WINSTONE AGGREGATES

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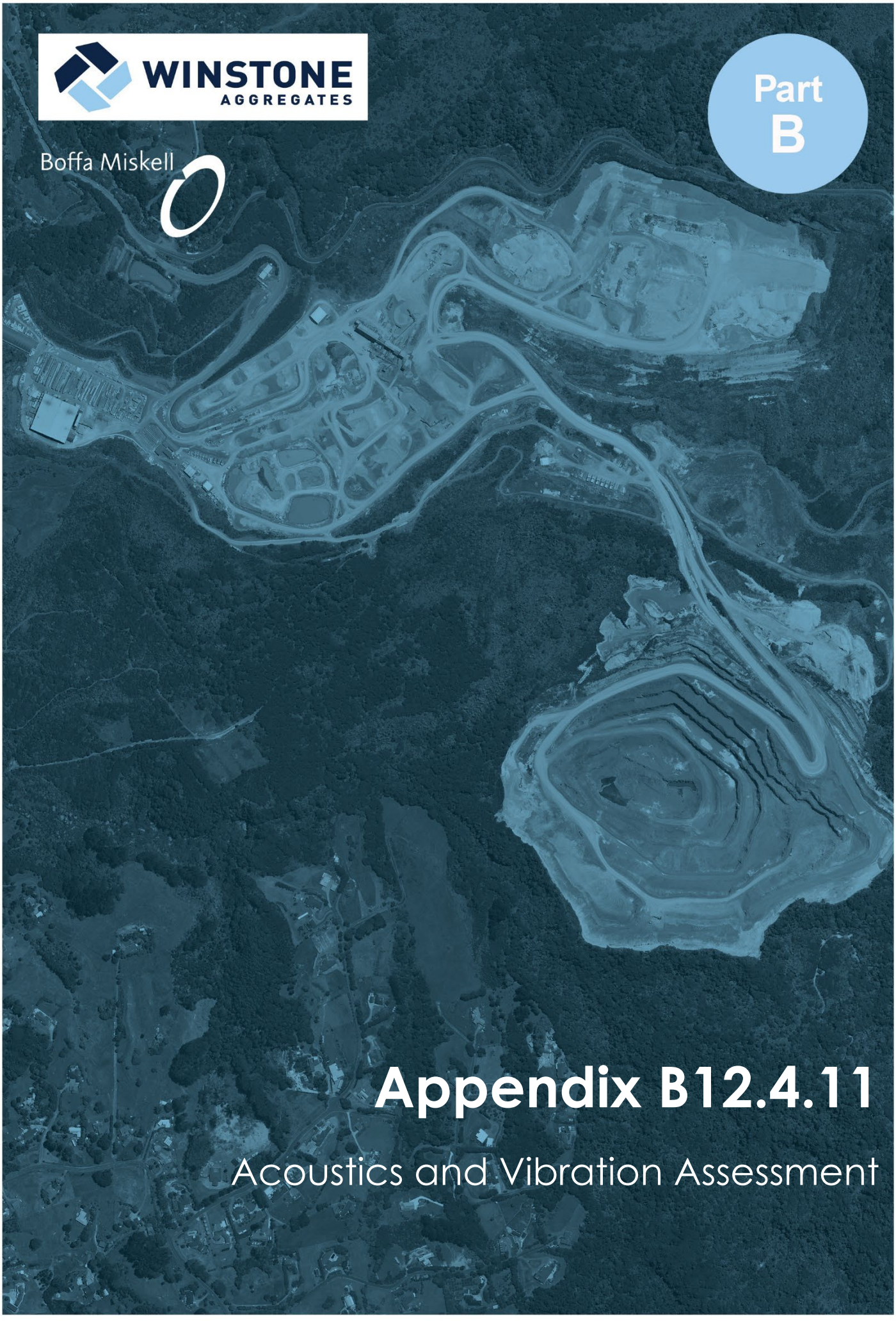
Part B



Appendix B12.4.11

Acoustics and Vibration Assessment

Styles Group
Acoustics & Vibration Consultants

ACOUSTICS AND VIBRATION ASSESSMENT

HUNUA QUARRY DEVELOPMENT PROJECT
HUNUA QUARRY

PREPARED FOR

Winstone Aggregates

DATE

23 March 2026

Assessment prepared by Styles Group for Winstone Aggregates.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	3/02/26	Progress draft	Draft	Jamie Exeter, MASNZ Principal Styles Group	Jon Styles, MASNZ Director and Principal Styles Group
2	23/02/26	90% draft	Draft		
3	23/03/26	Final	Final		

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Appendices

Executive summary

Winstone Aggregates has engaged Styles Group to assess the potential noise and vibration effects of the proposed expansion of Hunua Quarry.

This report has been prepared to accompany an application under the Fast-track Approvals Act 2024 to develop the existing Symonds Hill Pit within Hunua Quarry.

We have disregarded any noise and vibration effects on the following sites, for which written approval to the application has been provided: 369, 397, 411, 480-486, and 490 Hunua Road, 105, 106, 108, 115, 118, 119, and 195 Judge Richardson Drive, and 161, 163, 165, 167, 180, 193, and 255 Middleton Road.

Our assessment is based on site and plant specific noise measurements, information provided by Winstone Aggregates, the existing environment, and the relevant Auckland Unitary Plan standards.

The proposed activity will be undertaken within two zones under the Auckland Unitary Plan: The *Special Purpose – Quarry Zone* (where the existing activity takes place); and the *Rural – Mixed Rural Zone*. The two zones apply different noise limits at different assessment locations for the proposed activities.

We have identified all relevant construction and operational noise sources associated with the proposed activity and calculated the potential noise levels at the neighbouring sites using noise modelling software. Our calculations and assessments have identified that construction and operational noise from the proposed activity will comply with all relevant noise standards of the Auckland Unitary Plan, with the following exceptions:

- H28.6.2.1: The operational noise limits under this standard cannot be complied with because the proposed activities will be undertaken at and beyond the relevant assessment locations. Additionally, it would be impracticable to monitor compliance where different noise limits apply to activities as they cross back and forth between the two zones.
- H28.6.2.2: Deviation from this blasting noise standard is required to clarify ambiguities around monitoring and assessment and to adopt industry best practice.
- E25.6.31.(1): Infringement of the permitted blasting noise standard by activities in the Rural – Mixed Rural Zone when assessed at the boundaries of properties where written approval to the application has been provided.

We have recommended conditions to cover the existing and proposed activities at Hunua Quarry. These would be adopted in place of H28.6.2.1 and H28.6.2.2. Adopting the recommended conditions will not result in any increase in noise effects on any neighbouring noise sensitive site. They will instead provide better controls for noise management that are clear, enforceable, and more certain for both the neighbouring residents and Hunua Quarry. They will ensure that noise effects do not exceed a reasonable level at all relevant notional

boundaries, whereas the existing noise limits under Chapter H28 only apply at the notional boundaries of dwellings that existed at 1 January 2001. Overall, the proposed conditions provide better controls for the surrounding residents in terms of potential noise effects.

We have recommended a condition to require an Operational Noise and Vibration Management Plan for the expanded quarry. The plan will set out all mitigation measures and restrictions required to ensure that the relevant noise and vibration limits are complied with. It will also include procedures for undertaking noise and vibration measurements, communicating with neighbours, managing any noise complaints, and making updates to adapt to changes over the life of the quarry such as new site vehicles and machinery.

Construction noise will be audible at the nearest notional boundaries when works are undertaken in the closest parts of the site. At other times, construction noise will range from inaudible to just perceptible. Construction noise will comply with the relevant Auckland Unitary Plan limits by a considerable margin and is not expected to cause unreasonable noise effects. Construction vibration will also comply with the relevant AUP limits and is unlikely to be perceptible within any neighbouring dwelling.

Operational noise will comply with our recommended limits, which are slightly more stringent than the Auckland Unitary Plan noise limits under Chapter H28 and apply at all relevant notional boundaries in the rural zone, not just at sites where dwellings were constructed by 1 January 2001.

Adopting our recommendations will ensure that operational noise and vibration does not cause unreasonable annoyance or disruption during the day or sleep disturbance at night at any existing or future rural zone sites.

We consider overall that noise and vibration emissions from the proposed activity will not exceed a reasonable level provided that our recommended conditions are adopted.

Report release and reliance

Styles Group has prepared this report on the instructions of our client and in accordance with the agreed scope of work.

This report can be relied upon by an Expert Panel and relevant administering agencies for the purposes of assessing an application under the Fast-track Approvals Act 2024.

Styles Group has exercised due care in preparing this report but does not accept liability for any use of the report beyond its intended purpose. Information that has been supplied by the client or obtained from external sources is identified in this report and has been assumed to be accurate unless otherwise stated.

1.0 Introduction

Winstone Aggregates (**Winstone**), a division of Fletcher Concrete and Infrastructure Limited (**FCIL**), has engaged Styles Group to assess the potential noise and vibration effects of a proposal to expand Hunua Quarry at 489 Hunua Road, Hunua, Auckland (the **Site**).

The proposal involves the expansion of the existing quarry to increase annual production to a peak of 5.4 million tonnes of aggregate and enabling the continued extraction of aggregate for a further 80 years (the **Project**).

Winstone is seeking approval to the Project under the Fast-Track Approvals Act 2024 (**FTAA**). The Hunua Quarry Development is a Listed Project in Schedule 2 of the FTAA, reflecting its regional and national significance. Through the approval process, Winstone propose to update the consent conditions and quarry management plans applying to the Site to incorporate the changes and enable greater operational efficiency.

The purpose of this report and information on its preparation are set out below in Sections 1.1 to 1.3. A glossary of acoustics terms is included as Appendix A.

1.1 Purpose of report

This technical report has been prepared to accompany the application under the FTAA. Its purpose is to:

- identify the construction and operational noise and vibration sources associated with the Project and the noise and vibration levels at the neighbouring sites
- identify whether consent is needed for any infringements of the relevant AUP noise and vibration standards
- describe the potential noise and vibration effects of the Project in the context of the existing environment, the relevant AUP standards, and s16 of the Resource Management Act 1991 (the **Act**)
- recommend mitigation measures and propose conditions of consent based on our findings.

This report should be read together with other technical assessments prepared in support of the application.

1.2 Basis of assessment and relevant Standards

Our assessment is based on our site visits and noise measurements, operational and design information provided by Winstone, and the application plans.

Our calculations and assessments comply with the following Standards and guidance where relevant:

- NZS 6801:2008 Acoustics – Measurement of environmental sound
- NZS 6802:2008 Acoustics – Environmental noise
- NZS 6803:1999 Acoustics – Construction noise
- Association of Australasian Acoustical Consultants Guideline for Interpreting and Applying NZS 6803-1999.

We have assessed the noise levels against the requirements of s16 of the Act, which states:

> Every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level.

We have based our assessment of 'reasonable' on the level, character, timing, frequency, and duration of the noise emissions in the existing environment, including the noise levels and effects authorised by existing consents and those enabled by the relevant permitted standards of the AUP.

1.3 Author and code of conduct statement

The author of this report, Jamie Exeter, is a Principal at Styles Group Acoustics & Vibration Consultants and has over 20 years' experience in acoustics. Jamie has specialised for more than 18 years in the measurement, prediction, and assessment of environmental noise and vibration in relation to District Plans and the Resource Management Act 1991.

Jamie holds a Diploma in Audio Engineering and is a professional Member of the Acoustical Society of New Zealand. He has experience in quarrying and construction projects and regularly undertakes peer review work for local authorities. Jamie is one of three authors of the Association of Australasian Acoustical Consultants (**AAAC**) *Guideline for Interpreting and Applying NZS 6803-1999*, the New Zealand Standard for measuring and assessing construction noise.

The reviewer, Jon Styles has been the Director and Principal of Styles Group Acoustics and Vibration Consultants for over 20 years. He has twice been the President of the Acoustical Society of New Zealand and has been an elected Council Member for more than 17 years. He is also on the Board of Directors of the AAAC.

Jon has over 25 years' experience providing advice on managing noise and vibration effects and is an experienced expert witness for Council, Environment Court, District Court, High Court, and Board of Inquiry hearings.

This report has been prepared and reviewed in accordance with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2023. Other than where it is stated that reliance is placed on the advice of another person, the author(s) confirm that the issues addressed in this report are within their area of expertise. The author(s) have not omitted consideration of any material facts known to them that might alter or detract from the opinions expressed.

2.0 Project description

The Project seeks to expand and deepen the existing Symonds Hill Pit to enable sustainable extraction of additional greywacke resource and continue quarrying on the Site for up to 80 years. The Project will be undertaken in eight stages, initially focussing on the southern and northwestern ends of the quarry complex. The new extraction footprint will expand the existing Symonds Hill Pit to the south and east, followed by areas to the north and west. These development works will occur entirely within Winstone-owned land and integrate with existing quarry infrastructure.

The proposed Symonds Hill Pit expansion will cover an area of approximately 108 hectares, with a maximum depth of -50 m RL. However, Winstone may seek consent in the future to drop the pit below -50 m RL once Stage 8 is completed. This would occur within the same footprint and would not generate any additional noise or vibration effects. Noise and vibration emissions from a deeper pit can be effectively managed by the recommendations provided further in this report for the proposed pit.

The quarry will continue to use the existing access from Hunua Road. A new right turning lane is proposed to improve safety and accommodate the increase in truck volumes as production on the Site increases. The Project will also use the existing processing facilities, staff facilities, and bores.

We understand that the existing quarry is consented to operate on a 24-hour basis, but hours for general sales are restricted to between 6:00 am and 5:30 pm on Monday to Friday and between 6:00 am and 4:00 pm on Saturdays. The Project will generally retain these hours but will include occasional early morning activity during periods of high demand, when purchasing trucks will access the Site from 5:00 am.

In summary, the key aspects of the proposed quarry development include the following components:

- Diversion and reclamation of approximately 1.2 km length of a tributary to Mangapū Stream to enable the expansion of the extraction footprint. This includes construction of a temporary 7 m wide bridge to enable access for construction of the stream realignment channel.
- Draining and modification of up to 21 identified natural inland wetlands.
- Providing additional overburden capacity within the Site (from Stage 7), primarily by backfilling the Symonds Hill Pit.
- Construction of new sediment retention ponds, haul road, drainage networks, and Mangapū Stream tributary diversion integrated with the existing quarry systems.
- Removal of 48.61 ha of indigenous vegetation, associated with the stripping of overburden.
- Amending the consented groundwater takes and discharges to Mangapū Stream.

- Increasing average daily traffic movements during both the AM and PM peak hours when the quarry is operating at peak capacity:
    - AM peak hour: 161 truck movements corresponding to approximately 80 entry and 80 exit truck movements
    - PM peak hour: 135 truck movements corresponding to approximately 68 entry and 68 exit truck movements.
- Constructing a western haul road, including two culverts, to provide a more efficient connection between the pit and the processing yard as part of Stage 2. The haul road will then be removed during Stage 7 and a new haul road constructed.
- Providing for some in-pit crushing to enable a greater volume and more efficient processing of aggregate.
- Providing for the placement of a greater volume of overburden within the Site.
- Implementing progressive rehabilitation (where practicable), ecological offsetting, landscape mitigation, compensation, and stream enhancement measures throughout the Project. The expansion necessitating the Mangapū Stream tributary diversion is the first stage of the project, and the ecological offsetting needed for this will occur in the early phases.

The major noise and vibration generating activities associated with the Project are:

- construction works for vegetation clearance, new sediment retention ponds, a new western haul road, eastern access road, drainage networks, construction of culverts, stream diversion works, and rehabilitation works
- stripping overburden
- blasting and excavation of greywacke
- use of a mobile crusher in the Symonds Hill Pit
- continued use of the existing processing, stockpiling, and dispatch facilities in the main operations area
- up to 160 purchasing truck movements per hour and processing work between 5:00 am and 7:00 am during periods of high demand.

A breakdown of the proposed activities during each of the eight stages is provided in Table 1.

Table 1: Proposed stages 1 – 8

Stage	Activity and nature or work
1	• Bridge instalment (construction) • Stream realignment (construction) • Vegetation clearance (construction) • Stripping overburden in Symonds Hill Pit (operational) • Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)
2	• Complete the stream realignment (construction) • Vegetation clearance (construction) • Construction of the western haul road (construction) • Incremental rehabilitation work (construction) • Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)
3	• Vegetation clearance (construction) • Stripping overburden in Symonds Hill Pit (operational) • Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)
4	• Vegetation clearance (construction) • Stripping overburden in Symonds Hill Pit (operational) • Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)
5	• Vegetation clearance (construction) • Stripping overburden in Symonds Hill Pit (operational) • Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)
6	• Vegetation clearance (construction) • Stripping overburden in Symonds Hill Pit (operational) • Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)
7	• Vegetation clearance (construction) • Realignment of the western haul road (construction) • Stripping overburden in Symonds Hill Pit (operational) • Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)
8	• Cut and extraction in Symonds Hill Pit including internal haulage (operational) • Processing and dispatch including early morning activity (operational)

The proposed quarry design for Stage (8) is shown below in Figure 1.

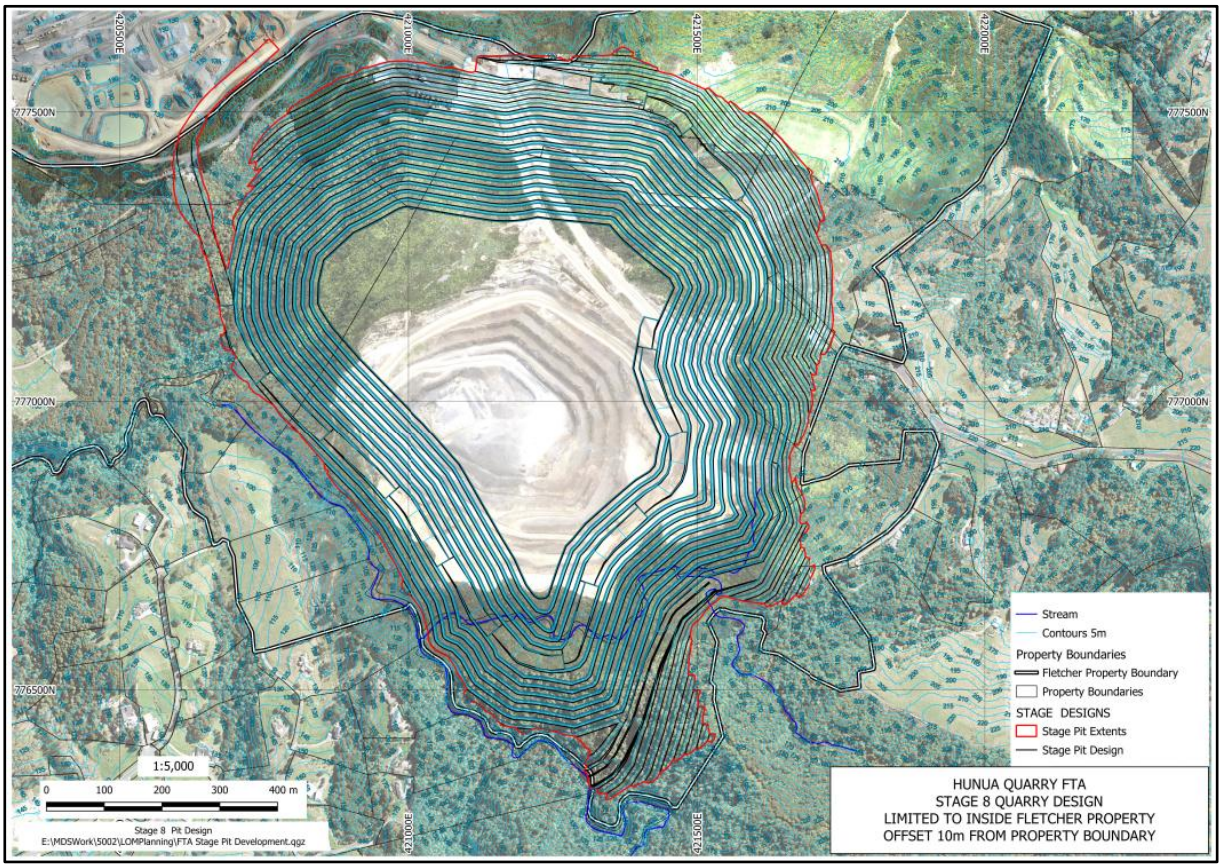

Figure 1: Proposed expansion of Hunua Quarry (Stage 8)

3.0 The existing environment

This section describes the existing environment including the current layout and operation of Hunua Quarry, the neighbouring sites, and the noise emissions enabled by both the AUP and existing consents.

The existing Hunua Quarry is within the *Special Purpose – Quarry Zone* (**SPQZ**) under the AUP. Part of the Project area will be within the *Rural – Mixed Rural Zone* (**RMRZ**). The relevant AUP noise and vibration standards for operational activities in these zones are discussed in Sections 3.4 and 3.6.

3.1 The existing quarry

Hunua Quarry is in South Auckland, approximately 5 km southeast of Papakura and 35 km southeast of the Auckland Central Business District. It has been operating on the Site since the 1920s producing greywacke rock. The current layout of Hunua Quarry is illustrated in Figure 2. The current operation of the quarry is described in Section 3.3.

Figure 2: Existing layout of Hunua Quarry

3.2 The neighbouring sites

The neighbouring sites outside of the SPQZ are all in rural zones under the AUP. We understand that all the adjacent (and closest) dwellings were constructed after 1 January 2001, so the notional boundary noise limits do not apply at these properties. The only applicable operational noise limits for quarry activities within the SPQZ are those at the QEL.

FCIL own the Site and the following adjacent properties:

- 369, 397, 411, 480-486, and 490 Hunua Road
- 106, 108, 118, and 195 Judge Richardson Drive
- 165, 180, 193, and 255 Middleton Road.

Written approval to the application has been provided for the above sites owned by FCIL and by the owners and occupiers of the following properties:

- 161, 163, and 167 Middleton Road
- 105, 115, and 119 Judge Richardson Drive.

We understand that the written approvals for the Project include potential infringements of the relevant AUP noise limits as a reason for consent. We have disregarded any potential noise effects on any site that is owned by FCIL or where written approval has been provided.

Figure 3 shows a map of the existing Hunua Quarry area and the approximate extent of the proposed pit expansion. The properties nearest to the proposed expansion area and the site entrance that are not owned by FCIL and where written approval has not been provided (the **receivers**) are listed below and cross referenced in Figure 3:

- **A**: 341 Hunua Road (northwest of site entrance, contains a dwelling)
- **B**: 367 Hunua Road (northwest of site entrance, contains a dwelling)
- **C**: 191 Judge Richardsons Drive (existing dwelling in western portion of site)
- **D**: 610 Ponga Road (existing dwelling in western portion of site)
- **E**: 159 Middleton Road (existing dwelling at eastern boundary)
- **F**: 170 Middleton Road (existing dwelling at southern boundary)
- **G**: 138 Middleton Road (existing dwelling in southern portion of site).

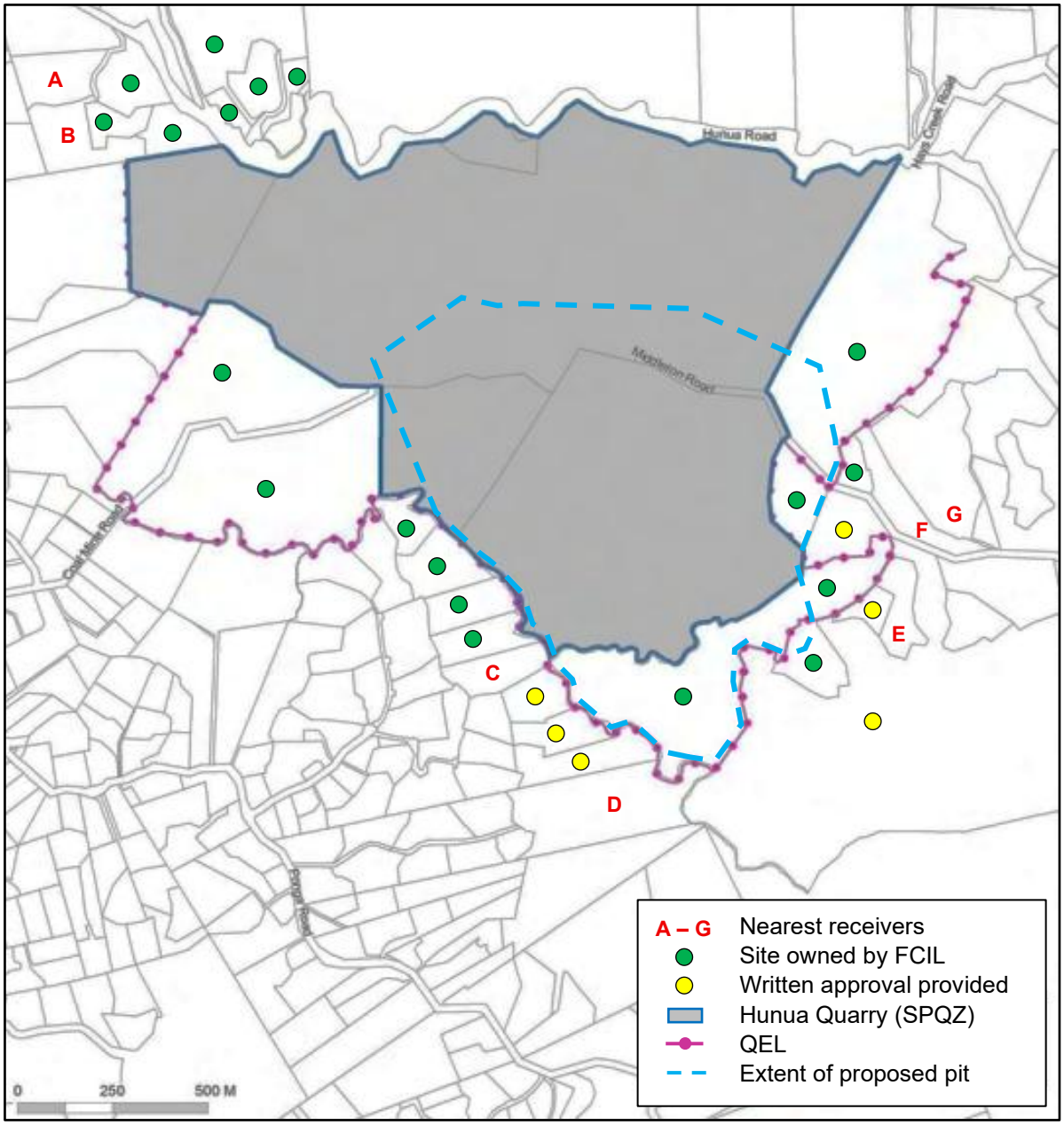

Figure 3: The existing quarry and the neighbouring sites

3.3 Existing quarry operation

The operation of the existing quarry involves extracting rock from the ground and processing it to produce aggregates suitable for building, construction and roading.

Material is extracted from the Symonds Hill Pit and processed on-site. Material with no value (referred to as overburden) is deposited in the overburden disposal area (**OBDA**) at the north-east of the Site (the previous Hunua Pit).

The key noise-generating activities at the existing quarry are:

- construction works for removal of vegetation, haul road construction, and rehabilitation work
- stripping of overburden (soils and low-quality material) overlying the rock resource
- loosening and fragmenting rock from the ground using explosives and heavy machinery
- excavating rock using heavy machinery
- stockpiling and crushing
- processing rock with a three-stage crushing and screening circuit
- operating heavy machinery and trucks in the OBDA
- truck movements on the haul road and internal accessways between extraction zones, the processing and load-out area, and the OBDA.

3.4 Existing operational noise limits

Operational noise generated by the existing quarry within the SPQZ must comply with the limits set out in AUP standard H28.6.2.1 when measured and assessed in accordance with the New Zealand Standards NZS 6801:2008 and NZS 6802:2008.

The AUP limits are summarised below. An assessment against these standards is provided in Section 4.0.

- At the notional boundary of any dwelling outside the SPQZ that existed at 1 January 2001 (the **pre-2001 notional boundary limits**):
    - 7:00 am to 6:00 pm on Monday to Friday: 55 dB L_{Aeq}
    - 7:00 am to 4:00 pm on Saturday: 55 dB L_{Aeq}
    - All other times: 45 dB L_{Aeq} and 75 dB L_{Amax}.
- Noise levels received at all other sites outside the SPQZ are controlled by the following noise limits at the quarry effects line (**QEL**) as illustrated in AUP Figure H28.6.2.1.1 (reproduced in Figure 4):
    - 7:00 am to 6:00 pm on Monday to Friday: 65 dB L_{Aeq}
    - 7:00 am to 4:00 pm on Saturday: 65 dB L_{Aeq}
    - All other times: 45 dB L_{Aeq} and 75 dB L_{Amax}.

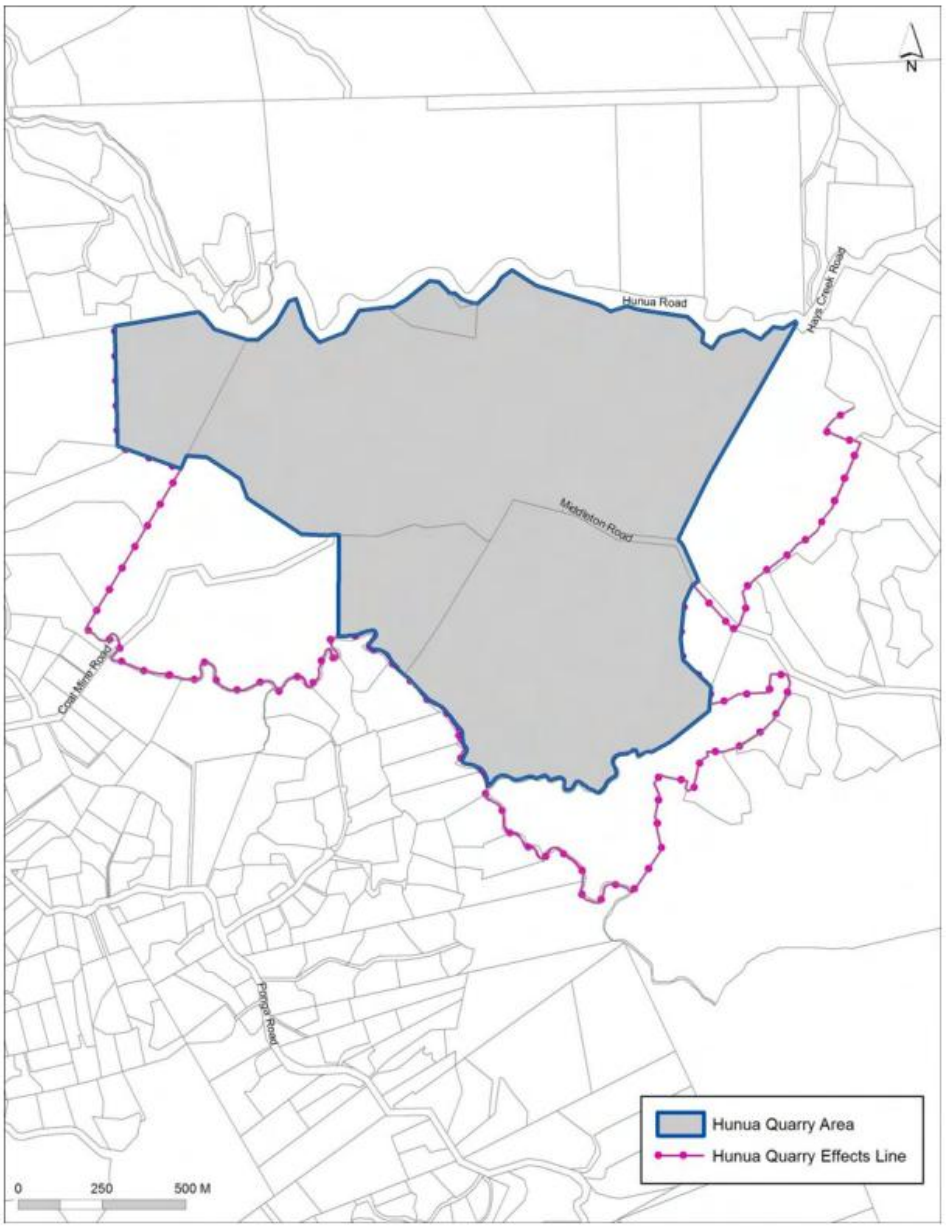

Figure 4: Hunua QEL (H28.6.2.1.1)

The pre-2001 notional boundary noise limits of 55 dB L_{Aeq} during the day and 45 dB L_{Aeq} at night are very typically adopted in District Plans and resource consents at houses near to quarries, industry, and other infrastructure.

The noise limits applying at the QEL are 10 dB higher during the day at 65 dB L_{Aeq}. The noise limits at the QEL at night are the same as the pre-2001 notional boundary limits (45 dB L_{Aeq}).

The dwellings (and therefore the notional boundaries) nearest to the quarry were all established after 1 January 2001. Noise from the quarry is not subject to the pre-2001 notional boundary limits in H28.6.2.1.1 at these notional boundaries. The only control on noise from the quarry at houses constructed after 1 January 2001 are the noise limits at the QEL, and the AUP does not restrict the hours of operation at Hunua Quarry.

In our view, compliance with the QEL noise limits does not ensure that adverse noise effects will be avoided at houses constructed after 1 January 2001. There is no certainty as to the actual noise level that might be received at these properties, and it could be less or greater than the pre-2001 notional boundary limits. We consider that this creates an unnecessary risk to the receivers of noise and the noise generator because it potentially allows for unreasonable noise levels at houses established after January 2001. Section 4.1.1 of this report explains further why the QEL controls are inappropriate and why alternative noise limits are required to address this.

3.5 Existing construction noise limits

Construction noise generated by the existing quarry must comply with the AUP construction noise standards set out below.

E25.6.27. Construction noise levels in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone

1) Noise from construction activities in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone must not exceed the levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone when measured 1m from the façade of any building that contains an activity sensitive to noise that is occupied during the works.

Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone

Time of week	Time Period	Maximum noise level (dBA)	
		L_{eq}	L_{max}
Weekdays	6:30am – 7:30am	60	75
	7:30am – 6:00pm	75	90
	6:00pm - 8:00pm	70	85
	8:00pm - 6:30am	45	75
Saturdays	6:30am – 7:30am	45	75
	7:30am – 6:00pm	75	90
	6:00pm - 8:00pm	45	75
	8:00pm - 6:30am	45	75
Sundays and public holidays	6:30am – 7:30am	45	75
	7:30am – 6:00pm	55	85
	6:00pm - 8:00pm	45	75
	8:00pm - 6:30am	45	75

2) Noise from construction activities in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone must not exceed the levels in Table E25.6.27.2 Construction noise levels for noise affecting any other activity when measured 1m from the façade of any other building that is occupied during the works.

Table E25.6.27.2 Construction noise levels for noise affecting any other activity

Time Period	Maximum noise levels L_{eq} (dBA)
7:30am – 6:00pm	75
6:00pm – 7:30am	80

3) For a project involving a total duration of construction work that is less than 15 calendar days, the noise levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above may be increased by 5dB in all cases.

4) For a project involving a total duration of construction work that is more than 20 weeks the noise limits in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above may be decreased by 5dB in all cases.

Activities sensitive to noise are defined in Chapter J of the AUP as:

> Any dwelling, visitor accommodation, boarding house, marae, papakāinga, integrated residential development, retirement village, supported residential care, care centres, lecture theatres in tertiary education facilities, classrooms in education facilities and healthcare facilities with an overnight stay facility.

The nearest activities sensitive to noise are dwellings. We understand that all noisy construction works is undertaken between 07:30 and 18:00 Monday to Saturday. The overall construction project is longer than 20 weeks, which requires the limits set out in AUP Table E25.6.27.1 to be reduced by 5 dB (in accordance with E26.6.27.4).

The permitted construction noise limits are therefore 70 dB L_{Aeq} and 85 dB L_{Amax} at 1 m from the most exposed façade of any occupied dwelling.

3.6 Existing construction vibration limits

Construction vibration generated at the existing quarry must comply with AUP standard E25.6.30. Construction works during the day are required to comply with a vibration limit of 2 mm/s PPV in any occupied building containing an activity sensitive to noise and compliance with the guideline vibration values of DIN 4150–3:1999 in all buildings (whether occupied or not). AUP standard E25.6.30 does not apply to blasting vibration (see Section 3.7).

E25.6.30 is reproduced below:

E25.6.30. Vibration

1) Construction and demolition activities must be controlled to ensure any resulting vibration does not exceed:

   a. the limits set out in German Industrial Standard DIN 4150-3 (1999): Structural vibration – Part 3 Effects of vibration on structures when measured in accordance with that Standard on any structure not on the same site; and

   b. the limits in Table E25.6.30.1 Vibration limits in buildings in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building.

Table E25.6.30.1 Vibration limits in buildings

Receiver	Period	Peak Particle Velocity Limit (mm/s)
Occupied activity sensitive to noise	Night time 10pm to 7am	0.3 mm/s
	Daytime 7am to 10pm	2 mm/s
Other occupied buildings	At all times	2 mm/s

Works generating vibration for three days or less between the hours of 7am to 6pm may exceed the limits in Table E25.6.30.1 Vibration limits in buildings above, but must comply with a limit of 5mm/s peak particle velocity in any axis when measured in the corner of the floor of the storey of interest for multi-storey buildings, or within 500mm of ground level at the foundation of a single storey building, where:

   i. all occupied buildings within 50m of the extent of the works generating vibration are advised in writing no less than three days prior to the vibration-generating works commencing; and

   ii. the written advice must include details of the location of the works, the duration of the works, a phone number for complaints and the name of the site manager.

3.6.1 Construction vibration limits controlling building damage

The vibration limits under E25.6.30.1.a are higher than the 2 mm/s PPV amenity limit in part (b) of the rule. The purpose of the standard is to ensure that vibration does not cause structural or cosmetic damage in buildings.

The DIN 4150–3:1999 Standard referenced in AUP standard E25.6.30.1.a recommends vibration limits for avoiding cosmetic building damage according to the design, occupancy, and sensitivity of the subject building. The classifications are:

- Line 1: Buildings used for commercial purposes, industrial buildings, and buildings of similar design
- Line 2: Dwellings and buildings of similar design and/or occupancy
- Line 3: Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g., listed buildings under preservation order).

We have based our assessment on Line 2 of the DIN 4150–3:1999 limits because all the nearest structures are dwellings. We are not aware of any nearby heritage buildings or other vibration sensitive structures that would meet the Line 3 classification criteria.

The guideline values provided in DIN 4150–3:1999 also depend on whether the vibration is 'short-term' or 'long-term'. Short-term vibration is defined by the Standard as vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance. Long-term vibration is all other types of vibration. Our experience of measuring vibration in modern residential dwellings is that vibration generated by heavy trucks and machinery operating at quarries typically meets the short-term criteria.

The DIN 4150–3:1999 frequency-dependent values for short-term vibration are illustrated in Figure 5 for reference. Typical dominant frequencies will be less than 50 Hz.

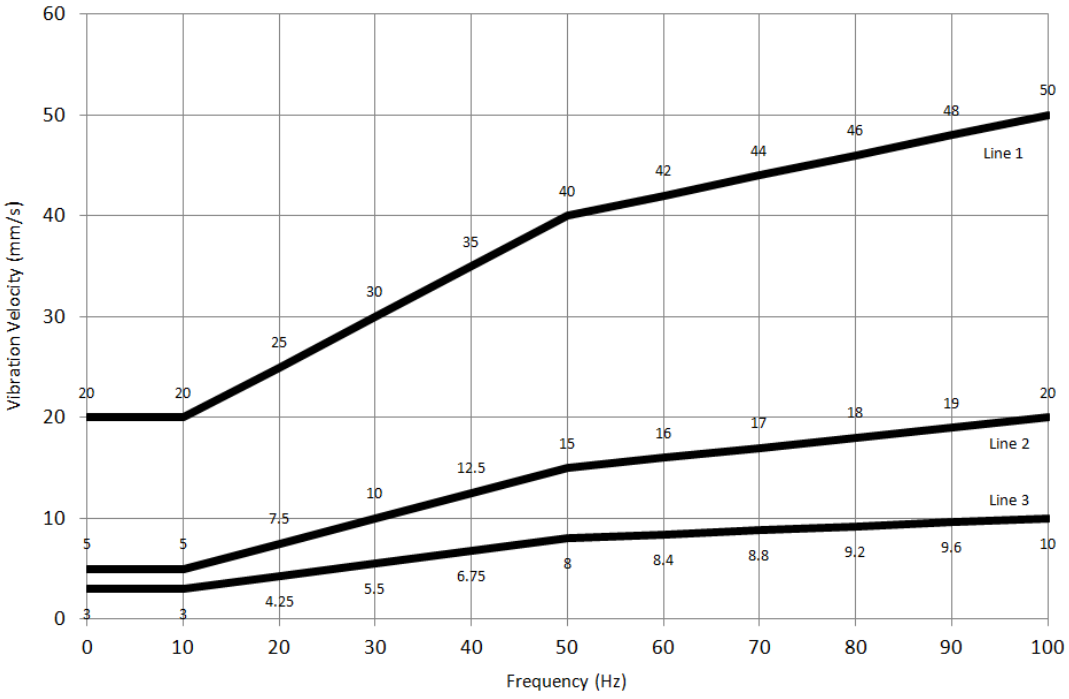

Figure 5: DIN 4150–3: 1999 guideline values for short-term vibration

3.6.2 Construction vibration limits for managing amenity

The vibration limits under E25.6.30.1.b are designed to avoid adverse effects on people inside buildings. The 2 mm/s PPV standard only applies at buildings that are occupied during the activity.

In our experience, vibration levels of up to 2 mm/s PPV are noticeable inside buildings during normal residential activities but are unlikely to cause complaint if the source of the vibration is known and the receivers know that the effects are temporary.

3.7 Existing blasting noise and vibration limits

This section sets out the AUP standards for blasting noise and vibration at the existing quarry and identifies issues with applying these to the Project.

3.7.1 AUP standards

AUP standard H28.6.2.2 sets out blasting noise and vibration limits and timing restrictions for blasting at the existing quarry within the SPQZ. These are reproduced below:

> **H28.6.2.2. Vibration and blasting**
>
> (1) Noise created from the use of explosives must not exceed a peak overall sound pressure of 128 dB L_{Zpeak}.
>
> (2) The measurement of blast noise (air blast) and ground vibration from blasting must be measured at the notional boundary of a dwelling that existed at 1 January 2001.
>
> (3) Vibration generated by blasting shall be measured within a building in accordance with Appendix J of Part 2 of Australian Standard AS 2187 2006.
>
> (4) All blasting is restricted to:
>
> (d) 9am-5pm, Monday to Saturday:
>
> (e) an average of two occasions per day over a calendar fortnight; and
>
> (f) except where necessary because of safety reasons.
>
> (5) Blasting activities must be controlled to ensure any resulting ground vibration does not exceed the limits set out in German standard DIN 4150-3 1999: Structural vibration - Part 3 Effects of vibration on structures when measured on the foundation in the horizontal axis on the highest floor of an affected building.
>
> (6) A siren must be used prior to blasting to alert people in the vicinity.

3.7.2 Issues with AUP controls for blasting in the SPQZ

We consider that the AUP controls for noise and vibration from blasting in the SPQZ are unclear and conflicting as follows:

- The existing blasting noise limits only apply at dwellings that existed at 1 January 2001. The dwellings nearest to the Symonds Hill Pit (identified in Section 3.2) were all built after this date. The absence of any limits at these properties means

the effects are not controlled (and could theoretically be unreasonable), which creates risk for the residents and Winstone.

- The existing blasting vibration limits reference three different measurement locations and two different Standards for managing damage to buildings. This results in there being conflicting requirements and limits under one AUP standard.
- The existing blasting vibration limits only control vibration in the horizontal axis when measured at the notional boundary or the foundations of a building. This is inconsistent with the guidance of DIN 4150–3:1999 which is the Standard that is referenced in the AUP standard itself.

We recommend that a set of resource consent conditions are imposed for blasting noise and vibration that deliver the same fundamental outcome and level of effect as the AUP standards but ensure that the limits are clear and certain to all stakeholders and apply to all receivers. We have recommended conditions in Section 7.0.

3.8 Compliance with existing noise and vibration limits

We have reviewed historical noise and vibration measurements (undertaken by others) of operational and blasting activities at Hunua Quarry. The results demonstrate compliance with both the QEL noise limits and the pre-2001 notional boundary limits at receivers A – G (Section 3.2). Noise monitoring has not been undertaken along the western and southern extents of the QEL (where the existing limits apply for houses constructed after January 2001) because extraneous noise generated by the nearby Mangapū Stream prevents any valid data being obtained at these locations.

We are not aware of any construction noise or vibration monitoring that has been undertaken to determine compliance during previous construction works. However, we expect that compliance will have been achieved historically by a significant margin based on the plant that was used and the significant separation distances to neighbouring properties.

3.9 Existing resource consents

We understand that the existing quarry is subject to several resource consents and a Certificate of Compliance (**CoC**). These consents and the CoC apply to differing activities and areas of land throughout the quarry. The different conditions and consents/certificates apply the same or similar noise limits to different activities (such as vegetation removal and managed fill activities) discretely. This means that each activity must comply with a specific noise limit individually. Most of the consent conditions and CoC requirements require compliance with a limit of 55 dB L_{A10} or L_{Aeq} at the notional boundary of the neighbouring dwellings during the day.

We consider that several of the historic noise limit conditions allow for cumulative noise levels to exceed 55 dB L_{Aeq} because the conditions apply to each individual activity, and not to the total activity on the Site. For example, if the managed fill[1] and vegetation removal[2] were both controlled to meet 55 dB L_{Aeq} at the same closest property, the cumulative level would be 58 dB L_{Aeq}. A cumulative level this high would be unlikely to occur in practice, but the example demonstrates the issue with separate noise limit conditions and the potential for cumulative effects.

We recommend that a global noise limit condition is applied to the expanded Hunua Quarry site as set out in our recommended consent conditions. The recommended consent conditions will apply a single cumulative noise limit to all activities in the daytime and one set of noise limits at night, regardless of nature and location of the activity or when the receiver's house was constructed. This is discussed further in Section 4.1.

4.0 Operational noise

This section provides an assessment of operational noise from the Project in terms of the existing environment and the relevant AUP noise standards.

To preface this section of the report, we introduce the proposed noise limits for the operation of the quarry development. The description of the proposed limits provides context for the noise level predictions and the assessment of operational noise effects.

4.1 Proposed operational noise limits

We have recommended noise limits for the proposed operation of the quarry to provide clarity and certainty to all neighbours and Winstone, and to simplify the existing controls. Our recommended condition to achieve this is provided in Section 7.0.

The recommended condition excludes all properties owned by or under the control of FCIL, or where written approval has been provided. It imposes noise limits at the notional boundaries of all dwellings, regardless of when they were constructed, and applies to all operational quarrying and overburden stripping activities.

The noise limits in our recommended condition:

- set the same noise limits and timeframes for day and night as the pre-2001 notional boundary limits
- apply instead of the noise limits at the QEL and control noise at houses built after 1 January 2001

[1] Condition 28 of BUN6035690

[2] Conditions 29 and 30 of consent 8730

- apply at the notional boundaries of all receivers regardless of when the houses were built
- are numerically the same as the existing noise limits for receivers outside the SPQZ where dwellings existed at 1 January 2001 and the AUP permitted noise limits between sites in the RMRZ
- apply over the same timeframes as the noise limits for activities in the SPQZ, but apply more stringent daytime timeframes than the RMRZ
- apply to all operational activities assessed cumulatively.

The two most significant changes that our proposed noise limits deliver are to remove the noise limit at the QEL and to apply noise limits at all notional boundaries regardless of when they were constructed.

Adopting our recommended noise limits will deliver consent conditions that:

- are practicable for Winstone to comply with
- are practicable for Winstone and Auckland Council to monitor and assess compliance against
- are consistent with the existing noise limits in the surrounding rural zones and the existing noise limits at dwellings that existed at 1 January 2001
- ensure that noise levels are reasonable under all operating scenarios
- ensure that noise levels generated by the quarry comply with the guidance of NZS 6802:2008 for the reasonable protection of health and amenity
- provide certainty for Hunua Quarry, the receivers, and Auckland Council.

4.1.1 Noise limits at the QEL

We understand that the noise limits at the QEL were originally proposed to provide some certainty over the noise effects across land that did not have any houses on it prior to 1 January 2001.

We understand that the noise limits at the QEL are intended to act as a proxy control for noise effects over surrounding land. However, our assessment of the noise limits at the QEL is that they are an unreliable control for houses built after 1 January 2001.

We consider that our recommended noise limits at the notional boundaries of all receivers are more appropriate than the existing limits at the QEL for the following reasons:

- Compliance with the QEL limits does not prevent noise levels from exceeding 55 dB L_{Aeq} during the daytime period at the notional boundaries of the nearest receivers. Noise from the quarry could exceed 55 dB L_{Aeq} at the notional boundary of houses built after 1 January 2001 but comply at the QEL where the noise is

generated some distance from the QEL and where topography screens the noise emissions at the QEL but not (or not as much) at the nearby houses.

- There will be some phases of the development that are proposed at, across, and over the QEL. The noise will be significantly higher than the limits at the QEL in these cases as the machines and plant may be on the QEL itself.[3] Our noise level predictions demonstrate that such work can take place and still comply with the proposed noise limits at all notional boundaries. Retaining the noise limits at the QEL would prevent a considerable amount of the proposed development from being undertaken. We consider that in this context, the noise limits at the QEL will significantly reduce the size and efficiency of the proposal and for no benefit to the receivers.
- The proposed noise limits are consistent with the existing environment, the AUP permitted noise limits between sites in RMRZ, the guidelines of NZS 6802:2008, and our experience with other quarries in rural areas. We consider that noise up to the proposed limits will be reasonable because they have been conditioned or permitted for quarrying activities for a significant length of time at houses constructed before 1 January 2001.
- Noise cannot be measured at many points along the QEL because of the noise generated by the Mangapū Stream.

We consider that the noise limits at the QEL are uncertain because it is an unreliable proxy location for assessing noise effects across land that did not have a notional boundary before 1 January 2001. We consider that this presents a risk to Winstone and the owners of that land because the noise limits at the QEL do not guarantee that noise levels will be reasonable at houses constructed after 1 January 2001.

4.1.2 Applying noise limits at the notional boundary of all dwellings

Our recommended conditions propose the same noise limits at all notional boundaries whether they were constructed before or after 1 January 2001. Consent will be required for an infringement of the noise limits at the QEL.

In our view, this provides a more robust and certain noise limit arrangement than noise limits at the QEL.

4.1.3 Proposed operational activity outside the SPQZ

All operational activities at the existing quarry are undertaken within the SPQZ. The proposed expansion extends beyond the SPQZ and into the RMRZ. Noise limits for permitted activities in the RMRZ are under AUP standard E25.6.3. These are summarised below:

[3] The southern extent of the proposed pit follows the QEL and the proposed pit extends outside the QEL at 165 Middleton Road (owned by FCIL).

> The noise (rating) level from any activity in the Rural – Mixed Rural Zone measured within the notional boundary on any site in any rural zone must not exceed the following limits:
>
> - Monday to Saturday 7:00 am – 10:00 pm: 55 dB L_{Aeq}
> - Sunday 9:00 am – 6:00 pm: 55 dB L_{Aeq}
> - All other times: 45 dB L_{Aeq} and 75 dB L_{Amax}.

These are very similar to the noise limits applying to quarrying in the SPQZ, except that they allow higher noise levels on Saturdays from 4:00 pm to 10:00 pm, and higher noise levels on Sundays between 9:00 am and 6:00 pm. The RMRZ limits therefore allow a greater level of noise than the limits for activities in the SPQZ and the proposed noise limits. We expect that this is because the noise limits for the RMRZ are designed to manage noise from less intensive activities that are either generally anticipated (as restricted discretionary) or provided for (as permitted activities) in the RMRZ, neither of which include quarrying activities.[4]

Noise will be generated by activities in both the SPQZ and RMRZ at the various times during the development. Quarry machinery and vehicles could work in the SPQZ and the RMRZ at the same time and may cross back and forth frequently between the two zones. It would be impossible to distinguish the noise from one zone or the other, and therefore impossible to accurately assess compliance with the standards for either zone. It will not be possible to monitor the noise emissions from each zone separately for assessment against different standards. Additionally, having a limit for activities in the RMRZ and a separate limit for activities in the SPQZ allows for the cumulative noise levels to exceed a reasonable level (e.g. 55 dB L_{Aeq}).

We therefore consider it necessary to adopt the recommended single operational noise limit and assessment location for the proposed activities. This would enable robust noise monitoring and compliance assessments, and effective management of noise effects on the receivers.

4.2 Proposed noise mitigation

We recommend the following specific physical noise mitigation measures, which are accepted and proposed by Winstone. We have recommended conditions of consent in Section 7.0 to require these.

- An Operational Noise and Vibration Management Plan (**ONMP**) will be prepared for the existing and proposed activities at Hunua Quarry. The ONMP will set out the procedures for minimising noise and vibration effects on the neighbours, ensuring compliance with the relevant noise and vibration limits, communicating with the neighbours, and managing any complaints. A draft ONMP is provided as Appendix B.

[4] Noting, however, that Policy H19.2.4(2)(e) identifies noise from mineral extraction as a typical activity within the Rural Mixed Rural Zone, and therefore generally not giving rise to reverse sensitivity effects. Mineral extraction is a discretionary activity in the RMRZ.

- Tonal reversing alarms (beepers) can generate additional annoyance at neighbouring sites, so they will not be used on quarry-based machinery. Alternatives such as broadband reversing alarms (squawkers) can be used.
- A crusher will occasionally be used at the pit floor. The need for this during various stages of the Project will be assessed in the ONMP. Different size crushers are available with various noise outputs and specifications, and an acoustically rated shed or enclosure will be used to reduce the noise emissions by at least 10 dB. The screening provided by the enclosure and the pit will ensure that noise generated by the crusher will not contribute to the cumulative noise emissions from the site.

4.3 Operational noise measurements to inform noise modelling

Styles Group has undertaken short-term attended noise measurements on-site and long-term noise monitoring of the existing activities and quarry fleet at Hunua Quarry. The noise monitoring has been undertaken to ensure that the computer noise models we have prepared are as accurate as possible.

We have used Cetaware™ environmental noise and weather loggers to continuously measure noise levels at several locations inside the quarry. All Cetaware™ instruments meet Type 1 accuracy requirements in accordance with the requirements of NZS 6801:2008.

The locations of the loggers and their primary measurement purpose are illustrated in Figure 6 below. The instruments are labelled WIN1 to WIN5.

Figure 6: Cetaware™ measurement locations

Photos of the Cetaware™ instruments in their respective locations are provided in Appendix C. Further information on the configuration and use of the Cetaware™ instruments is provided below:

- The Cetaware™ instruments measure sound and frequency data (in 1/12 octave bands) every second and calculate the unweighted $L_{Zeq(1\ sec)}$ and A-weighted $L_{Aeq(1\ sec)}$ noise levels.
- The instruments calculate L_{Zeq}, L_{Aeq} (average), and L_{A90} (background) levels for every 15-minute period starting on the hour. The instruments also record and store the highest $L_{Aeq(1\ sec)}$ level for every 15-minute period as a proxy for the L_{AFmax}.
- The Cetaware™ instruments measure wind speed and direction every second and report this data with the noise level outputs. One-second periods when wind speeds exceed 3 ms^{-1} are flagged and excluded from the calculation of longer-term noise levels.
- All noise, weather, GPS position data is streamed to Styles Group servers using 4G cellular modems. The data is pushed from the instrument to the Styles Group servers every 15 minutes.
- The Cetaware™ instruments record audio at a 48 kHz sampling rate. The raw audio files are stored on the instruments for later analysis if required.
- Cicadas and crickets often contaminate noise measurements over the summer months. The Cetaware™ software uses complex neural networks based on AI models trained under supervision to identify and remove the influence of insect noise on the L_{Aeq} and L_{A90} noise levels in real time. Cetaware™ software analyses the audio in one-second increments and removes the insect noise based on its frequency content and temporal structure.
- The Cetaware™ measurement process began in December 2025 and will continue beyond the preparation and finalisation of this report. The data has provided highly accurate noise levels for hundreds of hours of activity and thousands of quarry-plant pass-bys.
- The Cetaware™ system has enabled Styles Group to very accurately determine L_{WA} levels and activity-based L_{Aeq} levels including 1/3 octave band data for the major[5] items of quarry plant.

The specific configurations and outputs of the different devices are set out below:

[5] This does not include small or quiet items of plant such as telehandlers and light vehicles that are typically 15-40 dB quieter than heavy trucks and plant, and much less frequently used.

4.3.1 WIN1 – Haul trucks on flat haul road

WIN1 was situated near the bottom of the Symonds Hill Pit where haul trucks regularly pass by on their way between the excavation area and the processing plant. The measured levels were filtered to remove data when wind speeds were greater than 3 ms^{-1} and when several vehicles passed at once. WIN1 was intermittently affected by mobile network coverage issues which limited the data available. The pass-by events were frequently affected by noise from other plant in the area meaning that clean pass-by samples were uncommon. However, a total of 30 accurate pass-by measurements were obtained. The logarithmically averaged sound power level is 107 dB L_{WA}.

The statistics from the sound events analysed are illustrated in Figure 7.

The box and whisker plots show the median levels (centre), 25th and 75th percentile levels (the bottom and top of the box) and the maximum and minimum levels excluding the outliers[6] (the whiskers).

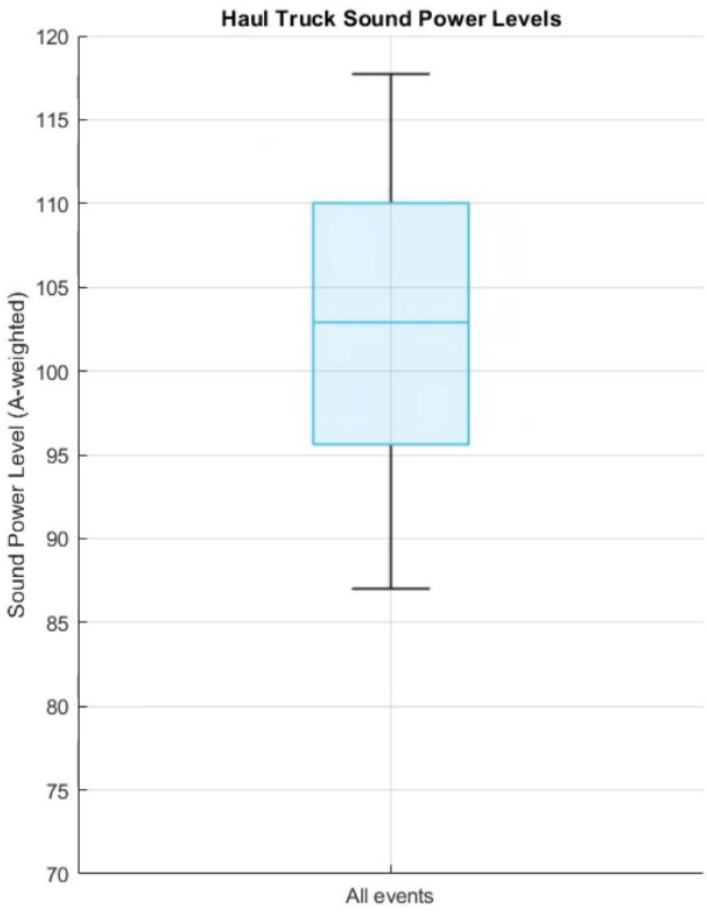

Figure 7: WIN1 Haul Trucks on flat road

[6] Outliers are more than 1.5 times the interquartile range above or below the 75th or 25th percentile levels

4.3.2 WIN2 – Haul trucks on steep section of haul road

WIN2 was located midway between the two steepest and most open sections of the haul road between the Symonds Hill Pit and the processing area. Haul trucks generally pass downhill into the pit on one side of WIN2 and uphill on the other side. The measured levels were filtered to remove data when wind speeds were greater than 3 ms^{-1}.

A total of 1680 pass-bys have been accurately recorded and analysed with a split of approximately 50% uphill and 50% downhill.

The logarithmically averaged sound power levels for trucks are 114 dB L_{WA} going uphill and 107 dB L_{WA} going downhill.

The statistics from the sound events analysed are illustrated in Figure 8.

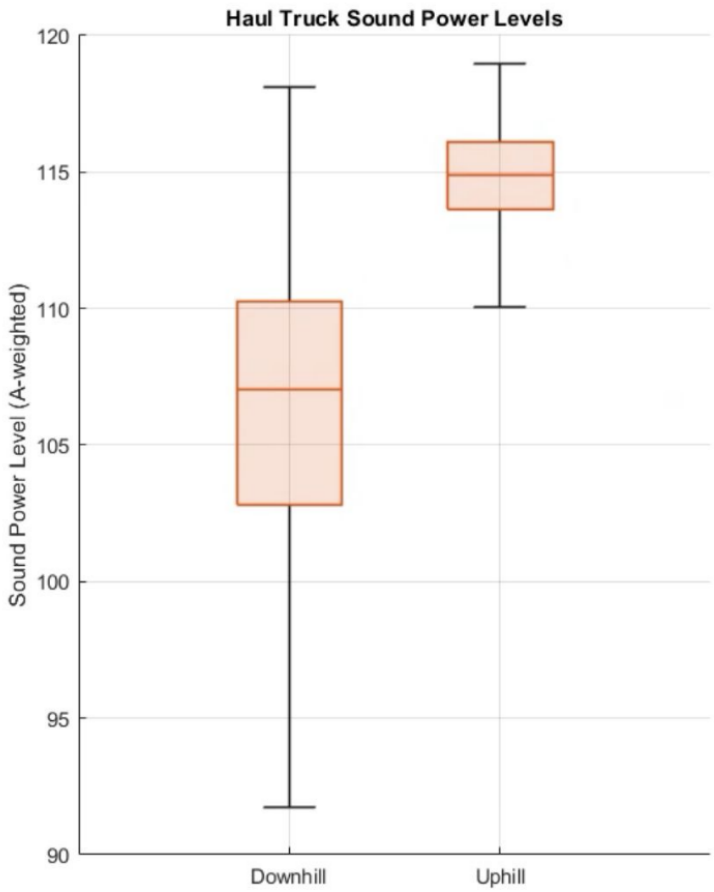

Figure 8: WIN2 Haul trucks on steep road

4.3.3 WIN3 and WIN4 – Processing Yard

WIN3 and WIN4 were set up in the processing yard and at the southern perimeter of the processing yard (respectively). These instruments were configured to measure plant noise only. Pass-by levels were not generally workable at these locations because of the relatively high ambient noise levels (from plant and vehicles) which prevented pass-by events from reaching levels at least 10 dB above the background and ambient levels.

The data from WIN4 has been used to calibrate the computer noise model for busy days in the processing yard.

Figure 9 shows the logged $L_{Aeq(15\ min)}$ data during working hours on all survey days with periods when wind exceeded 3 ms^{-1} removed. This data includes weekends and holidays which are evidently the quietest days.

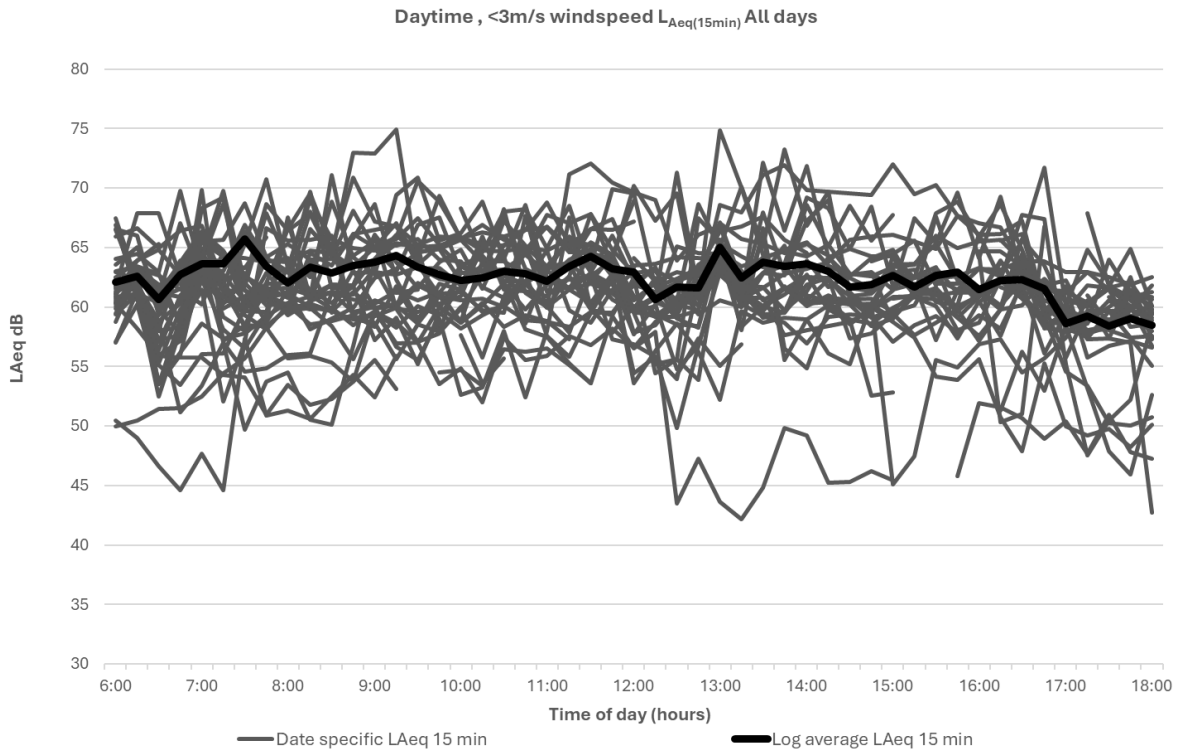

Figure 9: WIN4 Measured levels on south perimeter of processing yard

4.3.4 WIN5 – Purchasing trucks on access road

WIN5 was set up adjacent to the steepest part of the access road leading into the processing area, and where noise from purchasing trucks has the greatest influence on the cumulative noise emissions to the west.

Purchasing trucks are not fitted with GPS units that we have access to, so WIN5 was configured to measure and detect pass-bys that met the criteria for obtaining valid noise samples. The criteria included wind speeds below 3 ms^{-1}, only one truck pass-by per sample

(two trucks passing were detected and excluded), and heavy vehicles only (light vehicles were detected and excluded because they lower the average).

A total of 12,284 pass-bys met the criteria and have been analysed. The log average Sound Exposure Level (**SEL** or **L_{AE}**) was 84 dB. The statistics from the analysed L_{AE} events are illustrated in Figure 10.

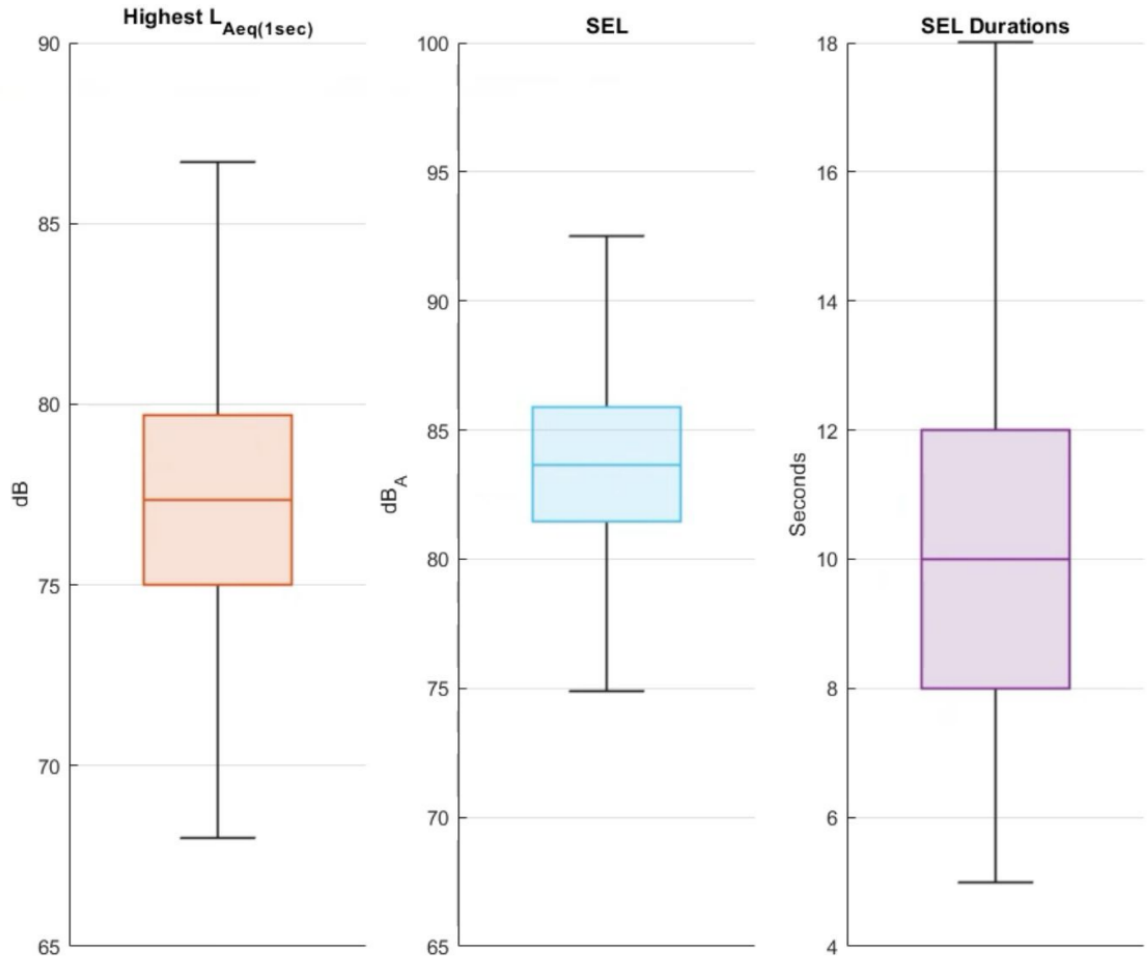

Figure 10: WIN5 Purchasing truck statistics

To our knowledge, the Cetaware™ measurement campaign at Hunua Quarry is the most comprehensive quarry noise measurement project that has been undertaken to date in New Zealand. We consider that the data provided by the Cetaware™ system for input into a computer noise model are the most accurate and reliable that can practicably be obtained at this time. The site and plant specific data provided by Cetaware™ has enabled us to calibrate our noise models to represent the operations at Hunua Quarry with a high degree of accuracy and reliability.

4.4 Operational noise modelling

We have created noise models to represent the cumulative noise emissions from all activities on the site during the proposed early morning activity, stripping campaigns, and all other works during the various stages.

All noise level predictions have been prepared used DGMR iNoise computer noise modelling software, a successor to Bruel & Kjaer Predictor which is no longer supported. DGMR iNoise is widely used by acoustics consultants internationally. The noise level predictions calculated by the models are based on the International Standard ISO 9613-2:2024 *Attenuation of sound during propagation outdoors*.

We have calibrated our operational noise models using the results of our noise measurements at Hunua Quarry and at other Winstone quarries. Where data from other quarries has been used, it is supported by site and plant specific measurements undertaken by others at Hunua Quarry during historical compliance monitoring. Other operational information such as the pit extents, ground heights, stripping and staging scenarios, and machinery type and location have been provided to us by the pit designers and quarry operators.

The following sections provide our noise modelling input data, methodology, and results.

4.4.1 Operational noise sources and methodology

Table 2 displays the operational noise sources used in our modelling and the relevant reference data and methodology. The 3D noise model was used to identify the areas on the Site where each receiver will be the most exposed to noise from the proposed activities. The cumulative noise levels were then calculated based on all relevant plant operating in these areas simultaneously. The reference sound power levels[7] (L_{WA}) stated below are all based on L_{Aeq} measurements.

Table 2: Operational noise references and modelling methodology

Activity at the quarry	Plant	Reference sound power level	Modelling details
Early morning operation between 5:00 am and 7:00 am	Purchasing trucks travelling between the front gate and the loadout area adjacent to the processing plant	114 dB L_{WA} trucks uphill 107 dB L_{WA} trucks downhill	Based on 10 trucks (20 movements) per hour. Modelled as a moving point source with average speeds of 21 km/hr (uphill) to 28 km/hr (downhill). Based on long-term measurements of laden and unladen purchasing trucks travelling on the steepest section of the internal road near to the lab. Source height is 3 m

[7] L_{WA} is the acoustical energy emitted by a sound source. It is an absolute value and is not affected by distance or the environment. The L_{WA} is used in computer noise modelling to calculate the L_{Aeq} sound pressure level at a given distance (which includes the effects of environmental factors such as screening, topography, and weather conditions).

Activity at the quarry	Plant	Reference sound power level	Modelling details
	Loader	107 dB L_{WA}	Three loaders modelled as point sources in the stockpile and loadout area. Source height is 2 m
	Processing plant	113 dB L_{WA}	Processing plant running continuously. Source height is 5 m
Overburden stripping during the daytime period (plant is evenly distributed across two separate stripping areas)	Two dump trucks travelling between the stripping area and the OBDA	112 dB L_{WA}	Each based on 12 movements per hour. Modelled as moving point sources with average speeds of 25 km/hr. Source heights are 3 m
	Two 120-t excavators stripping overburden	112 dB L_{WA}	Modelled as point sources. Source heights are 3 m.
	Two 30-t excavators stripping overburden and loading trucks	98 dB L_{WA}	Modelled as point sources. Source heights are 2 m.
	Two D9 dozers shifting overburden to be loaded into trucks	115 dB L_{WA}	Modelled as point sources (working in small areas). Source heights are 2 m.
Operational activities during the daytime period (plant is split across two separate areas in each stage)	Two dump trucks travelling between the excavation area and the OBDA	112 dB L_{WA}	Each based on 12 movements per hour. Modelled as moving point sources with average speeds of 25 km/hr. Source heights are 3 m.
	Two 180-t excavators extracting aggregate	112 dB L_{WA}	Modelled as point sources. Source heights are 3 m.
	Two 120-t excavators extracting aggregate	112 dB L_{WA}	Modelled as point sources. Source heights are 3 m.
	Two 40-t excavators loading trucks	100 dB L_{WA}	Modelled as point sources. Source heights are 2 m.

Activity at the quarry	Plant	Reference sound power level	Modelling details
	30-t excavator loading trucks	98 dB L_{WA}	Modelled as a point source. Source height is 2 m.
	Two 10-t excavators loading trucks	95 dB L_{WA}	Modelled as point sources. Source heights are 1.5 m.
	Two D9 dozers	115 dB L_{WA}	Modelled as point sources (working in small areas). Source heights are 2 m.
	Two drilling rigs drilling holes for blasting	121 dB L_{WA}	Modelled as point sources. Source heights are 0.5 m.
	Two graders maintaining surfaces of pit and haul roads	113 dB L_{WA}	Modelled as moving point sources with average speeds of 10 km/hr. Source heights are 2 m.
	Mobile crusher at the Symonds Hill Pit floor	109 dB L_{WA}	Modelled as a point source. Operating at the pit floor and fully enclosed within an acoustically effective shed. Reference level includes 10 dB mitigation. Source height is 3 m.
	Processing plant	113 dB L_{WA}	Processing plant being loaded and running continuously. Source height of plant is 5 m.
	Operation of OBDA	Various, see references above	40-t excavator, D9 dozer, and loader working in the OBDA area. All modelled as point sources.

4.4.2 Predicted operational noise levels

The AUP permitted noise limits and proposed limits are in terms of a Noise Rating Level derived in accordance with NZS 6802:2008. A Noise Rating Level is derived by assessing the highest cumulative noise emissions from the site and making any applicable adjustments for special audible characteristics and duration.

Noise from the site will not have special audible characteristics because tonal reversing alarms will not be used on the Site.

A duration adjustment will not apply because noise will be generated at various levels over the entire prescribed timeframe for the nearest receivers when stripping or excavation is near to

the pit boundary. No duration adjustment is allowed for noise levels during the night-time period e.g. for the early morning activity between 5:00 am and 7:00 am.

The highest predicted Noise Rating Levels at the nearest receivers are displayed in Table 3. These are worst-case noise levels based on all noisy equipment working in the nearest part of the Site simultaneously. There will be no noise generating activity in the Symonds Hill Pit during the night-time period.

Table 3: Predicted worst-case Noise Rating Levels

Receiver and cross reference to Figure 2	**Daytime predicted Noise Rating Level** (7:00 am to 6:00 pm Mon-Fri and 7:00 am to 4:00 pm Sat)	**Night-time predicted Noise Rating Level** (all other times)	**Stage of works when highest noise levels will be generated**
341 Hunua Rd (A)	44 dB L_{Aeq}	44 dB L_{Aeq}	Daytime: Stage 1 Night-time: during occasional early morning processing and load out between 5:00 am and 7:00 am
367 Hunua Rd (B)	39 dB L_{Aeq}	36 dB L_{Aeq}	Daytime: Stage 1 Night-time: during occasional early morning processing and load out between 5:00 am and 7:00 am
191 Judge Richardsons Dr (C)	49 dB L_{Aeq}	n/a	Stage 7
610 Ponga Rd (D)	51 dB L_{Aeq}	n/a	Stage 1
159 Middleton Rd (E)	53 dB L_{Aeq}	n/a	Stage 7
170 Middleton Rd (F)	55 dB L_{Aeq}	n/a	Stage 7
138 Middleton Rd (G)	54 dB L_{Aeq}	n/a	Stage 7

Noise Rating Level contours for Stages 1 and 7 are provided in Appendix D. These show the extent of the noise emissions up to 55 dB L_{Aeq} at the surrounding properties. The activities that have been modelled together represent the worst-case scenarios for all receivers. They will not all take place simultaneously during operation of the quarry. The noise contours are plotted on a 10 m x 10 m grid so are indicative of the noise propagation across the surrounding land. The noise levels shown in Table 3 are calculated using point receivers in the model which provide precise predictions at a specified locations and heights.

The predicted Noise Rating Levels demonstrate that the worst-case operational noise levels will comply with the proposed noise limit at the notional boundaries of all receivers. These noise levels will only be generated when stripping and excavation is near to the pit boundaries.

At other times, noise emissions from the site will be lower and compliant by a greater margin. For the receivers nearest to the Symonds Hill Pit, the noise levels will reduce considerably as the activity progresses further from the boundary and deeper into the pit.

The noise level predictions are based on the current fleet of diesel trucks and machinery at Hunua Quarry. The proposed operations are expected to continue for approximately 50 years. Based on our experience, noise emissions from quarry activities typically reduce over time as older equipment is progressively replaced with modern machinery. However, it is not possible to reliably quantify the extent to which noise emissions may reduce over the life of the quarry.

4.5 Blasting noise and vibration

Blasts on site are designed, managed, and carried out by trained and qualified personnel. Each blast is designed to comply with the current limits by adjusting factors such as charge weight, hole placement, and timing based on the relative locations of the nearest dwellings. This process will continue under the proposed operation.

The following sections set out our recommendations for the proposed blasting within the SPQZ and RMRZ.

4.5.1 Blasting within the SPQZ

We recommend imposing noise and vibration consent conditions for blasting within the SPQZ because the AUP standards contain ambiguity and don't apply limits at the nearest receivers (see Section 3.7.2).

Our recommended conditions will not enable any increase to noise and vibration effects at any site, and they will impose overpressure limits at the receivers nearest to the Symonds Hill Pit where there are presently none. The conditions will provide more appropriate controls on noise and vibration effects at the neighbouring sites and remove ambiguity for Winstone when undertaking monitoring, predictions, and assessments.

Our recommended conditions are based on AUP standard H28.6.2.2 but make the following updates:

- The terminology and noise descriptor for overpressure (blasting noise, also known as airblast) have been updated for consistency with relevant Standards and best practice.
- Overpressure limits are applied at all sites outside the SPQZ and not only where a dwelling existed at 1 January 2001 (except those where written approval has been provided).
- The required measurement position for blasting vibration is at the subject dwelling. This is a more appropriate location for assessing potential vibration effects on a structure than at the notional boundary. This location is in accordance with the DIN 4150–3 and best practice.

- The latest version (2016) of the DIN 4150–3 Standard is adopted for best practice. This update will not result in any changes to vibration limits or effects.
- The reference to AS 2187.2–2006 is removed for vibration because the Standard is inconsistent with the guidance of DIN 4150–3:2016 (which prescribes the vibration limits).
- The condition relevant to timing and frequency restrictions has been updated for clarity but no material changes are proposed.

Our recommended blasting overpressure and vibration conditions are provided below and in Section 7.0. Exclusions are made in Section 7.0 for sites where written approval has been provided.

- All blasting at Hunua Quarry must comply with the following overpressure and vibration limits:
    - Overpressure generated by explosives must comply with a limit of 128 dB L_{Zpeak} when measured at the notional boundary of any dwelling outside the Special Purpose – Quarry Zone. Overpressure must be measured in accordance with the guidance of Appendix J *Ground Vibration and Airblast Overpressure* of AS 2187.2:2006 *Explosives—Storage and use, Part 2: Use of explosives*.
    - Vibration generated by blasting activities must comply with the limits set out in the German Standard DIN 4150-3 2016: *Vibration in buildings – Part 3 Effects on structures* when measured and assessed in accordance with the Standard.
- All blasting is subject to the following restrictions except where it is necessary for safety reasons:
    - Blasting must only take place between 9:00 am and 5:00 pm on Monday to Saturday.
    - The number of blasts over any calendar fortnight must not exceed an average of two per day.
- A siren must be used prior to blasting to alert people in the vicinity.

4.5.2 Blasting within the RMRZ

The Project includes blasting in the RMRZ. The AUP permitted noise limit for blasting in the RMRZ is reproduced below.

> E25.6.31. Noise levels for blasting
>
> 1) The noise created by the use of explosives for any blasting activity measured at the boundary of the site on which the explosives are used must not exceed a peak sound pressure of 120 dB (Lzpeak).

The AUP does not contain permitted vibration standards for blasting in the RMRZ. We recommend that the limits for blasting vibration generated in the SPQZ are adopted for blasting in the RMRZ.

Winstone have confirmed that all blasts within the RMRZ will be designed to comply with these limits at any property they do not own or where written approval has not been provided. This requirement is included in the draft ONMP and recommended conditions.

5.0 Construction noise and vibration

This section of the report provides an assessment of the construction noise and vibration associated with the Project. The construction methodologies, plant, timeframes, and locations included in our assessment have been provided to us by Winstone.

In accordance with the definitions of NZS 6803:1999 and AAAC guidelines, construction work is temporary work undertaken to establish, maintain, or reconfigure a site. The following proposed activities are within the scope of NZS 6803:1999 and have been assessed as construction work:

- vegetation clearance
- haul road construction
- culvert construction and stream realignment
- rehabilitation work.

We have not assessed overburden stripping and blasting activities associated with the stream realignment as construction work because they will be undertaken together with operational excavation and processing, and some of the material excavated for the stream realignment is likely to be processed into aggregate. We have assessed noise from these activities against the relevant operational noise standards.

All works associated with blasting for the purpose of excavating rock are considered operational and not construction.

Construction work in the expansion areas of the quarry will take place at least 10 m below the existing ground level at the nearest boundary and in all cases at least 150 m to 300 m from the nearest dwellings. Construction activities will involve similar (and possibly the same) machinery as stripping and extraction activities.

Most of the construction work required over the eight proposed stages will be similar in nature to construction work already undertaken in the Symonds Hill Pit. The noise and vibration generated by the proposed construction work will mostly be indistinguishable from that generated by operational extraction activities.

The proposal includes two distinct construction components that may at times be distinguishable from operational extraction works. These are the construction of the proposed western haul road between the Symonds Hill Pit and the processing area, and the stream realignment works at the south end of the Symonds Hill Pit. The locations of the proposed haul road and stream realignment construction works are illustrated in Figure 11.

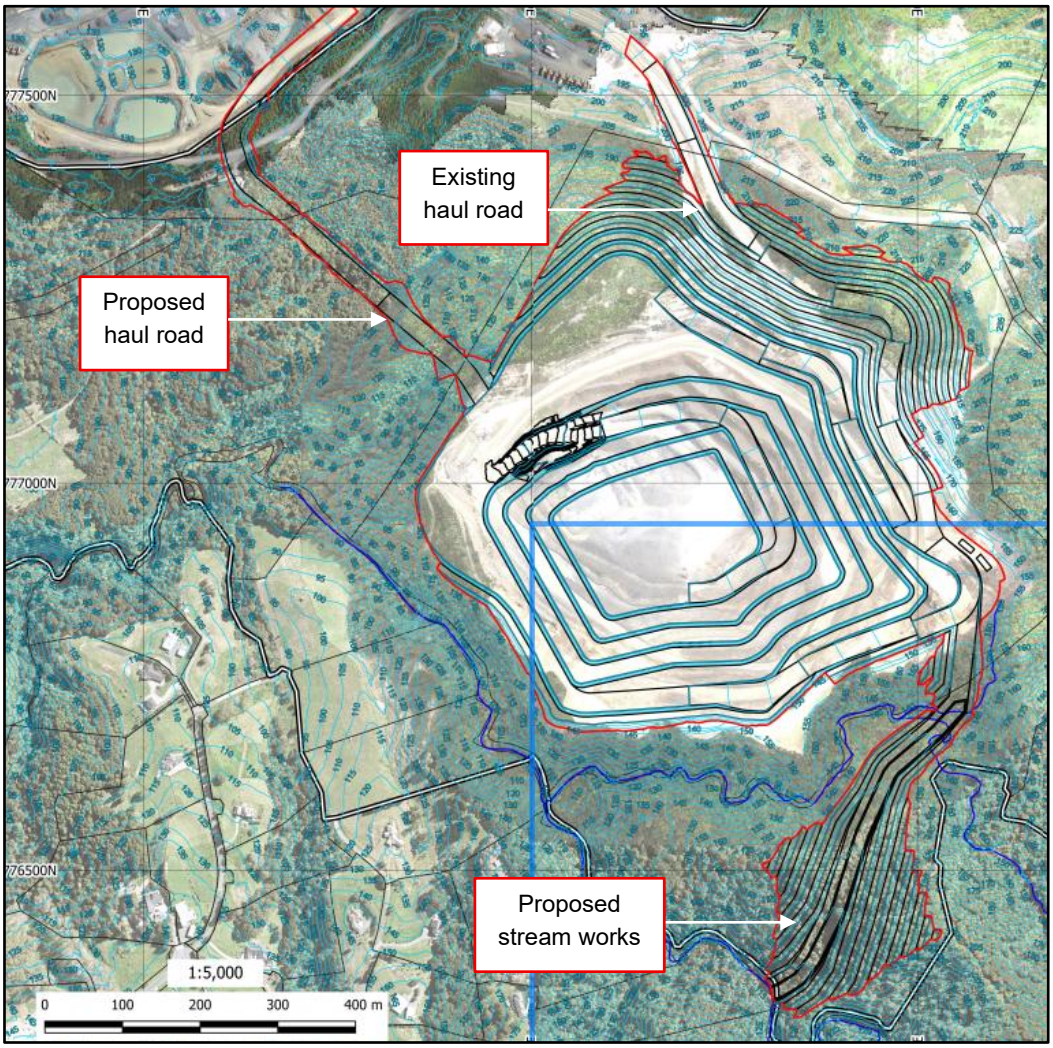

Figure 11: Locations of proposed haul road and stream realignment works

5.1 Proposed construction noise limits

The Project does not seek consent to infringe any of the construction noise standards in E25.6.27. The proposal is to comply with the requirements of E25.6.27.

5.2 Proposed construction vibration limits

The Project does not seek consent to infringe any of the permitted construction vibration standards in E25.6.30. The proposal is to comply with the requirements of E25.6.30.

5.3 Predicted construction noise levels

We have calculated construction noise levels at the neighbouring sites during vegetation removal, site preparation, and haul road construction based on worst-case scenarios and the references displayed in Table 4. Our references are based on measurement data. They are generally consistent with the data provided in NZS 6803:1999 Appendix C *Guide to Sound Level Data on Site Equipment and Site Activities* but more appropriate for modern construction equipment.

Table 4 also displays the minimum separation distances for each activity to comply with the AUP permitted construction noise limits. These are based on the following assumptions:

- There is no acoustically effective screening between the noise source and the receiver (e.g. no temporary construction noise barriers or bunds).
- The minimum distance stated is from the noise generating plant to the assessment position at 1 m from the most exposed façade of the building e.g. from the excavator engine to 1 m from the façade.
- The plant is being used continuously over a 15-minute sample period (i.e., 100% on-time) unless otherwise stated.
- The distances include a +3 dB adjustment to the noise levels for reflections from the façade of the receiving building (as required by NZS 6803:1999).
- Acoustically reflective ground is assumed between the noise source and the receiver.

Table 4: Reference noise levels and compliance distances

Construction activity	Unmitigated $L_{Aeq(15\ min)}$ noise level at 10 m	Unmitigated compliance distance
D9 bulldozer working in a small area	87 dB	95 m
Woodchipper	83 dB	60 m
Mulcher mounted on 10-t excavator	83 dB	60 m
Petrol chainsaw felling trees (33% on-time)	77 dB	30 m
Excavation with a 120-t excavator	82 dB	53 m
Excavation and loading trucks with a 45-t excavator	72 dB	17 m
Loading trucks with a 10-t excavator	67 dB	10 m

The construction noise models include dump truck movements between the works area and the OBDA to dump topsoil and a grader working on the proposed western haul road (using a sound power level of 113 dB L_{WA}). The sound power level for the dump trucks has been taken from the measurements described in Section 4.3 of this report.

We have analysed the various stages of construction required for the Project and used computer noise modelling to identify the areas where construction works will generate the highest noise levels at the closest receivers. This process of reverse-engineering has allowed us to focus on the construction works that will generate the highest construction noise levels at the neighbouring properties when considering the separation distances and any screening provided by topography.

Table 5 displays the predicted worst-case cumulative construction noise levels for each receiver during the works that will generate the highest construction noise levels. The predicted levels represent peak 15-minute periods for construction noise and are not averaged over longer periods or the day.

Table 5: Predicted worst-case construction noise levels

Construction works	Receiving site	Predicted $L_{Aeq(15\ min)}$ noise level	Predicted L_{Amax} noise level
Vegetation removal on slopes exposed to neighbouring properties with direct line of sight to properties on Judge Richardsons Dr and Middleton Rd	191 Judge Richardsons Dr (receiver C)	37 dB $L_{Aeq(15\ min)}$	49 dB L_{Amax}
	610 Ponga Rd (receiver D)	39 dB $L_{Aeq(15\ min)}$	51 dB L_{Amax}
	159 Middleton Rd (receiver E)	44 dB $L_{Aeq(15\ min)}$	56 dB L_{Amax}
	170 Middleton Rd (receiver F)	59 dB $L_{Aeq(15\ min)}$	71 dB L_{Amax}
	All other receivers	<37 dB $L_{Aeq(15\ min)}$	<49 dB L_{Amax}
Site preparation, stream realignment, haul road construction, culvert construction occurring simultaneously in exposed locations	191 Judge Richardsons Dr (receiver C)	34 dB $L_{Aeq(15\ min)}$	46 dB L_{Amax}
	610 Ponga Rd (receiver D)	48 dB $L_{Aeq(15\ min)}$	60 dB L_{Amax}
	159 Middleton Rd (receiver E)	40 dB $L_{Aeq(15\ min)}$	52 dB L_{Amax}
	170 Middleton Rd (receiver F)	47 dB $L_{Aeq(15\ min)}$	59 dB L_{Amax}
	All other receivers	<34 dB $L_{Aeq(15\ min)}$	<46 dB L_{Amax}

The predicted construction noise levels demonstrate that the relevant AUP limits of 70 dB L_{Aeq} and 85 dB L_{Amax} will be complied with by significant margins. This is mainly due to the substantial separation distances between the works and receivers.

Based on our assessment of the staging plans and the construction works required across all stages, we expect the following regarding construction noise:

- There will be long periods of the total development timeframe when no construction works are taking place and noise from Hunua Quarry will only be generated by operational extraction activities
- For the short periods of the overall development timeframe that involve construction works, the noise and vibration effects from most of the work will be indistinguishable from the operational extraction activities. This is because the construction work will largely use the same plant and equipment and will be undertaken near to the operational extraction areas and haul roads.
- There may be some very short-term construction activities where the noise effects are distinguishable from the operational extraction activities. For example, the vegetation clearing required on the exposed slopes adjacent to 170 Middleton Road. The predicted worst-case noise level for this activity is 59 dB $L_{Aeq(15\ min)}$. This is 4 dB above (subjectively noticeable) the proposed (and currently permitted) noise limit of 55 dB L_{Aeq} for operational activities, and 11 dB lower than (less than half as loud as) the proposed (and currently permitted) noise limit of 70 dB L_{Aeq} for construction work.
- The noise from some stream realignment work may be distinguishable from operational activities because it is occurring in a different location to the normal operational extraction works. This may lead an observer to perceive the noise from stream realignment construction works as subjectively different to noise from operational activities. However, the overall noise level of the stream realignment construction works is likely to be the same, or less than, noise from operational extraction work in the main Symonds Hill Pit. We understand that the portion of the stream realignment works that may be distinguishable in this way will only be at the southern end of the works and will take less than six months to complete.
- Rehabilitation work will generate lower construction noise levels than those predicted for the other more intense phases of construction work because it will involve smaller plant and fewer truck movements.

Construction noise will comply with the relevant AUP limits by an even greater margin at all other neighbouring sites and for all other construction activities. We expect that it may be audible and potentially distinguishable above operational noise for short periods at some dwellings when works occur in the portions of the Site closest to them, but it will otherwise range from inaudible to just perceptible. Noise from construction work is unlikely to cause annoyance or disruption on any neighbouring site.

5.4 Construction vibration levels

The proposed vibration generating activity includes excavation and the movement of heavy vehicles and machinery. Based on our extensive database of vibration measurements, typical vibration levels for these activities range from less than 1 mm/s PPV to approximately 4 mm/s PPV at 10 m, depending on how the equipment is used. For example, banging excavator buckets on the ground and tracking heavy plant at high speeds can generate excessive levels of vibration but these are typically avoided by experienced operators.

Vibration levels above 0.3 mm/s PPV within buildings are generally perceptible, depending on the occupant activity and whether they are standing, sitting, or lying down. Due to the separation distances between the construction activities and the nearest dwellings, and the intervening topography, construction vibration will not reach levels of 0.3 mm/s PPV within the neighbouring dwellings and will not be perceptible. For example, if a vibration level of 4 mm/s PPV at 10 m were generated by a 30-t excavator bucket being used to break up the ground, the vibration would not be perceptible within a dwelling at 100 m due to the attenuation over distance and the loss of energy when the vibration transfers into the foundations of the building. The separation distances between all construction works and the closest receivers are approximately 150 m to 300 m.

Any vibration generated by construction work associated with the proposal will comply with the AUP permitted construction vibration amenity limit of 2 mm/s PPV and will be significantly lower than the AUP vibration limits for avoiding building damage.

6.0 Potential operational noise effects

We understand that Hunua Quarry is presently consented for 24-hour operation and to generate noise levels at the QEL of up to 65 dB L_{Aeq} during the day and 45 dB L_{Aeq} at night.

An ONMP is proposed for the quarry which will set out all mitigation and management measures, operational restrictions, and monitoring required to ensure that the relevant noise and vibration limits are complied with. The ONMP will include a process for making updates to adapt to any changes in the receiving environment or to the vehicle fleet and machinery. This will ensure that the noise limits are complied with over the life of the quarry.

We consider that where noise emissions are managed through the ONMP to comply with the proposed limits at the nearest sites:

- noise emissions will be consistent with the character, timing, duration, and frequency of noise emissions that are enabled by the AUP in the SPQZ and between sites in rural zones
- operational noise levels above 55 dB L_{Aeq} will no longer be enabled at the nearest notional boundaries, which is an improvement for the receivers
- the duration of operational noise from the quarry will be extended due to the additional years of quarrying in the expansion areas.

We have weighed these factors and consider overall that noise emissions from the proposed operation of Hunua Quarry will not exceed a reasonable level provided that our proposed conditions are adopted. Noise is not expected to cause disruption to rural activities during the day, or sleep disturbance at night for any existing or future receivers.

Where noise effects are managed to be reasonable at the nearest receivers, the noise effects at more distance receivers will be lower and reasonable.

7.0 Recommended conditions

We recommend the following conditions:

Construction noise and vibration

1. Construction work may only take place on site between the hours of 7:30 am and 6:00 pm, Monday to Saturday. This condition does not prevent quiet construction activities from taking place at any time, provided that any noise generated is generally inaudible at the notional boundary of any occupied dwelling.

   Advice note: construction work includes (without limitation) temporary activities associated with vegetation clearance, stream realignment, rehabilitation work, and the construction of sediment retention ponds, haul roads, drainage networks, culverts, and earth bunds.

Blasting noise and vibration

2. All blasting at Hunua Quarry must comply with the following limits, except that no overpressure limits apply at 369, 397, 411, 480-486, and 490 Hunua Road, 105, 106, 108, 115, 118, 119, and 195 Judge Richardson Drive, and 161, 163, 165, 167, 180, 193, and 255 Middleton Road.

   i. Overpressure generated by using explosives within the *Special Purpose – Quarry Zone* must comply with a limit of 128 dB L_{Zpeak} when measured at the notional boundary of any dwelling outside the zone. Overpressure must be measured in accordance with the guidance of Appendix J *Ground Vibration and Airblast Overpressure* of AS 2187.2:2006 *Explosives—Storage and use, Part 2: Use of explosives*.

   ii. Overpressure generated by using explosives within the *Rural — Mixed Rural Zone* must comply with a limit of 120 dB L_{Zpeak} when measured at the boundary of any other site.

   iii. Vibration generated by blasting activities must comply with the limits set out in the German Standard DIN 4150-3 2016: *Vibration in buildings – Part 3 Effects on structures* when measured and assessed in accordance with the Standard.

   iv. All blasting is restricted to the following except where it is necessary for safety reasons:

      - Blasting must only take place between 9:00 am and 5:00 pm on Monday to Saturday.

- The number of blasts over any calendar fortnight must not exceed an average of two per day.

v. A siren must be used prior to blasting to alert people in the vicinity.

Operational noise

3. All operational activities except blasting must comply with the following limits when measured and assessed in accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound* and NZS 6802:2008 *Acoustics – Environmental noise*. The noise limits apply at the notional boundary of any site outside the *Special Purpose – Quarry Zone* except at 369, 397, 411, 480-486, and 490 Hunua Road, 105, 106, 108, 115, 118, 119, and 195 Judge Richardson Drive, and 161, 163, 165, 167, 180, 193, and 255 Middleton Road.

    - 7:00 am to 6:00 pm on Monday to Friday: 55 dB $L_{Aeq.}$
    - 7:00 am to 4:00 pm on Saturday: 55 dB $L_{Aeq.}$
    - All other times: 45 dB L_{Aeq} and 75 dB L_{Amax}.

4. An Operational Noise and Vibration Management Plan (ONMP) must be prepared for Hunua Quarry before operational activities begin in any of the expansion areas.

    The objective of the ONMP is to set out procedures to ensure that noise and vibration emissions from Hunua Quarry comply with the relevant limits and do not cause adverse effects on the neighbouring properties.

    The ONMP must include (as a minimum):

    - roles and responsibilities for the implementation of the ONMP
    - the activities and noise sources at Hunua Quarry
    - the relevant noise and vibration limits
    - the neighbouring receivers
    - the mitigation measures required to ensure that the relevant noise and vibration limits are complied with
    - procedures for undertaking noise and vibration measurements
    - procedures for managing noise and vibration complaints
    - corrective action measures
    - provisions for updating the ONMP to adapt to any changes in the receiving environment or any material changes to the quarry vehicle fleet and machinery

5. Tonal reversing alarms (beepers) must not be used on quarry-based machinery. Alternatives without tonal characteristics such as broadband reversing alarms (squawkers) are permitted.

8.0 Conclusion

Styles Group has assessed the potential noise effects of the proposed expansion of Hunua Quarry. We have disregarded any effects on the following sites where written approval to the application is provided: 369, 397, 411, 480-486, and 490 Hunua Road, 105, 106, 108, 115, 118, 119, and 195 Judge Richardson Drive, and 161, 163, 165, 167, 180, 193, and 255 Middleton Road.

Construction noise will readily comply with the relevant AUP limits by a considerable margin and is not expected to cause unreasonable noise effects. It will be audible temporarily at the nearest notional boundaries during the day when works occur in the closest parts of the site but will otherwise range from inaudible to just perceptible.

Construction vibration will readily comply with the relevant AUP limits. It is unlikely to be perceptible within any neighbouring dwelling.

The Project can comply with the AUP blasting noise and vibration limits within the SPQZ and RMRZ. However, we have recommended noise and vibration conditions for blasting in the SPQZ that we consider to be better controls than the current AUP standards. The recommended conditions are clearer and align with best practice. They will reduce potential effects on the neighbouring residents by applying overpressure limits at all receivers rather than only at sites where dwellings existed at 1 January 2001.

We have modelled and assessed operational noise based on our measurement data, the existing environment, and the relevant AUP noise standards for the RMRZ and SPQZ. We have recommended an ONMP and operational noise limits for existing and proposed activities at Hunua Quarry. Adopting these recommendations will ensure that operational noise does not cause unreasonable disruption to rural residential activities during the day, or sleep disturbance at night for any existing or future receivers outside the SPQZ.

We consider overall that noise emissions from the Project will not exceed a reasonable level provided our recommended conditions are adopted. We have recommended conditions of consent based on our findings.

Resource consent will be required for infringements of the following AUP standards:

- H28.6.2.1: Infringement of the QEL noise limits by activities in the SPQZ.
- H28.6.2.2: Deviation from the AUP blasting noise and vibration standard to clarify ambiguities around monitoring and assessment and to adopt industry best practice.
- E25.6.31.(1): Infringement of the AUP blasting noise standard in the RMRZ at the boundaries of properties that are either owned by FCIL or where written approval was obtained.

Appendix A Glossary

Noise	A sound which serves little or no purpose for the exposed persons and is commonly described as ‘unwanted sound’. The definition of noise includes vibration under the Resource Management Act.
dB (decibel)	The basic measurement unit of sound. The logarithmic unit used to describe the ratio between the measured sound pressure level and a reference level of 20 micropascals (0 dB).
A-weighting	A frequency filter applied to the full audio range (20 Hz to 20 kHz) to approximate the response of the human ear at lower sound pressure levels.
Z-weighting	Zero frequency weighting. No filter is applied to the measured level.
Ambient sound	Ambient sound is the total of all sound within a given environment, comprising a composite of sounds from sources near and far.
Total sound	The totally encompassing sound in a given situation at a given time, from all sources near and far including the specific sound.
Residual sound	The total sound remaining at a given position in a given situation when the specific sounds under consideration are suppressed or are an insignificant part of the total sound.
Specific sound	The component of total sound that can be identified as associated with a specific source e.g. the noise from a proposed activity.
Background sound	See $L_{A90(t)}$.
$L_{A90(t)}$ (dB)	The A-weighted sound level in decibels equalled or exceeded for 90% of the of the measurement interval. It is the component of the total sound perceived as continuously present. Used in current New Zealand Standards as the descriptor for background noise.
$L_{Aeq(t)}$ (dB)	The A-weighted equivalent sound pressure level with the same energy content as the measured varying acoustic signal over a sample period (t). The preferred metric for sound levels that vary over time because it considers the total sound energy over the time period of interest.
L_{AFmax} (dB)	The maximum A-weighted sound pressure level recorded during the measurement period using a fast time-weighting response.
L_{Zpeak} (dB)	The maximum un-weighted peak sound pressure level recorded during the measurement period.

L_{WA} (dB)	Sound power level (L_{WA}) is the acoustical energy emitted by a sound source. It is an absolute value and is not affected by distance or the environment. The L_{WA} is used in computer noise modelling to calculate the sound pressure level (e.g. L_{Aeq}) at a given distance.
SEL or L_{AE} (dB)	The A-weighted single event noise exposure level. It is used to quantify the noise generated by individual events referenced to a standard period of one second. It is the dBA noise level over one second that would produce the equivalent sound energy as the actual event.
Noise Rating Level	A noise level derived in accordance with NZS 6802:2008 for comparison with a limit.
Notional boundary	A line 20 metres from any side of a residential unit or other building used for a noise sensitive activity, or the legal boundary where this is closer to such a building.
PPV (mm/s)	Peak particle velocity is the metric commonly used for measuring construction vibration in New Zealand. It is the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.

Appendix B Draft ONMP

Styles Group
Acoustics & Vibration Consultants

HUNUA QUARRY DRAFT ONMP

OPERATIONAL NOISE & VIBRATION MANAGEMENT PLAN

PREPARED FOR

Winstone Aggregates

DATE

23 March 2026

ONMP prepared by Styles Group for Winstone Aggregates.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	23/03/26	Draft version based on recommended conditions	Draft	Jamie Exeter, MASNZ Principal Styles Group	Jon Styles, MASNZ Director and Principal Styles Group

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Appendices

Appendix A	Glossary
Appendix B	Resource consent conditions
Appendix C	Updates to the ONMP

1.0 Introduction

Winstone Aggregates (**Winstone**), a division of Fletcher Concrete and Infrastructure Limited (**FCIL**), has engaged Styles Group to prepare an Operational Noise and Vibration Management Plan (**ONMP**) for Hunua Quarry.

This ONMP has been prepared in accordance with the requirements of resource consent [TBC] (the **resource consent**) and the Auckland Unitary Plan (the **AUP**).

Winstone has resource consent to undertake the following activities over eight stages. These activities must be managed to ensure they do not generate unreasonable noise and vibration effects on neighbouring properties:

- expansion and deepening of the Symonds Hill Pit
- construction activities including:
    - vegetation clearance
    - constructing sediment retention ponds, haul roads, drainage networks, and culverts
    - stream realignment work
    - rehabilitation work.
- stripping overburden
- crushing in the Symonds Hill Pit
- processing, stockpiling, and dispatch in the main operations area
- purchasing truck movements and processing in the main operations area between 5:00 am and 7:00 am during periods of high demand.

The objective of this ONMP is to set out procedures to ensure that noise and vibration emissions from Hunua Quarry comply with the relevant limits and do not cause adverse effects on the neighbouring properties.

The final version of this ONMP must be submitted to Auckland Council for approval before operational activities are undertaken in the consented expansion areas. If any material updates are made to the ONMP the revised version must be provided to Auckland Council for information before any changes are actioned.

A glossary of acoustics terms used in this document is provided in Appendix A.

2.0 Contents of this ONMP

In accordance with condition [TBC] of the resource consent, this ONMP includes:

- the relevant noise and vibration limits — Section 6.0
- the mitigation measures required to ensure that the relevant noise and vibration limits are complied with — Section 10.0
- procedures for undertaking noise and vibration measurements — Section 11.0
- procedures and managing any noise complaints — Section 12.0
- provisions for updating the ONMP to adapt to any changes in the receiving environment or any material changes to the quarry vehicle fleet and machinery — Section 14.0.

3.0 Roles and responsibilities

This document will be maintained by Winstone and updated as necessary in accordance with Section 14.0.

The provisions of this ONMP must be followed by all parties involved with the operation of Hunua Quarry and all permanent staff at Hunua Quarry must be familiar with its requirements.

The latest version of the ONMP must be made available to Auckland Council on request.

The key contacts for Hunua Quarry with respect to noise and vibration management are set out in Table 1.

Table 1: Key contacts for noise and vibration

Name	Role / responsibilities	Contact details	
[TBC]	Manager responsible for implementation of the ONMP	Phone Email:	
[TBC]	Contact for noise and vibration complaints	Phone: Email:	
Styles Group	Acoustics consultants for noise and vibration monitoring, noise level predictions, and advice on mitigation	Phone: Email:	09 308 9015 info@stylesgroup.co.nz

The ONMP manager is responsible for:

- ensuring the ONMP is maintained and updated as necessary over the life of the quarry
- ensuring that the mitigation measures identified in this ONMP are integrated into all relevant operations
- ensuring that induction and training processes include making permanent staff aware of the requirements of the ONMP.

4.0 Activities at Hunua Quarry

Noise and vibration will be generated by the activities listed below. Refer to Section 5.0 for the relevant noise and vibration limits, which depend on whether the activity is defined as construction or operational.

4.1 Construction activities

Construction activities, as defined by NZS 6803:1999 (and AAAC guidelines[1]), include temporary activities undertaken to establish, maintain, or reconfigure a site.

Construction activities at Hunua Quarry include:

- haul road construction
- earth bund construction
- vegetation clearance
- construction of sediment retention ponds
- construction of drainage networks
- construction of culverts and bridges
- stream realignment works
- rehabilitation work.

The noise and vibration limits for construction activities are set out in Sections 6.1 and 6.2. Limits for construction hours are provided in Section 8.0.

4.2 Operational activities

Operational activities are all other activities at Hunua Quarry, including:

- stripping overburden

[1] AAAC Guideline for interpreting and applying NZS 6803:1999

- cut and extraction in the Symonds Hill Pit
- loading and operation of processing plant
- use of mobile crushers
- truck and vehicle movements
- use of loaders, trucks, and other plant for stockpiling and dispatch
- use of trucks, and heavy plant in the overburden disposal area
- all activities associated with blasting, such as drilling, use of excavators, and haulage.

The noise limits for operational activities are set out in Section 6.3.

The use of explosives (blasting) is also an operational activity, but it has separate limits. These are set out in Section 6.5.

5.0 Nearest receivers

The nearest receivers where the noise and vibration limits apply are listed below. These sites all contain dwellings. They are not owned by FCIL and did not provide written approval to the consented activity.

- **A**: 341 Hunua Road
- **B**: 367 Hunua Road
- **C**: 191 Judge Richardsons Drive
- **D**: 610 Ponga Road
- **E**: 159 Middleton Road
- **F**: 170 Middleton Road
- **G**: 138 Middleton Road.

The noise and vibration levels at all other receivers will be lower because they are further from the quarry activity.

The nearest receivers and the area of Hunua Quarry zoned *Special Purpose — Quarry Zone* (**SPQZ**) are illustrated in in Figure 1. The SPQZ is relevant to the applying the correct noise and vibration limits (see Section 6.0).

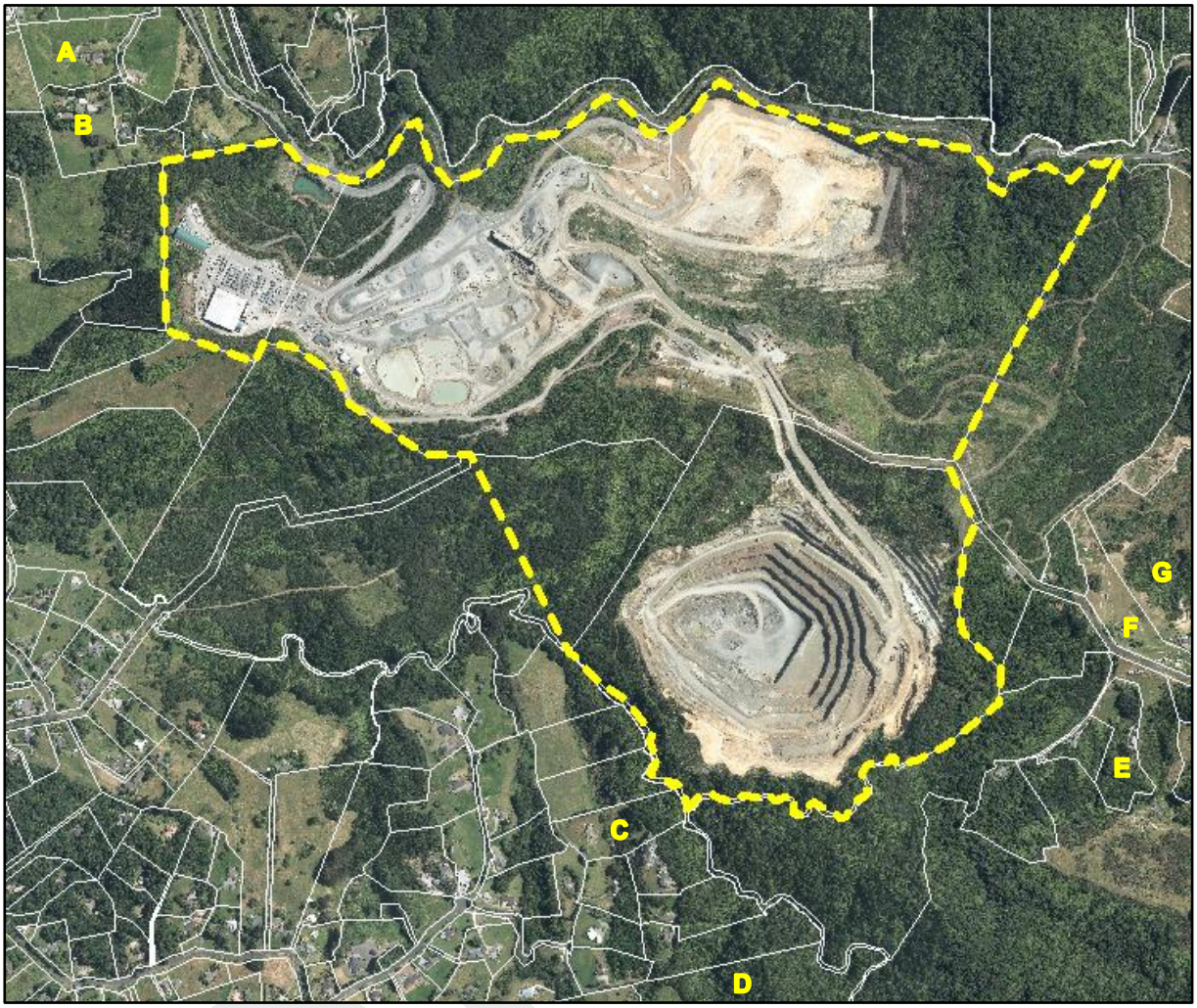


Figure 1: Nearest receivers and the SPQZ area of Hunua Quarry

6.0 Noise and vibration limits

This section summarises the noise and vibration limits for construction work, operational activities, and blasting. The resource consent conditions relevant to noise and vibration limits are provided in Appendix B.

The noise and vibration limits in this section do not apply at the following sites:

- Hunua Road: 369, 397, 411, 480-486, and 490
- Judge Richardson Drive: 105, 106, 108, 115, 118, 119, and 195
- Middleton Road: 161, 163, 165, 167, 180, 193, and 255.

6.1 Construction noise limits

Construction noise must comply with the following limits when measured at 1 m from the façade of any occupied dwelling and 1.2–1.5 m above ground level. These limits do not apply at the sites referenced in Section 6.0.

- Monday to Saturday 7:30 am to 6:00 pm: 70 dB L_{Aeq} and 85 dB L_{Amax}
- All other times: no noisy construction work is permitted. Any quiet construction activity must be generally inaudible outside the neighbouring dwellings.

6.2 Construction vibration limits

Construction vibration at Hunua Quarry must comply with:

- **Vibration amenity limit**: 2 mm/s PPV in any axis when measured in the corner of the floor of the storey of interest for multi-storey dwellings, or within 0.5 m of ground level at the foundation of a single storey dwelling. This limit only applies at dwellings that are occupied during the construction works.
- **Building damage limit**: The guideline vibration values of DIN 4150–3:2016 in all buildings when measured and assessed in accordance with the Standard. The relevant limits are provided in Section 7.0.

These limits do not apply to vibration from blasting (see Section 6.5).

6.3 Operational noise limits

All operational activities (except blasting – see Section 6.4) must comply with the following limits when measured and assessed in accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound* and NZS 6802:2008 *Acoustics – Environmental noise*.

The noise limits apply at the notional boundary of any site outside the *Special Purpose – Quarry Zone*.

- 7:00 am to 6:00 pm on Monday to Friday: 55 dB $L_{Aeq.}$
- 7:00 am to 4:00 pm on Saturday: 55 dB $L_{Aeq.}$
- All other times: 45 dB L_{Aeq} and 75 dB L_{Amax}.

6.4 Blasting noise limits (overpressure)

The overpressure limits depend on the location of the blast. Refer to Section 5.0 to determine whether the blast is within the SPQZ.

Overpressure must be measured in accordance with the guidance of Appendix J *Ground Vibration and Airblast Overpressure* of AS 2187.2:2006 *Explosives—Storage and use, Part 2: Use of explosives*.

6.4.1 Blasting in the SPQZ

Overpressure generated by using explosives within the *Special Purpose – Quarry Zone* must comply with a limit of 128 dB L_{Zpeak} when measured at the notional boundary of any dwelling outside the zone.

6.4.2 Blasting in the RMRZ (all other blasting)

Overpressure generated by using explosives within the *Rural — Mixed Rural Zone* must comply with a limit of 120 dB L_{Zpeak} when measured at the boundary of any other site.

6.5 Blasting vibration limits

Vibration generated by blasting activities must comply with the limits set out in the German Standard DIN 4150-3 2016: *Vibration in buildings – Part 3 Effects on structures* when measured and assessed in accordance with the Standard.

The relevant limits are provided in Section 7.0.

7.0 Vibration limits under DIN 4150-3:2016

DIN 4150-3:2016 recommends guideline values for avoiding cosmetic building damage according to the design, occupancy, and sensitivity of the subject building, and the frequency of the vibration.

The building classifications are:

- Line 1: Buildings used for commercial purposes, industrial buildings, and buildings of similar design
- Line 2: Dwellings and buildings of similar design and/or occupancy
- Line 3: Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g., listed buildings under preservation order).

The guideline values also depend on whether the vibration is ‘short-term’ or ‘long-term’. Short-term vibration is defined by the Standard as vibration which does not occur often enough to cause structural fatigue, and which does not produce resonance. Long-term vibration is all other types of vibration.

The relevant limit for activity at Hunua Quarry can be determined (in most cases) by considering the following:

- The nearest buildings to Hunua Quarry are all dwellings (Line 2).
- Vibration measured in dwellings typically meets the short-term criteria when generated by trucks, heavy machinery, and blasting at quarries.
- The dominant frequency of the vibration is very likely to be less than 50 Hz.

The DIN 4150–3:2016 limits for short-term vibration at the foundations of dwellings are illustrated in Figure 2. The Standard includes other considerations, limits, and measurement locations, and should be referred to in full when assessing the potential for vibration to cause damage.

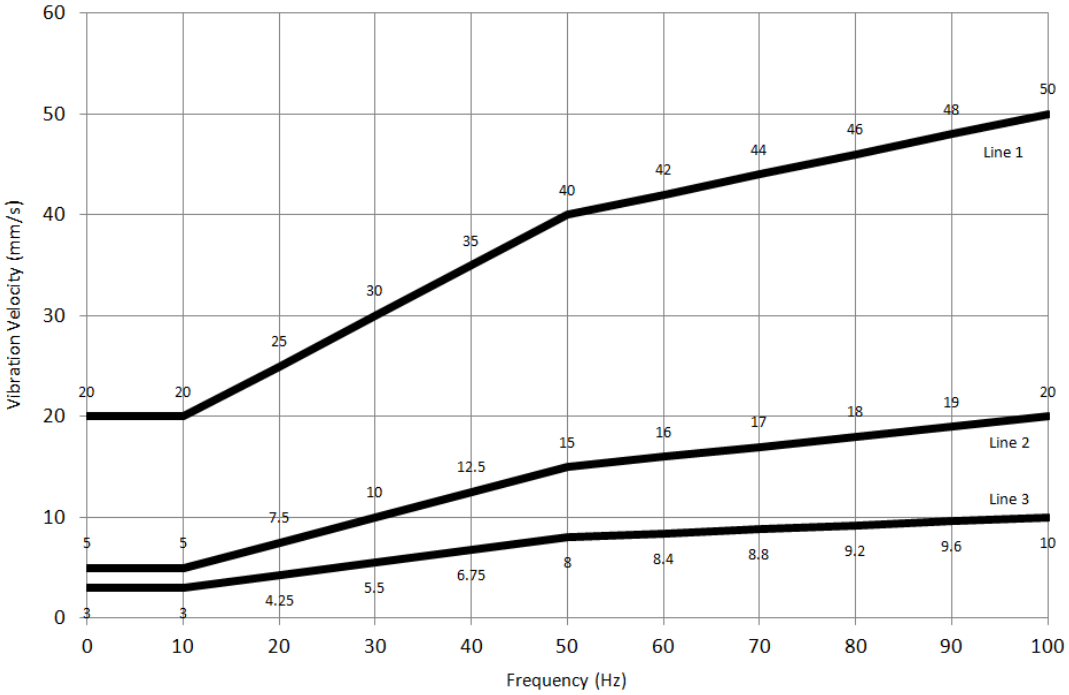


Figure 2: DIN 4150–3:2016 guideline values for short-term vibration

8.0 Construction hours

Noisy construction work, such as the use of heavy trucks and machinery, may only take place on site between the hours of 07:30 and 18:00, Monday to Saturday.

Quiet construction activity may take place at any time provided that any noise generated is generally inaudible at the notional boundary of any occupied dwelling.

9.0 Quarry noise sources

This section sets out the reference sound levels for construction and operational activities at Hunua Quarry.

9.1 Construction noise sources

Table 3 displays the current construction noise sources at Hunua Quarry. This will be updated as necessary when vehicles or equipment are replaced, or long-term noise measurements provide updated data.

Table 2: Reference noise levels and compliance distances from occupied dwellings

Construction activity	Unmitigated $L_{Aeq(15\ min)}$ noise level at 10 m	Unmitigated compliance distance
D9 bulldozer working in a small area	87 dB	95 m
Woodchipper	83 dB	60 m
Mulcher mounted on 10-t excavator	83 dB	60 m
Petrol chainsaw felling trees (33% on-time)	77 dB	30 m
Excavation with a 120-t excavator	82 dB	53 m
Excavation and loading trucks with a 45-t excavator	72 dB	17 m
Loading trucks with a 10-t excavator	67 dB	10 m

9.2 Operational noise sources

Table 3 displays the current operational noise sources at Hunua Quarry. This will be updated as necessary when vehicles or equipment are replaced, or long-term noise measurements provide updated data.

The reference sound power levels (L_{WA}) are all based on L_{Aeq} measurements.

Table 3: Operational noise sources

Activity at the quarry	Plant	Reference sound power level
Early morning operation between 5:00 am and 7:00 am	Purchasing trucks travelling between the front gate and the loadout area adjacent to the processing plant	114 dB L_{WA} trucks uphill 107 dB L_{WA} trucks downhill
	Loader	107 dB L_{WA}
	Processing plant	113 dB L_{WA}
Overburden stripping	Dump truck travelling between the stripping area and the OBDA	112 dB L_{WA}
	120-t excavator stripping overburden	112 dB L_{WA}
	30-t excavator stripping overburden and loading trucks	98 dB L_{WA}

Activity at the quarry	Plant	Reference sound power level
	D9 dozer shifting overburden to be loaded into trucks	115 dB L_{WA}
Operational activities during the daytime period	Dump truck travelling between the excavation area and the OBDA	112 dB L_{WA}
	180-t excavator extracting aggregate	112 dB L_{WA}
	120-t excavator extracting aggregate	112 dB L_{WA}
	40-t excavator loading trucks	100 dB L_{WA}
	30-t excavator loading trucks	98 dB L_{WA}
	10-t excavator loading trucks	95 dB L_{WA}
	D9 dozer	115 dB L_{WA}
	Drilling rig drilling holes for blasting	121 dB L_{WA}
	Grader maintaining surfaces of pit and haul roads	113 dB L_{WA}
	Mobile crusher at the Symonds Hill Pit floor	109 dB L_{WA}
	Processing plant	113 dB L_{WA}

10.0 Operational noise mitigation

This section sets out the operational noise mitigation measures that must be implemented.

10.1 Crushing in Symonds Hill Pit

Any crushing undertaken within Symonds Hill Pit must only be at the pit floor.

The crusher must be enclosed with acoustically rated shed. The shed must be designed to reduce the noise emissions from the crusher by at least 10 dB. It should be constructed using materials with a surface mass of no less than 7 kg/m^2 or from proprietary noise barriers (such as Echo Barrier[2], Soundbuffer[3] or Hushtec[4]).

[2] https://supplyforce.co.nz/echo-barrier

[3] http://soundbuffer.co.nz

[4] https://duraflex.co.nz/hushtec

Noise measurements must be undertaken when the crusher is first operated in the pit to confirm that a reduction of 10 dB is being achieved. If measurements identify that the minimum reduction is not being achieved, crushing must stop and the shed must be upgraded and retested.

10.2 Reversing alarms on quarry plant and vehicles

Tonal reversing alarms (beepers) can generate additional annoyance at neighbouring sites, so must not be used on quarry-based machinery. Alternatives such as broadband reversing alarms (squawkers) can be used.

10.3 General noise mitigation measures

The following mitigation measures must be implemented:

- Equipment must be maintained to ensure it is not generating excessive or unnecessary noise.
- Equipment generating excess or unnecessary noise should be stopped and reported to the site manager.
- When noisy equipment is not required to be running, it should be switched off and not left idling.
- All personnel operating heavy machinery near to the site boundaries must be aware of the provisions of this ONMP and the potential impacts of noise on the neighbours.

11.0 Noise and vibration monitoring

This section sets out the relevant monitoring locations, Standards, and requirements for noise and vibration monitoring. The results of all monitoring should be retained and provided to Auckland Council upon reasonable request.

11.1 Noise monitoring requirements

All noise and vibration measurements must be undertaken by a suitably qualified and experienced person (e.g., MASNZ) or any quarry personnel trained by the Hunua Quarry noise and vibration consultants identified in Section 3.0.

All noise monitoring must be undertaken using a sound level meter conforming to at least IEC651 Type 2 criteria.

Regular operational noise monitoring is necessary to ensure that noise emissions are compliant with the relevant limits set out in Section 6.0. All operational noise must be measured and assessed at the notional boundary (or a suitable proxy location) in accordance with NZS 6801:2008 and NZS 6802:2008.

Any noise modelling used to design mitigation or check compliance must be undertaken in accordance with NZS 6802:2008.

Construction and blasting noise should be monitored periodically and in response to any reasonable complaint. All construction noise must be measured and assessed at 1 m from the façade of any occupied building (or a suitable proxy location) in accordance with NZS 6803:1999. All overpressure (blasting noise) must be measured and assessed in accordance with the guidance of Appendix J of AS 2187.2:2006.

11.2 Frequency of noise monitoring

Noise monitoring must be undertaken at the following times (as a minimum):

- Stage 1 – within 6 months of commencement.
- Stage 2 – during construction works associated with the stream alignment.
- Stage 4 – when operational activities are within 400 m of the nearest receiver.
- Stage 7 – when operational activities are within 400 m of the nearest receiver.
- Stage 8 – when operational activities are within 400 m of the nearest receiver.
- Periodically throughout the life of the quarry to check compliance with operational, construction, and blasting noise limits.
- In response to any reasonable complaint received by Auckland Council or made directly to Huna Quarry.
- To test the noise levels generated by new plant, machinery, or vehicles.
- To test the effectiveness of mitigation implemented for compliance with the noise limits.

Periodic noise monitoring is not required where a permanent or semi-permanent noise monitoring system installed on site can provide robust and reliable data to assess compliance and reference sound levels.

11.3 Vibration monitoring requirements

Vibration must be monitored in response to any reasonable complaint.

All vibration must be measured and assessed at the foundations of the subject building in accordance with DIN 4150:2016 (or as otherwise directed by the Standard).

12.0 Complaints about noise and vibration

Any complaints received by quarry staff from residents will be directed to the relevant contact identified in Section 3.0.

The details of any complaints will be recorded in a register, including:

- the time and date of the noise or vibration causing the complaint
- the nature of the noise or vibration and what it was caused by, if known

- the name and contact number of the complainant, if provided
- the action taken in response to the complaint
- any corrective action measures implemented in accordance with Section 13.0.

The register will be made available to Auckland Council on request.

13.0 Corrective action measures

The corrective action measures illustrated in Figure 3 must be followed if non-compliance with the project noise or vibration limits is identified through monitoring.

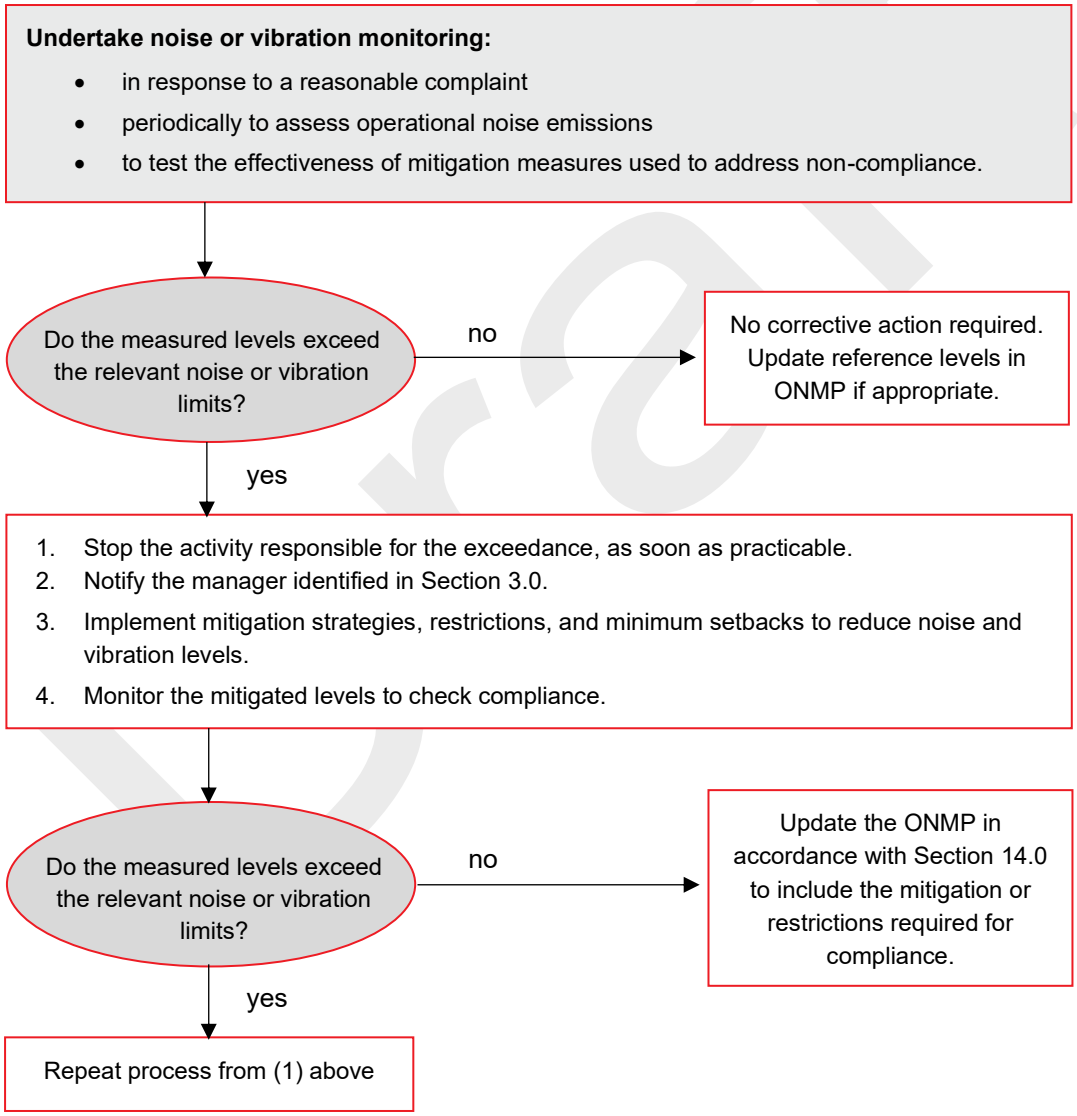


Figure 3: Corrective action measures

14.0 Revisions to this ONMP

This ONMP must be reviewed and updated where necessary:

- if changes in methodology or management are required to respond to non-compliance with noise or vibration limits being identified through monitoring, or in response to complaints
- if new plant, trucks, or vehicles are purchased for use on site that may change the cumulative operational noise emissions (higher or lower)
- to adapt to changes in the receiving environment where an existing dwelling:
  - becomes unoccupied (permanently or semi-permanently)
  - is acquired by or under the control of FCIL
  - changes use and is no longer an activity sensitive to noise.
- to adapt to changes in the receiving environment where a new dwelling is established within a rural zone near to Symonds Hill Pit
- at least every five years.

Any updated version of this ONMP must:

- be based on enabling compliance with the relevant noise and vibration limits in Section 6.0
- meet the objectives stated in Section 1.0
- record any material changes in Appendix C
- be provided to Auckland Council for information before any material changes are actioned.

Appendix A Glossary

Noise	Noise is unwanted, harmful, or inharmonious (discordant) sound which serves little or no purpose for the exposed persons. Sound is wave motion within matter, be it gaseous, liquid, or solid. Noise usually includes vibration as well as sound. The Resource Management Act 1991 defines noise as 'includes vibration'.
dB (decibel)	The basic measurement unit of sound. The decibel is a logarithmic scale that allows a wide range of values to be compressed into a more comprehensible range, typically 0 dB to 120 dB. Noise levels in decibels cannot be added arithmetically since they are logarithmic numbers. If one machine is generating a noise level of 50 dB, and another similar machine is placed beside it, the level will increase to 53 dB and not 100 dB.
$L_{Aeq(t)}$ (dB)	The A-weighted equivalent sound pressure level with the same energy content as the measured varying acoustic signal over a sample period (t). The preferred metric for sound levels that vary over time because it considers the total sound energy over the period of interest.
L_{AFmax} (dB)	The maximum A-weighted sound pressure level recorded during the measurement period using a fast time-weighting response.
L_{WA} (dB)	Sound power level (L_{WA}) is the acoustical energy emitted by a sound source. It is an absolute value and is not affected by distance or the environment. The L_{WA} is used in computer noise modelling to calculate the sound pressure level (e.g. L_{Aeq}) at a given distance.
L_{AE} (dB)	The A-weighted single event noise exposure level (also known as SEL). It is used to quantify the noise generated by individual events referenced to a standard period of one second. It is the dBA noise level over one second that would produce the equivalent sound energy as the actual event.
Noise Rating Level	A noise level derived in accordance with NZS 6802:2008 *Acoustics – Environmental noise*.
Notional boundary	A line 20 metres from any side of a residential unit or other building used for a noise sensitive activity or the legal boundary where this is closer to the building.
PPV	Peak particle velocity, measured in mm/s. The standard metric for the measurement of ground borne vibration in New Zealand. The instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.

Appendix B Resource consent conditions

Recommended noise and vibration consent conditions — to be updated.

Construction noise and vibration

1. Construction work may only take place on site between the hours of 7:30 am and 6:00 pm, Monday to Saturday. This condition does not prevent quiet construction activities from taking place at any time, provided that any noise generated is generally inaudible at the notional boundary of any occupied dwelling.

   Advice note: construction work includes (without limitation) temporary activities associated with vegetation clearance, stream realignment, rehabilitation work, and the construction of sediment retention ponds, haul roads, drainage networks, culverts, and earth bunds.

Blasting noise and vibration

2. All blasting at Hunua Quarry must comply with the following limits, except that no overpressure limits apply at 369, 397, 411, 480-486, and 490 Hunua Road, 105, 106, 108, 115, 118, 119, and 195 Judge Richardson Drive, and 161, 163, 165, 167, 180, 193, and 255 Middleton Road.

   i. Overpressure generated by using explosives within the *Special Purpose – Quarry Zone* must comply with a limit of 128 dB L_{Zpeak} when measured at the notional boundary of any dwelling outside the zone. Overpressure must be measured in accordance with the guidance of Appendix J *Ground Vibration and Airblast Overpressure* of AS 2187.2:2006 *Explosives—Storage and use, Part 2: Use of explosives*.

   ii. Overpressure generated by using explosives within the *Rural — Mixed Rural Zone* must comply with a limit of 120 dB L_{Zpeak} when measured at the boundary of any other site.

   iii. Vibration generated by blasting activities must comply with the limits set out in the German Standard DIN 4150-3 2016: *Vibration in buildings – Part 3 Effects on structures* when measured and assessed in accordance with the Standard.

   iv. All blasting is restricted to the following except where it is necessary for safety reasons:

   - Blasting must only take place between 9:00 am and 5:00 pm on Monday to Saturday.
   - The number of blasts over any calendar fortnight must not exceed an average of two per day.

   v. A siren must be used prior to blasting to alert people in the vicinity.

Operational noise

3. All operational activities except blasting must comply with the following limits when measured and assessed in accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound* and NZS 6802:2008 *Acoustics – Environmental noise*. The noise limits apply at the notional boundary of any site outside the *Special Purpose – Quarry Zone* except at 369, 397, 411, 480-486, and 490 Hunua Road, 105, 106, 108, 115, 118, 119, and 195 Judge Richardson Drive, and 161, 163, 165, 167, 180, 193, and 255 Middleton Road.

    - 7:00 am to 6:00 pm on Monday to Friday: 55 dB $L_{Aeq.}$
    - 7:00 am to 4:00 pm on Saturday: 55 dB $L_{Aeq.}$
    - All other times: 45 dB L_{Aeq} and 75 dB L_{Amax}.

4. An Operational Noise and Vibration Management Plan (ONMP) must be prepared for Hunua Quarry before operational activities begin in any of the expansion areas.

    The objective of the ONMP is to set out procedures to ensure that noise and vibration emissions from Hunua Quarry comply with the relevant limits and do not cause adverse effects on the neighbouring properties.

    The ONMP must include (as a minimum):

    - roles and responsibilities for the implementation of the ONMP
    - the activities and noise sources at Hunua Quarry
    - the relevant noise and vibration limits
    - the neighbouring receivers
    - mitigation measures and all operational restrictions required to ensure that the relevant noise and vibration limits are complied with
    - procedures for undertaking noise and vibration measurements
    - procedures for managing noise and vibration complaints
    - corrective action measures
    - provisions for updating the ONMP to adapt to any changes in the receiving environment or any material changes to the quarry vehicle fleet and machinery
    - Procedures for ensuring that the use of any mobile crushing plant in the Symonds Hill Pit is enclosed, screened, or otherwise operated to ensure that it does not exceed a reference noise level of 81 dB LAeq(15 min) at 10 m.

5. Tonal reversing alarms (beepers) must not be used on quarry-based machinery. Alternatives without tonal characteristics such as broadband reversing alarms (squawkers) are permitted.

Appendix C Updates to the ONMP

Material updates to the ONMP must be recorded in the table below

Date	Sections updated	Reasons for updates	Changes to methodology or mitigation required

Appendix C Cetaware^{TM} measurement locations

WIN1

WIN2

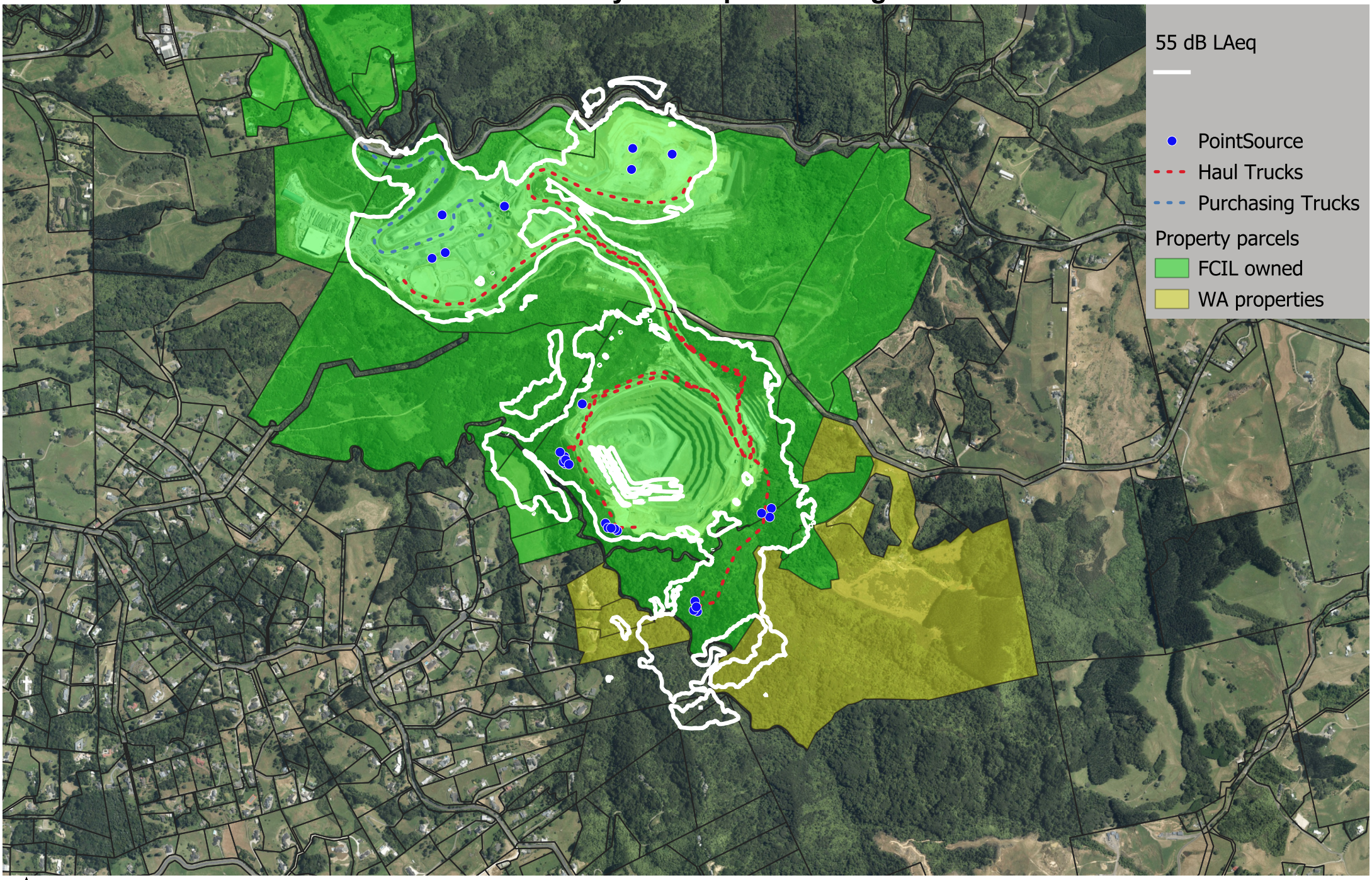
WIN3

WIN4

WIN5

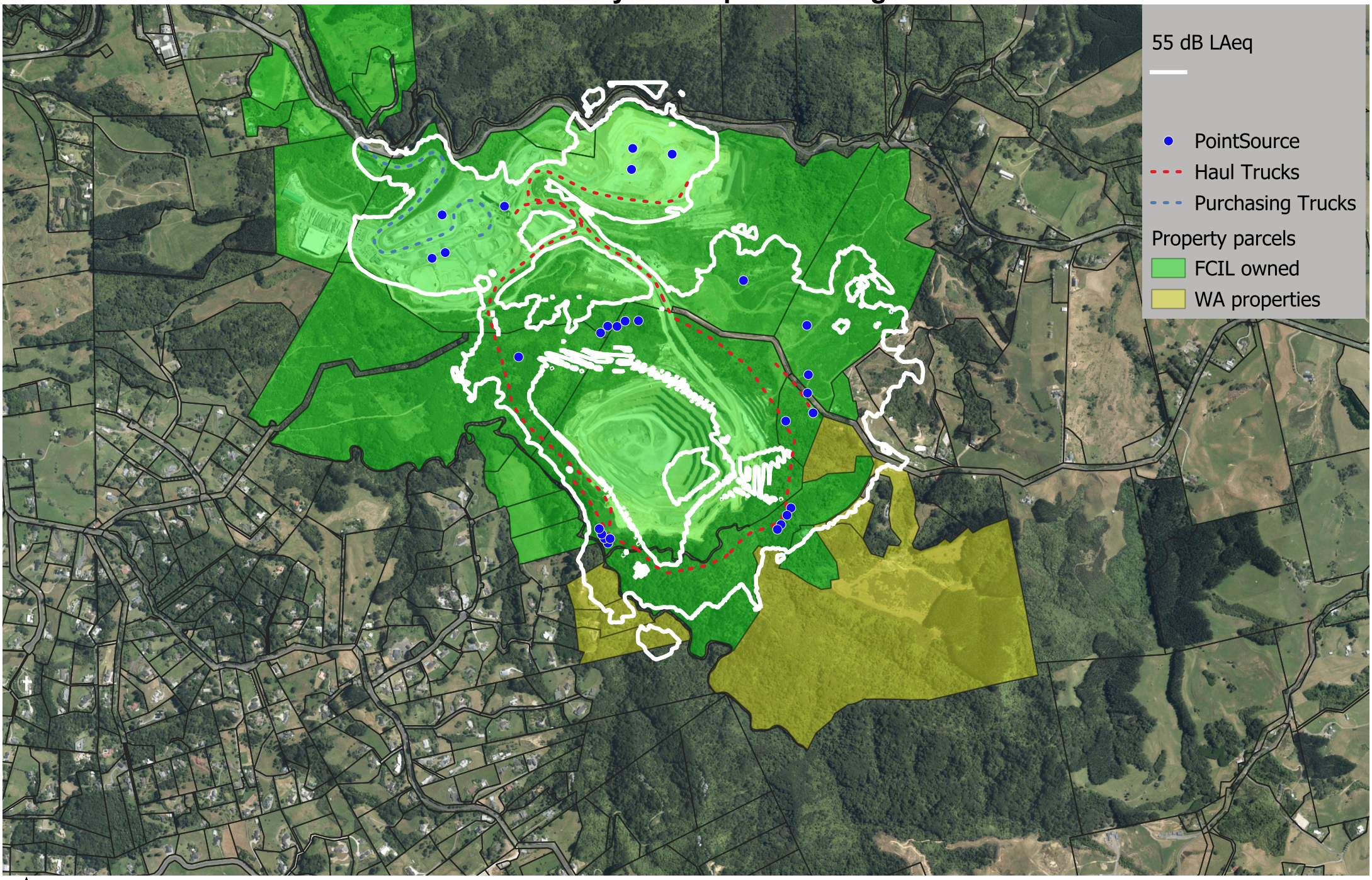
Appendix D Noise level contours

Hunua Quarry Development - Stage 1



Styles Group
Acoustics & Vibration Consultants

Hunua Quarry Development - Stage 7



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