

**BEFORE INDEPENDENT HEARING COMMISSIONERS APPOINTED BY THE  
WAIMAKARIRI DISTRICT COUNCIL**

**IN THE MATTER OF**

The Resource Management Act 1991 (**RMA** or  
**the Act**)

**AND**

**IN THE MATTER OF**

Hearing of Submissions and Further  
Submissions on the Proposed Waimakariri  
District Plan (**PWDP** or **the Proposed Plan**)

**AND**

**IN THE MATTER OF**

Hearing of Submissions and Further  
Submissions on Variations 1 and 2 to the  
Proposed Waimakariri District Plan

**AND**

**IN THE MATTER OF**

Submissions and Further Submissions on the  
Proposed Waimakariri District Plan by **Mike  
Greer Homes NZ Limited**

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**EVIDENCE OF WILLIAM PETER REEVE  
ON BEHALF OF MIKE GREER HOMES NZ LIMITED REGARDING STREAM 12E**  
DATED: 5 March 2024

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## INTRODUCTION

- 1 My name is William Peter Reeve. I am employed as a Senior Associate with Acoustic Engineering Services.
- 2 I hold a Bachelor of Engineering with Honours from the University of Auckland. I am a member of the Acoustical Society of New Zealand.
- 3 I have over 12 years' experience in the field of acoustic engineering consultancy and have been involved with many environmental noise assessments on behalf of applicants, submitters and as a peer reviewer for Councils. My experience includes assessing noise from transportation sources near noise sensitive development.
- 4 My role in relation to the Waimakariri Proposed District Plan and Variation 1 is as an independent expert witness to Mike Greer Homes NZ Limited (**Mike Greer Homes**) on noise and vibration matters.
- 5 Although this is not an Environment Court proceeding I have read the Environment Court's Code of Conduct and agree to comply with it. My qualifications as an expert are set out above. The matters addressed in my evidence are within my area of expertise, however where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.

## SCOPE OF EVIDENCE

- 6 I have been asked to comment on the relief sought by Mike Greer Homes Limited (Submitter 332) in relation to the proposed Waimakariri District Plan (**Proposed Plan or PWDP**). Specifically, the request to rezone rural lifestyle zoned land in South Kaiapoi encircled by Kaikainui Stream, Courtenay Stream, Main North Road and Main North Railway for medium density residential (**the Proposal**).
- 7 In my evidence I discuss the following issues:
  - (a) Noise and vibration arising from Main North Road, Main North Railway and Woodford Glen
  - (b) Suitable internal noise and vibration levels and controls

(c) External noise levels within residential outdoor areas

8 While this site is located within the operative 50 dB  $L_{dn}$  aircraft noise contour – it is either partially, or completely outside the remodelled 50 dB  $L_{dn}$  aircraft noise contours. Since aircraft noise is being discussed in a separate hearing stream, I have only commented briefly on this matter in relation to cumulative noise.

#### **SUMMARY OF MY EVIDENCE**

9 I have calculated noise levels that may be experienced on the subject site from both Main North Road and Main North Railway. I have also measured vibration levels from rail movements at a relevant location on the site, and reviewed controls and likely noise levels from Woodford Glen.

10 For both road and rail noise, I agree that the sound insulation rule as described in the Proposed Plan, and further developed in the Acoustic and Planning Joint Witness Statements for Stream 5, will control internal noise levels within the future dwellings on this site to an appropriate level.

11 Based on the external levels I have predicted, compliance with this rule will require some upgrades to the building envelope of the closest row of dwellings to Main North Road and Main North Railway, as well as fresh air ventilation systems for these same dwellings.

12 My vibration investigation confirms that the levels of rail vibration experienced inside new dwellings constructed on the portions of the site closest to the railway are unlikely to be unusually high or inconsistent with a typical residential target value of 0.3 mm/s  $V_{w,95}$ .

13 The proposed sound insulation rule does not control outdoor noise levels. Road traffic noise levels received in outdoor areas of dwellings closest to Main North Road will be elevated where the outdoor area is un-screened – although noise levels in outdoor areas could be reduced with attention to dwelling layout and local screening.

14 The site is outside the Speedway Noise Contour – which has the dual purpose of restricting new noise sensitive uses close to Woodford Glen and restricting noise emissions via event frequency and duration controls. When an event is held at Woodford Glen, it will still be the dominant noise source in outdoor

areas of dwellings on the easternmost lots of this site. I note that these dwellings would receive sound insulation upgrades due to proximity to Main North Railway – which would also be of benefit to this source. Residential activities indoors with windows and doors closed would still be possible with minimal modification or disruption.

- 15 While various sources will all be audible to some degree on this site, I consider that the site layout and location relative to key sources will limit cumulative noise effects for individual lots / receivers. It is unlikely that there would be any locations on the site where a cumulative noise increase of more than 3 dB  $L_{dn}$  would be experienced for transportation noise sources (road + rail + aircraft).

### **CONTEXT**

- 16 The site is currently zoned Rural Lifestyle under the Operative Waimakariri District Plan and primarily used for pastoral farming and cropping. There is a dwelling and farm buildings on the site. It adjoins the southern boundary of the Kaiapoi urban limits.
- 17 The submitter is proposing to rezone this land to Medium Density Residential as part of a South Kaiapoi Development Area.

### **THE PROPOSAL**

- 18 The Version 5 Outline Development Plan (**ODP**) for the site includes a central area of residential development, with two access points from Main North Road. I have attached the ODP as **Appendix 1**.
- 19 The ODP includes a shared path which forms a loop near the perimeter of the site through proposed reserve and stormwater management areas. Proposed greenway, reserve and stormwater management areas establish a buffer between Main North Road, and the Main North Railway and proposed residential areas of the site.

### **NOISE AND VIBRATION LEVELS**

- 20 I have calculated noise levels from both road and rail noise and taken site-specific measurements of rail vibration to quantify the levels of exposure

across the subject site. I have also reviewed information available about the noise levels expected from Woodford Glen.

- 21 I have primarily used the ODP to guide my understanding of the likely location of dwellings and internal roads on this site. I have also been provided an Indicative Lot Layout Plan prepared by Davie Lovell Smith (Jamie Verstappen) to assist preparation of my evidence.
- 22 The Proposed Plan includes a sound insulation requirement (either via an internal noise level requirement or a façade reduction method) for dwellings close to arterial roads, and railways. A refined form of this has been agreed in a Joint Witness Statement (**JWS**) from the acoustic experts.<sup>1</sup> A rail vibration alert overlay is also proposed – although no specific rules are attached to this.
- 23 I have discussed my calculations below and note that where the rule provides direction on calculation assumptions and methodology, I have used these.

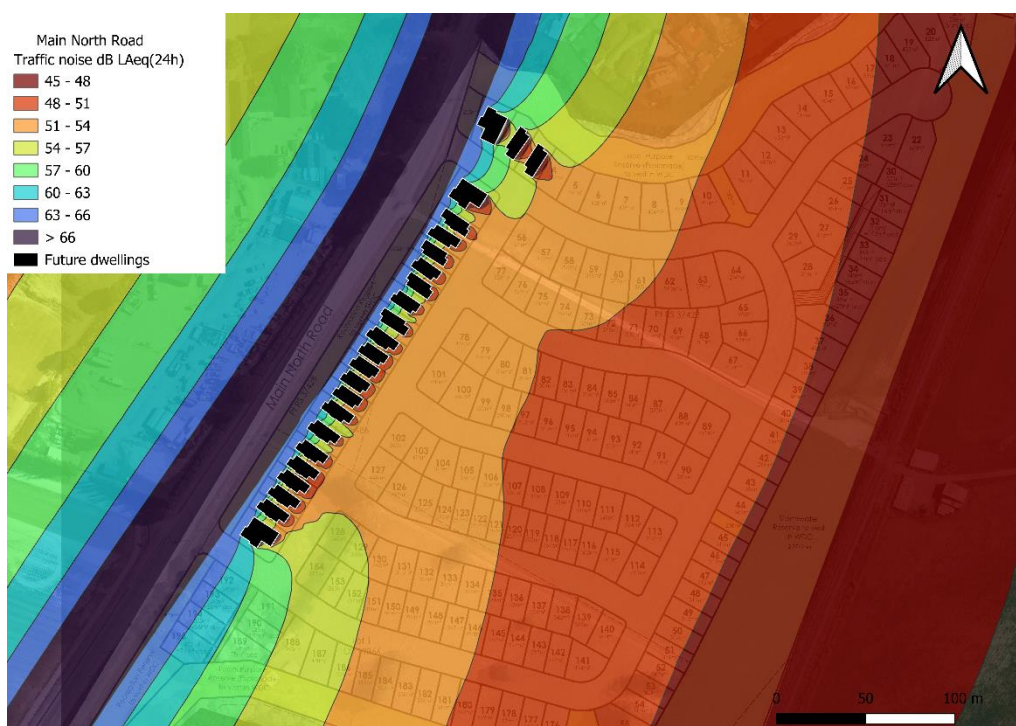
#### **Future road noise levels**

- 24 To predict future road traffic noise levels, I have used the Calculation of Road Traffic Noise (**CoRTN**) algorithm applied with SoundPLAN 3D noise modelling software.
- 25 I have used Annual Average Daily Traffic (**AADT**) information for the relevant section of Main North Road sourced from Mobile Road and assumed the road surface will remain the same. I have confirmed with Mr Collins that the Mobile Road data is a reasonable baseline in this location.
- 26 It is common practice to include an allowance for future traffic volumes – as outlined in the proposed rule. Taking the advice of Mr Collins I have applied a 1% annual increase in traffic volume per year for a 20-year projection period. This percentage increase is based on the medium population projection given by Stats NZ for the Waimakariri District. The final AADT that I have used in my modelling is 20,370 which equates to an increase of 4 dB from the current situation. Since the rule would permit a +3 dB adjustment in lieu of a site-specific forecast, this is conservative.

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<sup>1</sup> Mr S Camp, Dr S Styles, Mr J Styles 'Joint Witness Statement – NOISE-R16', 24 October 2023

- 27 I understand that the intended development on the site may generate in the order of 1,600 vehicle movements per day, which will be relatively evenly distributed between those travelling north or south along Main North Road. I have not added this separately to the projected AADT volume above, as I consider it is likely inherent in the projection, although note that doing so would not lead to a consequential change in predicted noise levels (0.1 dB).
- 28 In this case, to demonstrate potential future traffic noise effects, I consider it reasonable to model the likely layout of single storey dwellings closest to the road, to demonstrate the screening they would provide for dwellings located more centrally on the site. Figure 1 below demonstrates the results of this modelling.
- 29 Figure 1 shows that noise levels in the order of 65 – 66 dB LAeq (24 hr) may be received at the closest dwelling facades, or in outdoor areas oriented towards the road. Noise levels are lower along the sides and rear of the dwellings due to inherent screening.



**Figure 1.** Traffic noise levels received by dwellings in the central areas of the site

- 30 Single storey dwellings on lots that are not directly alongside the road, or near the road accesses from Main North Road will receive levels of 57 dB  $L_{Aeq}$  (24 hr) or less.

### **Rail noise levels**

- 31 I have used the rail noise prediction methodology described in the proposed rule to predict the likely rail noise levels at the closest dwelling location – which it appears may be in the order of 35 metres from the edge of the railway line.
- 32 At this distance, a level of 65 dB  $L_{Aeq}$  (1h) is predicted, reducing to 56 dB  $L_{Aeq}$  (1h) at 100 metres from the railway line in locations where there is no further screening from intermediate dwellings.
- 33 It appears the rule could include an allowance for a more detailed modelling approach in a similar manner to the traffic modelling I have shown above. As for traffic noise, this would demonstrate that dwellings along the perimeter of the development will screen more centrally located dwellings.
- 34 The railway track is currently higher than the land on the subject site, and I understand there may be changes in the relative heights for necessary flood mitigation. I consider that this type of detailed modelling exercise would be best undertaken when the likely relative heights are confirmed as this will influence the degree of screening provided by the closest dwellings.

### **Rail vibration**

- 35 The level of vibration that may be experienced inside dwellings near the rail corridor is dependent on both the condition of the track, and the local ground conditions. This makes it more difficult to predict than noise, and a site-specific investigation is a useful point of reference to understand the likely magnitude of vibration effects.
- 36 I deployed vibration monitoring equipment in the north-east corner of the subject site, at 45 metres from the railway line, in a location representative of a possible future dwelling. Vibration levels were measured over a seven-day period commencing the 26<sup>th</sup> of January 2024.

- 37 In this case vibration in the ground was measured to be 0.27 mm/s  $V_{w,95}$  at 45 metres from the track. This is a statistical maximum value calculated from the 15 passings which generated the highest vibration levels in this week. Because the monitoring was unattended, I am unable to confirm the train types measured, although the intent of the monitoring was to capture a typical week of activity. During this monitoring period there were typically 4 to 5 train pass-by events in a day.
- 38 These levels were measured in the ground, and it is common to see a small further coupling loss of at least 0.2 mm/s into the floor slab of a single storey dwelling.
- 39 This means that while vibration levels will be slightly higher at 35 metres from the track (which appears to be the closest a dwelling is likely to be built), on slab levels are likely to remain below 0.3 mm/s  $V_{w,95}$  at this distance.

### **Woodford Glen**

- 40 Woodford Glen Speedway is located to the east of the subject site, with the closest point of the track over 700 metres from the boundary of this site.
- 41 A Speedway Noise Contour has been included in the PWDP, although this does not extend as far as this site. As per NOISE-R22, Residential units are a non-complying activity within the extent of this contour – which indicates incompatibility due to noise.
- 42 While there does not appear to be a noise limit attached to the Speedway Noise Contour, NOISE-R12 does provide a restriction on the number of events and their duration which will moderate the noise effects associated with this source.
- 43 Some further information is available from an 8 October 2019 Noise Monitoring Report prepared by Marshall Day Acoustics as part of the District Plan Review. Measurements were undertaken during an event, and at the closest residential boundary to the north (which is approximately 100 metres closer to the track than this site) noise levels of up to 71 dB  $L_{Aeq}$  were recorded during the loudest race, and 64 dB  $L_{Aeq}$  during the quietest race – with lower levels in between races.



- 44 The report is careful to note that as the distance from Woodford Glen increases, noise levels received will be more variable because of the influence of environmental conditions such as wind direction and speed. However, the monitoring is still a useful snapshot of the order of magnitude of noise levels that may be experienced at this site.
- 45 For the line of dwellings closest to the railway, I expect that noise levels of this order would mean that during an event Woodford Glen would often be the dominant source outside, and conversations could at times require raised voices.
- 46 Since dwellings on this site which are most exposed to noise from the east will require sound insulation to address noise from the railway, I expect that residential activities indoors with windows and doors closed would still be possible with minimal modification or disruption.

## **NOISE AND VIBRATION EFFECTS**

### **Road and rail noise**

- 47 Overall, I consider that the sound insulation rule as described in the PWDP, and further developed in the Acoustic and Planning Joint Witness Statements for Stream 5, will control internal noise levels within the future dwellings on this site to an appropriate level.
- 48 While there appears to be some disagreement, or uncertainty about the trigger distances where the controls would be implemented, the general format of the rule appears to be agreed between experts.
- 49 Because of the source levels, and inherent setbacks from Main North Road and Main North Railway included in the ODP, the types of upgrades required to achieve the target internal levels will not require unusual construction techniques.
- 50 For example, if the construction schedule provided as an Appendix to the JWS were used, this would require additional layers of plasterboard for some wall types, and to typical profiled metal roof constructions. The rule would also require mechanical fresh air ventilation in affected buildings so residents can keep windows closed.

- 51 The scope of these upgrades could be refined with a dwelling specific assessment (for example areas of dwellings facing away from the road would not need the same level of upgrades). Such an assessment could be undertaken on an individual dwelling basis once specific layout detail is available, or for the overall subdivision at a higher level once the rule is confirmed.
- 52 I note that there is no specific protection provided for noise levels in residential outdoor areas adjoining arterial roads or rail corridors in the Proposed Plan, and no discussion of this issue within the associated JWS.
- 53 57 dB  $L_{Aeq, 24h}$  is a typical threshold above which controls for traffic noise commence. It is implied that where levels are below this threshold, residential use is appropriate without further consideration. As demonstrated by Figure 1, noise levels in outdoor areas facing Main North Road will be in the order of 65 – 66 dB  $L_{Aeq, 24h}$ . It would be possible with screening to achieve 57 dB  $L_{Aeq}$  in some outdoor areas of the closest dwellings – for example with an acoustic boundary fence along the roadside boundary of the lots, or by using the screening from the dwelling to create a sheltered area.
- 54 I note that with an alternative Rural Lifestyle Zoning, while at a lower density, dwellings could already be constructed on the subject site. This is currently the case for many existing dwellings adjoining busy roads throughout the Waimakariri District, and new dwellings which could be constructed ‘as of right’ on other sites. This demonstrates that outdoor noise levels of the magnitude expected are not incompatible with residential use.

### **Rail vibration**

- 55 NS 8176E:2017 *Vibration and shock - Measurement of vibration in buildings from land-based transport and guidance to evaluation of effects on human beings* is commonly used in New Zealand as a reference guide. While not directly referenced in the Acoustic JWS for the Noise Chapter, it is discussed in the preceding expert evidence.
- 56 NS 8176.E:2017 recommends that vibration levels in new residential buildings comply with a Class C classification of 0.3 mm/s  $V_{w,95}$ . If this is met, then it is

expected that potential reverse sensitivity effects associated with road traffic vibration will be adequately mitigated.

- 57 Vibration levels may vary across the site due to ground and track conditions. They could also increase if the type of track use changes, or if track quality degrades. However, my investigation confirms that the levels of vibration experienced are unlikely to be unusually high or inconsistent with this typical target value.
- 58 I note that achieving this standard does not mean that vibration from trains on Main North Railway will not be noticed by residents – although the potential for vibration effects to be present will be signalled to residents by the rail vibration alert overlay discussed in the JWS from the acoustic experts (discussed above).

### **Cumulative effects**

- 59 I am not aware of an accepted methodology to predict combined exposure effects for transportation (and other) sources. While this is an everyday occurrence, the body of research on health effects generally focusses on relationships due to exposure from individual sources.
- 60 While various sources will be audible to some degree on this site, I consider that the site layout and location relative to key sources will limit cumulative noise effects for individual lots / receivers.
- 61 For example, it is only the lots along the western edge of the site that will receive traffic noise levels high enough to warrant dwelling upgrades. While noise levels will vary based on typical diurnal traffic patterns, traffic noise will be a dominant, and relatively steady source in this location.
- 62 Because of the inherent screening from dwellings on these lots, as well as the increased distance to Main North Road, traffic noise levels received by dwellings in the central areas of the site will be lower – as illustrated by Figure 1.
- 63 Similarly, the highest noise and vibration levels from the Main North Railway (and intermittent noise from Woodford Glen events) would be received by dwellings along the eastern edge of the site, which will receive low traffic

noise levels. Those dwellings located more centrally on the site will not require any upgrades to control rail noise levels.

- 64 The different metrics used to quantify each noise source in this case (i.e.  $L_{Aeq, 24h}$  for traffic,  $L_{Aeq, 1h}$  for trains,  $L_{dn}$  for aircraft), and degree of intermittency of noise make a more objective comparison difficult – particularly for a less well-defined source such as Woodford Glen. It is however possible to use generic conversion tables<sup>2</sup> for transportation noise to provide an indicative conversion to a common  $L_{dn}$  parameter – which is effectively a 24-hour average with a penalty for night-time noise.
- 65 An analysis using this method shows that it is unlikely that there would be any locations on the site where a cumulative noise increase of more than 3 dB  $L_{dn}$  would be experienced for transportation noise sources (road + rail + aircraft).

#### **MATTERS RAISED BY SUBMITTERS**

- 66 I am not aware of any matters raised by submitters that are relevant to my evidence.

#### **CONCLUSION**

- 67 For both road and rail noise, I agree that the sound insulation rule as described in the Proposed Plan, and further developed in the Acoustic and Planning Joint Witness Statements for Stream 5, will control internal noise levels within the future dwellings on this site to an appropriate level.
- 68 This rule will require some upgrades to the building envelope of the closest row of dwellings to Main North Road and Main North Railway, as well as fresh air ventilation systems for these same dwellings.
- 69 My site investigation confirms that the levels of rail vibration experienced inside new dwellings on the portions of the site closest to the railway are unlikely to be unusually high or inconsistent with a typical residential target value of 0.3 mm/s  $V_{w,95}$ .

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<sup>2</sup> Brink, M., Schaffer, B., Pieren, R., Wunderli, J. M. (2017) Conversion between noise exposure indicators  $Leq_{24h}$ ,  $L_{Day}$ ,  $L_{Evening}$ ,  $L_{Night}$ ,  $L_{dn}$  and  $L_{den}$ : principles and practical guidance

- 70 The proposed sound insulation rule does not control outdoor noise levels. Traffic noise levels received in outdoor areas of dwellings closest to Main North Road will be elevated where the outdoor area is un-screened – although noise levels in outdoor areas could be reduced with attention to dwelling layout and local screening.
- 71 The site is outside the Speedway Noise Contour for Woodford Glen, although when an event is held, it still may be the dominant noise source in outdoor areas of the easternmost dwellings. These dwellings would receive sound insulation upgrades due to proximity to Main North Railway – which would also be of benefit to this source. Residential activities indoors with windows and doors closed would still be possible with minimal modification or disruption.
- 72 While various sources will all be audible to some degree on this site, I consider that the site layout and location relative to key sources will limit cumulative noise effects for individual lots / receivers. It is unlikely that there would be any locations on the site where a cumulative noise increase of more than 3 dB  $L_{dn}$  would be experienced for transportation noise sources (road + rail + aircraft).
- 73 Thank you for the opportunity to present my evidence.

William Reeve  
5 March 2024

APPENDIX 1

