

BEFORE SELWYN DISTRICT COUNCIL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of a Resource Consent Application by RC185627 and a change of Resource Consent RC192408-414 by Fulton Hogan Ltd

STATEMENT OF EVIDENCE OF JEREMY WILLIAM TREVATHAN

DATED 2 SEPTEMBER 2019

INTRODUCTION

Qualifications and experience

1. My name is Jeremy Trevathan. I am an Acoustic Engineer and Director of Acoustic Engineering Services Limited, an acoustic engineering consultancy with offices in Auckland, Wellington and Christchurch. I hold the degrees of Bachelor of Engineering with Honours and Doctor of Philosophy in Mechanical Engineering (Acoustics) from the University of Canterbury. I am an Associate of the New Zealand Planning Institute, and a Member of the Acoustical Society of New Zealand.
2. I have over ten years' experience in the field of acoustic engineering consultancy and have been involved with a number of environmental noise assessment projects throughout New Zealand. I have previously presented evidence at Council and Environment Court Hearings, and before Boards of Inquiry. I have acted on behalf of applicants, submitters and as a peer reviewer for Councils.
3. In the last ten years, I have been involved in over 15 quarry projects in Canterbury, along with others in Auckland, Tasman, Marlborough, Westland and Southland. My experience includes noise assessments of new quarry activities and expansions in both Christchurch and Selwyn Districts, as well as being engaged by the Christchurch City Council and Selwyn District Council to assist them with quarry Resource Consent applications. I have also previously been engaged by neighbours who have submitted on proposed quarry operations.
4. While this matter is not before the Environment Court, I have read and agree to comply with the Code of Conduct for Expert Witnesses (Environment Court Practice Note 2014). I confirm this evidence is within my area of expertise, except where I state I am relying on facts or information provided by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Background

5. In November 2018, I was engaged by Selwyn District Council (SDC) to provide acoustic engineering advice relating to the application for Resource Consent for Fulton Hogan to establish and operate a gravel quarry and processing operation at Roydon Quarry on Jones Road between Curraghs Road and Dawsons Road in Rolleston.
6. I have reviewed the Applicants Consent Documents including the *Acoustic Assessment* prepared by Marshall Day Acoustics and dated 14 November 2018.
7. I provided material for Requests for Further Information issued by the Selwyn District Council and dated 21 December 2018, 11 July 2019 and 25 July 2019. I reviewed the responses received from Marshall Day Acoustics titled *Consultant Advice – Response to Further Information Request* dated 28 February 2019 and *Consultant Advice – Additional Further Information Request (11 and 25 July 2019)* dated 16 August 2019. I also reviewed the overall document *Fulton Hogan Limited Roydon Quarry Proposal (Reference CRC192408-192414, RC185627) - Response to additional Requests for Further Information* prepared by Golder and dated August 2019. Appendix B of that document was a set of revised draft conditions.
8. I attended a preliminary meeting with the noise experts engaged by Fulton Hogan (Jon Farren and Gary Walton), Canterbury District Health Board (Stephen Chiles), the New Zealand Motor Caravan Association (Richard Jackett) and the Templeton Residents Association (Michael Smith) on the 8th of August 2019. No Joint Statement was produced from that meeting. It is intended that further conferencing will take place prior to the hearing, and a Joint Statement will be produced.
9. I am familiar with the site and regularly pass through the area on foot and by car. I also visited the site specifically in relation to this project between 1300 and 1500 hours on the 17th of December 2018, and between 0600 and 0645 hours on the 20th of June 2019 to observe the existing environment and undertake my own noise measurements in the vicinity of the site. Rewa Satory from my company also visited

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the site between 0830 and 0930 hours on the 11th of June 2019 to observe and undertake noise measurements in the vicinity of the site.

PROPOSED NOISE LIMITS AND CONTROLS

10. The noise limits and other relevant controls have changed significantly over the course of my involvement with the project. In my view the changes have all been positive from a noise perspective. I have summarised my understanding of what is currently proposed below.

Summary of noise-related conditions

11. Based on Appendix B of the document *Fulton Hogan Limited Roydon Quarry Proposal (Reference CRC192408-192414, RC185627) - Response to additional Requests for Further Information* prepared by Golder and dated August 2019 I understand that the key noise control mechanisms which have been volunteered or form part of the Application are as summarised below.

Operational noise limits (Conditions 28 and 29 of 'General')

12. All activities on the site (other than construction), measured in accordance with the provisions of NZS 6801:2008 "Acoustics – Measurement of environmental sound", and assessed in accordance with NZS 6802:2008 "Acoustics – Environmental Noise", shall not exceed the following noise limits at any point within any other site, during the following times:
 - a. Daytime 0700 to 1800 hrs 55 dB L_{Aeq}
 - b. Evening 1800 to 2000 hrs 50 dB L_{Aeq}
 - c. Night 2000 to 0700 hrs 45 dB L_{Aeq} and 70 dB L_{Amax}

In order to permit vehicle access onto the site, the noise limits above shall not apply to vehicle movements when measured within 250 m of the site's heavy vehicle entrance.

Construction noise limits (Condition 30 of 'General')

13. Construction activities including the establishment of the site, roadworks, topsoil stripping, bund construction and site rehabilitation, shall be conducted in accordance with NZS 6803: 1999 "Acoustics - Construction Noise", and shall comply with the "typical duration" noise limits contained within Table 2 of that Standard.

A restriction on tonal reversing alarms (Condition 31 of 'General')

14. Should audible vehicle reversing alarms be required, only broadband noise alarms are to be used on quarry-based equipment. Tonal reversing alarms are not permitted.

Noise monitoring (Condition 32 of 'General')

15. Within the first 12 months following the commencement of Stage 1 gravel extraction activities, noise emissions from the site shall be measured and assessed in accordance with Condition 28) above, by a suitably qualified and experienced acoustic consultant. A report describing the measurement results shall be submitted to Selwyn District Council within 20 working days of completion of the survey.

A restriction in what activities can occur on site at various times (Condition 7 of 'General')

16. The hours of operation are 7.00 am to 8:00 pm, Monday to Saturday. Outside of these hours restricted processing operations and load out of trucks may occur as detailed in Table 1 below.

Table 1: Hours of operations/activities.

Hours	Duration	Range of activities
6.00 am to 7.00 am	Monday to Saturday	Load out of trucks, site pre-start up including operational warm up of conveyors and machinery. Clean fill deposition.
7.00 am to 6.00 pm	Monday to Saturday	Full range of quarry activities.
6.00 pm to 8.00 pm	Monday to Saturday on 150 days per annum.	Full range of quarry activities with the exception of processing using mobile plant and backfilling.
8.00 pm to 6.00 am.	Monday to Saturday on 150 nights per annum	Load out of trucks and truck movements, and ancillary activities such as operation of weighbridge and site offices and clean fill deposition.
Sunday and public holidays	For up to 15 days per year	Truck movements – load out of aggregate and clean fill deposition.
At all times, dust suppression, operation of weighbridge office activities, site security and light maintenance as required.		

A restriction on the number of truck movements per hour outside the hours of 0700 to 2000 hours (Condition 9 of ‘General’)

17. Truck movements outside the hours of 7.00 am to 8.00 pm Monday to Saturday shall be restricted to no more than 30 vehicle movements per hour.

A restriction in the number of truck movements (Conditions 22 and 23 of ‘General’)

18. Heavy vehicle movements shall not exceed a maximum of 1,200 movements per day. For the avoidance of doubt, this would equate to 600 trucks in and out of the site in a day.

Heavy vehicle movements shall not exceed more than 800 vehicle movements per day, as an average, over any consecutive 60 calendar day period.

Protocols around heavy vehicle movements through Templeton (Condition 24 of ‘General’)

19. The following shall apply with respect to heavy vehicle movements through Templeton (i.e., along Jones Road):
 - a. Fulton Hogan controlled trucks will only travel into or through Templeton if a delivery is in the immediate vicinity of Templeton.

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- b. Fulton Hogan will require any non FH-controlled truck drivers accessing the site to sign on to a code of practice committing to the same.
- c. A prominent sign will be established inside the quarry gate reminding drivers not to travel through Templeton unless a delivery is in the immediate vicinity.
- d. The site induction shall include a section on truck route options to and from the site and specifically address point (b) above.

A restriction on the location of any processing plant (Condition 18 of 'General')

- 20. Any fixed processing plant and associated stockpiling shall be set back at least 500 m from the site boundaries and any mobile processing plant and associated stockpiling shall be set back at least 250 m from the site boundaries.

A requirement for bunding to be established (Condition 4 a and b of 'General')

- 21. Establishment of 3 m high earth bunds around the site perimeter, with the exception of site accessways, with a 1 m wide flat top shall be constructed around the site. The bunds shall have a profile with an outside slope of up to 1:3 (one vertical to three horizontal) and a 1 m wide top and shall have a minimum width of 15 m.

Overlapping bunding, or a planted island barrier, shall be established to the heavy vehicle accessway entrance adjacent to Jones Road, so as to obscure views into the quarry from Jones Road (as per the example shown on Page 25 of the LVIA prepared by DCM Urban, Project No. 2017_31, dated 12 August 2019, or as otherwise may be approved by the Team Leader, Resource Consents).

Site access restriction (Condition 5 of 'General')

- 22. Vehicle access shall be provided on Jones Road, between Curraghs and Dawsons Road, for light and heavy vehicles. This may involve a separate access point exclusively for light vehicles. These access points shall be designed and constructed/ upgraded in accordance with the recommendations of the Stantec ITA (Appendix C of the AEE).

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Extraction setback from dwellings (Condition 19 of 'General')

23. No extraction shall occur within 100 m of any dwelling existing at [the date of consent being granted] being 151 Curraghs Road and 319 Maddisons Road, without the prior written consent of the owners and occupiers of these dwellings.

Other restrictions which form part of the Application

24. Sections 10.3 and 10.3.3 of the Marshall Day Acoustics report dated 14 November 2018 contained the following statements, which I have assumed form part of the Application, and should be captured in a condition:

"We understand that there will be relatively low numbers of heavy vehicles outside of normal daytime operating hours, and that vehicles will be prohibited from using smaller local roads at night (e.g. Dawsons, Curraghs). As such, we expect that all night time traffic will travel via SH1.", [emphasis added] and

"Although heavy traffic movements will not be permitted up smaller roads during the night..." [emphasis added]

25. The noise assessment relies on these controls being in place. No condition is currently proposed to this effect. When Marshall Day Acoustics report dated 14 November 2018 was written the 'night time' period with regard to noise finished at 0600 hours. As above, this has now been revised to 0700 hours in proposed Condition 28. I have assumed the meaning of 'night' and 'night time' in the above statements can be assumed to have also changed accordingly.
26. Overall, I consider that the above restrictions are generally appropriate and with some modifications will ensure that the noise effects of the activity are minimal, for the reasons I discuss below. My comments regarding conditions in the following sections have been integrated into the set appended as Attachment 1 to the s42A report of Mr Henderson, to the extent that is relevant given the other changes Mr Henderson is recommending.

Discussion regarding the ambient noise environment

27. The noise limits described in paragraph 12 above include some key changes from what was originally proposed – in particular:
- The start of the daytime period was originally proposed to be 0600 hours, now it is 0700 hours, and
 - The start of the night time period was originally proposed to not occur until 2200 hours. Now it is 2000 hours. This means the evening period is from 1800 to 2000 hours.
28. The existing ambient noise environment early in the morning and late in the evening were relied upon to justify the original noise limits. Before the changes to the day and night time limits were proposed, I had therefore spent some time reviewing the extensive ambient noise measurements undertaken by MDA, undertaking my own measurements and seeking further information as to the ambient noise analysis via the RFI process.
29. I remained unconvinced that during the periods from 0600 to 0700 hours and from 2000 to 2200 hours at key receiving locations (primarily 319 Maddisons Road, 153 Curraghs Road and the New Zealand Motor Caravan Association (NZMCA) site – the location of which is shown in attachment 1 of this evidence) ambient noise levels will be sustained at the elevated levels needed to justify the originally proposed limits.
30. I am however satisfied that the ambient noise levels at these and other locations closer to the Main South Road (MSR) / Christchurch Southern Motorway Stage 2 (CSM2) are typically elevated compared to an isolated rural area, and this ambient noise does have an impact on the amenity currently experienced by residents - which is relevant when assessing the effects of the proposal.

31. I have formed this view by observing the ambient noise during my site visits and reviewing the measurement data of my colleague Ms Satory and the ambient noise measurement data provided by MDA.
32. During my site visits, road traffic was the dominant noise source at all locations I visited. Noise from MSR was audible for the entire time. From several positions the dominant source appeared to be from the direction of MSR / CSM2 interchange rather than the nearest point on MSR. This may be due to the elevated traffic on the new flyover. In the early morning before 0615 hours traffic on Maddisons and Jones Road was infrequent with individual cars heard from a long way off. Noise from traffic on MSR noticeably increased between 0600 and 0620 with an increase of from 43 to 47 dB L_{Aeq} on Curraghs Road at a point approximately halfway between Maddisons and Jones Roads. I did not observe any traffic on Curraghs Road during my visit. Noise within the residential area in Templeton was in the order 54 dB L_{Aeq} at the furthest point from MSR on Globe Bay Drive at 0630 hours.
33. During Ms Satory's visit the dominant noise source was again road traffic. At properties on Maddisons Road, noise from heavy and light vehicles was dominant, with some periods between separate vehicles where bird noise was audible and distant noise from MSR could be heard. Curraghs and Dawsons Roads had a rural feel, with various types of birds' noises and few vehicles – however traffic noise from MSR was always audible in the background. To the south of the site at properties between MSR and Jones Road noise from traffic on both these roads was audible; constant for MSR and there were few periods where vehicles were not passing along Jones Road. A train was also observed during the visit and aeroplanes flying overhead were audible above the traffic noise in the vicinity of Jones Road.
34. Based on the above, I consider that properties in the vicinity of MSR, Jones Road or Maddisons Road typically experience ambient noise sustained at higher levels than those in an isolated rural area. At locations set back from these roads (for example 153 Curraghs Road and the NZMCA site) the ambient noise environment has a more rural character, albeit with near-constant background noise from MSR

and/or Maddisons Road. Within the Templeton residential area, background noise levels are elevated due to traffic on MSR.

35. MDA have undertaken an extensive survey of the existing noise environment including long-term unattended noise monitoring and short-term attended monitoring. The monitoring locations are shown in figure 6 of the of the MDA report dated 14 November 2018. Their results support my observations. Based on the 16 August 2019 RFI response I expect that ambient noise levels may decrease in some locations when CSM2 is complete – however there is some uncertainty as to the extent of any reduction, and this is unlikely to change the overall character of the ambient noise in the area which I have described above, or the conclusions I have outlined below.

Are the proposed operational noise limits appropriate?

36. In the 14 November 2018 MDA report, they considered the proposed operational noise limits for the project in the context of the general Selwyn District Plan and Christchurch District Plan noise limits, guidance provided by NZS6802:2008 *Acoustics – Environmental Noise* and by the World Health Organisation *Guidelines for community noise* (1999), and the ambient noise environment. As discussed above, the originally proposed limits were then further modified in the 16 August 2019 RFI response as follows:

- The start of the daytime period was delayed until 0700 hours (it had been 0600 hours). A noise limit of 55 dB L_{Aeq} at the site boundary is still proposed during the daytime.
- The start of the night time period was brought forward to 2000 hours (it had been 2200 hours). A noise limit of 45 dB L_{Aeq} at the site boundary is still proposed during the night time. This means the evening period is from 1800 to 2000 hours. A noise limit of 50 dB L_{Aeq} at the site boundary is still proposed during the evening.

- The exemption to allow vehicle access onto the site was modified to apply to a 250 metre radius (not 300 metres), and now applies only to noise from vehicles (not to all sound from the site).
37. As described above, I had some concerns about the noise limits originally proposed – in particular due to the departure from what might have reasonably been anticipated by people in the area based on the underlying District Plan limits, the limited ‘night time’ period compared to the general guidance, and the robustness of the arguments about elevated ambient noise in the early morning and late evening. However, I am supportive of the modified limits, for the following reasons.
38. Compliance with the daytime limit will provide adequate protection of rural and residential amenity. I note that this limit is more stringent than the general noise limit in the Selwyn District Plan, except for the period 0700 to 0730 hours when I accept that ambient noise levels in the area are commonly high due to existing traffic, the operation of the Christchurch International Airport and the Main South Line railway line. Applying the limit at the boundary of any other site (as opposed to the notional boundary of dwellings) provides protection from reverse sensitivity effects, should new dwellings be established in the area. The proposed daytime limit is more lenient than the general daytime noise limit in the Christchurch District, should new dwellings be built in close proximity to the site. However, based on point 5 of the 28 February 2019 RFI response I understand that dwellings within 250 metres of the quarry boundary would require Resource Consent if the quarry is consented, and that is unlikely that development will occur prior to this. In any event I am satisfied that the noise effects on any such future dwellings would be minimal, for the reasons above.
39. The evening limit is reasonable and is more restrictive than the Selwyn Plan and equal to the Christchurch Plan limit from the period from 1800 to 2000 hours. It will also ensure that noise from the site is typically lower than other ambient noise in the area, thereby protecting rural and residential amenity during a period when people may be enjoying outdoor living.

40. The night time limit of 45 dB L_{Aeq} noise limit is also appropriate as the guidance documents I have referred to above are unanimous that this will allow occupants to sleep with their windows open and provide adequate protection of rural and residential amenity. The on-set of the night time limit at 2000 hours is early, and provides for an extended period of higher protection. As with the daytime limit, after 2200 hours the night time limit is more lenient for the Christchurch District should new dwellings be built in close proximity to the site. However, as outlined above, I consider that the proposed night time limit is suitable to protect such future dwellings.
41. I consider that the exemption provided for vehicles on the site access is reasonable, and this condition is unlikely to result in unintended consequences now that it is limited to noise from vehicles only.
42. I am however concerned that all of the MDA modelling scenarios are based on a specific assumed location of the heavy vehicle access, to the east of the dwelling at 1090 Main South Road. However, the condition currently proposed (Condition 5) would theoretically allow the establishment of that access point anywhere along the Jones Road frontage of the site. If the access was to move closer to the 1090 Main South Road dwelling, the majority of quarry heavy vehicles would then travel in close proximity to that site – which is not a scenario that was presented in the MDA analysis. It may therefore be appropriate to require the heavy vehicle access to also remain at least 250 metres from the 1090 Main South Road dwelling.
43. I have considered whether more restrictive noise limits should apply at the NZMCA site, due to the fact that this activity is different from normal residential use. However, the separation between the NZMCA site and the quarry site boundary will ensure noise levels at that site are at least 3 dB lower than the proposed noise limits. As above, this is one of the areas where I accept that the ambient noise levels are also elevated frequently due to other sources such as traffic in the area – so in that context I expect the proposed limits to provide an acceptable level of protection.

Are the construction noise limits appropriate?

44. The proposed condition requires construction noise to comply with the 'typical duration' noise limits outlined in table 2 of NZS 6803:1999 *Acoustics - Construction Noise*. This is good practice, and is appropriate in this situation.
45. I do however consider the blanket inclusion of 'site rehabilitation' in proposed condition 30 to be problematic – as site rehabilitation can generate sustained noise levels for ongoing periods, and in the MDA analysis ongoing rehabilitation activity has been assessed against the operational noise limits. The only 'rehabilitation' activity identified by MDA in the 28 February 2019 RFI response as being necessary to assess as 'construction' was the formation of final batter slopes in the area between 0 and 5 metres below existing ground level. I also consider the deconstruction of bunds and spreading topsoil to reasonably fall under 'construction'. I therefore consider that wording of this condition should be modified to remove the general reference to 'site rehabilitation' but include those specific activities.

Discussion regarding the suitability of other conditions

46. I consider a number of the other conditions I have summarised in paragraphs 11 to 23 require some development, as follows:

Tonal reversing alarms

47. I support the intent of this condition. However, the condition is currently limited to "quarry-based equipment" – which would either exclude, or be uncertain in terms of controlling trucks. I consider that the same 'code of practice' protocol referred to in condition 24 relating to heavy vehicles in Templeton should be used to ensure no equipment on the site is fitted with tonal reversing alarms.

Noise monitoring

48. As I will discuss below, the critical phases of the project in terms of compliance with the operational noise limits are when excavation approaches 319 Maddisons Road and 153 Curraghs Road, when mobile crushing is undertaken within 400 metres of dwellings and when rehabilitation activities are undertaken within 400 metres of dwellings. This condition should be modified to require additional monitoring to be undertaken at these critical times. I have suggested a framework for this in the condition set attached to the s42A report of Mr Henderson.

Restriction on what activities can occur at what times on site

49. I support the intent of this condition. However, the condition should be reviewed and rationalised and only defined and unambiguous terms should be used for the sake of clarity of interpretation – for example are “load out of trucks”, “load out of aggregate” and “load out of trucks and truck movements” intended to be distinctly different activities? Are “backfilling” and “clean fill deposition” distinctly different activities? What is the definition of “operational warm up”?

Site access restriction to Jones Road

50. This condition is required from a noise perspective, because the noise effects may be fundamentally different at some receivers if the site access was on Curraghs or Dawsons Roads. However as discussed above, the situation would also be noticeably different for the occupants of 1090 Main South Road should the heavy vehicle access move significantly closer than the location which has been assumed in the MDA analysis. It may therefore be appropriate to require the heavy vehicle access to also remain at least 250 metres from the 1090 Main South Road dwelling.

Heavy vehicles using local roads

51. As discussed further below, a key issue is noise and vibration from heavy vehicles using local roads – in particular those travelling past 153 Curraghs Road, and the group of dwellings adjacent to the north side of Jones Road, to the west of the site

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entrance. As above, the MDA 14 November 2018 assessment was based on all heavy vehicles travelling directly to MSR during the 'night time'. This should be captured in a condition, which also makes clear which roads are included in the prohibition, and that it applies from 2000 hours to 0700 hours the next day.

52. As I discuss further below, I consider that a night time restriction should be applied to Curraghs Road (between Jones Road and Maddisons Road) and Jones Road (to the west of the site access point). I also consider that a daytime prohibition is appropriate on Curraghs Road (between Jones Road and Maddisons Road).
53. I note the volunteered Condition 24 restriction regarding heavy vehicles travelling into Templeton area to the east of the site, which I consider to be appropriate.

Noise Management Plan

54. A noise management plan is currently not proposed. This would outline any monitoring requirements and provide clear processes and procedures to be implemented upon receiving any noise complaints and other communication with neighbours and the wider community. This could also provide a framework for notification of nearby residents prior to events which may generate high noise levels – for example construction of the bund. I consider that this is reasonable for a project of this scale, given the proximity of receivers such as 153 Curraghs Road and 319 Maddisons Road. A condition to this effect should be included.

EXPECTED NOISE AND VIBRATION LEVELS

55. I agree that the modelling methodology and analysis provided in the MDA report is appropriate, and will provide conservative results such as in situations where particular dwellings are not downwind of the quarry, for example. The noise level predictions are based on ISO 9613-2:1996 which assumes supportive propagation conditions from the quarry as is typical best practice.
56. The sound power levels assumed by MDA for quarry equipment and operations on site are generally consistent with our own data for similar equipment. Loaders have

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been modelled as a point source (rather than an area of operation), which is conservative if appropriate worst case locations are selected.

57. With this in mind I note that the RFI response dated 16th of August 2019, presents a revised quarrying sequence. The screening provided by the quarry face, and location of mobile machinery is likely to change when compared to the original MDA assessment. However, I consider that the scenarios shown in the MDA assessment were always indicative to an extent as they have assumed specific locations for loaders and conveyors which will vary due to the day to day operation of the quarry. I still consider the locations of equipment and modelled scenarios to be a reasonable worst case, and the predictions to be 'representative noise levels' consistent with the approach outlined in NZS 6802:2008.
58. I am of the opinion that the modelling to date provides sufficient detail to demonstrate that the proposed limits can be complied with, and the general range of noise levels likely to be experienced at each receiver.

Daytime operational noise generated on site

59. The calculated noise levels provided by MDA show that at the notional boundary of the majority of dwellings, noise from the daytime operation of the site will be less than 50 dB L_{Aeq} . An exception is the dwellings located near the site entrance, at 1033, 1053 and 1090 Main South Road where levels up to 52 dB L_{Aeq} are predicted, due to the use of the site access. The location of these dwellings is shown in Attachment 1 of this evidence. This is expected to be indicative of the noise levels experienced at these dwellings, although will be dependent on the final location of the site access.
60. In the 16 August 2019 RFI response, MDA have included predicted noise levels for the scenario where backfilling occurs in an area close to the dwelling at 319 Maddisons Road, with fixed processing equipment in operation. Noise levels of up to 50 dB L_{Aeq} are expected at the notional boundary of this dwelling when this occurs. In a scenario when backfilling occurs in an area close to the dwelling at 319

Maddisons Road and mobile plant is in operation 250 metres from this dwelling, a cumulative noise level of 55 dB L_{Aeq} is expected.

61. There are several other dwellings where noise levels will increase up to 54 dB L_{Aeq} when mobile processing occurs at the same time as the modelled operational scenarios.
62. The noise levels at residential properties in Templeton are expected to be 46 dB L_{Aeq} or less at all times, even with the mobile processing plant operating.
63. I understand that conveyors will be used where possible to transport product to the central processing area. A conveyor system has been shown in the various noise prediction scenarios. I understand that dump trucks will also be used on occasion and expect this would lead to a small variance from the predicted noise levels when this occurs.

Evening and night-time operational noise generated on site

64. During the evening period, between 1800 and 2000 hours, I understand there will be no processing using mobile plant, or backfilling. In this scenario operational noise levels of up to 48 dB L_{Aeq} are predicted at the worst affected dwellings at 319 Maddisons Road and 1053 and 1090 MSR.
65. During the night-time period, there will only be load-out of aggregate and clean-fill deposition. Predicted noise levels are typically below 40 dB L_{Aeq} at the notional boundary of dwellings, with the exception of 1033, 1053 and 1090 Main South Road due to the use of the site access.
66. The predicted L_{max} noise levels associated with one-off events such as gravel being dumped into an empty truck and chassis rattle are expected to be up to 60 dB L_{AFmax} at 200 metres from the boundary of the site. Based on these levels the noise could be up to 65 dB L_{AFmax} at 319 Maddisons Road and 153 Curraghs Road.

Noise and vibration levels associated with off-site trucks

67. MDA have considered the change in 24 hour L_{Aeq} noise level due to the addition of quarry traffic on both the MSR and local roads. They have also calculated hourly L_{Aeq} values at the dwellings at 4 Dawsons Road, 153 Curraghs Road and on Jones Road to the west of Curraghs Road during the quietest night-time periods.
68. The predicted increase to the 24-hour L_{Aeq} traffic noise level on MSR is 1 dB. A similar increase is expected on Hamptons and Curraghs Road with minimal change on Jones Road and Dawsons Road. I note that these predictions do not take into account the lower number of predicted daily heavy vehicle movements discussed in the RFI response dated August 2019, although I do not expect this to result in significantly different levels.
69. In their original assessment MDA predicted hourly L_{Aeq} values at the façade of dwellings at 4 Dawsons Road, Jones Road, and at 153 Curraghs Road comparing the increased noise levels to the 'existing' situation. I note that these predictions for the 'existing' situation do not take into account the decrease in ambient noise levels upon the completion of CSM2, or the proposed 30 quarry truck per hour limitation, although this is only expected to result in a small change (1-2 dB) to the predicted noise levels.
70. The MDA predictions based on 40 quarry trucks per hour during the night-time, show noise levels of 54 dB $L_{Aeq (1hr)}$ from quarry traffic at 4 Dawsons Road, compared to 50 dB $L_{Aeq (1hr)}$ from existing traffic during the quietest night-time period (0200-0300 hours), a 4 dB increase. When considering the decrease in ambient noise levels upon the completion of CSM2 and the 30 truck per hour limitation, I expect an increase at this dwelling in the order of 4 to 5 dB L_{Aeq} during this time.
71. MDA have also predicted increased night-time traffic noise levels to the group of dwellings on the northern side of Jones Road, to the west of the site. A lower number of truck movements has been assumed on this section of Jones Road (4 movements per hour). When this occurs, predicted noise levels of 55 dB $L_{Aeq (1 hr)}$ are expected,

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compared to 53 dB $L_{Aeq(1\text{ hr})}$ from existing traffic. When considering the decrease in ambient noise levels, I expect there may be an increase at these dwellings in the order of 4 to 5 dB L_{Aeq} at night.

72. The original MDA assessment predicted noise levels received at 153 Curraghs Road due to a low number of heavy vehicle movements (4 per hour) between 0600 – 0700 hours, with a 1 dB increase shown. This was reproduced again in the 16 August 2019 RFI response under point 9. However, based on statements in the 14 November 2018 MDA report and the subsequent change to the night time hours, I understand that no quarry trucks will be permitted to travel on Curraghs Road during night time hours.
73. With regard to vibration - MDA have compared measured data from quarry traffic on roads in other areas of Christchurch to existing ambient vibration levels on Maddisons Road. This data indicates that at 10 – 20 metres from a road which includes quarry or other heavy vehicle traffic, peak particle vibration (PPV) levels are typically less than 0.3 mm/s, with a few events generating up to around 0.65 mm/s.
74. Based on the guidance provided in BS 5228-2 which suggests 0.3 mm/s is the typical threshold of perceptibility for vibration in residential environments, I agree that many events are therefore likely to be imperceptible in residential environments. Occasional events associated with quarry heavy vehicles will be noticeable, but will be below the typical levels that is likely to cause complaint in this environment and will be experienced at similar levels to the vibration generated by other heavy vehicles on the road.
75. I do note however, that the overall number of perceptible events is likely to increase for the closest dwellings, given the increased number of heavy vehicle movements on these roads. The increase in perceptible vibration events will be proportional to the overall increase in heavy vehicle movements on each road, when quarry heavy vehicles are added to existing heavy vehicles.

Noise and vibration levels associated with construction

76. The highest predicted noise level due to construction activity is expected at 319 Maddisons Road, due to bund construction near this dwelling. MDA predict a noise level of 71 dB L_{Aeq} at this location. Construction noise levels will be significantly lower (less than 60 dB L_{Aeq}) at other dwellings.
77. The bund construction is also likely to generate the highest levels of vibration at nearby dwellings. MDA have used peak particle velocity data from their own measurements and also from NZTA reference data to estimate likely vibration levels from an excavator constructing a bund. I consider this to be a reasonable approach.
78. This analysis indicates that at 319 Maddisons Road while vibration will be felt, building damage is unlikely to occur as both the NZTA and MDA measured data indicate that vibration levels will be below the residential building damage criterion of 5 mm/s outlined in DIN 4150-3:1999. I therefore consider it unlikely that a pre-commencement assessment would be required at this dwelling.
79. At 153 Curraghs Road vibration due to construction of the bund could be in the order of 1.0 mm/s. A vibration (PPV) level of 1.0 mm/s is defined in BS 5228-2:2009 as the level in residential environments which is likely to cause complaint, but can be tolerated if prior warning and explanation has been given to residents. Again building damage would not be expected.

DISCUSSION OF EXPECTED NOISE AND VIBRATION EFFECTS AT SPECIFIC RECEIVERS

80. As described above, I generally consider that the proposed noise related conditions will be adequate to ensure the effects of the proposal are minimal, with the various provisos and additions I have discussed above. As I have also discussed above, the MDA analysis demonstrates that it is realistic for the proposal to comply with these controls. In this section I have considered specific situation in terms of noise effects of the most relevant receivers in the area. The location of these dwellings is shown in Attachment 1 of this evidence.

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319 Maddisons Road

81. The dwelling situated at 319 Maddisons Road will experience the highest construction noise and vibration levels, and the operational noise levels most likely to approach the daytime limits when excavation, mobile processing and/or rehabilitation are underway close to this property. Night time noise levels are expected to be 5 dB below the proposed limits. This property also experiences an elevated ambient noise environment, being set back only some 65 metres from Maddisons Road. I therefore consider that provided noise complies with the proposed limits, noise effects on this property will be minimal. I do however have the following additional observations.

Construction noise and vibration

82. Noise and vibration levels at this dwelling will be high during the construction of the bund. As per the 16 August 2019 RFI response, these levels could be reduced if the closest portion of the bund followed the 100 metre 'no excavation' setback, instead of the site boundary. However, such a bund would be more complex to construct and maintain, and may be less effective in many operational noise scenarios. While it may be useful to consult further with the occupant on this, it seems likely that higher construction noise and vibration is a reasonable compromise, for a bund which is then more effective over the life of the quarry.

Monitoring of operational noise

83. As discussed above, noise monitoring is recommended as excavation, mobile crushing and/or rehabilitation approach this dwelling, as the current modelling suggests that this is where achieving compliance may be most challenging for the Applicant.

Noise and vibration from quarry heavy vehicles on Maddisons Road

84. I understand that very few quarry trucks would be expected to pass down this portion of Maddisons Road. Even if they did, the setback of the dwelling from the road and

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the fact that Maddisons Road already carries over 300 heavy vehicles per day means that noise and vibration from quarry trucks will be indistinguishable from other heavy vehicles, and there will be no noticeable cumulative noise from the site and quarry trucks.

153 Curraghs Road

85. Operational noise levels at the dwelling situated at 153 Curraghs Road are expected to be 4 – 8 dB below the evening and daytime limits, but may approach the daytime limits if mobile crushing conducted in close proximity. Night time levels are expected to be 7 dB below the 45 dB L_{Aeq} limit for operational noise.
86. The dwelling is in the order of 30 metres from Curraghs Road and 120 metres from Maddisons Road – so it does receive moderate levels of elevated ambient noise from these sources – although the closer road (Curraghs) carries much less traffic than Maddisons. Curraghs Road currently carries in the order of 50 heavy vehicles per day.

Noise and vibration heavy vehicles quarry during night

87. Curraghs Road is shown as a possible route for quarry heavy vehicles, and due to the proximity of the dwelling to the road and low ambient heavy vehicle count, this is the location where noise and vibration effects from heavy quarry vehicles on the road are most likely to be noticeable. The passage of heavy vehicles on Curraghs Road is likely to be experienced differently from ambient noise and vibration from the much more frequent heavy vehicles on Maddisons, due to relative differences in setback and frequency of occurrence. If quarry trucks did use Curraghs Road during the night time period, they would generate noise levels of over 45 dB L_{Aeq} at this dwelling.
88. However, as discussed above based on statements in the 14 November 2018 MDA report and the subsequent change to the night time hours, it appears that the intention may be that no quarry trucks will travel on Curraghs Road during night time hours. I recommend that this is captured via a condition. I note however that MDA's

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view on this should be clarified, as in the 16 August 2019 RFI response under point 9 they still provide an assessment where 4 quarry trucks use Curraghs Road during the (now night time) period of 0600 to 0700 hours.

Noise and vibration heavy vehicles quarry during day and evening

89. I accept that a low number of quarry trucks travelling on Curraghs Road during the daytime and evening would not have a significant effect, in the context of a road which already carries approximate 50 heavy vehicles per day. However, I also understand that there is currently no certainty that this will always be the case. A scenario with a high number of quarry trucks on Curraghs Road has not been assessed by MDA, and would be of concern. I therefore recommended that quarry heavy vehicles are also prohibited from using this portion of Curraghs Road during the daytime and evening.

Cumulative noise from heavy vehicles on road and operational noise

90. In my view 153 Curraghs Road is the one location where cumulative noise levels – particularly heavy vehicles and mobile processing, could realistically increase noise levels above any of the scenarios which have been presented in the MDA analysis. As above due to the uncertainty regarding the likelihood of frequent and sustained quarry heavy vehicle use of Curraghs Road I have recommended a condition prohibiting the use of Curraghs Road by quarry heavy vehicles during both the day and night time. This will avoid any possible cumulative effect.

NZMCA site

91. The NZMCA site is in a unique situation as it is located 'mid-block' with a reasonable separation from all local roads, and the activity involves recreation and sleeping in structures which are not permanent, but have a low level of sound insulation.
92. However as discussed above, due to the additional setback, this location will receive operational quarry noise at levels lower than the proposed limits – at least 3 dB, and up to 4 – 8 dB below the daytime / evening / night time noise limits for the specific

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scenarios which MDA have modelled. In addition, while being further removed from local roads, the site does still experience near constant ambient noise from MSR / CSM2 and so while there are likely to be periods of quiet, these periods are infrequent and the existing ambient noise including train and aircraft noise would already be expected to present challenges for those seeking 'peace and quiet' in this location, regardless of whether the quarry is established.

93. Quarry heavy vehicles travelling on Curraghs Road and Jones Road to the west of the site access are likely to be audible on the NZMCA site, particularly if that were to occur at night. However due to the considerable setback (250 metres to Curraghs Road and more than 400 metres to Jones Road) any noise effects from this aspect of the proposal are likely to be experienced more critically in other closer proximity locations (specially 153 Curraghs Road as discussed above, and Jones Road properties as discussed below). Due to the setbacks involved cumulative noise is also not of concern in this location. I therefore do not consider any further mitigation measures are required for the NZMCA site.

Jones Road dwellings to the west of the site entrance

94. There is a group of dwellings on the northern side of Jones Road, to the west of the site. Some of these dwellings are only set back in the order of 30 meters from the road. They are however located more than 300 metres from the site, so operational noise is expected to be low in this location.
95. These dwellings are subjected to elevated traffic noise from Jones Road (which carries over 300 heavy vehicles per day) and MSR (which is only approximately 200 metres away). In this context, I accept that the addition of 40 quarry heavy vehicles (5 % of the 800 quarry heavy vehicles may use this route) on average during the daytime is unlikely to be noticeable from a noise or vibration perspective.
96. From the 14 November 2018 MDA report it seems clear that Jones Road was never one of the 'smaller roads' where quarry heavy vehicles were intended to be prohibited at night. Figure 10 of the 14 November 2018 MDA report does suggest

that the existing Jones Road traffic decreases to very low levels between 2300 hours and 0400 hours, and MSR / CSM2 traffic is also expected to be the lowest at that time. Therefore, it is possible that if the level of use by night time quarry heavy vehicles was at times frequent and sustained, a concerning adverse effect could arise. Again, I have been unable to understand how realistic higher periods of sustained use of Jones Road during the night time period are and so consider an appropriately conservative approach to be to prohibit quarry heavy vehicles on this portion of Jones Road during the night time period.

Templeton residential area

97. The Templeton residential area is more than 700 metres from the quarry site, so operational noise levels are expected to be low (10 dB below the proposed limits). As discussed above, a condition has now been volunteered which will limit quarry heavy vehicles on Jones Road travelling into Templeton.
98. A potential noise impact in the Templeton residential area is associated with quarry heavy vehicles travelling on MSR during both the day and night time. This effect could be enhanced when CSM2 is operation, as the volume of 'other' traffic on MSR is predicted to decrease. However due to the setback distances and underlying traffic volumes MSR I do not expect noise from quarry heavy vehicles on MSR to be clearly noticeable as a new discrete noise source in the Templeton Residential area.

4 Dawsons Road

99. The dwelling at 4 Dawsons Road experiences high ambient noise levels from Jones Road and MSR / CSM2. However, it is also very close to the route via which most quarry heavy vehicles will travel during both the day and night time.
100. I do not expect operational noise to be an issue in this location, or noise from heavy vehicles during the daytime (due to the high ambient noise levels). I have given some thought to the night time situation, as the MDA analysis indicates that there will be a noticeable increase in noise compared to the 'existing' situation – and that

'existing' situation does not take into account the decrease in ambient noise levels upon the completion of CSM2.

101. However, I consider the MDA analysis to be conservative, as it compares the ambient noise levels at the quietest time of the night, with the noise generated by 40 quarry heavy vehicles per hour. As discussed above, a limitation to 30 quarry trucks per hour has now been volunteered, and the MDA ambient noise analysis indicates that for extended portions of the period from 2200 to 0700 hours when sleep disturbance is typically of most concern the ambient noise levels in this location are already elevated significantly above those which would be conducive to uninterrupted sleep with windows open. The occupants of this dwelling will therefore already need to take steps to manage the external noise situation in this location, such as keeping windows closed during the night-time period, or sleeping in rooms which are less exposed to noise from traffic. In this context, I consider the presence of additional noise from night time quarry trucks from time to time will only have a minor cumulative effect.
102. To ensure this potential effect is mitigated as far as possible, the design of the route between the quarry entry / exit and MSR should however incorporate best-practice low noise features as suggested in the CDHB submission.

Other receivers to the south of the site

103. Other receivers to the south of the site will experience similar noise levels to 4 Dawsons Road, apart from they are typically further from the path of quarry heavy vehicles moving between the site and MSR, and so noise from those vehicles is less likely to be easily distinguishable from other ambient sound. As discussed above, I consider that an additional restriction is however appropriate with regard to 1090 Main South Road, to ensure the heavy vehicle site access is not located within 250 metres of this dwelling.

Other receivers to the north and west of the site

104. The measures I have discussed above for 319 Maddisons Road and 153 Curraghs Road will ensure noise effects are adequately controlled for more distant receivers to the north and west of the site.

Future noise sensitive development

105. As discussed above, the proposed noise limits apply at the boundary of any neighbouring site, not at the notional boundary of existing dwellings. Therefore, even if a future dwelling was constructed in a worst-case location it would still be protected by the proposed noise limits. As I have described above, I consider the proposed noise limits to provide a reasonable level of protection in this environment.

SUBMISSIONS

106. 430 submissions have been received. 65 of the submissions relate directly to the Samadhi Buddhist Temple located at 358 Maddisons Road which is currently unconsented and therefore I have been advised that these submissions in so far as they relate to the unconsented activity cannot be considered. I have therefore considered the building at 358 Maddisons Road as if it were a residential dwelling, as I understand that is what is legally established on the site.

107. 142 of the remaining submissions mention noise or quiet (including 5 neutral or neither or partial and 7 in support) among other issues. Concerns of submitters include:

- Construction noise, operational noise, noise from vehicles on roads and the cumulative effect of all of these – and the cumulative effect of these sources in an area which already experiences high ambient levels.
- Noise generated by the proposed 24-hour operation, including during normal sleep hours and impacts on outdoor living at other times.
- Noise effects on animals and plants.

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- Noise effects on Templeton School, which is already affected by other ambient noise sources.
- Damage to buildings from vibration.
- Monitoring and enforcement of noise conditions.
- Health risks of constant noise and the long-term detrimental effects on mental and physical health of the residents including from high and low frequency noise and infrasound.
- Sensitive receivers at Brackenridge Estate, supported residential living for those with disabilities.
- NZCMA concerned that caravans have lower noise insulation than residences and therefore more sensitive to noise.

108. I read and considered these submissions before forming the opinions on the Application that I have set out in the sections above. I have also considered the suggestions Submitters have made regarding conditions, and note that many of these are now integrated into either the August 2019 Draft Conditions provided by the Applicant, or the further amendments I have proposed such as:

- Restrictions on the number of truck movements and routes (Condition 28 and 29 in the set attached to the s42A report of Mr Henderson).
- Quarry trucks to be banned from using Jones Road through Templeton (Condition 29 in the set attached to the s42A report of Mr Henderson).
- Further restrictions to the operating hours and heavy vehicle hours (Condition 12 in the set attached to the s42A report of Mr Henderson).
- Setbacks to residential dwellings (Condition 24 in the set attached to the s42A report of Mr Henderson).

- A requirement for noise monitoring (Condition 38 in the set attached to the s42A report of Mr Henderson).
- Restriction of reverse beeping (Condition 37 in the set attached to the s42A report of Mr Henderson).

109. With the proposed controls included in conditions, and taking account of the existing ambient noise levels, I expect the noise effects of the activity to be minimal.

Jeremy William Trevathan

2 September 2019

Attachment 1: Site and surrounding area (Canterbury Maps)



- [1] Site
- [2] Heavy vehicle entrance location assumed in noise modelling
- [3] 153 Curraghs Road (approximate 400 m radius from dwelling shown in green)
- [4] 319 Maddisons Road (approximate 400 m radius from dwelling shown in green)
- [5] Dwellings on Jones Rd to the west of the site
- [6] NZMCA
- [7] Templeton residential area
- [8] 1090 Main South Road (
- [9] 1033 Main South Road
- [10] 1053 Main South Road
- [11] 4 Dawsons Road