

**ENVIRONMENT COURT OF NEW ZEALAND
WELLINGTON REGISTRY**

**I MUA I TE KOOTI TAIAO O AOTEAROA
TE WHANGANUI-A-TARA**

ENV-2023-WLG-000005

Under the Resource Management Act 1991

In the matter of the direct referral of applications for resource consent and notices of requirement under sections 87G and 198E of the Act for the Ōtaki to North of Levin Project

By Waka Kotahi NZ Transport Agency

**STATEMENT OF EVIDENCE OF MICHAEL SMITH
ON BEHALF OF WAKA KOTAHİ NZ TRANSPORT AGENCY**

NOISE AND VIBRATION

Dated: 4 July 2023

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INTRODUCTION

1. My full name is **Michael James Smith**.
2. I am a Principal Acoustics Engineer and a director of Altissimo Consulting Ltd. I have previously been employed by multi-disciplinary firms AECOM and URS, and specialist acoustics firm Marshall Day Acoustics.
3. I prepared¹ Technical Assessment B: Noise and Vibration (**Technical Assessment B**) as part of Volume IV of the Assessment of Environmental Effects (**AEE**), which accompanied the application for resource consents and notices of requirement for designations (**NoRs**) lodged with Manawatū-Whanganui Regional Council (**Horizons**), Greater Wellington Regional Council (**GWRC**), Horowhenua District Council (**HDC**) and Kāpiti Coast District Council (**KCDC**) in November 2022 in respect of the Ōtaki to north of Levin highway Project (**Ō2NL Project** or **Project**).
4. My qualifications and experience are set out in paragraph 38 of Technical Assessment B. My evidence is supplementary to Technical Assessment B.
5. In preparing Technical Assessment B and my evidence:
 - (a) I have provided advice on noise and vibration matters related to the Project to Waka Kotahi since August 2020;
 - (b) I am responsible for the assessment of operational and construction noise and vibration effects for the Ō2NL Project
 - (c) I have identified and recommended appropriate measures to avoid or mitigate potential adverse noise effects. This includes 'structural mitigation' such as low-noise surfaces and noise barriers, the avoidance of road features that can give rise to noise events, as well as a framework for the management of construction noise.
6. Since the consent applications and NoRs were lodged, I have:
 - (a) Assisted with responding to questions in the section 92 requests from the Councils related to Technical Assessment B;
 - (b) Reviewed and responded to submissions; and
 - (c) Reviewed and responded to the council officer's report.

¹ With assistance from Dr Robin Wareing (Altissimo Consulting) and Dr Stephen Chiles (Chiles Ltd).

Code of conduct

7. I confirm that I have read the Code of Conduct for expert witnesses contained in section 9 of the Environment Court Practice Note 2023. This evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Purpose and scope of the evidence

8. Technical Assessment B assesses the effects of operational and construction noise and vibration caused by the Ō2NL Project, and recommends measures appropriate to avoid or mitigate those effects.
9. My evidence does not repeat in detail the matters discussed in Technical Assessment B. Rather, in this evidence I:
 - (a) present the key findings of Technical Assessment B in an executive summary, updated to factor in the additional work carried out since lodgement;
 - (b) provide a more detailed description of the additional work carried out, information obtained, and discussions held since lodgement, and the implications for my assessment;
 - (c) comment on issues raised in submissions received in respect of the Project; and
 - (d) comment on the section 198D report prepared by HDC and KCDC (**council report**).

EXECUTIVE SUMMARY

10. My evidence outlines the operational and construction noise and vibration effects assessment for the Ō2NL Project and the proposed mitigation of these effects.

Operational noise

11. Road traffic is a major contributor to environmental noise in New Zealand. Mitigation for this Project has been considered and adopted at lower exposure levels than recommended by NZS 6806 and adopted on recent state highway projects. For a project of this scale, the number of people

exposed to road-traffic noise, and the receiving noise levels are relatively low. The Ō2NL Project will result in 167² dwellings (PPFs) that currently have little transportation noise, to experience road-traffic noise levels of 50 dB L_{Aeq(24h)} or more. All but 21 of these PPFs will be in NZS 6806 Category A (the category with the lowest noise levels, see below).

12. The Ō2NL Project will redistribute some exposure from some people and communities to others. Those currently exposed to state highway noise along the existing sections of SH1 and SH57 to be superseded by the Ō2NL Project will experience a benefit from this Project. While much of my evidence focuses on the adverse noise effects from the Project, there are positive noise effects for people living adjacent to the existing state highway corridors and for the Levin town centre.
13. The methodology for the design and assessment of operational noise can be summarised as follows:
 - (a) Qualification and quantification of the existing environment;
 - (b) Identification of relevant performance standards;
 - (c) Consideration and adoption of design principles to avoid or reduce potential noise and vibration effects;
 - (d) Noise modelling of scenarios with and without the Project, and a preliminary effects assessment;
 - (e) Evaluation and selection of specific mitigation (surfaces/barriers and building modification); and
 - (f) Assessment of residual effects after the adoption of specific mitigation.
14. In selecting this methodology, I have reviewed the learnings from the past decade of state highway projects, as well as the development of international research and best practices. This has resulted in a broader assessment than many recent projects. My assessment is consistent with NZS 6806 and the Waka Kotahi approach for implementing the standard, however I have supplemented the traditional approach with additional performance standards, and a more detailed assessment of residual effects.

² As explained in my evidence at paragraph 65, since Technical Report B was completed two additional PPF were identified. One of these PPFs (273 Arapaepae South Road) is Category A, and the other 129 Manakau Heights Drive) is Category B. For consistency with Technical Report B I have not updated the various summary tables, however these dwellings are included in Schedule 9 to the conditions, which provides the complete list of PPFs.

15. The proposed highway runs through a variety of areas from existing road corridors to rural areas with few manmade noise sources. Table B.12 sets out the results of attended measurements in terms of raw measurements (typically 15-minute measurements) and an estimate of the 24-hour average. In addition to the numeric levels, the contribution from state highways and other road traffic has been rated subjectively on a 5-point scale from 'not present' to 'dominates'.
16. Without formal evaluation, the Project definition included a low-noise road surface (nominally an open-graded porous asphalt). This selection has reduced road traffic noise levels of approximately 6 dB³ at all properties adjacent to the highway, compared to a chipseal surface.
17. Throughout the design development, evaluation of different options for interchanges / local road connections were performed, with noise as an input. Decisions regarding the corridor selection were made at earlier Project stages.
18. The New Zealand Standard for road-traffic noise (NZS 6806⁴) provides three noise categories, which provide varying levels of external and internal amenity. For new roads, these categories are shown in **Figure 1** below.

³ Decibel (dB) is a unit of relative magnitude. For a difference in sound level, the metric $L_{Aeq(24h)}$ does not need to be specified.

⁴ New Zealand Standard NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads.

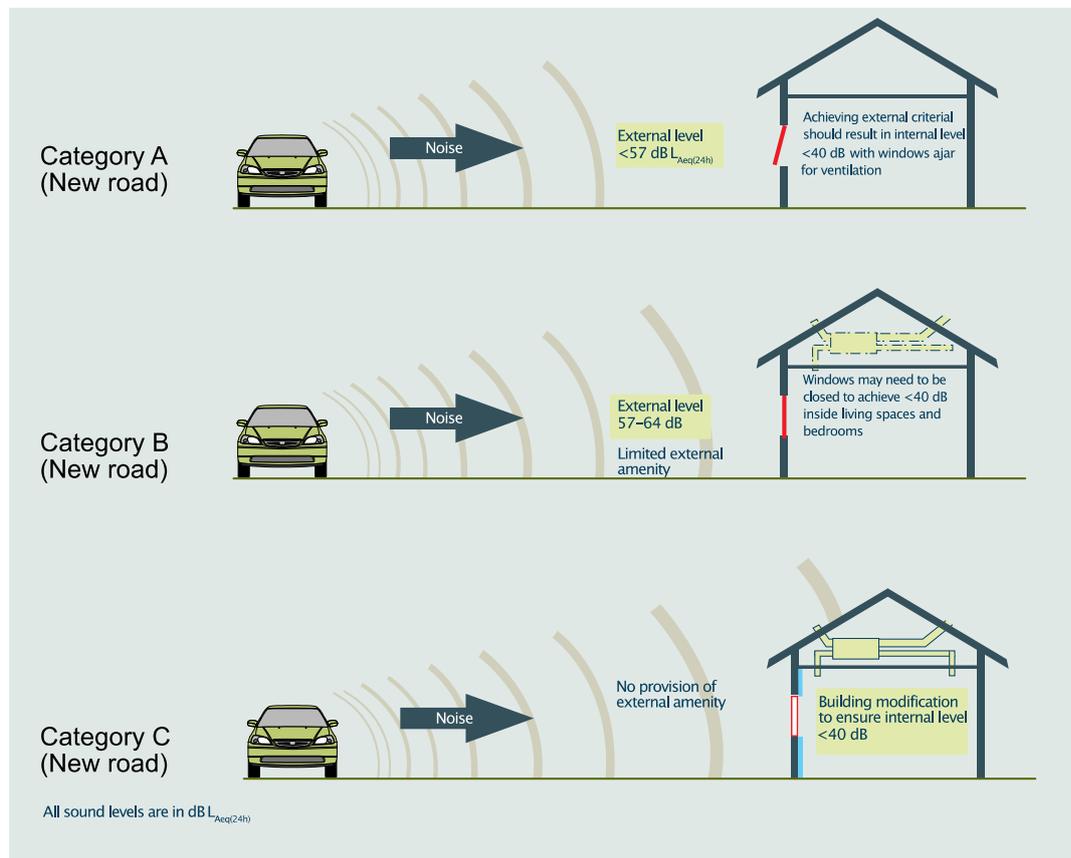


Figure 1. NZS 6806 noise categories (new road)

19. I have adopted an additional performance standard of $50 \text{ dB L}_{\text{Aeq}(24\text{h})}$, based on guidance from the World Health Organisation⁵ that identifies high road-traffic noise levels are associated with adverse health effects.
20. Recognising that annoyance from road-traffic noise often relates to noise with a specific character or from individual vehicles, I have recommended the development and then adoption of design principles to avoid or reduce these effects. In particular, I have:
 - (a) recommended that Audio Profile Tactile markers not be used within 200m of dwellings;
 - (b) identified that roundabouts and interchanges require landscape and highway design to encourage smooth braking and acceleration;
 - (c) recommended that, where mechanical bridge joints are necessary, a control process is put in place to ensure they are installed consistent with Waka Kotahi specifications to avoid excessive noise generation.

⁵ World Health Organisation, Environmental Noise Guidelines for the European Region, 2018.

21. Interchanges and roundabouts require landscape and highway design to encourage smooth braking and acceleration. To achieve this, the Cultural and Environmental Design Framework (CEDF)⁶ illustrates that the landscape and highway design could include:
- (a) use of appropriate approach lengths and manipulation of carriageway alignment (horizontal and vertical);
 - (b) reduced carriageway, shoulder and berm widths;
 - (c) bold planting including tall mature height trees and other vertical elements such as gateway/threshold features;
 - (d) integration of constructed landforms around stormwater wetlands to increase sense of enclosure and where they are able to be tied into existing contours; and
 - (e) use specific paving textures/colours at interchanges and roundabouts (in addition to required signage and lighting).
22. The CEDF illustrates concepts for the northern termination, SH57 roundabout, and the southern termination which include number of the above elements to signify to drivers the change from a high-speed environment to a slow-speed feature.
23. Condition DTW5 requires the Project to remain consistent with the design principles in Chapter 3 of the CEDF, and includes periodic design review processes. This will provide appropriate design consideration for managing noise effects from these features.
24. I have predicted road-traffic noise levels at all relevant receivers for existing⁷ and future scenarios without the Project to use as a baseline, in addition to with the Project.
25. I have considered specific noise mitigation throughout the Project area to reduce noise levels and associated effects further. The forms of mitigation considered were noise walls of different heights, earth bunds, and a high-performance low-noise road surface.
26. The high-performance low-noise road surface (**High-Performance Low-Noise Road Surface**) mitigation option is the best acoustically-performing

⁶ Attached as Appendix 3 to Volume II of the application material.

⁷ The 'existing' scenario was based on 2018 and the road network at the time, which did not include the Peka Peka to Ōtaki highway, which was only completed in 2022.

surface available in New Zealand⁸. There is currently only 3km of this surface installed elsewhere on the state highway network as of March 2023.⁹ This surface results in a further reduction in road traffic noise levels of approximately 2 dB¹⁰.

27. Mitigation options were subject to a multi-disciplinary analysis guided by NZS 6806, which balanced the noise reductions achieved with engineering constraints, as well as the potential effects that the mitigation would have on visual / landscape values, ecology, and social and heritage values. This evaluation process was informed by a preliminary assessment of potential noise effects.
28. In terms of evaluating noise mitigation options, I have considered both the efficacy of the mitigation, as well as compliance with the NZS 6806 and health guidelines¹¹. Specifically, when evaluating different mitigation options for each assessment area, the impact ratings in **Table 1** have been used.

Table 1 MCA values (extract from Table 8 of Noise Modelling Report¹²)

Impact key	NZS 6806 compliance	Health compliance
+++	All in Cat A	All PPFs < 50 dB
++	Cat A or 5% or fewer in Cat B	-
+	All in Cat A or B	-
o	-	Fewer than 25% of PPFs > 50 dB
-	5% or fewer in Cat C	More than 25% of PPFs > 50 dB
--	10% or fewer in Cat C	More than 50% of PPFs > 50 dB
---	More than 10% in Cat C	More than 75% of PPFs > 50 dB

29. If NZS 6806 was applied mechanically, in the scenario where all PPFs for a given assessment area were in Category A, mitigation would not need to be considered. In my opinion, this would not provide an appropriate noise management outcome in all cases. Therefore, I considered the adoption of

⁸ Waka Kotahi (2020) Technical Memorandum, Noise and Vibration, No 5 Version 2. High performance low-noise road surfaces.

⁹ The section is on the Christchurch Northern Corridor.

¹⁰ In addition to the 6 dB reduction compared to chipseal discussed in paragraph 16, for a total of 8 dB reduction.

¹¹ Ms Wilkening in her s198D technical report states that I used long-term health effects (DALYs) as a performance standard. That is not correct.

¹² This is included as Appendix B6 of Technical Report B.

the WHO Guidelines to provide an evidence-based reason for considering the potential requirement for mitigation in such a situation.

30. The preferred mitigation was established by consensus at Noise Mitigation Workshops attended by a range of experts. The mitigation comprises a total of 18 km of the High-Performance Low-Noise Road Surface in three sections, and a total of 4.2 km of 1.1m high concrete safety barriers in 5 sections. This forms what I consider to be the BPO for operational noise.
31. Despite the general measures to reduce noise generation, and the specific mitigation identified above, the Project will result in a significant change to the environment, and a degree of residual noise effects.
32. To assess the potential effects on both an individual and Project-wide basis, I have used three different approaches:
 - (a) Comparison with performance standards (NZS 6806 and WHO);
 - (b) Subjective response; and
 - (c) Long-term health effects.
33. The number of PPFs in each exposure category is shown in **Table 2** for both scenario without specific mitigation, and with the mitigation that I have recommended. **Table 2** covers only the PPFs not currently exposed to significant road traffic noise from the existing state highways¹³.

Table 2 Summary of PPFs in different noise categories (Project)

Scenario	WHO thresholds		NZS 6806 Categories		
	<= 50 dB	>50 dB	Cat A	Cat B	Cat C
Ō2NL without specific mitigation (2039)	81	195	227	49	0
Ō2NL with recommended mitigation (2039)	109	167	255	21	0
Total	276		276		

34. With the recommended mitigation, there will be 21 dwellings where operational noise levels will not achieve the preferred Category A criterion from NZS 6806. 15 of these are currently Crown-owned¹⁴, or within the

¹³ See Table B.32 for PPFs adjacent to the existing state highways.

¹⁴ Crown-owned properties are included as they may, after construction, be sold and therefore remain part of the environment during operation of the Project when they will be subject to operational noise.

proposed designation corridor, but there are six which are privately owned and/or outside the proposed designation corridor. NZS 6806 considers that noise within Category A levels, which will be achieved at all other dwellings, allows for reasonable residential amenity and some protection from health effects.

35. NZS 6806 Category B will be achieved at all 21 dwellings where Category A is not achieved (no dwellings will be in Category C). For the 21 PPFs (of which 15 are Crown-owned or within the proposed designation corridor) in NZS 6806 Category B, while external noise levels will be higher than desirable, appropriate internal noise levels can be achieved by keeping windows closed.
36. Where necessary and subject to landowner agreement, Waka Kotahi will (as required through the proposed conditions) design and implement modifications to buildings to achieve appropriate internal noise levels. Where windows will need to be kept closed to achieve these internal noise levels, mechanical ventilation (including cooling) will generally be provided, and in some instances other building modifications will be appropriate.
37. There are 167 PPFs where noise levels with the Project exceed 50 dB $L_{Aeq(24h)}$, and on that basis, occupants may experience some degree of adverse health effects.
38. For people currently exposed to road-traffic noise, the subjective response to change depends on the combined magnitude of the change, the nature of the noise, as well as overall noise levels.¹⁵ For locations where the existing environment primarily consists of natural sounds, the amenity effects will often result as much from the change in character as from the change in level.
39. Factors that influence the human response to noise include non-acoustic factors such as an individual's sensitivity to noise, underlying health conditions, prior exposure to noisy environments, relationship with the noise source and expectations in general.

¹⁵ LTNZ Research Report No. 292: Road traffic noise: determining the influence of New Zealand Road surfaces on noise levels and community annoyance, Table 18.

40. There is no standardised method for estimating or describing the subjective response to a new noise source. Approaches used at times include:
- (a) Loudness based: “perceptible” based on change in noise level;
 - (b) General terms such as “reasonable”, “acceptable”; and
 - (c) RMA rating terms such as “minor” or “significant”.
41. In my assessment, I have used a structured method based on UK Planning Guidance.¹⁶ This method uses the terms present, intrusive and disruptive and provides examples of when they might apply (**Table 3**). While I am not aware of this framework being used for noise assessment in New Zealand, I consider the examples of outcomes to provide a useful way of expressing the spectrum of effects.

Table 3 Subjective noise framework

Response to new transportation noise	Example of outcomes
Not present	No effect
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, eg turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life of people living there.
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Quality of life for people affected is moderately diminished due to change in acoustic character of the area.
Present and very disruptive	The noise causes extensive and regular changes in behaviour, attitude or other physiological response. Quality of life for people affected is significantly diminished due to change in acoustic character of the area.

42. I have identified that there is likely to be residual intrusive (a small actual or perceived change in the quality of life of people living there) or disruptive (the quality of life for people affected is moderately diminished) noise (at times) at some locations after mitigation has been applied.

¹⁶ UK Planning Guidance 005 Reference ID: 30-005-20190722.

43. The full extent of the effect will depend on the individuals exposed to road traffic noise. Nevertheless, I have estimated¹⁷ the range of likely subjective responses within each community, and collectively over the entire Project area, as shown in **Table 4**.

Table 4 Subjective response by community

Community	Present and not intrusive	Present and intrusive	Present and disruptive or very disruptive
North East Levin	11	11	4
Levin East	25	21	3
Ohau East	42	24	7
Manakau	51	54	4
North Ōtaki	14	3	2
Total	143	113	20

44. While there is likely to be a degree of behavioural adaption for most people living in the Project area, for the 20 PPFs where the subjective response has been identified as disruptive or very disruptive, the likely consequence is that the residents will change how they use their property. That is, some activities will be undertaken inside rather than outside, and other activities may be avoided. This is consistent with expectations for Category B PPFs.¹⁸

45. While road-traffic noise will still be audible inside, the sound reduction provided by the building facade will allow most tasks to be undertaken with minimal disturbance. For the 21 Category B PPFs where windows are required to be closed to achieve these internal noise levels, Waka Kotahi will offer to provide alternative ventilation to allow this. While this is not an optimal outcome for the affected residents, this is standard practice consistent with the construction of new transportation corridors near established housing.

46. Absolute noise levels (with the Project) will be reasonable, as guided by the identified performance standards, and they are likely to be acceptable to the

¹⁷ The estimate is based on the future noise level with the Project, and whether the existing state highway noise is 'low', 'medium' or 'high'. This estimate excludes those living beside the existing SH1 who will receive beneficial subjective responses to a reduction in road traffic noise.

¹⁸ There is no direct mapping between Category B status and disruptive effects so the totals do not match.

general population. That said, I have identified that for 20 PPFs noise may be disruptive or very disruptive, and for a further 113 PPFs noise may be intrusive.

47. With the Ō2NL Project, noise levels along the existing state highway corridors (SH1 and SH57) will be lower than the scenario without the Project, such that in 2039:
- (a) the number of PPFs exceeding 67 dB $L_{Aeq(24h)}$ (Category C) is predicted to reduce from 105 to 23 - a reduction of 78%;
 - (b) the number of PPFs exceeding 64 dB $L_{Aeq(24h)}$ (Categories B and C combined) is predicted to reduce from 225 to 65 - a reduction of 71%; and
 - (c) The number of PPFs exceeding 50 dB $L_{Aeq(24h)}$ (WHO Guidelines) is predicted to reduce from 997 to 680 - a reduction of 32%.
48. I have estimated the number of people likely to experience potential health effects noise from the proposed highway (**Table 5**). I have also calculated the subsequent burden in terms of Disability Adjusted Life Years (**DALYs**) which applies to the affected population as a whole.

Table 5 Health outcomes

Health outcome	Number of people likely to experience outcome	Disability Adjusted Life Years
Annoyance	56.1	1.123
Sleep disturbance	17.7	1.242
Ischaemic heart disease	0.61	0.249
Premature mortality due to IHD	0.0040	0.004
Total		2.618

49. While some people are likely to experience annoyance and sleep disturbance (and to a significantly lesser degree increased risk of heart disease) from noise from the new Ō2NL Project highway, the number of DALYs from these effects is much lower than those associated with the current, state highway network. The number of DALYs on the current state highway network once Ō2NL Project opens reduces.
50. The Ō2NL Project provides an overall positive DALY outcome, representing a reduction compared to the current state highway network situation (16.9

DALYs) and the 2039 position without the Ō2NL Project (23.8 DALYs) to 16.9 DALYS with the Project. This number relates to total number of years of reduced health over the entire population, not an average number of years per person.

51. Also, while the Ō2NL Project is providing a net improvement in health effects due to road traffic noise on a population basis, caution should be used when combining positive and adverse health effects which relate to different people. NZS 6806 does not require modelling road-traffic noise outside the extent of the physical works, therefore judgement is required to select an appropriate modelling extent if such an approach is to be undertaken. That extent is shown in Technical Report B.

Operational vibration

52. Vibration from road traffic (particularly heavy vehicles) has the potential to cause disturbance for people near roads, particularly roads in poor condition. Road-traffic vibration is largely caused by steps or other discontinuities in the road surface. For a well-built pavement such as a new highway, operational vibration will be limited to 15m from the road edge, and there are no sensitive receivers within this distance.
53. As such, there will be minimal adverse operational vibration effects from the Ō2NL Project. The reduction in traffic on SH1 and SH57 (particularly heavy vehicles) will reduce the number of vibration events from the existing network, and thus result in a positive effect.

Construction noise and vibration

54. Construction of the Ō2NL Project will require a range of standard equipment. The Ō2NL Project involves extensive earthworks, paving and compaction, but there are also structures requiring piling, and there will be general construction activities including construction traffic. Construction noise has the potential to be intrusive and/or disruptive to residents, and therefore proactive management will be required to adequately manage these effects.
55. As the construction methodology has not been developed, conservative parameters were applied to determine unmitigated construction noise levels. The levels of conservatism include assuming equipment are operating continuously at a high power setting, and located at the closest point within the construction footprint to the receiver.

56. The predictions showed approximately 55 houses might have daytime noise levels 5-10 dB $L_{Aeq(15min)}$ above the long-term construction noise limits for a period of time, from bulk earthworks. For a project of this scale, this number and extent of potential exceedance is small, which confirms the low risk compared to other projects. This is primarily due to the distance between the construction area and houses. Furthermore, for many locations along the Project, the 'minor earthworks' scenario of a single digger and dump truck will be more appropriate than the 'bulk earthworks' scenario with multiple scrapers and dump trucks operating in tandem.
57. In my opinion it is misleading to specify physical mitigation as part of construction noise assessment at this stage as I do not have the necessary detail. That is usual in such projects, and why there is well established and tested processes for ensuring construction noise BPOs are adopted. In my experience, despite the scale of equipment used, mitigation methods are effective and well-established.
58. Further flexibility of mitigation methodology is key and specific responses and parameters should not, in my opinion, be implemented now, to enable the best outcomes for affected people at the time of construction.
59. Key to ensuring appropriate construction noise management is having clear conditions with limits and then a flexible tool kit of actions set within a clear process framework. To implement the conditions, a Construction Noise and Vibration Management Plan (**CNVMP**) will be prepared, which will detail the project specific actions required to appropriately manage actual and potential construction noise and vibration effects. Key to the flexibility of this plan will be the use of Schedules to the CNVMP to address activities and properties that may cause an exceedance of the noise limit. Again, that is standard practice which in my experience works well. This process is reflected in, and required by, the proposed conditions (DNV3 and 4).
60. A key component of the Project design is the selection of a low-noise porous asphalt road surface, and in some locations a High-Performance Low-Noise Road Surface. The concept design has a "foamed bitumen" pavement design, which uses chipseal as a waterproofing layer, and requires the road to be trafficked for up to a year before the final porous asphalt is installed. This is common practice¹⁹ although on some other projects, a structural

¹⁹ For example, Christchurch Northern Corridor, Christchurch Southern Motorway Stage 2, Waikato Expressway (Tamahere-Cambridge).

“deep lift” asphalt pavement design has been used, which allows the porous asphalt to be installed prior to opening²⁰.

61. I have considered the temporary noise effects that occur in this period between the road being open to traffic and when the final surface is laid. From an acoustic perspective (chip seal noise levels are approximately 6-8 dB $L_{Aeq(24h)}$ higher) whilst considerable these temporary effects will generally be acceptable if they are adequately communicated, and such communication is proposed²¹.

WORK SINCE LODGEMENT

62. Since the application was lodged, I have been involved in further work related to noise and vibration as set out below.

Response to section 92 requests for further information

63. I have assisted with the response to further information requests from the Councils related to Technical Assessment B. The responses were only to clarify information provided in the report and provide one additional reference.
64. No additional investigations were undertaken to provide this information.

Additional dwellings identified

273 Arapaepae South Road

65. A large portion of this property is within the designation, and my assessment assumed that the dwelling would be removed. Since the application has been notified, I have since been advised that the extent of the designation will be reduced after construction such that the dwelling can remain.
66. The proposed highway includes the High-Performance Low Noise Road Surface from Muhunoa East to the SH57 roundabout, which includes the section of highway adjacent this dwelling. With this surface, the predicted noise level at this dwelling is 57 dB $L_{Aeq(24h)}$. While noise levels are at the upper end of NZS 6806 Category A, I consider the selected mitigation to be the BPO and additional mitigation at this dwelling is not necessary.

²⁰ For example, Peka Peka to Ōtaki, Ara Tūhoo (Pūhoi to Warkworth).

²¹ Schedule 5 of the proposed conditions states that the communications plan will include “*targeted notification of the road being open for public use, and the resulting changes to the traffic and noise environment.*”

129 Manakau Heights Drive

67. Since the application was notified, I have been advised of a second dwelling at 129 Manakau Heights Drive, which was not included in my noise assessment, specifically Appendix 4 of Technical Report B. Based on aerial photography, this dwelling has been constructed between 2019 and 2020.
68. This dwelling is approximately 80m from the proposed highway edge, and the predicted noise level from the highway in 2039 is 58 dB $L_{Aeq(24h)}$. In comparison, the northern dwelling on this property is approximately 140m from the road edge, and the predicted noise level from the highway in 2039 is 52 dB $L_{Aeq(24h)}$.
69. For reference, the existing noise level will typically vary between 40-50 dB $L_{Aeq(24h)}$ and largely comprises natural sounds, with some distant traffic noise.
70. A noise level of 58 dB $L_{Aeq(24h)}$ is within NZS 6806 Category B. If the noise level at this dwelling remains above 57 dB $L_{Aeq(24h)}$ in the detailed design, then this should be investigated to determine whether building modification is required to achieve internal noise levels below 40 dB $L_{Aeq(24h)}$. Given the modern construction and the fact that most of the building is exposed to lower noise levels, I do not anticipate building modification will be required.
71. Mitigation was considered in this location (Area C1) and the High-Performance Low-Noise Road Surface was selected. I do not consider that the knowledge of this dwelling would have altered the selection of the mitigation.

Engagement with stakeholders

72. I have been involved in ongoing post-lodgement engagement with the Councils and other stakeholders. Since the consent applications were lodged, this has included:
 - (a) Attending a public meeting in January 2023, including discussions with landowners and residents afterwards; and
 - (b) Preparing content for the planning team to include in responses to landowners on submissions raising noise and vibration issues.

COMMENTS ON SUBMISSIONS

73. I have reviewed the submissions which the planning team identified noise or vibration as an issue. In reviewing these submissions, I considered whether they contain any new information or other factors warranting further investigation.
74. Where submitters have requested specific relief, I have commented on whether I consider that it is required or appropriate.

Nestbox / Summers, 217 Kimberley Road / 345 Arapaepae South Rd

75. The submitter operates a free-range egg farming business at this property and is concerned about the effects of the construction and operation of the project on the chickens, and the associated impact on his business. Mr Summers states that chickens are easily spooked by passing vehicles or construction activities and submits that additional mitigation (earth bunds / acoustic fencing) are required.
76. Effects on animals, including chickens, are outside of my area of expertise, however, the sensitivity of chickens to noise is discussed in the evidence of **Mr Goldwater**. In addition, I can infer likely effects by drawing comparisons to the present noise environment. experienced at Nestbox.
77. It is assumed that the chickens occupy the large rectangular buildings (and the surrounds) located on the northern end of this property. Noise levels currently are estimated to range between 57-67 dB $L_{Aeq(24h)}$. Without the Project that traffic on SH57 is forecast to increase from the current 6,000 to 12,000 vehicles per day by 2039, and noise levels at the buildings would increase to 60-70 dB $L_{Aeq(24h)}$.
78. With the Project in place the noise levels from the new highway on the rectangular buildings will be between 55 and 60 dB $L_{Aeq(24h)}$. The above noise levels include the High-Performance Low-Noise Road Surface selected as the mitigation option for this area of the Project.
79. While residual traffic remains on Arapaepae Road, the Project will result in most traffic transferring to the highway. In terms of the character of the noise, unlike the current SH57 where vehicles need to slow to negotiate the 90-degree corner, vehicles on the highway will be travelling at constant speed, and accordingly there will be less variation and character to the noise.

80. Construction noise and vibration effects require proactive management and the adoption of good construction behaviours to manage effects. As the construction footprint runs hard up against the submitter's boundary this is a location where good communication between the contractor and the owner / resident will be required. I have recommended and Condition DNV4 has been amended to include a requirement to prepare a Construction Noise and Vibration Management Schedule for any works within 100m of the egg farm.
81. Extensive earthworks are not required in this area. Accordingly, works close to the farm are anticipated to be undertaken within a single construction season, and in phases entailing earthworks, then laying pavements followed by surfacing and completion works.
- ~~82.~~ Based on the predicted noise levels I do not consider that additional mitigation is required for this property. I consider that the proposed construction noise and vibration management processes can appropriately address any site-specific issues.

Sjaan Henry, 82 Waihou Road, Levin

83. Ms Henry questions the accuracy of the noise predictions, potential for hearing damage, and requests building modification (double glazing).
84. This dwelling is approximately 55m from the highway edge, and the predicted noise level from the highway in 2039 is 56 dB $L_{Aeq(24h)}$. For reference, the existing noise level will typically vary between 47-52 dB $L_{Aeq(24h)}$ and largely comprises natural sounds, with some distant traffic noise.
85. I met online with the Ms Henry and a family member on 5 December 2022, along with others in the Project team to explain the Project and discuss her concerns.
86. As set out in paragraphs 232-252 of Technical Report B, the Project was split into 16 different assessment areas, and different mitigation options were evaluated as part of a multi-disciplinary process guided by NZS 6806. Based on this process, the selected mitigation was the High-Performance Low-Noise Road Surface, and a 1.1m high concrete barrier on the eastern edge of the highway.
87. The mitigation has resulted in a predicted reduction of 5 dB over the base scenario of a standard low-noise road surface.

88. While noise levels are at the upper end of NZS 6806 Category A, building treatment is not required to achieve internal noise levels below 40 dB $L_{Aeq(24h)}$. On this basis, I do not support double glazing.
89. The World Health Organisation²² 2018 states “No studies were found, and therefore no evidence was available for the association between road traffic noise and hearing impairment and tinnitus”. Both operational and construction noise levels are well-below hearing damage thresholds set for occupational noise. On this basis, I do not consider hearing damage is a potential effect of the Project. For context, there are currently almost 38,000 people in New Zealand estimated to be exposed to road-traffic noise levels of 64 dB $L_{Aeq(24h)}$ or higher²³.
90. Predictions have been made using industry-standard techniques, using conservative input parameters. These include high (95%) population growth in the Horowhenua with associated traffic demand, as well as a 110 km/h speed limit. While every prediction methodology has uncertainties, I consider the modelling I have undertaken to be an appropriate basis for design and objective analysis.

Neil & Sheryl Whyte, 24 Koputaroa Road, Levin

91. The submitters are concerned about potential engine braking from trucks negotiating the northern roundabout. They request planting to assist with reducing noise effects.
92. The dwelling is approximately 360m north of the roundabout, and is beyond the extent of the noise model. The predicted noise level from the highway is below 50 dB $L_{Aeq(24h)}$.
93. I have identified that interchanges and roundabouts require landscape and highway design to encourage smooth braking and acceleration. As discussed in my evidence above, the CEDF includes a number of elements to signify to drivers the change from a high-speed environment to a slow-speed feature. Other highway features (eg linemarking) should be complementary to the environment to assist in controlling driver behaviour. I do not consider that there are other effective tools available to further reduce the prevalence of engine braking.

²² World Health Organisation (2018) *Environmental noise guidelines for the European Region*.

²³ Based on AECOM (2019) *National Land Transport (Road) Noise Map – 2019 Project Report* Table B1.

94. Planting can assist with reducing the perception of noise, but does not reduce noise levels directly. **Mr Lister** has responded further to this submission in relation to potential planting on their land to prevent views of the road.

Wendy McAlister-Miles & Dion Miles, 195 Muhunoa East Road, Ohau

95. The submitter is primarily concerned with construction noise, and how this will affect their ability to use outdoor amenity areas. They request fencing and regular / effective communication during construction.
96. The dwelling is:
- (a) 200m from main highway construction footprint; and
 - (b) 80m from Muhunoa East Road, and base of the bridge over the highway.
97. Muhunoa East Road is proposed to be used as a construction access.
98. The highway in this area is on fill, and a large embankment will be created for the bridge. Therefore, earthworks will be the noise generating activity that will take the longest to complete. Predicted (and conservative) construction sound levels are listed in Technical Report B (Table B.14) which would apply for periods of intense activity.
99. As construction activity is highly variable, there will be periods during construction where residents of the property will not want to use their outdoor areas because of construction noise. However, for the majority of time construction activity during this period will either be remote or of low intensity and will not interfere with use of outdoor areas.
100. As set out in Technical Report B, good communication is a key part to construction noise mitigation. As part of the CNVMP, the contractor is required to communicate with affected residents and to schedule activities to minimise disturbance. Works will be limited to core working hours unless there is a specific operational need. Any night works will be subject to a Construction Noise and Vibration Management Schedule (DNV4) which will require residents to be notified of such works. In my experience, done well as is proposed, this will meet the submitter's requested relief around effective communication.

Helen Naylor, 45 Wi Tako Street, Manakau

101. The submitter requests lower daytime construction noise limits and building modification to mitigate construction noise effects. The submitter also identifies and accepts that there will be adverse effects from road-traffic noise.
102. This dwelling is:
- (a) 220m from main construction footprint; and
 - (b) 120m from the Shared User Path link into Manakau.
103. As set out in Tables B14 and B16 of Technical Report B, conservatively assessed, construction noise will achieve (and generally be well below) the limits set out in Condition DNV-1 at the above distances.
104. The noise limits in DNV-1 are part of a broader suite of noise controls and is not permission for the contractor to generate more noise than is necessary to complete the task. I do not agree with the submitter that lower noise limits in Condition DNV-1 are appropriate.
105. Building modification is generally not appropriate²⁴ mitigation for construction noise and temporary relocation would be investigated if internal noise levels exceeded acceptable levels. Given the distance from construction activities and predicted noise levels, I do not support building modification nor temporary relocation for this submitter.

Christine Wallis, 62 Kuku East Road

106. The submitters own two parcels of land (188 and 199) which have been identified as required for the construction of the Project, including the Kuku East Road bridge. A portion of 62 Kuku East Road (parcel 188) will remain available for residential living. The submission states that highway will demean the current associative and liveable values of the adjoining remaining land block. The submission requests that the full effects of the Project are explained to the submitter.
107. The dwelling is 240m from highway edge, and the predicted 2039 road-traffic noise level is 51 dB $L_{Aeq(24h)}$. Currently, the location only has “a little”

²⁴ Ms Wilkening shares this position at paragraph 76 of her s198D technical report.

contribution from distant traffic noise, and the existing noise environment is estimated to vary between 40-50 dB $L_{Aeq(24h)}$.

108. Multiple noise mitigation options were evaluated for this area (D2), including the High-Performance Low-Noise Road Surface and noise walls / bunds of varying heights. In this area, the selected mitigation option was to use a standard low-noise road surface. My opinion remains that this is appropriate.
109. The predicted noise level at the dwelling (51 dB $L_{Aeq(24h)}$) is well below the NZS 6806 Category A criterion (57 dB $L_{Aeq(24h)}$) and in the context of a project of this scale, this is at the lower end of noise exposure. Nevertheless, there will be a change in the observed environment, and the perception of noise will likely be complicated by the loss of land²⁵.

Glenys Anderson, 413 Arapaepae South Road

110. The submitter is concerned about the effects (both operation and construction) of the Project on their rural lifestyle, and in particular the effects on a family member with severe depression and anxiety. The submitter identifies that access to quality sleep is important. The submitter requests background noise monitoring, updated modelling based on survey, and building modification and glazing.
111. The dwelling is 160m from the highway, and 130m from the construction footprint. The predicted 2039 road-traffic noise level is 52 dB $L_{Aeq(24h)}$. For reference, the existing noise level will typically be between 40-50 dB $L_{Aeq(24h)}$, as discussed in my evidence below. The existing environment comprises mostly natural sounds, with some local traffic noise from Arapaepae Road.
112. I met with the Andersons on 17 November 2022, along with others in the Project team, and their property consultant. The selected mitigation in this area is the High-Performance Low-Noise Road Surface.
113. The highway at this location is relatively flat and is approximately 1.4km south of the Tararua Road interchange. Vehicles should be travelling at constant speed, with no labouring engines or braking noise.
114. The submitter requests that noise monitoring is undertaken at their property to fully assess the effects and is required to model the noise accurately. Long-term noise monitoring was performed at two locations in the vicinity of

²⁵ See Technical Report B at paragraph 67 for a discussion of acoustic and non-acoustic factors that can influence individual's response to noise.

the Anderson property: 378 and 459 Arapaepae South Road²⁶. The average values for these two locations are listed below (**Table 6**). I note that 378 Arapaepae South is closer to Kimberley Road (SH57) and has a greater contribution from road-traffic noise.

Table 6 Measured sound levels in the vicinity of the Anderson property

Measurement location	L _{Aeq(24h)}	L _{Aeq(day)}	L _{Aeq(night)}
459 Arapaepae South Road	45 dB	46 dB	36 dB
378 Arapaepae South Road	50 dB	51 dB	42 dB

115. I expect the existing noise environment at the Anderson property to be similar to these two monitoring locations. I do not conder additional noise monitoring to be necessary, and the modelling of highway noise does not use the ambient noise environment as an input.
116. For an external noise level of 52 dB L_{Aeq(24h)}, 3% of the population reports as highly sleep disturbed²⁷. This is 1% over the baseline reporting of sleep disturbance in the absence of an external stimulus.
117. While I cannot make any assessment on the effects on individuals, particularly with underlying health conditions, the predicted noise levels are within guidelines for the protection of sleep for the general population.
118. For many currently living in a quiet rural area, the change in noise environment may be challenging to adjust to. I have recommended that Waka Kotahi is required to assist with this by providing information about road-traffic noise immediately prior to opening. This is discussed in paragraphs 306-307 of Technical Report B and reflected in the communication plan required by DCE4 and Schedule 5 (iv. E).
119. Indicative vibration levels²⁸ for different construction activities are presented in **Figure 2**. Based on this information and the distance to proposed construction footprint, I do not consider disturbance from construction vibration to be likely at the dwelling.

²⁶ See Appendix B6 *Noise survey report* to Technical Report B.

²⁷ Guski, R. et al., 2017, 'WHO environmental noise guidelines for the European region: a systematic review on environmental noise and annoyance', *International Journal of Environmental Research and Public Health* 14(12), p. 1539 (DOI: <https://doi.org/10.3390/ijerph14121539>).

²⁸ Cenek, Sutherland and Mclver 2 (2012) *Ground vibration from road construction*. NZ Transport Agency Research Report 485. Figure 8.2.

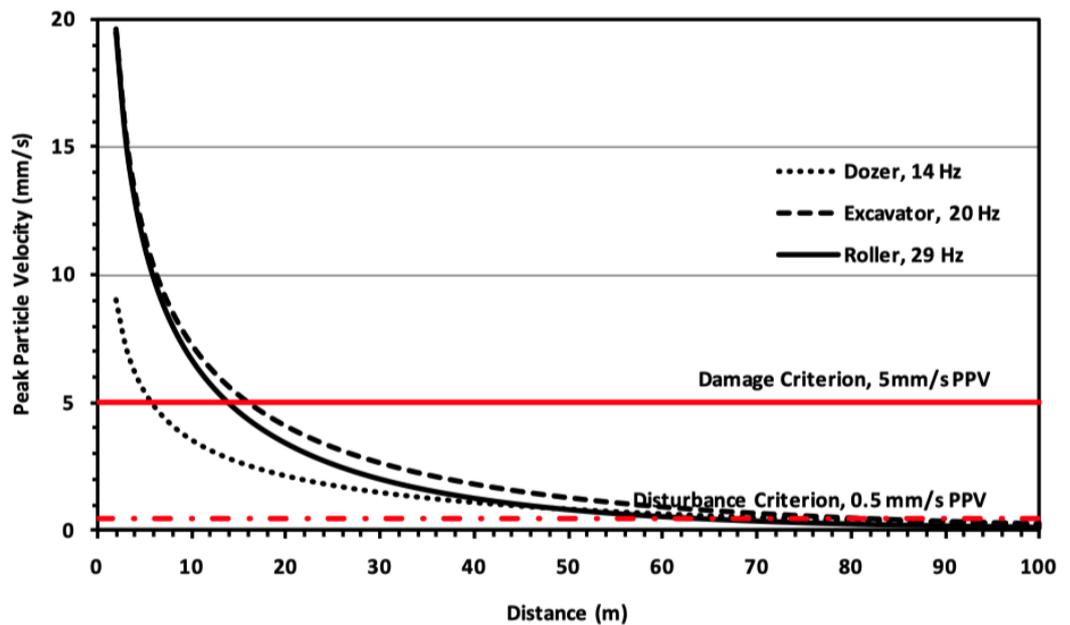


Figure 2 Indicative levels of construction vibration

Stephen & Miriam Main, 28 Mountain View Drive, Ōtaki

120. The submitter is concerned about construction noise and vibration, particularly on weekends. They request that their double-glazed windows are upgraded to triple glazing. They also request that construction activity is limited to core business hours, and residents are consulted for any works outside these hours.
121. The dwelling is 150m from the construction footprint, 205m from the Waiauti Stream Bridge, and 280m from the South Manakau Road Bridge.
122. The highway is on approximately 3-4m of fill in this area. Predicted sound levels from earthworks activities are set out in Table B.14 of Technical Report B for a conservative scenario, with plant running continuously, and at a constant distance from the receiving location. Building modification is generally not appropriate mitigation for construction noise and temporary relocation would be investigated if internal noise levels exceeded acceptable levels. At the distance of this dwelling, the predicted external noise levels will be within the proposed noise limit, and therefore I consider internal noise levels will be acceptable without building modifications, including triple glazing.
123. Indicative vibration levels for different construction activities are presented in **Figure 2** (in the response to the Anderson submission). Based on this

information and the proposed construction footprint, I do not consider disturbance from construction vibration to be likely.

124. As set out in Technical Report B, good communication is a key part to construction noise mitigation. As part of the CNVMP, the contractor is required to communicate with affected residents and to schedule activities to minimise disturbance (and this is set out in the conditions). Works will be limited to core working hours unless there is a specific operational need. Any night works will be subject to notification. In my experience, done well as is proposed, this will meet the submitter's requested relief around communication.
125. Bridges are proposed to be constructed with mechanically stabilised earth (MSE) abutments constructed in fill, with single-span beams. Extensive piling is not anticipated for the bridge construction. More detail on the construction methodology is provided in Section 4.7.5.1 of the Design and Construction Report.
126. Nightworks will only be undertaken when necessary. It is a preference to work during the day. Where nightworks are required, a Construction Noise and Vibration Management Schedule (DNV4) will be prepared to detail the nature of works, mitigation necessary, and notification requirements.
127. Triple glazing, as requested by the submitter, is primarily designed for thermal performance. High-performance acoustic glazing typically has one pane constructed of laminated glass. In general, I do not consider building modification an appropriate method for controlling construction noise effects, and I do not support the request at this specific location. While construction noise may cause some disturbance at times, it can be managed using standard practices.

Maria Storey, 24 Arapaepae Road, Levin

128. Ms Storey is currently affected by significant (predicted²⁹ at 70 dB $L_{Aeq(24h)}$) road-traffic noise and vibration from Arapaepae Road (SH57).
129. As set out in paragraph 76-77 of Technical Report B, NZS 6806 provides different criteria for 'new' and 'altered' roads, with the latter being less stringent. While this property is subject to noise from the proposed highway, the majority of the exposure will remain from Arapaepae Road rather than the

²⁹ Note predictions at buildings close to the road edge have an increased sensitivity to distance and uncertainties in the input spatial data.

proposed highway. The 'Altered Road' criteria results in the Category A increasing from 57 dB to 64 dB $L_{Aeq(24h)}$.

130. While I did predict noise levels at this dwelling, I did not specifically assess and tabulate (Appendix B.4) noise levels at dwellings that will remain exposed to more noise from existing roads than for the Project as is the case for this submitter. In her submission, Ms Storey raises concerns with being surrounded on three sides, by major roads, and the resultant road-traffic noise effects. She is also concerned with construction noise and vibration. No specific relief is sought.
131. The submitter's dwelling is approximately 16m from the edgeline of Arapaepae Road, and additionally 220m from Queen Street roundabout.
132. Ms Storey's dwelling is approximately 120m from the proposed highway. The predicted noise levels from the highway at the eastern façade are 57 dB $L_{Aeq(24h)}$, while noise levels on the western (Arapaepae Road) façade are predicted as 70 dB $L_{Aeq(24h)}$. This assumes that Arapaepae Road (SH57) remains 80 km/h with the current chipseal surface. This, combined with its present high traffic volume, numerous driveways and intersections, makes Arapaepae Road a noisy environment for the numerous nearby dwellings.
133. The Project will shift most of the traffic (particularly heavy vehicles) from Arapaepae Road to a purpose-built, modern, highway. This in itself provides mitigation.
134. NZS 6806 states at paragraph 6.2.2:

Where PPFs are affected by noise from an existing road, mitigation is only required for road-traffic noise generated on [the project] road.
135. Looking holistically at the effects of road-traffic noise on this property, the appropriate way to further reduce road-traffic noise levels would be building modification, or constructing a noise wall on Arapaepae Road. However, using the guidance from NZS 6806 above, this is not a matter for the Ō2NL Project to address. For this reason, I have not listed Ms Storey's property as a PPF in Schedule 9 of the Conditions.
136. With the transfer of the majority of heavy vehicles from Arapaepae Road to the highway, the number of vibration events at Ms Storey's dwelling is expected to reduce. Vibration from vehicles on the proposed highway will not be perceptible at her dwelling.

137. While this dwelling will remain exposed to road-traffic noise from Arapaepae Road, it will not be exacerbated by this Project. Without the Ō2NL Project, traffic on SH57 would increase and exacerbate the existing noise and vibration problems.
138. Extensive earthworks are not required in this area for the main highway itself, however the primary construction effects will be associated with the construction of the Queen Street Bridge. To minimise effects on SH57, as much work will be completed “offline” as possible without Temporary Traffic Management. All work will be completed in accordance with the Project CNVMP and residents will be advised on how the Project will affect them, and of any upcoming night works.

Martyn Vause, 677A State Highway 1, Kuku East

139. The submitter owns land in Kuku East which is currently undeveloped, but the owner lives on the land in a caravan. The submitter states that the predicted noise levels (55-60 dB $L_{Aeq(24h)}$) are above Waka Kotahi’s guideline values, which are quoted incorrectly as 40 dB (which is the target *internal* noise level). The submitter requests significant noise barriers as well as a low-noise road surface.
140. The caravan is approximately 130m from the highway edge, and the predicted 2039 noise level with the highway is 55 dB $L_{Aeq(24h)}$. The existing noise levels at the caravan are predicted in Technical Report B to be 40-50 dB $L_{Aeq(24h)}$.
141. This is within NZS 6806 Category A. This is an external noise level, whereas the 40 dB guideline value referred to by the submitter is an internal value. The external and internal criteria are explained in paragraph 72 of Technical Report B.
142. Mitigation options were evaluated for the area, including noise barriers and a standard low-noise road surface (such as on Peka Peka to Ōtaki). After considering this submission, I remain of the opinion that this selection is appropriate.
143. The caravan is located approximately 80m from the construction footprint. The road is on approximately 2m of fill in this area, and widespread earthworks will be required at the start of the Project. Noise from construction activities will be varied during the life of the Project. All work will be completed in accordance with the CNVMP and residents will be advised

on how the Project will affect them. With these measures in place, I consider that construction noise effects will be appropriately mitigated.

Dakin & Ally Bramwell, 289 Tararua Road

144. The submitters are concerned with both construction and operational noise, and request that noise is “kept to near zero” as they have moved to the country to live a “low stress life”.
145. The property is over 600m from the highway edge. While this property is beyond the extent of the noise model, I can advise that road-traffic noise levels from the highway are predicted to be below 45 dB $L_{Aeq(24h)}$. This level is well below any health effects, and while highway noise will be audible, the overall noise level is likely to be similar to the existing noise environment experienced at this location.
146. Vehicles using the Tararua Road interchange may generate more noise at times than free-flowing traffic on the highway. The gradient will assist in minimising braking and acceleration at these transitions. The CEDF on page 108 sets out the standards and principles to obtain good environmental outcomes from the interchange design that in my opinion illustrate how noise generated from the interchange could be appropriately managed.
147. I do not consider that the requested “near zero” noise level is an appropriate design standard, nor do I consider it is required to appropriately address adverse noise effects of the Project.

Rochelle & Matthew Apatu, 73 Wakefield Road, Levin

148. The submission raises concerns with both operational and construction noise and vibration. No specific relief is sought.
149. The dwelling is approximately 250m from the proposed highway, and the predicted future (2039) noise level is with the Project is 50 dB $L_{Aeq(24h)}$. For reference, the existing noise level is estimated to range between 47-52 dB $L_{Aeq(24h)}$ with only “a little” contribution from road-traffic noise.
150. While not selected to address effects at this specific property, the proposed highway in this area is selected to have a High-Performance Low-Noise Road Surface. The mitigation options evaluation is set out in detail in Technical Report B. That reduces the noise levels to 50 dB $L_{Aeq(24h)}$. I

consider that the mitigation evaluation process has resulted in a good noise outcome for this property.

151. The dwelling is approximately 220m from the construction footprint. Significant earthworks are not required in this area. While audible, I do not expect construction noise to interfere with domestic activities.
152. I consider that Technical Report B accurately sets out the potential noise and vibration effects, including at this location.

Janice Jakeman, 197 Muhunoa East Road, Ohau

153. The submitter is concerned by construction and operation noise, and the associated loss of rural character. The submitter requests that night works during construction are minimised, planting around the construction compound to reduce perceived noise levels, and a low-noise surface on the bridge.
154. This dwelling is on a residential section, 20m from the edge of Muhunoa East Road. The dwelling will be 150m from the edge of the proposed highway. The predicted future noise level from the highway is 52 dB $L_{Aeq(24h)}$. For reference, the existing noise levels are estimated to range between 40-50 dB $L_{Aeq(24h)}$. At times, distant state highway noise can be heard in the area, but at other times the environment consists only of natural sounds.
155. The property will be affected by the construction of an overbridge, the highway, and by construction vehicles using Muhunoa East Road to access the alignment. Extensive earthworks are not required in this area for the highway itself. Accordingly, we would expect works close to the farm would be undertaken over relatively short periods, and in phases entailing earthworks, then laying pavements followed by surfacing and completion works. I predict that noise levels from the earthworks will meet NZS6803 and with the CNVMP earthworks will be appropriately managed to mitigate noise levels.
156. Formation of the embankments for the bridge will require fill to be imported and compacted and potentially piling. As part of the construction management process, residents directly affected by works such as the bridge construction will be provided with regular and specific updates through the CNVMP as to the nature of work, and where appropriate, construction sequencing may be altered to meet resident needs.

157. Condition DNV4 requires a Construction Noise and Vibration Management Schedule to be prepared where either noise (DNV1) or vibration (DNV2) limits are exceeded. This would provide more specific information to residents as to when activities will occur, for example, on a weekly basis.
158. Presently the “construction compound” is to be primarily used as a laydown area for large bridge components rather than as a primary work area. Noise from the yard is therefore anticipated to be of short duration and is not anticipated to exceed the noise limits of NZS6803. If the primary use of this compound changes that will be communicated to residents and potential noise effects will be managed through the CNVMP and, as required, through Schedules.
159. Nightworks will only be undertaken when necessary. It is a preference to work during the day. Where nightworks are required, the conditions require Construction Noise and Vibration Management Schedule to be prepared detailing the nature of works, mitigation necessary, and notification requirements. This will be prepared in consultation with affected residents.
160. I have been advised that during peak construction periods, approximately 130 heavy vehicles may use Muhunoa East Road per day. The CNVMP will prescribe necessary restrictions on vehicles using the access road.
161. The bridge is likely to be installed with a stone mastic asphalt (SMA) for engineering reasons. While not as quiet as the porous asphalt on the highway, it is still a low-noise surface.
162. **Mr Lister** comments on the requested planting.

Kevin Daly, 257-267 Tararua Road

163. The submitter is involved in the Tara-Ika development and is concerned by the lack of noise mitigation in the area, and that reliance on NZS 6806 has resulted in effects on the proposed development being inadequately assessed.
164. The submission requests noise bunds along the full length of Tara-Ika.
165. The relationship between the Project and the Tara-Ika development is shown in **Figure 3** below, based on the zoning that was notified with PC4. The structure plan was developed in the knowledge of the proposed highway. In my opinion, better acoustics outcomes could be achieved with an integrated

design of Tara-Ika that either locates less sensitive uses closer to the highway, or allows well-designed development that incorporates adequate outdoor amenity.

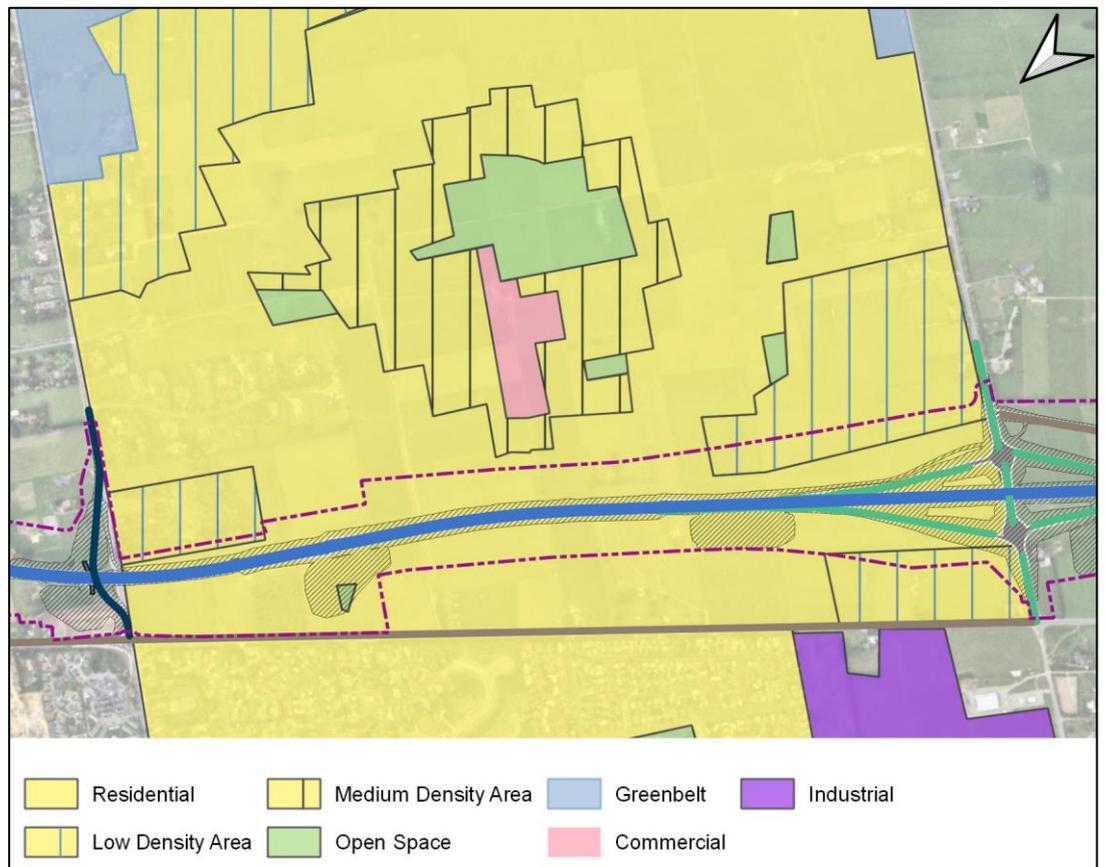


Figure 3 Tara-Ika zoning

166. The land owned by Daly (this submission) and James McDonnell Limited (see below) is shown in **Figure 4**.



Figure 4 Tara-Ika landownership

167. The Project as lodged includes a High-Performance Low-Noise Road Surface along this location. As discussed above, this the quietest road surface presently available for the state highway network. An extract of the noise contours for the Tara-Ika area is shown in **Figure 5**, based on the concept design.

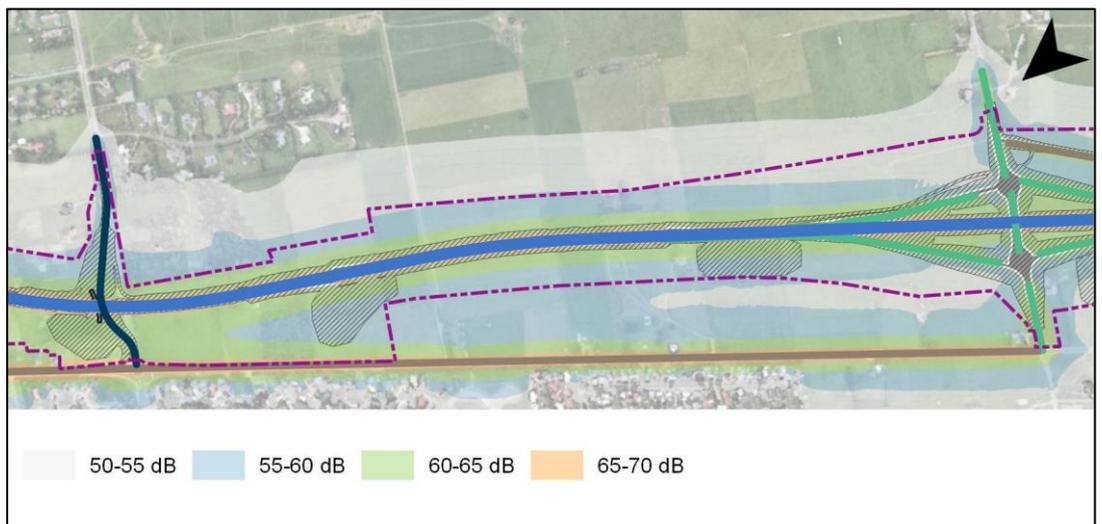


Figure 5 Predicted noise level (2039) with High Performance Low-Noise Road Surface

168. Noise levels from the proposed highway³⁰ are predicted to be less than 52 dB $L_{Aeq(24h)}$ in the land owned by Daly. These noise levels will, in my opinion, be appropriate for urban development.
169. In response to this submission, the submission from James McDonnell Ltd (see below) and comments from Ms Wilkening (see below), I have given further thought to noise within the Tara-Ika area, including bunding / additional noise modelling.
170. In **Figure 6** below, I have predicted the reduction in noise level provided by a 3m high bund/wall located between the highway and Tara-Ika. While the exact noise reduction will depend on both the location of the bund, and the ground level of the Tara-Ika development, this figure shows that outside of the designation, noise levels typically reduce by less than 1 dB. This includes that Daly land.

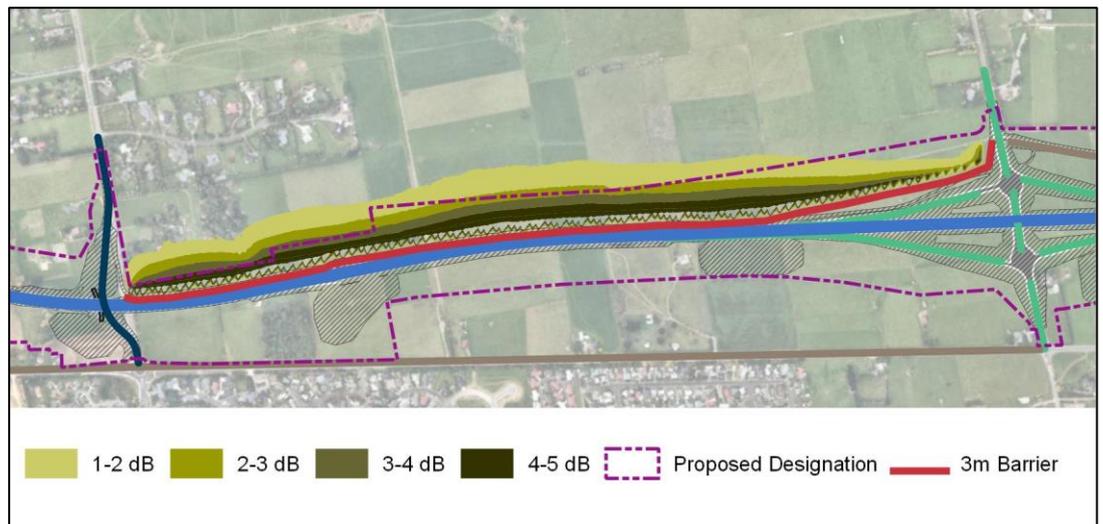


Figure 6 Noise level reduction provided by a 3m high earth bund / noise wall

171. In Noise Mitigation Workshop N4 it was noted that the Project has a deficit of fill material. This means that any earth for bunds would need to be imported from outside of the Project area. In addition, the area was noted as having a high flood risk and that bunds would complicate flow paths.
172. The submitter is concerned that noise below 45 dB $L_{Aeq(24h)}$ has not been considered, and points to paragraph 103 of my Technical Report B saying that noise at 45 dB $L_{Aeq(24h)}$ outside results in 8% of population highly annoyed and 3% suffer sleep disturbance. As stated in paragraph 101 of Technical Report B, a percentage of a population will report annoyance or

³⁰ This excludes noise from Tararua Road.

sleep disturbance in the absence of significant environmental noise. I am not aware of any infrastructure project in New Zealand where mitigation has been designed to reduce noise levels below 45 dB $L_{Aeq(24h)}$.

Prouse Trust Partnership, Karen and Stephen Prouse , 1024 Queen Street East

173. The Prouse submission is concerned with both operational noise and construction noise and vibration, and request the following relief:
- (a) Best practicable option for road surfacing;
 - (b) Noise walls/fences and planted bunds;
 - (c) Mitigation for the Queen Street overbridge; and
 - (d) Building modification mitigation for the homestead "Ashleigh".
174. The submitter's dwelling is 110m from the edge of the proposed highway, and 120m away from the re-aligned Queen Street East. It is 90m from the current Queen Street East alignment, and 280m from Arapaepae Road.
175. The present noise level at the dwelling has been predicted as 53 dB $L_{Aeq(24h)}$ based the traffic from Queen Street East. As traffic on Queen Street East predominantly occurs during the daytime, I expect nighttime noise levels will be similar to that measured at Redwood Grove (closer to 40 dB $L_{Aeq(15min)}$). Without the Project noise levels are predicted to increase to 56 dB $L_{Aeq(24h)}$ in 2039. Again, this is based on traffic from Queen Street East rather than noise from Arapaepae Road. Both noise levels are based on the current chipseal surface, and if the Horowhenua District Council was to resurface Queen Street East with an asphalt, the future noise level would reduce.
176. The future (2039) noise levels with the Project are predicted to be 54 dB $L_{Aeq(24h)}$ at the ground floor and 57 dB $L_{Aeq(24h)}$ at the upper floor³¹. The highway will be the predominant noise source for this scenario.
477. As stated in Technical Report B, noise levels at the dwelling are likely to be intrusive at times. Much of the western curtilage will experience noise levels between 55-60 dB $L_{Aeq(24h)}$. Road-traffic noise is likely expected to be either intrusive or disruptive to people using the outdoor spaces, although in the

³¹ At Paragraph 356 of Technical Report B this was reported as 56 dB, whereas Drawing NV205 shows a level of 57 dB. The modelled noise level was 56.5 dB and the rounding was handled inconsistently.

northern gardens, highway noise may be comparable to noise from Queen Street East.

178. Noise mitigation for the highway was determined using the multi-disciplinary evaluation approach (through workshops) as required by NZS 6806 and described in paragraph 232 of Technical Report B / Figure B.15. This area was reviewed in February 2022 due to the revised vertical alignment of the proposed highway in the area (example of 'Design changes' in Figure B.15).
179. At the previous (July 2021) workshop, the High-Performance Low Noise Road Surface was selected in this area, and while this was listed as a mitigation option, it was considered as the starting point for the mitigation design. As set out in my evidence above, this surface is quietest presently available for the network, and therefore the "best practicable option for road surfacing" requested in the submission will be provided.
180. The mitigation options considered were:
 - (a) The High-Performance Low-Noise Road Surface and a 2m high noise wall;
 - (b) The High-Performance Low-Noise Road Surface and a 3m high noise bund / wall; and
 - (c) The High-Performance Low-Noise Road Surface and a 5m high noise wall / wall.
181. As set out in Appendix E of Technical Report B, the acoustics performance for each option was evaluated as:
 - (a) The 2m high noise wall provides negligible acoustic benefit;
 - (b) The 3m high noise wall Achieves 2-4 dB reduction in the outdoor areas of the Prouse homestead and ground floor facades; and
 - (c) The 5m high noise wall achieves 4-6 dB reduction in the outdoor areas of the Prouse homestead and ground floor facades.
182. Similar to the response to Daly (see above), mitigation in this area is complicated by the deficit of fill material and flood risk. The evaluation of landscape effects by **Mr Lister** prior to the workshop are as set out in Appendix E of Technical Report B.

183. Roadside barriers or bunds were not selected due to their limited acoustic benefit (in the context of the size and extent) and other factors listed above. The benefit of a 3m high bund is shown in **Figure 6** above in the response to the Daly submission.
184. The submission requests mitigation for the Queen Street overbridge. Noise from Queen Street East was not considered when evaluating highway mitigation, however this would not affect the highway mitigation. As set out in Technical Report B (at paragraph 267) the detailed design of Queen Street East should include measures to reduce noise, including a low-noise (asphaltic mix) surface, concrete safety barriers on the bridge deck and eastern abutment³². DRN1 sets out the requirement for an asphalt (SMA) road surface on the overbridge.
185. I have made enquiries and Mr Povall advised that the Road geometrics on Queen Street East are such that no braking is required to negotiate the curve when heading east from the bridge. The noise model I used in my assessment included the elevated nature of the Queen Street East bridge, and increased engine noise for vehicles going uphill.
186. The submission requests building modification mitigation. Based on the predicted external noise levels for the year 2039, I do not consider that this will be required to achieve internal noise levels below 40 dB $L_{Aeq(24h)}$.

Emma & Carl Chalmers, 366 Arapaepae South Road

187. The submission queries how noise will be managed, and requests consideration of noise barriers, double glazing, ventilation systems and the best-performing surfaces.
188. The submitter's dwelling is 130m from the edge of the proposed highway. The contribution from road traffic to the existing noise environment is predicted as 57 dB $L_{Aeq(24h)}$. The predicted future noise level from the highway is 52 dB $L_{Aeq(24h)}$.
189. As a standard practice, multiple noise mitigation options were considered in this area, and subject to a multidisciplinary evaluation, guided by NZS 6806. The design process is discussed in detail from paragraph 232 in Technical Report B and discussed above.

³² See Technical Report B at paragraph 267.

190. The mitigation selected for this area is the High-Performance Low-Noise Road Surface. The different surfaces are shown in Volume 3 Drawing Set 12. See figure NV208. The legend item “EPA (50mm)” refers to the High-Performance Low-Noise Road Surface. I consider this was a robust process and noise barriers are not required.
191. The predicted external noise level 6 dB below the threshold where Waka Kotahi would investigate a property for building modification. Noise levels inside the dwelling will be at reasonable levels with windows ajar for ventilation. I therefore do not support the requested double glazing and ventilation systems.

Alauta & Frederick van Iddekinge, 679A State Highway 1, Kuku

192. Mr and Ms van Iddekinge raise the noise standard used in the design, and request that the High-Performance Low-Noise Road Surface is used instead of the standard low-noise surface selected. They also request that the spoil bund shown indicatively on plans is required as a condition. They request a design report to be prepared confirming that this additional mitigation is effective.
193. The submitter’s dwelling is 80m from the edge of the proposed highway. The predicted future noise level from the highway is 59 dB $L_{Aeq(24h)}$. Currently, the location only has “a little” contribution from distant traffic noise, and the existing noise environment is estimated to vary between 40-50 dB $L_{Aeq(24h)}$.
194. Multiple noise mitigation options were evaluated for this area (D2), including the High-Performance Low-Noise Road Surface and noise walls / bunds of varying heights. It was noted that there may be opportunities to use spoil (unwanted earth from construction) to form bunds.
195. In this area, the Selected Option was to use a standard low-noise road surface. With this surface, all PPFs were within NZS 6806 Category A with the exception of the two Category B PPFs (the submitter’s and 679B SH1). I have identified that these PPFs should be investigated for building modification to ensure that internal noise levels will remain below 40 dB $L_{Aeq(24h)}$. The predicted noise levels for the construction design will include the final ground levels including spoil sites. If noise levels reduce to 57 dB $L_{Aeq(24h)}$ or below, investigations for building modification will not be required.

196. I have recommended the High-Performance Low-Noise Road Surface for approximately 14km of the highway length³³, generally where the density of dwellings supports the intervention, and the surface can be specified in long lengths (generally >1km). In my opinion, in this area these preconditions are not met.
197. I have considered the submission, and I confirm in my opinion the selected mitigation option of a standard-low noise road surface is appropriate, with the proviso that the dwelling is investigated for building modification if the construction design cannot reduce noise levels to 57 dB or below using spoil. This requirement is specified in the conditions.

Sarah Hodge, 11 Ihaka Hakuene Street, Manakau

198. Ms Hodge is concerned with how noise from the construction of the Project, and the long-term operation of the highway, will affect her enjoyment of her property. The submission requests that the southern section of the highway be reassessed, with a stronger resolution to a range of factors, including noise.
199. The distance from the edge of the proposed highway to the dwelling is 340m, and 305m to the workshop at the east of the property. The future (2039) road-traffic noise level with the Project is predicted to be between 48-49 dB $L_{Aeq(24h)}$.
200. For context, the dwelling is 430m from the existing State Highway 1. Existing noise levels are expected to be between 40-50 dB $L_{Aeq(24h)}$, which will primarily comprise natural sounds.
201. I have spoken with Ms Hodge on several occasions, and I have visited her house and workshop in Manakau.
202. This submission states: *we have been assured that mitigation such as tree planting will help us however this is incorrect as we are too high and additionally the noise will bounce off of the opposing immediate hillside.* I have not represented that planting will reduce noise levels, however I have identified that planting / visual screening can assist with the perception of noise. The proposed planting is as set out by **Mr Lister**.
203. The primary mitigation, as with the majority of the Project, is to reduce noise at source with the High-Performance Low-Noise Road Surface. As set out

³³ Subject to multidisciplinary analysis and confirmation as the Selected Option.

above, with this mitigation in place, the predicted sound level based on 2039 traffic is 49 dB $L_{Aeq(24h)}$.

204. The highway behind Manakau is on 2-3m of fill which will be imported from elsewhere. Once these initial earthworks are completed, construction activities in this area will primarily be paving followed by surfacing and completion works.
205. As the construction will be “offline” in this area there will be few reasons for work to occur out of normal business hours.
206. Given the distances involved, construction noise is expected to generally be below 50 dB $L_{Aeq(15min)}$. While this will be audible, I consider noise at this level to be reasonable and should not cause undue effects. I consider that no specific mitigation beyond the adoption of good construction practices (as required by the CNVMP) is required. I note the CTMP will restrict the use of tonal reversing beepers, which are known to cause annoyance even at low sound levels.

James McDonnell Limited (JML)

207. The JML submission relates to the Tara-Ika area, and requests the following:
- (a) Provide an assessment of the noise effects on the planned development and future residents of the Tara-Ika Growth Area, and provide mitigation of these effects accordingly, which could include noise bunds or walls and/or other suitable mitigation.
 - (b) Provide a detailed assessment of the construction noise effects on the planned development in the Tara-Ika Growth Area and provide mitigation of these effects accordingly.
 - (c) Amend the conditions to require that noise emitted during the initial 18 months will comply with the design criteria, and to require that the effects of the chip seal surface will be mitigated accordingly.
 - (d) Amend Proposed Condition DRN3 to clarify what the categories of noise criteria are, and ensure that the noise categories selected and the level of noise effects they would allow are appropriate.
208. As set out in the response to the Daly submission, I have been cognisant that future residential development in the Tara-Ika is planned. The detailed evaluation of noise mitigation alongside Tara-Ika, developed through

workshops and reevaluated in response to submissions, is addressed in response to the Daly submission above.

209. I consider that noise levels will be suitable for urban development with the mitigation provided by the High-Performance Low-Noise Road Surface. While I have not specifically assessed the effects on the utility of the land, I consider that I have appropriately evaluated the relevant mitigation option.

210. I disagree with the need for a more detailed assessment of construction noise effects than set out in Technical Report B. **Figure 7** below is an extract from Figure NV306 in Volume 3 Drawing Set 12, and sets out the anticipated construction footprint³⁴ and the 50m and 200m buffers from this footprint.

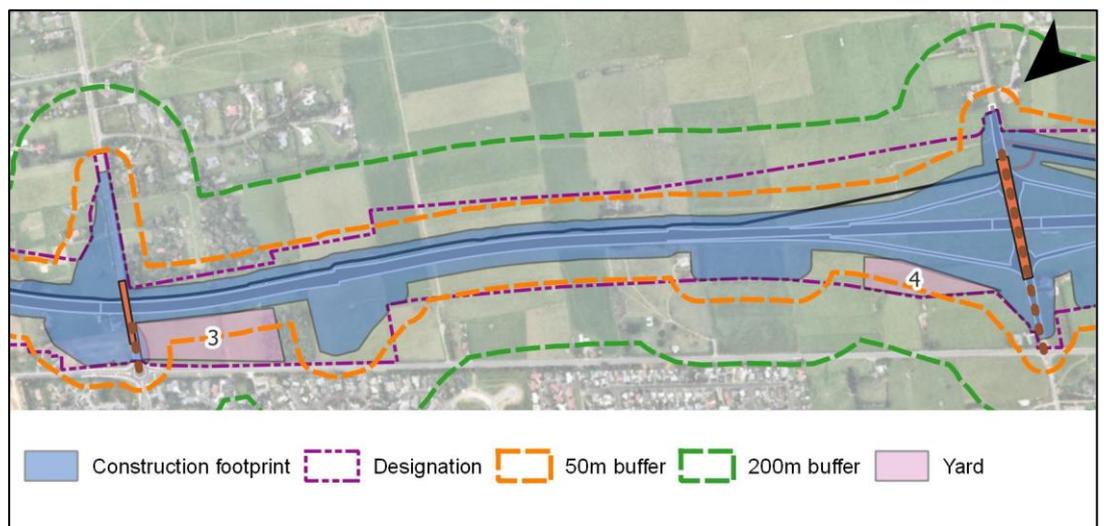


Figure 7 Construction noise adjacent Tara-Ika

211. As set out in Technical Report B³⁵:

- (a) At a distance of 50m there is the potential exceedance of the noise limits from DNV1 for major (bulk) earthworks, however noise from most other activities will comply with these limits.
- (b) At a distance of 200m, while works will be audible, construction noise will be at a level where daytime annoyance is unlikely, and no specific controls are required, beyond standard good practice.

212. Some night works are likely to be required around Tararua Road during the formation of the interchange and will be subject to the requirements of Condition DNV4.

³⁴ Based on the concept design. The footprint may change as the design and construction methodology is refined.

³⁵ See Tables B.14-B.19.

213. While not affecting my assessment and recommended mitigation, the following points are relevant:
- (a) Tara-Ika itself will be an extended construction project for many years. In addition to the construction of the dwellings themselves, there will be intensive infrastructure required to be installed (roads, pipes, stormwater); and
 - (b) Without the final form of the Tara-Ika subdivision and a programme for when dwellings will be built and occupied in various locations, any assessment would be meaningless.
214. I consider the opening of the road with an interim chipseal surface to be a construction effect, and I do not consider amending the conditions to insert a noise limit for this period required or appropriate.
215. For existing PPFs, Condition DRN4 has been edited for clarity, and the Category of each PPF is set out in Schedule 9 of the conditions. I do not consider that setting a “Noise Category” for Tara-Ika “receivers” practical or necessary, as their location is not yet known, and mitigation is set directly by conditions. NZS 6806 explicitly states that undeveloped residential land does not qualify as a PPF. Ms Wilkening agrees that this land does not need to be identified and assigned with a “Noise Category”³⁶.
216. The submission requests that the conditions be amended such that Construction Noise and Vibration Management Plan is required to be “approved” by the District Council. As the CNVMP will form part of the Outline Plan, I do not consider any additional certification to be necessary or appropriate.

Kāinga Ora

217. Kāinga Ora has submitted regarding two facilities in the Project area.
218. The first is at 242 Muhunua East Road (Ohau), which is within the proposed designation and is required for both the construction and operation of the highway. The property will be purchased by the Crown and the buildings removed. On this basis, I have not commented further on this.
219. The second facility is at 96/98 Arapaepae Road, Levin. The submission identifies that the facility is home to residents that have special needs which

³⁶ See p82 of her s198D report.

specifically require these residents to be in an isolated and secure environment, and that they are highly sensitive towards noise and disruption.

220. The submission requests that noise and vibration effects are specifically assessed by qualified specialists, pertaining to each of the two properties, with specific mitigation measures proposed that take into account the particular needs of the residents residing within the two properties.
221. The location of the 4 buildings owned by Kāinga Ora is shown in **Figure 8** below. For clarity, I have referred to these as 96A, 96B, 98A and 98B Arapaepae Road.
222. As lodged, the Project required the eastern portion of the Kāinga Ora parcels, including the land that 96B is sited on. In response to this submission and subsequent discussions with Kāinga Ora, Waka Kotahi has reviewed their land requirement, and has determined that the Project can be constructed without this land, and thus avoid displacing the residents of this building. The extent of the designation sought has been revised as shown in **Figure 8**.

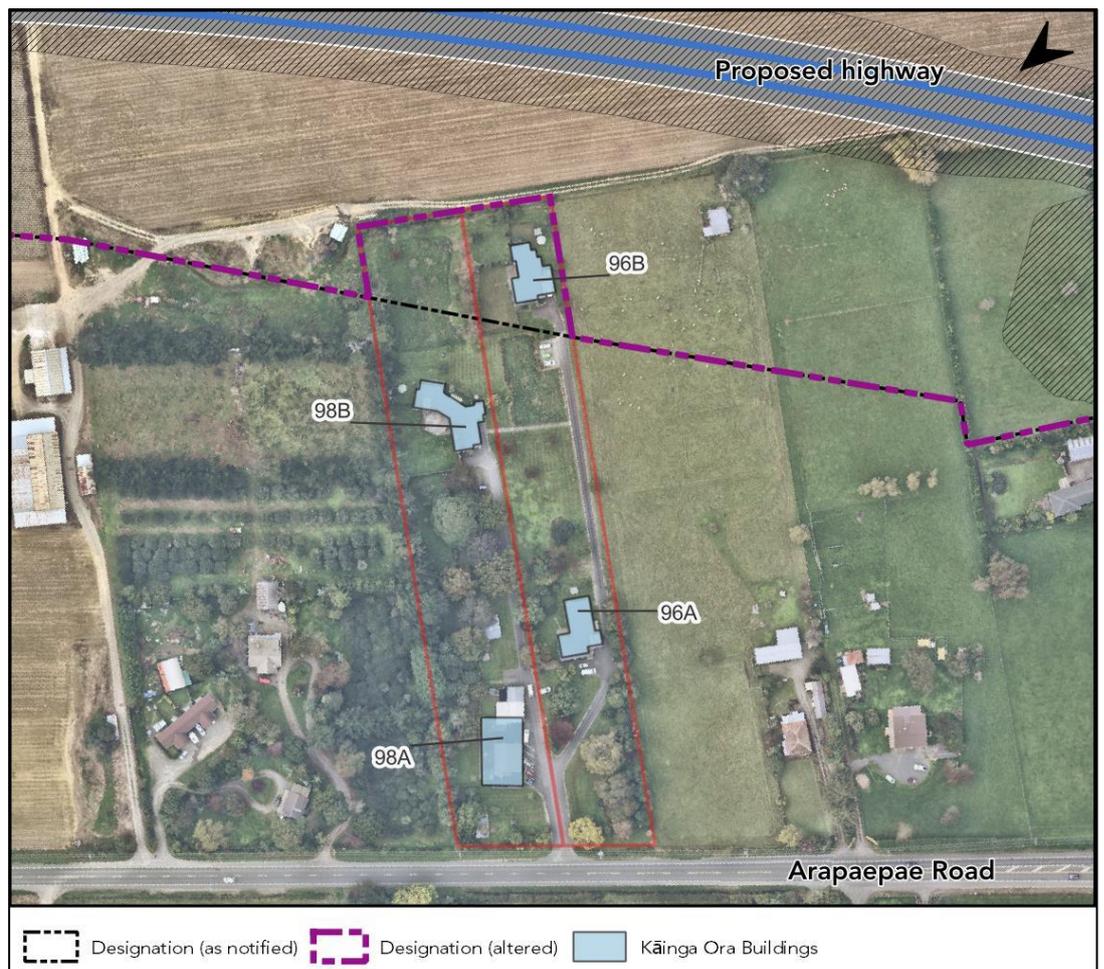


Figure 8 Buildings on Kāinga Ora land

223. In Technical Report B, I predicted noise levels at each of these buildings, except for 98A which was not identified as in residential in use. The selected mitigation in this area is the High-Performance Low-Noise Road Surface, which is common to the highway from Muhunua East to the northern SH57 roundabout. 96B was identified as a Category B PPF which would be investigated for building modification³⁷ but it was also within the designation, and it was assumed to be purchased. As the PPFs in this area did not form a 'cluster', other mitigation options were not evaluated³⁸.
224. The submission requests that noise and vibration effects be assessed taking into consideration particular needs of the residents within the two properties.
225. As set out in paragraph 67 of Technical Report B, the response to road-traffic noise varies from person to person. I do not have the expertise to assess the sensitivity of these individuals, and I therefore cannot assess the specific effects. All acoustics criteria used in New Zealand (including NZS 6803 and 6806) are based on the general population, and there will be people who will be more sensitive than average. Level is just one aspect of noise that people can be sensitive to.
226. While I cannot comment on specific effects from the highway, comparison to existing noise exposure from Arapaepae Road provides useful context to the present noise environment at the site and the Kāinga Ora submission has not identified any existing issues for residents. I have also predicted the future noise levels in 2039 both with, and without, the Project. Noise contours are presented in Drawing Set 12.
227. That modelling shows that:
- (a) For the two dwellings adjacent Arapaepae Road (96A and 96B), Arapaepae Road will remain the dominant source of noise. The future noise levels with Project will be 1-4 dB higher than the current road-traffic noise levels, both with and without the Project
 - (b) For the two dwellings closer to the proposed highway, the eastern facades will experience a new noise source. Road-traffic noise from Arapaepae Road was previously screened by the buildings themselves, however they now face the new highway.

³⁷ If it remains Category B in the detailed design.

³⁸ A 'cluster' is defined by NZS 6806 as three or more PPFs that would benefit from common mitigation. The two dwellings closer to Arapaepae Road (96A and 98A) would not materially benefit from noise walls along the highway.

228. Based on the concept design, 96B Arapaepae Road is in NZS 6806 Category B, albeit at the lower end. As identified in Technical Report B, these building should be investigated for building modification. I also understand that Waka Kotahi offers boundary improvements (fence/wall) between their land and the Project land and reasonable mechanical ventilation for 96B (as set out in **Mr Dalzell's** evidence).
229. As identified in the Kāinga Ora submission, any mitigation measures specific to the residents of these properties will need to be developed by mental health specialists. This would be a continuation of the support provided during the construction period (discussed below).
230. The Project will result in a shift of many of the heavy vehicles using Arapaepae Road (currently SH57) to the new purpose-built highway, where they will travel at constant speed and result in a reduction in the number of 'high noise events' that my currently be experienced. Nevertheless, traffic volumes (and noise) on Arapaepae Road will remain high in the future, even with the construction of the proposed highway.
231. Despite the purpose-built highway and the quietest road surface on the network, there will be some residual noise effects from the Project. This is consistent with the remainder of the Project and common to the construction of major infrastructure.
232. In response to this submission, I have considered whether additional physical mitigation is appropriate. I revisit this after discussing construction noise.
233. In relation to construction noise, earthworks in this area are considered minor in the scale of the Project, with the proposed highway designed to be on approximately 1m of fill above the existing ground level. In my assessment (Technical Report B) I have predicted construction noise levels based on typical earthmoving equipment. Ranges of source levels for construction equipment are provided in the Waka Kotahi guide to construction noise and vibration³⁹.
234. For each building, I have set out a range of construction noise levels likely to be experienced when works are occurring adjacent the site.

³⁹ NZ Transport Agency (2019) *State highway construction and maintenance noise and vibration guide*. V1.1.

Table 7 Indicative construction noise levels from earthworks, dB $L_{Aeq}(15min)$

	96A	96B	98A	98B
Distance to construction footprint	180m	40m	220m	90m
Indicative noise levels from earthworks	55-60 dB	65-70 dB	53-58 dB	60-65 dB

235. Vibration from earthworks may be perceptible and cause some disturbance for people living at 96B Arapaepae Road during construction. The most significant vibration will be from the use of a vibratory roller. At 98B Arapaepae Road, vibration has the potential to be perceptible at time times but is unlikely to cause disturbance.
236. Construction activities adjacent to these properties can be limited to daytime hours, which will generally correlate to elevated noise levels from Arapaepae Road.
237. The predicted noise levels are all within the noise limits within DNV1. However, as set out in Technical Report B, compliances with these noise limits does not mean that there will not be any effects.
238. As mentioned above for construction noise communications will be important. In addition to communication, given the sensitivities of those living at the site, I recommend, and the conditions (DNV-4) have been amended accordingly, that a Construction Noise and Vibration Management Schedule is to be prepared for any construction works occurring within 100m of the site. This will provide Kāinga Ora with the necessary details of the nature of the activity, likely noise and vibration levels, duration, and any specific mitigation which would be tailored to the needs of the individuals. These measures are in addition to general good practices set out in the CNVMP. As mentioned above, Waka Kotahi has also offered a fence/wall and ventilation funding for 96B.

Simon Austin, 63 Arapaepae Road, Levin

239. This submitter is concerned about the “background roar” of road-traffic noise from the highway, and states that noise is disruptive and not life enhancing. He requests that mitigation is employed to reduce these effects.
240. The submitter’s dwelling is 230m to the west of Arapaepae Road (SH57), and over 450m to the proposed highway. Given these distances, this dwelling is not considered a PPF under NZS 6806, and has not been specifically assessed in Technical Report B.

241. I have predicted a future road-traffic noise level of less than 50 dB $L_{Aeq(24h)}$ at this property, and the contribution to this level is mostly from Arapaepae Road, which will remain a busy road despite the introduction of the proposed highway. This is a comparable level to the existing road-traffic noise level from SH57.
242. The Project includes the High-Performance Low-Noise Road Surface in this area (from the northern interchange with SH57 south to Muhunua East Road). I do not consider additional mitigation is warranted.
243. As set out on paragraph 52 of Technical Report B, all corridor options for the road alignment that were considered during the development and option assessment for the Project affected a significant and similar number of houses, and there was no clear noise preference for any particular corridor option. To the degree the submitter questions corridor section, I do not consider there to be an acoustics reason for reconsidering the corridor selection process and that the Project's noise effects have been appropriately mitigated.

COMMENTS ON THE COUNCIL REPORTS

244. I have reviewed the s198 report of Ms Helen Anderson and in particular Appendix 3 which is the report of Ms Siiri Wilkening. I have responded to the report in the order it was presented, rather than the order of Technical Report B.

Construction noise

245. Ms Wilkening agrees that construction noise and vibration can be appropriately managed through a well-understood and tested process of Construction Noise and Vibration Management Plan (**CNVMP**) and Schedules. Ms Wilkening identifies that conditions proposed by Waka Kotahi in the application did not reflect this established process, nor all of the recommendations of Technical Report B. In general, I agree with her observations, and discuss conditions collectively later in my evidence.
246. While Ms Wilkening agrees that the level of detail in my assessment is appropriate, she considers I could give a higher level of confidence to my predictions, given that equipment and processes typically do not materially change between projects.

247. I agree that equipment and processes are relatively unchanged, however the key uncertainties are the location and duration of activity adjacent PPFs. In my assessment I have been conservative as to the intensity of work at the locations closest to PPFs. This has been to both inform the level of effects, and to also identify which activities and locations are likely to require further scrutiny during the construction process (especially as Ō2NL is being consented only with a concept design).
248. Ms Wilkening notes that I have not assessed construction effects on any non-residential receivers such as businesses (commercial or industrial). Unlike many urban projects, there are no industrial or commercial areas affected by the construction of the Project. Although an individual business is not a PPF, I agree with Ms Wilkening that businesses should be considered as appropriate, and that the management framework addresses effects as required should they arise. DNV-1 has been updated to include stipulated buildings that accommodate commercial activities, consistent with Table B.8 from Technical Report B which did identify appropriate limits for commercial and industrial receivers.
249. Ms Wilkening questions whether vibration from rolling / compaction is likely to exceed the Category A limit. I have reviewed the distances and predicted vibration levels from the alignment itself, rather than the entire construction footprint. There is the potential for some PPFs (fewer than 10) in the Arapaepae South Road to have vibration exceeding Category A depending on ground conditions and the final layout of the road. However, in general, I expect vibration levels from rolling / compaction to be below the Category A limit.
250. The appointed contractor would be expected to perform vibration trials in multiple locations to better understand both emission levels from equipment and the propagation through the ground. Informed by these vibration trials, the contractor will predict vibration at relevant PPFs and where the vibration limits from DNV-2 are exceeded, a Schedule will be prepared in accordance with DNV-5 setting out anticipated effects and the mitigation that will be implemented. This mitigation may be limited to enhanced communication, or alternative equipment or settings with reduced vibration generation may be selected.

Operational noise and vibration

251. There is a high degree of agreement between Ms Wilkening and I in regard to potential operational effects of the Project and the appropriateness of the selected mitigation. Specifically, we agree that:

- (a) The proposed mitigation appropriately manages the actual and potential noise effects from the operation of the new highway;⁴⁰
- (b) The residual effects are overall acceptable, provided the mitigation proposed is implemented;⁴¹ and
- (c) Operational vibration has no material effects and has been adequately assessed.⁴²

252. Ms Wilkening has identified some areas where clarification is sought, and others where she would have taken a different approach had she conducted the assessment. Key themes are:

- (a) Use of guidance other than NZS 6806;
- (b) Quantification of the existing environment; and
- (c) Description / assessment of the change in environment.

253. She has also comment on the proposed conditions, which I have discussed under a separate section.

Guidance other than NZS 6806

254. As set out in my evidence above, my assessment has considered matters beyond the typical NZS 6806 approach. While Ms Wilkening questions the usefulness of these additional matters, she agrees with the mitigation that I selected, and residual effects are acceptable for a project of this scale.

255. Ms Wilkening considered that the reported 'existing' noise levels reported in Appendix B4 for areas remote from the road network are likely to be at the lower end of the range I have reported, and thus I may have understated the effect of the Project. In particular, she is concerned with the use of long-term noise monitoring without the removal of adverse weather conditions.

⁴⁰ s198D Report at paragraph 16(c).

⁴¹ s198D Report at paragraph 16(d).

⁴² s198D Report at paragraph 58.

256. I disagree that my results in Appendix B4 understate the effects of the Project because:

- (a) The 'existing' noise levels in Appendix B4 are primarily based on my observation of the sources heard in each area as well as attended measurements. For these measurements I was able to confirm that the measurements were valid.
- (b) During community engagement, I was advised that the sea breeze (westerly) increases noise propagation from SH1 to areas such as Manakau Heights. As such, I did not want to exclude all measurements outside of the 'weather window' defined by NZS 6801.
- (c) In addition, wind can cause vegetation noise, which raises the residual sound levels. In my view, this is a valid component of the 'existing environment'. That said, I acknowledge that for wind speeds over 8m/s, wind noise directly on the microphone may exceed 50 dB L_{Aeq} and present a false reading⁴³.
- (d) For this Project I have not focussed on presenting the "existing environment" as a single number, but rather what it is composed of, how this varies over both time of day, and also from day-to-day.
- (e) I have clearly identified that the subjective response for many people near the proposed highway will be intrusive or disruptive, and I have not used the existing noise levels to discount effects.

257. The existing noise levels in Appendix B4 are primarily guided by attended measurements and have been grouped by area. I have not investigated properties individually to ascertain the level of foliage that may generate background noise, nor the amount of birdlife.

Change in environment

258. Ms Wilkening states⁴⁴ "*New roads tend to change not only the noise levels but also the character of the environment. This is inevitable. Mitigation is intended to reduce the effects as far as practicable, however, the change in character will still occur.*"

⁴³ Cooper, Leclercq and Stead (2010) *Wind induced aerodynamic noise on microphones from atmospheric measurements*. Proceedings of 20th International Congress on Acoustics, ICA 2010.

⁴⁴ s198D Report at paragraph 80.

259. I agree. For this reason, I have not focussed on the change in noise level in simple numeric terms. In addition to the uncertainty associated with expressing the existing environment as a single number (discussed above), I do not consider that the effect of the Project is lower for properties with Kowhai trees with noisy Tūī in them, compared to a property with sparse vegetation with lower existing noise levels.
260. I have identified that road-traffic noise from the Project is likely to be intrusive for many properties near the alignment. I have provided examples of how people are likely to experience these effects, including potential behavioural adaptations that will be required.

Tara-Ika

261. Ms Wilkening identifies that if a landscaping bund on the interface between the highway and Tara-Ika provided an acoustics benefit, she would be supportive of such a bund. As set out in my response to the submissions from Daly and JML, the acoustics benefit of such a bund would be primarily limited to land within the designation and should be considered incidental to the landscape benefit.
262. However, unless the case for a bund is made for a landscape / urban design reasons for a bund, my interpretation of Ms Wilkening's report is that she does not require this for noise mitigation purposes. I therefore disagree with Ms Anderson where she states in the table in paragraph 16, and at paragraphs 80(e) and 83 of her 198D report that Ms Wilkening recommends a requirement to provide an acoustic bund. Irrespective, I have set out above, in relation to the Daly submission, the limited noise reduction utility that such a bund would provide.
263. Ms Wilkening states that noise management is a shared responsibility⁴⁵. I agree. This is particularly the case where the future landform and layout is not yet confirmed. As set out in my response to the Daly/JML submission above I also encourage an integrated design of Tara-Ika that either locates less sensitive uses closer to the highway, or allows well-designed development that incorporates adequate outdoor amenity.

⁴⁵ s198D Report at paragraph 82.

Conditions

264. Ms Wilkening has commented on the following conditions included in the application, made suggested changes and my response is shown in **Table 9**.

Table 8 Comments on conditions - construction noise

Para	Council Comment (Ms Wilkening)	My Response
31	There is currently no review process for Schedule to the CNVMP. If there is not a reviewer agreed between Waka Kotahi and the Councils, then the Councils should be provided copies of the Schedules	<p>The process for preparation, approval, and review of Schedules will be documented within the CNVMP.</p> <p>Schedules will generally be prepared by project staff and approved by the Contractor's Environmental Manager prior the activity taking place.</p> <p>DNV4 c) states that Schedules will be provided to Councils for information. This will give the Councils visibility of the process.</p> <p>I have recommended that the implementation of Schedules is regularly audited and monitored, with the results of these provided to the Councils. The CNVMP will set out the audit/monitoring requirements. If the Schedules are not adequately managing effects, this should trigger a review of the CNVMP.</p>
34	Criteria for non-residential receivers should be provided in DNV-1	Criteria for non-residential receivers has been added to DNV-1. This has been limited to buildings that have commercial activities within them (based on the definition from the Horowhenua District Plan)
35	Ambiguity in vibration criteria in DNV-2	<p>Condition DNV-2 has been reworded such that construction vibration achieves the limits set out in the table (both Category A and B) as far as practicable.</p> <p>Exceeding either or both of those criteria will result in a management response, which will depend on which criteria is exceeded.</p>
36	Condition DNV3, while labelled "Construction noise and vibration mitigation", only discusses noise levels but not vibration. I recommend that "and vibration" is added after each instance of "noise" in DNV3 (b) to be comp	<p>I agree with tis comment.</p> <p>DNV3 and 4 have been redrafted, and clearly reflect that both conditions equally refer to noise and vibration.</p>
38	CNVMP contents	
a	Receivers that are not PPFs are omitted. Subpoint (e) only references PPFs rather than all occupied or unoccupied buildings	Reference to "Buildings that accommodate commercial activities" has been added to Schedule 2 to the Conditions, which sets out the content for the CNVMP
b	The requirement for building condition surveys, should the construction methodology result in vibration levels approaching Category B (building damage) vibration limits, is also omitted	<p>I agree with this recommendation, although I note that Waka Kotahi / the Contractor may decide to conduct building conditions survey more broadly as a risk management exercise, even when predicted vibration levels are below cosmetic damage criteria.</p> <p>Schedule 2 now includes a requirement that the CNVMP must include:</p> <p><i>a methodology for condition surveys of properties and structures that may be subject to actual structural or cosmetic vibration damage from construction activities and a process to identify and respond to any such occurring;</i></p>

Para	Council Comment (Ms Wilkening)	My Response
c	There is no requirement for audits and inspections to be undertaken to ensure that the CNVMP, Schedules and BPO management of effects are being implemented.	I agree that the CNVMP should set out these requirements ⁴⁶ . As set out in the evidence of Ms McLeod, this matter is better addressed through the contract and specifications.
d	There is no requirement to review and update the CNVMP. Given the timeframe of this Project, the CNVMP should be updated annually or biannually to ensure it remains a live and relevant document, and Council should be informed of the updates. Should material changes be made to the CNVMP during such a review, the Council should re-certify the CNVMP	I agree the CNVMP should be reviewed and updated periodically. As set out in Schedule 2, the overarching CEMP will contain: methods, <u>and any triggers</u> , for reviewing, amending, augmenting and updating the Construction Environmental Management Plan (including the management plans listed in Table SCH2-1) consistent with Conditions DGA6 and RCM6.
e	There is no requirement for the CNVMP to be prepared by a suitably qualified person agreed between the Councils and the requiring authority. This is recommended by Mr Smith, and should be carried through to the conditions	There is a typographic error in Technical Report B at paragraph 324 (c). The report should read: The CNVMP should be prepared <u>reviewed</u> by an independent consultant prior to being issued to the Council(s) for certification. The CNVMP may be prepared by the Contractor's Environmental Manager (provided they are suitably qualified and experienced) or by a consultant acoustics expert. This person will not be "independent" from the project. Waka Kotahi standard practice for large and/or high risk projects is that CNVMPs will be peer reviewed prior to submission to Councils. For efficiency, it would be desirable if this consultant was agreeable to Councils.
40	The content or objective for schedules not defined in Conditions	DNV4 now sets out the content of the Schedule
41 f-g	Suggested content for new condition identifying when a schedule is required	The Objective recommended is consistent with what I recommended in TR-B 130(b) I agree with the content recommended, and this has been considered as part of broader re-drafting of the construction noise and vibration conditions in DNV4.
h	Submittal of Schedule to Council for comment	I agree that this is reasonable for transparently and this is addressed in condition DNV4 c)

265. In addition, Ms Wilkening has commented on the conditions included in the application relating to operational noise and my response is set out in **Table 10**.

Table 9 Comments on conditions - operational noise

Para	Council Comment (Ms Wilkening)	My Response
61	DRN1. Timing of low-noise surfaces. Why 18 months rather than 12?	This requirement has been redrafted. A winter season (May to October) is required before sealing to enable the pavement to settle and to

⁴⁶ As stated in Technical Report B at paragraph 324(h).

Para	Council Comment (Ms Wilkening)	My Response
		accommodate the High-Performance Low-Noise Road Surface.
62	Asphaltic mix vs EPA70 (30mm)	Condition DRN1 refers to asphaltic mix rather than (E)PA7 30mm or equivalent, on the basis that the full extent of road segments that will be subjected to higher stresses and will require a Stone Mastic Asphalt surface. SMA generates more noise than EPA7 (30mm). Condition DRN1 allows "Ramps, interchanges and merge areas" to be SMA10/14 or equivalent. These areas have greater wear and require a stronger surface.
63	DRN4(b) delay in post-construction review	I agree and condition DRN4 has been amended accordingly.
65	Maintenance	I agree with the intent of this comment, however I have been advised that is not a matter for conditions.

IMPLEMENTATION DETAILS

266. In Technical Report B I set out recommendations for conditions I considered necessary to adequately control the potential effects of the Project. These were not adopted in full in the conditions lodged with the application, as noted by Ms Wilkening and Ms Anderson. I am now satisfied that the proposed conditions are appropriate.
267. Since the application was lodged, there have been discussions within the Project team as to the framework for conditions and the relationship to the minimum contractual requirements. Ultimately the conditions, final design, procurement parameters and constructor approaches all influence the final outcome. My evidence addresses the first two and Mr Dalzell's evidence touches on the others.
268. In this section, I discuss:
- (a) Outcomes sought during the detailed design, construction, and opening of the highway. I have separated this from how the outcomes will be achieved;
 - (b) How procurement processes influence these outcomes; and
 - (c) What conditions are necessary, and what level of specificity is required so they provide certainty while retaining appropriate flexibility for the contractor to be innovative.

Outcomes

Operational noise

269. NZS 6806 provides guidance sufficient for a consenting environment, but a framework to take the consented design through to construction is required.
270. The desirable outcomes include:
- (a) Design and constructed noise levels are consistent with (but not necessarily equal to) the consented design;
 - (b) The form of mitigation applied during design and construction is consistent with the best practicable option established through the consenting process;
 - (c) Design and construction changes are reviewed by a suitably qualified person through the lens of the noise mitigation evaluations, and reconfirmed as BPO where there are material changes;
 - (d) Construction does not result in defects or other physical elements that give rise to unanticipated road-traffic noise; and
 - (e) Community expectations and concerns are proactively managed before road opening, including the temporary effects before installing the low-noise surfaces.
271. While the overall layout of the Project's construction design will remain in general accordance with the application, the vertical and horizontal alignments of traffic lanes will almost certainly move within the designation during design development and refinement. This may result in minor changes to noise levels at PPFs.
272. Predicted noise levels from the consenting design are not de facto noise limits (and as above I agree with Ms Wilkening on this matter). However, appropriate checks and balances are necessary to ensure that the design and constructed effects are consistent with those assessed in the application and authorised by the designations. As explained in Technical Report B, standard practice, and the Waka Kotahi framework, is to use any increase in NZS 6806 noise category (i.e. Category A to B, or Category B to C) as a threshold for re-evaluation of the required noise mitigation.

273. As the present best practicable option for noise mitigation has been selected through a multi-disciplinary evaluation process, the detailed design must include this as the starting point.
274. Any variation from the presently selected mitigation must pass through a robust change management process is required as set out in condition DRN3. Where mitigation is re-evaluated, this needs to be through a multidisciplinary process and the relevant considerations (including construction costs, engineering degree of difficulty, stormwater management, landscape and visual effects, and cultural effects) documented.
275. The construction design needs to be well coordinated to ensure all elements that affect noise generation or mitigation have been included. The contractor's acoustics specialist is responsible for gathering evidence that the acoustics requirements have been included in the design. This is captured by Condition DRN3 and will be amplified through the procurement process by reference to Specification P40⁴⁷.
276. The other element is to ensure strong resident and public communications. The proposed communications plan (Condition DCE4) is critical to ensuring expectation management and providing useful information to affected people and communities, at the relevant time. The Project's acoustics specialist should provide early input to the communications plan as it is drafted.

Construction noise and vibration management

277. Construction noise and vibration must be proactively managed. This is irrespective of whether the noise limits from NZS 6806 (and other vibration criteria) are achieved or exceeded (the later requiring additional process steps).
278. As mentioned above, residents are more tolerant of noise from construction if they understand what they will experience, the likely duration, progress, and a clear end date. Residents must have an informed and available contact to answer any questions about the construction progress or if an issue arises to provide a prompt response. This is all provided through the community liaison person (Condition DCE1) and communications plan (DCE4).
279. In addition to what is required through the conditions the contractor should instil a culture of reducing noise emissions where practicable. This can be

⁴⁷ NZ Transport Agency (2014) *NZTA P40 Specification for noise mitigation*. Currently under review.

through global behaviours such maintaining equipment, not having loud music playing, using radios to communicate rather than shouting) or specific actions such as selecting quieter alternatives or installing temporary noise barriers around generators, pumps, or cutting/grinding work areas. In my experience having training of the conditions, and good practice noise mitigation behaviours helps to deliver stronger outcomes. This will be covered in both the CEMP and CNVMP.

280. For high-risk activities (such as night works, or daytime works within 50m of dwellings), the contractor should predict noise (and vibration) levels for each step of the task. These predictions should be based on source levels validated on site. Based on these predictions, any additional mitigation warranted should be adopted, or the construction methodology should be revisited to avoid or reduce source levels. Affected residents should be informed of the proposed works, and any feedback on scheduling should be adopted where practicable. This Schedule process in Condition DNV4 sets out how this process will occur on this Project.
281. Residents should be offered temporary relocation as a backstop if construction noise levels cannot be sufficiently reduced. This is not anticipated on this Project but should remain an option. I expect this would only be warranted if a high-noise activity needed to work close to a dwelling throughout the night.

Procurement / Contract

282. Waka Kotahi can influence the Project outcomes through the procurement process. This includes the use of Minimum Requirements and other specifications, which manage effects beyond what is required by the designation conditions. As set out in the evidence of **Mr Dalzell**, the chosen procurement model of an alliance means that Waka Kotahi will be an active partner in the delivery of the Project.
283. For operational road-traffic noise, Specification P40 provides the necessary detail for the Noise Mitigation Plan required by DRN3 and the Post-Construction Review Report required by DRN4. It also sets out relevant quality assurance measures.
284. Waka Kotahi typically references that the contractor must follow the good practices detailed in the *Construction Noise and Vibration Management*

Guide, and is currently preparing a standalone specification for construction noise management.

285. Beyond requiring education, successful implementation of construction noise management is primarily behaviour-driven and is therefore difficult to condition.

286. This is best addressed by Waka Kotahi, and its ongoing relationship and general performance reviews with the appointed contractor and is explained in the evidence of **Mr Dalzell**.

287. However, I agree with Ms Wilkening,⁴⁸ that this is not directly a matter for the Court; I have provided it for context, so the Court is aware.

Conditions

288. I have addressed the matters raised by Ms Wilkening above.

Michael James Smith

4 July 2023

⁴⁸ s198 Report at paragraph 30.