

Appendix 10: Noise and Vibration Assessment



MARSHALL DAY
Acoustics



**WHITEHALL QUARRY PIT EXPANSION
NOISE AND VIBRATION IMPACT ASSESSMENT**

Rp 001 20240662 | 11 April 2025

Project: **WHITEHALL QUARRY PIT EXPANSION**

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Report No.: **Rp 001 r02 20240662**

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1.0 SUMMARY AND CONCLUSIONS

We have assessed the noise impact from the proposed expansion of Whitehall Quarry. We predict the expanded operation will remain compliant with the noise levels of the existing resource consent (RC3770.02). We conclude that effects on surrounding receivers will be consistent with what is already authorised under the existing resource consent.

Marshall Day Acoustics has performed a noise impact assessment of Winstone Aggregates' proposal to expand their quarry operation located in Whitehall, Waipā District.

Winstone Aggregates proposes to expand the quarry pit in a western direction by approximately 15.5 ha in area. The proposed expansion is anticipated to provide a 35-year resource based on current market projection. The expansion falls within the Significant Mineral Extraction Zone (SMEZ) and partially within the Rural Zone of the Waipā District Plan (WDP).

We have reviewed the provisions of the existing resource consent RC3770.02, and the provisions of the SMEZ and the Rural Zone of the WDP. The Rural Zone daytime noise limits are more stringent than the existing consent. However, given that:

- the same or comparable plant will be used,
- there will be no changes to truck movements, and
- there are no new potentially sensitive receivers in the area

we are of the opinion that the existing consent's noise conditions are appropriate to apply to the new resource consent for the long-term expansion area. The adoption of the same noise conditions will also provide consistency for compliance measurement and reporting purposes.

We have updated the existing acoustic model representing the quarry operation. We have calibrated the model to measurement results from on-site measurements and historical annual compliance surveys. The model forms the basis of noise predictions for the proposed quarrying to the west. The model includes terrain adapted to reflect expanded quarrying as well as associated noise sources.

Our modelling of operational noise from the expansion confirms that there will be a negligible change in level – maintaining compliance with Condition 3 of the consent, and with the relevant noise limits in the WDP.

We predict that blasting noise and vibration will comply with the existing conditions of consent. No change in effect will result from this activity.

The effects of the proposed expansion will be negligible, consistent with the noise levels of the existing noise environment, and therefore reasonable.

We recommend imposing the same noise conditions as those from the existing consent, should consent be granted.

Appendix A contains a glossary of acoustic terminology used in this report.

2.0 SITE AND EXPANSION DESCRIPTION

2.1 Background to project

Winstone Aggregates currently operates Whitehall Quarry (the quarry) in the Whitehall area, approximately 4km northeast of Karāpiro. They are applying for resource consents from Waipā District Council to authorise quarrying activities for the long-term expansion area, which includes a 15.5 ha extension of the quarry footprint west of the existing consented quarry footprint.

2.2 Proposed continued quarry operations

Continued quarry operations will involve the extraction, processing, storage and transportation of greywacke rock and overburden. Activities that will be undertaken at the site include:

- Exploration
- Water management
- Clearing of vegetation
- Stripping of topsoil
- Stockpiling of topsoil
- Removal of overburden
- Overburden disposal (to occur at the previously consented south-east OBDA)
- Drilling, blasting, excavation
- Aggregate transfer
- Aggregate processing
- Process fines disposal
- Aggregate storage, sale, distribution

2.3 Proposed expansion

We understand that the proposed expansion represents a continuation of existing quarry activity. The volume of material the quarry produces will remain at current levels. There will be no changes to the number of trucks entering or exiting the quarry. No changes to plant and equipment will be made.

Part of the expansion will be located in the Rural Zone, outside of the Significant Mineral Extraction Zone. The areas relevant to the proposal are shown on the Quarry Development Layout Plan (Appendix B).

In summary, the following activities are proposed:

- Overburden stripping
- Vegetation removal
- Drilling, blasting and excavation of expanded quarry pit
- Replanting
- Erosion and sediment control, and

Winstone Aggregates anticipates at this time that the works for which consent is sought will occur in two stages and are proposed to take place over several earthworks seasons, over approximately a 35 year duration.

2.4 Identified receivers

There are a number of receivers that will receive noise from the continued operation of the quarry as well as its expansion. We have selected the receivers where annual noise monitoring is conducted for several reasons:

- they provide a detailed dataset of historical ambient noise levels to draw upon
- they represent the closest three receivers in addition to a receiver cluster located further from the quarry to the southeast, and

- if compliance is shown at these receivers, then it can be inferred with a degree of confidence at any other receivers located further from the site that are not included in the assessment

We note that Winstone Aggregates is the owner of the 249 Whitehall Road property, and it is currently occupied by an employee. We have therefore excluded this receiver from our assessment.

Table 1 lists the identified receivers, zoning / primary use and distance to the centre of the quarry pit.

Table 1: Receiver table

Pos. No.	Address/location	Zoning / Usage	Location Relative to Site Centre ¹
MP1/R1	2/207 Whitehall Road	Rural / dwelling	1.4km to the southeast
MP2/R2	1/207 Whitehall Road	Rural / dwelling	1.4km to the southeast
MP3/R3	2/766 French Pass Road	Rural / dwelling	0.7km northwards
MP4/R4	17 Dunning Road	Rural / dwelling	2.2km to the southeast

Notes to table:

(1) Assumed quarry centroid 1825489 5803709 (NZTM2000)

Figure 1 shows the location of the identified receivers. Annual noise monitoring has historically been carried out at these properties.

Figure 1: Potentially affected receivers

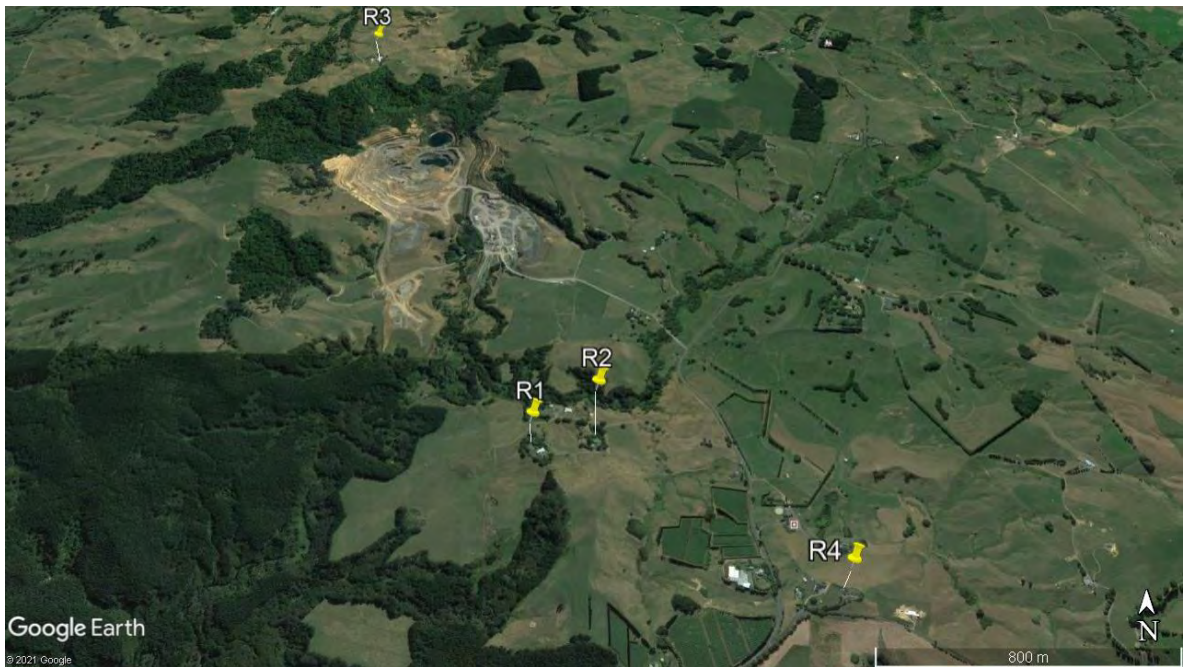


Image Source: Google Earth

3.0 EXISTING NOISE ENVIRONMENT

Our observations confirm that, when operating, the quarry typically controls the daytime acoustic environment surrounding the site. Historical compliance surveys indicate that average noise levels at the closest dwellings to the site range between 39 and 52 dB L_{A10} during the daytime.

Noise from quarry operations typically controls the existing acoustic environment surrounding the site when operating. This is interspersed with noise from heavy vehicle movements on Whitehall Road. Other seasonal factors will also contribute, and sometimes control, the existing noise levels e.g. wind and rain during winter and cicada / cricket noise in the warmer months.

Winstone Aggregates has conducted annual noise compliance surveys at properties surrounding the quarry, as required by Condition 6 of the existing land use consent. Table 2 summarises the historical measurement results for the 2016 to 2025 period. The dataset provides a robust indication of the range of existing daytime ambient noise levels at receiver locations, including from the quarry.

Table 2: Historical measured noise levels

Location Number	Noise Limit (dB L_{A10})	2016 - 2025 Noise Level (dB L_{A10})	
		Range	Average
MP1 2/207 Whitehall Road	55	44-51	48
MP2 1/207 Whitehall Road	55	40-50	45
MP3 2/766 French Pass Road	55	39-52	46
MP4 17 Dunning Road	55	40-51	46

4.0 NOISE PERFORMANCE STANDARDS AND LEGISLATION

Winstone Aggregates has an existing resource consent in place which enables quarrying activities to occur on site within the existing consented footprint. For the reasons of consistency, the predicted compliance, and the fact that the project is an expansion of an existing activity, we have used the relevant noise and vibration conditions from consent RC3770.02 in our assessment.

4.1 Resource consent RC3770.02

4.1.1 Operational noise

Condition 3 of the consent (RC3770.02) sets the following noise limits for the quarry operations.

“The noise level from all extraction and processing operations on the site shall not exceed the following levels when measured at or within the notional boundary (meaning a line 20 metres from the external walls of any rural dwelling outside the application site boundary or legal boundary of the rural dwelling whichever is closer to the rural dwelling), except for blasting operations:

<i>Daytime 6.00am to 8.00pm</i>	<i>55 dB L_{A10}</i>
<i>At all other times (including all day Sunday and public holidays)</i>	<i>40 dB L_{A10}</i>
<i>Everyday 8.00pm to 6.00am</i>	<i>65 dB L_{Amax}</i>

The noise level shall be measured and assessed in accordance with the requirements of New Zealand Standard NZS 6801:1991 “Measurement of Sound” and New Zealand Standard NZS 6802:1991 “Assessment of Environmental Sound”.

Noise levels shall be measured in accordance with the requirements of clause 5.3.3 of New Zealand Standard NZS 6801:1991 “Measurement of Sound” and the duration of any measurement shall not be less than 15 minutes.”

4.1.2 Blasting noise

Condition 8 of the consent sets a limit on air blast overpressure associated with blasting activities. It states:

“Noise generated by the use of explosives shall not exceed a peak overall sound pressure of 120 dBC (L_{peak}) at the notional boundary (meaning a line 20 metres from the external walls of any rural dwelling outside the application site boundary or legal boundary of the rural dwelling whichever is the closer to the rural dwelling), other than those on Certificate of Title 61A/508, 50B/848, and 21C/1171 from landowners and residents of which written approval has been obtained.”

4.1.3 Blasting vibration

The existing consent does not set specific limits for the control of blast vibration. However, Condition 7 states that *“Blasting shall be designed...and managed to minimise vibration...”*.

4.2 Waipā District Plan

Whitehall Quarry lies within a SMEZ in the WDP. However, part of the expansion will also be located in the Rural Zone.

4.2.1 Operational noise

The relevant receiver zone limits are summarised in Table 3.

Table 3: WDP operational noise performance standards

Zone	Rule	Time	Noise limit	Applies at
SMEZ	4A.4.2.2	7am – 10pm, Monday – Saturday All other times and on public holidays	55 dB L_{Aeq} 45 dB L_{Aeq} / 75 dB L_{Amax}	Notional boundary of any dwelling that existed at 1/1/97 not owned or controlled by the quarry operator or owner
Rural	4.4.2.15	7am – 10pm 10pm – 7am	50 dB L_{Aeq} 40 dB L_{Aeq} / 70 dB L_{Amax}	Notional boundary of any dwelling

The noise levels shall be measured and assessed in accordance with the requirements of NZS 6801:2008 *Acoustics – Measurement of environmental sound* and assessed in accordance with NZS 6802:2008 *Acoustics – Environmental noise*.

4.2.2 Blasting noise and vibration

The relevant receiver zone limits for blasting noise and vibration are summarised in Table 4 and Table 5 below.

Rule 4A.4.2.3 of the WDP states that, for blasting within the SMEZ, measurement of blast noise (air blast) and ground vibration for blasting shall be carried out in accordance with Appendix J of Part 2 of Australian Standard AS 2187.2:1993 *Explosives – Storage, transport and use – Use of explosives*.

All blasting is restricted to Monday to Saturday 9am to 5pm, and on only two occasions per day except where necessary because of safety reasons.

Table 4: WDP blasting noise performance standards

Zone	Rule	Noise limit	Applies at
SMEZ	4A.4.2.2(a)	128 dB L_{Zpeak}	Notional boundary of any dwelling that existed at 1/1/97 not owned or controlled by the quarry operator or owner

Zone	Rule	Noise limit	Applies at
Rural	4.4.2.16	115 dB L_{Zpeak} (95 percentile), 120 dB L_{Zpeak} ¹	Notional boundary of any dwelling not owned or controlled by the quarry owner or operator

Notes to table:

(1) 95% of blasts must not exceed 115 dB L_{Zpeak} . 5% of blasts may reach up to 120 dB L_{Zpeak} .

Table 5: WDP blasting vibration performance standards

Zone	Rule	Peak particle velocity (PPV)	Applies at
SMEZ	4A.4.2.3(d)	25mm/s commercial, 10mm/s dwelling	Foundation of occupied building outside the zone, or suitable location adjacent to the building
Rural	4.4.2.18 ¹	-	-

Notes to table:

(1) Rule 4.4.2.18 references NZS 4403:1996 *Code of Practice for Storage, Handling, and Use of Explosives*. This standard has been withdrawn and not replaced, therefore we have discussed appropriate blasting vibration limits for the Rural Zone in Section 4.3.

4.3 Discussion regarding noise and vibration limits

4.3.1 Operational noise

The operational noise limits laid out in RC3770.02 use the outdated L_{10} metric or average maximum noise level. Using the L_{eq} metric is approximately 2 dB more lenient than the L_{10} metric for the same limit i.e., 50 dB L_{Aeq} is approximately 52 dB L_{A10} . This means that the 55 dB L_{Aeq} SMEZ limit in the WDP is more lenient than the 55 dB L_{A10} limit in RC3770.02.

However, the Rural Zone limit in the WDP is 50 dB L_{Aeq} , which is more restrictive than both the Resource Consent and the SMEZ limits.

The quarry is expanding into the Rural Zone to the south-west of the existing site. Given that:

- there are no new potentially sensitive receivers with direct line of sight in this area, and
- the character of quarry noise will not change, though quarrying may get closer to some receivers,

we consider that the current consent limits are reasonable, particularly in a rural environment context, and will continue to provide an appropriate level of control if the expansion proceeds.

4.3.2 Blasting noise

The 128 dB L_{Zpeak} SMEZ blasting noise limit in the WDP is more lenient than the 120 L_{Cpeak} limit in RC3770.02 when assessing a typical blasting noise spectrum, even accounting for the applied C-weighting.

The Rural Zone blasting noise limit is slightly more restrictive, with 95% of blasts needing to comply with 115 dB L_{Zpeak} . For the sake of simplicity, we recommend applying this rule when assessing blasting noise.

4.3.3 Blasting vibration

The blasting vibration limits in the SMEZ are taken from AS 2187.2:1993 *Explosives – Storage, transport and use – Use of explosives*. We consider that Rule 4.4.2.18 for blasting vibration in the Rural Zone intends to use the same limits¹.

4.4 Resource Management Act

Under the provisions of the RMA there is a duty to adopt the best practicable option to ensure that noise (including vibration²) from any development does not exceed a reasonable level. Specifically, Sections 16 and 17 reference noise effects as follows.

Section 16 states that “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”.

Section 17 states that “every person has a duty to avoid, remedy, or mitigate any adverse effect on the environment arising from an activity carried on by or on behalf of the person, whether or not the activity is in accordance with –

(a) Any of sections 10, 10A, 10B and 20A; or

(b) A national environmental standard, a rule, a resource consent, or a designation”

Our report uses the guiding principles of Section 16 and 17 of the RMA as noted above in assessing effects and recommending mitigation measures.

5.0 OPERATIONAL NOISE IMPACT ASSESSMENT

We predict that the proposed expansion of Whitehall Quarry will not perceptibly change the existing noise environment. The expanded site will remain compliant with the existing consent and with the relevant WDP noise limits. No adverse effects would result.

5.1 Operational noise prediction results

We have predicted operational noise levels based on the continuance of existing quarry operations and incorporating the proposed western expansion area.

Table 6 presents the results for the identified receivers. The ‘Existing’ levels shown are our prediction results³ from the 2023 Whitehall expansion project.

The ‘Expansion’ results use the calibrated model from the previous consent, updated for this application to include the 15.5 ha long-term expansion footprint (refer to Section 5.3). These results consider activity in the worst-case location in the Rural Zone.

The results in Table 6 confirm that the proposed expansion will maintain the status quo in terms of site noise emission, including a small decrease in level at 2/207 Whitehall Road. The proposed expansion will generate noise which complies with the noise limits authorised by RC3770.02.

The results in Table 6 also confirm that noise levels will comply with the WDP noise limits in the Rural Zone and the SMEZ.

¹ NZS 4403:1996 *Code of Practice for Storage, Handling, and Use of Explosives* does not exist. NZS 4403:1976 was withdrawn without replacement, and the 4403 code was reassigned to a different standard. We consider that Australian Standard AS 2187.2:1993 *Explosives – Storage, transport and use – Use of explosives* provides the intended limits and is referenced elsewhere in the WDP.

² RMA 1991 Part 1 Section 2 Interpretation: Noise includes vibration

³ MDA report Rp 002 r01 20220089 dated 23 May 2023

Table 6: Proposed expansion

Rec. No.	Address	Noise Limit (dB LA10)	Existing (dB LA10)	Expansion (dB LA10)	Change in Level (dB)
R1	2/207 Whitehall Road	[55]	52	51	-1
R2	1/207 Whitehall Road	[55]	51	51	0
R3	2/766 French Pass Road	[55]	51	51	0
R4	17 Dunning Road	[55]	45	45	0

5.2 Assessment of the change in operational noise level

In assessing potential noise effects we have compared noise emission from the existing consented activity to that which will be generated by the proposed expansion. As confirmed by the results in the last column of Table 6, the proposed expansion is predicted to result in an imperceptible change in noise level at all assessed receivers.

Based on our results, we conclude that the project will not generate adverse effects above and beyond those already authorised by the existing consent. Therefore, the effects of the proposed expansion will be negligible, consistent with the noise levels of the existing noise environment, and therefore reasonable.

5.3 Operational noise prediction methodology

We have predicted operational sound levels in accordance with ISO 9613-2: 1996⁴ using SoundPLAN® environmental noise modelling software. ISO 9613 considers a range of frequency dependent attenuation factors including atmospheric absorption, ground and barrier effects, directivity, as well as spherical spreading.

We have predicted noise for the following project scenario:

- Proposed Expansion: models the expanded operation of the quarry with stripping/quarrying to the west (in the Rural Zone) and with overburden transported and deposited in the south-eastern OBDA

We have updated our noise model based on site measurements taken on 13 November 2024. These measurements were taken to confirm that our noise model is accurately predicting noise from the site. Measurement details are attached in Appendix C.

Our modelling uses the sound power levels listed in Appendix D.

6.0 BLASTING NOISE AND VIBRATION ASSESSMENT

Our predictions indicate that blasting noise and vibration associated with existing quarrying as well as from the western quarry expansion will readily comply with the WDP.

6.1 Predicted blasting noise and vibration levels

We predict that blast overpressure levels will readily comply with the 115 dB L_{zpeak} (95 percentile) Rural Zone noise limit, and will therefore comply with condition 8 of consent RC3770.02. We expect that noise effects from the blasts will be reasonable, based on the continuance of existing blast management practices.

⁴ ISO 9613-2: 1996 “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation”

Prior to blasting, a rock drill will be used to drill blastholes in the working face in preparation for charging with explosives. Using a source level of 117dB L_{WA} for a Sandvik drilling machine we predict noise levels of 29 to 35 dB L_{A10} will be received at the identified receivers.

We predict that blast vibration received by the identified receivers will be appreciably below 1mm/s PPV and will generally be imperceptible. Blasting vibration will therefore be readily compliant with the WDP limits for the SMEZ and the Rural Zone. Given that the surrounding receivers:

- have been communicated with regarding the use of blasting,
- already experience blasting events occasionally (on weekdays), and
- receive two warning sirens prior to blasting

we are of the opinion that noise and vibration effects from blasting will be controlled to reasonable levels.

6.2 Prediction methodologies

Our effects assessment is based on the following inputs:

- Blasting is undertaken between 9:00am and 4:00pm Monday to Friday only
- Blasting frequency is less than weekly, however the consent allows for up to two blasts per day
- Warning sirens are sounded 5 minutes and 1 minute before each blast

6.2.1 Blasting noise

We have predicted blasting noise levels in accordance with AS 2187-2:2006⁵ Section J7.2. It states:

"In the absence of either field data or the opportunity to conduct blasting trials in the region of interest, it is possible to estimate likely ground vibration and airblast levels using simple charge weight scaling laws. Such laws incorporate the charge weight per delay and the distance from the blast to the monitoring location. Two site parameters are assumed and these influence the peak level and the rate of decay for the levels."

Our predictions of blast noise are based on the following assumed site constants:

- Maximum Instantaneous Charge (MIC) average size of 5.5kg
- Assumed site constant $K_a = 3.3$
- Assumed site exponent $a = -1.2$

6.2.2 Blasting vibration

We have predicted blasting vibration levels in accordance with AS 2187-2:2006 Section J7.3. It states:

"It is useful to be able to estimate the ground vibration expected from any particular blasting operations. As many site factors will affect the transmission of vibration through the ground, the most accurate prediction graph for a site will be that generated from vibration measurements take at the site. However, in the absence of such site data, ground vibration may be estimated using equation [J7.3(1)]:"

Our predictions of blast vibration are based on the following assumed site constants:

- Maximum Instantaneous Charge (MIC) average size of 5.5kg
- Assumed ground constants of $K_g = 206$ and $B = 1.19$. We consider these ground constants to be conservative as they are based on hard rock (basalt)

⁵ AS 2187.2-2006 Explosives – Storage and use Part 2: Use of explosives

7.0 RECOMMENDED CONDITIONS OF RESOURCE CONSENT

We recommend that the conditions of resource consent for the proposed long-term expansion area at Whitehall Quarry are consistent with the conditions for the existing consent for quarrying operations, as follows:

Noise

That the noise level from all extraction and processing operations on the site (except for blasting operations) shall not exceed the following levels when measured at or within the notional boundary of any dwelling located in a site in different ownership:

Daytime (6.00am to 8.00pm) 55dB L_{A10}

At all other times (including all day Sunday and public holidays) 40dB L_{A10}

Everyday (8.00pm to 6.00am) 65dB L_{Amax}

The noise level shall be measured and assessed in accordance with the requirements of New Zealand Standard NZS 6801:1991 "Measurement of Sound" and New Zealand Standard NZS 6802:1991 "Assessment of Environmental Sound".

Noise levels shall be measured in accordance with the requirements of the New Zealand Standard NZS 6801:1991 "Measurement of Sound" and the duration of any measurement period shall not be less than 15 minutes.

Blasting shall be designed, supervised by a suitably qualified and experienced person, and will be designed and managed to minimize vibration and airblast. Blasting will be restricted to a maximum of twice per day between 9.00am and 4.00pm Monday to Friday, except where necessary for emergency or safety reasons. Distinctive warning signals will be given at predetermined times prior to a blast. A complete record of each blast shall be maintained.

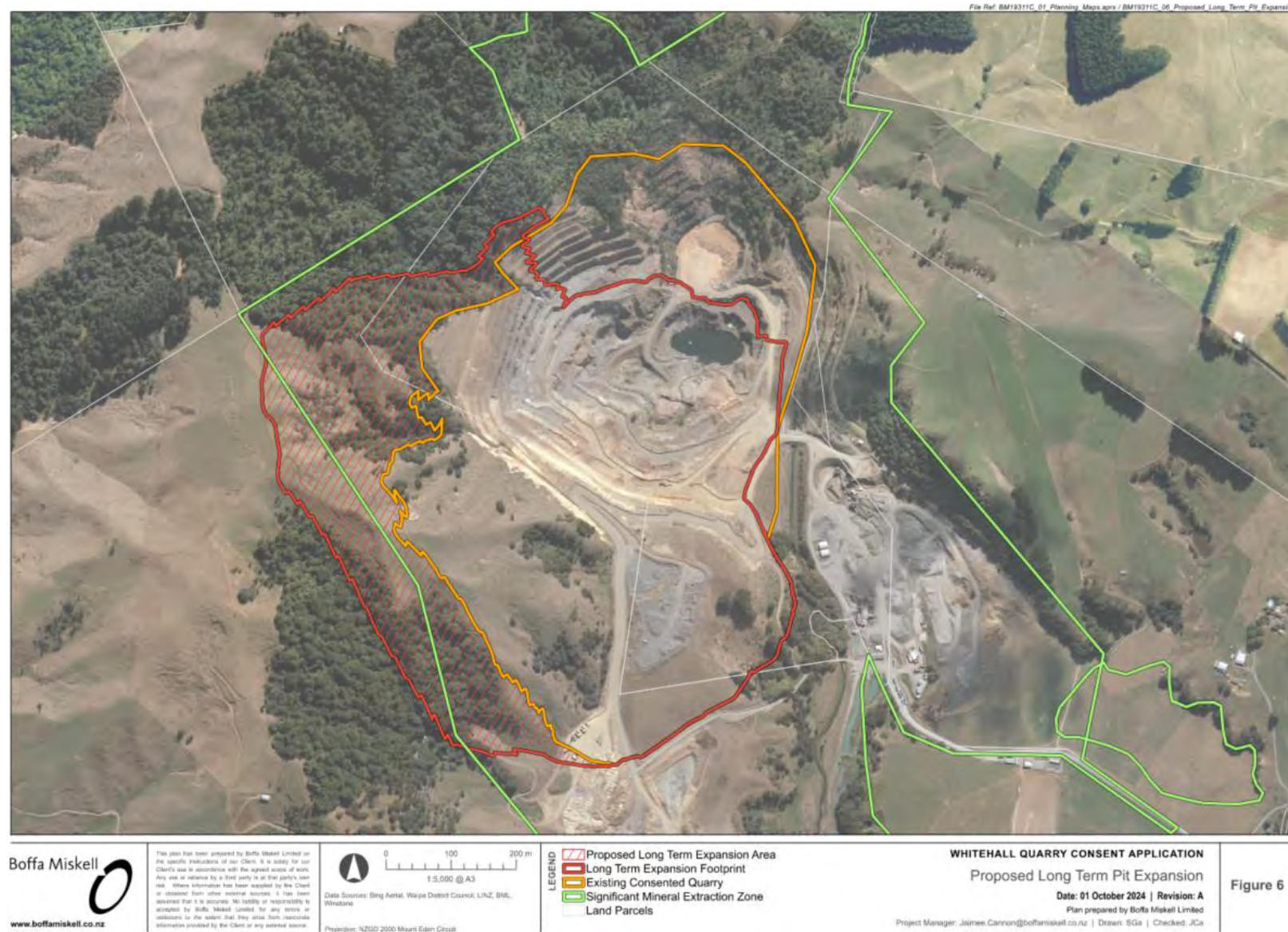
Noise generated by the use of explosives shall not exceed a peak overall sound pressure of 115 dB (L_{Zpeak}) at the notional boundary of any dwelling located in a site in different ownership.

Provided the conditions of resource consent are complied with, the noise and vibration effects of the long-term expansion at Whitehall Quarry are expected to be less than minor for all nearby sensitive receivers.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear. All noise levels are quoted relative to a sound pressure of 2×10^{-5} Pa
dB	Decibel. The unit of sound level. Expressed as a logarithmic ratio of sound pressure 'P' relative to a reference pressure of $P_r = 20 \mu\text{Pa}$ i.e. $\text{dB} = 20 \times \log(P/P_r)$
dBA	The unit of sound level, which has its frequency characteristics modified by a filter (A-weighted) to approximate the frequency bias of the human ear.
$L_{A10}(t)$	The A-weighted noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{Aeq}(t)$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
$L_{A\text{Fmax}}$	The A-weighted maximum noise level. The highest noise level that occurs during the measurement period.
NZS 6801:1991	New Zealand Standard NZS 6801:1991 "Measurement of Sound"
NZS 6802:1991	New Zealand Standard NZS 6802:1991 "Assessment of Environmental Sound"
SWL or L_w	<u>Sound Power Level</u> A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
Overpressure	The noise from blasting is called "overpressure" and is measured differently from other environmental noises. The noise level index used is $L_{C, \text{Peak}}$. This is the C-weighted peak noise level and is a measure of the absolute maximum acoustic pressure. This is not related directly to the noise level as perceived by the human ear but does relate directly to the ability of the acoustic pressure wave to do damage, either to human hearing or to building structures.
Vibration	When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity. Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).
PPV	<u>Peak Particle Velocity</u> For Peak Particle Velocity (PPV) is the measure of the vibration aptitude, zero to maximum. Typically used for building structural damage assessment.

APPENDIX B QUARRY DEVELOPMENT LAYOUT PLAN



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APPENDIX C SITE CALIBRATION MEASUREMENTS

Measurement position	Duration (mm:ss)	L _A F _{max}	L _A eq	Notes
MP1	01:02	63.2	55.7	Excavator operating in pit, dumpers and loaders moving around. Also excavator and loader up on the side of the pit opposite. Crushing plant screened and not audible.
MP2	00:54	67.8	63.1	Same as MP1.
MP3	00:31	70.0	68.9	MP3 to MP12 are calibration measurements of plant area. See diagram for locations below. Approx. 30m setback from screens.
MP4	00:31	71.1	70.1	30m setback from screens.
MP5	00:31	76.3	74.9	30m setback from new crushers.
MP6	00:39	78.8	76.6	30m setback from new crushers.
MP7	00:31	80.0	76.5	50m setback from old jaw crusher.
MP8	00:31	81.3	78.9	30m setback from old jaw crusher.
MP9	00:31	79.4	77.6	30m setback from new crushers.
MP10	00:31	70.4	68.8	Approx. 50m setback from processing area.
MP11	00:32	68.8	62.5	Approx. 100m setback from processing area.
MP12	00:31	68.0	61.5	Same as MP12.

APPENDIX D PLANT SOUND POWER LEVELS

Source	Octave Band Sound Power levels, dB								
	L _{WA}	63	125	250	500	1k	2k	4k	8k
HD785 dump truck	115	114	119	118	110	109	105	102	102
PC1250 excavator	118	113	114	113	112	111	111	110	110
PC450 excavator	105	102	111	106	104	99	95	91	85
CAT D10 bulldozer	115	108	114	107	109	111	109	105	102
CAT D9 bulldozer	114	116	113	109	108	109	107	105	-
Water cart (EMT600)	110	110	124	106	103	100	99	93	90
Grader (825-2)	113	106	119	113	113	107	102	96	88
Komatsu 605 bin truck	116	118	120	116	113	110	108	105	99
Road truck	113	110	107	108	109	111	105	93	-
Total for tertiary plant	125	136	125	122	122	120	118	114	107
Sandvik DP1100 rock drill	117	107	106	115	112	111	110	107	104