



MARSHALL DAY
Acoustics



**SANDY POINT ALLUVIAL GOLD MINE
NOISE ASSESSMENT**

Rp 001 20250974 | 5 December 2025

Project: **SANDY POINT ALLUVIAL GOLD MINE**

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Report No.: **Rp 001 20250974**

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SUMMARY

This report provides a noise assessment of the proposed mining operations at the Sandy Point Alluvial Gold Mine, Queensbury, prepared for Terramark Ltd. Our assessment evaluates potential noise levels at surrounding receivers as mining activities progress from the south to the north of the site.

We have assessed the predicted noise levels against the relevant noise limits of the operative Central Otago District Plan (CODP).

We predicted noise using SoundPLAN modelling in accordance with ISO 9613-2:1996, based on measured sound power levels from comparable applicant's equipment located at Inangahua, West Coast including excavators, dozers, dump trucks, a floating screen, and dewatering pumps.

Three operational scenarios were assessed with activity located at the south, centre and north of the site, in order to calculate noise levels from the worst-case proximities for all surrounding receivers.

Our analysis indicates:

- Daytime ambient noise levels typically ranged from 46–52 dB L_{Aeq} under normal and calm weather conditions. The existing noise environment is characterized by intermittent farm operations (machinery and farm animals), natural sounds (such as wind in trees and grass, birds, etc), and occasional distant road traffic.
- Predicted noise levels at the notional boundary of nearest dwellings are below the daytime noise limit in the CODP (55 dB L_{A10}) and the World Health Organization (WHO) guideline levels.
- Noise modelling indicates that scenario 2 (mining in the central area) has the potential to generate the highest noise levels at nearby receivers - up to 53 dB L_{A10} at 13 Pukerangi Drive. We predict that Scenarios 1 and 3 would generate lower noise levels at the nearby receivers.
- We consider the potential noise effects from the proposed activity to be acceptable at all surrounding noise sensitive receivers.

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1.0 INTRODUCTION

Marshall Day Acoustics has been engaged by Terramark Limited to assess operational noise from the proposed Sandy Point Alluvial Gold Mine, Queensbury.

Our assessment takes into consideration:

- Description of the proposed activity
- Applicable local noise standards and other relevant criteria
- The local noise environment
- Predicted noise levels from the proposed site based on Applicant's equipment
- Comparison of the predicted levels against the District Plan limits
- Noise assessment

A glossary of acoustical terminology used in this report is provided for reference in Appendix A.

2.0 PROPOSED ACTIVITY AND SURROUNDING ENVIRONMENT

2.1 Proposed activity

Awa Koura Mining Limited proposes to undertake alluvial gold mining for up to three years on farmland located on the Clutha River/Mata-Au terraces, between Luggate and Queensbury, Central Otago.

Mining will be undertaken progressively over an active area of approximately 2 hectares, with up to 4 hectares of peripheral disturbance at any one time. Works will occur Monday to Friday, up to 10 hours per day, using the following key plant and equipment:

- 6-foot floating wash plant (trommel/screen) – fitted with a noise-attenuating shroud
- Excavators (20–50 tonnes), dump trucks, bulldozer, and ancillary pumps
- Depot area with fuel storage ($\leq 10,000$ L), maintenance zone, and site office

Mining will progress northwards in a zigzag pattern, with concurrent rehabilitation following behind.

2.2 Surrounding environment

The site and most of the surrounding properties are located within the Rural Resource Area of the CODP and currently operates as a working beef and cattle farm. It occupies a low river terrace adjoining the Clutha River/Mata-Au, characterised by gently undulating terrain underlain by Quaternary gold-bearing gravels typical of the Clutha valley terraces.

The site is bounded to the north by the Autaia Scenic Reserve administered by the Department of Conservation (DoC) and to the east by the Clutha River/Mata-Au and its associated DoC marginal strip. To the south and west, the property adjoins pastoral farmland and emerging rural lifestyle blocks.

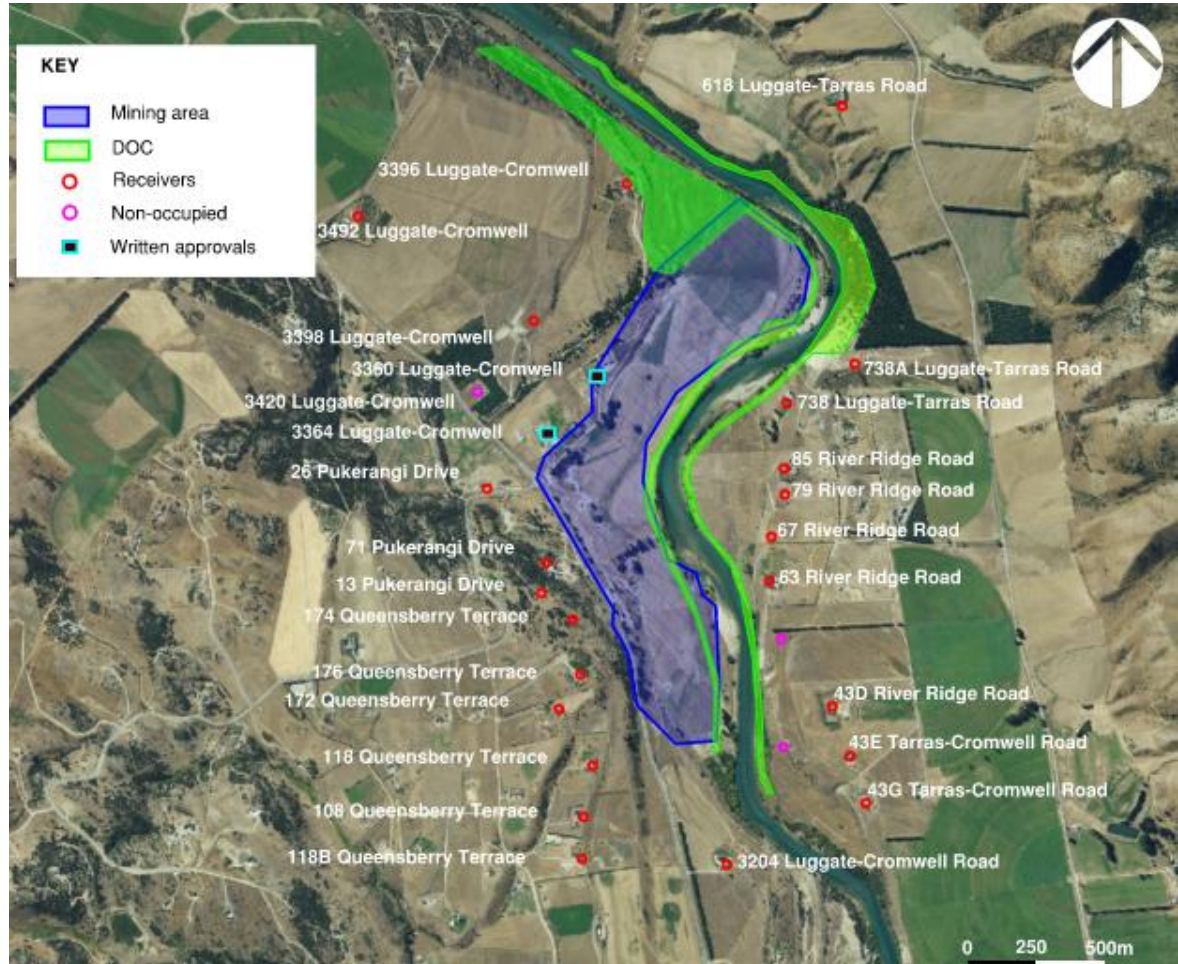
2.3 Nearest receivers have provided written approvals

The closest residential receivers are the Landreth and Hardaker dwellings, both of whom have provided written approval to the proposal.

2.4 Surrounding receivers are located to the east and west

The nearest residential receivers marked as red circles in Figure 1 are located to the east and west of the mining area. Site boundaries of non-occupied properties are marked with purple circles

Figure 1: Aerial view of mining area and surrounding environment



3.0 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.

3.1 The daytime District Plan noise limit is 55 dB L_{A10}

The proposed mine site and surrounding land are zoned *Rural Settlements Resource Area (RU)* under the CODP. The applicable noise limits are set out in Rule 4.7.6.E and are summarised in Table 1.

Table 1. 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)
<i>Rural Settlements Resource Area (RU)</i>	55 dB L _{A10}	40 dB L _{A10} 70 dB L _{AFmax}
At the notional boundary* of any dwelling, rehome or hospital;		

* 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*

We note that the Rule references the now outdated 'L_{A10}' metric. Current best practice, as described by the most recent versions of NZS 6801¹ and NZS 6802² is to use the equivalent continuous sound pressure levels metric or L_{Aeq}.

3.2 Properties to the north of the site are in the Queenstown Lakes District

The properties to the north of the proposed mine are located in the Queenstown Lakes District. Therefore, noise received at these properties must be assessed against the noise rules contained in the proposed Queenstown Lakes District Plan (PQDP).

Due to the significant distance from the mining operations (approximately 500m), we predict that noise levels from mining activity will be below the QLDP daytime noise limit of 50 dB L_{Aeq} at these receivers.

3.3 NZS 6802:2008 includes recommended upper noise limits

The latest version of New Zealand environmental noise assessment standard (NZS 6802:2008 *Acoustics - Environmental Noise*) refers to the following guideline noise limits:

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

The Standard states that these guideline noise limits offer reasonable protection of health and amenity where the use of land is for residential purposes. The standard also notes that local authorities may choose to set more stringent noise limits to afford greater protection to noise sensitive activities.

The limits should generally not be exceeded at any point within the boundary of a residential site. However, NZS 6802 also states that "where activities to be protected are in a rural area, the appropriate measurement location will generally be at any point within the notional boundary of any

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

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

rural dwelling...". This confirms that it is not typical to set these limits at a site boundary where there are no noise sensitive receivers.

3.4 World Health Organisation provides guidance for the potential onset of health effects

World Health Organization (WHO) Guideline Values for Community Noise (Berglund and Lindvall, 1999) give guidelines for environmental noise exposure. For community or environmental noise, the critical health effects (those effects which occur at the lowest exposure levels) are: sleep disturbance; annoyance (slight, moderate, high); and speech interference/communication disturbance.

The WHO Guideline Values for these three critical health effects for community or environmental noise are presented in Table 2. These guideline values are the exposure levels that represent the onset of the effect for the general population. That is, at these noise levels, critical health effects only begin to appear in a small number of vulnerable or sensitive groups.

Table 2: WHO guideline values for the critical health effects of community or environmental noise

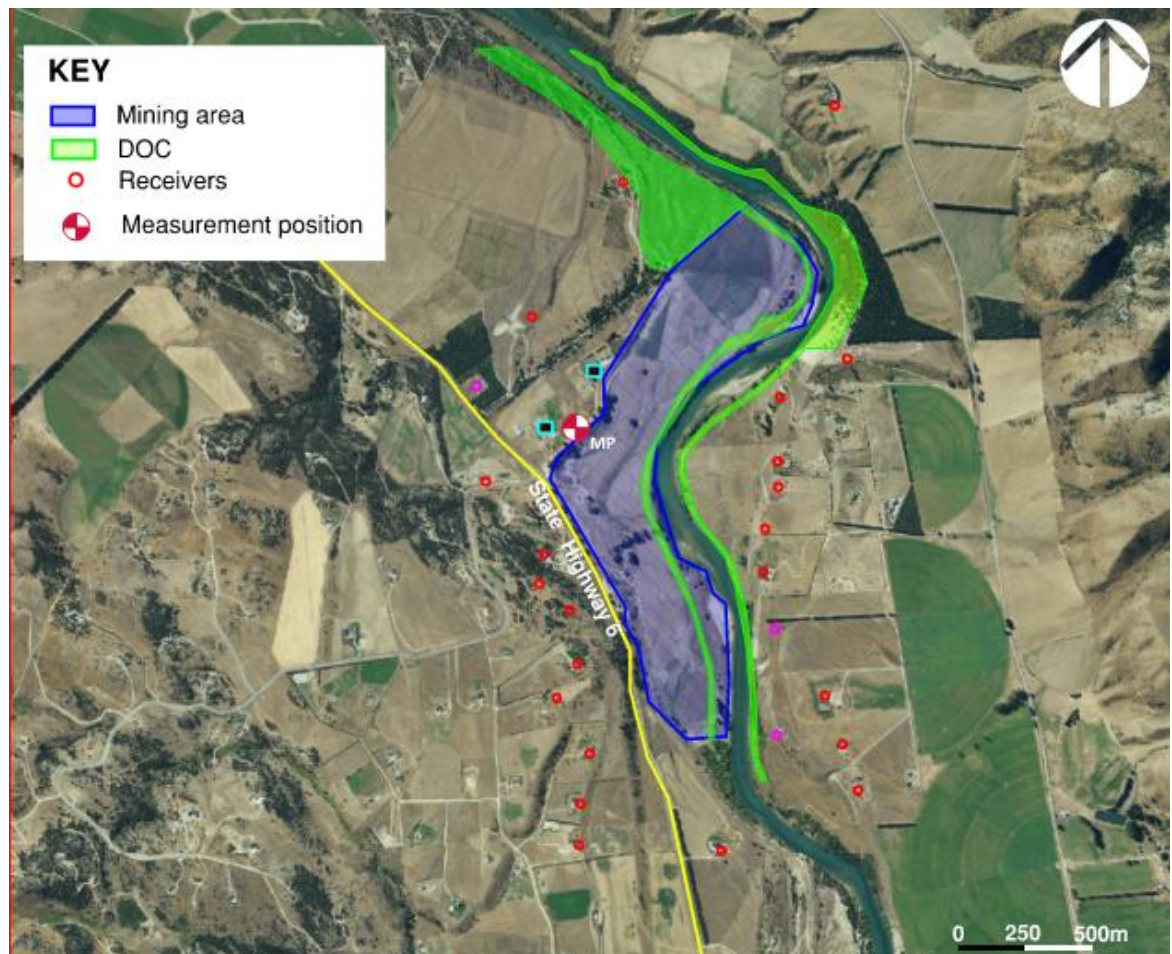
Specific Environment	Critical health effect(s)	dB LAeq	Time base (hours)	dB LAfmax
Outdoor living area	Serious annoyance, daytime & evening	55	16	-
	Moderate annoyance, daytime & evening	50	16	-
Dwellings, indoors Inside bedrooms	Speech Intelligibility and moderate annoyance, daytime & evening	35	16	-
	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values) night-time	45	8	60

4.0 EXISTING AMBIENT NOISE ENVIRONMENT

In order to characterise the existing ambient noise environment at the nearest dwellings, unattended noise monitoring was undertaken from 20 to 27 November 2025. Measurements were collected at a representative location of the nearest residential properties to the west (MP) identified in Figure 2, selected to capture typical acoustic conditions at nearby residential receivers.

The dwellings located to the other side of the river at a greater distance from the SH6 than the measurement position. Road traffic noise from SH6 influenced the measured noise levels. Therefore, ambient noise levels will potentially be lower at receivers on the eastern side of the Clutha River/Mata-Au.

Figure 2: Noise monitoring location



Noise measurements were taken in accordance with New Zealand Standard NZS 6801:2008 “Acoustics – Measurement of environmental sound”. The measurement durations were 15 minutes.

Details of our survey, including equipment and calibration details can be found in Appendix B.

Table 3 summarises the daily average noise levels recorded during the daytime assessment period (0700–2200 hrs).

Table 3: Summary of existing daytime ambient noise measurements

Date	Average noise levels per day between 0700-2200 hrs		
	dB L _{Aeq}	dB L _{A90}	dB L _{AFmax}
20 -11-2025	52	48	67
21-11- 2025	48	44	61
22-11- 2025	46	42	59
23-11- 2025	50	42	77
24-11-2025*	52	44	74
25-11-2025*	55	41	80
26-11-2025*	57	41	80

**Elevated wind and gust conditions*

The measured daytime levels ranged from 46–57 dB L_{Aeq} (15 hour). The upper end of this range (24–26 November) coincided with elevated wind and gusty conditions, which are known to increase broadband noise from vegetation and microphone wind-induced noise despite windshields. Excluding these weather-affected days, daytime ambient levels ranged from 46-52 dB L_{Aeq} (15 hour).

The noise levels are primarily influenced by intermittent farm-related activity (animals, light machinery), natural sound sources, and occasional distant road traffic. No persistent tonal, impulsive, or other special audible characteristics were identified in the baseline environment.

The L_{A90} parameter provides an indication of the stable background sound level that dominates 90% of the time. Across the monitoring period, the background noise level ranged from 41–48 dB L_{A90}, which is consistent with a busy New Zealand rural acoustic environment.

The recorded L_{AFmax} values ranged from 59–80 dB, reflecting short-duration events such as isolated farm machinery movements, horns, animal calls, or occasional wind gusts. These events were infrequent and do not define the underlying ambient environment; however, they demonstrate the presence of sporadic high-level rural noise typical of agricultural operations.

5.0 PREDICTED NOISE LEVELS

5.1 Prediction Methodology

We have used the noise modelling package SoundPLAN to predict noise levels. 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 consider a range of factors affecting the sound propagation including:

- The magnitude of the noise source in terms of sound power
- The distance between source and receiver
- The presence of obstacles such as screens or barriers in the propagation path
- The presence of reflecting surfaces
- The hardness of the ground between the source and receiver
- Attenuation due to atmospheric absorption, and
- Meteorological effects such as wind gradient, temperature gradient and humidity.

In ISO 9613, the effect of meteorological conditions is significantly simplified by calculating the average downwind sound pressure level. The Standard adopts the conservative approach of assuming that wind is always blowing from the noise sources to the receiver locations. The equations and calculations also hold for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights

5.2 We have used noise data from the Applicant’s equipment

Input noise source data in our model is based on measurements collected from equivalent equipment located at Walkers Flat Gold Mine, Inangahua. We understand the same equipment will be used for the proposed mining operation. Sound power levels used for our calculations are summarised in Table 4.

Table 4: Sound power levels of proposed plant

Item	Plant and equipment	dB L _w (L ₁₀ basis) ¹
1	55 tonne excavator (Hitachi ZX360) + Floating screen	116
2	De-watering pump	107
3	50 tonne excavator (Hyundai XE500)	111
4	30 tonne Excavator	106
5	Dump truck 3 movements per 15 min	88 L _{Aeq} at 10 metres
6	23 tonne Bulldozer (Komatsu D85A-18)	106

¹ Measure L_{A10} levels for mining sources were 1.5-2 decibels above the L_{Aeq} levels

5.3 We modelled mining activity at three locations on the site

We have assessed three operational scenarios with the proposed mining activity at different parts of the site. In all scenarios, the floating screen, associated excavator, and pumps are located within a 7m deep pit, while remaining plant operates at ground level. The locations of activity used in our assessment were selected due to their proximity to neighbouring residences. We consider that these represent the worst-case assessment locations i.e. locations that would generate the highest noise levels at nearby receivers.

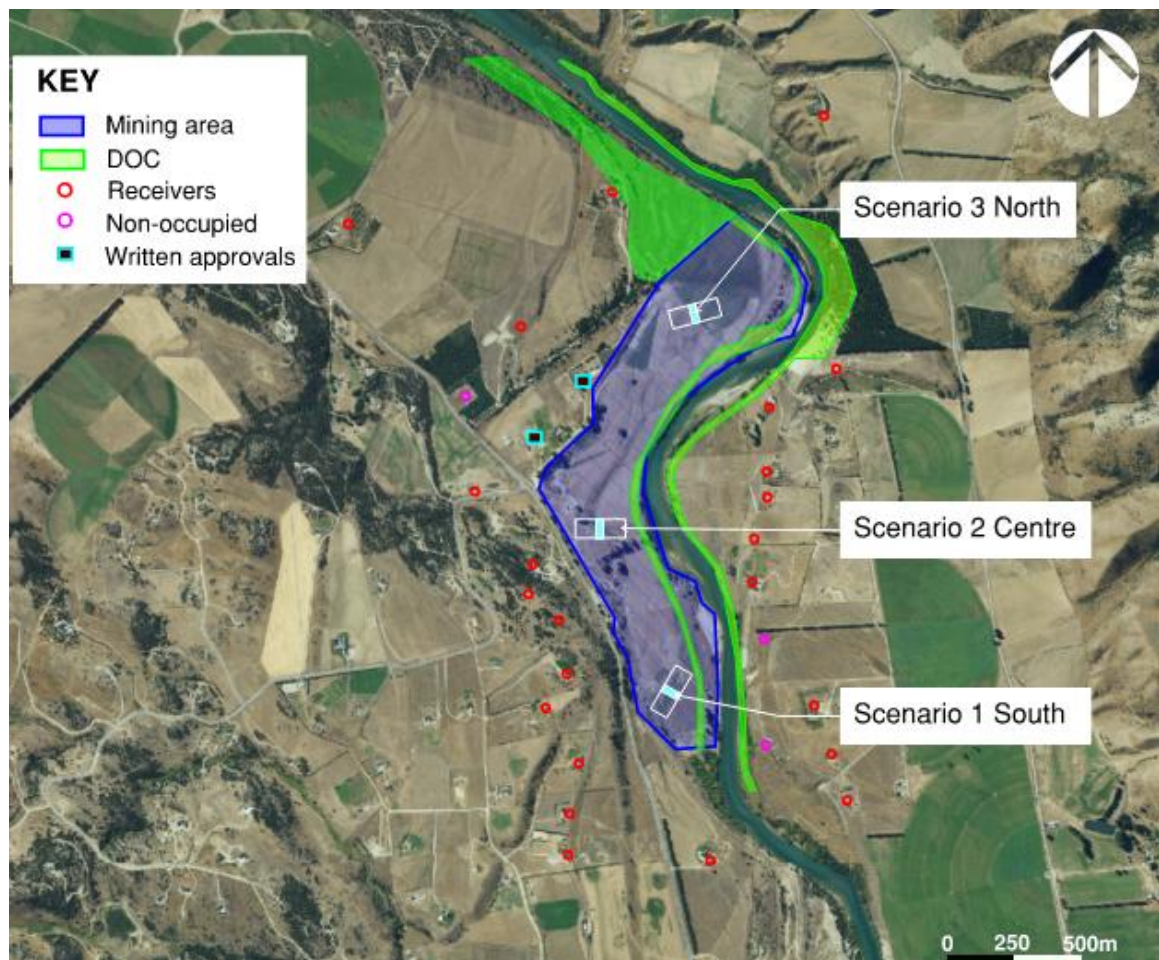
Our assessment assumes simultaneous operation of all plant and equipment fitted with broadband reversing alarms. Therefore, no special audible characteristic (SAC) penalty has been applied.

A summary of the assessed scenarios is provided in Table 5 and the corresponding equipment locations are shown in Table 5 below.

Table 5: Summary of assumed scenarios

Scenario	Operational plant	Mining location	Activity description
Daytime (0700-2000) Monday to Friday			
Scenario 1	-2 x 55 tonne Excavator -1 x Floating screen -2 x 30 tonne Dump trucks -1 x 23 tonne Dozer -3 x 30 tonne Excavator -3 x Dewatering Pumps	South	Overburden and extraction
Scenario 2	As above	Centre	Overburden and extraction
Scenario 3	As above	North	Overburden and extraction

Figure 3: Aerial view of modelling assessed scenarios



5.4 We predict that noise can comply with relevant noise limits at all sensitive receivers

Predicted noise levels for all operational scenarios are summarised in Table 6 for CODC receivers (with L_{A10} noise limit) and Table 7 for QLDC receivers (with L_{Aeq} noise limit). Noise contour maps are provided in Appendix C. The noise contour maps are based on L_{A10} levels which are approximately two decibels higher than L_{Aeq} levels for the proposed mining sources.

Table 6: Predicted notional boundary noise levels (L_{A10}) at nearest dwellings

Receiver		Predicted noise levels dB L_{A10} at notional boundary			
		Scenario 1 South	Scenario 2 Centre	Scenario 3 North	Noise Limit 55 dB L_{A10}
1	13 Pukerangi Drive	36	53	37	✓
2	26 Pukerangi Drive	34	43	36	✓
3	43D River Ridge Road	46	36	31	✓
4	43E River Ridge Road	42	34	30	✓
5	43G River Ridge Road	45	31	26	✓
6	63 River Ridge Road	49	46	34	✓
7	67 River Ridge Road	45	47	37	✓
8	71 Pukerangi Drive	33	49	36	✓
9	79 River Ridge Road	39	47	44	✓
10	85 River Ridge Road	38	47	45	✓
11	118 Queensberry Terrace	41	31	29	✓
12	118B Queensberry Terrace	37	31	28	✓
13	170 Queensberry Terrace	43	28	28	✓
14	172 Queensberry Terrace	45	31	30	✓
15	174 Queensberry Terrace	52	45	36	✓
18	738 Luggate-Tarras Road	34	46	48	✓
19	738A Luggate-Tarras Road	35	41	29	✓

Table 7: Predicted notional boundary noise levels (L_{Aeq}) at nearest dwellings (QLDC)

Receiver		Predicted noise levels dB L_{Aeq} at notional boundary			
		Scenario 1 South	Scenario 2 Centre	Scenario 3 North	Noise Limit 50 dB L_{Aeq}
20	3204 Luggate-Cromwell Road*	40	32	30	✓
21	3360 Luggate-Cromwell Road*	36	47	44	✓
24	3398 Luggate-Cromwell Road*	33	42	39	✓
25	3420 Luggate-Cromwell Road*	31	38	35	✓
26	618 Luggate-Tarras Road*	25	29	36	✓

The predicted noise levels for daytime activity on the site are below 55 dB L_{A10} at the notional boundaries of the nearest dwellings in the CODC and below 50 dB L_{Aeq} at the notional boundaries of the nearest dwellings in the QLDC.

The highest predicted noise level at a receiver occurs when mining operations are located in the central area. Due to the distance to dwellings, we predict that activity at north and south of the site will generate lower noise levels at nearby receivers.

6.0 NOISE ASSESSMENT

The predicted noise levels from three scenarios representing activity at different locations on the site comply with the daytime noise limit in both CODP and QLDP at all relevant receivers.

Maximum predicted levels are 53 dB L_{A10} at 13 Pukerangi Drive and 52 dB L_{A10} at 174 Queensbury Terrace when mining occurs in the central and southern areas respectively. However, these predicted noise levels are based on the closest mining activity, so noise levels will be significantly lower for the majority of the proposed 3 year mining period.

We conducted ambient noise monitoring near the dwellings to the west of the site. The existing ambient noise environment at this location is dominated by rural sounds and distant traffic along State Highway 6. The monitoring position is around 250m from SH6.

Due to the increased distance to the dwellings east of the site, across the Clutha River, influence of SH6 will be less at these locations. However, these dwellings are located closer to SH8A. Regardless, it is possible that the existing ambient noise levels will be lower at these dwellings. However, we also predict that noise levels will be less than 50 dB L_{A10} at all of these dwellings.

While noise from the mining activity is likely to be audible when operating near the closest receivers, we consider noise levels will be reasonable in the context of a 3 year mining consent.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
dB	<u>Decibel</u> The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of $P_r=20 \mu\text{Pa}$ i.e. $\text{dB} = 20 \times \log(P/P_r)$
dB(A)	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
$L_{Aeq}(t)$	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_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
Noise	A sound that is unwanted by, or distracting to, the receiver.
SPL or L_p	<u>Sound Pressure Level</u> A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing ($20 \mu\text{Pa}$ RMS) and expressed in decibels.
Special audible characteristics	Distinctive characteristics of a sound that make it more likely to cause annoyance or disturbance. A penalty of up to 5 decibels can be applied when assessing sounds with SAC Examples are tonality – a hum or a whine) and impulsiveness – bangs or thumps.

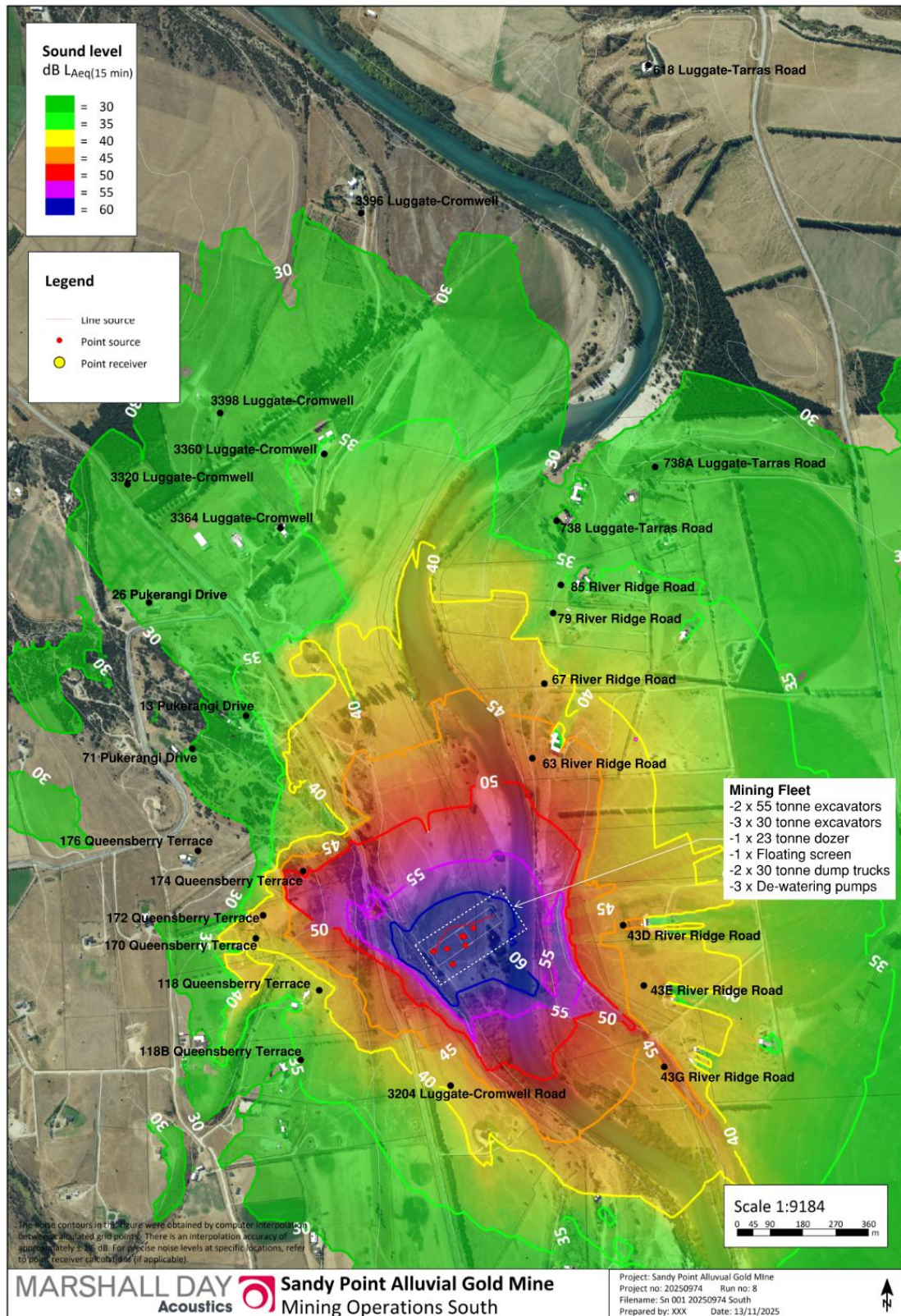
APPENDIX B NOISE SURVEY DETAILS

The key details of the noise survey are as follows:

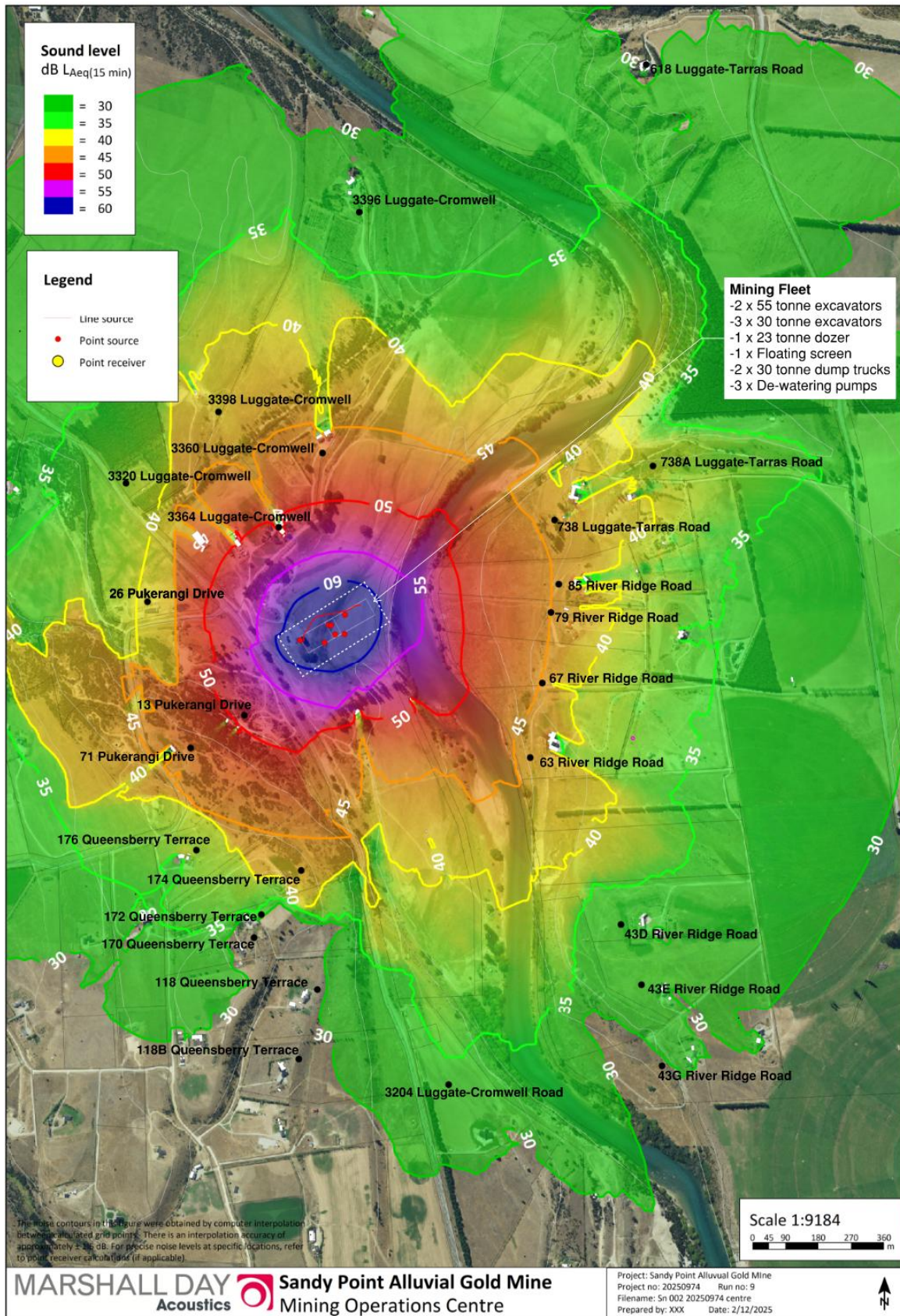
Date:	20 to 26 November 2025
Personnel:	Rob Hay, Marshall Day Acoustics
Weather:	Calm conditions from 21-24 November, 25-27 November wind, gust and rain.
Instrumentation:	NTi XL2-TA analyser, serial A2A-20483-E0, calibration due 04/04/2026 Brüel & Kjær Type 4231 calibrator, serial 1882775, calibration due 24/02/2026
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 CONTOURS

C1 Scenario 1 South



C2 Scenario 2 Centre



C3 Scenario 3 North

