Noise and Blast Management Plan

Bass Point Quarry Expansion

September 2022
Revision No. 12.1

Version Control

Revision No.	Date	Description	Prepared	Checked	Authorised
0	13 May 2014		Dick Godson	Mark Blake	Dick Godson
1	22 October 2015		Dick Godson	Mark Blake	Dick Godson
2	24 November 2015		Dick Godson	Mark Blake	Dick Godson
3	27 November 2015		Dick Godson	Mark Blake	Dick Godson
4	23 May 2016		Dick Godson	Mark Blake	Dick Godson
5	17 August 2016		Dick Godson	Mark Blake	Dick Godson
6	1 September 2016		Dick Godson	Mark Blake	Dick Godson
7	7 September 2016		Dick Godson	Mark Blake	Dick Godson
8	6 October 2016		Mark Blake	Ryan Wakeling	Mark Blake
9	20 November 2017		Belinda Pignone	Andrew Driver	Andrew Driver
10	7 August 2019		John Sleeman	Jason Qian	John Sleeman
11	8 April 2020	Review and revision after blasting non-compliance	Chelsea Flood	Belinda Pignone	Belinda Pignone
12	09 October 2020	Implemented changes requested by DPIE	Chelsea Flood	Belinda Pignone	Belinda Pignone
12.1	09 September 2022	Review and revision after blasting non-compliance	Chelsea Flood	Belinda Pignone	Belinda Pignone

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1. Introduction

This Air Quality Management Plan (the Plan) has been prepared by Hanson Construction Materials (Hanson) and SLR Pty Ltd (SLR) for the Bass Point Quarry (the Quarry). The Minister for Planning, Infrastructure and Environment (Formally Minister for Planning and Infrastructure) conditionally approved the continued operation of Bass Point Quarry, NSW until 31 January 2044. The associated Project Approval was issued on 28 January 2014.

The following report contains the Noise Management Plan (NMP) and Blast Management Plan (BMP) for the Quarry, prepared in consultation with the NSW Environment Protection Authority (NSW EPA), detailing monitoring locations, methods of monitoring noise and blasting. Correct compliance checking procedures for the subsequent reporting in accordance with Department of Planning and Environment (DPE) and EPA requirements is also discussed.

The NMP and BMP have, in turn, been prepared for inclusion in the Environmental Management Strategy in order to satisfy *Schedule 5, Condition 1* of Project Approval MP08_0143 (hereafter "the Project Approval"). The relevant sections of *Schedule 5, Condition 1* state:

1. *The Proponent must prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Secretary. This strategy must;*

   (b) provide the strategic framework for environmental management of the project;

and

   (f) include:

   - *copies of any strategies, plans and programs approved under the conditions of this approval; and*
   - *a clear plan depicting all the monitoring required to be carried out under the conditions of this approval.*

1.1. Management plan requirements

Schedule 5, Condition 3 of the Project Approval contains the requirements for the Quarry Management Plans and states that:

3. *The proponent must ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include:*
   - *(a) detailed baseline data;*
   - *(b) a description of:*
     - *i. the relevant statutory requirements (including any relevant approval, licence or lease conditions);*
     - *ii. any relevant limits or performance measures/criteria; and*
     - *iii. the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;*
   - *(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;*
   - *(d) a program to monitor and report on the:*
     - *iv. impacts and environmental performance of the project; and*
     - *v. effectiveness of any management measures (see (c) above);*

Table 1 provides a summary of the planned noise and blast monitoring programs and identifies the relevant sections in the NMP and BMP that contain the detailed program description.

Table 1: Summary of Planned Noise and Blast Monitoring Program

Monitoring Timing	Activity Monitored	Requirements and Program Reference
1. Undertaken when operational equipment commences work on site.	Noise emission level	Criteria and Program **Sections 2.1, 2.2** and **4** respectively
2. Undertaken quarterly after all components of the project are operating	Quantification of intrusive noise emissions	Program for on-site monitoring and community monitoring – **Sections 4** and **5**
3. Undertaken when a non-compliance is identified in Item 2 above	Actions to be determined at the time of non-compliance and would be specific to the individual situation May require unattended continuous noise logging	**Sections 6.3** and **6.4**
4. Undertaken for every blast	Airblast and ground vibration	Criteria – **Section 2.3** Program – **Section 7** Checklists – **Section 7.7, Appendix C**

2. Project Noise and Blast Management Plans / emission limits

2.1. Noise

Schedule 3, Condition 6 of the Project Approval states that:

6. *The Proponent must prepare and implement a Noise Management Plan for the project to the satisfaction of the Secretary. This plan must:*
   - *(a) be prepared in consultation with the EPA, and submitted to the Secretary for approval by 31 May 2014;*
   - *(b) describe the measures that would be implemented to ensure:*
     - *best management practice is being employed to minimise the construction, operational and transport noise of the project;*
     - *the noise impacts of the project are minimised during any meteorological conditions when the noise limits in this approval do not apply; and*
     - *compliance with the relevant conditions of this approval;*
   - *(c) describe the proposed noise management system in detail; and*
   - *(d) include a monitoring program that:*
     - *is capable of regularly evaluating the performance of the project, including noisy individual items of plant, such as haulage trucks, crushers and bulldozers;*
     - *includes a protocol for determining any exceedances of the relevant conditions in this approval at locations listed in Table 2; and*
     - *evaluates and reports on the effectiveness of the noise management system on site.*

Table 2 of the Project Approval and the associated notes and references are as follows:

***Table 2**: Noise Criteria dB(A)*

Location	*Day/Evening*	*Night*	
	LAeq(15min)	***LAeq(15min)***	***LA1(1min)***
R4	*44*	*44*	*54*
R5	*45*	*45*	*55*
R6	*42*	*42*	*52*
R7	*41*	*41*	*51*
R8	*35*	*35*	*45*
R9	*35*	*35*	*45*
R11	*45*	*45*	*55*
R12	*45*	*45*	*55*
Any residential property within the Shell Harbour Marina Precinct	*48*	*48*	*58*
Shell Cove Primary School (when in use)	*$L_{Aeq\ (1hour)}$ 40 (internal)*	*Not applicable*	

Notes

- *Receiver locations are shown in Figure 2 in Appendix 2*
- *After the first review on any EPL granted for this development under Section 78 of the POEO Act, nothing in this approval prevents the EPA from imposing stricter noise limits on the quarrying operations on site under the EPL.*

Noise generated by the project is to be measured in accordance with the relevant requirements of the NSW Industrial Noise Policy [since replaced by the Noise Policy for Industry, 2017]. Appendix 6 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

2.2. Noise compliance assessment

In turn, Appendix 6 of the Project Approval, Noise Compliance Assessment, contains the following:

Applicable Meteorological Conditions

1. *The noise criteria in Table 1 of the conditions are to apply under all meteorological conditions except the following:*
   - *(a) during periods of rain or hail;*
   - *(b) average wind speed at microphone height exceeds 5m/s;*
   - *(c) wind speeds greater than 3 m/s measured at 10 m above ground level; or*
   - *(d) temperature inversion conditions greater than 3°c/100 m.*

Determination of Meteorological Conditions

2. *Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station on or in the vicinity of the site.*

Compliance Monitoring

3. *Deleted (MOD 1)*
4. *Unless otherwise agreed with the Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:*
   - *(a) monitoring locations for the collection of representative noise data;*
   - *(b) meteorological conditions during which collection of noise data is not appropriate;*
   - *(c) equipment used to collect noise date, and conformity with Australian Standards relevant to such equipment; and*
   - *(d) modifications to noise data collected including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.*

2.3. Blasting

Schedule 3, Condition 13 of the Project Approval states that:

13. *The Proponent must prepare and implement a Blast Management Plan for the project to the satisfaction of the Secretary. This plan must:*
    - *(a) be prepared in consultation with the EPA, and be submitted to the Secretary for approval by 31 May 2014;*
    - *(b) describe the measures that would be implemented to ensure:*
      - *best management practice is being employed; and*
      - *compliance with the relevant conditions of this approval;*
    - *(c) include a specific blast fume management protocol to demonstrate how emissions will be minimised, including risk management strategies if blast fumes are generated; and*

(d) *include a monitoring program for evaluating the performance of the project including:*
- *compliance with the applicable criteria; and*
- *minimising fume emissions from the site.*

In turn, *Schedule 3, Condition 7* of the Project Approval states that:

7. *The Proponent must ensure that blasting on the site does not cause exceedances of the criteria in Table 3.*

***Table 3**: Blasting Criteria*

Location	*Airblast overpressure (dB(Lin Peak)*	*Ground vibration (mm/s)*	*Allowable exceedance*
Any residence on privately owned land	*120*	*10*	*0%*
	115	*5*	*5% of the total number of blasts over a period of 12 months*

However, these criteria do not apply if the Proponent has a written agreement with the relevant residential owner or infrastructure provider/owner, and the Proponent has advised the Department in writing of the terms of this agreement.

The EPA's comments on the current version of the NMP and the BMP is attached as **Appendix A**.

3. Noise management measures

3.1. Noise minimisation

Schedule 3, Condition 6(b) of the Project Approval states that:

> *(b) describe the measures that would be implemented to ensure:*
> - *best management practice is being employed to minimise the construction, operational and transport noise of the project;*
> - *the noise impacts of the project are minimised during any meteorological conditions when the noise limits in this approval do not apply; and*
> - *compliance with the relevant conditions of this approval;*

As demonstrated in Section 9, Noise Impact Assessment, of the Noise and Blasting Impact Assessment (NBIA) prepared by Heggies Pty Ltd (now SLR Consulting Australia Pty Ltd), dated 24 May 2010, the results of the construction, operational and transport noise modelling predictions *"indicate that the proposed operations will comply with the noise criteria during each assessment period at all surrounding receiver locations."*

Further, the results of the noise modelling, under a prevailing 3 m/s wind in all directions, presented in Table 2 of the document entitled "*Bass Point Quarry Environmental Assessment, Response to Submission from OEH*", prepared by SLR Consulting Australia Pty Ltd dated 20 October 2011, indicate compliance with the Project Approval Noise Criteria (*Schedule 3, Condition 3* dated 28 January 2014).

These two sets of results are in turn based upon "All fixed and mobile plant being selected to have a sound power level (SWL) not exceeding those outlined in Table 28," of the NBIA.

Table 28 is reproduced below.

***Table 28**: SWL of Plant for Base Point Quarry*

Plant Items	SWL LAeq (dBA)
Blasthole Drills	*121 dBA*
Cat 988 FEL	*114 dBA*
Komatsu 456 Quarry Truck	*113 dBA*
Cat 777C Quarry Truck	*119 dBA*
Cat 990 FEL	*115 dBA*
Cat 773 Watercart	*117 dBA*
Road Trucks	*110 dBA*
Bobcat	*113 dBA*
Grader	*107 dBA*
Conveyor Belt to Ships	*113 dBA*
Primary Gyratory Crusher	*118 dBA*
Primary Screen	*117 dBA*
Secondary Cone Crusher	*113 dBA*
Secondary Screen	*118 dBA*
Tertiary Cone Crusher 1	*113 dBA*
Tertiary Cone Crusher 2	*119 dBA*

Plant Items	SWL LAeq (dBA)
Tertiary Cone Crusher 3	*113 dBA*
Tertiary Cone Crusher 4	*113 dBA*
Surge Bin for Tertiary Crusher 1	*107 dBA*
Surge Bin for Tertiary Crusher 2	*113 dBA*
Surge Bin for Tertiary Crusher 3	*107 dBA*
Surge Bin for Tertiary Crusher 4	*107 dBA*
Product Screen	*117 dBA*

In order to monitor the SWLs of the fixed and mobile plant, a noise monitoring program will be implemented where the plant items are measured once the project is fully operational and subsequently at 12 monthly intervals, if operational practices vary significantly. Any additional plant items will be included in the subsequent annual SWL surveys. In this way, any deterioration in the condition or performance of the plant items can be monitored and action taken to reduce noise levels.

Further to the SWL noise surveys of the plant and equipment, Hanson will implement operational management and control measures to manage and reduce the noise impacts and to ensure that the noise from the BPQ is managed to acceptable levels, through a combination of the following:

- Ensuring best management practices are implemented onsite by all staff and contractors;
- Implementing noise controls to reduce noise from the source and attenuate noise transmission;
- Implementing a Noise Monitoring Program; and
- Additional mitigation measures:
  - maintaining community engagement via establishing a complaints register and conducting community consultation; and
  - Other measures and plans such as internal auditing and contingency measures.

The effectiveness of the noise management measures at the BPQ will be assessed through attended noise monitoring (refer to **Section 4**).

The following best practice construction, operational and transport noise management measures will be implemented at the Quarry.

3.2. Site procedures

- Optimise the site design and layout e.g. use of acoustic bunds.
- During extreme weather conditions i.e. strong winds, the quarry manager will relocate and operate major noise emitting mobile plant items away from areas where any adverse prevailing wind conditions would normally enhance noise emissions in the nearby residential areas in order to reduce noise levels, where reasonable and feasible.
- Raise the awareness and understanding of noise issues and the use of quiet work practices via site inductions for all staff, contractors and visitors to the Quarry;
- Avoid the simultaneous use of significant noise generating equipment wherever possible. The least amount of equipment as possible will be used for each project operation;
- Where practicable, schedule the use of any noisy equipment to the daytime only; and

- Where practical, site noisy equipment behind structures that act as barriers, or at the greatest distance from the noise-sensitive area, or orienting the equipment so that noise emissions are directed away from any sensitive areas in order to achieve the maximum attenuation of noise.

3.3. Plant equipment

- All machinery and plant used on site will be regularly maintained in order to minimise excessive noise generation;
- Where applicable, maintain the effectiveness of any noise suppression equipment (e.g. acoustic attenuator) on plant and ensure that defective plant is not operational until repaired;
- The least intrusive types of reversing alarms will be used; and
- Specify maximum noise/sound levels when purchasing equipment (refer to **Section 3.1**).

3.4. Source and transmission noise controls

Source and transmission noise controls include:

- Enclosure of specific fixed plant and noise intensive area such as hopper bins and loading bay – where equipment is enclosed ensure that they are well maintained and, if openable, kept closed when not in use; and
- Where applicable, mobile equipment such as front end loaders should be fitted with "noise suppressors".

4. Noise management / monitoring program

As discussed, *Schedule 3, Condition 6(d)* of the Project Approval states that:

> *(d) include a monitoring program that:*
> - *is capable of regularly evaluating the performance of the project, including noisy individual items of plant, such as haulage trucks, crushers and bulldozers;*
> - *includes a protocol for determining any exceedances of the relevant conditions in this approval at locations listed in Table 2; and*
> - *evaluates and reports on the effectiveness of the noise management system on site.*

4.1. General requirements

The noise measurement procedures employed throughout the monitoring program will be in accordance with the requirements of AS 1055 1997 "*Acoustics - Description and Measurement of Environmental Noise*" and the NSW EPA's Industrial Noise Policy, 2000 (INP) [since replaced by the Noise Policy for Industry, 2017].

4.2. Operator-attended noise surveys

Operator-attended noise measurements and recordings will be conducted to quantify the intrusive noise emissions from quarrying and processing operations as well as the overall level of ambient noise.

The operator will quantify and characterise the maximum (L_{Amax}) and the average ($L_{Aeq(15minute)}$) intrusive noise level from quarrying and processing operations over a 15 minute measurement period.

4.3. Monitoring locations and intervals

In order to check compliance, noise measurements will be carried out at the closest monitoring locations (R6, R7, R8, R9, R11 and R12) identified in Table 2, Schedule 3 of the Project Approval (replicated in **Section 2.1**). **Figure 1** (Appendix 2 of the Project Approval) shows the location of the closest adjoining residences identified in Table 2 of the Project Approval.

Noise measurements will be conducted quarterly (and in the event of a complaint) after all components of the project are operating in accordance with the DPE correspondence following review of the Noise and Blast Management Plans dated 17 December 2015.

If non-compliance is identified, it will be addressed appropriately. This may require unattended continuous noise logging in order to quantify the overall ambient noise levels resulting from quarrying and processing operations as well as from other environmental noise sources.

Noise emissions from the Quarry to the closest adjoining residences is expected to decrease over the life of the quarry due to increasing topographic shielding as a result of the lowering of the quarry floor over the life of the quarry. If in the future, the quarry is seeking to reduce monitoring frequency (due to continual compliance with nominated criteria), approval must be sought from the Department of Planning and Environment.

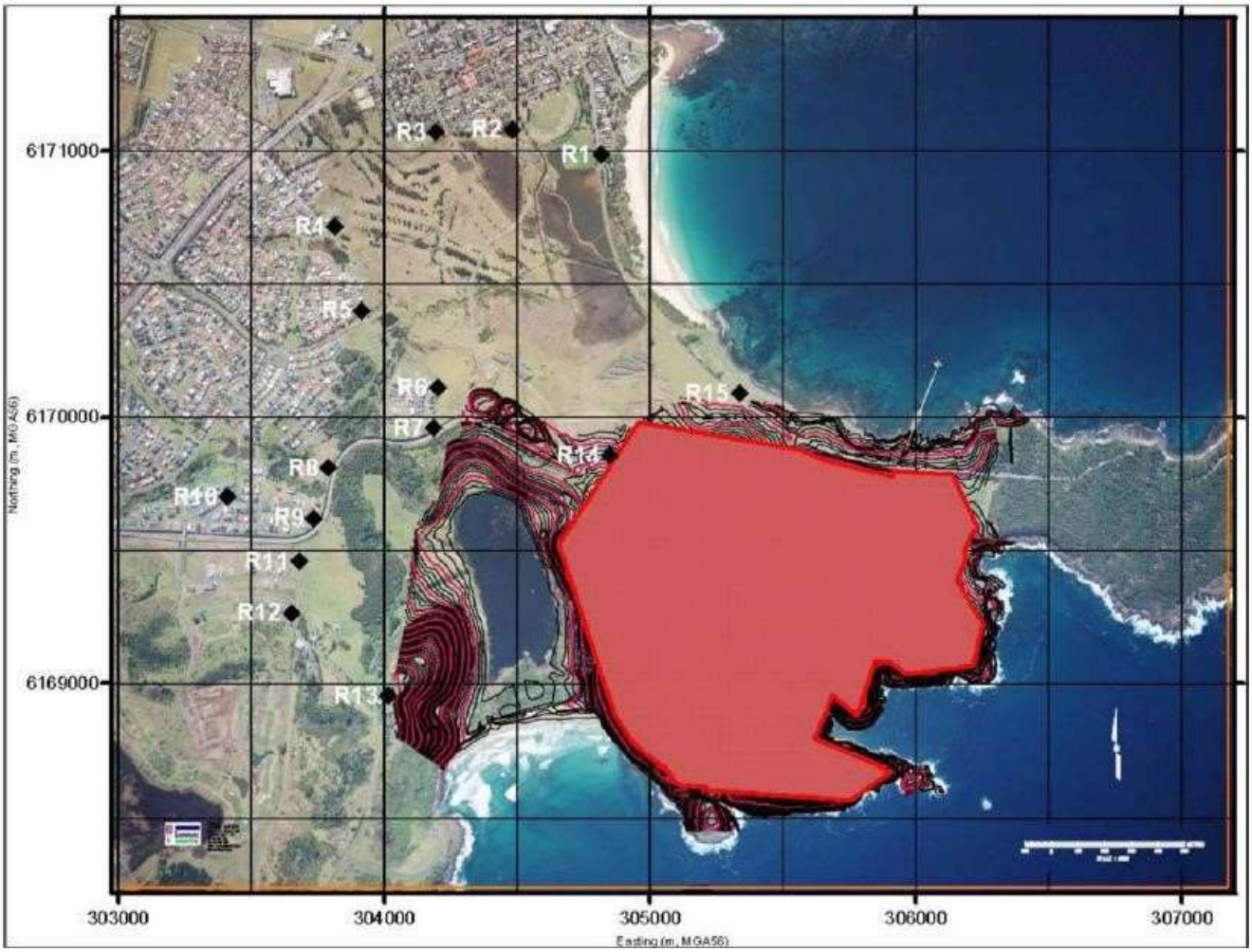

Figure 1: Location of the Closest Receivers to the Quarry

5. Instrumentation and measurement parameters

5.1. Operator-attended surveys

All acoustic instrumentation employed throughout the monitoring program will be designed to comply with the requirements of AS IEC 61672.1-2004: *'Electroacoustics - Sound level meters – Specifications'* (as amended, or as relevant to the sound monitoring device) and carry current NATA or manufacturer calibration certificates.

Instrument calibration will be checked before and after each measurement survey, with the variation in calibrated levels not to exceed ±0.5 dBA.

5.2. Weather monitoring instrumentation

All noise measurements will be accompanied by both a qualitative description (including cloud cover) and quantitative measurements of the prevailing local weather conditions throughout the survey period.

Meteorological measurements will be guided by the requirements of AS/NZS 3580.14:2014 *'Methods for sampling and analysis of ambient air: Meteorological monitoring for ambient air quality monitoring applications'*. A regional automatic weather station will be used to access the meteorological parameters shown in **Table 2**. The Bureau of Meteorology's (BOM) Kiama (Bombo Headland) Automatic Weather Station (AWS) [station 068242] will be used to source the required meteorological monitoring data. The Kiama (Bombo Headland) AWS is already used to source meteorological data in relation to air quality monitoring, under the requirements of the approved Bass Point Quarry *Air Quality Management Plan* (BPQ AQMP). The Kiama (Bombo Headland) monitoring station is considered to be representative of the weather conditions likely to be experienced at the Quarry due to its similar coastal siting. See the BPQ AQMP for further details.

Table 2: Meteorological Measurement Parameters

Measured Parameter	Unit	Sample Interval
Mean wind speed	km/hr (or m/s)	15 minute
Mean wind direction	Degrees	15 minute
Aggregate rainfall	mm	15 minute
Mean air temperature	°C	15 minute
Mean relative humidity	%/RH	15 minute

5.3. plant and equipment observations and log

During the attended noise measurements, the operator will record any significant quarry generated noise sources (i.e. haul trucks, dozers, crushers, etc.) and collect information regarding the operating equipment and machinery. Where relevant (i.e. incidence of an exceedance) Hanson will review copies of the relevant fixed plant and mobile quarrying equipment operating shift log to understand and address problematic noise sources.

6. Documenting, reporting and corrective action

6.1. Operator-attended noise surveys

The measured contributed noise emissions from quarrying, processing and transporting operations will be evaluated and assessed against the noise emission criteria presented in Table 2 of the Project Approval.

6.2. Reporting

The BPQ reporting requirements are outlined in *Schedule 3, Condition 6(d)* of the Project Approval, which requires the Proponent to report on the effectiveness of the noise management system on the site. This would, in turn, require reporting any exceedance of the goals/limits/performance criteria or an incident causing (or threatening to cause) material harm to the environment. Such a report would be submitted to the Department and any other relevant agencies within 7 days of the exceedances or incident (refer to *Schedule 5, Condition 7* of the Project Approval).

Schedule 5, Condition 4 of the Project Approval requires the Proponent to submit an annual review of environmental performance to the satisfaction of the Secretary each March.

6.3. Excessive noise emissions and corrective action

Schedule 5, Condition 2 of the Project Approval details procedures to follow should a situation occur where monitored project impacts are greater than the relevant impact assessment criteria.

Schedule 5, Condition 2 states that:

> *Where any exceedance of these criteria and/or performance measures has occurred, the Proponent must, at the earliest opportunity:*
> *(a) take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur;*
> *(b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measure or other course of action; and*
> *(c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary.*

6.4. Noise management zone

Depending on the degree of exceedance of the project specific criteria (1 dBA to 5 dBA) noise impacts could range from negligible to moderate. It is recommended, in accordance with the INP, that management procedures be implemented including:

- Noise monitoring on site and within the community, as outlined in **Section 4**.
- Prompt response to any community issues of concern.
- Refinement of on-site noise mitigation measures and quarry operating procedures, where practical.
- Discussions with relevant property holders to assess concerns.
- Consideration of acoustical mitigation at the receivers.

7. Blast management / monitoring program

Schedule 3, Condition 13 of the Project Approval requires the preparation and implementation of a Blast Monitoring Program.

7.1. Overview

The Monitoring Program has been developed with reference to the procedures described in AS 2187.2-2006, "Explosives - Storage, Transport and Use" and with reference to the ANZECC's "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration", September 1990.

The blast emissions will be quantified for all blast events conducted at the project site.

In the event that the quarry's blast monitoring equipment is unavailable for service, due to installation or calibration requirements throughout the monitoring program, then blast emissions will be monitored by alternative calibrated instrumentation.

7.2. Monitoring locations

A portable blast emissions monitor (to measure airblast overpressure and ground vibration) will be positioned at the nearest potentially affected residences or other blast emissions sensitive receivers to the blasting operations, if required, as a response to community feedback or concern.

Figure 1 shows the location of the potentially affected residences.

7.3. Instrumentation requirements

7.3.1. Blast emission monitors

The Quarry will ensure that the airblast overpressure from blasting at the Quarry does not exceed the criteria in **Table 3** at any residence on privately owned land.

Table 3: Airblast overpressure criteria in dB(Lin Peak), extracted from *Schedule 3, Condition 7* of the Project Approval

Airblast Level (dB(Lin Peak))	Allowable Exceedance
115	5% of the total number of blasts over a period of 12 months
120	0%

Note 1 To determine compliance with these limits, airblast from the quarry is to be measured at the most affected point at the residential boundary or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary (subject to the landowners consent).

Note 2: Airblast is not to be measured within 3.5 metres of any building.

The Quarry will ensure that the ground vibration level from blasting at the quarry does not exceed the criteria in **Table 4** at any residence on privately owned land.

Table 4: Ground vibration criteria in mm/s, extracted from *Schedule 3, Condition 7* of the Project Approval

Ground Vibration Level (mm/s)	Allowable Exceedance
5	5% of the total number of blasts over a period of 12 months
10	0%

Note 1: To determine compliance with these limits, ground vibration from the project is to be measured at the most affected point at the residential boundary, or 30 metres from the dwelling where the dwelling is more than 30 metres from the boundary (subject to the landowners consent).

7.3.2. Weather monitoring equipment

A regional automatic anemometer and wind vane station will be considered representative of wind propagation conditions in relation to blast emissions throughout the Blast Monitoring Program (see **Section 5.2**).

7.4. Blast design records and predicted emission levels

Blast design records will be maintained for individual blast events. The purpose of the record is to assist in the design and optimisation of future events, planning and control of blast emissions and to provide a traceable system of documentation in case of accident or complaint.

Hanson engaged SLR Consulting Australia in 2014 to undertake a detailed analysis of blast monitoring results, which resulted in the establishment of blast emission site laws in early 2016. The blasting contractor responsible for blasting activities at the Quarry uses the blast emission site laws, as well as additional data from every blast since the site laws were established, to inform the design of a blast. Each blast is designed by a competent blast designer who is familiar with the Quarry. Each blast design is then escalated to the contactor's technical team for formal assessment, and then the Hanson shot supervisor is required to sign off on the final blast design. Any potential deviations from agreed site design parameters, such as minimum stemming heights, trigger a robust change management process and require explicit agreement from Hanson management. After each blast, the technical team undertake a review, to further refine subsequent blast designs. This ongoing review process will become particularly important for later blasting, when operating closer to residences.

In order to maximise the benefits of the blast monitoring process, the significant design parameters, emission levels and meteorological data will be collated and maintained by the Quarry in a comprehensive blast package for each blast event. An example of part of a blast package – the MAXAM Drill and Blast Best Practice Risk Management Tool – is attached as **Appendix B**.

7.5. Notifying landowners or occupiers of blast events

Schedule 3, Condition 12(b) of the Project Approval states that:

> *During blasting operations, the Proponent must:*
>
> *(b) 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.*

Hanson has a centrally-managed emergency contact number – 1800 882 478 – which is available 24 hours a day, 7 days a week. The Quarry also fields calls at site level – 4247 3955 – on the Blasting Information Hotline. The Blasting Information Hotline allows landowners and the public access to up-to-date information regarding the blasting operations at Bass Point Quarry. The Blasting Information Hotline number is signposted at the quarry entrance as well as available on the Hanson website. The blasting schedule is also available for public viewing on the Hanson website.

7.6. Proactive response procedure

The Quarry Manager (or equivalent role) will perform visual checks and assess monitoring data and meteorological data on a regular basis (i.e. daily for meteorological conditions and on a monthly basis for review of monitoring results) to ensure that operations are relocated, modified and/or halted as required to ensure adverse noise and air quality impacts are not realised at off-site sensitive receptor locations.

If adverse weather conditions occur during a planned blasting event, the Quarry Manager or Shot Supervisor will assess the risk, taking into account all variables to ultimately decide whether to fire or delay to a later time or date. This risk based assessment allows flexibility for the Quarry Manager to manage the people involved in blast events and the unpredictability of weather conditions.

7.7. Monitoring checklists

In order to assist the on-site management and control of this monitoring program, the Quarry has developed a specific checklist that identifies activities that must be undertaken prior to each blast, such as the notification of site personnel, and establishment of sentry points to prevent unauthorised access within the exclusion zone (**Appendix C**). As of February 2020, the checklist includes a requirement to confirm that blast monitors are in place and ready to undertake monitoring activities prior to initiating the blast countdown. The checklist will be completed and retained with blast monitoring records and will provide a record of the actions associated with the blast.

8. Blast fume emissions

8.1. Blast fume mitigation

Mitigation measures for fume control during blasting include:

- Fine material collected during drilling will not be used for blast stemming.
- All blastholes would be adequately stemmed with aggregate.
- Blasting will only occur between the hours 8.00 am and 5.00 pm, Monday to Friday (excluding public holidays), or as otherwise approved by the Secretary and EPA as per the Project Approval and EPL conditions.
- In excessive wind events (i.e. prolonged visual dust in a particular area or following receipt of dust monitoring results in exceedance of the dust criteria), blasting activities will be temporarily halted and resumed only when weather conditions have improved following an appropriate assessment of weather conditions.

Blasting should only occur following an appropriate assessment of weather conditions by the Quarry Manager and/or Supervisor (or equivalent roles) to ensure that the prevailing wind speed and direction will not result in excessive fume (or dust) emissions from the site in the direction of sensitive receptor locations. This measure will be effective at controlling off-site impacts due to fumes released during blasting operations.

Additionally, the design for each blast will aim to maximise the blast efficiency and minimise the emission of fumes (as well as dust and odour) in order to ensure compliance with site specific blasting conditions.

The blasting schedule will also be made available to the public via the Hanson website.

Further details on blast fume mitigation and monitoring is contained in the Bass Point Quarry Project Air Quality Management Plan.

Fumes can be generated by the mechanisms as outlined in **Table 5**. Potential control measures are also presented in **Table 5**. It is noted that wet product is used in both wet and dry blastholes to minimise blast fume generation.

Table 5: Potential causes and possible controls for Blast Fume Generation*

Possible cause	Potential control measures
Explosive formulation	
Explosive incorrectly formulated or not manufactured to specifications	• Track explosive mix back with supplier • Perform visual check at discharge point • Use supplier who operates under an externally accredited quality system
Explosives product change	• Supplier to notify user sites of changes to product specifications, Technical Date Sheets, recommendations for use • Supplier to test changed product for adverse impacts
Improper mixing of raw materials/incorrect metering	• Perform visual check at load point • Perform density check (before production and on-bench) • Ensure Mobile Manufacturing Unit (MMU) is fully calibrated every 6 months by the explosives supplier, with minor calibrations completed monthly
Delivery system metering incorrectly	• Regular calibration of metering systems • Quality control of explosives products conducted in accordance with manufacturer's recommendations
Precursor degradation during transport and storage	• Appropriate storage location and stock rotation management (i.e. FIFO) • Appropriate transport and transfer of precursors • Inspection and/or testing of precursors prior to use in accordance with supplier's recommendations • Precursor Supplier/Owner to manage disposal or rectification
Geological conditions	
Lack of relief in weak/soft strata	• Understand geology of each shot and design blast (timing and explosive product) to ensure adequate relief in weak/soft strata, for example incorporation of a free face, reduction of powder factor, modified timing etc. • Minimise blast size and depth
Inadequate confinement in soft ground	• Appropriate explosives product selection – refer to supplier • Change design to suit conditions • Minimise blast size
Explosive product seeping into cracks	• Follow manufacturer's recommendations on explosive product selection • Maintenance of accurate drill records which are used to map geological conditions • Record and monitor blast holes which are slumped or require excessive explosive product to reach stemming height, but where water is not present
Dynamic water in holes	• Minimise or eliminate sleep time of shot e.g. load and shoot • Follow manufacturer's recommendations on explosive product selection • Record slumped holes and use this information to build understanding of pit hydrology • Understand hydrology of pit and plan blasting to avoid interaction between explosives and dynamic water (either natural or from other pit operations)

Possible cause	Potential control measures
Blast hole wall deterioration between drilling and loading e.g. cracks, voids, hole contraction	• Minimise time between drilling and loading • Use hole savers • Mine planning to ensure benches are unaffected by backbreak from earlier blasts, for example presplits, buffers etc. • Use drilling mud to stabilise hole (confirm chemical compatibility with explosives first)
Blast design	
Explosive desensitisation due to the blast hole depth	• Reduce bench height • Ensure adequate relief in deep holes • Follow manufacturer's recommendations on explosive product selection and blast design for deep holes, for example decking where appropriate
Inappropriate priming and/or placement	• Follow manufacturer's recommendations on placement of initiating explosives
Mismatch of explosives and rock type	• Appropriate blast design/approval process for site • Communication between user and supplier to determine product suitability for application
Initiation of significant explosive quantities in a single blast event	• Reduce blast size in order to reduce total explosive quantity being initiated in the one blast event • Reduce powder factor
Explosive product selection	
Excessive energy in weak/ soft strata desensitising adjacent explosive product columns	• Understand geology of each shot and design blast (timing and explosive product) to match, for example reduction of powder factor • Follow manufacturer's recommendations on explosive product selection • Obtain appropriate technical assistance if required to ensure optimal result
Primer of insufficient strength to initiate explosive column	• Follow manufacturer's recommendations on compatibility of initiating systems with explosives
On-bench management practices	
Hole condition incorrectly identified	• Dip all holes prior to loading • Record wet, dewatered and dry holes on blast plan and use this information as a basis for explosive product selection • Measure recharge rate of dewatered holes and choose explosive products according to manufacturer's recommendations • Record actual load sheets for each hole • Minimise time between dipping and loading, especially in soft and clay strata. Note: Enough time should be allowed for any dynamic water in the hole to be identified • Minimise sleep time • Training/competence of blast crew
Blast not drilled as per plan	• Maintenance of accurate drilling records and review of blast design if required to compensate for inaccuracies
Blast not loaded as per blast plan	• Blast crew are trained and competent • Effective supervision • Effective communication of loading requirements

Possible cause	Potential control measures
	• Product loadings recorded (e.g. product, quantity, height)
Blast hole contamination	
Penetration of stemming material into top of explosive column	• Use appropriate stemming material • Ensure explosive product is gassed to manufacture to specifications before stemming • Seal top of explosives column prior to stemming e.g. gas bag
Water entrainment in explosive product	• Training/competence of blast crew • Eliminate top loading into wet blast holes • Ensure all primers are positioned in undiluted explosive product. Increase number of primers in explosives column • Select explosive products for wet blast holes according to manufacturer's recommendations. • Verify correct hose handling practices are in place e.g. operator competence, procedures, use explosives supplier's personnel • Load low blast holes last where practical • Use suitable, safe dewatering techniques • Minimize sleep time

Rain, wind speed and direction can significantly alter the impact and severity of a post-blast gas event. Weather forecast knowledge regarding wind direction and speed can be exploited when blast scheduling in order to maximize dissipation of post-blast gases and to direct them away from sensitive areas. Temperature inversions can also be tracked and considered when determining when best to schedule the firing of an affected blast (AEISG, 2011, p. 22).

* Information sourced from the Australian Explosives Industry and Safety Group Inc. (AEISG) *Code of Practice: Prevention and management of blast generated NOx gases in surface blasting*, Edition 2, August 2011, and then adapted for site-specific usage.

8.2. Monitoring programme for blast fume emissions

The blast fume emissions will be monitored by a visual assessment being conducted by the Blast Supervisor/Quarry Manager or his delegate. Visual assessment occurs immediately after the blast and is later confirmed by watching back video footage of the blast event.

The following factors (taken from the "*Code of Good Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting*" issued by the Australia Explosives Industry and Safety Group Inc., 2011) should be considered for inclusion in a post-blast report if NOx gas associated with blasting activity is identified on site:

- Date and time of blast;
- Explosives type, quantity, mixing method, depth, initiation type;
- Ground geology;
- Presence of noticeable post-blast NOx gases;
- Post-blast NOx gas rating, e.g. 0-5 (refer **Appendix D**);
- Extent of post-blast NOx gas event, e.g. A, B or C (refer **Appendix D**);
- Duration of any post-blast NOx gas event (measure of time to disperse);
- Direction of movement of any post-blast NOx plume;
- Movement of any post-blast NOx gas plume relative to the established exclusion zone and any establishment management zone (i.e. maintained within, exceeded);
- Climate conditions, including temperature, humidity, wind speed and direction, cloud cover, rain;
- Results/readings of any NOx monitoring equipment employed for the blast;
- Video results of blast where relevant.

Appendix A

EPA comments on the Noise and Blast Management Plans

Appendix B

Example component of blast package

MAXAM Drill & Blast Best Practice Risk Management Tool

SITE: HANSON BASS POINT | **BLAST NUMBER:**

		Y/N	POTENTIAL RISKS List identified risks & hazards (refer to process step #)	REQUIRED RISK CONTROL For each risk & hazard identify EFFECTIVE control measures implemented to eliminate or reduce risk to an acceptable level			
1	Review previous blast performance against blast Outcome						
1.1	Has a Take 5 been completed by each person as a personal safety risk assessment identifying all hazards and applicable controls?						
1.2	Was the previous blast outcome in that area within expectation?						
1.3	Was the previous blast within standard blast parameters?						
1.4	Will blast parameters require change for the next blast? Were environmental results below 95% of the site environmental limit? Do current practices need to be reviewed?						
1.5	Is there a risk of poor outcomes (over break, Toe, Oversize, caprock etc)?						
1.6	Is this a standard production blast and has blast outcome been discussed with customer and understood by TD?						
1.7	Blast type, will it require TAP approval?						
1.8	Other						
2	Blast Overview						
2.1	Bench access, bench prep, crest and face is it safe to proceed and will it be safe to access for LV's and MEA's to load?						
2.2	Are there any quarry activities either above or below the blast mark up work area that may create a hazard?						
2.3	Upon inspection, and consultation with Site Representative, are there any ground conditions or geological structures on, above, below or adjacent to the blast bench, that may trend into the proposed blast area and therefore need to be taken into consideration?						
2.4	Have such conditions such as caprock, clay jointing, back break been noted, discussed and understood by both MAXAM and Site Representative?						
2.5	Is there edge protection in place? If so, is it adequate?						
2.6	Has a No Go line (20m at minimum, dependent on geological/crest conditions) been put in place and are any holes required within 2m of the edge? If so what impact will there be on blast design if holes are moved?						
2.7	Confirmation of Blast Parameters and Service Parameters received and understood?						
2.8	Confirmation of Environmental Risks received and understood?						
2.9	Confirmation within Current Licenced Extraction Limits received and understood?						
2.10	Clearance and exclusion zones for personnel, equipment, site infrastructure, public and private property discussed and resolved?						
2.11	Geological conditions that require consideration caprock, clay jointing etc discussed and understood?						
2.12	Highwalls, is the highwall stable, is a standoff required, is there a catch bund in place?						
2.13	Based on ground and geological conditions, is there a risk of Flyrock / face burst / rock ejection?						
2.14	Based on ground and geological conditions, is there a risk of Fume generation? (are conditions favourable for fume generation)						
2.15	Has the blast direction of Firing and tie up been discussed and understood?						
2.16	Site acceptance and approval of Blast Pattern Mark out and Blast Plan?						
2.17	Other						
	Customer Representative			Signature	Date		
	MAXAM Representative			Signature	Date		
3	Drilling Verification						
3.1	Borehtracking: Is rod rack level and in correct orientation? Are CCEU settings correct? Broken ground risk of losing the probe?						
3.2	Deviation detected, requiring redrills?						
3.3	Redrills not actioned? What can be done to mitigate risk? Variations to load design required. Risks noted and signed off by QM.						
3.4	Redrills barricaded, clearly marked on the ground, NOT backfilled and borehtrack report issued?						
3.5	Drill log sheets available and reviewed?						
3.6	Borehtrack Audit conducted on production and back row holes?						
3.7	Any other conditions that may result in an unplanned outcome?						
3.8	Other						
4	Completion of Blast Plan						
4.1	Approved Blast Plan completed?						
4.2	Blast Pack to customer and MAXAM team minimum 24 hours before blast?						
4.3	Have Environmental limitations been taken into consideration and monitor locations been confirmed?						
4.4	Other						
	Customer Representative			Signature	Date		
	MAXAM Representative			Signature	Date		

Appendix C

Airblast and Ground Vibration Monitoring Checklist (version: September 2022)

Bass Point Quarry Blast Report

Blast No:	#	**Blast Date:**		**Time:**	
Location of Blast:					
Description of Blast:					

Drilling, Profiling and Mark Out			
Blast area prepared for safe access		Driller - inducted / trained / competent - insert name	
Risk Assessment complete, issued electronically by Maxam		Blast area laser profiling & drill plan completed by Maxam	
Ensure safety barrier erected at minimum 2m from face		Bore Track / Audit completed	
Risk Assessment No. (Tech Services)		Stemming in place prior to blast crew arrival	

Day of Blast Notifications		**Time**	**Who?**			**Time**	**Who?**
Notify office staff time of blast to make calls				Westpac	9694 3100		
Blast details on Entry Blast Signs				Nowra Air Base	4424 1820		
Hanson Allocations	133 666			NSW Air / W'Gong Flight	0421 044 153		
Hanson Concrete	4295 1319			Ambulance (Option 4)	9553 2222		
Hanson Transport	0409 191 424			CWC	0418 421 549		

Traffic Route to blast site	Confirm with Maxam				
Blasting Contractor	Maxam	**Shot Firer**		**Shot Crew**	*As per QR Collect / Sign in & RA sign off*

Prior to Blast	☐ Walk the shot to check tie-up plan		☐ Two way radio check - Hanson frequency Channel 1	
	☐ Check blast area & surrounds		☐ 15 minute Blast Warning	
	☐ Erect exclusion signs for traffic mgt		☐ 5 minute Blast Warning	
	☐ Risk Assessment on bench signed off		☐ Explosives reconcillitation complete & correct	

Sentries ☐ *All Sentry Point personnel involved in blast procedure have been trained?*		**Who?**
No 1 Sentry Point	Ridge road 4T	
No 2 Sentry Point	Centre of New Plant Primary No2 conveyor	
No 3 Sentry Point	Top of Western Pit Ramp	
No 4 Sentry Point	Precoat Plant	
No 5 Sentry Point	Hold Point	
No 6 Sentry Point	Weighbridge roundabout	
No 7 Sentry Point	Quarry entrance rd	
No 8 Sentry Point	Blast Monitors Shellcove / Killalea	
	Sound Alarm	WEIGHBRIDGE

Blast Records							
Location of Blast Monitors:	☐ **Notify Monitors**		**# 1 - Rangoon Ave Shell Cove**		**# 2 - Killalea State Park**		
Time of Blast:							
No1 / Blast monitor results: **Hanson**		**Ground Vibration**			**Blast Over Pressure**		
No2 / Blast monitor results: **Hanson**		**Ground Vibration**			**Blast Over Pressure**		
No3 / Blast monitor results:**Hanson**		**Ground Vibration**			**Blast Over Pressure**		
Weather Conditions *(BOM)*		**Wind Direction**		**Wind Speed**		**Wind Gusting**	

Post Blast Records	☐ Post Blast Inspection form Complete	☐ Discussion with Shot firer post blast
	☐ No misfire	☐ No changes required for next blast
	☐ No other dangerous events	☐ No incidents or complaints

Blast Fume:			
Presence of noticeable post-blast Nox gases		Movement of any post-blast NOx gas plume	
Post-blast NOx gas rating (0 - 5)		Relevant climate conditions	
Extent of post-blast NOx gas event (A - C)		Results/readings of any NOx monitoring equipment	
Duration of any post-blast NOx gas event		Video results of blast where relevant	

Notes:					
Approved Shot Supervisor Name:		**Signature:**		**Date:**	
Approved Shot Firer Name:		**Signature:**		**Date:**	

Appendix D

Visual NOx Flume Rating Scale and Field Colour Chart

Australian Explosives Industry And Safety Group Inc.

APPENDIX 2 - VISUAL NOx GASES RATING SCALE

The following table, together with the Field Colour Chart in Appendix 3, details how NOx gases from a surface blast can be assessed.

Level	Typical Appearance
Level 0 No NOx gas	
Level 1 Slight NOx gas	
1A Localised	
1B Medium	
1C Extensive	
Level 2 Minor yellow/orange gas	
2A Localised	
2B Medium	
2C Extensive	
Level 3 Orange gas	
3A Localised	
3B Medium	
3C Extensive	
Level 4 Orange/red gas	
4A Localised	
4B Medium	
4C Extensive	
Level 5 Red/purple gas	
5A Localised	
5B Medium	
5C Extensive	

Assessing the amount of NOx gases produced from a blast will depend on the distance the observer is from the blast and the prevailing weather conditions. The intensity of the NOx gases produced in a blast should be measured on a simple scale from 0 to 5 based on the table above. The extent of the NOx gases also needs to be assessed and this should be done on a simple scale from A to C where:-

A = Localised (ie NOx Gases localised across only a few blast holes)

B = Medium (ie NOx Gases from up to 50% of blast holes in the shot)

C = Extensive (ie Extensive generation of NOx Gases across the whole blast)

APPENDIX 3 - FIELD COLOUR CHART

Pantone colour numbers have been included in the following Field Colour Chart to ensure colours will be produced correctly thereby ensuring a reasonable level of standardisation in reporting NOx gas events across the blasting industry.

Level	Colour	Pantone Number
Level 0 No NOx gas		Warm Grey 1C (RGB 244, 222, 217)
Level 1 Slight NOx gas		Pantone 155C (RGB 244, 219, 170)
Level 2 Minor yellow/orange gas		Pantone 157C (RGB 237, 160, 79)
Level 3 Orange gas		Pantone 158C (RGB 232, 117, 17)
Level 4 Orange/red gas		Pantone 1525C (RGB 181, 84, 0)
Level 5 Red/purple gases		Pantone 161C (RGB 99, 58, 17)