



Belmont Quarry Development – Part B

Substantive Application
Appendix B.10 – Acoustic Assessment
Winstone Aggregates

16 August 2026



ACOUSTIC ASSESSMENT

BELMONT QUARRY DEVELOPMENT PROJECT BELMONT QUARRY

PREPARED FOR
Winstone Aggregates

DATE
30 July 2026

Assessment prepared by Styles Group for Winstone Aggregates.

REVISION HISTORY

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Executive summary

Winstone Aggregates has engaged Styles Group to assess the potential noise and vibration effects of an application under the Fast-track Approvals Act 2024 for a new overburden disposal area (**OBDA**) to service Belmont Quarry.

We have undertaken noise measurements and software modelling to understand the existing noise environment and the potential noise emissions from the proposed OBDA.

Our ambient noise measurements in the existing environment show that the average residual noise level in the area adjacent to the proposed activity is presently 45 dB L_{A10} during the proposed operating hours of 7:00 am to 5:00 pm. For most of this period the existing residual noise levels range between 35 dB and 58 dB L_{A10} .

Our modelling demonstrates that construction noise will readily comply with the relevant Operative Hutt City District Plan and Proposed Hutt City District Plan limits, by considerable margins.

There are no permitted vibration limits under the Operative District Plan. Vibration generated by activities in the OBDA will not reach perceptible levels inside any neighbouring building and will not cause building damage. The PHCDP vibration limits will be complied with.

The Operative District Plan does not specify any operational noise limits for the OBDA at the nearest receivers. We have recommended cumulative noise limits based on the permitted standards for the existing activities at Belmont Quarry. Compliance with these limits will ensure that there will be no increase in noise effects beyond what is already enabled for the nearest receivers. Our modelling demonstrates that the recommended limits can be complied with.

The potential noise effects in Belmont Regional Park will be transient on park users as they cycle, run, or walk through the area. The noise effects will be highest during Stage 1, noticeably lower during Stages 2 and 3, and significantly lower during all other stages. We consider that the noise emissions into Belmont Regional Park will not exceed a reasonable level.

We consider overall that noise and vibration emissions from the proposed OBDA will be reasonable if our recommended conditions are complied with because they will be consistent with the existing environment and largely unnoticeable for the nearest receivers.

1.0 Introduction

Winstone Aggregates (**Winstone**), a division of Fletcher Concrete and Infrastructure Limited, has engaged Styles Group to assess the potential noise and vibration effects of the proposed Belmont Quarry development project at Belmont Quarry, Lower Hutt, Wellington (the **Site**).

Winstone is seeking approval under the Fast-track Approvals Act 2024 (**FTAA**) for:

- A land exchange involving Crown-owned recreational reserve land within Belmont Regional Park and privately owned land held by Winstone.
- The construction and operation of a new Overburden Disposal Area (**OBDA**) within the recreational reserve land to secure the ongoing operation of Belmont Quarry.

The purpose of this report and information regarding its preparation are set out below. A glossary of acoustics terms is included as Appendix A.

1.1 Purpose of report

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

- Identify the construction and operational noise and vibration sources associated with the proposal and the noise and vibration levels at the neighbouring sites.
- Identify whether noise and vibration emissions will exceed the relevant Hutt City District Plan (the **HCDP**) noise and vibration standards.
- Describe the potential noise and vibration effects of the project in the context of the existing environment, the relevant HCDP standards, and s16 of the Resource Management Act 1991 (the **RMA**).
- Recommend mitigation measures and conditions based on our findings.

The Proposed Hutt City District Plan (the **PHCDP**) does not currently have legal effect. It is unknown when the changes to zoning, noise limits, and referenced noise Standards in the PHCDP will become operative, or whether the final standards will vary from those currently proposed. We have assessed the proposal against the relevant noise and vibration standards of the latest version of the PHCDP for reference only.

This report should be read together with other technical assessments and the AEE 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 (discussed in Section 5.0), operational and design information provided by the project team, and the application plans.

Our calculations and assessments comply with the following Standards where relevant, as required by the HCDP:

- NZS 6801:1991 *Measurement of sound*.
- NZS 6802:1991 *Assessment of environmental sound*.
- NZS 6803P:1984 *The measurement and assessment of noise from construction, maintenance and demolition work*.

Schedule 5, clause 7(f) of the FTAA 2024 requires the assessment of environmental effects to address any unreasonable emission of noise associated with the proposed activity. This requires an assessment of the predicted noise emissions, the resulting effects on surrounding receivers, and any measures proposed to avoid, remedy, or mitigate adverse noise effects. This requirement aligns with the purpose of section 16 of the RMA, 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.

Accordingly, this assessment considers the anticipated noise effects of the proposal and makes recommendations to avoid unreasonable noise emissions.¹ We have based our assessment of 'reasonable' on the level, character, timing, frequency, and duration of the proposed noise emissions in the existing environment, which includes the noise levels and effects authorised by existing consents, those enabled by the relevant permitted standards of the HCDP, and noise from nearby infrastructure.

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, serving as an elected council member from 2012 until 2018. He has extensive experience in quarrying and construction projects and regularly undertakes peer review work for local authorities. Jamie is one of the three authors of the Association of

¹ The definition of noise under the RMA includes vibration.

Australasian Acoustical Consultants *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 21 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.

1.4 Report release and reliance

We have 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 FTAA.

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.

2.0 Project description

The FTAA application includes a land exchange between Winstone and the Department of Conservation (**DOC**) and the construction and operation of a new OBDA in the land exchange area. This report addresses the potential noise and vibration effects of the construction and operation of the OBDA.

The area of Belmont Regional Park proposed to be transferred to Winstone adjoins the northern boundary of the existing quarry footprint. This land includes utility tracks used by Transpower, a tramping track (Buchanan's Road track), and a paper road with no formed access. These blocks, known as Northern Gully Block, Southern Gully Block, Firth Block, and Dry Creek Block, and the proposed OBDA are illustrated in Figure 1.



Figure 1: The proposed land exchange areas

The proposed OBDA activity includes the following key aspects:

- The proposed OBDA is located directly to the north of the existing quarry and is approximately 23.86 ha in size. It includes a proposed central haul road and will be accessed through the existing quarry site.
- The construction and operation of the OBDA will be undertaken in ten sequenced stages (following preliminary enabling works). The final stage will provide for formal closure, revegetation, and rehabilitation of the OBDA area.
- Enabling works are required for each stage. These works include construction of temporary controls for erosion, stability, sediment, and subsoil drainage, and vegetation clearance. Temporary works may also be required outside of the OBDA footprint but within the land exchange area for structural stability, drainage, or maintenance access.
- There will be no blasting or processing undertaken in the proposed OBDA.
- The OBDA will accommodate approximately 2.8 million cubic metres of overburden over approximately 35 years.

- The working hours (except for emergency works) for overburden placement in the OBDA will be:
 - Monday to Thursday: 7:00 am to 5:00 pm
 - Friday: 7:00 am to 4:00 pm
 - Saturday: 7:00 am to 12:00 pm
 - No work on Sundays or Public holidays.

The staged development footprint areas are shown in Figure 2.

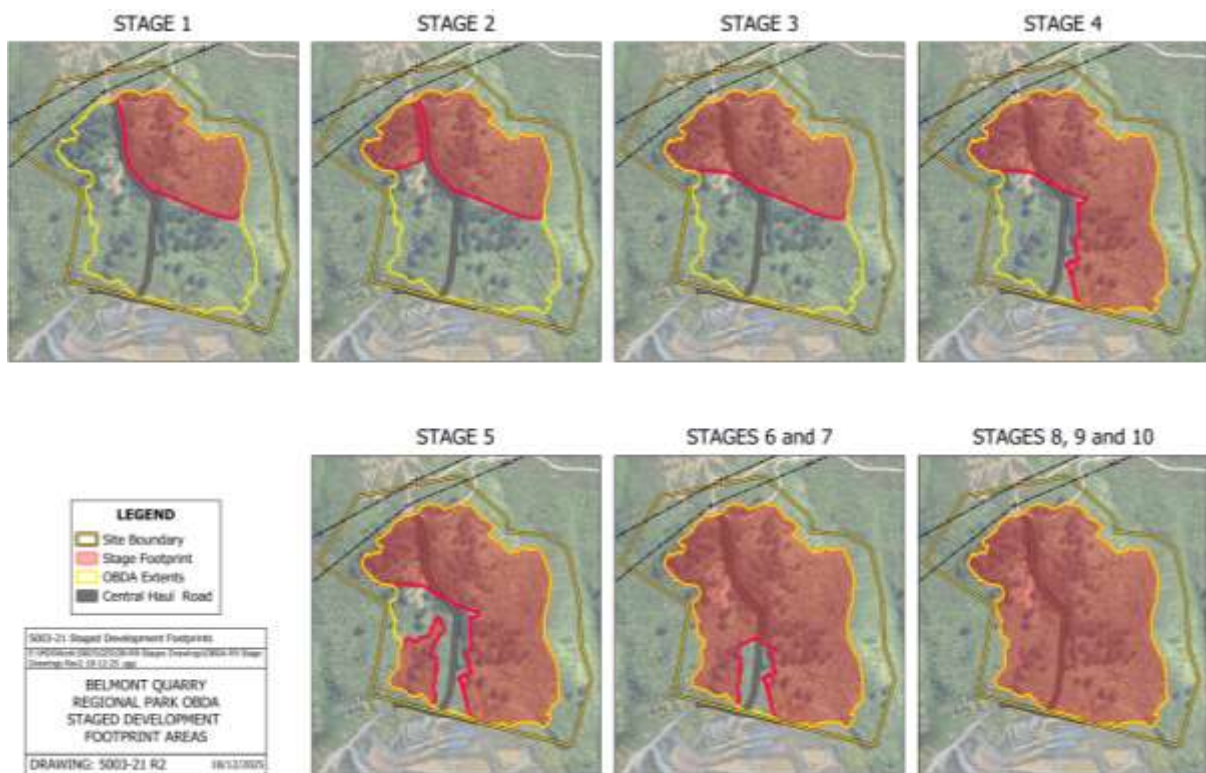


Figure 2: Staged development footprint areas

The activities during each of the 10 stages are described in Table 1. The definition of construction activities is discussed further in Section 0.

Table 1: Proposed stages

Stage	Activities within the OBDA
Preliminary	Construction activities: • Installation of fencing and signage. • Construction of northern earth bunds for amenity screening before earthworks begin in Stage 1. The bunds will be 3–5 m high², approximately 7 m wide, and planted with native vegetation. Their purpose is to restrict public access to the land exchange area where heavy vehicles will be operating, while also providing a visual and physical buffer between park users and activities associated with OBDA development. • A stockpile area will be established within the OBDA footprint to store any topsoil removed from site. The stockpile will remain in place until Stage 5. Operational activities: • None.
1	Construction activities: • Constructing the main haul road along the central ridge of the OBDA. • Enabling works and vegetation clearance. • Construction of the fines containment cell. • The construction works will involve truck movements, excavators, bulldozers, a compaction roller, a grader, chainsaws, a mulcher, and a woodchipper. Operational activities: • Topsoil stripping and overburden and fines placement involving truck movements, excavators, bulldozers, a compaction roller, a grader, and a water cart.
2 – 6	Construction activities: • Enabling works and vegetation clearance. • Progressive rehabilitation. • The construction works will involve truck movements, excavators, bulldozers, a compaction roller, a grader, chainsaws, a mulcher, and a woodchipper. Operational activities: • Topsoil stripping and overburden and fines placement involving truck movements, excavators, bulldozers, a compaction roller, a grader, and a water cart.

² The bunds are included in our modelling with a height of 3 m assumed.

Stage	Activities within the OBDA
7	Construction activities: • Enabling works. • Progressive rehabilitation. • The construction works will involve truck movements, excavators, bulldozers, a compaction roller, and a grader. Operational activities: • Topsoil stripping and overburden and fines placement involving truck movements, excavators, bulldozers, a compaction roller, a grader, and a water cart.
8	Construction activities: • Enabling works and vegetation clearance. • Progressive rehabilitation. • The construction works will involve truck movements, excavators, bulldozers, a compaction roller, a grader, chainsaws, a mulcher, and a woodchipper. Operational activities: • Topsoil stripping and overburden and fines placement involving truck movements, excavators, bulldozers, a compaction roller, a grader, and a water cart.
9	Construction activities: • Enabling works. • Progressive rehabilitation. • The construction works will involve truck movements, excavators, bulldozers, a compaction roller, and a grader. Operational activities: • Topsoil stripping and overburden and fines placement involving truck movements, excavators, bulldozers, a compaction roller, a grader, and a water cart.
10	Construction activities: • Final rehabilitation and closure works. • Fines containment cell fully capped and incorporated into the landform. • OBDA topsoiled and planted.

Stage	Activities within the OBDA
	The construction works will involve truck movements, excavators, bulldozers, a compaction roller, and a grader. Operational activities: None.

3.0 The existing environment

The proposed OBDA is zoned General Recreation Activity Area (**GRAA**) under the operative HCDP. We understand that recreational use of Belmont Regional Park includes walking, running, tramping, cycling, and nature observation along Buchanan's Road Track. The vegetation off the open tracks is dense and generally very difficult to navigate.

The dwellings nearest to the proposed OBDA are more than 750 m to the west of the proposed activity at 85, 87, 87A, 87B, 89, 120, 130, 138, 160, and 180 Kaitangata Crescent. They are all zoned Rural Residential Activity Area (**RRAA**) by the operative HCDP.

The Belmont Quarry site is mostly zoned Extraction Activity Area (**EAA**) by the operative HCDP. The western area of Belmont Quarry is within the General Rural Activity Area (**GRUAA**) and is presently used for fines and overburden placement (the **Cottle Block**). We understand the Cottle Block is near to its end of life and will essentially be replaced with the new OBDA.

The operation of the quarry involves extracting rock from the ground and processing it to produce aggregates suitable for building, construction and roading. Material is extracted and processed on-site. Material with no value (overburden) is currently deposited in the Cottle Block.

The key noise and vibration generating activities at the existing quarry are:

- construction works (e.g. removal of vegetation, haul road maintenance, and rehabilitation work)
- stripping of overburden overlying the rock resource
- loosening, fragmenting, and removing rock from the ground using explosives and heavy machinery
- crushing and processing rock
- stockpiling
- truck movements on the haul road and internal accessways between extraction areas, the Cottle Block, and the processing and load-out area.

State Highway 2 (**SH2**) is south-east of existing quarry and proposed OBDA.

The location of the proposed OBDA and the surrounding area are shown in Figure 3.

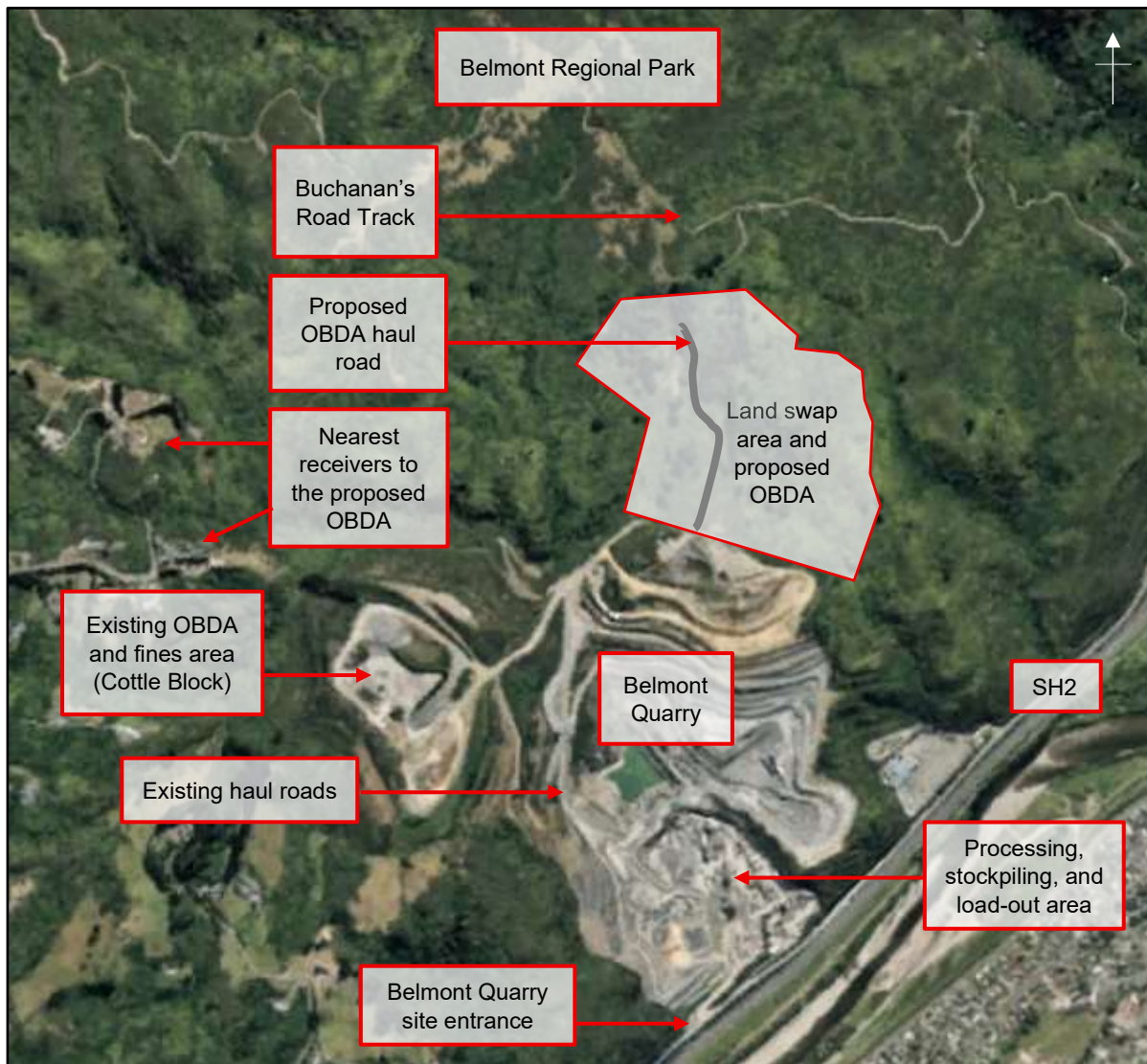


Figure 3: Proposed OBDA and the surrounding area

4.0 Noise and vibration standards

The relevant standards under the operative and proposed plans are summarised below. We have included the permitted noise and vibration standards for activities on the existing quarry site for reference when considering the existing noise environment.

4.1 Operative Hutt City District Plan

The relevant operational and construction noise and vibration limits under the operative HCDP are set out below.

4.1.1 Operational noise Standards

Section 14C.2.1.c of the operative HCDP requires operational noise levels to be measured and assessed in accordance with NZS 6801:1991 *Measurement of Sound* and NZS 6802:1991 *Assessment of Environmental Sound*.

4.1.2 General Recreation Activity Area

The operative HCDP does not include permitted noise or vibration limits for operational activities in the GRAA. Therefore, there are no permitted noise and vibration limits for the proposed operational activity in the new OBDA.

4.1.3 Extraction Activity Area

HCDP standard 14C.2.1.8 includes the following permitted noise limits for operational quarrying activities within the EAA. The limits apply on all days when measured and assessed anywhere within a residential or rural activity area.

- 6:00 am to 10:00 pm: 70 dB L_{A10}
- 10:00 am to 6:00 pm: 45 dB L_{A10} .

The only vibration controls in the HCDP for the existing quarry are for blasting activities. These are not relevant to the proposal because there will be no blasting in the new OBDA.

4.1.4 General Rural Activity Area

HCDP standard 14C.2.1.10 includes the following permitted noise limits for operational activities within the GRUAA. The limits apply on all days when measured and assessed beyond the site on which the Activity takes place:

- 7:00 am to 10:00 pm: 50 dB L_{A10}
- 10:00 am to 7:00 pm: 40 dB L_{A10} .

The Cottle Block is within the GRUAA. It is consented to operate with similar noise limits to the permitted standards, but they apply at the neighbouring notional boundaries, have different timeframes, and include an L_{Amax} noise limit at night. The consented operational noise limits at the notional boundary of any dwelling are:

- Monday to Friday 7:00 am to 6:00 pm: 50 dB L_{A10}
- Saturday 7:00 am to 2:00 pm: 50 dB L_{A10}
- All other times: 40 dB L_{A10} and 75 dB L_{Amax} .

4.1.5 HCDP construction noise and vibration limits

Section 14C.2.1.f of the HCDP requires all construction, demolition, and maintenance work to comply with NZS 6803P:1984 *Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work*.

The activities covered by this Standard are generally temporary works that are ancillary to the principal operational activities on the site, such as the construction and maintenance of roads and bunds, vegetation removal, and rehabilitation works. The guideline L_{A10} and L_{Amax} noise limits stated in this Standard are based on the timing and duration of the works, and the nature of the receiving building. The proposed works will take place between 07:30 and 18:00 on Monday to Saturday and could be over a 'long-term' duration. The relevant limits are therefore 70 dB L_{A10} and 85 dB L_{Amax} when measured at 1 m from the façade of any occupied dwelling.

The HCDP does not include vibration limits for permitted construction activities. Therefore, there are no permitted construction vibration limits for the proposed activity.

4.2 Proposed Hutt City District Plan

The relevant construction and operational noise and vibration limits under the PHCDP are set out below.

4.2.1 Operational noise standards

Section NOISE-S1 of the PHCDP requires operational noise levels to be measured and assessed in accordance with NZS 6801:2008 *Acoustics – Measurement of environmental sound* and NZS 6802:2008 *Acoustics – Environmental noise*.

4.2.2 Natural Open Space Zone

The PHCDP (NOISE-APP1) includes the following noise limits for permitted activities on all days within the Natural Open Space Zone (**NOSZ**) (within the proposed OBDA).

- When measured and assessed at any point within a site in a Residential Zone:
 - 7:00 am to 7:00 pm: 55 dB L_{Aeq}
 - 7:00 pm to 10:00 pm: 50 dB L_{Aeq}
 - 10:00 am to 7:00 pm: 40 dB L_{Aeq} and 70 dB L_{Amax} .
- When measured and assessed within the notional boundary of a dwelling in a Rural Zone:
 - 7:00 am to 7:00 pm: 55 dB L_{Aeq}
 - 7:00 pm to 10:00 pm: 50 dB L_{Aeq}
 - 10:00 am to 7:00 pm: 45 dB L_{Aeq} and 75 dB L_{Amax} .

- When measured and assessed at any point within the NOSZ outside of the proposed OBDA:
 - 7:00 am to 7:00 pm: 65 dB L_{Aeq}
 - 7:00 pm to 10:00 pm: 65 dB L_{Aeq}
 - 10:00 am to 7:00 pm: 55 dB L_{Aeq} and 75 dB L_{Amax} .

4.2.3 Quarry Zone limits

The PHCDP (NOISE-APP1) includes the following noise limits for permitted activities on all days when measured at the boundary of, or outside, the Quarry Zone (**QZ**):

- 7:00 am to 7:00 pm: 67 dB L_{Aeq}
- 7:00 pm to 10:00 pm: 55 dB L_{Aeq}
- 10:00 am to 7:00 pm: 45 dB L_{Aeq} and 75 dB L_{Amax} .

4.2.4 General Rural Zone

PHCDP standard NOISE-APP1 includes the following noise limits for permitted activities within the General Rural Zone (**GRUZ**). The limits apply on all days when measured and assessed at the notional boundary of any activity sensitive to noise in any rurally zoned site:

- 7:00 am to 7:00 pm: 55 dB L_{Aeq}
- 7:00 pm to 10:00 pm: 50 dB L_{Aeq}
- 10:00 pm to 7:00 am: 40 dB L_{Aeq} and 70 dB L_{Amax} .

4.2.5 PHCDP construction noise limits

NOISE-S2 of the PHCDP requires all construction noise to be measured in accordance with NZS 6803:1999 *Acoustics – Construction noise*.

The guideline L_{Aeq} and L_{Amax} noise limits stated in this Standard for construction works between 7:30 am and 6:00 pm on Monday to Saturday that are longer than 20 weeks in duration are 70 dB L_{Aeq} and 85 dB L_{Amax} when measured at 1 m from the façade of any occupied dwelling.

4.2.6 PHCDP vibration limits

Section NOISE-R5 of the PHCDP requires construction and operational activities in all zones (excluding blasting) to comply with the guideline vibration values of the German vibration Standard DIN 4150-3:1999. The limits in this Standard are designed to avoid cosmetic and structural damage to buildings from ground-borne vibration.

4.3 Noise limits under the proposed zone changes

Winstone has made submissions on the PHCDP requesting the following zoning changes:

- a) Rezoning of the proposed OBDA area as Quarry Zone with an Overburden Disposal Area overlay. The overlay will mean that there are limits on the type of quarrying activities that can occur in the OBDA, such as no blasting, excavation, crushing, or processing of aggregate.
- b) Rezoning of the areas anticipated to be owned by the Department of Conservation as a consequence of the proposed land exchange to Natural Open Space Zone with a Quarry Zone Protection Overlay (where noise sensitive activities do not restrict quarry activities through reverse sensitivity effects).

If these changes are accepted, the noise limits for operational activities in the OBDA under the PHCD would become those under NOISE-APP1 when measured at the boundary of the land swap areas that have been rezoned to NOSZ. These are:

- 7:00 am to 7:00 pm: 67 dB L_{Aeq}
- 7:00 pm to 10:00 pm: 55 dB L_{Aeq}
- 10:00 am to 7:00 pm: 45 dB L_{Aeq} and 75 dB L_{Amax} .

The noise limits that apply in the land swap areas would be the same as those that apply in Belmont Regional Park under the PHCDP. New noise-sensitive activities could not be established in the land swap areas in the future due to the proposed Quarry Zone Protection Overlay.

4.4 Recommendations for noise and vibration limits

There are no permitted limits for noise and vibration generated by the proposed operational activities in the OBDA. This section sets out our recommendations based on the existing environment.

We understand that the existing environment includes:

- The noise and vibration levels and effects that are enabled by the permitted standards of the HCDP. For example, the noise and vibration effects that could be generated at the nearest rural and residential areas by permitted activities in the GRAA and EAA.
- The noise and vibration levels and effects that are authorised by existing resource consents. For example, the noise and vibration authorised at the nearest rural and residential areas by the existing consents for the Activities at Belmont Quarry and the Cottle Block.
- The noise and vibration generated by existing infrastructure. For example, the existing road traffic noise levels generated by the current and future operation of SH2.

- Ambient and background noise and vibration in the area generated by other sources unrelated to the quarry.

We recommend that the EAA permitted noise limits, which presently apply to activities within the quarry, are adopted as cumulative noise limits for both the quarry and the OBDA.³ This would ensure that the nearest receivers in the RRZ are not exposed to noise effects greater than those already enabled in the existing environment. These limits would be very similar to those set out in NOISE-APP1 for activities in the QZ under the PHCDP, but with different descriptors (L_{A10} instead of L_{Aeq}) and different timeframes. They are however more stringent because they apply anywhere within the boundaries of adjacent rural properties, whereas the PHCDP noise limits apply at the notional boundaries.

Adopting our recommended cumulative limits would ensure that noise emission from the OBDA do not exceed a reasonable level because they will be completely or largely unnoticeable for the receivers. The limits can be imposed through the conditions for the OBDA and would not require any update to the existing conditions for the quarry.

Our recommended noise limit condition applies the L_{A10} noise limit set by HCDP standard 14C.2.1.8 for activities in the EAA but adopts timeframes that are consistent with the proposed operating hours for the OBDA. The recommended conditions is:

Noise generated within the OBDA must comply with the following limits when measured cumulatively with all other noise emissions from Belmont Quarry, except noise from blasting. Noise levels must be measured and assessed within the site boundary of any rural or residential activity area and in accordance with NZS 6801:1991 and NZS 6802:1991.

- Monday to Thursday 7:00 am to 5:00 pm: 70 dB L_{A10} .
- Friday: 7:00 am to 4:00 pm: 70 dB L_{A10} .
- Saturday 7:00 am to 12:00 pm: 70 dB L_{A10} .
- All other times: 45 dB L_{A10} .

The noise modelling presented further in this report demonstrates that the proposed activity can comply with our recommended limits.

Trucks and heavy plant will be used in the existing quarry and OBDA simultaneously, with some crossing back and forth between the two areas. It would be challenging, if not impossible, to separately measure and assess the noise emissions from the quarry site and the OBDA. This makes using different operational noise limits, descriptors, and Standards for the quarry and OBDA unworkable.

The PDHCP will introduce new limits and Standards for the main quarry activities, but it is unknown whether they will be modified before becoming operative, or when they will become operative. We recommend that the most practicable approach would be for Winstone to adopt our recommended cumulative noise limits for the OBDA and update them in the future to align

³ Excluding activities in the Cottle Block which will be significantly reduced when the new OBDA operates and are controlled by lower noise limits.

with the PHCDP once the relevant standards become operative. Adopting the PHCDP standards for the OBDA now is not recommended because:

- a) The proposed activity in the new OBDA would begin with noise limits that are impracticable to monitor compliance against or enforce.
- b) The noise limits would remain impracticable until such time as the PHCDP noise standards become operative.
- c) The PHCDP noise standards could be modified before becoming operative.

Our recommended approach ensures that it will be practical to monitor compliance with the noise limits when the activity begins, thereby providing certainty for Winstone, the neighbouring residents, and Council.

The lower limits that apply to the Cottle Block will not be an issue because there will be very little activity in that area once the new OBDA is established. Cumulative noise emissions from Belmont Quarry will be controlled by activities in the main quarry area and the OBDA and not in the Cottle Block.

The proposed activities will not generate vibration that is perceptible within any adjacent dwelling or that could cause damage to any structure due to the low vibration levels generated and the significant separation distances. We therefore do not consider it necessary to recommend specific vibration controls for the proposed OBDA.

5.0 Noise measurements

Styles Group carried out a site visit and deployed noise logging equipment in the area surrounding the proposed OBDA in August 2025. Noise loggers were deployed to measure ambient⁴ noise levels and monitor bird activity in Belmont Regional Park. Measurements were undertaken over a period of 128 days. The results of the wildlife noise monitoring have been processed and provided to the project ecologists for analysis.

The location of the ambient noise logger is shown in Figure 4.

⁴ Ambient noise is all sound within a given environment from sources near and far.

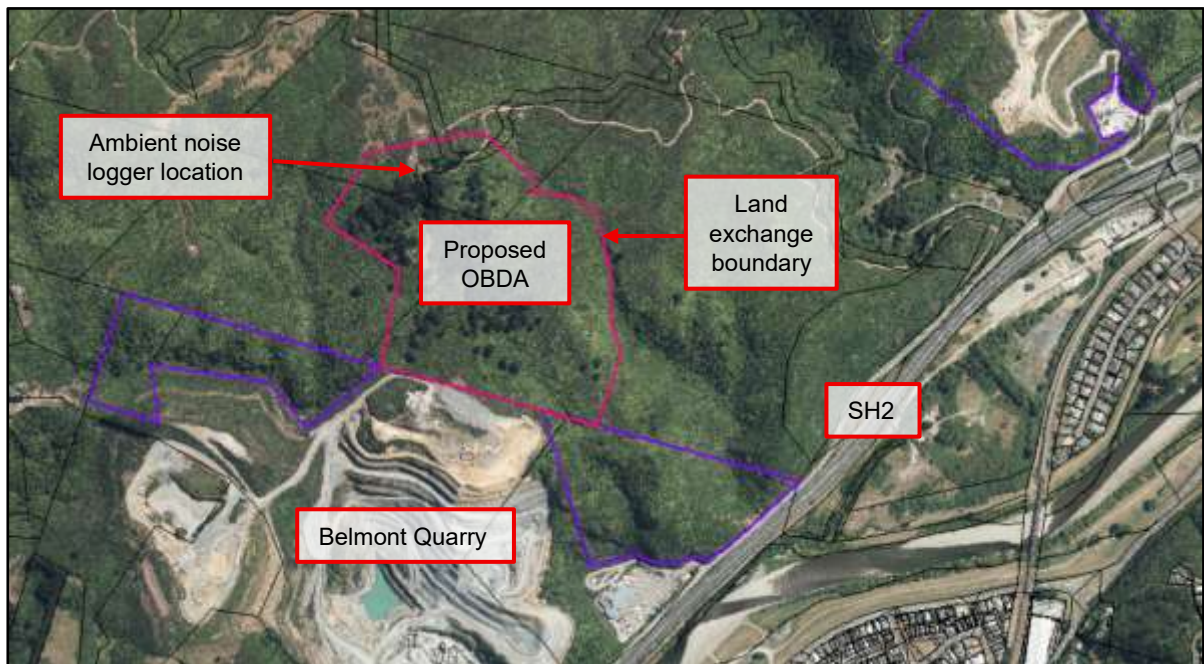


Figure 4: Location of ambient noise logger

The statistical distribution of the hourly noise levels measured from 7:00 am to 6:00 pm⁵ over the 128-day monitoring period is illustrated in Figure 5.

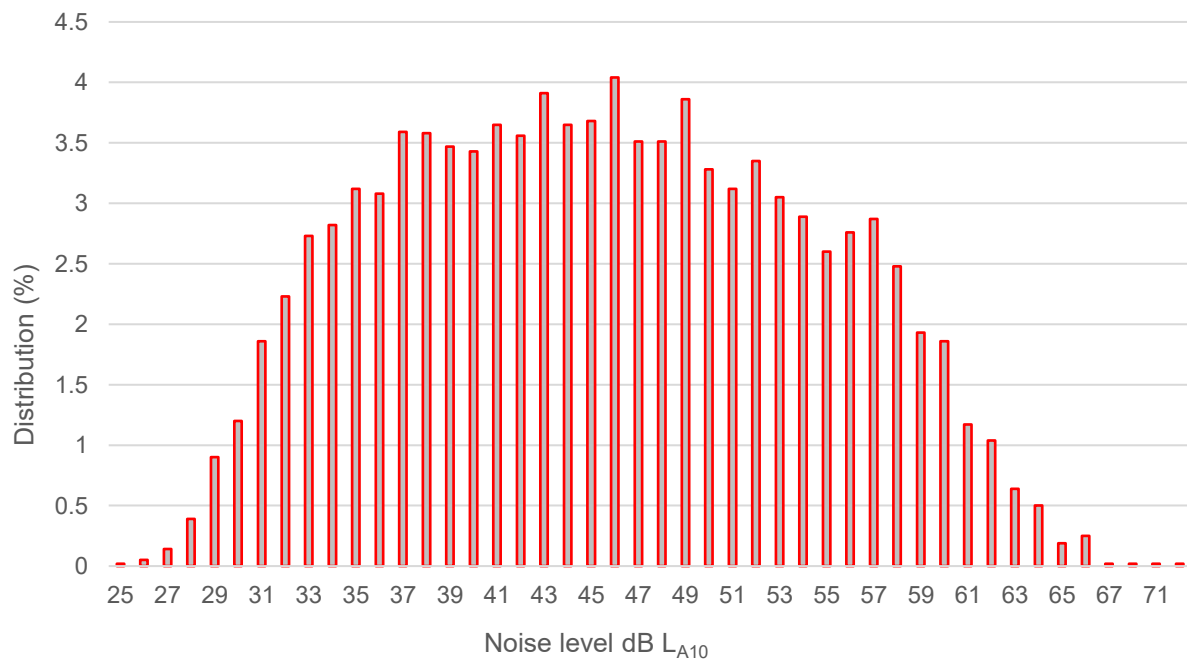


Figure 5: Statistical distribution of measured hourly L_{A10} noise levels

⁵ The proposed operating hours for the OBDA are 7:00 am to 5:00 pm.

Noise sources in the existing environment adjacent to the proposed OBDA include activity at Belmont Quarry, road traffic on SH2, birds, aircraft, and wind through vegetation.

Our analysis of the ambient noise data for the period 7:00 am to 6:00 pm has identified that:

- existing residual noise levels in Belmont Regional Park adjacent to the proposed OBDA range from 25 dB to 73 dB L_{A10}
- the average residual noise level in this area is 45 dB L_{A10}
- the residual noise level that occurs the most often in this area is 46 dB L_{A10}
- For 90% of the time, the residual noise levels in this area are between 35 dB and 58 dB L_{A10} .

The noise environment in the areas of Belmont Regional Park nearer to SH2 is dominated by road traffic noise. We have modelled the noise from SH2 based on the following: ⁶

- 38,211 AADT⁷ (peak hour flows assumed to be 150% of the hourly average)
- 4% heavy vehicles
- Porous asphalt road surface
- 100 km/hr speed limit.

The results of our modelling show that road traffic noise levels on the public walking track within 650 m of SH2 range from approximately 40 dB to 55 dB L_{A10} (decreasing with distance from SH2).

6.0 Operational noise

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

6.1 Operational noise modelling

We have created noise models to represent the operational noise emissions from the proposed OBDA and the cumulative noise from Belmont Quarry.

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

⁶ All data was sourced from www.mobileroad.org and www.nzta.govt.nz

⁷ Annual Average Daily Traffic is the average number of vehicles that pass a specific point on a road in a 24-hour period over the course of an entire year.

We have calibrated our operational noise models using the results of noise measurements at Belmont Quarry (undertaken by Styles Group and others) and at other Winstone quarries. Other operational information such as the pit and OBDA designs, ground heights, staging, and machinery type and location have been provided to us by Winstone.

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

6.2 Methodology and operational noise sources

The 3D noise models were used to identify the worst-case scenarios for noise emissions. The noise from the staged development of the OBDA was then modelled along with the concurrent development of the quarry itself and the existing operations.

Table 2 displays the operational noise sources used in our worst-case modelling and the relevant reference data and methodology. The reference sound power levels⁸ (L_{WA}) are all based on L_{A10} measurements. All operational assumptions have been provided by Winstone.

Table 2: Operational noise references and modelling methodology

Activity	Plant	Reference L_{WA}	Modelling details
OBDA during Stage 2 when plant is operating in the western portion	40-t articulated dump trucks travelling between the OBDA work area and the quarry via the haul roads	106 dB L_{WA}	Based on 20 movement per hour. Modelled as a moving point source with an average speed of 20 km/hr. Based on measurements undertaken at the existing quarry (by others). Source height is 3 m
	15,000 litre watercart travelling between the OBDA work area and the quarry via the haul roads	104 dB L_{WA}	Based on 4 movements per hour. Modelled as a moving point source with an average speed of 10 km/hr. Based on measurements undertaken at the existing quarry (by others). Source height is 1.5 m
	22-t grader (CAT-14M)	106 dB L_{WA}	Based on 20 movement per hour over 100 m. Modelled as a moving point source with an average speed of 20 km/hr. Based on measurements undertaken at the existing quarry (by others). Source height is 2 m

⁸ 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_{A10} or L_{Aeq} sound pressure levels at a given distance (which includes the effects of environmental factors such as screening, topography, and weather conditions).

Activity	Plant	Reference L _{WA}	Modelling details
	10-t vibratory compactor	101 dB L _{WA}	Based on 20 movement per hour over 60 m. Modelled as a moving point source with an average speed of 20 km/hr. Based on measurements undertaken at the existing quarry (by others). Source height is 1.5 m
	D9 dozer	118 dB L _{WA}	Modelled as a point source (working in a small area). Source height is 2 m.
	85-t excavator	106 dB L _{WA}	Modelled as a point source. Source height is 4 m.
	40-t excavator	103 dB L _{WA}	Modelled as a point source. Source height is 3 m.
	20-t excavator	100 dB L _{WA}	Modelled as a point source. Source height is 2 m.
Northern area of existing Belmont Quarry	40-t articulated dump trucks travelling between the work area and the processing area via the haul roads	106 dB L _{WA}	Based on 20 movement per hour. Modelled as a moving point source with an average speed of 20 km/hr. Based on measurements undertaken at the existing quarry (by others). Source height is 3 m
	15,000 litre watercart travelling between the work area and the OBDA via the haul roads	104 dB L _{WA}	Based on 4 movements per hour. Modelled as a moving point source with an average speed of 10 km/hr. Based on measurements undertaken at the existing quarry (by others). Source height is 1.5 m
	85-t excavator	106 dB L _{WA}	Modelled as a point source. Source height is 4 m.
	30-t excavator	102 dB L _{WA}	Modelled as a point source. Source height is 3 m.
	30-t loaders	118 dB L _{WA}	Two loaders modelled as point sources. Source height is 3 m
Cottle Block	D9 dozer	118 dB L _{WA}	Modelled as a point source (working in a small area). Source height is 2 m.

Activity	Plant	Reference L _{WA}	Modelling details
	35-t excavator	110 dB L _{WA}	Modelled as a point source. Based on measurements of Hitachi excavator at the existing quarry (undertaken by others). Source height is 2 m.
	21-t excavator	100 dB L _{WA}	Modelled as a point source. Based on measurements of Hitachi excavator at the existing quarry (undertaken by others). Source height is 2 m.
	22-t grader	106 dB L _{WA}	Based on 20 movement per hour over 100 m. Modelled as a moving point source with an average speed of 20 km/hr. Based on measurements undertaken of a CAT-14M at the existing quarry (by others). Source height is 2 m
	Dump truck manoeuvring within Cottle Block	106 dB L _{WA}	Based on 4 movement per hour over 300 m. Modelled as a moving point source with an average speed of 10 km/hr. Based on measurements undertaken of a Terex dump truck at the existing quarry (by others). Source height is 4 m
	Slimes trucks travelling between Cottle Block and the processing area via the haul roads	105 dB L _{WA}	Based on 8 movement per hour. Modelled as a moving point source with an average speed of 20 km/hr. Based on measurements of a Volvo truck undertaken at the existing quarry (by others). Source height is 2 m
	15,000 litre watercart travelling between the Cottle Block and the processing area via the haul roads	104 dB L _{WA}	Based on 8 movements per hour. Modelled as a moving point source with an average speed of 10 km/hr. Based on measurements undertaken at the existing quarry (by others). Source height is 1.5 m
Processing and load out area	Loader	110 dB L _{WA}	Four loaders modelled as point sources in the processing and loadout area. Source height is 3 m

Activity	Plant	Reference L _{WA}	Modelling details
	Processing plant	116 dB L _{WA}	Processing plant running continuously. Source height is 5 m
	Purchasing trucks travelling between the front gate and the loadout areas	112 dB L _{WA}	Based on 10 trucks (20 movements) per hour. Modelled as a moving point source with average speeds of 25 km/hr. Based on long-term measurements of laden and unladen purchasing trucks at another Winstone quarry. Source height is 2 m

6.3 Predicted operational noise levels

The HCDP requires that noise must be measured and assessed in accordance with NZS 6901:1991 and NZS 6802:1991. This means that noise limits must be adjusted for any special audible characteristics and noise levels adjusted for averaging over the day.

Noise from the site will not have special audible characteristics because tonal alarms will not be used. As a worst-case, an averaging adjustment of -1.7 dB applies because noise will be generated for 10 hours (on Monday to Thursday) of the 15-hour daytime period (7:00 am to 10:00 pm). We have applied this to our noise level predictions. The adjustments on Fridays and Saturdays would be -2.13 dB and -4.5 dB, respectively, resulting in lower noise level predictions.

Table 3 displays the predicted worst-case operational noise levels at the nearest RRZ properties and within Belmont Regional Park. It also displays the cumulative noise levels from the operation of the proposed OBDA, the existing quarry, and the Cottle Block. Noise levels have been predicted within the boundary of any rural or residential activity area. This is where the quarry noise limits and the proposed OBDA limits apply. The Cottle Block noise limits apply at the notional boundary of any dwelling.

For comparison, we have included the relevant noise limits under the HCDP for activities in the OBDA (GRAA), the existing extraction and processing areas (EAA), and the Cottle Block (GRUAA). The EAA permitted noise limit is the same as our recommended noise limit for the cumulative noise emissions from Belmont Quarry.

The worst-case operational noise levels for the receivers in the RRZ will be generated during Stage 2 while heavy plant is used in the north-western area of the OBDA. The worst-case noise levels at Belmont Regional Park will be generated during Stage 1. There will be no noise generated at night.

Table 3: Predicted worst-case noise levels and existing noise limits (L_{A10})

Receiver	Predicted noise level (OBDA only)	Cumulative noise level (all activities)	OBDA – GRAA permitted noise limit	Quarry – EAA permitted noise limit	Cottle Block consented noise limit
85 Kaitangata Cres	40 dB	46 dB	No limit	70 dB	50 dB
87 Kaitangata Cres	40 dB	44 dB	No limit	70 dB	50 dB
87A Kaitangata Cres	42 dB	48 dB	No limit	70 dB	50 dB
87B Kaitangata Cres	46 dB	51 dB	No limit	70 dB	50 dB
89 Kaitangata Cres	44 dB	48 dB	No limit	70 dB	50 dB
120 Kaitangata Cres	36 dB	43 dB	No limit	70 dB	50 dB
130 Kaitangata Cres	39 dB	45 dB	No limit	70 dB	50 dB
138 Kaitangata Cres	40 dB	46 dB	No limit	70 dB	50 dB
160 Kaitangata Cres	41 dB	47 dB	No limit	70 dB	50 dB
180 Kaitangata Cres	43 dB	47 dB	No limit	70 dB	50 dB
Belmont Regional Park	64 dB	64 dB	No limit	No limit	No limit

The predicted noise levels demonstrate that the worst-case operational noise emissions will comply with all relevant HCDP limits and our recommended cumulative noise limit.

For reference, the predicted cumulative noise levels demonstrate that the current versions of the PHCDP standards can also be complied with. These are:

- Activities within the proposed OBDA:
 - 55 dB L_{Aeq} (58 dB L_{A10}⁹) at any notional boundary and 65 dB L_{Aeq} (68 dB L_{A10}) within Belmont Regional Park.
- Activities within main area of Belmont Quarry:
 - 67 dB L_{Aeq} (70 dB L_{A10}) at the boundary of, or outside, the Quarry Zone.

⁹ The approximate L_{A10} NZS 6802:1991 equivalent of the PHCDP limits which are in L_{Aeq} NZS 6802:2008. This considers the typical measured difference between the descriptors for continuous variable noise and the different approaches to averaging noise levels between the 1991 and 2008 Standards.

- Activities within Cottle Block:
 - 55 dB L_{Aeq} (58 dB L_{A10}) at any notional boundary in a rural zone and 65 dB L_{Aeq} (68 dB L_{A10}) within Belmont Regional Park.¹⁰

Noise level contours for Stage 2 are provided in Appendix B. These are plotted over a 25 m x 25 m grid to show the extent of the noise emissions beyond the boundaries of the proposed OBDA. The noise level predictions displayed in Table 3 have been calculated using point receivers at specific locations and are more precise than the contours.

The noise level predictions are based on the current fleet of diesel trucks and machinery at Belmont Quarry. The proposed operations are expected to continue for several decades. 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.

The potential noise effects of the proposed activity on the nearest receivers and within Belmont Regional Park are discussed in Section 9.0.

7.0 Construction noise

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

In accordance with the definitions of the New Zealand construction noise Standard (NZS 6803), construction work is temporary work undertaken to establish, maintain, or reconfigure a site. The following proposed activities are within the scope of NZS 6803 and have been assessed as construction work:

- vegetation clearance
- construction of haul roads
- construction of fines containment area
- rehabilitation work.

Construction work in the proposed OBDA will involve similar (and possibly the same) machinery as stripping and extraction activities at Belmont Quarry.

Most of the construction work required over the ten proposed stages will be similar in nature to construction work already undertaken at Belmont Quarry. The noise generated by the proposed construction work will mostly be indistinguishable from the noise presently generated by Belmont Quarry.

¹⁰ This is the PHCDP permitted noise limit for activities in the General Rural Zone. The consented noise limit for activities in the Cottle Block is 50 dB L_{A10} .

7.1 Construction noise references

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 measurements of modern construction equipment.

Table 4 also displays the minimum separation distances for each activity to comply with the HCDP 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 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 an 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).
- Acoustically reflective ground is assumed between the noise source and the receiver.

Table 4: Reference noise levels and compliance distances

Construction activity	Unmitigated L_{A10} noise level at 10 m	Unmitigated compliance distance
D9 bulldozer working in a small area	90 dB	135 m
Mulcher mounted on 10-t excavator	86 dB	85 m
Woodchipper	86 dB	85 m
Petrol chainsaw felling trees (33% on-time)	80 dB	43 m
40-t articulated dump trucks on haul road	78 dB	34 m
22-t grader (CAT-14M)	78 dB	34 m
10-t vibratory compactor	73 dB	19 m
Excavation and loading trucks with a 20-t excavator	72 dB	17 m
Loading trucks with a 10-t excavator	70 dB	15 m

7.2 Predicted construction noise levels

We have created computer noise models to predict the worst-case cumulative construction noise levels for each receiver during the works that are nearest to them. The resultant noise levels displayed in Table 5 represent the peak 15-minute periods for construction noise for each receiver.

Table 5: Predicted worst-case construction noise levels

Receiving site	Predicted L_{A10} noise level	Predicted L_{Amax} noise level
85 Kaitangata Cres	44 dB L_{A10}	59 dB L_{Amax}
87 Kaitangata Cres	38 dB L_{A10}	53 dB L_{Amax}
87A Kaitangata Cres	45 dB L_{A10}	60 dB L_{Amax}
87B Kaitangata Cres	41 dB L_{A10}	56 dB L_{Amax}
89 Kaitangata Cres	45 dB L_{A10}	60 dB L_{Amax}
120 Kaitangata Cres	42 dB L_{A10}	57 dB L_{Amax}
130 Kaitangata Cres	44 dB L_{A10}	59 dB L_{Amax}
138 Kaitangata Cres	45 dB L_{A10}	60 dB L_{Amax}
160 Kaitangata Cres	46 dB L_{A10}	61 dB L_{Amax}
180 Kaitangata Cres	47 dB L_{A10}	62 dB L_{Amax}

The predicted construction noise levels demonstrate that the HCDP permitted limits of 70 dB L_{Aeq} and 85 dB L_{Amax} will be complied with by a significant margin. This is due to the substantial distance between the proposed works and the nearest receivers.

The permitted construction noise limits under the PHCDP will be 70 dB L_{Aeq} and 85 dB L_{Amax} when assessed in accordance with NZS 6803:1999 *Acoustics – Construction noise*. The predicted construction noise levels also demonstrate compliance with these limits by a significant margin.

8.0 Vibration

The construction and operational activities in the OBDA that will generate vibration are excavation, vibratory compaction, and the movement of heavy machinery and vehicles. Based on our extensive database of vibration measurements, typical vibration levels for these activities range from less than 1 mm/s to approximately 5 mm/s PPV at 10 m, depending on how the equipment is used and the ground conditions.

Vibration levels below 0.3 mm/s PPV are generally imperceptible inside dwellings. Construction vibration generated by the proposed works will not reach levels of 0.3 mm/s PPV inside the nearest dwellings and will not be perceptible due to the significant separation distances of more than 700 m.

Vibration generated by the proposed activity will not cause disturbance to residential activities or damage to buildings¹¹.

9.0 Potential noise and vibration effects

This section sets out our assessments of the potential noise and vibration effects on the nearest receivers in the RRZ and on users of Belmont Regional Park.

9.1 Potential noise and vibration effects in the RRZ

The permitted standards of the HCDP enable the following noise levels at the nearest receivers during the proposed hours of the OBDA:

- Up to 70 dB L_{A10} from the operational activity at Belmont Quarry
- Up to 50 dB L_{A10} from operational activity in the Cottle Block¹²
- No permitted noise limits for operational activity in the in the OBDA.

Our recommended cumulative noise limit of 70 dB L_{A10} for all activities at Belmont Quarry and in the proposed OBDA does not enable any increase in potential noise effects at the receiving sites. Our modelling demonstrates that the proposed limit can be complied with.

Noise from the proposed OBDA will be consistent with the existing noise environment for the nearest receivers in the RRZ in terms of level, character, timing, and frequency. There will be no noise generated at night. The proposed OBDA will enable Belmont Quarry to continue operating (and generating noise). However, the operational activities at Belmont Quarry are anticipated in the EAA so the duration of the noise is also consistent with the existing environment.

¹¹ Based on the guidance of DIN 4150-3:2016.

¹² This is also the consented noise limit for the Cottle Block.

Construction noise may be audible for short periods outside the nearest dwellings when works occur in the portions of the Site closest to them, but it will otherwise range from inaudible to just perceptible. Construction noise from the ODDA will comply with the permitted limits under both the operative HCDP and the PHCDP. Noise from construction work is not expected to cause annoyance or disruption on any neighbouring site. Construction vibration from works in the proposed OBDA will not cause disturbance to residential activities or damage to buildings in the RRZ due to the separation distance.

We expect that the addition of the OBDA will be completely or largely unnoticeable for the closest receivers in terms of noise effects. We consider overall that noise emissions from the proposed OBDA will not exceed a reasonable level in the RRZ if our proposed conditions are adopted.

9.2 Potential noise effects in Belmont Regional Park

The results of our ambient noise monitoring over 128 days show that the existing noise levels in Belmont Regional Park during the proposed operating hours of the OBDA mostly range from 35 dB to 58 dB L_{A10} , with an average level of 45 dB L_{A10} .

We have modelled the worst-case one-hour L_{A10} noise emissions into Belmont Regional Park for comparison with the existing noise levels to determine the potential noise effects on users of the park. The model has been configured to represent the worst-case noise levels during both construction and operational activities and does not include any adjustments for averaging.

The worst-case noise levels in Belmont Regional Park will be generated during Stage 1 when machinery is working at the northern extent of the OBDA. The machinery represented in this area includes 20-t, 40-t, and 80-t excavators, a D9 bulldozer, a 22-t grader, a 10-t vibratory compaction roller, a watercart, and 40-t articulated dump trucks (20 movements per hour).¹³

We have placed point receivers in the model along Buchanan's Road Track where users of the park may hear the noise. Figure 6 illustrates the results of our modelling and is followed by descriptions of the potential noise effects.

¹³ Worst-case scenario provided by Winstone.

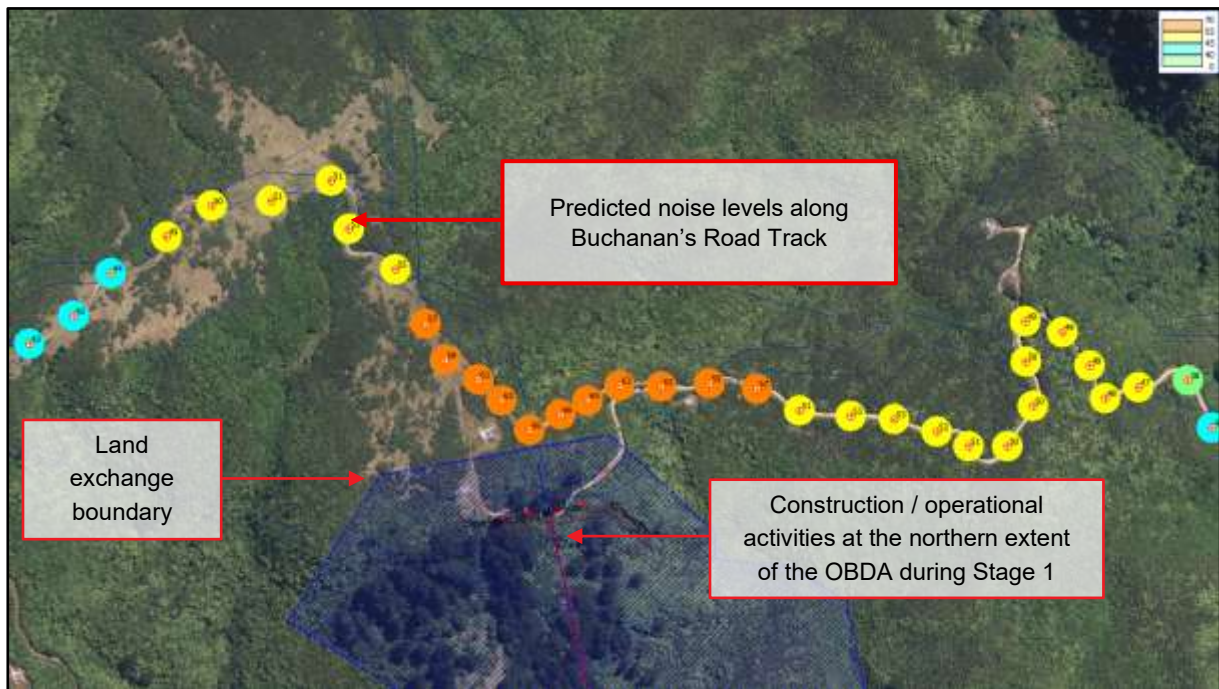


Figure 6: Worst case L_{A10} noise levels along Buchanan's Road Track

- Orange: noise levels from 56 dB to 66 dB L_{A10}**

Noise from the OBDA is likely to be dominant and mask other sounds in the environment such as birdsong and background traffic noise. Voices may need to be slightly raised for conversation. These are similar noise levels to a moderately busy office environment or a lively café.
- Yellow: noise levels from 46 dB to 55 dB L_{A10}**

Noise from the OBDA will be noticeable and slightly louder than other noise sources in the environment.
- Blue: noise levels from 41 dB to 45 dB L_{A10}**

Noise from the OBDA will be similar to, or slightly lower than, other sounds in the environment. It will not be noticeable at times.
- Green: noise levels of 40 dB L_{A10} or lower**

Noise from the OBDA will be lower than other sounds in the environment and will largely be unnoticeable.

We understand that Buchanan's Road Track is predominantly used by the public for running, tramping, and walking. It is less frequently for mountain biking and horse riding. There are no designated picnic areas, vista points or benches that invite people to stop and spend time in the area near to the proposed OBDA.

The highest noise levels on Buchanan's Road Track from the OBDA during Stage 1 will be dominant at the locations marked in Figure 6 with orange, clearly noticeable at the locations marked with yellow, and less noticeable at the locations marked with blue. The highest noise levels will be 5-10 dB lower during Stages 2 and 3 and significantly lower during all other stages.

The use of the nearest area of Buchanan's Road will be transient as people move through these areas. Additionally, construction and operational activities in the northern area will be intermittent and transient. Earthworks will be undertaken on a campaign and seasonal basis and may not occur every year. There will also be long periods when there is little activity in the northern area during the operational stages.

For reference, the worst-case noise emissions from the OBDA are compliant with the PHCDP operational¹⁴ noise limit of 70 dB L_{Aeq} (approximately 67 dB L_{A10}) within Belmont Regional Park.

Based on the overall noise levels, the existing noise environment, and the limited duration and transient nature of the potential noise effects, we consider that the noise emissions into Belmont Regional Park will not exceed a reasonable level.

10.0 Recommended conditions

We recommend the following conditions:

Construction noise and vibration

1. Construction work may only take place on site between the hours of 07:30 am and 6:00 pm, Monday to Saturday. This condition does not prevent quiet construction activity from taking place outside standard construction hours providing the noise emissions are inaudible at the notional boundary of any occupied dwelling.

Advice note: construction work includes (without limitation) temporary activities associated with vegetation clearance, enabling and foundation works, the construction of haul roads and earth bunds, and rehabilitation work.

Operational noise

2. Noise generated within the OBDA must comply with the following limits when measured cumulatively with all other noise emissions from Belmont Quarry, except noise from blasting. Noise levels must be measured and assessed within the site boundary of any rural or residential activity area and in accordance with NZS 6801:1991 and NZS 6802:1991.

a) Monday to Thursday 7:00 am to 5:00 pm: 70 dB L_{A10}.

b) Friday: 7:00 am to 4:00 pm: 70 dB L_{A10}.

¹⁴ Construction noise limits do not apply within Belmont Regional Park because there are no occupied buildings

- c) Saturday 7:00 am to 12:00 pm: 70 dB L_{A10} .
 - d) All other times: 45 dB L_{A10} .
3. Tonal reversing alarms (beepers) must not be used on quarry-based machinery. Alternatives without tonal characteristics such as broadband reversing alarms (squawkers) are permitted.

11.0 Conclusions

Construction noise will readily comply with the relevant HCDP and PHCDP limits by a considerable margin and is not expected to cause unreasonable noise effects.

There are no permitted vibration limits under the HCDP. Vibration generated by activities in the OBDA will not reach perceptible levels at any building in the RRZ or cause building damage. Vibration will also comply with the relevant PHCDP limits.

There are no permitted operational noise limits in the RRZ for the proposed activity under the operative HCDP. We recommend that the HCDP permitted noise limits for the existing activities at Belmont Quarry are adopted as cumulative noise limits for the quarry and the new ODDA. Our modelling demonstrates that the recommended limits can be complied with. Complying with this limit will ensure that operational noise emissions do not exceed a reasonable level. There will be no noise generated at night. Our predicted noise levels also demonstrate compliance with the operational noise limits currently proposed by the PHCDP.

We recommend that Winstone update the noise limits for the OBDA to align with the PHCDP once the new noise standards are operative. We consider this to be a more practical approach than adopting the PHCDP noise standards now because:

- a) The proposed activity in the new OBDA would begin with noise limits that are impracticable to monitor compliance against or enforce.
- b) The noise limits would remain impracticable until such time as the PHCDP noise standards become operative.
- c) The PHCDP noise standards could be modified before becoming operative.

Our recommended approach ensures that it will be practical to monitor compliance with the noise limits when the activity begins, thereby providing certainty for Winstone, the neighbouring residents, and Council.

Construction and operational activities in the northern area of the OBDA will only generate noise effects on the nearest section of Buchanan's Road Track intermittently. Earthworks will be undertaken on a campaign and seasonal basis and may not occur every year. There will also be long periods when there is little activity in the northern area during the operational stages. Noise effects will be clearly noticeable for a limited duration during Stage 1 when use of the track coincides with activities in the northern area of the OBDA. The noise effects will be

noticeable intermittently during Stages 2 and 3, and significantly lower during all other stages. These effects will be transient as users of Buchanan's Road Track move through the area adjacent to the OBDA. Based on the limited duration and transient nature of the potential noise effects, we consider that the noise emissions into Belmont Regional Park will be reasonable.

We consider overall that noise and vibration emissions from the proposed OBDA will be consistent with the existing environment and will not exceed a reasonable level if our recommended conditions are complied with.

We have reviewed the final draft conditions for the project and consider they appropriately reflect our recommendations.

Appendix A Glossary

Ambient sound	Ambient sound is the total of all sound within a given environment, comprising a composite of sounds from sources near and far.
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. Represented by the 'A' in L_{A10} .
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).
$L_{A10(t)}$ (dB)	A statistical noise descriptor. The A-weighted sound level which is just exceeded for 10% of the measurement period (t). Sometimes referred to as the average maximum noise level.
$L_{Aeq(t)}$ (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_{A10}) at a given distance.
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.
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 and assessing ground-borne vibration in environmental acoustics. It is the instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
Residual noise	The total sound remaining at a given position in a situation when the specific sounds under consideration are absent or an insignificant part of the total sound.

Appendix B Noise level contours for Stage 2

