

under: the Resource Management Act 1991

in the matter of: an application by Ryman Healthcare Limited for resource consent to construct, operate and maintain a comprehensive care retirement village at 26 Donald Street and 37 Campbell Street, Karori, Wellington

between: Ryman Healthcare Limited
Applicant

and: Wellington City Council
Consent Authority

Statement of evidence of **Siiri Wilkening** on behalf of Ryman Healthcare Limited

Dated: 29 August 2022

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STATEMENT OF EVIDENCE OF SIIRI WILKENING ON BEHALF OF RYMAN HEALTHCARE LIMITED

INTRODUCTION

- 1 My full name is Siiri Wilkening.
- 2 I am a Director of Marshall Day Acoustics Limited (*MDA*). I have more than 25 years' experience in acoustic engineering in Germany and New Zealand, specialising in environmental noise control and computer noise modelling. I hold a Master's degree in Environmental Engineering (Land Improvement and Environmental Protection) from the University of Rostock, Germany. I am a full Member of the Acoustical Society of New Zealand, and have been the Society's secretary (2000 to 2008) and treasurer (2012 to now).
- 3 Over the last 24 years, in New Zealand, I have been involved in investigating and reporting on environmental noise and vibration effects for a wide range of projects, including in relation to road, rail, ports, quarries, urban development and construction, industrial and power generation activities and educational facilities.
- 4 I have given evidence at council hearings, the Environment Court, the Arbitration Court and before five Boards of Inquiry. I have also taken part in Environment Court mediations.
- 5 I am familiar with Ryman Healthcare Limited's (*Ryman*) resource consent application to construct and operate a comprehensive care retirement village (*Proposed Village*) at 26 Donald Street and 37 Campbell Street, Karori, Wellington (*Site*).
- 6 A colleague from MDA¹ prepared the Operational Noise Assessment Report dated 27 August 2020 (*Operational Noise Report*) that was lodged with the application. He also prepared the Construction Noise and Vibration Assessment dated 24 November 2020 (*Construction Noise and Vibration Report*) and the Section 92 Response – Acoustics memorandum dated 14 October 2020 (*Further Information Response*). I reviewed, and provided input into, the construction computer noise model and the Construction Noise and Vibration Report at the time of issue and have subsequently reviewed the Operational Noise Report and Further Information Response prior to preparing this evidence. Where I refer in this evidence to "we" I am referring to that earlier work. I also refer to my opinion for this evidence as relevant. I confirm that I support the methods used in the earlier assessment and the conclusions reached.
- 7 I have visited the Site and its surroundings on 18 August 2022.

¹ Mr Bill Wood.

CODE OF CONDUCT

- 8 Although these proceedings are not before the Environment Court, I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note (2014), and I agree to comply with it as if these proceedings were before the Court. My qualifications as an expert are set out above. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

- 9 My evidence sets out the following:
- 9.1 An overview of the Construction Noise and Vibration Assessment;
 - 9.2 An overview of the Operational Noise Assessment;
 - 9.3 My response to the noise and vibration issues raised in submissions;
 - 9.4 My response to the noise and vibration matters addressed in the Council Officer's Report (*Officer's Report*), and particularly the evidence of Mr Lindsay Hannah, Wellington City Council's (*Council*) acoustics specialist;
 - 9.5 My comments on the draft conditions; and
 - 9.6 My conclusions.

SUMMARY OF EVIDENCE

- 10 I, and my colleagues at MDA, have assessed the noise and vibration from the construction and operation of the Proposed Village.
- 11 Construction will occur for 36 to 40 months. However, works that cause high noise or vibration levels such as earthworks and piling are likely to occur mostly during the first 12 to 18 months. The Site is large, and construction activities and equipment will move around the Site. This means that individual neighbouring houses will only be affected for limited periods of a few days or weeks before high noise activities move on.
- 12 I predict that construction noise can generally comply with the noise criteria. Where exceedances are predicted, they are generally slight (2 to 3 dB only) and for a limited period when the equipment operates immediately adjacent to the boundary.

- 13 Construction vibration levels can generally comply with the relevant criterion. Any piling will be undertaken using a drill rig, which is a low vibration (and noise) form of piling. Where compaction with a vibratory roller is required, I have recommended that an alternative option is chosen within 8m of any dwelling, such as compaction without the vibratory function, or the use of smaller equipment such as plate compactors, to ensure that compliance with the vibration criterion is achieved.
- 14 I have recommended mitigation and management measures that should be implemented to reduce construction noise and vibration effects. These include the construction of a 2.4m high construction fence around the Site, use of temporary barriers on Site where effective, mindful spacing and choice of equipment, considerate timing of high noise works to avoid sensitive times (e.g. for the neighbouring school) and the avoidance of unnecessary noise (e.g. from tonal reversing alarms). These measures will be included in the recommended Construction Noise and Vibration Management Plan (CNVMP).
- 15 Operational noise from the Site that is required to comply with relevant noise limits of the Operative District Plan includes mechanical noise (e.g. from air conditioning and similar plant) and service vehicles on the Site. Noise from residents and visitors would be classed as residential noise, which does not need to comply with the Operative District Plan noise limits. Noise from light vehicles on the Site would also be classed as residential noise, but I have assessed this noise in response to submissions.
- 16 I have predicted compliance for all Site operations that are required to comply with Operative District Plan noise limits. Light vehicles on the Site are also predicted to comply with the Operative District Plan noise limits, irrespective of not being required to.
- 17 The emergency generator is not covered by any Operative District Plan rules that apply to the Site zone. However, I have assessed the emergency generator against Operative District Plan rules that apply in another zone. In my opinion, these rules are appropriate for the Site also. I consider that the emergency generator can be designed and placed to comply with those limits.
- 18 I have reviewed and responded to submissions discussing noise or vibration issues. The submissions broadly discuss construction noise and vibration (e.g. duration, level, management and similar), and operational noise (e.g. air conditioning and carpark tyre squeal). I consider that with appropriate Site management and design, both construction noise and vibration, and operational noise, can be managed to be within reasonable levels.
- 19 I have reviewed the Officer's Report and the acoustic assessment of Council's acoustics specialist and find that they agree with the MDA assessment. I consider some amendments to the draft conditions in

the Officer's Report are necessary to clarify the intention and outcomes of some conditions.

CLOSEST POTENTIALLY AFFECTED RECEIVERS

- 20 The Site is surrounded by residential properties and activities that may be noise sensitive. The closest receivers that have the potential to be affected by noise and vibration from the Proposed Village are:
- 20.1 21 to 45 Donald Street (uneven numbers only) across Donald Street and 42 Donald Street. All of these receivers are residential, except for 37 Donald Street, which is an Early Childhood Education Centre;
 - 20.2 Karori Normal School on Donald Street (specifically classrooms 2 to 7, 10 and 11);
 - 20.3 27, 27A, 29, 31A, 33 and 33A, 49 and 51 Campbell Street. All of these receivers are residential, except for 29 Campbell Street, which is an Early Childhood Education Centre. 33 Campbell Street is owned by Ryman and I understand written approval for the Proposed Village has been provided;
 - 20.4 22 Donald Street (Karori Swimming Pool);
 - 20.5 6 to 26 Scapa Terrace (even numbers only); and
 - 20.6 221A and 221B Karori Road.
- 21 The receiver buildings vary in distance from 1 to 12m from the boundary. Most are single storey. One Karori Normal School building (containing classrooms 10 and 11 on the upper floor) and 31A, 33A and 49 Campbell Street, 21, 23 and 37 Donald Street, and 24 Scapa Terrace are double storey buildings.

CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Performance Standards

Construction noise

- 22 Construction noise is assessed against the provisions of NZS 6803:1999 'Acoustics – Construction Noise', as required by the operative Wellington City Council District Plan (*Operative District Plan*) and also the Wellington City Proposed District Plan (*Proposed District Plan*). Since the construction duration of the Proposed Village will be more than 20 weeks, the long duration criteria apply.
- 23 These criteria are 70 dB L_{Aeq} and 85 dB L_{AFmax} from 7.30am to 6pm, Monday to Saturday. During the weekday shoulder periods from 6.30am to 7.30am, and from 6pm to 8pm, the criteria are 55 and 65 dB L_{Aeq} respectively.

- 24 These criteria generally restrict noisy construction works close to the Site boundaries. The morning shoulder period is thus often used for site meetings, setup of machinery and similarly low noise activities. At all other times, the relevant noise criteria of 45 dB L_{Aeq} and 75 dB L_{AFmax} do not generally allow noisy construction works.

Construction vibration

- 25 The Operative District Plan does not contain any construction vibration criteria. The Proposed District Plan proposes vibration limits based on DIN 4150-3:2016 'Vibrations in buildings – Part 3: Effects on structures'. The Construction Noise and Vibration Report recommended applying the widely used vibration criteria in DIN 4150 and I agree with this approach. This Standard sets vibration limits to avoid cosmetic damage, such as cracking plaster, to buildings. DIN 4150 states "*Experience has shown that if these values are complied with, damage will not occur*".
- 26 In summary, the relevant vibration criteria for long-term vibration (i.e. vibration that may excite a building structure such as vibratory rolling) are 5 mm/s peak particle velocity (PPV) and 10 mm/s PPV for dwellings and commercial buildings respectively. For short-term vibration (i.e. vibration generated from individual events such as excavation) vibration criteria are frequency dependent and, for dwellings, range from 5 mm/s PPV for low frequencies at 1-10 Hz to 20 mm/s PPV for high frequencies at 50-100 Hz. They are higher again for commercial buildings.
- 27 I note that people are able to 'feel' vibration at levels that are often much lower than would cause cosmetic and structural damage to buildings. The threshold of humans feeling vibration is 0.14 mm/s PPV.²

Indicative Construction Method

- 28 At this stage, a detailed construction methodology is not yet available. However, Ryman have provided the following indicative construction method:
- 28.1 Site preparation earthworks will be minimal because the Site is well prepared and graded already and only minor excavation and fill will be required. Existing building foundations will also need to be removed during this stage.
- 28.2 Foundations for Buildings B02 to B07 will be constructed with poured concrete slab foundations.
- 28.3 Any required piling will be bored piling, which is the piling method that generates the lowest noise and vibration levels. Piling will be required for much of the new sections of

² British Standard BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

Buildings B01A and B01B, as well as for the floor slabs under the existing Tennant Block (part of proposed Building B01A).

- 28.4 Additional bored piling is proposed for a stormwater retention tank, to be located between Buildings B03 and B04, adjacent to Scapa Terrace.
- 28.5 The main noise source for works on the existing Allen Ward Hall (part of the proposed Building B01A) will be saw cutting of a small number of the exterior wall panels.
- 29 I understand that construction may take approximately 36 to 40 months to complete. However, this does not mean that all stages of construction and all construction locations will be equally noisy. On the contrary, for large sites such as this one, construction will ebb and flow depending on each construction stage, and equipment will move around the Site. This means that each receiver will only be affected for part of the time.
- 30 In addition, once the building envelopes are constructed, internal finishing and fitout works will be largely inaudible, and in any event significantly below external construction noise levels. Similarly, outdoor finishing works such as planting, and the installation of outdoor furniture are low noise activities.
- 31 Most of the high noise works (e.g. earthworks, piling, and building envelope construction) are likely to be completed within 12 to 18 months, during which time activities will move around the Site.

Construction Noise and Vibration Assessment **Construction Plant**

- 32 Since a detailed construction methodology is not yet available, we based our assessment on construction equipment that would commonly be used for projects such as the Proposed Village. Sound level data for each item of plant was based on relevant standards and MDA measurement data for comparable projects, including other Ryman construction projects.
- 33 For each item of plant, we determined the setback distance needed to achieve compliance with the daytime noise criterion of 70 dB L_{Aeq} . We recommended that a 2.4m high temporary construction noise barrier be installed around the entire Site (excluding site access). This barrier may be a temporary metal frame with noise control mats, and can be placed inside the Site (e.g. 1m from the boundary) where this is required.
- 34 I consider that with such a barrier in place, most equipment can comply with the daytime noise criterion where the distance between equipment and dwelling façade is 10 to 15m.
- 35 Highest noise levels would be generated from items such as a concrete saw and the bored piling rig. For such equipment, I

consider that further mitigation in addition to the site barrier will be required to achieve compliance at closest houses, and I discuss my recommendations further below.

Computer Noise Modelling

- 36 We modelled noise levels across the Site for different construction scenarios when the highest noise activities would occur. The computer noise model utilises a three dimensional terrain model into which all noise sources and receiving buildings are placed, at their respective heights. All modelled scenarios include the recommended 2.4m high construction noise barrier.
- 37 We modelled the following scenarios:
- 37.1 Site preparation and earthworks;
 - 37.2 Slab construction;
 - 37.3 Area 1 stormwater tank piling;
 - 37.4 Building B01A and B01B piling;
 - 37.5 Tennant Block piling; and
 - 37.6 Allen Ward Hall concrete cutting.
- 38 I observe that when predicting noise from construction activities, there is always a level of uncertainty because of numerous variables and factors. These factors include the variations in the specific models and individual items of equipment, the exact location of each item, the operator idiosyncrasies, and the exact location of the various receivers.
- 39 The predicted noise levels are therefore based on a conservative worst-case scenario of the noisiest equipment being operated 100% of the time and only the 2.4m perimeter fencing as mitigation. In reality, equipment is not normally operated 100% of the time but rather intermittently, and additional mitigation such as localised noise barriers will be in place for many of the high noise works.
- 40 Given the work Site space constraints, close proximity of receivers and sequencing, any high noise events would almost always be dominated by one noise source (e.g. concrete cutting or the closest piling rig). This would also be the case when considering concurrent use of equipment on the Site. While the ambient noise level may increase due to concurrent operation of equipment (e.g. more than one piling rig), the resulting cumulative noise level would generally increase by less than 1 – 2 decibels. This is an indiscernible change in noise level. Therefore, while we have modelled several items of equipment across the Site, it is generally the closest high noise machine that would control the noise level at any one receiver.

- 41 As noted in paragraphs 29 to 31, based on my experience of similar projects, any one receiver would be exposed to high noise activities for only a fraction (i.e. a matter of days or at most weeks) of the entire construction period. Groups of receivers will receive higher construction noise levels during construction activities closest to them. Although at times still elevated above ambient levels, noise levels will be lower during construction activities further away or when shielded by intervening structures or equipment.
- 42 People react to construction noise irrespective of compliance with the relevant noise limits being achieved. Generally, the construction noise limits allow for noise levels outside a building that are higher than would be appropriate for ongoing noise. When construction is reaching these levels, people may not want to spend time outside.
- 43 Because of this reaction, people would generally experience construction noise inside a building, with doors and windows closed. A typical New Zealand building achieves a noise level reduction of at least 20 to 25 decibels, therefore, a noise limit of 70 dB L_{Aeq} would translate to an internal noise level around 45 to 50 dB L_{Aeq} .
- 44 I consider internal noise levels up to 55 dB L_{Aeq} can be accepted for limited periods (e.g. for a few days) in office environments. Depending on the internal noise level, in a residential environment, people may react by turning the TV or radio up or moving to a quieter part of the house.

Predicted Construction Noise Levels

- 45 I have predicted noise levels for the scenarios when the highest noise levels would be generated. I discuss these individually in paragraphs 46 to 68, as well as mitigation that should be implemented for all works on the Site in paragraphs 77 to 81.

Site preparation and earthworks

- 46 The Site will require some preparation in terms of removal of previous building foundations, flattening, compaction, and preparation of surfaces for slab construction. Generally, this phase involves the use of trucks, excavators, potentially some limited use of concrete brakers, and vibratory rollers to compact the ground. Most of the Site will be somewhat affected by this activity, and we have predicted noise levels from equipment across the Site.
- 47 We have calculated that the noise from site preparation and earthworks may marginally exceed the 70 dB L_{Aeq} noise criterion at a small number of dwellings³ on Scapa Terrace. Depending on the location of the various activities on the Site in relation to the dwellings, this exceedance is predicted to be less than 2 dB, which is an unnoticeable difference compared to the noise criteria and will occur only intermittently when works are closest to the relevant

³ 8, 10, 12, 14, 24 Scapa Terrace.

boundary. Should concrete brakers be required for the removal of existing foundations, these would be at sufficient distance from neighbouring buildings to not add to the overall predicted noise levels.

- 48 Based on the prediction results, I do not recommend any additional specific noise mitigation measures beyond normal good site practice.

Slab construction

- 49 The main anticipated noisy equipment for slab construction will include concrete trucks and pumps, concrete vibrators, trucks and plate compactors. Construction would extend across the entire Site, with equipment moving around the Site as construction progresses. If more than one slab is constructed simultaneously, these slab areas will normally be separated to ensure safe Site operations and not cause noticeable cumulative noise level increases at any one receiver.

- 50 We have calculated that the noise from slab construction will generally comply with the 70 dB L_{Aeq} noise criterion. Compliance can be achieved by controlling the number of items of equipment close to a boundary. Otherwise, noise levels may at limited times reach levels of 71 or 72 dB L_{Aeq} , which would not be a noticeable difference for any receivers, compared with the noise criteria.

- 51 Based on the prediction results, I do not recommend any additional specific noise mitigation measures beyond normal good site practice.

Area 1 Stormwater Detention Tank Piling

- 52 Given the Site constraints and limited area within which the stormwater retention tank is to be installed, our predictions are based on one drill rig only.
- 53 One dwelling (at 24 Scapa Terrace) may experience noise levels up to 2 decibels above the 70 dB L_{Aeq} criterion at its upper floor during these works. While the main noise source of a drill rig is the diesel engine, which will be located slightly further from the boundary and will face away from the dwellings, the dwelling at 24 Scapa Terrace is double storey and will therefore not receive effective shielding from the 2.4m fence at the upper floor. The ground floor noise level at 24 Scapa Terrace is predicted to comply with the relevant noise criterion. All other dwellings in the area are single storey and will receive effective shielding from the 2.4m site barrier.
- 54 There are no practicable additional noise mitigation measures that could be applied to 24 Scapa Terrace. Good site management and timely communication with the occupiers of the dwelling will assist in managing effects. The predicted noise level is only marginally above the noise criterion, and I consider the difference would be unnoticeable.

Buildings B01A and B01B Piling

- 55 We have assumed, and understand from Ryman, that one piling rig will move along the Site to undertake the piling. Should two piling rigs be used on the Site at the same time, I recommend that these be at least 50m from each other so that the overall noise level at any one receiver is not materially affected. This outcome will be addressed in the CNVMP which I discuss in paragraphs 77 to 81 below.
- 56 During these piling operations, exceedances of the 70 dB L_{Aeq} criterion are predicted to occur at two buildings:
- 56.1 Karori Swimming Pool by up to 7 dB; and
- 56.2 Karori Normal School by up to 6 dB.
- 57 In my opinion, additional mitigation could be considered for the school area, such as scheduling the piling works to be undertaken during school holidays, when the school is not occupied for teaching purposes if that is practicable. A higher barrier or use of stacked containers may not be practicable along that boundary because of the terrain sloping away from the school.
- 58 I consider it appropriate that specific management of construction noise received at Karori Normal School be addressed in the CNVMP.
- 59 In my opinion, the pool is not particularly noise sensitive as the indoor environment already has elevated noise levels, and I do not consider that additional mitigation is required.

Tenant Block Piling

- 60 We have assumed that one piling rig will be used for these works.
- 61 We predict only marginal exceedances of up to 1 decibel above the 70 dB L_{Aeq} criterion at Karori Normal School. Such exceedances would not be noticeable or audible compared to the daytime noise criterion.
- 62 Based on the prediction results, I do not recommend any additional specific noise mitigation measures beyond normal good site practice.

Allen Ward Hall

- 63 A small number of external concrete façade wall panels are proposed to be removed from Allen Ward Hall. Much of the external façade concrete cutting would be elevated in relation to the Site noise barrier fence. Therefore, the fence will provide no mitigation.
- 64 The noisiest activity for these works will be the use of concrete saws. Given the limited workspace, we have assumed that only one concrete saw is used for the deconstruction of the concrete panels. Other saw options may also be available.

- 65 The panel cutting works will be of limited duration. We understand that Ryman anticipates the façade panel works will take no more than one week, with intermittent breaks when the loosened elements are taken off the building.
- 66 During the external concrete cutting, we predict that the noise is likely to exceed the 70 dB L_{Aeq} criterion at ten buildings, with the most affected dwellings being those immediately opposite the works:
- 66.1 27 Donald Street – 81 dB L_{Aeq}
 - 66.2 29 and 31 Donald Street – 80 dB L_{Aeq}
 - 66.3 25 Donald Street – 78 dB L_{Aeq}
 - 66.4 23 and 33 Donald Street – 76 dB L_{Aeq}
 - 66.5 35 Donald Street – 74 dB L_{Aeq}
 - 66.6 37 Donald Street (Donald Street Pre-School) – 74 dB L_{Aeq}
 - 66.7 Karori Normal School – 73 dB L_{Aeq}
 - 66.8 21 Donald Street – 72 dB L_{Aeq}
- 67 In my opinion, no mitigation by way of barriers or other shielding is possible due to the height of the works. Alternative measures that could be investigated include the use of diamond wire cutters instead of concrete saws. Measurements by MDA show that these wire cutters are between 5 and 15 decibels quieter than the saw. However, Ryman will have to determine if this is a practicable alternative in the circumstances.
- 68 I also consider communication and consultation, as well as timing of works will be important management measures to be implemented through the CNVMP (see paragraphs 77 to 81 below).
- L_{AFmax} Levels*
- 69 All predictions in the previous paragraphs relate to the L_{Aeq} noise levels. These levels can be generally reliably predicted and assessed and are largely determined by the equipment sound power level.
- 70 Conversely, the maximum noise levels from construction operations depend on non-standardised sources such as an excavator operator putting down the bucket too hard, track squeal of a tracked excavator or the initial falling of fill into an empty truck bed. None of these sources are homogenous, and therefore L_{AFmax} levels can vary widely.
- 71 However, generally, L_{AFmax} noise levels for construction activities are typically 10 to 15 dB above the L_{Aeq} value. Therefore, the 85 dB

L_{AFmax} noise criterion for daytime works Monday to Saturday is predicted to be complied with for most receivers and activities.

- 72 In any event, daytime L_{AFmax} events are unlikely to cause adverse effects on neighbouring building uses given the brevity of the event. People's reaction to construction noise would normally be related to the L_{Aeq} level rather than an L_{AFmax} event.

Predicted Construction Vibration Levels

- 73 Of all activities proposed to be undertaken on the Site, only the use of vibratory rollers for compaction may cause elevated vibration levels.

- 74 Our predictions show that at a distance of 8m, vibration from vibratory rollers can comply with the 5 mm/s PPV vibration criterion for dwellings. Two dwellings (33 and 33A Campbell Street) are closer than 8m from Proposed Village buildings. I recommend that the vibratory function is switched off if rollers are proposed to be used within 8m of any dwelling, and specifically the dwellings at 33 and 33A Campbell Street.

- 75 With this mitigation measure in place, I consider that the relevant vibration criteria will be complied with at all buildings surrounding the Site and for all construction activities.

- 76 The construction methodology already incorporates bored piling for foundations, which is the lowest noise and vibration generating piling method. This shows that Ryman has already considered methods to reduce vibration as far as practicable through design.

Construction Noise and Vibration Management Plan (CNVMP)

- 77 Large projects where the construction period extends over several years and where multiple receivers and stages need to be addressed generally require the preparation and implementation of a CNVMP.

- 78 The objective of the CNVMP is to provide a framework for the development and implementation of the Best Practicable Option for the management of construction noise and vibration effects so that noise and vibration do not exceed a reasonable level. I consider a CNVMP with that objective is appropriate for the Proposed Village.

- 79 Further, to achieve this objective, I consider the CNVMP should be prepared in accordance with Annex E2 of NZS6803:1999 and address the following issues:

79.1 The relevant noise and vibration criteria;

79.2 Community liaison and engagement;

79.3 Mitigation and management measures;

79.4 Noise and vibration monitoring provisions;

79.5 Details on pre- and post-construction building condition surveys in relation to potential damage from construction vibration; and

79.6 Staff training.

80 The CNVMP requires detailed information as will only be available once a detailed construction methodology is available. The CNVMP will assist with achieving compliance with the relevant noise and vibration limits and would be certified by Council to ensure that all relevant information is included.

81 As noted above, the CNVMP would set out details on the mitigation measures to be implemented. For the Proposed Village, these measures will specifically include:

81.1 A 2.4m high acoustic barrier around the Site perimeter;

81.2 Temporary noise barriers on the Site for specific high noise activities (e.g. plate compactors);

81.3 The use of broadband (rather than tonal) reversing alarms on equipment;

81.4 The spacing of drill rigs (should more than one be used on the Site) to not operate within 50m of each other;

81.5 The timing of high noise and vibration works in the vicinity of Karori Normal School to occur in school holidays if practicable; and

81.6 The use of non-vibratory rollers within 8m of any building.

OPERATIONAL NOISE ASSESSMENT

Performance Standards

82 The Site, and all neighbouring sites apart from the Karori Swimming Pool site, are zoned Outer Residential in the Operative District Plan. The pool site is zoned Open Space A. The Proposed District Plan proposes to change the zoning of the site and all neighbouring sites (except pool site) to Medium Density residential, with the pool remaining an Open Space zone.

83 The Operative District Plan does not provide general noise standards for a residential activity. Accordingly, we have not assessed noise levels from the residential activities of the Proposed Village.

84 There is one exception. Although the onsite movement of service vehicles is part of the residential activity, we have assessed the noise effects from service vehicles against the non-residential noise standards of the Operative District Plan, which are, Monday to Sunday:

- 84.1 50 dB L_{Aeq} 7am to 7pm;
- 84.2 45 dB L_{Aeq} 7pm to 10pm; and
- 84.3 40 dB L_{Aeq} and 70 dB L_{AFmax} 10pm to 7am.
- 85 Noise from plant such as air conditioning and extract fans (i.e. fixed mechanical plant) have different noise standards in the Operative District Plan, namely, Monday to Sunday:
- 85.1 45 dB L_{Aeq} 7am to 10pm; and
- 85.2 40 dB L_{Aeq} and 65 dB L_{AFmax} .
- 86 Emergency generators are not covered by the above noise limits. The Operative District Plan Central Area rules (13.6.1.1.2 and 13.6.2.1.1) exempt fixed plant used solely for emergency purposes if maintenance is only carried out weekdays between 8am and 5pm and it can comply with noise levels of 60 dB L_{Aeq} and 85 dB L_{AFmax} on any other site. While this rule does not apply in the Outer Residential zone, I consider it appropriate and reasonable for application for this Site also.
- 87 The reason for this approach is that emergency generators would emit higher noise levels than would be expected from ongoing day to day equipment on the Site. Since emergency generators would only operate rarely, in an emergency, higher noise standards are appropriate. I consider that controlling the noise from the generator to a reasonable level as provided for in the Operative District Plan for other areas, is appropriate here too. I note that the Proposed District Plan provides an exemption from the noise limits for emergency generators, however this does not change my approach outlined above.
- Noise Prediction Methodology**
- 88 We predicted noise levels from service vehicles on the Site using a computer noise model into which we entered the source data for service vehicles such as rubbish trucks and delivery vehicles. We then predicted noise levels at all receivers.
- 89 The computer noise model implements the standard prediction methodology of ISO 9613-2:1996 'Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation', which takes account of a range of frequency dependent attenuation factors, including spherical spreading, atmospheric absorption, screening and ground effects.
- 90 Predicted noise levels are assessed against NZS 6802:2008 'Acoustics - Environmental Noise'. The Standard states that where a sound is not continuously present, it is likely to create lesser annoyance. For sound with a duration of less than 30% of the prescribed daytime period, an adjustment of 5 dB can be subtracted

from the predicted noise level. For the Site, the prescribed daytime is 12 hours (7am to 7pm). All temporary activities such as service vehicles on Site and the use of the waste compactor would have a duration significantly less than 30% of a 12 hour period, therefore, we have applied the 5 dB correction to these noise predictions. I agree with this approach.

- 91 We conservatively predicted noise levels from all service vehicle movements occurring at the same time. In my opinion, this situation is highly unlikely as the anticipated two rubbish trucks per week and two catering vehicles per week would not enter the Site on the same day, and at the same time. I therefore comment on likely actual noise levels below.

Operational Noise Assessment **Service Vehicles**

- 92 Two types of service vehicles will enter the Site; up to two rubbish trucks per week and up to two catering vehicles per week.⁴ We understand that both types of service vehicles would only enter the Site during daytime, between 7am and 7pm. Therefore, the daytime noise limit of 50 dB L_{Aeq} applies.
- 93 The rubbish trucks would enter at the Donald Street entrance and travel through the Site by skirting around the western and part of the northern boundary to reach the waste compactor. Closest receivers are 27A and 29 Campbell Street, 221A and 221B Karori Street and the Karori Swimming Pool.
- 94 Our modelling results are based on all four rubbish truck movements (two in and two out) occurring within the same hour of the same day. Based on that scenario, we predicted a slight exceedance of 3 dB for the Childcare Centre at 29 Campbell Street, and compliance at all other closest receivers. However, as I explain in paragraph 91, that is a highly unlikely scenario. With the more realistic two rubbish truck movements in one time period, I predict compliance at all receivers.
- 95 Catering vehicles will also enter the Site from the Donald Street entrance and travel to the middle of the Site to the proposed main entrance. These vehicles are smaller trucks with lower noise levels and will not travel close to any boundary. Ready compliance is predicted at all receivers, even with four vehicle movements within the same time period.
- 96 Overall, I consider service vehicle movements on the Site will not generate noise levels that are likely to cause adverse effects on neighbouring sites due to their noise levels, location, infrequent occurrence and brief duration.

⁴ As advised by Commute Transportation Consultants.

Fixed Plant

- 97 Most fixed mechanical plant such as ventilation, air conditioning and extract fans may operate 24 hours per day and 7 days per week. Therefore, they will need to be designed to comply with the most stringent night-time noise criteria of 40 dB L_{Aeq} and 65 dB L_{AFmax} .
- 98 Mechanical plant selections are typically finalised at the detailed design stage; therefore, location, type or sizing of most plant is not yet available. The acoustic design of such plant will need to take the relevant noise limits into account and ensure that compliance is achieved. Based on experience, with appropriate location and, if required, the use of conventional noise control treatments, noise from all mechanical plant items can be made to comply with the relevant Operative District Plan noise limits. I recommend that this be explicit in the conditions for the Proposed Village.
- 99 We received some information on three types of mechanical plant that are likely to be installed on the Site, which I discuss below.
- 100 A waste compactor is proposed to be installed in a specialised building between Buildings B01A and B01B. The compactor would operate up to 30 minutes per day, during daytime hours only. Based on the building detail provided by Ryman and a waste compactor noise level based on comparable equipment, the daytime noise limit of 45 dB L_{Aeq} can be complied with at all closest dwellings. The potentially most affected building (the Karori Swimming Pool) is predicted to receive a noise level of 49 dB L_{Aeq} , however, I do not consider the pool to be noise sensitive. It will also unlikely be adversely affected by the 30 minute use of the compactor given the short duration. The most affected dwellings (221A and 221B Karori Road) are predicted to receive noise levels of 43 and 40 dB L_{Aeq} respectively. This prediction takes into consideration the -5 dB adjustment for the short operating duration of 30 minutes per day and the +5 dB adjustment for special audible character. If the chosen model of waste compactor requires additional mitigation to achieve compliance, I consider it can be incorporated into the design of the enclosure building.
- 101 Two transformers (with capacities of 1 MVA and 500 kVA) are proposed to be installed in a service compound at the rear of the junction of Building B01A and Building B07. These generators will be well shielded from neighbouring sites to the south as they are located at a low level behind a significant retaining wall. Based on common sound data for transformers of this type, the transformers will not contribute to the overall noise level at closest receivers in Scapa Terrace due to shielding and distance, with a highest predicted noise level below 30 dB L_{Aeq} . Accordingly, I consider the transformers can therefore readily comply with the 40 dB L_{Aeq} noise limit.
- 102 A 500 kVA containerised emergency generator is proposed to be installed in a specialised enclosure and service building, also at the

rear of the junction of Building B01A and Building B07, below the Main Entrance building of the Proposed Village. It will be partially shielded by a retaining wall. Based on common sound data for similar generators, I predict that with appropriate mitigation, the generator would be able to operate within a reasonable noise level range, with predicted levels below 50 dB L_{Aeq} at closest receivers. If the chosen generator model is significantly noisier than we have assumed, I recommend that additional mitigation be incorporated into the design of the enclosure building during detailed design.

Resident, staff and visitor vehicles on site

- 103 The Operative District Plan does not provide general noise standards for a residential activity, which in this case would include resident and visitor vehicles that could be expected on a normal residential site. Accordingly, we had not assessed noise levels from the residential activities of the Proposed Village.
- 104 Nevertheless, in response to submissions, I have reviewed the noise from light vehicles on the Site, namely those of residents, staff and visitors. There are two vehicle entrances to the Site; one from Campbell Street leading straight into the carparking undercroft areas of Building B02 to B06, and one from Donald Street leading on an elevated internal roadway to the main building and underground and at grade carparking on the Site.
- 105 Based on the Transportation Report,⁵ only 15% of all vehicle movements will occur at the Campbell Street entrance, which leads immediately into the underground carpark. The remaining 85% of traffic will enter and exit the Site at the Donald Street entrance.
- 106 A total of 801 vehicle trips per day⁶ are predicted to be generated by the Site, roughly 120 through the Campbell Street entrance and 681 through the Donald Street entrance. The Proposed Village is likely to operate similarly to other comparable comprehensive care villages across New Zealand, with the likely peak hour of a total of 70 vehicle trips through both entrances between 1 and 2 pm.
- 107 The predicted peak hour traffic numbers for the Proposed Village would generate noise levels at closest dwellings at the northwest of the Site of between 36 and 42 dB $L_{Aeq(1h)}$. This noise level is readily compliant with the daytime and evening noise limits of 50 and 45 dB L_{Aeq} respectively.
- 108 Given that peak night-time movements (between 6pm and 7am) are generally between 10% and 25% of peak daytime hour traffic, I predict that night-time compliance is also readily achievable.

⁵ Transportation Assessment Report by Commute, dated 20 July 2020.

⁶ Transportation Assessment Report, Table 5-3.

RESPONSE TO SUBMISSIONS

- 109 I have reviewed all of the submissions and considered the 25 submissions that address noise and vibration issues. For ease of reference, I have grouped the noise and vibration-related submissions into subjects, as many similar points are made by several submitters.
- 110 The following noise and vibration issues have been noted in submissions:
- 110.1 Construction noise over an extended construction period (e.g. years), and its effects on amenity on residential and work-from-home uses;
 - 110.2 Construction vibration and its potential to cause building damage;
 - 110.3 Noise from tyre squeal in the carpark;
 - 110.4 Operational noise from the Site and mechanical plant such as air conditioning and ventilation; and
 - 110.5 Audible warning signals on the carpark roller door.

Construction noise and its duration

- 111 Construction noise, its overall duration and effects on neighbouring buildings is one of the most common noise and vibration-related submission points.⁷ I have addressed construction noise in paragraphs 22 to 72 above and respond to the specific submission issues below.
- 112 Many submitters are concerned about the long construction duration of the Proposed Village. This concern is apparently based on the assumption that that high construction noise levels will occur for the entirety of the overall period of some 36 to 40 months. That is not the case. The predicted noise levels I discuss earlier in my evidence, are the highest noise levels that I consider may occur when activities are closest to any one receiver. Works tend to move around a construction site, particularly where the site is large as is the case for the Proposed Village.
- 113 Generally, any high noise levels would be experienced for a matter of days or, at most, weeks, rather than for months at a time. As construction progresses and building envelopes are constructed, these structures provide additional shielding to neighbouring

⁷ Submission 1 (Hu), 38 (Carruthers), 39 (McArdle), 41 (Fraser), 43 (Wallace), 46 (Mattlin), 49 (Gestro), 50 (van Amelsfort), 54 (Brandon), 55 (Eyles), 56 (Cooper), 57 (Leikis & Porter), 58 (Moran), 60 (Sprott), 62 (Dunstan), 65 (Responsible Development Karori Inc), 70 (Moore), 72 (Ingham), 74 (Major) and 75 (King & McKinnon-King).

houses. Once the external building envelope works are complete, internal finishing works will generate low noise levels. External finishing works such window fitting, painting and planting are also low noise activities.

- 114 In addition, many of the submitters seek a reduction in construction times so that either no construction occurs on weekends, or construction is limited to between 8am and 5pm Monday to Friday only.
- 115 Such restrictions are not contemplated by the New Zealand Standard for construction noise, and I do not support them. These restrictions would inevitably lead to an extension of the overall construction period, and a longer drawn out time of high noise levels. Limiting weekly and daily construction times may result in activities taking longer to complete in the vicinity of each receiver, for example piling may move slower along the boundary and extend from one to two weeks. Generally, I consider it preferable to complete the noise generating activities as fast as practicable to reduce adverse effects on neighbouring houses.
- 116 While during recent years, more and more people have been working from home, there appears to be currently more choice as to the workplace, i.e. many workplaces are open to people choosing to either work from home or in the office. One common management measure for construction sites is to determine through consultation, as part of preparing the CNVMP, when most houses are unoccupied due to people being at the office, and to undertake high noise activities closest to those houses during those times.
- 117 In my opinion, construction activity is a common part of society and needs to be enabled to continue using best practicable noise mitigation. Construction activities generally create higher noise levels than ongoing day to day activities, which is recognised in the noise criteria set by the construction noise standard NZS 6803. Therefore, where people can choose to work in the office rather than from home, they are able to remove themselves from construction noise.
- 118 Ms Nikki Fraser⁸ comments on noise generated on the Site during demolition works, including from the use of radios and loud conversations. These matters are normally addressed in the CNVMP as part of good site management. I recommend that unnecessary noise on the Site is avoided, which includes the use of radios, truck horns, shouting on site and similar where it may impact neighbours.

⁸ Submission 41 (Fraser).

Construction vibration and its potential to cause building damage

- 119 A number of submitters⁹ comment on the potential for “ground movement” from excavation and piling, and the potential for resulting building damage. I have addressed construction vibration in paragraphs 73 to 76 above.
- 120 The construction methodology already includes the requirement for all piles to be bored rather than driven. This methodology addresses the submission by Mr Michael Hamilton.¹⁰
- 121 There are two aspects of vibration effects that may affect buildings. I discuss only the mechanism of vibration caused by construction equipment entering the ground, travelling to a building and causing vibration of and in the building. This is the mechanism addressed in my predictions in relation to the use of vibratory compactors within 8m of any building.
- 122 The other mechanism of construction vibration potentially affecting buildings is where the construction vibration enters the ground and causes the ground to “compact” or move through settlement, which in turn can affect buildings. This mechanism is not discussed in my evidence and is addressed in the Statement of Evidence of Pierre Malan.
- 123 The submissions are not clear on which issue causes the potential concern. Therefore, I respond to it as if the submissions refer to construction vibration causing buildings to excite.
- 124 As I noted in paragraph 27 above, while people can feel vibration at a very low level, significantly higher levels are needed to cause cosmetic damage to buildings, and then again even higher levels to cause structural damage.
- 125 If the vibration limits of DIN 4150-3:2016 are complied with, then I consider no cosmetic or structural damage would occur through the vibration of the building itself.
- 126 Nevertheless, a number of submitters¹¹ request pre- and post-construction building condition surveys. I consider that any building abutting the Site should receive such a building condition survey if requested. The documentation will ensure that building condition is

⁹ Submission 43 (Wallace), 45 (Hamilton), 46 (Mattlin), 49 (Gestro), 50 (van Amelsfort), 56 (Cooper), 57 (Leikis & Porter), 58 (Moran), 60 (Sprott), 65 (Responsible Development Karori Inc), 70 (Moore), 72 (Ingham), 74 (Major) and 75 (King & McKinnon-King).

¹⁰ Submission 45 (Hamilton).

¹¹ Submission 43 (Wallace), 49 (Gestro), 50 (van Amelsfort), 56 (Cooper), 65 (Responsible Development Karori Inc), 70 (Moore) and 74 (Major).

clearly recorded and provides certainty to both the residents and Ryman. I do not recommend ongoing building condition surveys throughout construction for the assessment of construction vibration effects, as has been requested by Mr Joost and Ms Kerry von Amelsfort,¹² because no high vibration inducing works are proposed on the Site.

Tyre squeal within the carpark

- 127 Several submitters¹³ are concerned with tyre squeal when vehicles travel inside the carpark along the southern boundary of the Site. The entire southern car park wall will not have any openings, i.e. the façade will be a mixture of brick, timber framed plastered wall elements and non-openable aluminium joinery windows.
- 128 Tyre squeal may occur if the car park surface is smooth and coated with a glossy material. Generally, squeal may only occur when vehicles corner, rather than during straight drive past.
- 129 The design of the car park can include design features that ensure that no tyre squeal occurs from normally driven cars. This is most often achieved by a slightly rough, non-polished surface material. In any event, tyre squeal is dominated by high frequency sound, which is well insulated by any solid façade material as will be used for the southern carpark façade.
- 130 I therefore consider that with appropriate design of the carpark surface, no tyre squeal would occur.

Noise from operations on the Site and mechanical plant such as air conditioning and ventilation

- 131 Ms Maryann Healy¹⁴ seeks a high timber fence along her common boundary with the Site to reduce noise effects and improve her amenity. Her dwelling is adjacent to the proposed Pocket Park and Memorial tree, and open greenspace. There are no noise generating activities or equipment proposed for the area immediately north of Ms Healy's property. I therefore do not recommend a fence from a noise point of view. Nevertheless, I understand that Ryman has offered a fence as sought by Ms Healy.
- 132 Ms Fraser¹⁵ seeks a "noiseless operation" of the Site, specifically mentioning noise from air conditioning units, fans, and laundry. I do not consider that inaudibility is an appropriate design level. In a suburban and residential context, one can expect some noise such as air conditioning and extract fans to operate on neighbouring

¹² Submission 50 (van Amelsfort).

¹³ Submission 49 (Gestro), 56 (Cooper), 60 (Spratt), 65 (Responsible Karori Inc), 70 (Moore), 72 (Ingham) and 75 (King and McKinnon-King).

¹⁴ Submission 17 (Healy).

¹⁵ Submission 41 (Fraser).

sites. The noise limits for such equipment set by the Operative District Plan are more stringent than is the case in many other New Zealand District Plans and more stringent than recommended by NZS 6802:2008. I therefore consider that achieving compliance with the relevant Operative District Plan noise limits will create an appropriate and low noise environment for neighbouring sites. I also note that Ms Fraser's house is at a distance from the Site such that the noise levels at her dwelling will be even lower than those predicted at the closest dwellings, and will be shielded by intervening dwellings, so noise from mechanical plant may well be inaudible at her house.

Audible warning signals on the carpark roller door

- 133 Mr Andrew and Ms Julie Cooper¹⁶ are concerned that the carpark roller door will have an audible warning device and that the operation of the garage door may cause elevated noise levels. I understand from Ryman that no warning devices are proposed for the carpark. Should this approach change, I consider that any warning device, should be visible rather than audible (e.g. a flashing light) to avoid annoyance of neighbours, especially during night-time hours. Operation of the garage door would not, in my experience, give rise to unreasonable noise levels and would be able to comply with the most stringent night-time noise limits.

RESPONSE TO COUNCIL OFFICER'S REPORT

- 134 I have read the relevant parts of the Council Officer's Report, and reviewed the evidence of Mr Hannah, Council's acoustics specialist.
- 135 Mr Hannah agrees with the assessment of operational noise effects. He discusses the various aspects of operational noise assessment and recommends an operational noise condition relating to the noise performance standards of fixed plant as well as a requirement for an acoustic design certificate for fixed plant noise emissions.
- 136 Mr Hannah agrees with the assessment of construction noise and vibration effects. He comments on the management measures recommended, such as the CNVMP, and concludes that effects can be managed appropriately with the implementation of the best practicable option. He has recommended conditions limiting construction hours and requiring the preparation and implementation of a CNVMP.
- 137 In summary, there is full agreement between Mr Hannah and myself on the assessment and management of construction noise and vibration and operational noise effects, which carries through to the Officer's Report.

¹⁶ Submission 56 (Cooper).

COMMENTS ON DRAFT CONDITIONS

- 138 The Officer's Report contains draft conditions of consent. The noise and vibration conditions in the report are generally those recommended by Mr Hannah in his evidence, albeit in different order. While I am in full agreement with the intention of the conditions, I recommend some refinement below to clarify the outcomes sought.
- 139 Draft Condition 34 sets out the minimum content of the CNVMP. I consider that a further bullet point should be added to this condition requiring a mechanism of review and recertification in the event of a change to the construction methodology or, as set out in the last sentence in this Condition, on request by the Council Compliance Monitoring Officer.
- 140 Draft Condition 36 sets out the hours during which noisy construction works can be undertaken, namely 7.30am to 6.00pm Monday to Saturday. I agree with the intention of this Condition, however, I consider that the Condition does not clearly identify that only noisy construction activities are to be limited. Most large construction sites have safety and toolbox meetings prior to 7.30am or may pack up after 6pm. Neither of those activities would generate high noise levels and should therefore not be restricted beyond compliance with the relevant noise limits.
- 141 Draft Conditions 37 and 38 relate to construction noise and vibration limits and management, referencing back to Draft Condition 34 (CNVMP). I agree with the intended methodology of providing additional information if activities cannot practicably comply with the relevant noise and/or vibration limits. Draft Conditions 37 and 38 seek a "*written assessment of physical and managerial noise control methods*" and "*an assessment of vibration control methods*" respectively. However, I consider that a different mechanism is simpler to apply – the use of Schedules.
- 142 Schedules are routinely used for large projects across New Zealand. For large projects, exceedances may not always be able to be anticipated at the outset of the multi-year construction. If a potential non-compliance is identified during the construction period, a Schedule is produced to be certified by Council. A Schedule is a "mini" CNVMP for a specific activity that is predicted to exceed the noise limits.
- 143 Schedules need to be certified by Council (similar to the main CNVMP) and are an addendum to the CNVMP. The Schedule does not need to repeat the content of the CNVMP but focuses only on the activity at hand.
- 144 I therefore recommend removing the second paragraph of both Draft Conditions 37 and 38 and replacing them with a new Condition 36A that addresses Schedules to the CNVMP. The recommended

condition wording would make clear what the objectives of the additional assessment is and also ensure that consultation is undertaken with the affected parties.

- 145 Draft Condition 41 responds to the submitters' concern about wheel squeal by requiring "*certification from a suitably qualified person that the undercroft car parking surfaces have been treated to reduce wheel squeal noise*". I anticipate that this certification would take the form of a noise monitoring report from an acoustic consultant, of cars being driven in the undercroft car park. I recommend clarifying this requirement in the Condition as this is an unusual requirement.

CONCLUSION

- 146 I, and my colleagues at MDA, have assessed the noise and vibration from the construction and operation of the Proposed Village.
- 147 With the mitigation and management recommended, I consider that the Proposed Village can be constructed and operated to within reasonable noise and vibration levels, and broadly in compliance with the relevant limits of the Operative District Plan.
- 148 The draft conditions reflect the intended mitigation and management, and I have recommended some amendments to make the outcomes sought clearer.

Siiri Wilkening
29 August 2022