MARSHALL DAY Acoustics

BENDIGO-OPHIR GOLD PROJECT
ASSESSMENT OF NOISE AND VIBRATION EFFECTS

Rp 001 R05 20230685| 26 September 2025

MARSHALL DAY Acoustics

292 Montreal Street
PO Box 4071
Christchurch 8140
New Zealand
T: +64 3 365 8455
www.marshallday.com

Project: **BENDIGO-OPHIR GOLD PROJECT**

Prepared for: **Matakanui Gold Limited**
15A Chardonnay St
Cromwell

Attention: **Mary Askey**

Report No.: **Rp 001 R03 20230685**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Draft	-	-	12 December 2024	Juan Gaviria	Jon Farren
Approved	R01	Minor amendments	1 May 2025	Juan Gaviria	Jon Farren
Approved	R02	Updated traffic	13 May 2025	Juan Gaviria	Jon Farren
Approved	R03	Minor amendment	19 June 2025	Juan Gaviria	Jon Farren
Approved	R04	Blasting amendment	4 September 2025	Juan Gaviria	Jon Farren
Approved	R05	Minor amendment	26 September 2025	Juan Gaviria	Jon Farren

Cover Photo: Land Information New Zealand

EXECUTIVE SUMMARY

This assessment of operational noise from the proposed Bendigo-Ophir Gold Project [project] in Central Otago finds that noise effects from onsite activities will be minimal in the context of the existing rural residential noise environment and what can be reasonably anticipated by the District Plan permitted activity noise limits.

Marshall Day Acoustics has assessed noise and vibration effects for the proposed project. This report evaluates potential impacts during the construction and operational phases, providing recommendations to ensure compliance with regulatory standards and to minimise disturbance to nearby sensitive receivers.

The large distances between primary noise sources and sensitive receivers, combined with the natural screening effects provided by the terrain, means that activity noise levels will comply with the Central Otago District Plan (CODP) permitted activity noise limits of 55 dB L_{A10} (daytime) and 40 dB L_{A10} (night-time) at the closest residential receivers. On site construction noise and blasting activities are also expected to comply with the CODP permitted activity standards.

While vehicle noise from public roads is exempt from compliance with the District Plan permitted activity noise limits, we note the dwelling at 213 Ardgour Road will experience a temporary (2 to 3 months) adverse noise effect from increased construction phase truck movements along Ardgour Road - noise levels will be in the order of 60 dB L_{Aeq} at this dwelling. Other dwellings are sufficiently set back from Ardgour and Thomson Gorge Roads such that truck noise levels will be less than 54 dB L_{Aeq} which is below World Health Organisation and NZS 6802:2008 guideline values. Given the relatively short duration of the construction phase and peak truck movements, we consider that truck noise effects will be reasonable.

In Section 11.0 we have proposed several consent conditions for the project including:

1. Noise limits that reflect the CODP numerical values but with updated metrics and Standards to reflect current best practice
2. Blasting noise (overpressure) and vibration limits to reflect current best practice
3. The requirement of a Noise and Vibration Management Plan to manage the day-to-day noise and vibration emissions at the mine, including a procedure for handling complaints
4. A requirement that the best practicable option is adopted on site to minimise noise at all times.

TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics has been engaged by Matakanui Gold Ltd to assess the potential noise and vibration effects from their proposed Bendigo-Ophir Gold Project located in the Central Otago District Council area.

This report provides:

- An overview of the proposed mining activity with respect to noise generation;
- A review of applicable noise assessment criteria;
- A description of the existing noise environment;
- Predicted noise levels from the proposed mining activity;
- Predicted noise levels during the construction phase;
- An assessment of the potential noise effects at nearby noise sensitive receivers;
- A review of blasting noise (overpressure) and vibration; and
- Recommendations for the management of noise for the future life of the mine.

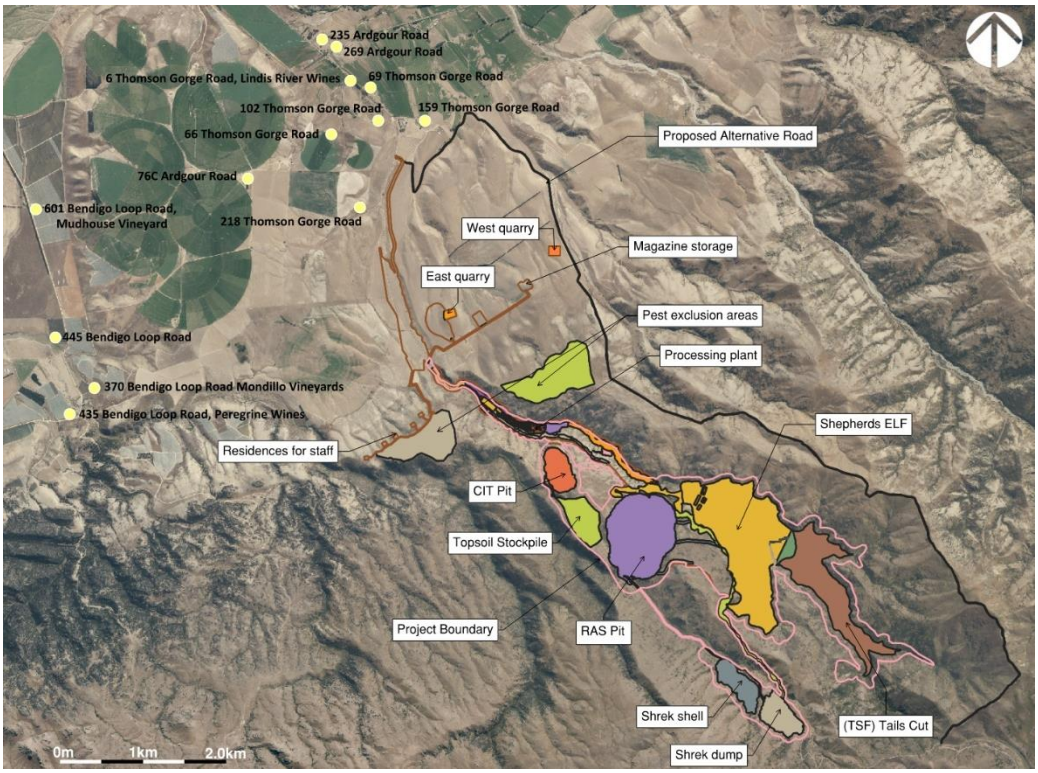
A glossary of the terminology used in this report is provided in Appendix A.

2.0 SURROUNDING ENVIRONMENT AND PROPOSED MINE SITE

2.1 Surrounding environment

The proposed mine site is located in the Dunstan Mountains, northeast of Bendigo. There are several residential dwellings and commercial properties, including vineyards located to the north and west, as identified in Figure 1. The closest residential receiver to site infrastructure and mining operations is located at 218 Thomson Gorge Road (approximately 2.8 km from the proposed processing area). Both the site and surrounding properties are zoned Rural Resource Area in the Central Otago District Plan.

Figure 1: Proposed mine layout and nearest receivers



2.2 Proposed Mine Site and Activity Description

A detailed description of the Bendigo-Ophir Gold Project is provided as part of the application. With respect to noise generation, the project will employ both open pit and underground mining methods and includes a processing area where the extracted material will be crushed and processed. Operations will focus on several deposits as shown in Figure 1:

2.2.1 Summary of mining phases

The mining phases for the Bendigo -Ophir project can be summarised as follows:

Table 1: Summary of mining phases

Year	Description of Phase
0 to 0.5	Pioneering / RAS Pre-Strip, Initial Jean Creek Silt Pond, earthworks at process plant.
0.5 to 2	Construction of process plant, Tailing Storage Facility (TSF), Shepherds Creek Silt Pond, North Diversion Channel, Commissioning, mining RAS pre-strip (Pre-strip ends month 19).
3 to 4.5	Operations (Pit ore production in month 20. UG Development begins month 54
4.5 to 5	Operations (Underground Ore production begins month 70)
6 to 11	Operations (Underground Ore production months 70 to 150) Operations (CIT Pit mined months 102 to 114) Operations (Pits mined months 145 onwards)
10 to 13.3	Operations (all mining halted month 160)
11 to 31	Active closure of pits, TSF, and wider site, plus setup of active water treatment plant (option)
31 onwards	Passive treatment and maintenance

2.2.2 Site Infrastructure

- Most infrastructure will be in the lower Shepherds Creek Valley, including the processing plant, mining offices, workshops, vehicle facilities, and warehousing areas.
- Underground portals will be in the Shepherds Creek Valley, upstream of the main infrastructure but downstream of the RAS pit and ELF/TSF.
- Explosives magazines and the emulsion facility will be on terraces outside the Shepherds Creek Valley.
- A new 66kV powerline will be installed from Lindis Crossing sub-station to the plant site, following the existing road corridor.
- Road upgrades include the Ardgour and Thomson Gorge Roads from State Highway 8 to Shepherds Creek Valley, a new road from Thomson Gorge Road to the process plant area.

2.2.3 Noise generating activities

For the purpose of this assessment, we have considered a conservative scenario where the entire mining fleet and the processing plant are operating simultaneously. In addition, we have assumed that mining is occurring at existing ground level at the nearest pit (CIT) to the residential receivers. When operating at existing ground level, the mining fleet at the CIT pit has less natural screening from the surrounding terrain compared to the RAS and SRX pits, as well as the SRX and Shepherds ELFs. As a result, we consider our assessment will provide worst-case noise emissions which are likely to be much lower in practice.

Table 2 provides a schedule of noise generating components of the project and when they will be operational. Whilst underground mining will occur, noise sources operating underground are insignificant with respect to overall noise emissions from the activity and are not discussed further in this report.

Table 2: Summary of noise generating components

Activity	Description	Hours of operation
Open Pit Mining (RAS, CIT, SRX, SRE)	- 165-tonne haul trucks x 22 - 260 tonne backhoe excavators x 2 - CAT D10 bulldozers x 3 - Rotary drills (e.g., Sandvik D50KS) x 2 - Graders x 2 - Water carts x 2	24-hour operation
Ore Processing Plant	- Rock crushing plant - SAG mill for grinding - Centrifugal concentrators - Leaching and smelting equipment - 988 Front End Loader x 1-	Crushing: 24 hours/day Other plant operations: 24 hours/day, 7 days/week
Underground Mining (RAS)	- 50-tonne underground trucks - 17-tonne Load-Haul-Dump (LHD) units - Electric and diesel-powered drills.	24-hour operation
Blasting	- Blasting equipment for open pits (RAS), underground mining and intermittently in the west quarry	Day shift only
Hauling/Transport	- Haul trucks for transporting ore from pits to the Run of Mine (ROM) pad - Secondary trucks for underground ore transport	24-hour operation
Waste Rock and Overburden Removal	- 165-tonne haul trucks for transporting overburden to the Engineered Landforms (ELF) - Bulldozers for landform shaping	24-hour operation
Tailings Storage Facility (TSF) Construction	- Haul trucks and bulldozers for embankment construction - Drilling and compaction equipment	Day shift operations
Vehicle Maintenance and Workshops	- Noise from workshops, vehicle refuelling, and maintenance operations	24-hour operation

3.0 EXISTING NOISE ENVIRONMENT

To assess the existing noise environment near the proposed site, noise measurements were conducted during September 2024. Three measurement positions were chosen, MP1 to MP3 in Figure 2, to represent the existing rural residential noise environment in the vicinity of the site. Attended measurements were conducted on a cyclical basis and unattended noise logging instrumentation was installed at 218 Thomson Gorge Road (MP2), the closest dwelling, to record noise levels over 24 hours.

All measurements followed the New Zealand Standard NZS 6801:2008 *Acoustics – Measurement of environmental sound*. Measurements were undertaken during favourable weather conditions. Results, summarised in Table 3, were based on 15-minute measurement intervals.

Further information such as equipment and calibration details are provided in Appendix B.

The daytime noise environment at all locations included birdsong, wind generated noise, intermittent traffic on local roads, farm machinery, and the continuous underlying traffic noise from State Highway 8. Distant traffic and wind noise were dominant at night. While not captured during the noise survey, we anticipate there will be seasonal use of bird scarers and frost fans (wind machines) in the area.

Figure 2: Ambient noise measurement positions

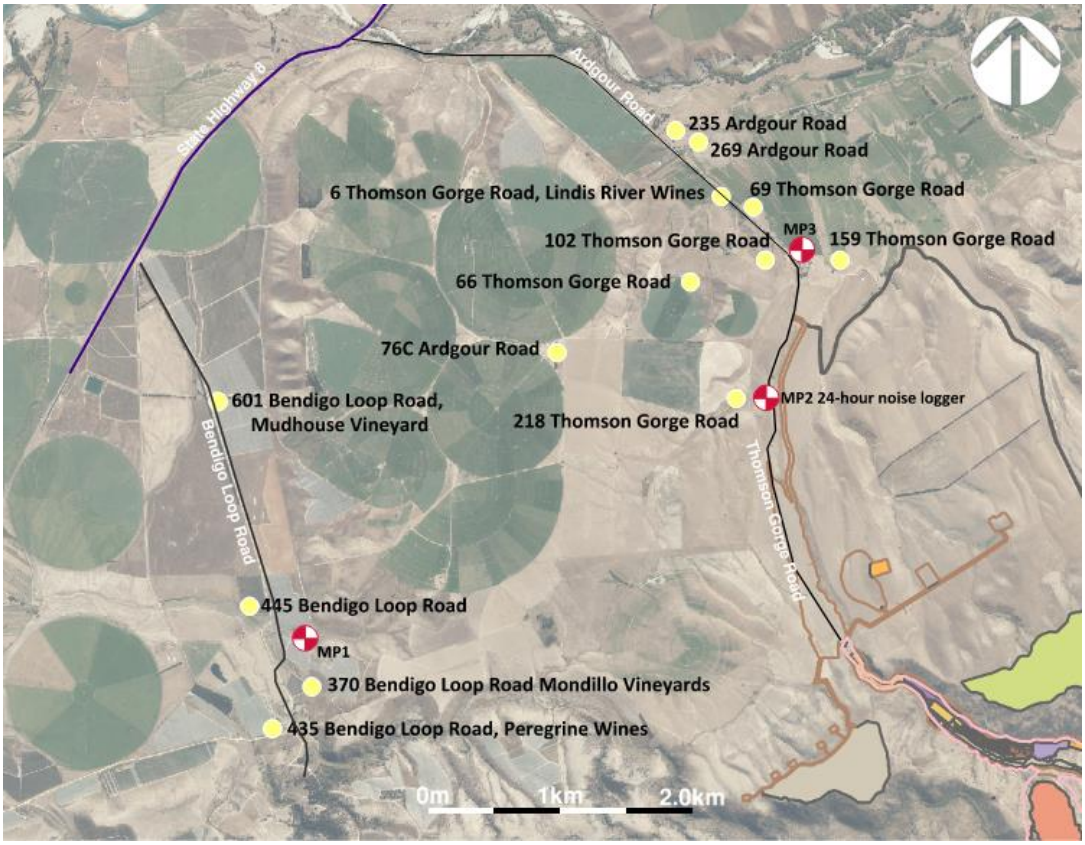
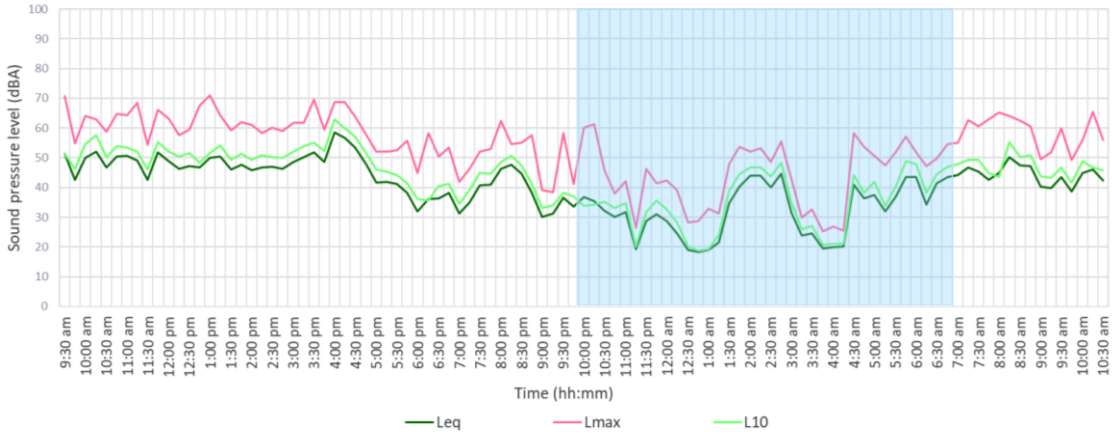


Table 3: Summary of ambient noise survey results

Position	Time(hh:mm)	Measured noise levels			
		dB L_{Aeq}	dB L_{A10}	dB L_{A90}	dB L_{AFmax}
	DAYTIME				
MP1	0743	55	51	33	79
	0801	43	46	33	58
	0958	41	42	35	57
	1859	37	39	32	54
MP2	0932	51	44	35	74
	1033	41	44	36	54
	1753	32	36	25	53
	Logged average	48	51	37	62
MP3	0830	49	45	38	71
	1013	59	53	37	89
	1830	37	40	32	56
	NIGHT-TIME				
MP1	2232	36	39	30	51
	2329	33	36	27	55
MP2	Logged average	38	42	30	52
MP3	2300	36	38	32	52
	2357	34	35	32	39

Figure 3: Measured ambient noise level data at MP2 (Night-time period shaded blue)



Attended noise measurements indicate daytime noise levels are in the order of 40 to 50 dB L_{Aeq} during the core workday hours and reduce to approximately 30 to 40 dB L_{Aeq} in the early evening and into the night-time. The typical variation in noise level over a 24 hour period can be seen in Figure 3 which shows a relatively consistent noise environment between 7am and 5pm after which time noise

levels begin to reduce. Figure 3 also shows a notable increase in noise level between 1.30 and 2.30 am at this location which we expect is as a result of irrigation mechanical plant or similar. There are several notable noise sources associated with the rural production activity in the area and several of these, such as irrigation pumps and frost fans, can operate during the night-time as defined in the District Plan.

4.0 NOISE ASSESSMENT CRITERIA

This section discusses the applicable District Plan permitted activity limits that apply to the project and other relevant published guidance for assessing potential adverse noise effects.

4.1 District Plan Noise Standards

Both the proposed mine site and surrounding land are zoned *Rural Settlements Resource Area (RU)* under the Central Otago District Plan (CODP). The applicable noise limits are set out in Rule 4.7.6.E and are summarised in Table 4.

Table 4. Central Otago District Plan noise standards

Receiving zone and assessment location	Daytime -07:00 to 22:00 hours (inclusive)	Night-time 22:00 to 07:00 hours (the following day)
Rural Settlements Resource Area (RU) At the notional boundary* of any dwelling, resthome or hospital;	55 dB L_{A10}	40 dB L_{A10} 70 dB L_{AFmax}

* *A line 20 metres from any side of a dwelling, or the legal boundary where this is closer to the dwelling* as defined in NZS6802-2008 *Acoustics Environmental Noise*

As extraction and processing activity is proposed to occur 24 hours per day, seven days per week, the critical applicable permitted activity noise limit is 40 dB L_{A10} at the notional boundary of the nearest dwelling.

We note that the Rule references the now outdated 'L_{A10}' metric. Current best practice, as described by NZS 6801[1] and NZS 6802[2] is to use the equivalent continuous sound pressure levels metric or 'L_{Aeq}'.

4.1.1 Blasting

We understand blasting is proposed as part of the extraction process. CODP Rule 12.7.4.iv provides the following noise and vibration limits:

(a) Vibration from any site due to blasting shall not exceed a peak particle velocity of 5mm/sec measured in the frequency range 3-12 Hz measured at any point within the notional boundary of any dwelling, residential institution or educational facility.

(b) Airblast overpressure from blasting on any land or in water shall not exceed a peak sound pressure level of 115 dBC measured at any point within the notional boundary of any dwelling, residential institution or educational facility

The CODP limits are approximately aligned with the recommended values from Appendix J of Australian Standard AS 2187-2:2006 *Explosives – Storage and use Part 2: Use of explosives*, which we propose is adopted for measuring and assessing potential adverse effects from blasting.

[1] New Zealand Standard NZS 6801:2008 *Acoustics – Measurement of environmental sound*

[2] New Zealand Standard NZS 6802:2008 *Acoustics - Environmental Noise*

4.1.2 Construction Noise

Rule 12.7.4.ii of the CODP provides construction noise limits through reference to the superseded version of the New Zealand Standard: *NZS 6803P:1984 The measurement and Assessment of Noise from Construction, Maintenance, and Demolition Work.* The numerical limits in NZS 6803P are numerically similar to those in the current version of the Standard, NZS 6803: 1999 *Acoustics - Construction Noise*, except that the metric 'L_{Aeq}' is used instead of the now outdated 'L_{A10}'. As the 1999 version of the Standard represents current best practice, we recommend this is adopted to manage and assess potential adverse effects from construction activity. We discuss this further in Section 4.4 below.

4.2 World Health Organisation Guidelines

The World Health Organisation (WHO*) Guidelines for Community Noise* (Berglund, Lindvall and Schwela, 1999) provide guidelines for environmental noise exposure. For community or environmental noise, the critical amenity effects (those effects which occur at the lowest exposure levels) are sleep disturbance and annoyance.

These guideline values are the exposure levels that represent the onset of the effect for the general population.

Table 5: WHO guideline values for the critical health effects of community or environmental noise

Specific Environment	Critical amenity effect(s)	dB L_{Aeq}	Time base (hours)	dB L_{AFmax}
Outdoor living area	Serious annoyance, daytime & evening	55	16	-
	Moderate annoyance, daytime & evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

4.3 NZS 6802:2008 Guideline Upper Noise Limits

The 2008 version of NZS 6802:2008 *"Acoustics - Environmental Noise"* (note that the District Plan refers to the 1991 version) makes reference to the following guideline upper limits of sound exposure at or within the notional boundary of a rural dwelling:

- Daytime: 0700 to 2200 55 dB $L_{Aeq(15min)}$
- Night-time: 2200 to 0700 45 dB $L_{Aeq(15min)}$ and 75 dB L_{AFmax}

4.4 NZS 6803:1999 Construction Noise Standard

The appropriate guidance for assessing construction noise in New Zealand is NZS 6803: 1999 *"Acoustics - Construction Noise"*. Activities on site that would generally be considered as construction noise include the construction of site access roads, perimeter bunding, construction of processing plant and site buildings. As the duration of the construction works will be more than 20 weeks, the applicable noise limits are the "long-term" duration limits presented in Table 6.

Table 6: Recommended upper limits for construction noise received in residential zones and dwellings in rural areas

Time of week	Time period	Duration of work					
		Typical duration (dBA)		Short-term duration (dBA)		Long-term duration (dBA)	
		L_{Aeq}	L_{max}	L_{Aeq}	L_{max}	L_{Aeq}	L_{max}
Weekdays	0630-0730	60	75	65	75	55	75
	0730-1800	75	90	80	95	70	85
	1800-2000	70	85	75	90	65	80
	2000-0630	45	75	45	75	45	75
Saturdays	0630-0730	45	75	45	75	45	75
	0730-1800	75	90	80	95	70	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75
Sundays and public holidays	0630-0730	45	75	45	75	45	75
	0730-1800	55	85	55	85	55	85
	1800-2000	45	75	45	75	45	75
	2000-0630	45	75	45	75	45	75

In table 2:

a) *"Short-term" means construction work at any one location for up to 14 calendar days;*

b) *"Typical duration" means construction work at any one location for more than 14 calendar days but less than 20 weeks; and*

c) *"Long-term" means construction work at any one location with a duration exceeding 20 weeks.*

4.5 Discussion

Based on our review of the published guidance discussed above, we propose the following construction and operational phase limits are adopted for the project to ensure that effects are acceptable in the context of what can reasonably be expected at residential receivers based on the CODP permitted activity standards.

4.5.1 Operational noise

The following noise limits shall not be exceeded at any point within the notional boundary of a rural dwelling during the following timeframes:

0700 to 2200	55 dB $L_{Aeq(15min)}$
2200 to 0700	40 dB $L_{Aeq(15min)}$ and 75 dB L_{AFmax}

Noise levels shall be measured in accordance with NZS 6801:2008 *Acoustics – Measurement of environmental* sound and assessed in accordance with NZS 6802:2008 *Acoustics - Environmental Noise.*

4.5.2 Construction Noise

Noise from construction activities shall be managed and assessed in accordance with NZS 6803: 1999 *Acoustics - Construction Noise,* and shall comply with the long term duration noise limits in Table 2 of that Standard as far as reasonably practicable.

4.5.3 Blasting

Blasting activities must be measured and assessed in accordance with Appendix J of Australian Standard AS 2187-2:2006 *Explosives – Storage and use, Part 2: Use of explosives*.

Blasting must be managed to ensure that in any calendar year, 95% of airblast levels do not exceed 115 dBL, with a maximum of 120 dBL, when applied at any point within the notional boundary of any rural dwelling.

Blasting vibration shall not exceed a peak component particle velocity of 5mm/s for 95% in any calendar year, with a maximum of 10 mm/s at the foundation of any dwelling.

5.0 PREDICTED NOISE LEVELS

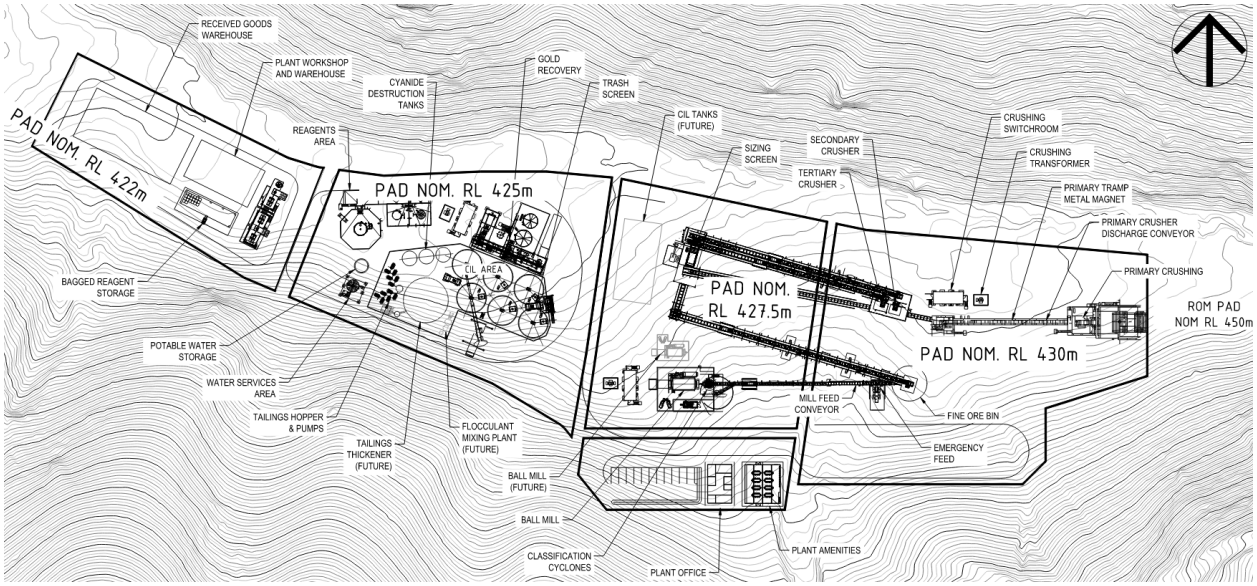
In this section, we provide predicted noise levels from proposed extraction and processing activities based on multiple noise sources operating at the same time. We have identified key noise sources at worst-case locations (i.e. high elevations and close proximity to the nearest dwellings) as anticipated over the duration of the Bendigo-Ophir Gold Project.

5.1 Prediction Methodology

To predict noise levels from various mining scenarios and activities, the noise modelling package SoundPLAN has been used. Calculations in SoundPLAN are based on ISO 9613-2:1996 "*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*". This method has the scope to take into account a range of factors affecting the sound propagation including:

- Mine site layouts provided by the Applicant in April 2025 including detailed layout of the proposed processing plant as per Figure 4.
- Sound Power Levels for the processing and mobile equipment as listed in Table 7
- Existing terrain data obtained from LINZ[3] :

Figure 4: Processing plant layout



[3] https://data.linz.govt.nz/layer/50768-nz-contours-topo-150k/

5.2 Input Noise Data

Our modelling is based on noise source data collected through measurements of other mining and processing operations around New Zealand.

We have used the sound power levels provided in Table 7 for our predictions which have been calculated on an L_{A10} basis in order to enable comparison to the District Plan limits – 'L_{Aeq}' values will typically be 2 dB less. The sound power level data is representative of typical non-enclosed rock processing equipment. The sound power levels for each piece of equipment were selected to reflect a conservative scenario, assuming all noise sources are operating simultaneously and 100% of the time.

Table 7: Sound power levels of processing plant equipment used in the noise model

Quantity	Plant and equipment	Source noise data L_{A10} Basis	Source height (m)
Processing plant			
1	Primary crusher	119 dB L_{AW}	16
1	Secondary crusher	120 dB L_{AW}	5
1	Tertiary Crusher	120 dB l_{AW}	5
1	SAG Mill	118 dB L_{AW}	5
1	Ball Mill	115 dB L_{AW}	5
1	Tracked conveyor	88 dB L_{Aw}/metre	25*
4	Pumps	110 dB L_{AW}	8
3	Screw Compressors	105 dB L_{AW}	1.8
2	Front End Loader	111 dB L_{AW}	3
1	Miscellaneous allowance	124 dB L_{AW}	25
Mining equipment			
2	260 tonne excavators	118 dB L_{AW}	4
3	CAT D10 Bulldozers	108 dB L_{AW}	4
3	Rotary drill	112 dB L_{AW}	4
1	40 tonne Excavator mounted 160 Drills	102 dB L_{AW}	4
2	100 tonne water trucks	103 dB L_{AW}	2
22	165 tonne Haul truck CAT 785	89 dB L_{AE} at 10 metres	4
Auxiliary fleet			
1	15 tonne loader CAT 930k	110 dB L_{AW}	2
1	32 tonne grader CAT 16G	73 dB L_{WA}/metre	2

* Highest point

5.3 Worst-case operational noise levels

The greatest potential for adverse noise effects is during simultaneous operation of the processing plant, and when the mobile mining fleet is working at the CIT pit crest (highest point) at the closest point to the nearest dwellings north of the site.

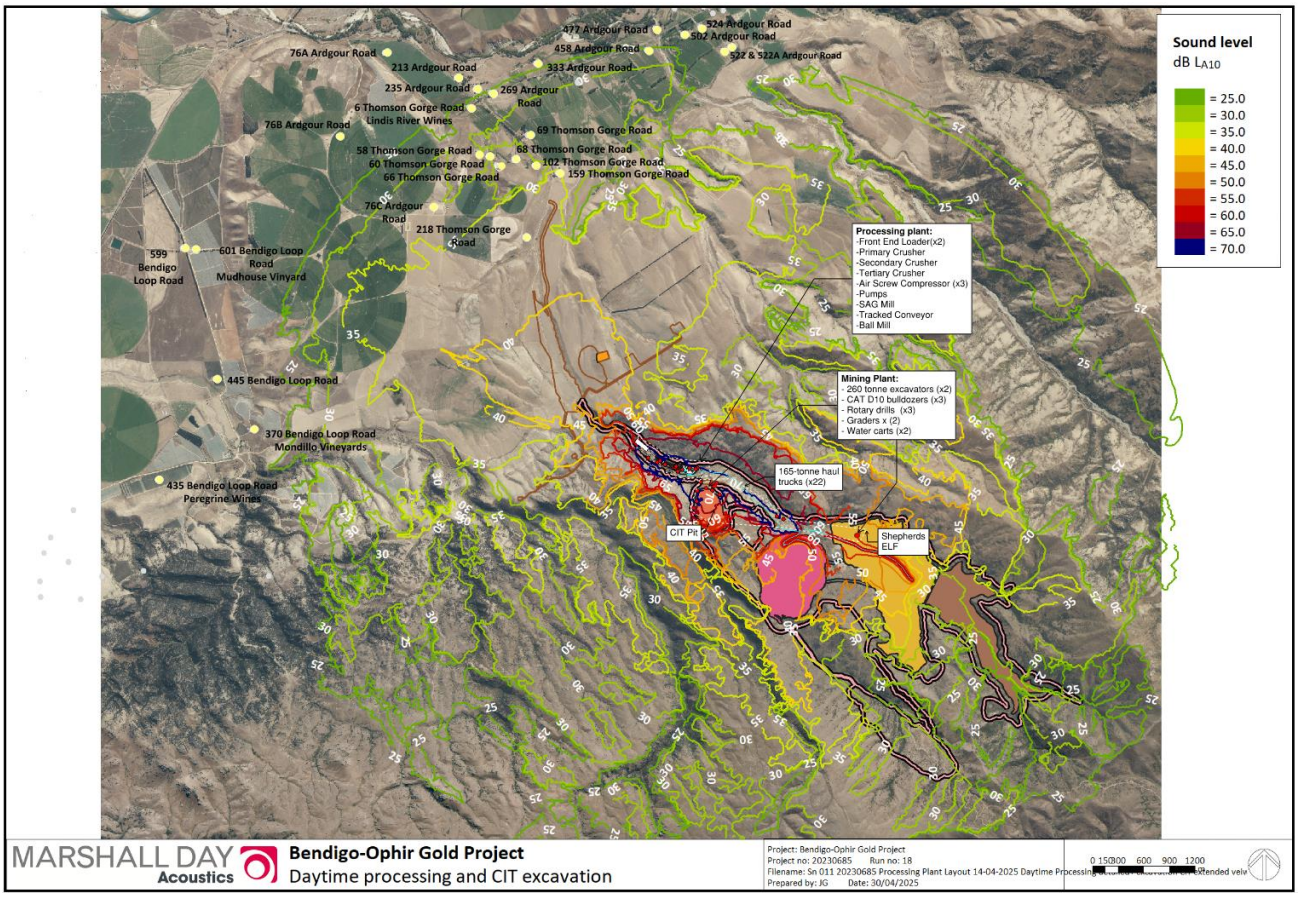
Table 8 and Figure 5 shows the predicted noise levels comfortably comply with both the daytime and night-time District Pan permitted activity noise limits of 55 and 40 dB L_{A10} respectively. Because of the conservatism in our assessment, in practice we expect that operational noise levels will be lower than predicted for most of the time.

In terms of the proposed metric L_{Aeq}, the predicted noise levels will be approximately 2dB lower than the L_{A10} values presented in Table 8.

Table 8: Predicted night-time noise levels at notional boundary of nearest residential receivers

Item	Receiver	Predicted noise level dB L_{A10}	CODP daytime/night-time limits dB L_{A10}	Comply? Y/N
1	218 Thomson Gorge Road	35	55 / 40	✓
2	159 Thomson Gorge Road	32	55 / 40	✓
3	76C Ardgour Road	33	55 / 40	✓
4	66 Thomson Gorge Road	26	55 / 40	✓
5	68 Thomson Gorge Road,	27	55 / 40	✓
6	102 Thomson Gorge Road	25	55 / 40	✓
7	360 Ardgour Road, Tarras	29	55 / 40	✓
8	6 Thomson Gorge Road	25	55 / 40	✓
9	601 Bendigo Loop Road	<20	55 / 40	✓
10	445 Bendigo Loop Road	<20	55 / 40	✓
11	370 Bendigo Loop Road	<20	55 / 40	✓
12	435 Bendigo Loop Road	<20	55 / 40	✓

Figure 5: Predicted worst case operational noise levels (larger version is provided in Appendix C)



6.0 CONSTRUCTION NOISE

Construction activities on site include the formation of site access roads (including rock extraction and crushing), erecting the processing plant and construction of the site compound. Both mobile machinery and hand tools will be used and these can generate relatively high levels of noise.

However, the separation distances between construction activities and the nearest dwellings are relatively large and, as result, construction noise levels will be relatively low. For example, the processing plant is approximately 2.5 km from the nearest dwelling. The Ardgour Infrastructure Area will be approximately 600 metres at its closest point.

Table 9 provides predicted noise levels for a range of high-noise construction activities and illustrates how noise levels reduce with distance. The right-most column provides the separation distance required to comply with the applicable NZS 6803: 1999 noise limit of 70 dB L_{Aeq}. For example, compliance would be achieved at distances greater than 132 metres for a Concrete /rock breaker with a sound power level of 121 dB L_{Aw}. In the context of the separation distances at the proposed site, we expect that construction noise levels will be substantially below the 70 dB L_{Aeq} limit.

Table 9: Indicative noise levels at a building façade

Phase	Equipment	Sound Power	Façade Noise Level (dB L_{Aeq}) at distance:			Setback distance (m) to achieve70 dB L_{Aeq}
		(dB L_{wA})	500m	1000m	2000m	
Demolition	Concrete/rock breaker (20-30T)	121	56	48	40	132
	Concrete cutting	115	50	42	34	76
	Excavator pulveriser	104	39	31	23	28
Piling	Impact piling (casing & dolly)	114	49	41	33	69
	Vibratory sheet piling	116	51	43	35	83
	Bored or screw piling (excavator)	103	38	30	22	25
	Diaphragm wall piling	110	45	37	29	48
Excavation	Hydrovac excavator	107	42	34	26	36
	Excavator (20T)	103	38	30	22	25
	Excavator (5T)	102	37	29	21	22
Quarrying	Semi-mobile crusher	118	53	45	37	100
	Wheeled loader	110	45	37	29	48
	Excavator (20T)	103	38	30	22	25
	Pulveriser mounted on excavator	104	39	31	23	28

Phase	Equipment	Sound Power	Façade Noise Level (dB L_{Aeq}) at distance:			Setback distance (m) to achieve70 dB L_{Aeq}
		(dB L_{wA})	500m	1000m	2000m	
General	Grinder (handtools)	108	43	35	27	40
	Directional drilling	105	40	32	24	30
	Concrete truck and pump	103	38	30	22	25
	Mobile Crane (35T) operating	98	33	25	17	14
	Hydraulic power pack	97	32	24	16	13
	Generator (150kVA)	93	28	20	12	8
	Pump (150mm dia)	93	28	20	12	8
	Compressor	93	28	20	12	8
	Truck idling	91	26	18	10	6
Road	Milling machine	110	45	37	29	48
	Plate compactor	108	43	35	27	40
	Paving machine	103	38	30	22	25
	Static or vibratory roller	103	38	30	22	25

7.0 TRAFFIC MOVEMENTS ON PUBLIC ROADS

Noise from vehicle movements on public roads is exempt from compliance with the District Plan permitted activity noise limits that apply to other land use activities. However, for a discretionary activity, there is a potential noise effect from traffic that should be considered.

Trucks during the construction phase have the greatest potential for noise generation and these will travel to the site from State Highway 8 via Ardgour and Thomson Gorge Roads as indicated in Figure 6. Traffic generation during the construction phase of the project is described in the Stantec Integrated Transport assessment. We understand that for a relatively short period of time, heavy vehicle volumes are expected to reach a peak of about 150 vpd[4] to 170 vpd in Q2 2026 and then fall to about 100 vpd to 120 vpd through to the end of 2026. Once the construction works are completed, heavy vehicle volumes will fall further to about 40 vpd once the mine becomes fully operational.

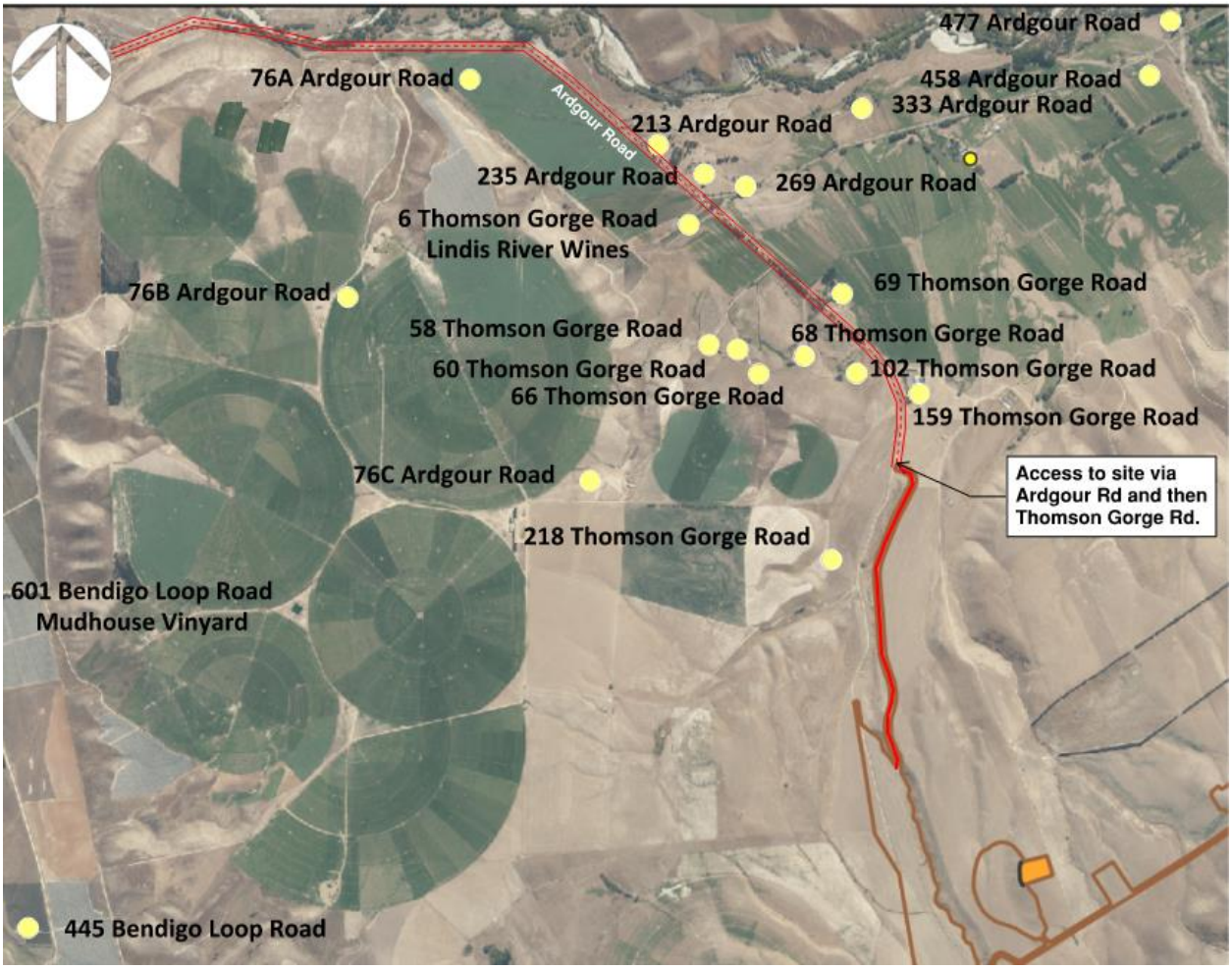
The daily volume of light vehicles is expected to increase steadily through the construction phase to a peak of about 275 vpd in mid-2026 before reducing to about 210 vpd when the mine is operational.

From a noise perspective, 10 light vehicles are approximately equivalent to 1 heavy vehicle. Therefore, peak vehicle activity will result in noise generation equivalent to approximately 200 trucks per day. Assuming a typical 10 hour day, this equates to an average of 20 equivalent truck noise events per hour.

[4] vpd - vehicle movements per day

Existing vehicle movements on these roads are relatively low - less than approximately 100 vehicles per day on Thomson Gorge Road. Figure 6 also shows the existing dwellings along this route, and most are set back a minimum of approximately 40 metres from the road.

Figure 6: Aerial view of proposed access route to site and relevant receivers



Based on a typical truck noise level of 84 dB L_{AE} at a distance of 10 metres, we calculate that dwellings will experience construction vehicle noise levels of approximately 54 dB $L_{Aeq(1hr)}$ or less. This predicted noise level is below both the NZS 6802:2008 and WHO guideline limit of 55 dB L_{Aeq} for the protection of residential amenity discussed in Section 4.0.

The building at 213 Ardgour Road is closer to the road and will receive truck noise levels approximately 6 dB higher of 60 dB $L_{Aeq(1hr)}$ as a result. Construction vehicle noise will result in a moderate noise effect at this dwelling during the relatively brief period (2 to 3 months) when the highest traffic volumes are predicted.

During the operational phase, heavy vehicle movements will be substantially reduced compared to the construction phase. Light vehicles travelling to site are anticipated to be the dominant source of operational noise that could affect nearby sensitive receivers, and this activity will primarily occur around shift changes. Traffic noise levels are anticipated to be in the order of 50 dB $L_{Aeq(1hr)}$ for most dwellings along the route.

8.0 BLASTING NOISE AND VIBRATION

We understand that blasting will be required in both the open pit and underground, and intermittently in the west quarry. At this early stage of the project, a detailed blasting plan has not been developed. However, we understand that approximately four or five blasts will occur each week in the open pit and, in line with good practice, these will occur at a regular time each day. Blasting underground will occur regularly at times throughout the day and night up to four times, when those underground operations commence. Blasting in the west quarry will occur intermittently over the year and will align with open pit blasting practices including only occurring during daytime.

Australian Standard *AS 2187.2-2006 Explosives – Storage and Use, Part 2: Use of Explosives* provides recommended limits for ground vibration and noise (airblast/overpressure) based on maintaining human comfort. These are:

1. 95% of airblast levels do not exceed 115 dB L_{Zpeak} in any calendar year, with a maximum of 120 dB L_{Zpeak}, when applied at any point within the notional boundary of any occupied rural dwelling.
2. 95% of vibration levels shall not exceed a peak component particle velocity of 5mm/s in any calendar year, with a maximum of 10 mm/s at the foundation of any dwelling.

We note that airblast and vibration levels for avoiding structural damage to buildings are significantly higher than these values.

AS 2187.2-2006 recognises that accurately estimating ground vibration and airblast levels is complex because the blasting process is highly non-linear and the variability of most rock types contributes to the difficulty in accurate predictions of the environmental outcomes. However, even with this variability, data obtained from other sites suggests that airblast and vibration levels for the Bendigo-Ophir project can comfortably comply as a result of the large separation distances (several kilometres) between blast sites and sensitive receivers.

By way of example, Figures 6 and 7 show the generic variation in peak sound pressure level and ground vibration with Effective Maximum Instantaneous Charge (MIC) per delay (kg), based on the prediction methodology from AS-2187.2. These graphs indicate that human comfort criteria discussed above are achieved over relatively short distances. For example, for a relatively large MIC of 660 kg, both the vibration and overpressure criteria are achieved at distances of less than approximately 1100 metres. The distances between the blasting locations and nearest dwellings are substantially greater than this and therefore we expect the criteria can be appropriately achieved.

Initial test blasts and monitoring will establish the appropriate blast design constraints for the site to ensure the appropriate limits can be achieved. Factors such as charge weight, depth and delay intervals can be adjusted to alter vibration and airblast overpressure.

Irrespective of compliance, blasting can be an emotive issue for residents and effective liaison between the site operator and residents represents good practice. We recommend that effective communication about blasting forms part of the proposed noise management plan for the site.

Figure 7: AS 2187 Blasting Noise Levels (dB L_{Zpeak}) [site exponent (a) of –1.45, and site constant (K_a) is of 10]

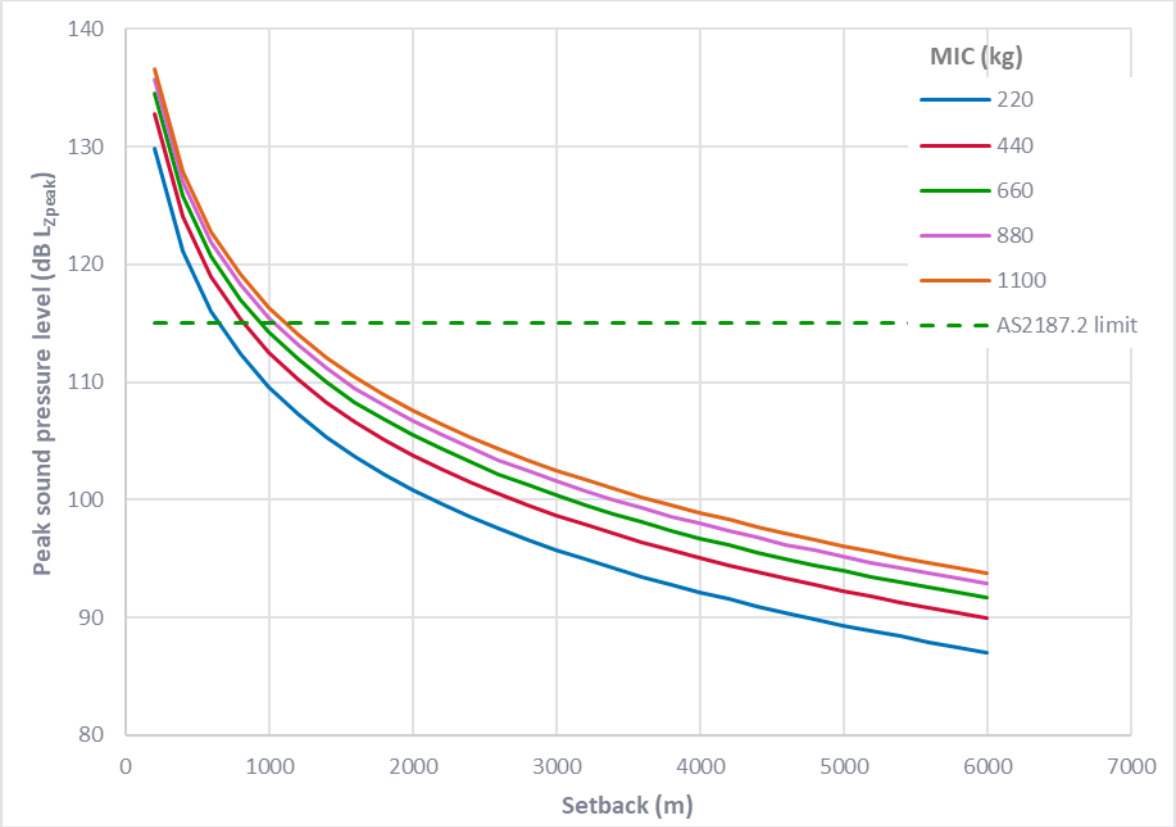
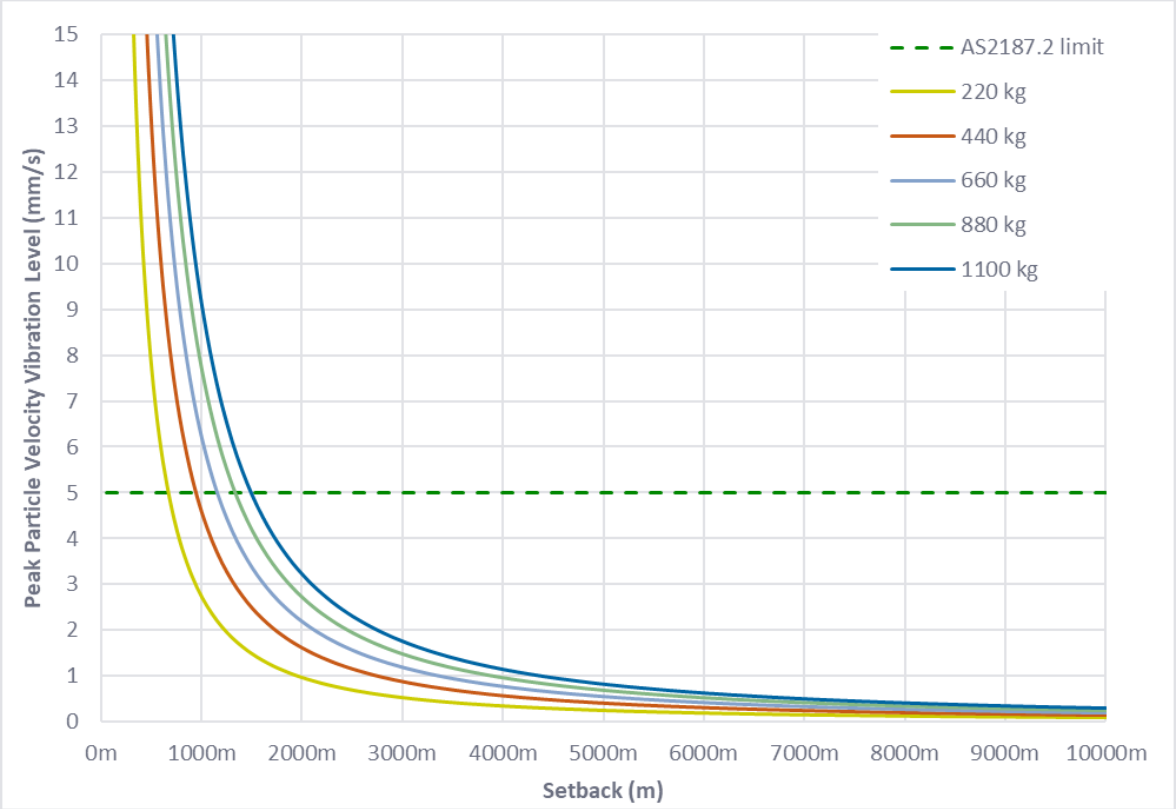


Figure 8: AS 2187 Blasting Vibration Levels (mm/s PPV) [assumed site constants K_g = 1500 and B = -1.5]



9.0 EFFECTS ON RECREATIONAL USERS

A Recreation Assessment has been prepared by Rob Greenaway and Associates which identifies several recreational activities in the vicinity of the site.

Four wheel drive enthusiasts and cyclists using the re-aligned Thomson Gorge Road will experience noise levels in the order of 50 dB L_{Aeq} along this road for the brief periods where there is direct line of sight to mining activity as they transition along the road. For most of the time, mining noise levels are likely to be lower than the self-noise generated by both the vehicles and cyclists which, in additional to the relatively short exposure to the noise, means that noise effects will be negligible for these recreational users.

10.0 ASSESSMENT OF NOISE EFFECTS

Marshall Day Acoustics has assessed the potential noise effects of Matakanui Gold Ltd's proposed Bendigo-Ophir Gold Mine Project in Central Otago. This assessment considers both construction and operational phases, identifying potential noise impacts on nearby sensitive receivers.

Noise from operations

We have evaluated noise effects from continuous operational activities, including open-pit mining, ore processing, blasting, haulage, and vehicle movements.

Key findings:

- Predicted operational noise levels comply and are substantially below the Central Otago District Plan (CODP) permitted activity noise limits of 55 dB L_{A10} for daytime and 40 dB L_{A10} for night-time at the nearest receiver located at 218 Thomson Gorge Road.
- We propose the project's noise limits are updated from L_{A10} to L_{Aeq} in line with current best practice. The day and night noise limits will become 55 and 40 dB L_{Aeq} respectively.
- Appropriate blasting noise (airblast) and vibration limits of 115 dB L_{Zpeak} and 5 mm/s PPV respectively are proposed for the 'human comfort' of nearest residents, based on published guidance. The large separation distances between the site and sensitive receivers mean that blasting activities can comfortably comply with these limits.

Overall, operational noise effects will be minimal in the context of a rural residential noise environment and what can be reasonably anticipated by the District Plan permitted activity noise limits.

Noise from Construction Phase

Construction activities will have a relatively short duration and include the formation of site roads, construction of the Ardgour Infrastructure Area and erection of the processing plant structure and equipment.

Key findings:

- All construction activities are predicted to comfortably comply with the applicable noise limits from New Zealand Standard NZS 6803: 1999 *Acoustics - Construction Noise*. The construction phase is expected to have no significant adverse noise effects, with all activities compliant with relevant standards, even under worst-case scenarios.
- Parts of the construction phase will require increased truck movements on local roads. Whilst vehicle movements are exempt from compliance with the District Plan noise limits, local residents will experience periods of increased traffic noise during the construction process which will be a change to the relatively infrequent traffic activity that currently exists. Most residents along Ardgour and Thomson Gorge Roads will experience daytime truck noise levels below 55 dB $L_{Aeq(1hr)}$. 213 Ardgour Road is closer to the road and will experience higher noise levels of approximately 60 dB $L_{Aeq(1hr)}$ during the busiest periods. Given the relatively short duration of the

construction phase and peak truck movements, we consider that truck noise effects will be reasonable.

11.0 RECOMMENDED CONSENT CONDITIONS

To ensure that noise from the activity is adequately controlled throughout the life of the consent, we recommend that the following noise and vibration related conditions are included.

These conditions contain noise limits that are broadly equivalent to the District Plan noise standards. We have proposed adopting the 2008 versions of NZS 6801 and NZS 6802 as these versions are considered industry best practice. The primary result of adopting these standards is the use of the L_{Aeq} noise metric.

1. Mining activities shall be conducted such that the following noise limits are not exceeded within the notional boundary of any dwelling:

   - Daytime 0700 to 2200hrs: 55 dB $L_{Aeq(15\ min)}$
   - Night-time 2200 to 0700hrs: 40 dB $L_{Aeq(15\ min)}$ and 75 dB L_{AFmax}

   "Notional boundary" means a line 20 metres from the façade of any building used for residential activity, or the legal boundary of the site on which the building is located where the boundary is closer to the building than 20 metres.

   Noise shall be measured and assessed using New Zealand Standard NZS 6801:2008 *"Acoustics - Measurement of environmental sound"* and NZS 6802:2008 *"Acoustics - Environmental Noise"*, respectively.

2. Blasting activities must be measured and assessed in accordance with Appendix J of Australian Standard AS 2187-2:2006 *Explosives – Storage and use Part 2: Use of explosives*.

   - Blasting must be managed to ensure that in any calendar year, 95% of airblast levels do not exceed 115 dB L_{Zpeak}, with a maximum of 120 dB L_{Zpeak}, when applied at any point within the notional boundary of any rural dwelling.
   - Blasting vibration shall not exceed a peak component particle velocity of 5mm/s for 95% in any calendar year, with a maximum of 10 mm/s at the foundation of any dwelling.

3. Construction activities, such as the formation of site roads, building platforms and structures and earth bunds for noise control purposes shall be planned and managed in accordance with New Zealand Standard NZS 6803:1999*"Acoustics - Construction Noise*. For the avoidance of doubt, the removal of overburden shall not be considered as construction activity.

4. Mining operations shall utilise the best practicable option to minimise noise at all times. This includes the requirement that site vehicles shall not be fitted with tonal or beeper reversing alarms, regular replacement of worn parts, maintenance of mufflers, lubrication of all moving parts to avoid speaks and squeals, and appropriate operation of all equipment.

5. The consent holder shall prepare a Noise and Vibration Management Plan (NVMP) to control day-to-day emissions from the site during construction, operational and blasting activities. As a minimum, the NVMP shall include:

   - The person(s) responsible for implementing the NVMP
   - Applicable noise conditions relating to noise and vibration
   - Specific procedures for informing neighbours of when blasting will occur
   - Procedures for noise and vibration monitoring
   - Training of staff relating to how to minimise noise and vibration
   - Maintenance schedule for site access road surfaces to avoid excessive noise and vibration

- Activity risk analysis for noise and vibration generation
- Procedure for handling complaints.

We have prepared a draft NVMP which is attached as Appendix D.

With respect to proposed Condition 4, broadband reversing alarms or strobe lights are suitable alternatives if a reversing alarm is required.

APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A sound that is unwanted by, or distracting to, the receiver.
Masking Noise	Intentional background noise that is not disturbing, but due to its presence causes other unwanted noises to be less intelligible, noticeable and distracting.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
SPL or L_P	Sound Pressure Level A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 µPa RMS) and expressed in decibels.
SWL or L_W	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 µPa i.e. dB = 20 x log(P/Pr)
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq\ (t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{A90}	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
L_{A10}	The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
SEL or L_{AE}	Sound Exposure Level The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of environmental sound"*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise"*
NZS 6803:1999	New Zealand Standard NZS 6803: 1999 *"Acoustics - Construction Noise"*

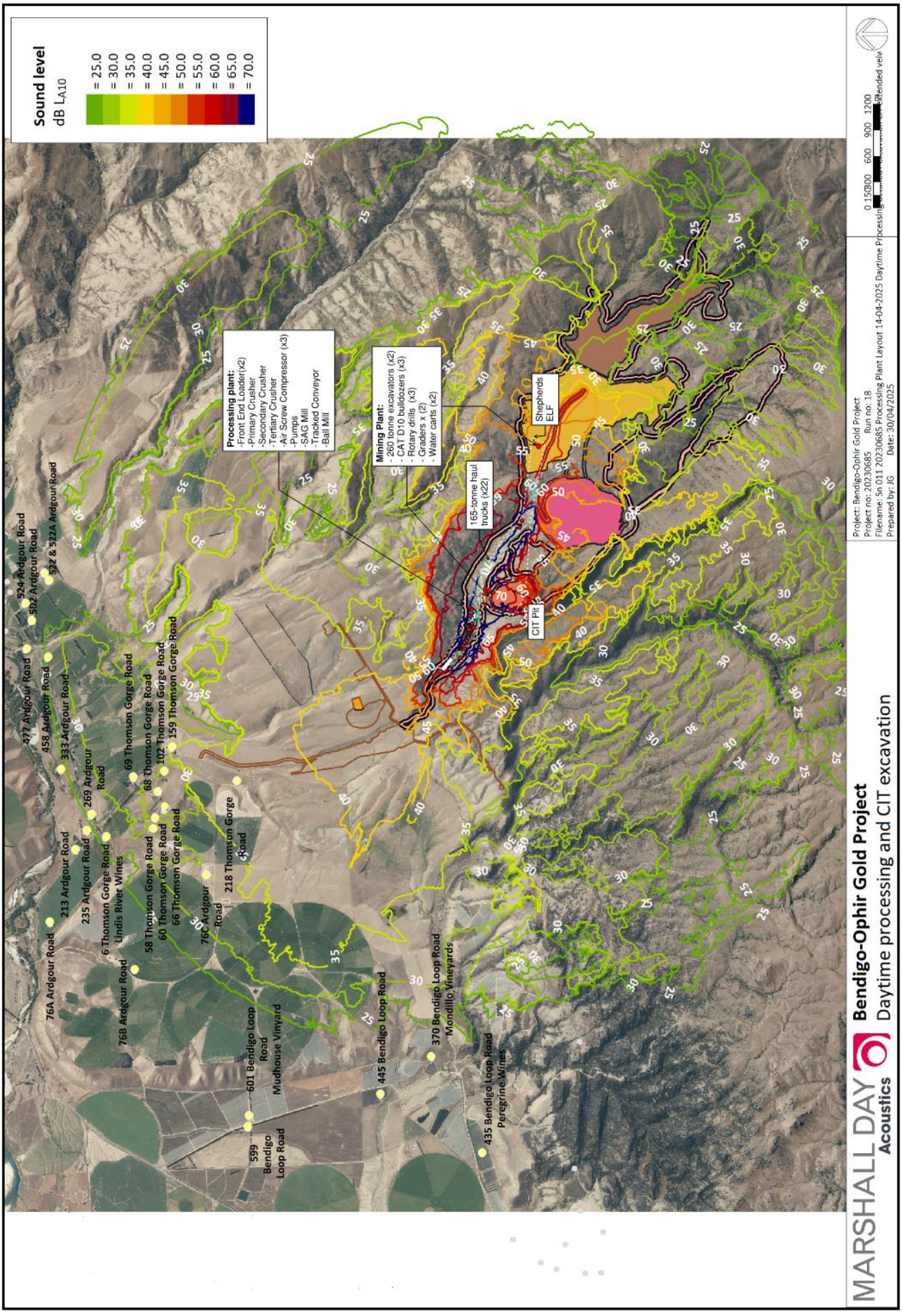
APPENDIX B NOISE SURVEY DETAILS

The key details of the noise survey are as follows:

Date:	09 September 2024 07:40 AM to 10 September 2024 10:40 AM
Personnel:	Anton J. Wolf, Marshall Day Acoustics
Weather:	Average temperature 8°C, cloudy sky, ~2 m/s wind from the North
Instrumentation:	01dB CUBE Noise Monitoring Terminal, serial 11191, calibration due 22/06/2025 NTi XL2-TA analyser, serial A2A-20483-E0, calibration due 04/04/2026 Brüel & Kjær Type 4231 calibrator, serial 1882775, calibration due 22/02/2025
Calibration:	Field calibration of the equipment was carried out before measurements, and the calibration checked after measurements. Observed change less than 0.1 dB.

APPENDIX C NOISE CONTOUR PLOT

(following page)



APPENDIX D NOISE AND VIBRATION MANAGEMENT PLAN

(following pages)