



MARSHALL DAY  
Acoustics



MCNICOL ROAD QUARRY PLAN CHANGE  
ACOUSTIC ASSESSMENT

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Project: **MCNICOL ROAD QUARRY PLAN CHANGE**

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Report No.: **Rp 001 20201046**

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## 1.0 SUMMARY

Marshall Day Acoustics has been engaged by Stevenson Aggregates Lt to prepare an acoustics assessment to support the proposed Private Plan Change for the McNicol Road Quarry in Clevedon (the 'Plan Change').

The quarry is currently fully within the Quarry Zone as set out in the Auckland Unitary Plan (AUP). Stevenson proposes to expand the Quarry Zone to the south into an area of pine forest and reduce the extent of the Quarry Zone at the north of the site. This change would result in quarry activities moving further away from residences, with only one dwelling close to the proposed expansion.

This assessment discusses the appropriateness of the existing Quarry Zone objectives, policies and noise rules in relation to the effects of the proposed Plan Change.

In summary:

- The acoustic effects of the Plan Change will be unnoticeable to the nearby receivers when compared to what is enabled in the current Plan. The southern extension of the Quarry Zone will still be well shielded from surrounding dwellings through terrain, so noise levels would not materially change
- The Quarry Zone objectives and policies, and noise and vibration rules are appropriate to manage the potential effects of the Plan Change

A glossary of acoustic terminology is included in Appendix A.

## 2.0 BACKGROUND

Marshall Day Acoustics was involved in the Resource Consent application for the expansion of McNicol Road Quarry. The project began in 2015 and was granted consent in 2018. Our assessment considered the future operational daytime and night-time scenarios, as well as trucks on the low-volume rural roads leading to the quarry. The project involved the assessment itself, consultation with the community and was consented through the Environment Court in mediation.

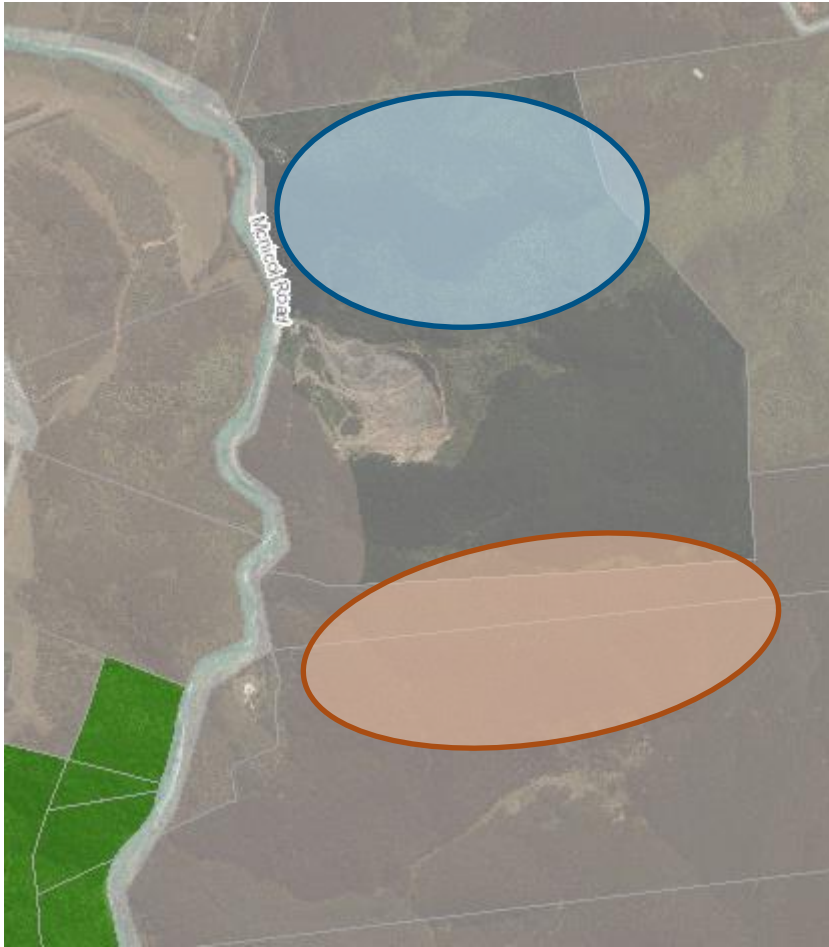
That previous assessment is referred to as the 'Resource Consent assessment' throughout this report. It forms the baseline for the assessment of acoustic effects from the proposed Plan Change.

## 3.0 EXISTING AND PROPOSED ZONING

The quarry is currently fully located within the Special Purpose Zone – Quarry Zone. The Plan Change would extend the Quarry Zone into an area that is currently zoned Rural – Rural Production Zone.

Figure 1 shows the existing zoning, with the Quarry Zone clearly visible amongst the Rural Production Zone. The proposed Plan Change involves a contraction (indicative location shown in blue, north of the current quarry) and expansion (in orange, to the south) of the Quarry Zone are indicated in the figure.

Figure 1: Existing AUP zoning



#### 4.0 OBJECTIVES AND POLICIES

The Objectives and Policies govern how a zone is operated and which areas of interest are specifically protected or noted in relation to that zone.

##### 4.1 Quarry Zone Objectives and Policies in the AUP

Section H28.2 of the Auckland Unitary Plan sets out the following objectives for the Quarry Zone:

- 1) *Mineral extraction activities and appropriate compatible activities are carried out efficiently at significant mineral extraction sites.*
- 2) *The significant adverse effects associated with mineral extraction are avoided, remedied or mitigated.*
- 3) *The rehabilitation of quarries is assisted by cleanfills and managed fills.*

Section H28.3 contains the policies:

- 1) *Apply the Special Purpose – Quarry Zone to significant mineral resources and extraction sites that provide for mineral extraction.*
- 2) *Enable appropriate compatible land uses within or adjoining the zone, including mineral recycling activities and the manufacture of products using raw materials from mineral extraction activities.*
- 3) *Avoid where practicable, or otherwise remedy and mitigate significant adverse effects on areas where there are natural and physical resources that have been scheduled in the Plan in*

*relation to natural heritage, Mana Whenua, natural resources, coastal, historic heritage and special character.*

- 4) *Manage noise, vibration, dust and illumination to protect existing adjacent activities sensitive to these effects from unreasonable levels of noise, vibration, dust and illumination.*
- 5) *Require the rehabilitation of sites following mineral extraction activities to enable the land to be used for other purposes.*
- 6) *Avoid, remedy or mitigate adverse effects of traffic generation and maintain safety for all road users, and particularly measures to manage heavy vehicles entering or exiting the site and on quarry transport routes.*
- 7) *Require quarry operators to internalise the adverse effects associated with new or enlarged mineral extraction activities as far as practicable while recognising the need to allow for the efficient ongoing extraction of mineral resources.*
- 8) *Enable cleanfills and managed fills where they can assist the rehabilitation of quarries.*

## 4.2 Summary of Key Objectives and Policies

The objectives and policies relevant to this acoustic assessment are summarised in Table 1.

**Table 1: Summary of objectives and policies**

Objective/Policy	Acoustic Implications
Objective 2 – avoid, remedy or mitigate significant adverse effects	Use the best practicable option to minimise noise and vibration emissions from the quarry and achieve compliance with the relevant noise and vibration rules
Policy 4 – manage operations to protect adjacent sensitive activities from unreasonable levels of noise and vibration	Consider equipment selection, placement, and operation times to ensure noise/vibration levels comply with the relevant limits
Policy 7 – internalise adverse effects associated with new or enlarged mineral extraction areas	Use topography/bunds/barriers and consider equipment locations to screen noise from surrounding receivers

We note that Policy 6 states requires measures to manage adverse effects from heavy vehicles on quarry transport routes. Policy 6 has not been addressed in this assessment because:

- This policy is not relevant to the Plan Change assessment because the change of the quarry zone boundary would not affect the location, number or frequency of heavy vehicles entering/exiting the site.
- Noise from trucks on the road has been addressed during the 2015 – 2018 Resource Consent assessment, consultation and mediation

## 5.0 ACOUSTIC PERFORMANCE STANDARDS

### 5.1 Noise from Quarry Operations

Under the AUP, the current quarry site is zoned as *Special Purpose Zone – Quarry Zone*. Rule H28.6.2.1 states that:

- (1) *Noise from mineral extraction activities must not exceed the noise levels in Table H28.6.2.1.1 at a notional boundary from any dwelling that existed at 1 January 2001 outside the Special Purpose – Quarry Zone. [...]*

- (2) Noise must be measured and assessed in accordance with New Zealand Standard on Acoustics - Measurement of Environmental Sound (NZS 6801:2008) and New Zealand Standard on Acoustics - Environmental Noise (NZS6802:2008).

**Table H28.6.2.1.1 Noise levels**

Times	Noise levels
7am-9pm, Monday to Friday	$L_{Aeq}$ 55dB
7am-4pm, Saturday	$L_{Aeq}$ 55dB
All other times and on public holidays	$L_{Aeq}$ 45db $L_{AFmax}$ 75dB

For the purposes of this assessment, it has been assumed that all nearby dwellings existed on 1 January 2001, and therefore the above limits apply in relation to quarry operation for all nearby receivers.

The noise limits in the Rural Production Zone are set out in E25.6.3 and in summary are the same noise limits as for the Quarry Zone, but with extended time periods:

**Table E25.6.3.1 Noise levels in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone**

Time	Noise level
Monday to Saturday 7am-10pm	55dB $L_{Aeq}$
Sunday 9am-6pm	
All other times	45dB $L_{Aeq}$ 75dB $L_{AFmax}$

This means that the rezoning through the Plan Change would have no adverse effect on the permitted noise limits as received by dwellings in the vicinity.

## 5.2 Noise and Vibration from Blasting

Blasting can cause high noise and vibration levels that differ in character from other quarry operations. For that reason, blasting noise has its own criteria in the Unitary Plan. Rule H28.6.2.2 sets out the limits for blasting as follows:

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

## 6.0 EXISTING NOISE ENVIRONMENT

For the Resource Consent assessment, four attended 15-minute noise level surveys were undertaken at locations that may be affected by quarry or truck noise, at different times of the day. The relevant results relating to properties close to the quarry only, are shown in Table 2.

**Table 2: Measured Ambient Noise Levels**

Period	Location (Driveway of)	Time / Date	Measured Noise Levels		Controlling noise sources and comments
			dB L <sub>Aeq</sub> (15min)	dB L <sub>A90</sub> (15min)	
<i>Early Morning (6am-7am)</i>	458 McNicol Rd	6.45am 1/8/2016	46	35	<u>Plane flyover, 1 car movement. Stream.</u>
<i>Daytime (7am-9pm)</i>	520 McNicol Rd	3.20pm 5/11/2015	41	36	<u>Birds.</u> Quarry audible intermittently and at low level (excavators)
<i>Night-time (9pm-7am)</i>	458 McNicol Rd	11:55pm 26/4/2017	29	28	<u>Crickets, Stream.</u> 1 distant car movement, leaves rustling in trees

Noise levels can be described in different ways, e.g. as energy average levels (L<sub>Aeq</sub>) incorporating all noise that occurs in a certain period, or as background noise levels (L<sub>A90</sub>), which is the noise that is exceeded for 90% of the time and excludes shorter duration noise such as vehicle passes. Therefore, the background noise level does not change significantly over a larger area, while the average noise level is more responsive to the distance to noise sources.

Ambient noise levels close to the quarry are generally low due to the absence of manmade continuous noise sources. Intermittent high noise events (e.g., trucks passing) form part of the ambient noise environment but are not continuous in nature.

The background noise levels (L<sub>A90</sub>) indicate that the overall noise environment is low, with noise levels in the mid-30 dB L<sub>A90</sub> during daytime.

## 7.0 PREDICTED LEVELS

### 7.1 Model Inputs

We have based our discussion of the Plan Change on the computer noise model prepared for the Resource Consent assessment. Noise levels from quarry operations in the proposed Plan Change area have been predicted using SoundPLAN® environmental noise modelling software.

The following information has been incorporated in the noise model:

- Topographical contours at 1m intervals (Obtained from Auckland Council, as of July 2014)
- Topographical contours from the Resource Consent assessment for the future pit design
- Cadastral boundaries (obtained from LINZ)
- 2010 – 2012 Aerial maps (obtained from LINZ, verified with 2021 Google Earth imagery)
- Equipment from the Resource Consent assessment for potential future locations, with the stripping equipment (excavator, bulldozer and bin truck) moved to the southern-most ridge in the extended quarry zone, while processing remained in the same location as previously



modelled. For equipment refer to Appendix C and equipment locations to the figure in Appendix D.

We predicted noise levels in accordance with the algorithm detailed in ISO9613-2: 1996- *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO9613) as implemented in SoundPLAN®.

ISO9613 considers a range of frequency dependent attenuation factors, including spherical divergence, atmospheric absorption, ground effect, acoustic screening and directivity effects. It assumes meteorological conditions favourable to propagation from sources (downwind at wind speeds 1 – 5m/s in all directions), and as such, calculates slightly conservative sound levels.

The noise contours are obtained by computer interpolation between calculated grid points at 20m intervals, 1.5m above ground level. Appendix E contains noise level contours for the future operational scenario from the Resource Consent assessment, adapted for the Plan Change.

## 7.2 Quarry Operations

For modelling purposes, all plant that may operate within the quarry has been assumed to work simultaneously and continuously. This is considered a worst-case situation when maximum extraction, processing and stockpiling occurs up to consented and practicable limits. Production within the quarry is likely to fluctuate depending on demand, and noise levels may therefore be lower than predicted at times of lesser operations within the quarry.

It is understood that all quarry plant would operate during daytime hours (7am – 9pm). Night-time operations (9pm – 7am) would only include the crushing plant with a loader and bin truck and small excavator. Refer to Appendix C for the full list of equipment and operation times.

In the model, the crushing plant sources have been positioned in a location close to the rock face at the north of the quarry pit. This location provides the most shielding for the surrounding receivers and is understood to be a practicable location within the quarry operations. The location of each plant item considered in the calculations is marked on the figure in Appendix D.

Noise levels have been predicted for future proposed operations as per the Resource Consent assessment, with the stripping equipment (excavator, bulldozer and bin truck) moved to the southern-most ridge in the extended quarry zone as a worst-case scenario.

### 7.2.1 Daytime Quarry Operations

The predicted noise levels for daytime operations at the most affected receivers are around 40 dB  $L_{Aeq}$ . This is readily compliant with the Unitary Plan noise limits and we consider these are reasonable noise levels in a rural environment. Predicted noise levels are generally similar to existing ambient noise levels.

Table 3 overleaf compares the predicted noise levels for the most affected receivers with the measured existing noise levels in the vicinity and the AUP OP noise limit.

**Table 3: Summary of Noise Levels for Closest Receivers – Daytime Operations (7am – 9pm)**

Address	Predicted noise levels (dB L <sub>Aeq</sub> )	
	No Plan Change	With Plan Change
458 McNicol Rd	41	40
498 McNicol Rd	36	37
510 McNicol Rd (currently no dwelling)	38	38
520 McNicol Rd	37	37
600 McNicol Rd	29	32
426 Otau Mountain Rd	39	39
373 Otau Mountain Rd	34	33

The table above shows that the calculated change in noise level is 1 decibel or less for all receivers, except 600 McNicol Road.

A 3-decibel increase is predicted at 600 McNicol Road, which is subjectively just noticeable. However, the overall level of 32 dB L<sub>Aeq</sub> is very low and within the existing environment (measured level of 41 dB L<sub>Aeq</sub> at 520 McNicol Road).

A noise level of 32 dB L<sub>Aeq</sub> would mean that quarry operations may be audible intermittently, but at a level well below even the night-time noise limit of 45 dB L<sub>Aeq</sub>. We consider that no adverse effects would result from such a low level of noise.

### 7.2.2 Night-time Quarry Operations

The Plan Change is not predicted to have any change on night-time operations, because the equipment that could operate 24/7 (crusher, stockpiling and road trucks) would still be located in the existing production area of the quarry.

### 7.2.3 Blasting

Due to the significant distance between the nearby receivers and quarry operations, any relevant vibration limits can be readily complied with for all proposed quarry operations.

In relation to blasting, given that the closest dwelling would now be at a distance of 150 metres (600 McNicol Road), blast charges will need to be managed to ensure that vibration levels are compliant with the 5mm/s PPV limit.

Blast noise can be managed by the size of the charge used. At 150 metres, even large charges of up to 100 kg could be used and compliance with the noise limit of 128 dB L<sub>zpeak</sub> achieved. Therefore, compliance with the vibration limits will be the limiting factor when deciding on blast locations and charge weight.

## 8.0 PLAN CHANGE ASSESSMENT

Table 4 compares the relevant objectives and policies with the results of our assessment.

**Table 4: Comparison of objectives and policies with the findings of our assessment**

Objective/Policy	Assessment findings
Objective 2 – avoid, remedy or mitigate significant adverse effects	<p>Noise levels are readily compliant with the relevant rules and are generally similar to the existing ambient environment.</p> <p>Noise and vibration levels from blasting (only activity likely to be perceptible at nearby receivers) is also predicted to comply with the relevant limits with appropriate management.</p> <p>Based on the above, we consider that significant effects on surrounding receivers have been avoided.</p>
Policy 4 – manage operations to protect adjacent sensitive activities from unreasonable levels of noise and vibration	<p>The proposed operations are reasonable as they comply with the relevant limits and are comparable to the existing environment.</p> <p>Quarry operations are subject to the noise management plan, which contains measures to ensure there is not unreasonable noise and vibration.</p>
Policy 7 – internalise adverse effects associated with new or enlarged mineral extraction areas	<p>The new quarry zone is still will shielded by terrain from nearby receivers, which is why the noise levels received at the houses are so low. We consider that the adverse effects have been internalised.</p>

In summary, we predict that the proposed Plan Change will have no noticeable acoustic effects (either adverse or positive) compared to what is enabled under the current zoning.

## APPENDIX A GLOSSARY OF TERMINOLOGY

<b>Noise</b>	A sound that is unwanted by, or distracting to, the receiver.
<b>Ambient</b>	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
<b>dB</b>	<u>Decibel</u> The unit of sound level.  Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of $P_r=20 \mu\text{Pa}$ i.e. $\text{dB} = 20 \times \log(P/P_r)$
<b>dba</b>	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.
<b>A-weighting</b>	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
<b><math>L_{Aeq}(t)</math></b>	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.  The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
<b><math>L_{A90}(t)</math></b>	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background 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.
<b><math>L_{Amax}</math></b>	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
<b><math>L_{peak}</math></b>	The peak instantaneous pressure level recorded during the measurement period (normally <b>not</b> A-weighted).
<b>NZS 6801:2008</b>	New Zealand Standard NZS 6801:2008 " <i>Acoustics – Measurement of environmental sound</i> "
<b>NZS 6802:2008</b>	New Zealand Standard NZS 6802:2008 " <i>Acoustics – Environmental Noise</i> "
<b>PPV</b>	<u>Peak Particle Velocity</u> For Peak Particle Velocity (PPV) is the measure of the vibration aptitude, zero to maximum. Used for building structural damage assessment.



## APPENDIX B UNITARY PLAN NOISE RULES

### C1 QUARRY ZONE

#### H28.6.2. Controlled activity standards

All activities listed as a controlled activity in Table H28.4.1 and Table H28.4.2 must comply with the following controlled activity standards.

##### H28.6.2.1. Noise

- (1) Noise from mineral extraction activities must not exceed the noise levels in Table H28.6.2.1.1 at a notional boundary from any dwelling that existed at 1 January 2001 outside the Special Purpose – Quarry Zone.

[...]

- (3) Noise must be measured and assessed in accordance with New Zealand Standard on Acoustics - Measurement of Environmental Sound (NZS 6801:2008) and New Zealand Standard on Acoustics - Environmental Noise (NZS:6802:2008).

**Table H28.6.2.1.1 Noise levels**

Times	Noise levels
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[...]

##### H28.6.2.2. Vibration and blasting

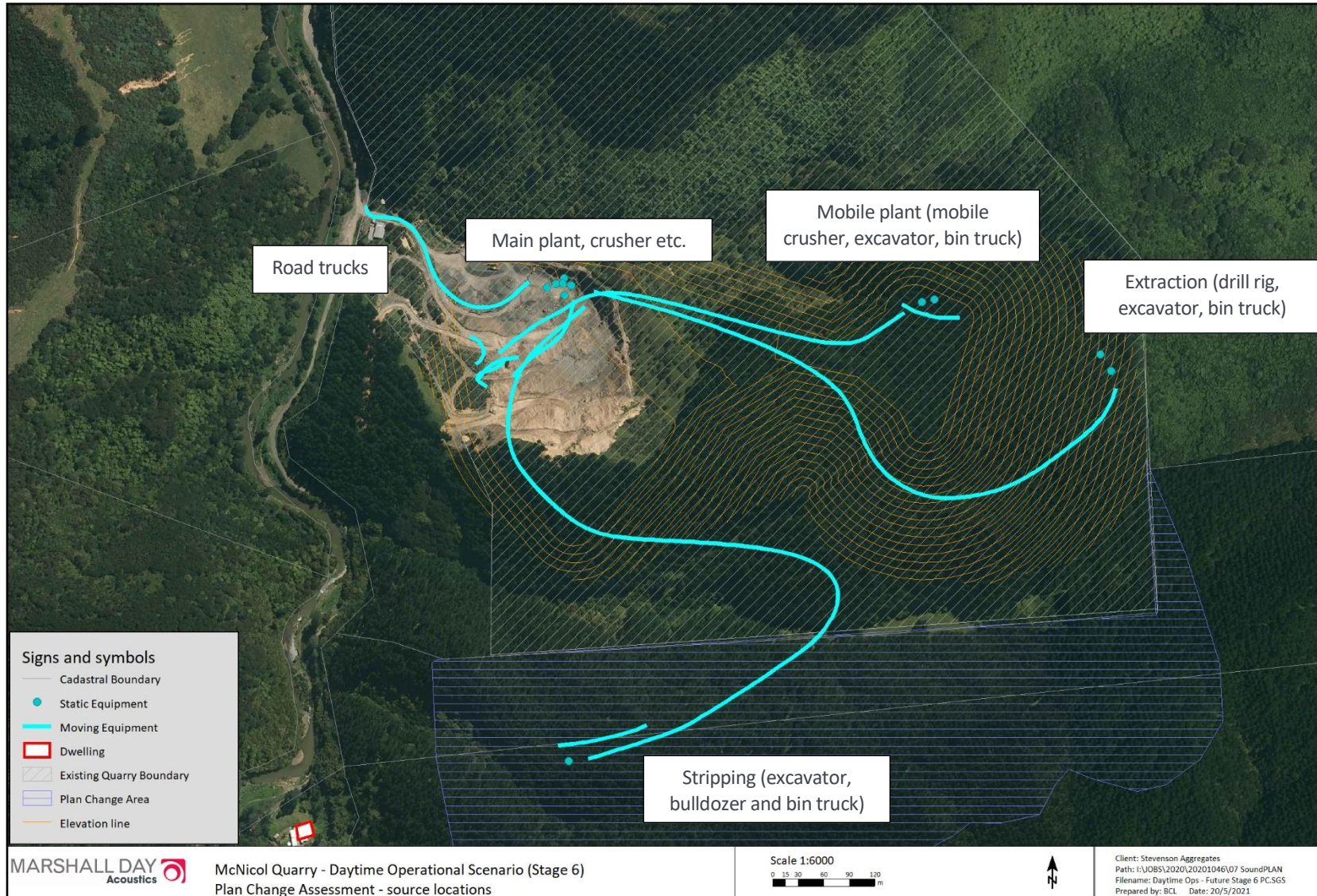
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- (2) The measurement of blast noise (air blast) and ground vibration from blasting must be measured at the notional boundary of a dwelling that existed at 1 January 2001.
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- (5) Blasting activities must be controlled to ensure any resulting ground vibration does not exceed the limits set out in German standard DIN 4150-3 1999: Structural vibration – Part 3 Effects of vibration on structures when measured on the foundation in the horizontal axis on the highest floor of an affected building.
- (6) A siren must be used prior to blasting to alert people in the vicinity.

**APPENDIX C LIST OF QUARRY EQUIPMENT**

<b>Area</b>	<b>Equipment Item</b>	<b>Operation Time</b>	<b>Sound Power Level (dB L<sub>WA</sub>)</b>
Stockpile	CAT980 Loader x2	Day and night	106
	CAT966 Loader (spare/backup)	N/A	105
Crushing Area	Jaw Crusher	Day and night	116
	Cone Crusher	Day and night	114
	Barmac Crusher	Day and night	119
	Screen	Day and night	105
	Conveyer	Day and night	109
	CAT305 Excavator	Day and night	102
Extraction Area	CAT374 Excavator	Day only	116
	CAT773 Dump Truck x2	Day only	114
	Drill Rig	Day only	121
Mobile/Top Bench	Mobile Crusher	Day only	112
	CAT336 Excavator	Day only	116
	CAT966 Loader	Day only	105
Stripping	CAT D7 Bulldozer	Day only	109
	CAT730 Dump Truck	Day only	113
	CAT349 Excavator	Day only	105



APPENDIX D QUARRY NOISE SOURCE LOCATIONS





APPENDIX E QUARRY NOISE CONTOURS

