

File Ref: AC19355 – 04 – 01

29 September 2020

Nelson City Council
Victoria Woodbridge
C/- Landmark Life Ltd
PO Box 343
Nelson 7040

Email: victoria@landmarklife.co.nz

Dear Victoria

Re: RM205196 - S92 Further information request

We have reviewed the further information request received from Jane Hilson at Planscapes. Our review related to comments arising from the technical peer review of our noise assessment reports (AES Reports AC19355 – 02 - R3 and AC19533 – 03 - R3 Noise risk assessment, dated 31 July 2020) which supported the application for resource consent RM205196 (points 5 to 16 of the RFI).

The peer review of the noise assessment report was undertaken by Marshall Day Acoustics (MDA) and we have been liaising with several MDA staff (Michael Morrow, Gary Walton and Jon Farren) while preparing our responses, as follows:

- We provided draft responses to the peer review comments in writing to MDA on 26 August 2020. They confirmed we had addressed their comments appropriately, however they asked for some additional information aimed to assist submitters and the Council to better understand what the noise effects might look like at different offset distances from the works.
- We sent MDA a draft of the further information relating to noise effects at different offset distances on 8 September 2020. We subsequently received a request for further information from MDA on 10 September 2020 which we have also considered when preparing this letter.

Please find our respond to the RFI points 5 to 16 below.

S92 Point 5 AES state that the noise contours are based on a flat ground model without screening from buildings or terrain (top of page 13). The local topography is not flat and MDA anticipate that at a number of the proposed locations there will be a large number of properties elevated above the road – they will overlook the road and noise levels may be higher than predicted. Accounting for the local topography and screening and reflections offered by existing buildings is necessary for an accurate noise level assessment – while this may increase the noise levels at some properties, the total affected area may decrease.

Please confirm why AES consider a flat model to be appropriate or provide updated noise models accounting for topography and buildings.

For the example sites, we did undertake modelling with topography and buildings (along with flat earth) – see table 4.2, and the noise contour plots in Appendix C of our report dated 31 July 2020.

We agree that dwellings overlooking the noise source could potentially be 'even worse' than flat earth – however the differences are unlikely to be large. The example sites are only indicative, and the proposed management approach would see the circumstances of actual sites considered on a case by case basis.

S92 Point 6 *It is unclear if noise contours indicate façade noise levels. Typically, noise contours are presented as freefield levels. However, as the construction noise limit in NZS 6803 is a façade noise level and the main concern is sleep disturbance within dwellings, presenting façade noise level contours would be most appropriate.*

Please confirm if the noise contours are façade noise level or not and provide commentary on how AES have considered façade noise levels in their assessment.

The predicted noise levels are facade noise levels, which is explained in Section 4.0 *Noise Modelling* of our report dated 31 July 2020.

S92 Point 7 *Practicable noise reducing measures are not discussed. There may be some noise mitigation options that could be easily adopted to reduce noise equipment noise levels – such as localised noise barriers around equipment. AES do not appear to have considered any practicable noise reducing mitigation measures in their analysis. It is noted that the use of the best practicable option to minimise noise emissions is a requirement of NZS 6803 and of Section 16 of the Resource Management Act 1991.*

Please provide commentary on whether AES have considered any practicable noise reducing measures or indicate why they have not allowed for any noise mitigation in their analysis.

Noise reducing measures are included in the Noise Risk Assessment template appended to our report dated 31 July 2020. The application of the noise reducing measures is explained in detail in that document.

S92 Point 8 *The noise maps only provide contours up to 60 dB LAeq. There are a significant number of properties that are shown within the 60 dB LAeq noise contours. However, it is anticipated that the noise level incident on the façades of these properties will be significantly higher than 60 dB LAeq.*

Please provide updated noise maps showing noise contours up to 75 dB LAeq.

The noise contour maps were developed for the investigation and may not represent works that will actually occur. The actual locations and type of works will be decided in the future as part of planning the works program by the Council. Adding more contour increments to these maps is therefore of limited value, in this case.

S92 Point 9 *Further commentary is required on the existing ambient noise environment. AES highlight that existing ambient noise levels are an important factor in determining the noise risk level rating. However, they do not provide any indication of the expected ambient noise levels at each of the sites. They do comment on the 24 hr traffic noise levels, but this does not address the local environment or that noise levels at night will be significantly less than the average noise level over 24 hours. Low levels of background noise will exacerbate the noise effects.*

Please confirm how AES have accounted for these expected low levels of ambient noise in their risk level rating.

The work will occur at locations across the city and the existing ambient noise levels could vary widely. Accurately quantifying the actual existing ambient noise levels at a specific site would likely require measurement of noise levels over a period of days and then selection of noise control based on that information would then also require more work by consultants. All of which could be considered excessive for works that would likely be completed over just a few days. As such, we have instead assumed all the sites will have low ambient noise levels (a worst-case assumption) and some may have elevated ambient levels due to transport noise, as shown in the Noise Risk Assessment template.

S92 Point 10 AES have determined set back distances for the proposed ranges of activities beyond which a level of 45 dB LAeq is calculated – the complying noise limit for night-time construction works. However, within this set back area there will be a vast range of noise effects depending upon the façade noise level and the duration of the construction works. Establishing a compliance set back distance does not address the adverse noise effects experienced at dwellings within the set back area. MDA consider that it would be appropriate to use set back distances as means of identifying affected parties. But as the effects will vary with noise level, establishing a more refined range of set back distances – for example in 5 decibel increments – would be necessary to determine the appropriate mitigation measures. These setback distances may also vary for each construction activity. The duration of the night-time works will also significantly influence the noise effects – an activity occurring for 30 mins may have a lesser effect than an activity occurring for 6 hours, dependent on noise level. Whether occupants have their windows open or not will also be an influencing factor that should be taken into account.

Please provide an assessment of noise effects of each activity for affected parties based on:

- the calculated façade noise levels in maximum 5 decibel increments up to the highest calculated façade noise level (likely to be in excess of 70 - 75 dB LAeq);
- the duration of the construction works during the night;
- whether windows are open or closed;
- the expected ambient noise levels at night.

The consent application is being publicly notified, so every person could be deemed to be an affected person. The actual site locations and type of activity is not yet decided, so we are unable to provide the assessment of noise effects in the way that has been requested.

As requested by MDA subsequently, we have provided additional information about the range of noise effects at different offset distances in an Appendix at the end of this letter. This table is very complex due to all the variables involved, and as above does not reflect any specific actual situation. We remain unconvinced that this provides any more clarity to submitters or the reviewers regarding “an objective assessment of noise effects”.

S92 Point 11 There is no assessment of the expected L AFmax noise levels from the proposed range of activities and how this may affect receivers.

Please provide detail of expected L AFmax noise levels with an assessment of noise effects.

While the majority of noise from the construction equipment will be reasonably steady state, we expect there could be instantaneous maximum noise events that cause levels in the order of 10 - 15 dB higher than those presented. The recommended noise limit for these transient noise events is 75 dB LAmax, which is 30 dB higher than the recommended noise limit of 45 dB LAeq. The LAeq based noise limit will therefore be the controlling limit.

S92 Point 12 The draft noise risk assessment and management statement discusses vibration effects. However, the AES report does not provide any details on vibration from the proposed range of activities, appropriate vibration limits or the expected vibration effects on affected parties.

Please provide details on any expected vibration levels from the activities and their effects.

For the type of activity planned, we expect that airborne noise emission will be the dominant issue when compared with intermittent construction vibration that may occur during periods of vibratory compaction across a site. In the Noise Risk Assessment template, the discussion of vibration was limited to one recommended mitigation measure relating to suggested methods for operation of vibratory rollers. We do

not expect the planned activity to generate levels of vibration that would exceed typical vibration guide values for building damage.

S92 Point 13 *Limiting construction activities to weekday nights seems unnecessary. The draft noise risk assessment and management statement states that no work can occur on Sundays or Public Holidays. As the works occur at night, the noise effects are unlikely to alter whether they occur on a weekend night or a weeknight. It is noted also highlight the NZS 6803 does not highlight any special protections for Saturday/Sunday nights compared to weeknights.*

Please comment on the rationale to restrict activities during these times.

The Council informed us there would be no work on Sundays or Public Holidays, which was the rationale for restricting the activities. If the Council consider this to be a practicable type of mitigation option, we see no reason to insist that work be done on these days.

S92 Point 14 *The range of catchment type does not appear to be reflective of Nelson City. The draft noise risk assessment and management statement lists receiver catchment types as:*

- *Urban – Medium density of housing*
- *Urban – High density of housing*
- *Urban – Inner City*

These types do account for the predominant suburban environment outside of the Nelson CBD. MDA consider that the receiver catchment type would be based on factors such as the site zoning, the building use (commercial, residential, etc) and the ambient noise levels.

Please develop a more appropriate range of receiver catchment types.

The categories in the Noise Risk Assessment template do reflect the types of built environment surrounding sites that would likely be selected for night-time works. They are not intended to align with zoning categories, but rather, describe the density of housing as is relevant for providing noise screening. The “medium density housing” option is representative of a typical ‘suburban’ environment. We accept the terminology may have been confusing.

We do not agree that night-time effects on commercial uses or zones are likely to be a major concern.

S92 Point 15 *The draft noise risk assessment and management statement lists only two mitigation options for reducing noise levels at the receiver:*

- *Inform residents about ‘masking noise’*
- *Provide earplugs to residents*

While these may be appropriate at some dwellings, these would not adequately address the noise effects all affected parties. It is recommended that a more comprehensive range of mitigation options is developed dependent upon the noise effects received at each receiver – in some instances this may even include offering residents alternative accommodation for the nights on which construction will occur.

Please provide a range of appropriate mitigation measures based on the revised noise level assessment (refined set back boundaries as recommend above).

We would be happy to consider other mitigation options that MDA could suggest and can include these in the list of options which may be available in a particular situation. The Council and contractor will however also then have a view as to how practical those other options will be for them to implement. The Council has advised us they would not be likely to consider offering alternative accommodation to be the best practicable option for non-acoustic reasons in many situations. The short duration of the works would likely preclude engineering type solutions at a receiver location; hence our recommended options were centered around personal protection options. As per the process we have proposed, mitigation would be implemented where practicable at source, which would reduce noise levels at receivers.

S92 Point 16 *The noise complaint management procedure does not promptly address complainants' queries. The draft noise risk assessment and management statement indicates that any Service Requests would "generally be addressed the next morning". There is concern that this will not be timely enough respond to queries or prevent recurrence of complaints, particularly where further construction works would be occurring the following night.*

Please provide a detailed complaints response procedure outlining the response timeframes, mitigation options that would be offered to complainants where appropriate and how any changes to the activities will be incorporated into the management plan.

Volunteered condition 6 and 7 (refer to section 3.6 of the application) require a letter to be provided to residents within the 'site' area of works notifying them of the details of the works. This letter will include details of the relevant complaints procedure and contact details for Council and the Site Manager who will be available on site at all time.

Council already have a process for dealing with any compliant and that process would be adhered to in relation to any complaints concerning works approved by this consent. The volunteered conditions of consent require that Council's Monitoring Staff are provided with a copy of the works programme and Noise Risk Assessment for the specific work as well as being notified 48 hours prior to work commencing. Monitoring Staff will, therefore, be familiar with the parameters of the resource consent and the Noise Risk Assessment (NRA) which includes consideration of mitigation measures, details of notification of works etc. Council's Monitoring Staff are on a 24 hour call out roster and make prompt contact with the complainant and discuss the nature of the compliant – this is standard practice for all after hours complaints received and so this is a well-established practice for which there are existing processes and procedures to be followed.

Based on the procedure proposed via the NRA, mitigation measures to reduce noise effects will already have been assessed and considered prior to work commencing. Council Monitoring Staff, when responding to the initial compliant will make a check to ensure that all mitigation measures indicated as being proposed for that particular work in the NRA are in place as required. If the mitigation measure indicated on the NRA has not been established Contractors will take immediate action to rectify this error as far as practical.

Feedback regarding the compliant will be provided to the relevant Council staff the following morning who can discuss the incident with the Contractor and the complainant to try and reach a resolution. If it is possible, based on the required work programme and outcome requirements, to make changes to the schedule of work then this will be considered by Council staff and if appropriate changes will be made. Likewise, Council staff will review the NRA to ascertain whether all appropriate and reasonable mitigation measures have been deployed in relation to the particular work. Any changes to the work programme or mitigation measures will be communicated to the Complainant. As noted in the NRA there are limited mitigation options which are practical and realistic to establish onsite and whilst every attempt will be made to reach a compromise and liaise with a complainant there may be instances where the short duration of the work is the only available mitigating factor.

Please do not hesitate to contact me if you have any queries or comments.

Kind Regards,



James Boland
Senior Acoustic Engineer
Acoustic Engineering Services Ltd

Appendix A

Noise effects at different offset distances and noise mitigation options

	Offset distance to work site, and the expected noise levels ($L_{Aeq}(1.5 \text{ min})$)							
	Up to 50 m		50 to 100 m		100 to 200 m		Beyond 200 m	
	The first 50 m from the work activity is likely to include some uninhabited spaces such as within the road corridor and the front yards of some residential buildings. People that live in buildings close to busy roads may already experience elevated noise levels at times due to noise from road traffic. These people may already be managing noise themselves by keeping certain windows closed.		As the offset distance from the works increases beyond 50 m (larger than a typical urban section) the amount of screening from other buildings will likely increase and the noise effects could vary in different directions from the works accordingly.		At these distances from the works, in many situations, there could be at least two intervening buildings between a receiver of interest and the activity, which could provide some degree of acoustic screening and therefore noise reduction.		At distances of greater than 200 m from the works we expect the noise effects would begin to diminish significantly, with direct line of sight very unlikely and in a typical residential area other noise sources of a similar magnitude could occur from time to time – e.g. traffic on intervening local roads.	
Milling, Surfacing (AC) or Surfacing (CS)	Incident noise levels up to 75 dB		Incident noise levels up to 60 dB		Incident noise levels up to 55 dB		Incident noise levels less than 55 dB	
The noise during these activities will be reasonably steady throughout the shift, with occasional louder events caused by plant movements.	The resulting internal noise levels shown below will depend on orientation of the building relative to the works and the window details.	Noise effects and mitigation	The resulting internal noise levels shown below will depend on orientation of the building relative to the works and the window details.	Noise effects and mitigation	The resulting internal noise levels shown below will depend on orientation of the building relative to the works, the presence of other buildings that would provide screening, and the window details.	Noise effects and mitigation	The resulting internal noise levels shown below will depend on orientation of the building relative to the works, the presence of other buildings that would provide screening, and the window details.	Noise effects and mitigation
Most exposed facade, windows open (Noise reduction of approximately 10 dB, refer NZS6809 C5.2)	up to 65 dB	Normal conversation or television viewing could be impacted. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Use rooms that are less exposed to the works.	up to 50 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Sleep in a room that is less exposed to the works.	up to 45 dB	Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping. Sleep in a room that is less exposed to the works.	<45 dB	Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping. Sleep in a room that is less exposed to the works.
Screened facade, windows open (Additional noise reduction of at least 10 dB likely for facades facing away from the works)	up to 55 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping.	up to 40 dB	Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping.	up to 35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.

	Offset distance to work site, and the expected noise levels ($L_{Aeq}(15 \text{ min})$)							
	Up to 50 m		50 to 100 m		100 to 200 m		Beyond 200 m	
Most exposed facade, windows closed, single glazing (Noise reduction of approximately 20 dB, refer NZS6803 7.2.7)	up to 55 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Sleep in a room that is less exposed to the works.	up to 40 dB	Sleep disturbance possible for some people. Sleep in a room that is less exposed to the works.	up to 35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.
Most exposed facade, double glazing, well-sealed (Noise reduction of at least 30 dB possible)	up to 45 dB	Sleep disturbance likely. Sleep in a room that is less exposed to the works.	up to 30 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	up to 25 dB	Sleep disturbance unlikely.	<25 dB	Sleep disturbance unlikely.
Screened facade, windows closed, single glazing (Additional noise reduction of at least 10 dB likely for facades facing away from the work, refer NZS6803 7.2.7)	up to 45 dB	Sleep disturbance likely. Use ear plugs for sleeping.	up to 30 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	up to 25 dB	Sleep disturbance unlikely.	<25 dB	Sleep disturbance unlikely.
Screened facade, double glazing, well-sealed (Additional noise reduction of at least 10 dB likely for facades facing away from the work)	up to 35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	up to 20 dB	Sleep disturbance unlikely.	<20 dB	Sleep disturbance unlikely.	<20 dB	Sleep disturbance unlikely.

	Offset distance to work site, and the expected noise levels ($L_{Aeq}(1.5 \text{ min})$)			
	Up to 50 m	50 to 100 m	100 to 200 m	Beyond 200 m
Seal cutting	Incident noise levels of 70 to 85 dB		Incident noise levels of 65 dB and below.	
Seal cutting is a short-term louder activity which will mostly occur early in the shift on sites that include Milling or Surfacing. The seal cutting activity will generally last for half an hour for each occurrence.	The resulting internal noise levels shown below will depend on orientation of the building relative to the works and the window details.	Noise effects and mitigation	The resulting internal noise levels shown below will depend on orientation of the building relative to the works, the presence of other buildings that would provide screening, and the window details.	Noise effects and mitigation
Most exposed facade, windows open (Noise reduction of approximately 10 dB, refer NZS6809 C5.2)	60 to 75 dB	Normal conversation or television viewing could be impacted. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Use rooms that are less exposed to the works.	<55 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Sleep in a room that is less exposed to the works.
Screened facade, windows open (Additional noise reduction of at least 10 dB likely for facades facing away from the works)	50 to 65 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping.	<45 dB	Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping.
Most exposed facade, windows closed, single glazing (Noise reduction of approximately 20 dB, refer NZS6803 7.2.7)	50 to 65 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Sleep in a room that is less exposed to the works.	<45 dB	Sleep disturbance likely. Sleep in a room that is less exposed to the works.
Most exposed facade, double glazing, well-sealed (Noise reduction of at least 30 dB possible)	40 to 55 dB	Sleep disturbance likely. Sleep in a room that is less exposed to the works.	<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.

	Offset distance to work site, and the expected noise levels ($L_{Aeq(15\ min)}$)					
	Up to 50 m		50 to 100 m		100 to 200 m	Beyond 200 m
Screened facade, windows closed, single glazing (Additional noise reduction of at least 10 dB likely for facades facing away from the work, refer NZS6803 7.2.7)	40 to 55 dB	Sleep disturbance likely. Use ear plugs for sleeping.		<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	
Screened facade, double glazing, well-sealed (Additional noise reduction of at least 10 dB likely for facades facing away from the work)	30 to 45 dB	Sleep disturbance unlikely but possible for some people. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.		<25 dB	Sleep disturbance unlikely.	
Manual tasks	Incident noise levels up to 70 dB		Incident noise levels up to 65 dB			Incident noise levels less than 55 dB
The noisiest manual tasks such as using a plate compactor or a hand operated breaker will be undertaken intermittently as part of the main Milling and Surfacing activities. Manual tasks may cause elevated noise levels for relatively short periods during the shift.	The resulting internal noise levels shown below will depend on orientation of the building relative to the works and the window details.	Noise effects and mitigation	The resulting internal noise levels shown below will depend on orientation of the building relative to the works and the window details.	Noise effects and mitigation	The resulting internal noise levels shown below will depend on orientation of the building relative to the works, the presence of other buildings that would provide screening, and the window details.	Noise effects and mitigation
Most exposed facade, windows open (Noise reduction of approximately 10 dB, refer NZS6809 C5.2)	up to 60 dB	Normal conversation or television viewing could be impacted. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Use rooms that are less exposed to the works.	up to 55 dB	Normal conversation or television viewing could be impacted. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Use rooms that are less exposed to the works.	<45 dB	Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping. Sleep in a room that is less exposed to the works.

	Offset distance to work site, and the expected noise levels ($L_{Aeq}(15 \text{ min})$)						
	Up to 50 m		50 to 100 m		100 to 200 m	Beyond 200 m	
Screened facade, windows open (Additional noise reduction of at least 10 dB likely for facades facing away from the works)	up to 50 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping.	up to 45 dB	Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping.		<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.
Most exposed facade, windows closed, single glazing (Noise reduction of approximately 20 dB, refer NZS6803 7.2.7)	up to 50 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Sleep in a room that is less exposed to the works.	up to 45 dB	Sleep disturbance possible for some people. Sleep in a room that is less exposed to the works.		<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.
Most exposed facade, double glazing, well-sealed (Noise reduction of at least 30 dB possible)	up to 40 dB	Sleep disturbance possible for some people. Sleep in a room that is less exposed to the works.	up to 35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.		<25 dB	Sleep disturbance unlikely.
Screened facade, windows closed, single glazing (Additional noise reduction of at least 10 dB likely for facades facing away from the work, refer NZS6803 7.2.7)	up to 40 dB	Sleep disturbance possible for some people. Use ear plugs for sleeping.	up to 35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.		<25 dB	Sleep disturbance unlikely.

	Offset distance to work site, and the expected noise levels ($L_{Aeq(15\text{ min})}$)					
	Up to 50 m		50 to 100 m		100 to 200 m	Beyond 200 m
Screened facade, double glazing, well-sealed (Additional noise reduction of at least 10 dB likely for facades facing away from the work)	up to 30 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	up to 25 dB	Sleep disturbance unlikely.		<20 dB Sleep disturbance unlikely.
Line marking	Incident noise levels less than 45 dB					
The line marking will be undertaken after the surfacing is complete, to re-instate the required road markings. There may also be sites where line marking is undertaken for maintenance reasons.	The resulting internal noise levels will depend on orientation of the building relative to the works, the presence of other buildings that would provide screening, and the window details.					
Most exposed facade, windows open (Noise reduction of approximately 10 dB, refer NZS6809 C5.2)	<35 dB Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.					
Screened facade, windows open (Additional noise reduction of at least 10 dB likely for facades facing away from the works)	<25 dB Sleep disturbance unlikely.					
Most exposed facade, windows closed, single glazing (Noise reduction of approximately 20 dB, refer NZS6803 7.2.7)	<25 dB Sleep disturbance unlikely.					

	Offset distance to work site, and the expected noise levels ($L_{Aeq}(15 \text{ min})$)			
	Up to 50 m	50 to 100 m	100 to 200 m	Beyond 200 m
Most exposed facade, double glazing, well-sealed (Noise reduction of at least 30 dB possible)	<25 dB Sleep disturbance unlikely.			
Screened facade, windows closed, single glazing (Additional noise reduction of at least 10 dB likely for facades facing away from the work, refer NZS6803 7.2.7)	<20 dB Sleep disturbance unlikely.			
Screened facade, double glazing, well-sealed (Additional noise reduction of at least 10 dB likely for facades facing away from the work)	<20 dB Sleep disturbance unlikely.			

	Offset distance to work site, and the expected noise levels ($L_{Aeq}(15 \text{ min})$)					
	Up to 50 m		50 to 100 m		100 to 200 m	Beyond 200 m
Road sweeping	Incident noise levels up to 70 dB		Incident noise levels up to 60 dB		Incident noise levels of 55 dB and below.	
<p>Road sweeping noise will be very short-term as the sweeper truck passes by each building. The activity will occur from 5:00 am each day and some sites will have more frequent cleaning according to the requirements outlined in the NCC sweeping contract activity schedule. Most people that live in urban areas will be used to noises of this type and others that occur during regular city maintenance activities. Occasional disturbance of sleep is not uncommon in urban environments and many people would readily accommodate this sort of temporary short-term noise.</p>	<p>The resulting internal noise levels shown below will depend on orientation of the building relative to the works and the window details.</p>	<p>Noise effects and mitigation</p>	<p>The resulting internal noise levels shown below will depend on orientation of the building relative to the works and the window details.</p>	<p>Noise effects and mitigation</p>	<p>The resulting internal noise levels shown below will depend on orientation of the building relative to the works, the presence of other buildings that would provide screening, and the window details.</p>	<p>Noise effects and mitigation</p>
<p>Most exposed facade, windows open (Noise reduction of approximately 10 dB, refer NZS6809 C5.2)</p>	<p>up to 60 dB</p>	<p>Normal conversation or television viewing could be impacted. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Use rooms that are less exposed to the works.</p>	<p>up to 50 dB</p>	<p>Noise from the works will be clearly audible. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping. Sleep in a room that is less exposed to the works.</p>	<p><45 dB</p>	<p>Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping. Sleep in a room that is less exposed to the works.</p>

	Offset distance to work site, and the expected noise levels ($L_{Aeq}(15 \text{ min})$)					
	Up to 50 m		50 to 100 m		100 to 200 m	Beyond 200 m
Screened facade, windows open (Additional noise reduction of at least 10 dB likely for facades facing away from the works)	up to 50 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Keep windows closed. Use ear plugs for sleeping.	up to 40 dB	Sleep disturbance possible for some people. Keep windows closed. Use ear plugs for sleeping.	<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.
Most exposed facade, windows closed, single glazing (Noise reduction of approximately 20 dB, refer NZS6803 7.2.7)	up to 50 dB	Noise from the works will be clearly audible. Sleep disturbance likely. Sleep in a room that is less exposed to the works.	up to 40 dB	Sleep disturbance possible for some people. Sleep in a room that is less exposed to the works.	<35 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.
Most exposed facade, double glazing, well-sealed (Noise reduction of at least 30 dB possible)	up to 40 dB	Sleep disturbance possible for some people. Sleep in a room that is less exposed to the works.	up to 30 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	<25 dB	Sleep disturbance unlikely.
Screened facade, windows closed, single glazing (Additional noise reduction of at least 10 dB likely for facades facing away from the work, refer NZS6803 7.2.7)	up to 40 dB	Sleep disturbance possible for some people. Use ear plugs for sleeping.	up to 30 dB	Sleep disturbance possible for some people. Sleep in a room that is less exposed to the works.	<25 dB	Sleep disturbance unlikely.
Screened facade, double glazing, well-sealed (Additional noise reduction of at least 10 dB likely for facades facing away from the work)	up to 30 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	<20 dB	Sleep disturbance unlikely. Other noise sources inside the buildings, such as a fridge or heat pump, could be at similar levels to any noise from the works that is received inside.	<20 dB	Sleep disturbance unlikely.

