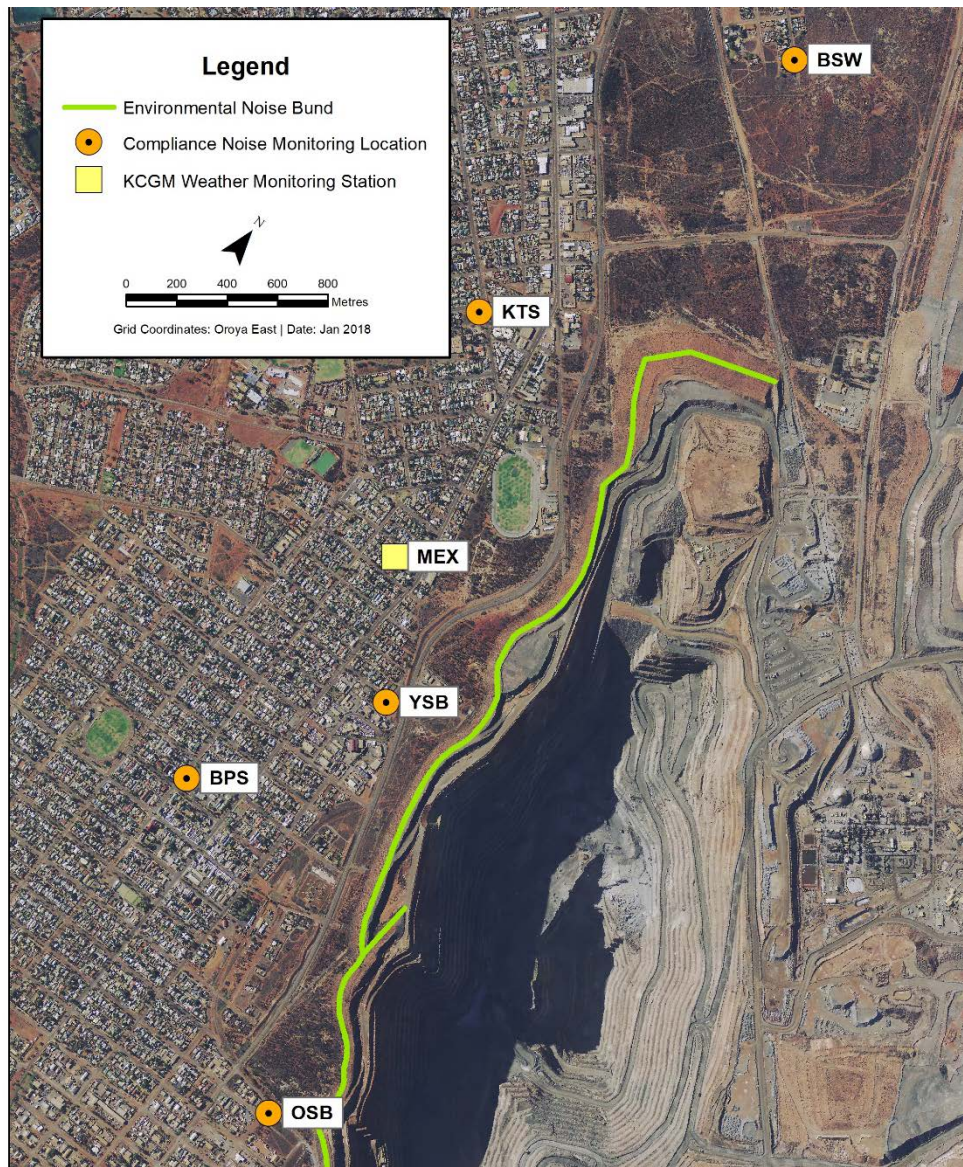
### 5.2.3 Weather Monitoring

In accordance with Condition 4(2) of the 2016 Fimiston Noise Approval, KCGM is required to determine the WIF for the weather conditions prevailing at the time the noise is measured, to calculate the approved noise levels for the Fimiston Gold Mine (Table 3).

KCGM's uses data obtained from a wind sensor installed at KCGM's MEX weather station to meet the above requirement, as detailed below.

- Wind monitoring (wind speed and wind direction) is undertaken at MEX (Figure 5) using MET ONE model 50.5 sonic anemometer equipment positioned at approximately 20 m above ground level.
- The wind sensor is wind tunnel calibrated every two years in accordance with the manufacturer's recommendations.
- Wind Direction data is recorded as degrees (0 - 360) which are averaged (using vector averages) over 5 minutes.
- Wind Speed data is recorded as metres per second (m/s) which are averaged over 5 minutes.
- If required, weather data can also be obtained from the Bureau of Meteorology site located at the Kalgoorlie-Boulder airport.





**Figure 5: Compliance Noise Monitoring Locations**

#### 5.2.4 Real Time Noise Monitoring

In October 2011, KCGM installed a “real-time noise monitor” to satisfy a recommendation<sup>10</sup> made by the Appeals Committee in relation to an appeal against the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009 gazetted on 14 July 2009. MEP was selected for the real-time noise monitoring site, based on an assessment undertaken by Herring Storer Acoustics (2010) and the existing equipment/communication capabilities at the site.

Noise data is recorded as  $L_{Aeq}$  which are averaged over 5 minutes. Whilst it was initially suggested that the  $L_{A50}$  noise level data be used, the SLMs used by KCGM (Brüel & Kjaer 2250) are only capable sending an analogue output as the  $L_{Aeq}$  noise level. In consultation with KCGM’s noise consultants Herring Storer Acoustics, the  $L_{Aeq}$  was selected as it is considered to be more easily understood by the public.

<sup>10</sup> “(ii) detail, where practicable, the work required for the future installation and maintenance of a real-time noise monitoring site that is accessible by the public via the internet and preferably through the KCGM website.

The Appeals Committee recommendation also required that data be accessible by the public via the internet. To achieve this, KCGM set up a web-based report on the KCGM website which graphically displays the real-time noise monitoring data over a 48 hour period; the report is automatically updated every 15 minutes. The SLM used to record the real-time noise monitoring data is the same unit used to record the continuous environmental noise data at MEP (refer to Section 5.2.1).

### 5.2.5 Blast Vibration and Airblast Monitoring

In accordance with Condition 8(3) of the 2016 Fimiston Noise Approval, and Conditions 9-5 and 9-6 of 782:M, KCGM is required to record airblast levels and vibration.

KCGM's "Blast Monitoring Programme" has been implemented to meet the above requirements, as detailed below.

- Blast monitoring is undertaken at six (6) reference locations (Alpha, Bravo<sup>11</sup>, Charlie, Delta, Echo<sup>12</sup> and Foxtrot) which were established in 1993 (as defined in Table 9 and shown in Figure 66).
- Blast monitoring is measured and recorded using Advanced Texcel remote blast monitor (ETM) equipment. The blast monitoring equipment and siting meet the requirements of regulation 21 and schedule 4 of the Noise Regulations and sections J3.2.1, J3.2.2 and J4.2 of AS2187.2-2006 as demonstrated in Section 10.2.
- The ETMs are NATA calibrated annually in accordance with schedule 4 of the Noise Regulations, the manufacturer's specifications, and section J3.1.2 of AS2187.2-2006. A performance check of the equipment is automatically completed daily and a copy of the performance report is sent to the drill and blast personnel.
- Blast vibration is measured as peak particle velocity which is recorded in millimetres per second (mm/s).
- Airblast is recorded in decibels as Lz peak.
- Recording of a blast is triggered by ground vibration exceeding the set trigger level of 0.5 mm/s. The trigger level is an internal level set well below the applicable standards and regulations in order to track blast vibration patterns and trends.
- Blast monitoring records for each blast undertaken in the Fimiston Open Pit are stored in KCGM's Operational Management Databases (MMRS and Connected Mine). Procedures for recording of blast information in accordance with section J3.4 of AS2187.2-2006 are included in Section 10.3.

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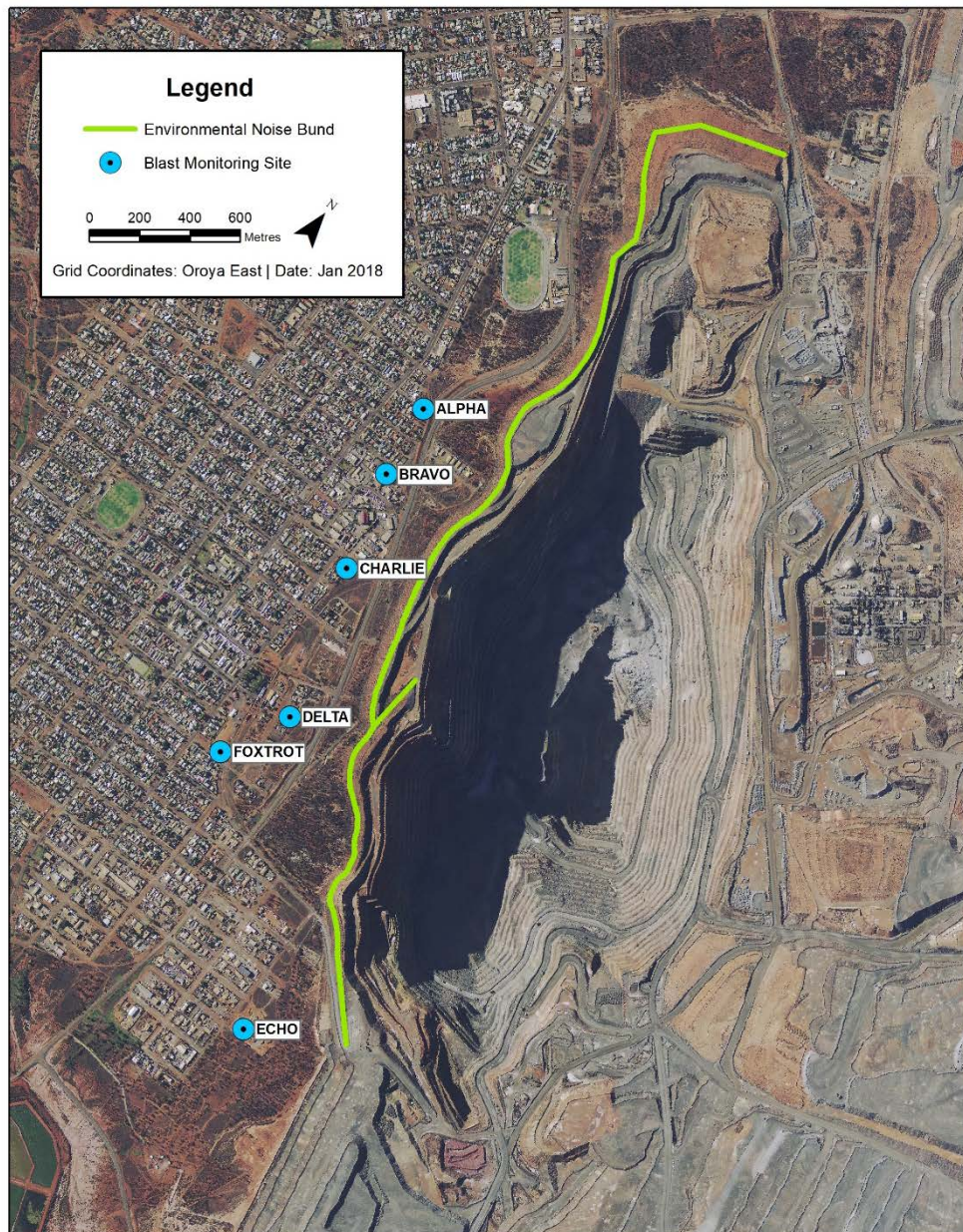
<sup>11</sup> As a result of the Golden Pike Cutback project the Bravo blast monitoring site was relocated in 2010 to a more representative location as the previous location, within close proximity to the open pit, resulted in unusually large variation recordings which did not correlate with the other monitors. Approval from DWER was obtained prior to relocation through amendment of the NVMMP in October 2010.

<sup>12</sup> This version of the NVMMP has been amended to reflect the proposed relocation of the Echo blast monitoring site, following an assessment of blast induced ground vibration and airblast, associated with the proposed Morrison mining project (George Boucher Consulting, 2017). The assessment report recommended that the Echo blast monitoring site be relocated to a point further south of the existing site.



**Table 9: Blast Monitoring Sites**

Name	Description
Alpha	Sensitive site
Bravo	Sensitive site on a residential property owned by KCGM
Charlie	Sensitive site on a residential property owned by KCGM
Delta	Sensitive site on a residential property owned by KCGM
Echo	Location other than a sensitive site
Foxtrot	Location other than a sensitive site



**Figure 6: Fimiston Open Pit Blast Monitoring Sites**

## 6. COMPLAINT MANAGEMENT

KCGM's Public Interaction Line (PIL) was established in 1993 and is available 24 hours (08 9022 1100) for anyone to contact KCGM for a wide range of issues including emergencies, complaints, inquiries and feedback.

The PIL is backed up by an electronic database. Each interaction is logged in the database and is categorised based on the nature of the interaction and the topic. For example a public interaction may be logged as a complaint regarding nuisance noise, or as an inquiry regarding noise monitoring results. The database automatically sends out an email notification to key internal stakeholders based on the topic to ensure a timely response, especially if the interaction requires any follow-up actions. KCGM has made a commitment to respond to complainants within 24 hours (or the next working day).

Information received via community feedback can assist KCGM to identify noise emission sources and improve noise management in general.

KCGM has implemented a Complaints and Grievance Management procedure to manage the actions taken to resolve complaints. Where the complaint is in relation to blast vibration, KCGM offers property inspections to determine if any damage has been caused. This is managed in accordance with KCGM's property inspection process.

## 7. REPORTING PROVISIONS

### 7.1 Quarterly Noise and Blast Monitoring Report

Since 1993 (in accordance with the Noise Level Standards for Operations at Kalgoorlie set by the Minister in 1992), a Quarterly Noise and Blast Monitoring Report has been submitted. This report contains the following information:

#### Environmental Noise Monitoring

- Continuous noise monitoring data;
- Compliance noise monitoring results; and
- Information on any data loss, maintenance or calibration.

#### Blast Vibration and Airblast Monitoring

- Number of shots fired;
- Number of blast events (triggered by vibration greater than 0.5 mm/s);
- Results of vibration and airblast levels recorded from a blast event;
- Information on any data loss, maintenance or calibration; and
- Summary of any blast/s that occurred on a Sunday.

#### Complaints

- Summary of any complaints regarding noise and/or vibration received.

#### Noise Management

- Comments regarding any noise management initiatives (e.g. the UWA research project).

The quarterly report is submitted to the CEO (DWER).

### 7.2 Annual Noise Monitoring Report

In accordance with Condition 10 of the 2016 Fimiston Noise Approval, KCGM is required to prepare a written annual report for the year beginning on the 22 March each year. The annual report will include:

- a) a summary of the noise and airblast levels recorded under clause 8 during the year; and
- b) a summary of the progress of the implementation of the noise management plan submitted or revised under clause 9.

The annual report is due for submission to the CEO (DWER) within one month after the end of the reporting year (i.e. by the 22 April each year). The data presented in the annual report will be for the year beginning on 1 April each year to align with the quarterly reporting period.

## 7.3 Publishing of Noise Monitoring Results

Since 1993, KCGM has been advertising noise monitoring results in the Kalgoorlie Miner newspaper each quarter to satisfy Condition C4 of the Noise Level Standards for Operations at Kalgoorlie set by the Minister in 1992. Initially the newspaper advertisement contained information on how many triggers were recorded at the continuous noise monitoring sites and what the dominant noise was for each event recorded. In 2005 the formatting (graphic design) of the advertisement was revised based on public feedback. In 2011, the format of the advertisement was amended to advertise the results from the Quarterly Compliance Noise Monitoring compared with the approved noise levels<sup>13</sup> (rather than the trigger events).

To date KCGM has not received any public feedback regarding the noise monitoring results published in the Kalgoorlie Miner and for this reason KCGM considers it more appropriate to provide the Quarterly Compliance Noise Monitoring results on the KCGM website; the reporting format will remain unchanged.

## 7.4 Blasting Outside Daylight Hours (24 Hour Report)

In accordance with Condition 9-2 of 782:M, if blasting occurs outside of the hours 0700 to 1800, KCGM is required to submit a report outlining why the blast was necessary to the CEO within 36 hours.

If required, an email notification will be sent to [compliance@dwer.wa.gov.au](mailto:compliance@dwer.wa.gov.au)

## 7.5 KCGM Website

Condition 9(2)(c) of the 2016 Fimiston Noise Approval requires KCGM to include details of a programme for the provision of information to the community regarding noise and airblast levels from mining operations.

To meet the above requirement, the following information is available on the KCGM website:

- Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016;
- Noise and Vibration Monitoring and Management Plan;
- Annual Noise Monitoring and Management Report;
- Results of Quarterly Compliance Noise Monitoring;
- Real-time Noise Monitoring Report;
- KCGM Noise Information Sheet;
- KCGM Blasting Information Sheet; and
- Noise and Blast Monitoring Network Maps.

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<sup>13</sup> Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009

## 7.6 Reporting on Exceedance of Environmental Criteria

In the event that the threshold criteria for noise, airblast or vibration is exceeded, the CEO will be notified within seven (7) days of identification of the exceedance. Such events will include the following:

- Compliance Noise Monitoring result which indicates a measured level to be greater than the approved level (Table 3).
- Airblast level recorded above the approved limit level or more than 1 in any 10 consecutive blasts above the approved level (Table 5 or Table 6).
- Vibration level recorded above the approved limit level or more than 1 in any 10 consecutive blasts above the approved level (Table 7).

If required, an email notification will be sent to [compliance@dwer.wa.gov.au](mailto:compliance@dwer.wa.gov.au)

Additionally, KCGM is required to contact the Office of Heritage with regards to inspection of State Registered Places should a vibration level be recorded above the approved limit level (Table 5).



## 8. ADAPTIVE MANAGEMENT AND REVIEW OF THE CONDITION EMP

KCGM will also implement adaptive management to learn from the implementation of mitigation measures, monitoring and evaluation against the environmental criteria in order to meet the condition environmental objective. The following approach will be followed:

- Compliance Noise Monitoring data will be systematically evaluated and compared to the environmental criteria on a quarterly basis. Monitoring results which indicate a measured level to be within 1 dB of the corresponding approved level will be reviewed in a process of adaptive management to verify whether noise management practices are being implemented effectively, if there has been a change to operating conditions or if the noise source is external to the Fimiston Operations.
- Blast monitoring data will be systematically evaluated and compared to modelled results, internal limits and environmental criteria following each blast in a process of adaptive management to verify whether responses to the impact are the same or similar to predictions. Blast monitoring results above KCGM's internal limits (i.e. a vibration reading between 4 mm/s and 5 mm/s and airblast levels within 5 dB of the regulatory limit for that monitoring site) are reviewed to identify potential improvements to existing blast vibration and airblast controls.
- An increased number of complaints or repeated complaints from the same area will be reviewed to verify whether noise management practices are being implemented effectively, if there has been a change to operating conditions or if the source is external to the Fimiston Operations. Information received via community feedback can assist KCGM to identify noise emission sources and improve noise management.

Review of the Condition EMP will be undertaken as per the following:

- When requested by the CEO;
- When required by a condition of a subsequent ministerial approval;
- Where management actions identify the requirement for improvement; or
- When external changes occur during the life of the proposal which indicate a change to the proposed management actions (e.g. changes to the open pit operations).

## 9. STAKEHOLDER COMMUNICATION

KCGM's close proximity to the City of Kalgoorlie-Boulder has necessitated a sustained effort in stakeholder engagement. It is this proximity, along with the principles of JV Owners Newmont and Barrick, which drive a concerted effort to engage local and government stakeholders. The KCGM Stakeholder Engagement Plan details key stakeholders, engagement methods and ongoing reviews of external relationships. KCGM utilises a range of mechanisms to facilitate consultation, provide information and capture input from the wider Kalgoorlie-Boulder community on an ongoing basis.

A summary of key stakeholder consultation undertaken by KCGM with regards to noise and vibration management and the development of this Condition EMP is provided in the following sections.

### 9.1 Social Impact Assessments

The views of Kalgoorlie-Boulder residents are captured regularly in KCGM's Social Impact Assessments (SIA), which are conducted around every five years or when there is a major operational change. The most recent SIA in 2015 included questions regarding management of environmental impacts, including noise and vibration. Both key stakeholders and public phone survey respondents rated KCGM highly in management of environmental impacts.

### 9.2 Goldfields-Esperance Regional Planning Strategy

Condition 8-2 of 782:M required KCGM to undertake noise modelling to determine whether a special control area is required in accordance with the Goldfields-Esperance Regional Planning Strategy. To implement Condition 8-2, KCGM consulted with the Western Australian Planning Commission (WAPC), Department of Planning and Infrastructure (DPI), and the City of Kalgoorlie-Boulder (CKB).

KCGM provided copies of the following reports, prepared for the noise assessment of the project, to the DPI (representing WAPC) and CKB:

- Golden Pike Noise Report June 2005.
- Northern Waste Rock Dump Report July 2006.
- Supplementary Golden Pike Noise Report July 2006.
- Effects of Blasting in the Golden Pike Cutback February 2006.

Consultation is documented in the minutes of a meeting held between DPI, CKB and KCGM on 24 July 2009. A Noise Contour Map of worst case emissions overlain on CKB Town Planning Scheme was also prepared for this consultation and provided to DPI, CKB on 18 December 2009.

### 9.3 Heritage Council of Western Australia

In accordance with Condition 10-2 of 782:M KCGM were required to liaise with the Heritage Council of Western Australia to minimise environmental impacts associated with active mining on State Registered Places known as the Boulder Railway Station, Subway and Loopline, and Cornwall Hotel.

The feedback received in a letter dated 02 March 2010 included "If during the course of regular reporting, the vibrations go beyond the limit allowed under the Australian Standards for structural damage, KCGM is to contact the Office of Heritage to discuss way forward and to also discuss the inspection of the State Registered Places." (Refer to Section 7.6).

## 9.4 DWER

Since 1991 when the 188:M was issued by the Minister, KCGM has continuously consulted with the DWER including EPA Services and Noise Services with regards to development of the NVMMMP including confirmation and approval of noise measurement sites and instruments, and inclusion of additional information in the NVMMMP when requested.

Since approval of the October 2010 version of the NVMMMP, received 06 December 2010, KCGM has consulted with the DWER with regards to the following:

- 19 January 2011 KCGM sent a letter to the OEPA and the DEC to advise them of the new format for advertising the quarterly noise results. No feedback received.
- 14 July 2011 KCGM sent a letter to DEC (Noise Regulation Branch) seeking approval for the location of the Real-Time Noise Monitoring Sites.
- 21 September 2011 DEC (Noise Regulation Branch) provided feedback via email approving the location of the Real-Time Noise Monitoring Site.
- 19 June 2013 KCGM emailed the DEC (Noise Regulation Branch) seeking approval to vary from the October 2010 NVMMMP regarding assessment of noise triggers and field calibration frequency.
- 21 June 2013 DEC (Noise Regulation Branch) provided comments via email regarding KCGM intention to vary from the October 2010 NVMMMP. The changes were accepted.
- 22 June 2016 KCGM submitted a revised NVMMMP, which was approved 19 September 2016.
- 24 January 2018 KCGM met with the DWER (Noise Services) to:
  - review the environmental noise assessments which were completed for the proposed Morrison Mining Operations and realignment of the ENB, the proposed Brownhill Mining Operations and proposed haulage of waste rock associated with a TSF Infrastructure Project; and
  - discuss the proposed relocation of the Echo Blast Monitor. Given the location of the proposed projects and results of the environmental noise assessments there were no concerns raised regarding potential noise impacts, and the relocation of Echo was to be sought through an amended NVMMMP.

## 9.5 Noise Working Group

A Noise Working Group was established in June 2010 to discuss KCGM's options to address the Appeals Committee recommendations with regards to the Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2009. The Noise Working Group consisted of KCGM personnel and stakeholder representatives from: CKB, DEC, Kalgoorlie-Boulder Community and Main Roads.

During the programme review, the function of the Noise Working Group was assessed and the decision made to incorporate discussions regarding the Noise Amelioration Programme and the Real-Time Noise Monitoring Programme into the CRG monthly meeting agenda, rather than coordinating a separate forum. Details are documented in KCGM's Quarterly Noise and Blast Monitoring Reports and the Annual Noise Monitoring and Management Report.

## 9.6 Community Reference Group

The CRG is a self-selected group of local community members and invited guests from the DWER, Department of Mines, Industry Regulation and Safety (DMIRS), Kalgoorlie-Boulder Chamber of Commerce and Industry (KBCCI), Department of Planning, Lands and Heritage (DPLH) and State

(elected Members) and Local (CKB) Government representatives. The group meets monthly to discuss current KCGM planning, operational activities and feedback from the community. Minutes of meetings are available on the KCGM website together with contact details for all CRG Members. The local community is encouraged to contact CRG members to discuss their issues if they do not wish to contact KCGM directly.

KCGM has consulted with the CRG regarding the following items regarding noise management:

- Noise Amelioration Programme;
- Real-Time Noise Monitoring Programme;
- New Format for the Quarterly Noise Advertisement; and
- Proposed mining projects (Morrison and Brownhill).

## 10. SUPPORTING TECHNICAL INFORMATION

### 10.1 Blast Monitoring Sites

The following information is provided to demonstrate that the siting of blast monitoring equipment used by KCGM for blast monitoring complies with the requirements of regulation 21 of the Noise Regulations and section J3.2.2 of AS2187.2.

- The Advanced Texcel remote blast monitor equipment are permanently installed outdoors.
- The microphone is positioned at least 1 m (1.2 m to 1.6 m) above the ground plane and at least 5 m away from any substantial sound reflecting surface (other than the ground plane).
- As measurements are repeated at the same location (permanent installation), the geophone is fixed to an embedded mount to ensure consistency of results.

### 10.2 Blast Monitoring Equipment

The following information is provided to demonstrate that the equipment used by KCGM for blast monitoring complies with the requirements of schedule 4 of the Noise Regulations and section J3.2.1 of AS2187.2.

#### 10.2.1 Vibration Monitoring

The Advanced Texcel remote blast monitor (ETM) equipment consists of a ground vibration transducer (geophone) for measuring particle velocity (expressed in mm/s). The vibration transducer records signals from three mutually orthogonal axes (vertical, radial and transverse). The recorded vibration signals are downloaded automatically and available for the full duration of the blast event.

The waveform data downloaded from the Texcel Easylink software indicates the absolute maximum signal value (referred to as the Peak Component Particle Velocity (PCPV)) and the maximum of a root sum of squares calculation (referred to as the Vector Peak Particle Velocity (VPPV)) for each of the three components over the whole signal duration.

Other specifications of the ETMs include:

- The frequency range of the geophone is 2 Hz to 250 Hz.
- Instrumentation noise is calculated during the annual calibration, which restricts instrumentation background interference to  $\pm 2.0\%$  of maximum PPV.

#### 10.2.2 Airblast Monitoring

The Advanced Texcel remote blast monitor equipment consists of a linear weighted microphone for recording airblast levels. Other specifications of the ETMs include:

- A windshield is fitted over the microphone in accordance with the manufacturer's recommendations.
- The microphone bandwidth is 2.0 – 500 Hz (-3dB).
- The sampling frequency is 1,000 Hz (which is greater than the recommended minimum sampling frequency of 500 Hz for a digital system).



## 10.3 Blast Monitoring Records

Blast monitoring records provide the data for determining any improvements in blast outcomes, including the management and control of ground vibration and airblast. The majority of KCGM's blast monitoring records are stored in the MMRS and Connected Mine database systems, which contain a full history of blast vibration and airblast monitoring data since 1999.

In accordance with section J3.4 of AS2187.2, KCGM's blast monitoring records include the following:

- Size of the blast i.e. number of blastholes and quantity of explosive in each blasthole:
  - Recorded in MMRS and Connected Mine.
- Method of initiation and design timing sequence:
  - Design saved electronically using SHOTPlus Premier software. Hardcopy printout kept on file with the Blast Report.
- Date and time of the blast:
  - Recorded by the Texcel Easylink software and entered into MMRS and Connected Mine.
- Location of the measurement transducers (blast monitoring sites):
  - Blast monitors are located at permanent fixed locations.
  - Geographical Information System (GIS) coordinates are recorded in Surpac which can be accessed as required by other software.
- Instrument trigger levels:
  - The trigger levels for each blast monitoring site are recorded in the Texcel Easylink software, this NVMMP, the Quarterly Noise and Blast Monitoring Report and internal documentation pertaining to the set-up of the blast monitoring equipment.
- Measurement equipment and operator details:
  - KCGM uses ETMs to measure blast vibration and airblast levels. The equipment is automatically operated by the Texcel Easylink software.
  - Details of the measurement equipment are recorded on the waveforms.
- Location of the blast (blasthole design) in relation to mine leases:
  - The location of the blast is recorded on the Blast Notice.
- Location of any structures and/or persons who may be affected by the blast:
  - A Blast Notice is prepared for each blast to record the location of the blast in relation to the mine operation and any structures and/or person who may be affected by the blast.
  - The Blast Notice also includes an action plan for managing access to the blast area (blast guard positions) and exclusion zones for personnel and equipment.
  - The Blast Notice is distributed electronically around the KCGM site and is put up on noticeboards and emailed to external stakeholders.

- Measured ground vibration and airblast values including the ppv values for each of the triaxial components, a derived vector ppv and the peak airblast levels:
  - Blast vibration and airblast values are recorded by the Texcel Easylink software and stored electronically. Full waveforms are produced for each blast event which are emailed to KCGM Drill and Blast personnel daily.
- Face Survey information indicating the proximity of the nearest blastholes to any free faces within the blast.
  - Survey data is recorded daily and is used to compare the proximity of blastholes to any free faces within the blast.
- Weather Conditions, especially wind speed, cloud cover and direction and any other notable conditions such as rain:
  - KCGM records wind speed and direction at the MEX weather station (refer to Section 5.2.3).
  - Weather data can also be obtained from the Bureau of Meteorology site (Station ID: 012038) located at the Kalgoorlie-Boulder airport if required.
- Information derived from a video of the blast:
  - Video footage is taken of each blast, using a high speed camera capable of showing blasts in one four-thousandth of a second frames.
  - Blasts videos are retained digitally on file and are examined by Drill and Blast personnel to confirm blasting outcomes have been met.
- Any subjective information from the shotfirer and any persons who may be affected by the blast:
  - Subjective information from the shotfirer is recorded on the Blast Report.
  - Any feedback received from any persons affected by the blast is recorded in KCGM's complaint database.

## 11. GLOSSARY OF TERMS

**188:M:** Ministerial Statement No.188 Fimiston Project Stage II – Mine and Waste Dumps.

**2016 Fimiston Noise Approval:** Environmental Protection (Fimiston Gold Mine Noise Emissions) Approval 2016.

**782:M:** Ministerial Statement No.782 Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning.

**Airblast level:** A noise level resulting from blasting.

**A-weighting:** A frequency-dependent scaling of a sound wave that mimics the response of human hearing.

**ARC:** Australian Research Council.

**Blasthole:** A hole that has been drilled or prepared for the purpose of being charged with explosives, or has been charged with explosives.

**Blasting:** The use of explosive material to fracture:

- a) rock, coal and other minerals for later recovery; or
- b) structural components or other items to facilitate removal from a site or for reuse.

**BPS:** Boulder Primary School. Means any place within the boundary of the premises known as Boulder Primary School at 200 Lane Street, Boulder.

**BSW:** Barton Street Williamstown. Means any place at or adjacent to the intersection of Barton Street and Baden Street, Williamstown.

**CEO:** Chief Executive Officer.

**CKB:** City of Kalgoorlie-Boulder.

**Competent person:** A person who has acquired through training, qualification or experience, or a combination of these, the knowledge and skills to carry out the required task.

**Component velocity:** One of the orthogonal particle velocities; typically one of radial, transverse, or vertical velocity.

**CRG:** Community Reference Group.

**DAA:** Department of Aboriginal Affairs

**Daytime:** any time in the period:

- a) between the hours of 0700 and 1900 on Monday to Saturday, excluding public holidays; and
- b) between the hours of 0900 and 1900 on Sunday and public holidays.

**Decibels (dB):** logarithmic unit used to measure sound levels.

**DEC:** Department of Environment and Conservation. (Now DWER)

**DER:** Department of Environment Regulation. (Now DWER)

**DMIRS:** Department of Mines Industry Regulation and Safety

**DPLH:** Department of Planning Lands and Heritage

**DWER:** Department of Water and Environmental Regulation

**EMP:** Environmental Management Plan.

**ETM:** Advanced Texcel remote blast monitor equipment.

**EPA:** Environmental Protection Authority.

**Evening:** any time in the period between the hours of 1900 and 2200.

**GIS:** Geographic Information Systems.

**Ground vibration:** Mechanical energy (vibration) produced by a blast and transmitted through the ground.

**Hz: Hertz.** Unit of frequency, equal to one cycle per second.

**KCGM:** Kalgoorlie Consolidated Gold Mines Pty Ltd.

**KTS:** Kalgoorlie Technical School. Means any place within the boundary of the premises known as Kalgoorlie Technical School at 13 Davidson Street, South Kalgoorlie.

**L<sub>A 10</sub> approved level:** an assigned level that, measured as an LA Slow value, is not to be exceeded for more than 10% of the representative assessment period.

**L<sub>A 10</sub>:** the noise level in decibels exceeded for 10% of the measurement period, obtained using the “A” frequency-weighting characteristic.

**L<sub>A 50</sub>:** the noise level in decibels exceeded for 50% of the measurement period, obtained using the “A” frequency-weighting characteristic.

**L<sub>A 90</sub>:** the noise level in decibels exceeded for 90% of the measurement period, obtained using the “A” frequency-weighting characteristic.

**L<sub>A max</sub> approved level:** an assigned level that, measured as an LA Slow value, is not to be exceeded at any time.

**L<sub>A slow</sub>:** the reading in decibels obtained using the “A” frequency-weighting characteristic and the “S” time-weighting characteristic as specified in AS IEC 61672.1-2004 Electroacoustics-Sound level meters Part 1: Specifications, for class 1 and class 2 meters, with sound measuring equipment that complies with the requirements of Schedule 4 of the *Environmental Protection (Noise) Regulations 1997*.

**L<sub>eq</sub>:** the Sound Pressure Level in dB, equivalent to the total Sound Energy over a given period of time.

**L<sub>Z peak</sub>:** the peak sound pressure level in decibels (dB) obtained using the “A” frequency weighting characteristic, as specified in AS IEC 61672.1-2004 Electroacoustics-Sound level meters Part 1: Specifications, with sound measuring equipment that complies with the requirements of Schedule 4 of the *Environmental Protection (Noise) Regulations 1997*.

**Measured:** In relation to the measurement of a noise emission, means measured and adjusted in accordance with the *Environmental Protection (Noise) Regulations 1997*.

**MEP:** KCGM Real-time / Continuous noise monitoring site.

**MEX:** KCGM weather monitoring station (located within the same premises as MEP).

**Monitoring:** Is the process of sampling and measuring certain parameters.

**mm/s:** millimetres per second.

**NATA:** National Association of Testing Authorities.

**Noise Regulations:** *Environmental Protection (Noise) Regulations 1997*.

**Noise Sensitive Premises:** has the meaning given in Schedule 1 Part C of the *Environmental Protection (Noise) Regulations 1997*.

**NVMMP:** Noise and Vibration Monitoring and Management Plan.

**OEPA:** Office of the Environmental Protection Authority. (Now DWER)

**OSB:** Outram Street Boulder. Means any place at or adjacent to the intersection of Outram Street and Shannon Street, Boulder.

**Particle velocity:** The time history of the velocity of particles within the ground.

**Peak component particle velocity (ppv):** The peak level of the particle velocity for an individual component.

**PER:** Public Environmental Review.

**PIL:** Public Interaction Line.

**Reference location:** A location specified in the terms in *Environmental Protection (Fimiston Gold Mine Noise Emissions Approval) 2009* for the assessment of noise emissions.

**Sensitive Site:** has the meaning given in regulation 11(1) of the *Environmental Protection (Noise) Regulations 1997*.

**SIA:** Social Impact Assessment.

**Significantly contribute to:** A noise emission is taken to “significantly contribute to” a level of noise if the noise emission exceeds a value which is 5dB below the assigned level at the point of reception. As defined in the *Environmental Protection (Noise) Regulations 1997*, Regulation 7(2).

**Sound level meter:** A measuring device that measures the level of sound, and may provide dBL, dBA or dBC values.

**Sound pressure level (dB):** A logarithmic scale of pressure with a reference pressure of 20 µPa.

**UWA:** University of Western Australia.

**Vector peak particle velocity:** The peak level of the particle velocity calculated from the vector formed by the magnitude of the three orthogonal components of the particle velocity over their measured time history.

**WIF:** Weather Influencing Factor.

**YSB:** York Street Boulder. Means any place on York Street, between the intersections of York Street with Lane Street and Hamilton Street, Boulder.



## 12. REFERENCES

Australian Standard AS1259.1 1990 *Sound Level Meters Part 1: Non-integrating*

Australian Standard AS1259.2 1990 *Sound Level Meters Part 2: Integrating-averaging*

Australian Standard AS2923-1987 *Ambient Air – Guide for measurement of horizontal wind for air quality applications*

ENVIRON Australia Pty Ltd (2006). *Public Environmental Review, Fimiston Gold Mine Operations Extension (Stage 3) and Mine Closure Planning*. Report prepared for Kalgoorlie Consolidated Gold Mines Pty Ltd.

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Western Australian Planning Commission (2000) *Goldfield-Esperance Regional Planning Strategy*