TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Strategic Assessment of Operational Noise Effects

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Version 1

WAKA KOTAHI
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Responsibility	Name
Author	Siiri Wilkening / Owen Li
Reviewer	Claire Drewery
Approver	John Daly

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Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
BPO	Best Practicable Option in accordance with Section 16 of the RMA
CC2W	City Centre to Westgate
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SG	Te Tupu Ngātahi Supporting Growth
SH16	State Highway 16
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Strategic Assessment Package	Four Notices of Requirement (for ASH, RTC, Station Road and SH16) and one alteration to an existing designation (SH16 Main Road) for the Whenuapai Arterial Transport Network for Auckland Transport.
Projects	North West Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement for Waka Kotahi NZ Transport Agency and Auckland Transport

1 Executive Summary

This assessment assesses operational noise from road and station operations, and road vibration against relevant standards and guidelines. Where necessary, we have investigated and recommended mitigation.

Road traffic noise for any new or altered roads as well as bus rapid transit has been assessed against NZS6806 and other relevant guidance, including the Waka Kotahi "Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects". In addition, we have assessed the change in noise level due to the Projects. We have assessed potential noise levels and recommended mitigation to achieve compliance with the recommended limits.

Station noise has been assessed against the underlying zone noise limits of the AUP:OP.

Walking and cycling are not expected to generate noise levels high enough to affect the ambient noise environment, especially where the facilities are adjacent to busy roads.

The Strategic Assessment Package results in a redistribution of traffic across the wider area. It enables people to choose different transport modes (other than cars) and therefore results in a redistribution of traffic, including freight and inter-regional trips from SH16 Main Road to the Alternative State Highway.

NoR S1 Alternative State highway (ASH), including Brigham Creek Interchange (BCI)

Results of assessment and recommended measures

The ASH corridor, including the BCI, is within a largely rural area, with the exception of the connections to the existing SH16, where residential and business uses prevail. Intermittent rural dwellings are generally located 50 metres or more from the road.

We have assessed the traffic noise levels from the proposed ASH and BCI against NZS6806. The introduction of a new major road into a currently low noise mainly rural environment is predicted to result in significant noise level increases for some PPFs, especially in the area removed from other main roads. This section of the Project is assessed as a New road. Where the ASH connects with SH16 (where it is assessed as an Altered road), the change in traffic volume due to the suite of NoRs discussed in this report and the proposed mitigation measures will result in a reduction in noise level.

The ASH is assumed to be constructed using low noise road surface (Open Graded Porous Asphalt PA10 has been assumed in the modellingPA10). In addition, 2.4m high roadside barriers along the ASH and 2m high boundary fences at some PPFs will ensure that no PPFs would receive noise levels within Category C, and that more PPFs would receive noise levels within Category A than would be the case without the Project. While one third of PPFs are predicted to receive noticeable to significant noise level increases (generally adjacent to the New road) , with mitigation the resultant noise levels are acceptable for residential use.

Conclusion

Overall, with the barrier mitigation implemented as recommended, the effect of the Project is on average positive, with two thirds of PPFs receiving noise levels that are at or below the levels that would be experienced without the Project.

NoR S2 SH16 Main Road Upgrade

Results of assessment and recommended measures

The SH16 Main Road upgrade will alter an existing designation which already authorises the operation of the road. The proposed alteration will provide walking and cycling facilities, without the provision of additional traffic capacity.

The proposed establishment of walking and cycling facilities along SH16 is predicted to not cause any appreciable noise level change. The noise environment is currently, and will remain, controlled by traffic on SH16. No additional traffic capacity is created on SH16; rather, changes to lane configurations and intersections upgrades are introduced to make walking and cycling safer. These changes do not cause any noticeable effect on the overall noise environment.

We have not proposed any additional mitigation given the works involve walking and cycling upgrades and do not significantly affect traffic lanes

Without the North West Strategic Package implementation, noise levels in the future will continue to increase significantly and range from around 60 to 70 dB $L_{Aeq(24h)}$ at the walking and cycling paths.

Conclusion

Overall, we predict a noise level reduction in the vicinity of SH16, due to the redistribution of traffic across the area as a function of the suite of NoRs assessed in this report. Traffic volumes will reduce, with many using the proposed ASH. This effect is not due to the project, but the overall changes anticipated in the area.

NoR S3 Rapid Transit Corridor (RTC) and Regional Active Mode Corridor (RAMC); NoR KS Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

Results of assessment and recommended measures

The RTC and RAMC will straddle the Rural Urban Boundary and connect Kumeū-Huapai with Westgate and Auckland City. The alignment traverses two distinct sections. The rural section connects BCI with the existing SH16 via the North Auckland Line (NAL). In this area, existing noise levels are in the 50s dB L_{Aeq} with intermittent noise from trains passing. The urban section along SH16 Main Road, with elevated noise levels of mid-60 to low 70 dB L_{Aeq}. For sections the corridor will be co-located with other SGA North West Strategic Projects (i.e. NoR1 ASH and NoR 2 SH16 Main Road). Should the ASH already have been implemented, existing noise levels at time of implementation would be higher than currently, due to the increased traffic in a currently rural area. The RTC will accommodate electric bus transport.

The two stations are both located in the vicinity of the existing SH16. The Kumeū Station is located in a business area with ambient noise levels in the mid to high-60 dB L_{Aeq}, which is unlikely to change in the future. Huapai Station is located in the Future Urban Zone (FUZ) adjacent to SH16, with ambient noise levels affected by SH16 and in the low to mid-60 dB L_{Aeq}. The land is currently used for rural activities. Noise levels in the area will remain affected by traffic on SH16 even when the FUZ is developed.

NoR S3 is intended to facilitate electric bus transport. We predict minimal effects on the overall noise environment. The buses would be co-located with existing transport routes (rail and road) and,

provided that the road surface is well maintained, buses would add only marginally to the overall noise level experienced by PPFs in the vicinity of the road.

Stations can be designed so that compliance with the relevant noise limits can be achieved. Closest sensitive receivers are at significant distances. Therefore, we do not anticipate that station noise will have any significant effect on the overall noise environment.

Conclusions

It is unlikely that specific mitigation will be required for the electric bus based RTC, provided that the road is maintained as a smooth and even surface. With appropriate design effects from the RTC and stations will be reasonable and may not be noticeable when adjacent to major roads.

NoR S4 Access Road

Results of assessment and recommended measures

Access Road is an existing road in a currently rural area. Existing noise levels are relatively low, given the distance from any major transport or commercial areas, except where Access Road connects with SH16. Should the ASH have been implemented already, ambient noise levels would be somewhat more elevated due to the new transport route.

It is proposed to widen the existing road and provide walking and cycling facilities. The proposed widening will bring traffic lanes closer to some dwellings. However, if the suite of NoRs discussed in this report are all implemented (as has been assumed for the design year 2048), an overall reduction in traffic volume is predicted on Access Road.

With the Project in place, including the proposed mitigation in the form of 2m boundary fences at two PPFs (59 and 76 Tawa Road), only one PPF (25 Tawa Road), which is a double storey dwelling, is predicted to receive noise levels in Category B. A barrier would need to be impracticably high to reduce the noise level at the upper floor.

Conclusions

With the Project in place and including other local roads in the area that are unaffected by the Project, the noise level is predicted to generally reduce by an average of 3 dB.

Overall Conclusion

Overall, the implementation of the suite of NoRs will have a positive effect on the traffic noise levels in the wider area as traffic is redistributed and more transport options are offered.

1 Introduction

This operational noise assessment has been prepared for the North West Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement (**NoRs**) for Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) (the "**Strategic Assessment Package**" and the "**Projects**").

The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West area of Auckland.

The Strategic Assessment Package will provide route protection for the strategic projects, which include:

- Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
- the Rapid Transit Corridor (RTC), including the Regional Active Mode Corridor (RAMC)
- Kumeū Rapid Transit Station
- Huapai Rapid Transit Station
- State Highway 16 (**SH16**) Main Road Upgrade

It also includes the upgrade of Access Road, a local arterial corridor within Kumeū-Huapai:

This report assesses the operational noise effects of the North West Strategic Assessment Package identified in Figure 5-1 and Table 1-1 below. Refer to the main AEE for a more detailed project description.

Table 1-1: North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
NoR S2	SH16 Main Road Upgrade
NoR S3	Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
NoR KS	Kumeū Rapid Transit Station
NoR HS	Huapai Rapid Transit Station
NoR S4	Access Road Upgrade

1.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Strategic Assessment Package. Its purpose is to inform the AEE that accompanies the Strategic Assessment Package sought by Waka Kotahi and AT.

This report considers the actual and potential effects of the Strategic Assessment Package on the existing and likely future environment as it relates to operational noise effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the ambient noise context of the Strategic Assessment Package area;
b) Identify and describe the actual and potential operational noise effects of each Project corridor within the Strategic Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential operational noise effects (including any conditions/management plan required) for each Project corridor within the Strategic Assessment Package; and
d) Present an overall conclusion of the level of actual and potential operational noise effects for each Project corridor within the Strategic Assessment Package after recommended measures are implemented.

Construction noise and vibration effects are assessed against different standards and criteria and are addressed in a different report.

1.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Strategic Assessment Package as it relates to operational noise;
c) Identification and description of the existing and likely future noise environment;
d) Description of the actual and potential operational noise effects of the Strategic Assessment Package;
e) Recommended measures to avoid, remedy or mitigate potential adverse operational noise effects; and
f) Overall conclusion of the level of potential operational noise effects of the Strategic Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Strategic Assessment Package. These have been reviewed by the author of this report and have been considered as part of this assessment of operational noise effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

1.3 Preparation for this Report

When preparing this report, we have relied on information from other experts, namely traffic, design and planning. We attended several team meetings where the information was discussed and undertook a site visit along all NoR alignments where this was publicly accessible.

We have reviewed relevant standards and guidance in relation to road-traffic noise and vibration.

Where information we rely on was provided by other experts, this is noted in the report.

2 Performance standards

New designations are sought for the Strategic Assessment Package, for all NoRs, except for NoR S1 (SH16 Main Road), which is an alteration to an existing designation. Therefore, we have reviewed a variety of criteria and standards and have recommended the operational performance standards that in our opinion should apply to all Projects irrespective of the requiring authority implementing it.

2.1 Noise

2.1.1 Guidelines and Standards reviewed

We reviewed the following guidelines and standards for the assessment traffic noise:

- AUP:OP, specifically rule E25.6.33 relating to transport noise and referencing NZ6806
- NZS6806:2010 Acoustics – Road-traffic Noise – New and altered roads
- Waka Kotahi's "Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects" (**Guide**), V1.1, August 2016

We recommend applying the requirements of NZS6806.

For NoR S1 and S2 (as appropriate), we recommend that the additional information provided in the Guide is applied to these projects. The Guide describes how NZS6806 should be implemented. It describes some Waka Kotahi specific processes, such as the use of a Waka Kotahi internal matrix of project discipline feedback when determining the BPO for noise mitigation. Overall, the Guide provides background on how to implement NZS6806, and is therefore a useful complimentary document to the Standard.

2.1.2 Road traffic noise

Road traffic noise is assessed in accordance with NZS6806. This Standard has been adopted by Waka Kotahi and is also required by the AUP:OP.

We consider the intent of NZS6806 is to provide a pragmatic approach to the use of noise mitigation. This approach includes the requirement that a roading project needs to have a noticeable noise effect before mitigation is considered, and that any mitigation needs to achieve a noticeable reduction in noise level.

NZS6806 applies to traffic noise assessments where a project falls within its thresholds, which are briefly explained below.

- **Assessment Positions** are described as "Protected Premises and Facilities" (**PPFs**). PPFs include dwellings (including those that have building consent but are not built yet), educational facilities and their playgrounds within 20m of any school building, boarding houses, retirement villages, Marae, hospitals with in-patient facilities and motels/hotels in residential zones.

  Note that:

  - Areas earmarked for future residential development are not PPFs as the location and specific type of the receiving buildings are not known. However, to provide information for the future developers, we have provided noise level predictions over vacant land also.

- Businesses are not PPFs as they are not considered noise sensitive and are often noise generators in their own right.

- **Assessment Extent** is 100m from the edge of the new carriageway for urban areas and 200m for rural areas, in accordance with NZS6806. Urban areas are defined by Statistics NZ and are independent from the underlying zoning. Different parts of the projects are in Urban and Rural areas as indicted in Figure 2-1.

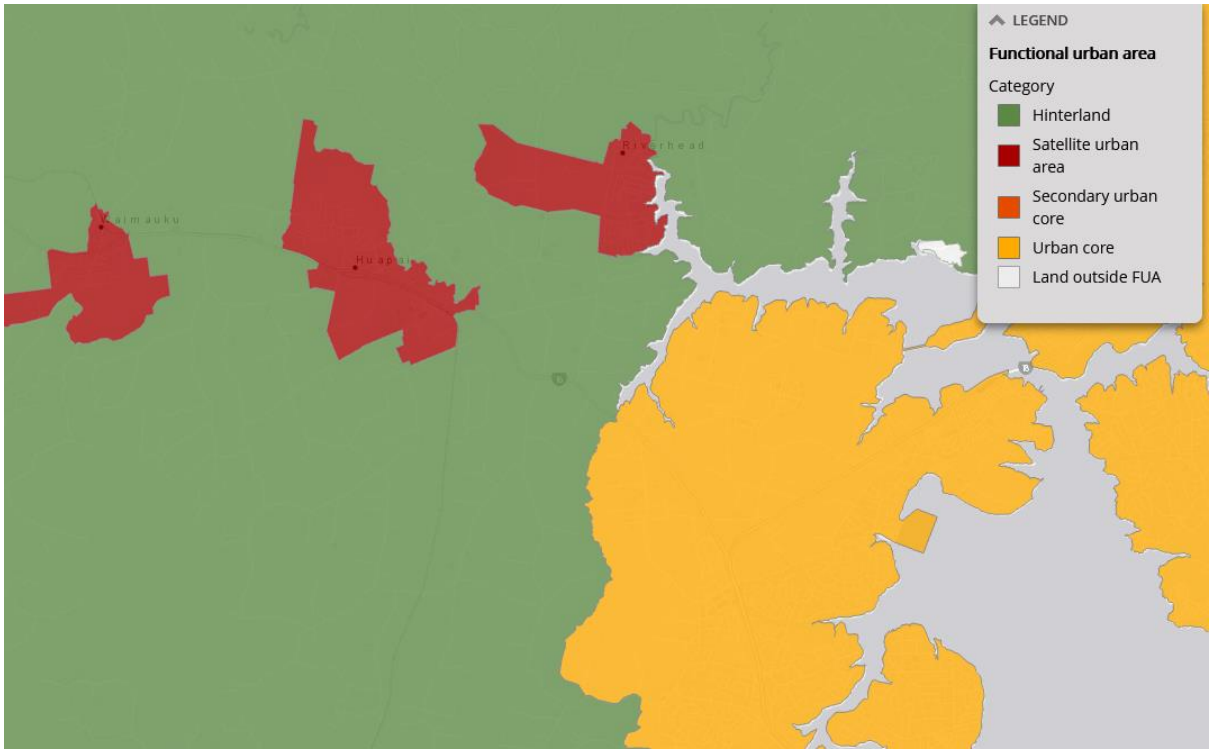


Figure 2-1: Indicative Urban/Rural classification in accordance with Statistics NZ

- **Assessment Areas** are areas which combine PPFs that would benefit from the same mitigation (e.g. barrier). For this Project, given the potential long implementation period, we have prepared an overview of proposed mitigation for each of the NoRs rather than dividing the areas further.

- **Design Year** is a year 10 to 20 years after opening of the Project. Since there are a number of NoRs assessed, without a defined implementation year, we chose a scenario where all NoRs are implemented, and the area is developed to its fullest potential. The design year for this scenario is 2048.

- **Noise Criteria** Categories are set out in the Standard for 'new' and 'altered' roads. This Project includes both new and altered roads, depending on the location of the project alignments. The Noise Criteria Categories are set out in Table 2-1 below.

Table 2-1: Traffic noise criteria categories

Category	New Road dB $L_{Aeq(24h)}$	Altered Road dB $L_{Aeq(24h)}$
A (primary external noise category)	≤ 57	≤ 64
B (secondary external noise category)	57 – 64	64 – 67
C (internal noise category)	40 (provided the external noise level is > 64)	40 (provided the external noise level is > 67)

The applicable category at any PPF depends on the BPO test, by progressively applying the noise criteria categories to determine which can practicably be achieved. NZS6806 is clear that preference is to be given to structural mitigation over building modification mitigation. NZS 6806 also requires achievement of the lowest external noise level with practicable structural mitigation, before considering building modification to mitigate internal noise levels.

- **Assessment Scenarios** are the various operational scenarios that we assess and compare. The Standard includes the following scenarios:
  - Existing noise environment: consists of the current road layout and traffic volume (for these Projects we sourced traffic data to be as current as practical while excluding data that was significantly affected by Covid restrictions, ranging from 2015 to 2021). (Note that a significant change in traffic volume is required to affect a noticeable change in traffic noise – refer Section 2.1.4)
  - Future Do-nothing scenario: This scenario only applies to Altered Roads, though we also predicted these noise levels for New Roads. It consists of the existing roads as for the existing noise environment, with traffic volume at the design year 2048. This scenario assumes that the full development of all surrounding areas has occurred, and traffic volumes have increased because of that development.
  - Future Do-minimum scenario: consists of all proposed transport corridors at the Design Year (2048), without any specific noise mitigation. This scenario means that the only barriers included are solid safety barriers, which are required for reasons other than noise mitigation. Where a low noise road surface such as PA10 30mm is proposed as the "base" road surface (as is the case for the alternative SH16 alignment NoR S1), this is also included in the Do-minimum scenario. Other roads that are not proposed to be altered by the Project (e.g. those crossing or connecting with the Projects) are not included in the assessment.
  - Future Project with mitigation: consists of the proposed Project roads at the Design Year, and includes mitigation that is designed specifically to reduce noise levels.
- **Mitigation Requirements** are set out in the Standard based on the BPO. Mitigation is split into structural (road surface, barriers, bunds) and building modification mitigation (improvement of building façades and ventilation, subsequent to the implementation of the structural mitigation, generally only considered for PPFs receiving noise levels within Category C). Any mitigation should achieve a noticeable noise level reduction of an average of 3 decibels within each assessment area or 5 decibels for standalone PPFs.

2.1.3 Station noise

There are two stations proposed to be operated as part of the RTC, within NoR HS and NoR KS. While the vehicle noise is covered by the assessment criteria set out in Section 2.1.2, other noise sources associated with the stations, such as from public address systems should be assessed against the relevant underlying zoning noise rules of the AUP:OP.

The stations are located in the Business – Town Centre zone (Kumeū Station between SH16 and the North Auckland rail line) and Future Urban zone (Huapai Station between Meryl Ave and the North Auckland rail line).

The noise limits applicable to these zones in relation to neighbouring zones are set out in Table 2-2 below.

Table 2-2: AUP:OP noise limits for Station locations

Station zone	Receiving zone	AUP:OP section	Assessment location	Noise limits	
Future Urban **(Huapai Station)**	Future Urban	E25.6.3.1	Notional boundary	Mon – Sat 7am – 10pm Sun 9am – 6pm All other times	55 dB L_{Aeq} 55 dB L_{Aeq} 45 dB L_{Aeq} 75 dB L_{AFmax}
Business – Town Centre **(Kumeū Station)**	Business – Town Centre	E25.6.8.1	Receiving building façade	7am – 11pm 11pm – 7am	65 dB L_{Aeq} 55 dB L_{Aeq} 65 dB L_{eq} at 63 Hz 60 dB L_{eq} at 125 Hz 75 dB L_{AFmax}
	Residential – Mixed Housing Suburban	E25.6.19.1	Receiving site boundary	Mon – Sat 7am – 10pm Sun 9am – 6pm All other times	55 dB L_{Aeq} 55 dB L_{Aeq} 45 dB L_{Aeq} 60 dB L_{eq} at 63 Hz 55 dB L_{eq} at 125 Hz 75 dB L_{AFmax}

2.1.4 Subjective perception of noise level changes

The subjective impression of changes in noise can generally be correlated with the numerical change in noise level. While every person reacts differently to noise level changes, research shows a general correlation between noise level changes and subjective responses.[1] Table 2-3 shows indicative subjective responses to explain the noise level changes discussed in this report. From experience, we have found that the subjective perception of a noise level change can be translated into an RMA effect. This effect is based on people's annoyance reaction to noise level changes.

The perception of these noise level changes generally applies to immediate changes in noise level, as would be the case for a new road, unlike for this Project where an existing road is modified in a minor way. However, people may subjectively have an annoyance reaction to a greater or lesser degree, depending on their perception of the Project.

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

Table 2-3: Noise level change compared with general subjective perception

Noise level change	General subjective perception[2]
1–2 decibels	Insignificant/imperceptible change
3–4 decibels	Just perceptible change
5–8 decibels	Appreciable to clearly noticeable change
9–11 decibels	Halving/doubling of loudness
>11 decibels	More than halving/doubling of loudness

Noise is measured on a logarithmic scale, meaning that a doubling in traffic volume (e.g. from 10,000 vehicles per day (vpd) to 20,000 vpd) results in a noise level increase of 3 decibels, a just-perceptible change. A tenfold increase in traffic volume (e.g. from 10,000 to 100,000 vpd) would result in a noise level increase of 10 decibels, which would sound twice as loud.

2.2 Vibration

The AUP:OP does not contain applicable vibration criteria for transport infrastructure. However, Waka Kotahi does reference the Norwegian Standard NS 8176.E:2005 in its reverse sensitivity guidelines.

2.2.1 Norwegian Standard NS 8176.E:2005

The Norwegian Standard NS 8176.E:2005 specifically addresses transportation vibration. The Standard's criteria (shown in Table 2-4 below) are based on studies of vibration annoyance in residences, and it provides guideline values for four vibration "classes".

The appropriate class for new infrastructure is considered to be Class C, which is the *"recommended limit value … in connection with the planning and building of new transport infrastructures"*.[3] According to the Section B.3.3 of the Standard, at this level of vibration "about 15% of the affected persons in Class C dwellings can be expected to be disturbed by vibration" and this is deemed by the Standard to be acceptable.

Table 2-4: Human response criteria for transport sources in NS 8176.E:2005

Type of vibration value	Class A	Class B	Class C	Class D
Statistical maximum value for weighted velocity, $v_{w,95}$ (mm/s)*	0.1	0.15	0.3	0.6

* $v_{w,95}$ = value exceeded for 5% of events (equivalent to L_{05} centile level in noise terminology)

2 Based on research by Zwicker & Scharf (1965); and Stevens (1957, 1972).

3 From NS 8176.E:2005, Annex B.3.

2.2.2 Road traffic

Traffic vibration is usually only generated when heavy commercial vehicles (**HCV**) drive over bumps or dips in the road. We have determined the road traffic vibration risk by reviewing data of HCVs travelling on existing roads with a range of surface conditions. Assessing this data against the recommended traffic vibration criterion (Class C of the Norwegian Standard NS 8176.E:2005) indicates that compliance with the criteria can be achieved at 25 metres from the road edge, even for roads in a degraded state.

For a newly sealed pavement, the risk contour is less than 2 metres from the road edge. There will be no receivers this close to the traffic lane edge.

Therefore, we do not consider that traffic vibration needs to be assessed for the NoRs.

3 Existing Noise Environment

The existing noise environment provides a baseline for assessing noise effects. Effects can be assessed by quantifying the noise levels and noise level changes that people would experience due to the implementation of a project. The change in noise environment can be interpreted in relation to subjective responses of people and possible annoyance. In addition, measured noise levels are used to verify the computer noise model.

The existing noise environment for those NoRs close to the existing SH16 and major transport corridors (NoRs 2 and 4, and in small parts NoR 1) are controlled by traffic on those roads. The existing NAL currently only carries a limited number of trains (we understand two per day), so does not significantly affect the ambient sound environment.

3.1 Surveys

We undertook short duration attended noise level surveys on 21 June 2022 between 10 am and 4 pm, in the vicinity of the Projects. As traffic distribution over the day is known, the short duration survey results can be used to derive a 24-hour traffic noise level.

All noise level survey results are shown in Table 3-1 and the location shown on Figure 3-1.

Table 3-1: Noise level survey results

Survey id descriptor	Location	Measured noise level	Derived noise level
		dB $L_{Aeq(T)}$	dB $L_{Aeq(24h)}$
MP1	187 Access Road, Kumeū	71	69
MP2	15 Boord Crescent, Kumeū	57	55
MP3	354 Main Road, Huapai	73	71
MP4	30 Meryl Avenue, Kumeū	50	48
MP5	62 Foster Road, Kumeū	63	61
MP6	36 Puke Road, Kumeū	55	53
MP7	137 Tawa Road, Kumeū	63	61
MP8	703 Waitakere Road, Kumeū	70	68
MP9	156 Boord Crescent, Kumeū	46	44
MP10	374 Taupaki Road, Taupaki	71	69
MP11	173 State Highway 16, Whenuapai	76	74

Figure 3-1: Noise survey locations

3.2 Modelling

In addition to measuring the noise levels at a few locations along the projects, computer noise modelling enables the prediction of existing noise levels at all PPFs.

The PPFs for each project have been assessed separately. Where a PPF would be affected by more than one NoR, this is noted in the report. For each NoR, we have calculated the noise levels received by all PPFs.

The number of PPFs for each NoR are shown in Table 3-2.

Table 3-2: Number of PPFs in each NoR

NoR	Number of PPFs
S1	134
S2	323
S3 (incl. HS and KS)	227
S4	56

4 Assessment Methodology

We have assessed the operational noise effects on people based on:

- the noise criteria categories of NZS; and
- noise effects (both beneficial and adverse) through determination of noise level changes.

The reason for the two-pronged approach is that in some circumstances, compliance with a Standard does not necessarily mean that the effects of a project would be minor, and vice versa.

Potentially, the effects of a noise level increase can be small (e.g. a noise level increase of less than 3 decibels). At the same time, the resulting noise environment can be very high, particularly adjacent to existing state highways, and cause (potentially further) adverse effects for residential use.

These Projects are intended to unlock the development potential of land surrounding the transport corridors. The proposed extensive urban development of land in the vicinity is predicted to result in traffic volumes increasing, thus resulting in significant noise level increases for some areas when comparing current and future 2048 traffic volumes.

4.1 Assumptions

Assessment of operational noise and vibration effects is based on information provided by other experts, specifically the team's traffic specialists.

Since we have assessed six NoRs, without a defined implementation year, we chose a scenario where all NoRs are implemented, and the area is developed to its fullest potential. The design year for this scenario is 2048.

The assessment of the Do-nothing scenario (refer Section 2.1.2) is that the surrounding environment is fully developed, but without any changes to the transport corridors. We understand from the traffic specialists that a sensitivity factor is included in these traffic volumes that do not allow for impractically high traffic volumes on existing roads. The assumption is that peak traffic would occur for more hours of the day.

We have assumed that all existing buildings inside the designation areas will be removed or will not represent a PPF (e.g. buildings may be repurposed to contain non-noise sensitive uses). We have therefore not assessed these buildings as PPFs. Should they be retained and be used for any uses identifying them as a PPF, they will need to be assessed and mitigation will need to be determined where necessary.

Some of the buildings may be affected by more than one NoR. We have identified them in each of the NoRs that may affect them (either through removal or assessment of effects).

4.2 Assessment basis

The NoRs represent different transport modes and different extents of change. Therefore, each NoR must be assessed according to its relevant changes and associated effects:

- **Walking and Cycling**: One NoR (NoR S2) provides for mostly walking and cycling improvements, and does not propose significant changes to the road alignments. Changes to the traffic volumes

are independent from the Project, and therefore the Project would not cause any change in noise effects. Walking and cycling facilities do not cause any significant noise levels that would be consistently noticeable adjacent to the integrated major transport corridors that they are located at. The proposed minor changes to the traffic lanes are predicted to not result in noticeable adverse changes to the noise level, so NoR S2 does not fall within the limitations of NZS6806 (refer Section 2.1.2). Nevertheless, an assessment in accordance with NZS6806 and in relation to the change in noise level has been undertaken for completeness.

- **Rapid transit** (and the regional active modes corridor – walking and cycling): NoR S3, HS and KS are intended to establish a rapid transit and active mode transport corridor. While walking and cycling does not generate elevated noise levels, electric bus rapid transit may generate noise. We have assessed the operational noise against the noise criteria of NZS6806. Stations are assessed based on their underlying AUP:OP zoning noise levels.

- **New and altered roads**: NoR S1 and NoR S4 represent a new road development and the widening of an existing road respectively. We have assessed these two NoRs against NZS6806 and in relation to the change in noise levels.

4.3 Computer noise modelling

The propagation of transport noise is affected by multiple factors, amongst them:

- Terrain elevations, including shielding from intervening terrain and exposure due to elevation
- Ground condition, including absorptive ground such as meadows or hard reflective ground
- Atmospheric conditions, including wind or temperature inversions
- Road parameters, including road surface, traffic speed, vehicle types and gradient

Because of the multiple factors and their interaction, computer noise modelling is a vital tool in predicting traffic noise impacts in the vicinity of major roads and for the determination of mitigation measures. Modelling enables a comprehensive and overall picture of noise impacts to be produced, taking into consideration all factors potentially affecting noise propagation.

We used the software SoundPLAN, which is an internationally recognised computer noise modelling programme. SoundPLAN uses a three-dimensional digital topographical terrain map of the area as its base. In addition, we entered data into the model for existing buildings, proposed earthworks edges and ground absorption within the assessment area. We digitised road traffic noise sources, with road lanes located on the terrain file, for the existing/Do-nothing scenarios and the Do-minimum scenario.

The SoundPLAN model implements the calculation algorithms of the “Calculation of Road Traffic Noise” methodology which is referenced in NZS6806 in Section 2.1.2.

The calculation algorithms take account of the factors set out above, including relevant atmospheric and ground conditions within appropriate parameters.

For road noise, we have used the adjustments for New Zealand road conditions, specifically road surface types, as set out in the Waka Kotahi “Guide to state highway road surface noise”, V1.0, January 2014, Table 2.1. Therefore, modelling results can be compared with the relevant criteria without further adjustment.

The accuracy of the computer model needs to be verified. We used the measurement results set out in Section 3.1 to verify that the computer model operates within satisfactory tolerances.

Table 4-1: Computer noise model verification

Survey id	Location	Derived Level	Predicted Level	Difference	Comment
		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	decibels	
MP1	187 Access Road, Kumeū	69	63	-5	Model based on 1,200 vpd[4], but much higher traffic count during survey
MP2	15 Boord Cres, Kumeū	55	57	2	
MP3	354 Main Road, Huapai	71	69	-2	
MP4	30 Meryl Avenue, Kumeū	48	62	14	Model based on 1,200 vpd, but only one car passed during the survey
MP5	62 Foster Road, Kumeū	61	62	1	
MP6	36 Puke Road, Kumeū	53	53	1	
MP7	137 Tawa Road, Kumeū	61	59	-2	
MP8	703 Waitakere Rd, Kumeū	68	58	-10	Model based on 1,200 vpd, but much higher traffic count during survey
MP9	156 Boord Cres, Kumeū	44	58	14	Model based on 600 vpd, but only two cars passed during the survey
MP10	374 Taupaki Rd, Taupaki	69	70	1	
MP11	173 SH 16, Whenuapai	74	72	-2	

A comparison of the measured and predicted levels shows that there is generally good agreement between measured and predicted levels, with a difference of no more than 2 decibels, for those positions where traffic on existing roads is the controlling noise source. This accuracy fulfils the requirements of NZS 6806 which states in Section 5.3.4.2: *"The difference between measured and predicted levels should not exceed ± 2 dB."*

The larger discrepancies are due to measurements being undertaken for 15 minute periods only. The roads in the vicinity of MP1, 4, 8 and 9 are roads with low traffic volumes: Access Road, Meryl Ave and Waitakere Road all with 1,200 vehicles per day (vpd), and Boord Crescent with 600 vpd. During the surveys, where fewer cars passed than is assumed by the traffic data, then the measured noise level was significantly lower than the predicted (e.g. MP4 and MP9), and where more cars passed than the traffic model suggests, then the measured noise levels were significantly higher than the predicted (e.g. MP1 and MP8). For low flow roads, even a small change in traffic volume over a short survey period will make a significant difference to the measured levels.

[4] Vehicles per day

4.3.1 Individual receiver noise levels

We have assessed noise effects at all PPFs. We have included predicted noise levels for all PPFs, for all scenarios, in the tables in Appendix 1. The locations of these dwellings are shown in the drawings in Appendix 2.

For NoRs S1 and S4, noise criteria categories for the PPFs are shown as a graphic representation by colouring the buildings with a colour scale, showing NZS 6806 Category A buildings in green, Category B buildings in orange and Category C buildings in red. Any buildings not shown in these three colours on the figures are outside the assessment area, or are not PPFs, e.g. garages, sheds or business premises.

For NoR S3 (and NoRs HS and KS), for the electric bus transport most, noise criteria categories for the PPFs are shown in green, orange and red as for NoRs S1 and S4 (i.e. in accordance with NZS6806). The noise levels from the stations within NoR HS and KS are predicted in Section 10.3.2 against the AUP:OP underlying zone noise limits. They are not shown specifically on the figures but are included in the overall predictions for NoR S3 as they fall within the assessment radius of the rapid transit corridor.

For NoR S2, the works are focused on walking and cycling improvements. This means that the change in traffic volume is not due to the project works. The assessment indicates that no noticeable adverse effect is generated due to the project, and NZS6806 does not apply. Nevertheless, for completeness, we also show the PPFs in accordance with the NZS6806 categories as for NoRs S1 and S4 and assess the change in noise level.

4.3.2 Noise contour plans

Noise contour plans are a useful tool to obtain a graphical overview of a project area including currently vacant land that may be developed in the future. The contours are calculated by SoundPLAN by interpolating a large number of individual points. Therefore, noise contour maps should not be used to “read” noise levels for specific locations. For individual noise levels specific for each PPF, the receiver noise levels in the tables should be used (refer Appendix 1).

Noise contour plans are contained in drawings in Appendix 2. These plans show interpolated noise level bands at 5 decibel intervals from 55 dB to 70 dB $L_{Aeq(24h)}$.

4.4 Assessment of operational vibration

As noted in Section 2.2.2, vibration from well-constructed and maintained roads is not an issue that causes adverse effects. As such vibration effects are not anticipated on the two heritage buildings within the existing heritage overlay along SH16 Main Road once re-positioned along the corridor following works commencing on the RTC (NoR S3). The buildings are transported to their new site, which will involve high levels of vibration through the loading, transport and unloading. Since the buildings will be able to withstand such levels of vibration without damage, traffic vibration, which is magnitudes lower, is expected to not cause any issues. We have therefore not assessed road traffic vibration further.

5 Strategic Assessment Package Overview

An overview of the Strategic Assessment Package is provided in Figure 5-1 below, with a brief summary of the Strategic Assessment Package projects provided in Table 5-1 below.

Figure 5-1: North West Strategic Assessment Package – Overview of NoRs for Assessment

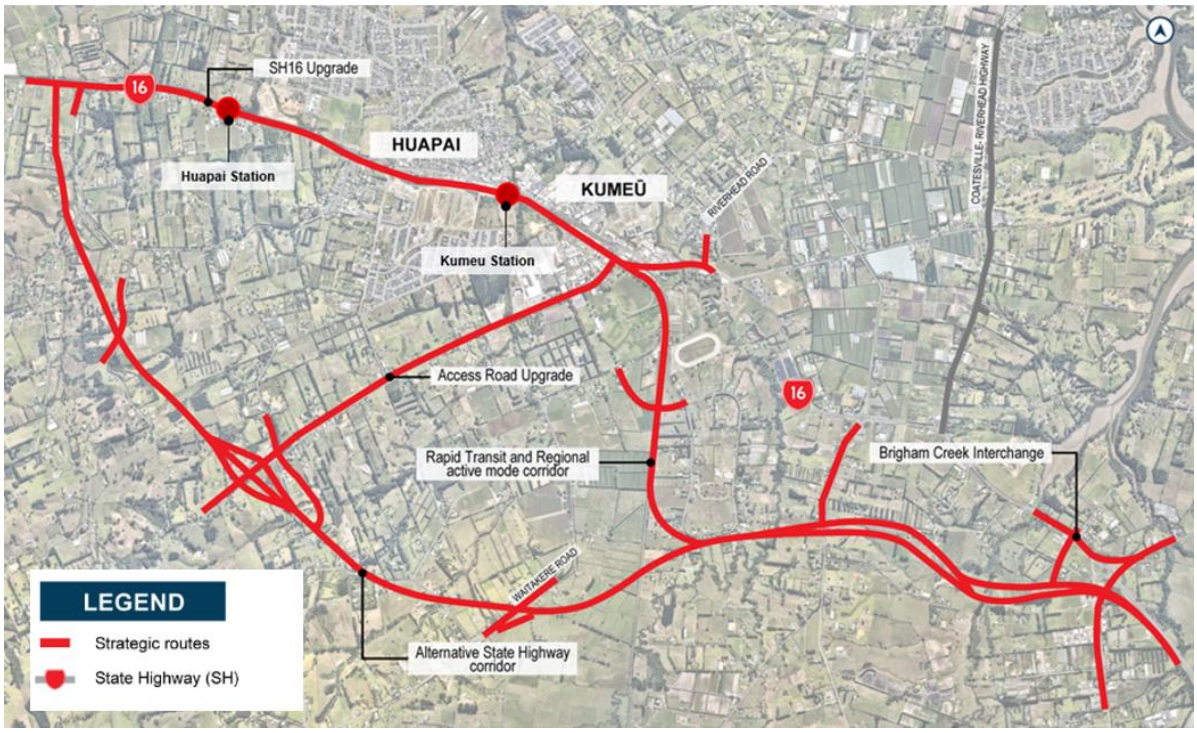


Table 5-1: Strategic Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Alternative State Highway	S1	A new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange	Waka Kotahi
State Highway 16 Main Road Upgrade (alteration to existing designation 6766)	S2	Upgrade to urban corridor including active modes and realignment of Station Road intersection with SH16.	Waka Kotahi
Rapid Transit Corridor	S3	New Rapid Transit Corridor and active mode corridor in one co-located corridor	Waka Kotahi
Kumeū RTC Station	KS	New rapid transit station, including transport interchange facilities and accessway	Waka Kotahi
Huapai RTC Station	HS	New rapid transit station, including transport interchange facilities, park and ride and accessway.	Waka Kotahi
Access Road Upgrade	S4	Upgrade of Access Road to a four-lane cross-section with separated cycle lanes	Auckland Transport

Corridor	NOR	Description	Requiring Authority
		and footpaths on both sides of the corridor.	

Refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

6 Positive Effects

The Strategic Assessment Package results in a redistribution of traffic across the wider area. It enables people to choose different transport modes (other than cars) and therefore results in a reduction in traffic that would otherwise use the existing roading network.

All NoRs except NoR S1 enable multi modal transport along established transport routes, with options including walking and cycling and public transport, in addition to the existing traffic lanes.

NoR S1 establishes a new State highway in a currently rural area, but also includes walking and cycling facilities. The new road will result in an increase in noise level adjacent to the road.

Overall, however, the Strategic Assessment Package enables a choice of transport options, resulting in a reduction in traffic on existing roads, and therefore a reduction in noise level over the wider area.

7 Recommended Measures to Avoid, Remedy or Mitigate Transport Noise Effects

Traffic on roads and stations generate noise from different sources and has different characteristics. Therefore, mitigation measures need to reflect and address relevant effects depending on the source. The sections below discuss road and station noise. The sections below discuss road and station noise.

7.1 Road traffic noise

There are broadly three mitigation options that can be applied to manage road traffic noise, and are discussed in NZS6806:

- The choice of **road surface material**, a mitigation option that reduces noise at the source (especially for roads with speeds above 40-50 km/h where the road-tyre interaction is the controlling noise source rather than engine noise);
- The installation of **noise barriers** either on the roadside or on the property boundary; and
- The inclusion (for new builds) or retrofitting (for existing buildings) of **Building Modification Mitigation** (e.g., alternative ventilation to enable windows and doors to remain closed, improved joinery and/or glazing, or, in rare cases, the installation of additional wall and ceiling lining).

NZS6806 states:

> *The noise criteria are intended to address the adverse effects of road-traffic noise on people. Land-use planning is the preferred method of avoiding these effects. Where this is impracticable, the Standard sets out procedures and methods of the prediction, measurement and assessment, and guidelines for mitigation of road-traffic noise in accordance with the duty to adopt the best practicable option.*[5]

This indicates that NZS6806 deals with the residual noise effects after land-use planning has been implemented (or where it has been omitted in the planning stage).

Generally, mitigation is implemented from source to receiver. This means that the road surface is the first choice of mitigation measure as it protects the largest extent of receivers. Second are barriers placed either on the road edge or the property boundary. Barriers protect the area behind them, so are not suitable to shield upper floors of multi storey buildings, however, they are suitable to protect ground floors and outdoor living areas where these are facing a road. Barriers may also not be appropriate in suburban and urban environments for urban design reasons – this would be discussed when the BPO is confirmed. Lastly, building modification can be implemented to existing PPFs where these are not sufficiently designed to reduce internal noise levels. Building modification is the last choice as it only protects individual living areas and has no benefit to the wider community.

Where future developments are not yet implemented, the road controlling authorities and developers have a shared responsibility to implement reasonable and appropriate mitigation.

[5] NZS6806, Section 1.1.1

7.2 RTC Station noise

The main noise source at stations would be the PA system. These systems can be designed to comply with the relevant noise limits.

We would recommend that PA systems are turned down or off at night-time in the vicinity of residential use, or that highly directional speakers are used that avoid noise spill to neighbouring sites.

7.3 Final measures

The final measures to mitigate noise from the Project will be confirmed through a Construction Noise and Vibration Management Plan which is a condition of the proposed designations.

8 NoR S1: Alternative State Highway, including Brigham Creek Interchange

It is proposed to submit a Notice of Requirement (NoR S1) to designate the land required to implement a new four-laned dual carriageway motorway referred to as the Alternative State Highway (**ASH**) and the upgraded Brigham Creek Interchange (**BCI**).

8.1 Project Corridor Features

The ASH extends from the future State Highway 16 (**SH16**) / Brigham Creek Interchange (north of Massey) to a proposed new intersection with SH16 near/at Foster Road on the western edge of the FUZ, west of Huapai. This proposed state highway corridor will be approximately 11km long, travelling westward across rural farmlands to the southwestern side of Kumeū and Huapai, with an additional interchange proposed at Tawa Road.

An overview of the proposed design is provided in Figure 8-1 below.

Figure 8-1: Overview of the Alternative State Highway, including Brigham Creek Interchange

Key features of the proposed new corridor include the following:

- A new four-lane motorway corridor with a cross-section of approximately 50m to accommodate a four-lane dual carriageway and separated cycle lanes and footpaths. The typical cross section includes an active mode corridor with central and side barriers.
- Road surface material of Open Graded Porous Asphalt (PA10 assumed as the basis of prediction).

- An underpass at Taupaki Road and bridges over the NAL with further grade separations at Waitakere Road, Pomona Road, Tawa Road, Puke Road and Foster Road. Tawa Road is designed to future proof for a full diamond interchange.
- The western end of the alignment ties-in at a proposed three-legged roundabout with SH16 Main Road, immediately west of Foster Road.
- The re-alignment of the following local roads:
  - Pomona Road, approximately 1.5km (two sections);
  - Motu Road, approximately 200m; and
  - Puke Road, approximately 500m.
- Likely posted speed of 100km/h which was used for our predictions.

8.2 Existing and Likely Future Environment

8.2.1 Planning context

The Alternative State Highway (**ASH**) corridor, including the Brigham Creek Interchange (**BCI**), is largely rural and is proposed to traverse land zoned under the AUP:OP as Rural – Countryside Living Zone, Rural – Mixed Rural Zone and Rural – Rural Production Zones.

The ASH corridor will also traverse two separate areas of FUZ in Redhills North and Kumeū-Huapai with the BCI also currently sitting within FUZ land.

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the ASH and BCI.

Table 8-1: Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[6]	Likely Future Environment[7]
Rural	Rural - Mixed Rural Zone, Rural - Countryside Living Zone Rural - Production Zone	Low	Rural
Undeveloped greenfield areas	Future Urban	High	Urban

8.2.2 Existing and Future Noise Environment

The alignment traverses a range of areas with different ambient noise environments. These range from existing high noise levels in the mid-60 dB L_{Aeq} at the BCI, connecting with the existing SH16 near Foster Road, to mid-40 dB $L_{Aeq(24h)}$ away from any current major roads.

[6] Based on AUP:OP zoning/policy direction
[7] Based on AUP:OP zoning/policy direction

These noise levels are expected to remain largely unchanged in the vicinity of the alignment. Only small parts of the project are in the Future Urban zone, where the environment is expected to change significantly once developed and occupied. Once these areas are developed, ambient noise levels without the project would increase due to increase household noise.

8.2.3 Buildings inside designation

The following Table 8-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or not used for noise sensitive uses once the Project is operational. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

We assume that the relevant requiring authority will acquire the parcels of land that these buildings are located on. In addition, auxiliary buildings are not generally occupied, so would not be relevant receivers in relation to this assessment.

Table 8-2: Buildings inside designation (not assessed)

Address	Address
134, 138, 142, 146, 149, 152, 154, 156, 162, 171, 176, 178, 182, 176A Boord Cres, Kumeū	36, 37, 41, 47, 54, 69, 78 Puke Rd, Kumeū
5, 7, 18, 21 Brigham Creek Rd, Whenuapai	191, 272, 278, 280, 727 SH16, Kumeū
30, 40, 62, 80, 104, 113 Foster Rd, Kumeū	380, 388, 389, 400, 401 Taupaki Rd, Kumeū
148 – 155 (uneven nos. only), 155, 159, 186, 188, 192, 202, 204, 206, 212 Fred Taylor Dr, Whenuapai	87, 97, 122 Tawa Rd, Kumeū
87 Joseph Dunstan Dr, Taupaki	249 Trigg Rd, Kumeū
146 Motu Rd, Kumeū	656, 660, 670, 691, 703 Waitakere Rd, Kumeū
2, 9, 34, 37, 55, 73, 103, 107, 121, 130, 138, 142, 144, 170, 191 Pomona Rd, Kumeū	

8.3 Assessment of Road Traffic Noise Effects

The ASH traverses an area that is mostly rural in nature. A small part at the southern end is located within the FUZ, as well as another small section passing through the Redhills North and Kumeū-Huapai FUZ, all of which will be developed in the future. There is no structure plan for this area at present, which means that the future receiving environment is currently unknown. We have provided traffic noise contours across the entire assessment area, which can be used for the future planning of the FUZ. Where noise sensitive buildings are established, they should be designed appropriately to provide suitable internal noise levels for future residents or occupiers.

The ASH will be constructed using low noise roads surface PA10 30mm as the base road surface. This would generally be considered a mitigation measure, however, for this project it is already included in the Do-minimum scenario.

The assessment of road traffic noise takes account of both the noise criteria categories of NZS6806 and the change in noise level for the reasons set out in Section 2.1. Both are discussed below.

8.3.1 NZS6806

The ASH is generally a **New road** in accordance with NZS6806, i.e. will consist of a new road that is established where there is currently no road. It will cross several smaller local roads; however, these roads carry relatively low traffic volumes and therefore do not affect the noise levels significantly.

At either end where the ASH connects with the existing SH16, including the area around the BCI, the State highway controls the ambient noise environment as it is the highest noise generator in the area. Similarly, where the ASH affects PPFs that are close to major roads such as Brigham Creek Road or Fred Taylor Drive, these roads control the ambient noise environment. For those areas we have assessed the ASH against the **Altered road** criteria. Note that there is a cluster of PPFs at Access Road that have been assessed against the Altered road criteria. Access Road is predicted to experience a significant increase in traffic volume in the Do-nothing scenario, i.e. without the implementation of the Projects. This means that these PPFs will be strongly affected by traffic on Access Road. For that reason, we have assessed them against the Altered road criteria, given that the base noise level without the Project would already be elevated.

There are currently 134 PPFs in the vicinity of the ASH. As discussed above, each PPF has been assessed against relevant criteria relating to their location in relation to existing roads, specifically 63 PPFs have been assessed against Altered road criteria and 71 PPFs against New road criteria. The location of the PPF distribution is indicated in Figure 8-2 below. Those PPFs assessed against New road criteria are coloured yellow, those assessed against Altered road criteria turquoise.

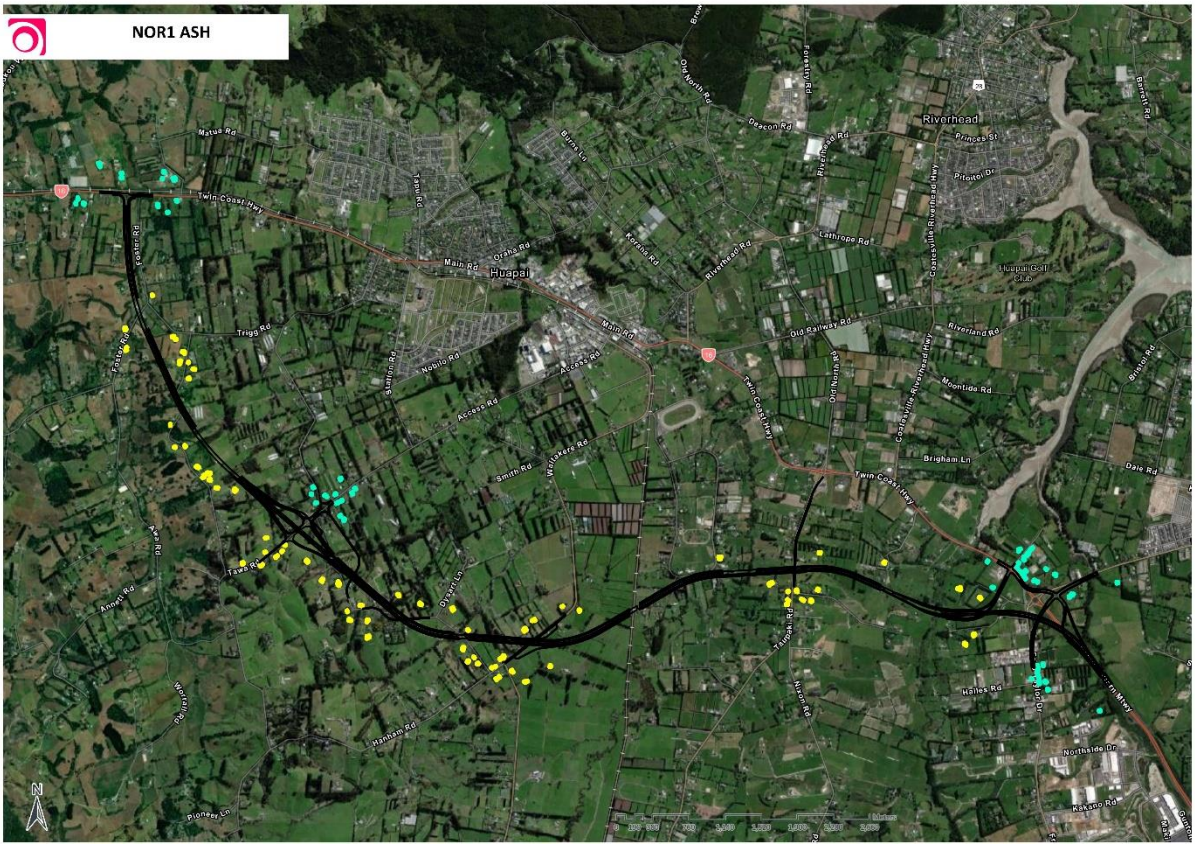


Figure 8-2: New and Altered Road sections within NoR S1

8.3.1.1 Altered Road

The future development in the area is also anticipated to increase the traffic volumes significantly.

This is reflected in the fact that the number of PPFs receiving noise levels in Category C is more than double in the Do-nothing scenario (i.e. where existing roads do not change but the traffic volumes change over time) compared with the existing situation.

The implementation of the ASH will result in a significant improvement for a number of PPFs, with no PPFs receiving noise levels in Category C from the ASH itself. For either Do-minimum scenario the number of PPFs in Category A increases or stay the same, even when compared with the existing scenario.

When local roads are included in the assessment (i.e. those already existing roads not altered by the Project, that have an effect on the ambient noise environment), the noise level at many PPFs would move into a higher noise level category. These roads are not affected by the Project, i.e. there is no change to their horizontal or vertical alignment. The requiring authority for the Project would not be required to upgrade these roads as they do not form part of the Project. For information (in grey), we have included noise levels with these roads, to ensure that the cumulative effect of all roads in the vicinity are taken into consideration when assessing the noise level changes (refer Section 8.3.2). This shows that these (unchanged) roads have an effect on the overall noise level received at some PPFs but are not subject to mitigation options as they are outside the responsibility of the requiring authority.

We tested the use of barriers along the ASH and, where more appropriate, along the property boundary. With a 2.4m barrier along parts of the ASH (as shown in the figures in Appendix 2.1) and 2m boundary fences for some limited properties, the noise level from the ASH as received at all PPFs can be reduced to be within Category A.

The number of PPFs assessed against the Altered road criteria is summarised in Table 8-3, and figures showing the location of the PPFs are included in Appendix 2.1.

Table 8-3: Summary of NZS 6806 assessment – Altered Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	44	12	7
Do-nothing	33	13	17
Do-minimum (ASH only)	59	4	0
Do-minimum (ASH and local roads)	44	16	4
Mitigation Option (ASH only) – 2.4m barrier on ASH or 2m barrier on property boundary	63	0	0

8.3.1.2 New Road

Those PPFs further removed from major roads generally receive lower noise levels in the existing situation. These PPFs are also those that would be more affected by the operation of a new State highway in a current green field environment.

At present, 58 of the 71 PPFs assessed against the New road criteria receive noise levels in Category A, and none receive noise levels in Category C. In the future, without and with the operation of the ASH (i.e. the Do-nothing and Do-minimum scenarios respectively), there is a shift to the higher noise levels, 31 PPFs for Do-nothing and 32 PPFs for Do-minimum scenarios predicted to receive noise levels in Category B (up from 13 for the existing situation).

When local roads are included in the assessment (i.e. those already existing roads not altered by the Project, that have an effect on the ambient noise environment), the noise level at many PPFs would move into a less stringent noise level category (e.g. 7 PPFs with noise levels in Category C compared with none where the noise level is based on the ASH only). These existing roads are not affected by the Project, i.e. there is no change to their horizontal or vertical alignment. The requiring authority for the Project would not be required to upgrade these roads as they do not form part of the Project. We have included noise levels with these roads for completeness, to ensure that the cumulative effect of all roads in the vicinity are taken into consideration when assessing the noise level changes (refer Section 8.3.2).

In addition to the assumed low noise road surface, we tested the use of 2.4m high barriers along the ASH and, where this was the more appropriate location, 2m high boundary fences along the property boundary.

Due to some of the surrounding sites being elevated above the ASH, barriers are not always effective. With barriers in place, the noise levels at the 32 PPFs predicted to receive noise levels within Category B can be reduced to Category A for 13 PPFs. For the remaining 20 PPFs, noise levels are predicted to remain in Category B irrespective of the barrier (where this has been found to be practicable).

For some of those PPFs, a barrier is recommended to reduce noise levels (and effects, refer 8.3.2.2 below), even though noise levels would remain within Category B. This is the case where noise levels can be reduced to a noticeable degree or where the noise barrier forms part of a larger barrier shielding several PPFs.

For others, barriers are not considered the BPO and not recommended. That is the case where the barriers would not achieve any noticeable noise level reduction at the PPFs, e.g. where the PPFs are elevated above the road, or where an existing road not related to the Project is the main noise source.

The number of PPFs assessed against the New road criteria is summarised in Table 8-4, and figures showing the location of the PPFs are included in Appendix 2.1.

Table 8-4: Summary of NZS 6806 assessment – New Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	58	13	0
Do-minimum (ASH only)	39	32	0
Do-minimum (ASH and local roads)	23	41	7
Mitigation Option (ASH only) – 2.4m barrier on ASH or 2m barrier on property boundary	52	19	0

8.3.2 Change in Noise Levels

Noise effects can be described based on the change in noise level with and without the Project. For PPFs assessed against the Altered road criteria, the Do-nothing and Do-minimum scenarios are compared, while for PPFs assessed against the New road criteria the existing and Do-minimum scenarios are compared. Where mitigation is recommended, the mitigation option is also included in the future assessment.

8.3.2.1 Altered Road

For the PPFs assessed against the Altered road criteria, we predict an average noise level increase from the existing to Do-nothing scenario of 3 dB across the 63 PPFs.

With the ASH in place (with low noise road surface assumed, as discussed above), and including local roads, noise levels are predicted to reduce on average 2 dB compared with the Do-nothing scenario. When predicting the noise levels from only the ASH, excluding local roads that are not being changed, then the average reduction is 7 dB.

With mitigation in the form of 2.4m barriers on the ASH and 2m boundary fences at selected properties, and including local roads, the noise levels are predicted to reduce on average by 3 dB, with many PPFs receiving noticeable to significant noise level reductions compared with the Project not being implemented.

shows the number of PPFs assessed against the Altered road criteria in each of the change in noise level bands discussed in Table 2-3. This shows clearly that noise levels will overall be lower, or similar to existing, as an effect of the redistribution of traffic away from the existing SH16. This comparison includes traffic on existing local roads as they will affect the noise environment and are therefore important when assessing potential noise level changes in the area.

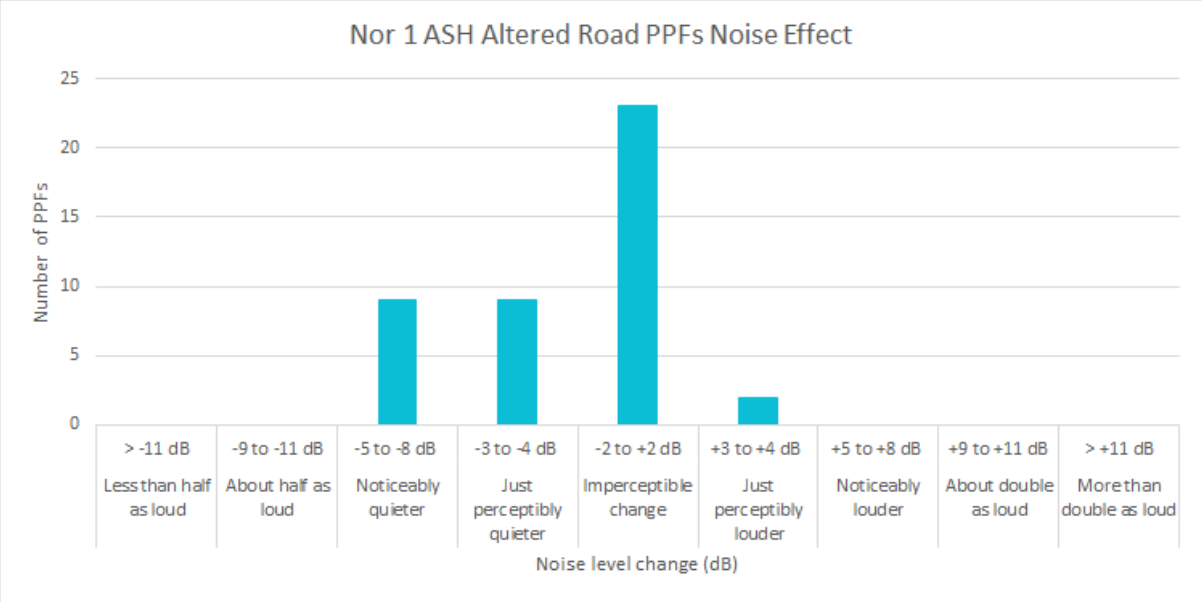


Figure 8-3 : Change in noise level

8.3.2.2 New Road

PPFs assessed against the New road criteria are generally in areas that are less affected by existing traffic noise on local roads. When comparing the existing and Do-minimum scenarios, the introduction of a new noise source, and the anticipated increase in traffic volume with the future development in the area, result in an average noise level increase of 2 dB. Some PPFs are predicted to receive noise level increases of up to 13 dB when compared with the existing situation.

When including other roads not affected by the Project (e.g. Tawa Road), noise levels increase further for a number of PPFs, which shows the effect of local roads on the overall noise level. The average increase would be 5 dB, which is a noticeable adverse change, which is largely unrelated to the Project and due to local roads.

With the recommended mitigation of 2.4m high noise barriers on the ASH and 2m high noise barriers at residential boundaries in place (refer to the figures in Appendix 2.1), in addition to the low noise road surface assumed, many PPFs will still experience noticeable noise level increases. This is the result of the introduction of a new noise source in a currently low noise environment with little man-made noise sources. The average noise level increase from the ASH only is predicted to be on average less than 2 dB. The highest noise level increases are predicted to be up to 13 dB, which would be perceived as more than a doubling in noise level. Nevertheless, the resultant traffic noise levels at all PPFs are generally within reasonable levels for residential use.

Figure 8-4 shows the number of PPFs assessed against the New road criteria in each of the change in noise level bands discussed in Table 2-3. As expected, noise levels are predicted to increase (as is generally the case for a new road in a greenfield situation). The comparison includes local roads in the area as the change in noise level experienced will be affected by traffic on those roads. The ASH itself is only one contributor to the overall change in noise level.

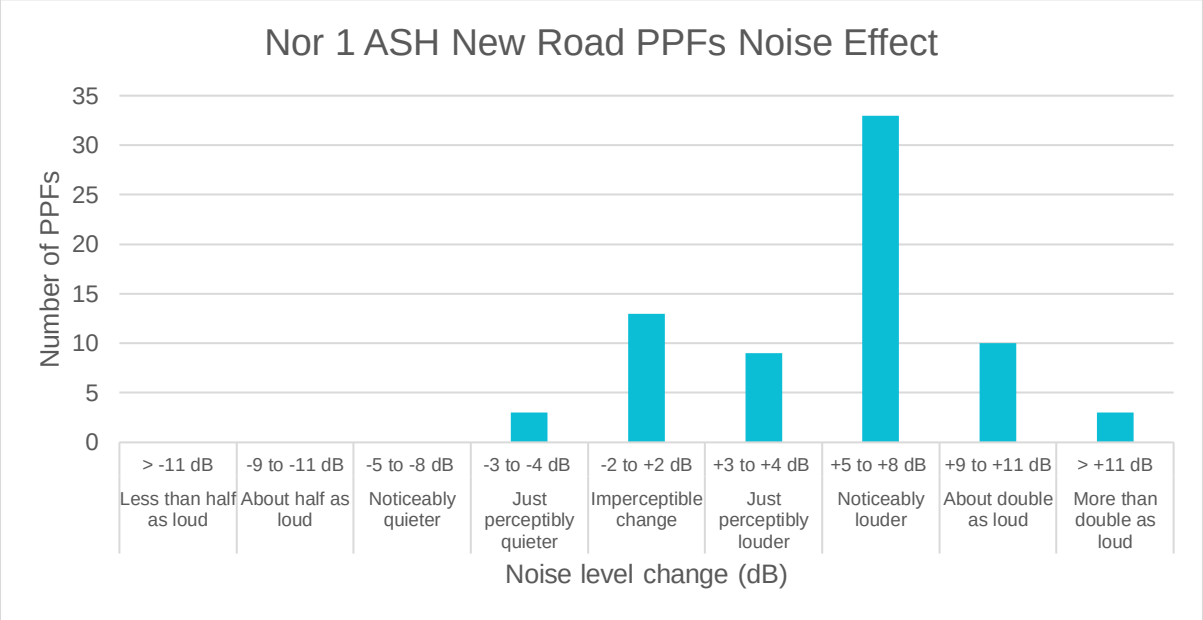


Figure 8-4: Change in noise level

8.4 Conclusions

We have assessed the traffic noise levels from the proposed ASH. The introduction of a new major road into a currently low noise mainly rural environment is predicted to result in significant noise level increases for some PPFs, especially in the area removed from other main roads. Where the ASH connects with SH16, the change in traffic volume due to the suite of NoRs discussed in this report and the proposed mitigation measures will result in an overall reduction in noise level.

The ASH is assumed to be constructed using low noise road surface (PA10). In addition, 2.4m high roadside barriers along the ASH and 2m high boundary fences at some PPFs will ensure that no PPFs would receive noise levels from the ASH within Category C, and that more PPFs would receive noise levels within Category A than would be the case without the Project.

Overall, while a small number of PPFs are predicted to receive noticeable to significant noise level increases (in the vicinity of the New road), the overall effect of the Project is positive.

9 NoR S2: SH16 Main Road Upgrade

It is proposed to submit a Notice of Requirement (NoR S2) to designate the land required to implement the upgrade of the existing State Highway 16 (**SH16**) to a two-lane corridor with walking and cycling facilities.

9.1 Project Corridor Features

The SH16 Main Road Upgrade extends approximately 4.5km between Old Railway Road, east of Kumeū to Foster Road, west of Huapai. The SH16 Main Road is currently a 20m wide two-lane urban arterial with no active mode facilities on either side of the corridor.

SH16 Main Road is proposed to be upgraded to a 24m urban corridor traversing through well-established retail, commercial and residential environs. The corridor generally follows the existing SH16 Main Road alignment and also includes a 600m section of active mode only upgrade between Oraha Road and Tapu Road. As part of this project, Station Road will be realigned to form a new signalised intersection with SH16 and Tapu Road.

An overview of the proposed design is provided in Figure 9-1 below.

Figure 9-1: Overview of the SH16 Main Road Upgrade

Key features of the proposed upgrade include the following:

- The widening of the existing 20m wide two-lane urban arterial to a 24m wide corridor with walking and cycling facilities on both sides of the corridor.

- Current existing road surface material is retained.
- The realignment of Station Road to form a new signalised intersection with SH16 and Tapu Road.
- Tie-ins with existing roads.
- Likely posted speed of 50km/h.

In terms of traffic noise, it is critical to consider that this project does not allow for any additional traffic lanes. Minor intersection upgrades are proposed to increase safety for the walking and cycling facilities that are the main feature of this project.

9.2 Existing and Likely Future Environment

9.2.1 Planning context

SH16 Main Road is proposed to be upgraded to a 24m urban corridor along the urban extent of SH16 traversing through well-established retail, commercial and residential environs through Kumeū Huapai. This corridor contains a range of business, residential and open space and rural land uses under the AUP:OP (see zoning column in Table 9-1) between the eastern extent of the Kumeū-Huapai township and the western extent of the upgraded corridor (the intersection with the proposed ASH).

Table 9-1 below provides a summary of the existing and likely future environment as it relates to the SH16 Main Road Upgrade.

Table 9-1: SH16 Main Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[8]	Likely Future Environment[9]
Rural	Rural Mixed Rural Zone, Rural Countryside Living Zone	Low	Rural
Business	Business (Industrial)	Low	(Business (Industrial)
	Business (Local Centre)	Low	Business (Local Centre)
	Business (Mixed Use)	Low	Business (Mixed Use)
Residential	Residential	Low	Residential
Open Space	Open Space – Sport and Active Recreation	Low	Open Space
Undeveloped greenfield areas	Future Urban	High	Urban

[8] Based on AUP:OP zoning/policy direction
[9] Based on AUP:OP zoning/policy direction

9.2.2 Existing and Future Noise Environment

Walking and cycling facilities are proposed to be established on either side of the existing SH16. The area is currently a high noise area, controlled by traffic on SH16. The suite of NoRs discussed in this report will change the traffic distribution across the area, with a large shift of traffic movements to the ASH (refer Section 8). This would lead to an overall reduction in noise levels experienced on the walking and cycling facilities.

Without the North West Strategic Package implementation, noise levels in the future will continue to increase significantly and range from around 60 to 70 dB $L_{Aeq(24h)}$ at the walking and cycling paths.

9.2.3 Buildings inside designation

The following Table 9-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or not used for noise sensitive uses once the Project is operational. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

Table 9-2: Buildings inside designation (not assessed)

Address	Address
21 Riverhead Rd, Kumeū	1 Trigg Road, Kumeū
619 SH16, Kumeū	

9.3 Assessment of Road Traffic Noise Effects

This project only involves minor intersection upgrades to the existing road. The main focus of this NoR is the establishment of walking and cycling facilities.

The establishment of walking and cycling facilities does not cause any appreciable noise levels and will not cause any change in noise level as the facilities are adjacent to a major road which controls the noise environment. Even with the redistribution of traffic across the area, the existing SH16 will remain a major road. Traffic noise from the road will be the controlling noise source and be well more than 10 dB louder than any noise from the walking and cycling facilities.

While this project does not involve a major road upgrade, the intersections will be slightly realigned, so we still have undertaken an assessment of traffic noise in accordance with NZS6806 and in relation to the change in noise level, both are discussed below.

9.3.1 NZS6806

The implementation of the suite of NoRs discussed in this report will result in a redistribution of traffic across the area, with a large number of vehicles using the ASH (refer Section 8). This is reflected in the Do-minimum scenario, where all PPFs would receive noise levels in Category A (if local roads are excluded from the predictions). Without the North West Strategic Package implementation, traffic volumes are predicted to increase (significantly for some extents of the existing roads).

There are 323 PPFs identified within the assessment area of this project. For all scenarios, the overwhelming majority (between 267 and 323 of the 323 PPFs) are receiving noise levels within Category A.

Looking at the future Do-minimum scenario, when assessing SH16 with its minor intersection alterations only, all PPFs are predicted to receive noise levels in Category A. If we include the local side roads, that are not part of the NoR and do not have a horizontal or vertical change, a small number of PPFs would receive noise levels in Category B (20 PPFs, compared with the 43 PPFs without the project) and Category C (four PPFs, compared with the 13 PPFs without the project). This means that all PPFs identified to receive noise levels in Categories B and C would not receive these noise levels from the upgraded SH16, but from local roads that are not being changed. None of these PPFs are predicted to receive noticeable noise level increases, and most are predicted to receive a noise level reduction of up to 2 dB. NZS6806 does not apply to this project as it does not trigger the relevant noise levels and changes (refer Section 2.1.2). Therefore, we have not identified additional mitigation as the project does not cause an adverse noise effect – which is the expected outcome for a walking and cycling upgrade.

Nevertheless, we have reported the number of PPFs (assessed against the Altered road criteria) for completeness, as summarised in Table 9-3, and figures showing the location of the PPFs are included in Appendix 2.2.

Table 9-3: Summary of NZS 6806 assessment – Altered Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	287	26	10
Do-nothing	267	43	13
Do-minimum (SH16 and intersections only)	323	0	0
Do-minimum (SH16 and local roads)	299	20	4

9.3.2 Change in Noise Levels

The provision of walking and cycling facilities does not have any effect on the overall noise environment, with traffic noise on SH16 remaining the controlling noise source. Nevertheless, we have assessed the noise level change from traffic on SH16 and its upgraded intersections to determine the potential effects of the change in traffic volume across the area, as a function of the North West Strategic Package overall).

As noted above, if the suite of NoRs is not implemented, traffic will increase, with noise level changes on average of 2 dB, with individual receivers potentially experiencing a noise level increase between 4 and 7 dB. These traffic noise changes would occur within the existing SH16 designation.

With the suite of NoRs in place, and with the SH16 intersection upgrades (and including other roads in the vicinity of the Project that are not affected by any works), noise levels are predicted to reduce on average 2 dB compared with the Do-nothing scenario, ranging from a no change to a more than 10

dB reduction. When predicting the noise levels from only SH16 including the intersection upgrades, excluding local roads that are not being changed, then the average reduction is 9 dB.

Figure 9-2 shows the number of PPFs in each of the change in noise level bands discussed in Table 2-3. Overall, noise level changes will be negligible or positive.

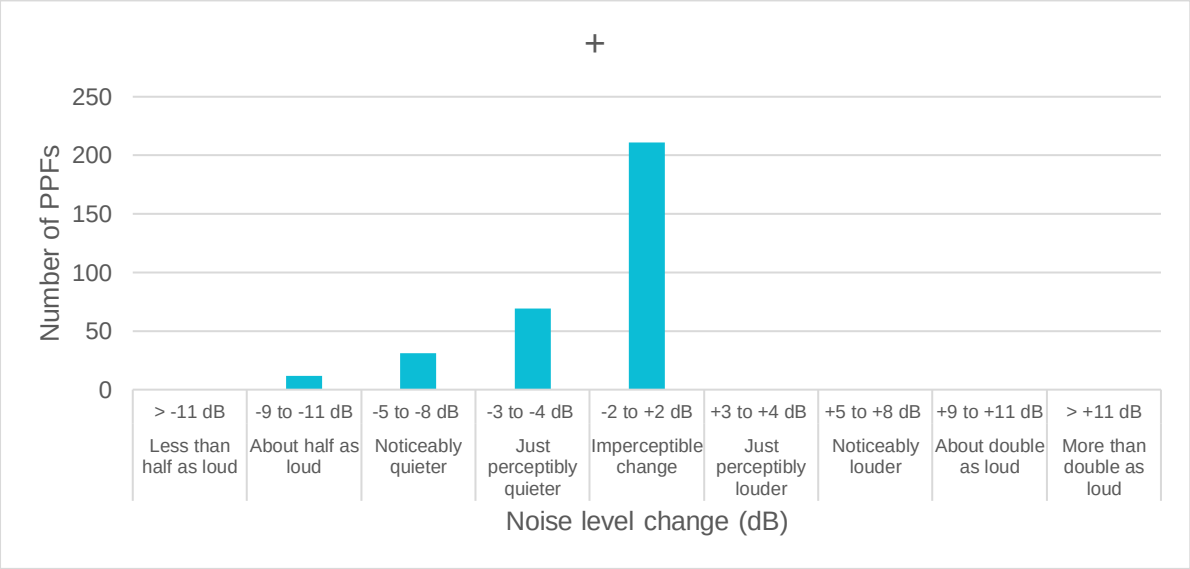


Figure 9-2: Change in noise level

9.4 Conclusions

The proposed establishment of walking and cycling facilities along SH16 is predicted to not cause any appreciable noise level change. The noise environment is currently, and will remain, controlled by traffic on SH16. No additional traffic capacity is created on SH16; rather, changes to lane configurations and intersections upgrades are introduced to make walking and cycling safer. These changes do not cause any noticeable effect on the overall noise environment.

Overall, we predict a noise level reduction in the vicinity of SH16, due to the redistribution of traffic across the area as a function of the suite of NoRs assessed in this report. Traffic volumes will reduce, with many using the proposed ASH. This effect is not due to the project, but the overall changes anticipated in the area.

All PPFs assessed will receive a noise level reduction because of the redistribution. When including local roads in the predictions, which are not affected by this project, all PPFs will experience either a noise level reduction or no noticeable change in noise level.

We have not proposed any additional mitigation given the works involve walking and cycling upgrades and do not significantly affect traffic lanes.

10 NoR S3: Rapid Transit Corridor; NoR KS: Kumeū RTC Station and NoR HS: Huapai RTC Station

It is proposed to submit a Notice of Requirement (NoR S3) to designate the land required to implement the new Rapid Transit Corridor (**RTC**) and Regional Active Mode Corridor (**RAMC**) in one co-located and integrated corridor.

10.1 Project Corridor Features

The proposed RTC is a new corridor which aims to complete a safe and frequent rapid transit system connecting Kumeū-Huapai with Westgate, Auckland City Centre and the North Shore. The RTC will extend the proposed City Centre to Westgate (**CC2W**) rapid transit corridor (a non-SG project) from the Brigham Creek Frequent Transit Network Station to the western edge of Kumeū-Huapai growth area near the Rural Urban Boundary (**RUB**).

The RTC will extend from the future SH16 / Brigham Creek Interchange to the west of Huapai. The RTC predominately traverses rural land outside of the FUZ at a total length of approximately 9.5km and is intended to operate in an uninterrupted free flowing manner with all road crossings grade separated.

The RTC is split into the following sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. Within the rural section, the RTC requires an extended width to accommodate both the RTC and RAMC.
- The **urbanised section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[10] along this section. Within this section, the RTC requires approximately 38m width to locate two FTN lanes, separated active mode facilities and the SH16 Main Road Upgrade.

It is proposed to route protect the RTC corridor for a future electric bus rapid transit system.

The RTC corridor will be at grade except at key sections to pass over local arterial roads or the Alternative State Highway, including Brigham Creek Road.

The RAMC is a segregated walking and cycling corridor that is located adjacent to the RTC alignment from the Brigham Creek Interchange to the western edge of Kumeū- Huapai, terminating at the signalised intersection of SH16 Main Road and Weza Lane. The corridor is co-located and integrated with the RTC and is proposed to be route-protected as a single NoR. The segregated corridor provides the opportunity for long-term amenity as a key cycling corridor, while connecting to the wider North Western Cycleway and ultimately to the Auckland city centre network.

[10] Refer Section 9 of this report

An overview of the proposed designs is provided in Figure 10-1.

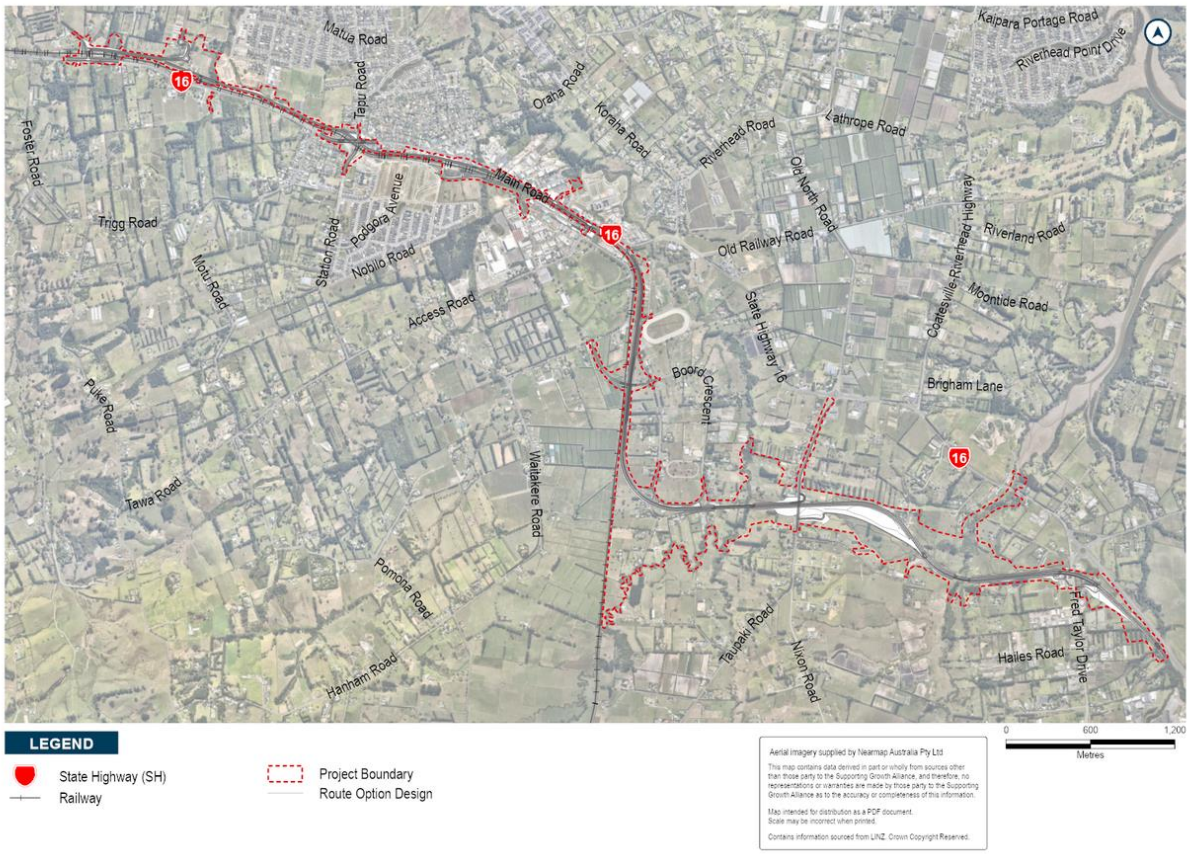


Figure 10-1: Rapid Transit Corridor and Regional Active Mode Corridor Overview

Key features of the proposed upgrade include the following:

- An approximately 9.5km long corridor intended to operate in an uninterrupted free flowing manner. The corridor has been designed to operate at 80km/h.
- The RTC will be at ground level except at key sections to pass over or under arterial roads (Fred Taylor Dr, Taupaki Rd, new Waitakere-Boord Cres Link Rd, Access Rd and Station Rd).
- The ASH (refer Section 8) goes over the RTC in the rural section.
- Grade separated road crossings at all intersections with adjoining roads.
- Within Kumeū-Huapai Township, upgrades of:
    - SH16 between Access Rd and John MacDonald Lane. At this section, the RTC abuts the KiwiRail boundary and the proposed SH16 upgrade which will need to be realigned north of its existing alignment.
    - Realignment of Station Road and Tapu Road to form a signalised cross-intersection. The RTC will pass under this proposed intersection to deviate to the north.

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

- Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary
- Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu Stream.

10.2 Existing and Likely Future Environment

10.2.1 Planning context

The Rapid Transit Corridor (**RTC**) and Regional Active Mode Corridor (**RAMC**) form a single, integrated corridor (Note the RAMC only extends to the eastern entrance to Kumeū). This corridor predominately traverses rural land outside of the FUZ (the rural section), however for assessment purposes it can be split into two sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. This rural section traverses land zoned under the AUP:OP as Rural – Countryside Living Zone, with an area zoned as FUZ in Redhills North.
- The **urban section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[11] along this section. This urban section contains a range of land uses zoned under the AUP:OP as a mix of business zonings between the eastern extent of the Kumeū-Huapai township and Station Road

Table 10-1 below provides a summary of the existing and likely future environment as it relates to the RTC and the RAMC.

Table 10-1: RTC and RAMC Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[12]	Likely Future Environment[13]
Rural	Rural	Low	Rural
Undeveloped greenfield areas	Future Urban	High	Urban
Business	Business (Industrial)	Low	Urban
	Business (Local Centre)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential	Low	Urban
Open Space	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

[11] Another North West Strategic project – refer to Section **Error! Reference source not found.** of this report

[12] Based on AUP:OP zoning/policy direction

[13] Based on AUP:OP zoning/policy direction

Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary. The land is zoned under the AUP:OP as Business - Town Centre Zone. An active modes overbridge is proposed across the NAL with active mode connections to:

- the Huapai Triangle crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and
- Wookey Lane crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and Business - Light Industry Zone.

Table 10-2: Kumeū Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[14]	Likely Future Environment[15]
Business	Business (Industrial)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential - Mixed Housing Suburban Zone	Low	Urban
Open Space (located to the north of the proposed station location)	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu Stream. The land is zoned under the AUP:OP as Future Urban Zone. An active modes overbridge is proposed across the NAL and SH16 to FUZ land. Future connections will be determined as part of structure plan process.

Table 10-3: Huapai Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[16]	Likely Future Environment[17]
Residential (located to the east of the proposed station location)	Residential – Single House Zone	Low	Urban
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

[14] Based on AUP:OP zoning/policy direction
[15] Based on AUP:OP zoning/policy direction
[16] Based on AUP:OP zoning/policy direction
[17] Based on AUP:OP zoning/policy direction

10.2.2 Existing and Future Noise Environment

The existing environment of the RTC ranges from relatively low (adjacent to the North Auckland Rail line, which currently carries approximately two trains a day) in the 40-50 dB $L_{Aeq(24h)}$ range, to elevated (mid-60 to 71 dB $L_{Aeq(24h)}$) where the RTC straddles the existing SH16.

With the redistribution of the traffic across each of the NoRs addressed in this report, we predict that noise levels will generally reduce, particularly in the vicinity of the existing SH16 (refer to Section 9). Increased use of the NAL, and additional activities in the developed FUZ may result in an increase in overall noise level, however, this will be dependent on the type of FUZ development and the potential future frequency of use of the rail line.

10.2.3 Buildings inside designation

The following Table 10-4 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or occupied by non-noise sensitive uses. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

Table 10-4: Buildings inside designation (not assessed)

Address	Address
42, 120, 122, 124, 130, 134, 138, 142, 146, 149, 152, 154, 156, 162, 176, 176A, 178, 182 Boord Cres, Kumeū	29, 30, 31 Meryl Ave, Kumeū
149 – 155 (uneven no. only), 186, 186, 188, 202, 204 Fred Taylor Dr, Whenuapai	191, 272, 278, 280, 609 SH16, Kumeū
51 Gilbransen Rd, Kumeū	2, 4, 6, 8 Tapu Rd, Huapai
87 Joseph Dunstan Dr, Taupaki	380, 388, 389, 400, 401 Taupaki Road, Taupaki
7 Main Road, Kumeū	9 Trotting Course Dr, Kumeū
335 – 347 (uneven no. only) Main Road, Huapai	903 Waitakere Road, Kumeū

10.3 Assessment of Operational Noise Effects

The use of the RAMC does not cause any appreciable noise levels compared with surrounding rail lines and roads. Therefore, we have not assessed it further. However, we note that the RAMC provides additional distance between the RTC and surrounding sites thus adding a small buffer.

For the RTC, we have assessed electric buses. There are a total of 227 sensitive receivers in the vicinity of the RTC.

10.3.1 Road Based Noise

We understand that only electric buses will be used on the RTC in line with the Auckland Transport "Low Emission Bus Roadmap"[18]. Electric buses emit significantly lower noise levels than diesel buses at lower speeds, but at speeds at and above 50 km/h noise levels are approximately the same as for diesel buses. Speeds of up to 80 km/h are proposed for the RTC.

No information is available as to the frequency of buses; however, we have assumed that at least 12 buses per hour will travel on the RTC, i.e. one every 10 min in each direction. We have predicted noise levels on a potential bus RTC using 100% heavy vehicles and a traffic volume of around 300 buses a day. Based on this assumption, we have predicted noise levels at each PPF adjacent to the RTC.

The bus transit lane will generally travel alongside existing roads or next to the NAL. However, as the NAL currently only carries a very limited number of trains, we have assumed that this part of the RTC would be assessed as a New road.

Of the total 227 PPFs, 37 have been assessed against the Altered road criteria, and 190 against the New road criteria. The location of the PPF distribution is indicated in Figure 10-2 below. Those PPFs assessed against New road criteria are coloured yellow, those assessed against Altered road criteria turquoise.

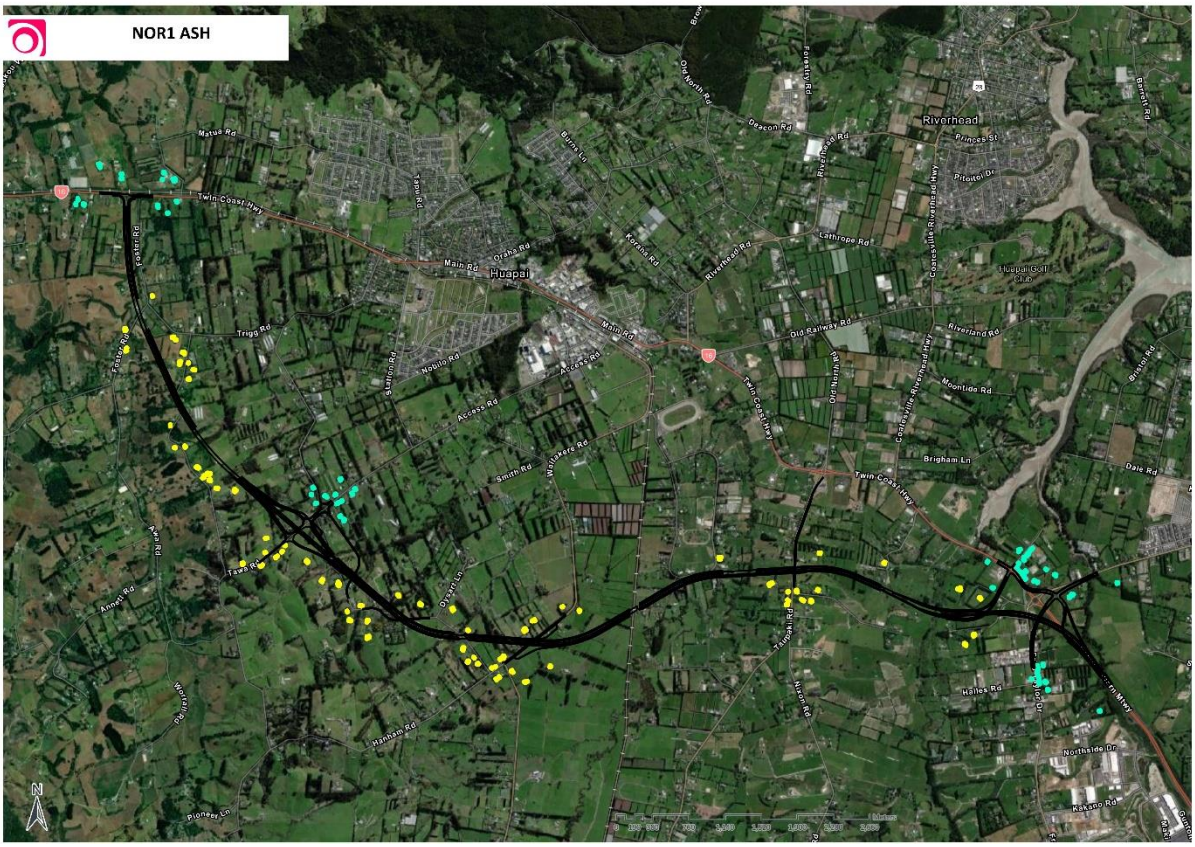


Figure 10-2: New and Altered Road sections within NoR S3 (Bus RTC)

[18] https://at.govt.nz/media/1985010/aucklands-low-emission-bus-roadmap-version-2-october-2020.pdf

For both New and Altered road sections, all PPFs are predicted to receive noise levels within Category A, with a highest predicted noise level of

- 56 dB $L_{Aeq(24h)}$ for the Altered road section and
- 48 dB $L_{Aeq(24h)}$ for the New road section.

We have predicted the noise environment from the future use of the roads in the design year. Noise levels from roads in the vicinity range from 43 dB $L_{Aeq(24h)}$ to 69 dB $L_{Aeq(24h)}$. The use of the RTC by electric buses may:

- add to the noise levels in low noise environments such as in the vicinity of the NAL), and
- not have any effect on the noise levels in high noise environments, e.g. where the RTC travels adjacent to SH16.

Should a significant increase in train numbers on the NAL occur, the establishment of the RTC with buses would be unlikely to contribute to the overall noise level, however, between trains, buses will still be audible and noticeable.

We have predicted noise levels of surrounding roads, with and without buses, and with the implementation of the suite of NoRs discussed in this report. The noise levels from the RTC only will be within Category A for all PPFs. Predicted noise levels for individual PPFs are included in Appendix 1.3. No noise level contours are included in Appendix 2 as the main noise source is traffic on neighbouring roads.

Overall, the effects will be negligible to unnoticeable.

10.3.2 Station Noise

As discussed in Section 2.1.3, station noise is generally defined by PA system noise. These can be easily designed to comply with the relevant AUP:OP zone noise limits. The closest sensitive receivers to both stations are at 105m at Huapai Station and 140m at Kumeū Station. At these distances, any common PA system will be able to comply with the most stringent night-time noise limit of 45 dB L_{Aeq} (refer Table 2-2).

10.4 Conclusions

The operational noise effects from electric buses are predicted to be minimal on the overall noise environment. The buses would be co-located with existing transport routes (rail and road) and, provided that the road surface is well maintained, buses would add only marginally to the overall noise level experienced by PPFs in the vicinity of the road.

Stations can be designed so that compliance with the relevant noise limits can be achieved. Closest sensitive receivers are at significant distances. Therefore, we do not anticipate that station noise will have any significant effect on the overall noise environment.

11 NoR S4: Access Road Upgrade

It is proposed to submit a Notice of Requirement (NoR S4) to designate the land required to implement the upgrade of Access Road to a four-lane corridor with separated walking and cycling facilities.

11.1 Project Corridor Features

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai. The proposed upgrade extends from the intersection of Access Road with SH16 (and entry to the Kumeū-Huapai township) in the east and continues into Tawa Road to its intersection with Puke Road in the west. Access Road plays a key role in connecting the existing and likely future business zones to both the RTC (refer Section 10) and ASH (refer Section 8). It is aligned along the south eastern boundary of the southern FUZ, providing for an enhanced collector network to connect to it.

It is proposed to widen the existing Access Road/Tawa Road corridor from its current width of 20m to accommodate a 30m wide four-lane cross-section. The cross-section of the corridor transitions from the rural edge cross-section to an urban cross-section west of Wookey Lane intersection. Along the western section of Access Road, which is a low-speed rural section, the corridor has a rural southern edge (swales, typically 9m wide top width) with walking and cycling facilities along its northern urban edge. Through the business and industrial area, a 30m urban corridor is provided, including walking and cycling infrastructure along both sides of this eastern section.

An overview of the proposed design is provided in Figure 11-1 below.

Figure 11-1: Overview of Access Road Upgrade

Key features of the proposed upgrade include the following:

- Upgrading the existing Access Road corridor to a 30m wide four-lane arterial road with walking and cycling provisions.
- Existing road surface is maintained, i.e. chip seal grade 3/5.
- A posted speed limit of 60km/h through the urban FUZ-rural edge area and 50km/h through the business and industrial area.
- Tie-ins with existing roads.

11.2 Existing and Likely Future Environment

11.2.1 Planning context

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai.

- The northern side of Access Road is zoned under the AUP:OP as FUZ, with Business – Light Industry Zoning at the north-eastern section of Access Road.
- The southern side of Access Road is predominantly zoned under the AUP:OP as Rural – Countryside Living, with exception to the Kumeū Showgrounds which are zoned as Rural – Mixed Rural Zone are identified as a precinct (I517 Kumeū Showgrounds Precinct) in the AUP:OP.

Table 11-1 below provides a summary of the existing and likely future environment as it relates to Access Road.

Table 11-1: Access Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[19]	Likely Future Environment[20]
Business	Business (Light Industrial) Zone	Low	Urban
Rural	Rural – Countryside Living Zone Rural – Mixed Rural Zone	Low	Rural
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

11.2.2 Existing and Future Noise Environment

Access Road straddles the boundary between an existing rural zone and the FUZ. This means that one side of the road will change significantly in the future, while the other is remaining largely similar to its current state.

[19] Based on AUP:OP zoning/policy direction
[20] Based on AUP:OP zoning/policy direction

Existing noise levels range from the 47 dB $L_{Aeq(24h)}$ to 66 dB $L_{Aeq(24h)}$ at neighbouring dwellings.

The potential future development in the area is predicted to generate a significant amount of extra traffic on local roads, which means that noise levels would increase significantly, around 7-8 decibels in the future, without the implementation of the suite of NoRs discussed in this report.

11.2.3 Buildings inside designation

The following Table 11-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or not occupied by noise sensitive uses when the project is complete. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

Table 11-2: Buildings inside designation (not assessed)

Address	Address
21, 123, 185, 187, 236 Access Road, Kumeū	166 Station Road, Kumeū

11.3 Assessment of Road Traffic Noise Effects

The upgrades proposed for this project involve the widening of the road, both to the north into the FUZ and to the south of the existing road, into the Rural Zone. This zone will not change significantly, while to the north urbanisation is planned in the FUZ. There is currently no structure plan or similar for the FUZ, which means we have no detail on potential future use. It may be developed as a THAB, Mixed Housing Urban, Town Centre or Business / Light Industry. In any event, we have provided traffic noise contours across the entire assessment area, which can be used for the future planning of the FUZ. Where noise sensitive buildings are established, they should be designed appropriately to provide suitable internal noise levels for future residents or occupiers.

11.3.1 NZS6806

The future development in the area is anticipated to increase the traffic volumes significantly. This is reflected in the fact that while currently all PPFs receive noise levels in Categories A, in the Do-nothing scenario there are 16 PPFs receiving noise levels in Category B, and 4 in Category C.

The implementation of the project will result in a significant improvement for a number of PPFs, with no PPFs receiving noise levels in Category C from the Project rather than other roads unrelated to the Project. When including noise from other surrounding roads (which are not altered by the Project), there are four PPFs with noise levels in Category C (150 and 164 Motu Road, 150 Station Road and 76 Tawa Road) controlled by traffic on Tawa and Motu Roads, which would occur irrespective of the Project. For either Do-minimum scenario (with and without local roads) the number of PPFs with noise levels in Category A increases, even when compared with the Do-nothing scenario.

When assessing traffic from Access Road only, only 76 Tawa Road is predicted to receive a slight (1 dB) noise level increase due to the Project, while also receiving noise levels in Category B. All other PPFs with predicted noise levels in Category B (25 and 59 Tawa Road) are predicted to receive noise level reductions. Nevertheless, we have assessed potential mitigation for these PPFs in the form of a barrier. With a 2m boundary fence, both 59 and 76 Tawa Road are predicted to receive noise levels in

Category A. 25 Tawa Road is a double storey dwelling. A boundary fence would not result in sufficient noise level reduction to reach noise levels in Category A unless such fence would be impracticably high. Since this PPFs is predicted to receive a noise level reduction from the implementation of the Project, irrespective of mitigation, we have not recommended any further mitigation.

The number of PPFs in each noise criteria category is summarised in Table 11-3, and figures showing the location of the PPFs are included in Appendix 2.3

Table 11-3: Summary of NZS 6806 assessment – Altered Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	56	0	0
Do-nothing	36	16	4
Do-minimum (Access Road only)	53	3	0
Do-minimum (Access Road and local roads)	46	6	4
Mitigation Option (2m boundary fences)	55	1	0

11.3.2 Change in Noise Levels

For the 56 PPFs assessed, we predict noise level increases from the existing to Do-nothing scenario of up to 11 dB, and an average 7 dB.

With the project in place, and including local roads unaffected by the Project, noise levels are predicted to reduce on average 3 dB compared with the Do-nothing scenario.

Noise level increases of 4 dB are predicted for three PPFs (two buildings at 83 Tawa Road and 236 Access Road). All of these PPFs are predicted to receive noise levels within Category A, so no further mitigation would be required.

With localised mitigation at 59 and 76 Tawa Road (where noise levels are otherwise within Category B), the average noise level reduction remains 3 dB.

Figure 11-2 shows the number of PPFs assessed in each of the change in noise level bands discussed in Table 2-3. It shows clearly that noise levels will overall be lower, as an effect of the redistribution of traffic away from the existing SH16.

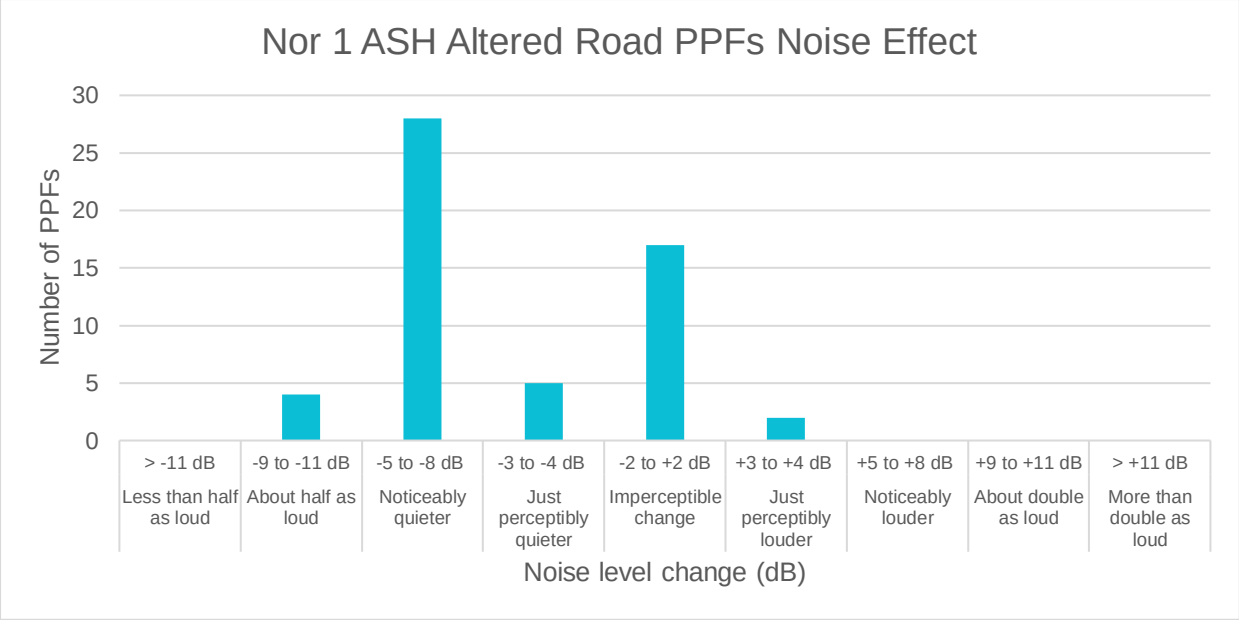


Figure 11-2: Change in noise level

11.4 Conclusions

NoR S4 involves the upgrade to an existing road by widening the road and providing walking and cycling facilities. The proposed widening will bring traffic lanes closer to some dwellings. However, with the implementation of the suite of NoRs discussed in this report, an overall reduction in traffic volume is predicted on Access Road.

With the Project in place, including the mitigation in the form of 2 m boundary fences at two PPFs, only one PPF (25 Tawa Road), which is a double storey dwelling, is predicted to receive noise levels in Category B. A barrier would need to be impracticably high to reduce the noise level at the upper floor. Therefore, no practicable mitigation was identified, and no further mitigation proposed.

With the Project in place and including other local roads in the area that are unaffected by the Project, the noise level is predicted to marginally reduce by an average of 3 dB.

Overall, while in some areas the noise levels will significantly increase (particularly in the vicinity of NoR S1 where a new major road is proposed in a current greenfield environment) the suite of NoRs will have an overall positive effect on the traffic noise levels in the wider area.

12 Conclusion

We have assessed operational noise for the Strategic Assessment Package. The package includes six NoRs: two new or altered roads (NoR S1 and NoR S4), one walking and cycling upgrade (NoR S2) and one rapid transit corridor (facilitating electric buses) and two stations (NoR S3, and NoRs HS and KS).

The road traffic noise of NoRs S1 and S4 has been assessed against NS6806 and in relation to the change in noise level. With limited mitigation in the form of roadside barriers or boundary fences, generally a noise level reduction can be achieved and noise levels within Category A or, for a small number of PPFs, Category B. NoR S1 will result in a noise level increase to a number of PPFs that are currently in a rural area with little major noise sources. Nevertheless, with mitigation, most are predicted to receive noise levels in Category A, with only 19 of the total 134 PPFs receiving noise levels within Category B, and no PPFs noise levels within Category C. For PPFs still predicted to receive noise levels in Category B, mitigation in the form of barriers is impracticable due to the location of the dwelling in relation to the road or because the dwelling is double storey. NoR S4 will result in a small noise level increase at three PPFs that are predicted to receive noise levels above Category A. With boundary fences, for two of these PPFs noise levels can be reduced to be within Category A, and there is no practicable mitigation to further reduce the noise level at the third PPF.

Walking and cycling (NoR S2) do not generate high noise levels and would not add to existing ambient noise levels, particularly where the walking and cycling facilities are located next to a busy road. No further mitigation has been proposed.

The rapid transit in NoR S3 is proposed to be via electric buses. We have assessed the noise against NZS6806, with all PPFs predicted to receive noise levels in Category A.

Road traffic vibration is not normally an issue, particularly for newly constructed and well-maintained roads. Therefore, we have not further assessed it here.

Station noise (NoRs HS and KS) has been assessed against the underlying AUP:OP zone limits. The main noise source from stations is the PA system, which can be designed to comply with the relevant limits. Sensitive receivers are at a significant distance, and we predict ready compliance including at night-time.

Overall, the implementation of the suite of NoRs assessed in this report is predicted to result in a reduction in noise level across all PPFs. While some PPFs are predicted to receive noise level increases (particularly in the vicinity of NoR S1), overall with mitigation in place, noise level will be lower than would have been the case without the suite of NoRs implemented.

1 Appendix A: Predicted Noise Levels at all PPFs

For all tables in this appendix, the following applies:

Situation	Description
Existing	current road layout and traffic volume
Do-nothing	current road layout and future traffic volume (2048+)
Do-minimum	future road layout of the Project of interest only, traffic volumes (2048+) assume that all Projects of the Nort Western Strategic Package have been implemented, but without specific noise mitigation
Mitigation Option	the same as for the Do-minimum Situation, but including noise mitigation in the form of barriers where considered to be BPO

1.1 NoR S1

1.1.1 Altered Road

PPF Address (NoR S1 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
2 Brigham Creek Road, Whenuapai, Auckland	GF	70.3	63.4	61.8	61.8
4 Brigham Creek Road, Whenuapai, Auckland	GF	72.8	64.2	62.6	62.6
6 Brigham Creek Road, Whenuapai, Auckland	GF	63.6	65.4	58.8	58.8
15 Brigham Creek Road, Whenuapai, Auckland (2)	GF	58.4	62.0	62.8	62.8
15 Brigham Creek Road, Whenuapai, Auckland (1)	GF	62.6	64.9	62.2	62.2
23-27 Brigham Creek Road, Whenuapai, Auckland	GF	58.4	60.5	51.5	51.5
107 Fred Taylor Drive, Whenuapai, Auckland	GF	51.9	56.5	53.2	53.2
121 Fred Taylor Drive, Whenuapai, Auckland	GF	55.7	59.4	53.4	53.4
125 Fred Taylor Drive, Whenuapai, Auckland	1.FL	55.7	59.1	55.6	55.6
127 Fred Taylor Drive, Whenuapai, Auckland	GF	65.3	69.0	52.7	52.2
129 Fred Taylor Drive, Whenuapai, Auckland	GF	63.5	67.2	51.8	51.2
131 Fred Taylor Drive, Whenuapai, Auckland	GF	62.4	66.2	51.6	51.6
133 Fred Taylor Drive, Whenuapai, Auckland	GF	64.6	68.4	51.6	51.6

PPF Address (NoR S1 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
135 Fred Taylor Drive, Whenuapai, Auckland	GF	65.5	69.2	56.8	55.8
137 Fred Taylor Drive, Whenuapai, Auckland	GF	64.6	68.3	57.7	56.8
139 Fred Taylor Drive, Whenuapai, Auckland	GF	57.6	61.3	57.9	54.6
141 Fred Taylor Drive, Whenuapai, Auckland	GF	65.3	69.0	63.7	61.1
143 Fred Taylor Drive, Whenuapai, Auckland	1.FL	57.0	60.7	58.8	58.8
172 Fred Taylor Drive, Whenuapai, Auckland	1.FL	66.7	70.4	57.9	58.0
1 Kennedys Road, Whenuapai, Auckland	1.FL	65.9	67.7	63.9	63.9
3 Kennedys Road, Whenuapai, Auckland	GF	58.5	60.2	54.1	53.9
5 Kennedys Road, Whenuapai, Auckland	GF	57.2	57.1	54.9	54.8
9 Kennedys Road, Whenuapai, Auckland	GF	56.9	58.4	55.2	55.2
11 Kennedys Road, Whenuapai, Auckland	GF	55.2	56.5	52.3	52.3
13 Kennedys Road, Whenuapai, Auckland	GF	54.5	55.7	52.1	52.1
15 Kennedys Road, Whenuapai, Auckland	1.FL	56.8	58.0	54.2	54.2
17 Kennedys Road, Whenuapai, Auckland	GF	54.2	55.6	51.6	51.6
19 Kennedys Road, Whenuapai, Auckland	1.FL	61.6	62.6	57.5	57.5
2-6 Kennedys Road, Whenuapai, Auckland	1.FL	57.1	59.0	54.8	54.7
17A Kennedys Road, Whenuapai, Auckland	GF	54.3	55.6	51.7	51.7
392 Matua Road, Kumeu	GF	59.1	59.7	51.7	51.6
402 Matua Road, Kumeu	1.FL	62.4	64.9	51.1	51.0
392B Matua Road, Kumeu	GF	59.7	60.0	52.0	52.0
150 Motu Road, Kumeu	1.FL	60.7	72.7	53.1	53.1
158 Motu Road, Kumeu	1.FL	55.6	65.9	58.0	58.0
164 Motu Road, Kumeu	1.FL	60.7	71.9	63.2	63.2
171 State Highway 16, Whenuapai, Auckland	GF	69.8	68.6	66.0	63.8
173 State Highway 16, Whenuapai, Auckland	GF	68.1	68.5	65.8	64.2
175 State Highway 16, Whenuapai, Auckland	GF	67.6	68.5	65.1	64.2
177 State Highway 16, Whenuapai, Auckland	GF	66.4	68.3	65.3	64.0
179 State Highway 16, Whenuapai, Auckland	GF	65.6	67.6	63.7	63.7
181 State Highway 16, Whenuapai, Auckland	GF	65.3	67.3	64.2	64.1

PPF Address (NoR S1 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
218 State Highway 16, Whenuapai, Auckland	GF	56.4	57.7	58.0	57.8
222 State Highway 16, Whenuapai, Auckland	GF	65.8	67.8	52.8	52.4
677 State Highway 16, Kumeu	GF	68.7	68.6	51.0	51.0
693 State Highway 16, Kumeu	1.FL	62.0	62.2	54.2	54.2
695 State Highway 16, Kumeu	GF	65.4	65.3	55.2	55.2
726 State Highway 16, Kumeu (2)	GF	57.7	58.4	48.9	48.9
726 State Highway 16, Kumeu (1)	1.FL	62.3	63.1	56.5	56.4
728 State Highway 16, Kumeu	1.FL	56.8	57.7	48.9	48.9
761 State Highway 16, Kumeu (2)	GF	67.7	68.6	41.9	41.9
761 State Highway 16, Kumeu (1)	GF	63.8	64.6	45.4	45.4
763 State Highway 16, Kumeu	GF	62.3	63.1	40.3	40.3
59 Tawa Road, Kumeu	GF	58.3	66.3	52.2	52.2
63 Tawa Road, Kumeu	GF	52.8	60.2	53.4	53.3
66 Tawa Road, Kumeu	GF	49.3	56.3	50.9	50.9
73 Tawa Road, Kumeu	GF	57.1	64.8	56.4	56.4
76 Tawa Road, Kumeu	GF	58.2	65.8	60.7	60.7
79 Tawa Road, Kumeu	GF	59.0	67.1	63.3	63.1
83 Tawa Road, Kumeu (2)	GF	51.0	57.6	61.1	61.1
83 Tawa Road, Kumeu (1)	GF	50.0	56.6	59.9	59.9
86 Tawa Road, Kumeu (2)	GF	54.6	62.3	61.7	61.7
86 Tawa Road, Kumeu (1)	GF	54.6	64.2	60.0	60.0

12.1.1 New Road

PPF Address (NoR S1 New Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
186 Boord Crescent, Kumeu	GF	57.3	55.8	60.0	59.1
4 Dysart Lane, Kumeu	GF	52.3	59.1	58.1	56.3
81 Foster Road, Kumeu	GF	56.6	62.9	55.5	54.6
116 Foster Road, Kumeu	GF	58.2	62.4	54.1	54.2
131 Foster Road, Kumeu	GF	57.2	61.5	53.8	53.8
196 Fred Taylor Drive, Whenuapai, Auckland	GF	50.2	51.9	55.1	55.1
198 Fred Taylor Drive, Whenuapai, Auckland	1.FL	49.3	51.3	54.1	54.1
208 Fred Taylor Drive, Whenuapai, Auckland	GF	54.2	55.7	58.3	57.3

PPF Address (NoR S1 New Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
210 Fred Taylor Drive, Whenuapai, Auckland	GF	53.9	55.8	55.4	55.0
2 Hanham Road, Kumeu	GF	55.3	62.7	59.3	56.6
6 Hanham Road, Kumeu	GF	53.0	59.9	54.6	53.9
8 Hanham Road, Kumeu	GF	57.4	64.3	55.7	53.6
9 Hanham Road, Kumeu	GF	53.0	60.6	54.6	54.1
14 Joseph Dunstan Drive, Taupaki	GF	51.1	53.4	55.6	54.8
28 Pomona Road, Kumeu	1.FL	52.3	58.9	61.2	59.8
48 Pomona Road, Kumeu	GF	53.4	60.1	58.2	56.1
66 Pomona Road, Kumeu	GF	60.5	67.5	59.6	57.6
90 Pomona Road, Kumeu	GF	59.5	67.1	60.0	57.7
94 Pomona Road, Kumeu	1.FL	56.0	62.8	57.7	57.1
95 Pomona Road, Kumeu	GF	61.4	68.6	62.3	59.3
96 Pomona Road, Kumeu	GF	54.9	61.7	59.3	59.2
114 Pomona Road, Kumeu	GF	50.4	56.8	56.0	56.0
123 Pomona Road, Kumeu (2)	GF	52.9	59.8	59.4	58.6
123 Pomona Road, Kumeu (1)	GF	51.2	58.1	58.0	57.4
151 Pomona Road, Kumeu	GF	53.1	60.1	54.9	54.9
191 Pomona Road, Kumeu	1.FL	57.8	64.8	62.1	59.9
194 Pomona Road, Kumeu	GF	57.1	64.0	62.1	59.7
212 Pomona Road, Kumeu	GF	61.3	68.3	59.4	57.0
214 Pomona Road, Kumeu	GF	53.5	60.3	58.4	57.1
218 Pomona Road, Kumeu	GF	61.5	68.4	58.1	56.4
18 Puke Road, Kumeu	GF	52.9	62.5	52.2	52.2
21 Puke Road, Kumeu	GF	52.4	65.1	50.4	50.3
22 Puke Road, Kumeu	GF	49.3	58.6	55.2	55.2
27 Puke Road, Kumeu	GF	49.7	54.2	47.3	47.3
37 Puke Road, Kumeu	GF	48.0	57.7	50.1	49.9
80 Puke Road, Kumeu	GF	47.6	59.3	48.6	48.5
104 Puke Road, Kumeu	GF	49.4	59.4	53.6	53.6
107 Puke Road, Kumeu	GF	50.5	63.2	56.4	56.4
133 Puke Road, Kumeu	GF	48.1	54.0	55.6	55.5
139 Puke Road, Kumeu (2)	GF	46.4	52.0	58.5	58.6
139 Puke Road, Kumeu (1)	GF	51.7	56.9	55.2	55.3
145 Puke Road, Kumeu	GF	46.4	51.8	55.6	55.6
151 Puke Road, Kumeu	GF	45.9	51.4	55.2	55.2
157 Puke Road, Kumeu	GF	46.4	52.4	59.6	59.3
284 State Highway 16, Kumeu	GF	50.9	52.3	57.8	55.7
362 Taupaki Road, Taupaki	GF	62.4	64.7	50.9	50.9
364 Taupaki Road, Taupaki	GF	63.7	65.9	51.6	51.5
367 Taupaki Road, Taupaki	GF	56.5	58.8	54.8	54.1

PPF Address (NoR S1 New Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
370 Taupaki Road, Taupaki	GF	61.2	63.5	53.3	53.2
374 Taupaki Road, Taupaki	1.FL	51.5	53.8	63.7	62.6
375 Taupaki Road, Taupaki	GF	63.7	65.9	55.8	55.1
377 Taupaki Road, Taupaki	1.FL	51.8	54.1	60.3	58.9
405 Taupaki Road, Kumeu	GF	49.6	51.9	55.5	55.8
137 Tawa Road, Kumeu	GF	59.1	57.6	64.1	63.2
141 Tawa Road, Kumeu	1.FL	55.0	56.6	60.0	59.3
145 Tawa Road, Kumeu	GF	52.4	53.8	55.4	54.9
148 Tawa Road, Kumeu	GF	48.5	53.1	56.5	56.5
154 Tawa Road, Kumeu	GF	54.5	55.2	57.8	57.3
155 Tawa Road, Kumeu	GF	56.5	55.1	56.4	56.2
176 Tawa Road, Kumeu	GF	51.0	51.6	49.1	49.0
227 Trigg Road, Kumeu (2)	GF	55.5	57.8	54.2	54.1
227 Trigg Road, Kumeu (1)	GF	54.3	56.8	52.5	52.5
609 Waitakere Road, Kumeu	GF	52.7	60.6	49.1	48.8
637 Waitakere Road, Kumeu	GF	62.4	70.4	57.9	57.4
646 Waitakere Road, Kumeu (2)	GF	55.6	63.4	57.9	57.5
646 Waitakere Road, Kumeu (1)	GF	54.2	60.3	60.6	57.7
670 Waitakere Road, Kumeu	GF	49.5	54.5	60.8	58.2
679 Waitakere Road, Kumeu	GF	47.6	53.1	59.6	58.7
682 Waitakere Road, Kumeu	GF	49.9	54.6	56.0	55.4
710 Waitakere Road, Kumeu	GF	51.2	55.9	54.9	54.1
723 Waitakere Road, Kumeu	GF	53.0	57.9	58.1	56.8

1.2 NoR S2

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
24 Access Road, Kumeu	GF	59.9	64.8	43.2
26 Access Road, Kumeu (3)	GF	60.4	65.3	40.2
26 Access Road, Kumeu (1)	GF	51.8	55.6	39.2
27 Access Road, Kumeu (2)	GF	55.5	60.2	44.6
1-23 Croatia Avenue, Huapai, Kumeu (14)	GF	47.4	50.4	41.0
1-23 Croatia Avenue, Huapai, Kumeu (13)	GF	47.5	50.1	40.0
1-23 Croatia Avenue, Huapai, Kumeu (12)	GF	46.5	50.2	41.6

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
1-23 Croatia Avenue, Huapai, Kumeu (11)	GF	47.6	50.5	42.6
1-23 Croatia Avenue, Huapai, Kumeu (10)	GF	46.9	49.2	41.9
1-23 Croatia Avenue, Huapai, Kumeu (9)	GF	48.4	49.8	45.7
1-23 Croatia Avenue, Huapai, Kumeu (8)	GF	47.9	49.4	44.4
1-23 Croatia Avenue, Huapai, Kumeu (7)	GF	50.3	50.6	47.9
1-23 Croatia Avenue, Huapai, Kumeu (6)	GF	47.4	49.9	39.7
1-23 Croatia Avenue, Huapai, Kumeu (5)	GF	47.2	49.8	39.7
1-23 Croatia Avenue, Huapai, Kumeu (4)	GF	46.7	49.7	41.1
1-23 Croatia Avenue, Huapai, Kumeu (3)	GF	47.1	49.6	42.6
1-23 Croatia Avenue, Huapai, Kumeu (2)	3.FL	54.7	57.5	53.5
1-23 Croatia Avenue, Huapai, Kumeu (1)	GF	48.3	52.0	43.6
56 Dida Park Drive, Huapai, Kumeu	GF	47.1	51.5	37.6
58 Dida Park Drive, Huapai, Kumeu	GF	49.4	52.5	44.5
44 Gilbransen Road, Kumeu	GF	56.3	55.5	44.2
47 Gilbransen Road, Kumeu (2)	1.FL	51.2	51.0	42.0
47 Gilbransen Road, Kumeu (1)	GF	58.1	57.2	47.6
50 Gilbransen Road, Kumeu (2)	GF	62.6	61.6	49.8
50 Gilbransen Road, Kumeu (1)	GF	59.3	58.4	47.0
44A Gilbransen Road, Kumeu	GF	57.4	56.6	45.7
44B Gilbransen Road, Kumeu	GF	57.2	56.4	45.8
44C Gilbransen Road, Kumeu	GF	58.0	57.1	46.4
44D Gilbransen Road, Kumeu	GF	58.5	57.6	46.9
8 Grivelle Street, Kumeu (2)	GF	51.5	55.0	42.7
8 Grivelle Street, Kumeu (1)	GF	51.3	55.8	40.6
7 Main Road, Kumeu	GF	61.2	61.7	57.3
342 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	60.7
344 Main Road, Huapai, Kumeu	GF	62.4	62.3	58.0
346 Main Road, Huapai, Kumeu	GF	57.4	57.5	53.0
348 Main Road, Huapai, Kumeu	1.FL	66.0	65.8	61.6
350 Main Road, Huapai, Kumeu	1.FL	63.8	63.7	59.7
351 Main Road, Huapai, Kumeu	GF	65.6	65.4	61.6
352 Main Road, Huapai, Kumeu	GF	64.4	64.3	60.2
353 Main Road, Huapai, Kumeu	GF	65.9	65.7	62.3
354 Main Road, Huapai, Kumeu	GF	62.6	62.6	58.8
355 Main Road, Huapai, Kumeu	GF	64.4	64.2	60.5
356 Main Road, Huapai, Kumeu	GF	64.5	64.4	60.4
357 Main Road, Huapai, Kumeu	GF	65.7	65.5	62.5
358 Main Road, Huapai, Kumeu	GF	60.8	60.8	56.7
359 Main Road, Huapai, Kumeu	GF	65.0	64.8	62.0
360 Main Road, Huapai, Kumeu	1.FL	62.0	61.9	57.9

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
361 Main Road, Huapai, Kumeu	GF	62.9	62.8	59.6
362 Main Road, Huapai, Kumeu (2)	1.FL	65.9	65.8	61.7
362 Main Road, Huapai, Kumeu (1)	1.FL	62.3	62.2	58.1
364 Main Road, Huapai, Kumeu	GF	60.8	60.8	56.7
365 Main Road, Huapai, Kumeu	GF	61.8	61.7	58.6
366 Main Road, Huapai, Kumeu	GF	57.9	57.9	53.7
367 Main Road, Huapai, Kumeu	GF	65.1	65.0	62.1
368 Main Road, Huapai, Kumeu	GF	61.4	61.3	57.3
370 Main Road, Huapai, Kumeu	GF	61.4	61.4	57.3
372 Main Road, Huapai, Kumeu	GF	63.8	63.7	59.6
376 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	61.0
382 Main Road, Huapai, Kumeu	GF	66.7	66.5	62.6
395 Main Road, Huapai, Kumeu (2)	GF	59.2	59.6	56.3
395 Main Road, Huapai, Kumeu (1)	GF	56.2	57.1	52.8
399 Main Road, Huapai, Kumeu	GF	62.0	62.3	59.2
401 Main Road, Huapai, Kumeu	GF	61.1	61.4	58.5
405 Main Road, Huapai, Kumeu	GF	66.8	66.4	55.2
407 Main Road, Huapai, Kumeu	GF	67.5	66.9	58.7
407A Main Road, Huapai, Kumeu	1.FL	66.6	65.9	58.2
9 Matua Road, Huapai, Kumeu	GF	53.0	56.3	41.5
11 Matua Road, Huapai, Kumeu	GF	51.6	54.4	42.0
15 Matua Road, Huapai, Kumeu	GF	50.4	52.8	40.0
17 Matua Road, Huapai, Kumeu	GF	50.1	52.8	42.1
19 Matua Road, Huapai, Kumeu	GF	49.7	51.6	42.4
21 Matua Road, Huapai, Kumeu	1.FL	53.0	55.7	43.0
22 Matua Road, Huapai, Kumeu	GF	62.0	66.8	41.6
23 Matua Road, Huapai, Kumeu	1.FL	51.7	54.4	41.9
24 Matua Road, Huapai, Kumeu	GF	52.9	56.0	40.6
384 Matua Road, Kumeu	GF	56.7	57.6	48.7
392 Matua Road, Kumeu	GF	59.1	59.7	48.2
402 Matua Road, Kumeu	1.FL	62.4	64.9	63.2
411 Matua Road, Kumeu	GF	58.1	59.3	55.8
392B Matua Road, Kumeu	GF	59.7	60.0	50.4
5 Merlot Heights, Huapai, Kumeu	1.FL	53.1	54.8	45.5
6 Merlot Heights, Huapai, Kumeu	GF	49.7	52.4	41.0
7 Merlot Heights, Huapai, Kumeu	1.FL	54.2	55.7	46.6
9 Merlot Heights, Huapai, Kumeu	1.FL	54.4	55.7	46.8
10 Merlot Heights, Huapai, Kumeu	GF	49.2	51.4	41.7
11 Merlot Heights, Huapai, Kumeu	GF	49.1	50.3	43.7
17 Merlot Heights, Huapai, Kumeu	GF	48.3	49.7	41.8
18 Merlot Heights, Huapai, Kumeu	GF	49.4	51.2	43.0

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
19 Merlot Heights, Huapai, Kumeu	GF	46.9	48.4	41.2
21 Merlot Heights, Huapai, Kumeu	GF	47.7	48.9	41.6
22 Merlot Heights, Huapai, Kumeu	GF	47.2	48.7	42.0
23 Merlot Heights, Huapai, Kumeu	GF	47.3	48.7	40.8
25 Merlot Heights, Huapai, Kumeu	GF	48.0	49.3	42.2
26 Merlot Heights, Huapai, Kumeu	GF	47.3	49.9	41.6
27 Merlot Heights, Huapai, Kumeu	GF	47.9	49.3	41.6
29 Merlot Heights, Huapai, Kumeu	GF	47.9	49.3	41.5
31 Merlot Heights, Huapai, Kumeu	GF	47.0	48.6	40.9
1 Oraha Road, Huapai, Kumeu	GF	52.9	53.5	46.1
3 Oraha Road, Huapai, Kumeu	GF	53.2	54.1	45.0
6 Oraha Road, Huapai, Kumeu	1.FL	56.0	61.2	43.5
8 Oraha Road, Huapai, Kumeu	GF	66.0	71.6	38.6
10 Oraha Road, Huapai, Kumeu	GF	61.3	66.9	41.9
12 Oraha Road, Huapai, Kumeu	GF	62.9	68.5	41.2
18 Oraha Road, Huapai, Kumeu	GF	59.5	65.0	40.4
20 Oraha Road, Huapai, Kumeu	GF	54.8	55.3	44.1
25 Oraha Road, Huapai, Kumeu	1.FL	65.0	70.1	43.9
27 Oraha Road, Huapai, Kumeu	GF	64.9	70.3	41.3
29 Oraha Road, Huapai, Kumeu	1.FL	61.2	66.5	41.7
31 Oraha Road, Huapai, Kumeu	GF	62.5	68.0	39.4
32 Oraha Road, Huapai, Kumeu	GF	49.9	53.5	43.0
33 Oraha Road, Huapai, Kumeu	GF	54.7	59.7	38.1
35 Oraha Road, Huapai, Kumeu	GF	61.9	67.3	40.1
39 Oraha Road, Huapai, Kumeu	GF	57.3	62.5	38.4
5-21 Oraha Road, Huapai, Kumeu	1.FL	64.0	66.7	52.2
1 Pinotage Place, Huapai, Kumeu	1.FL	52.4	55.6	40.6
3 Pinotage Place, Huapai, Kumeu	1.FL	54.0	57.5	41.5
5 Pinotage Place, Huapai, Kumeu	GF	50.3	53.7	38.6
7 Pinotage Place, Huapai, Kumeu	1.FL	51.6	55.2	39.8
9 Pinotage Place, Huapai, Kumeu	GF	48.7	52.1	37.4
11 Pinotage Place, Huapai, Kumeu	GF	48.8	52.1	37.7
13B Pinotage Place, Huapai, Kumeu	1.FL	53.9	58.3	40.2
22 Riverhead Road, Kumeu	1.FL	58.9	63.4	58.7
23 Riverhead Road, Kumeu	GF	57.8	63.2	57.7
24 Riverhead Road, Kumeu	1.FL	60.2	65.8	62.1
26 Riverhead Road, Kumeu	GF	58.8	64.9	61.3
27 Riverhead Road, Kumeu	GF	57.3	62.5	59.4
28 Riverhead Road, Kumeu	1.FL	59.9	65.8	62.5
29 Riverhead Road, Kumeu	GF	56.8	62.3	59.1
30 Riverhead Road, Kumeu	GF	57.8	63.7	60.4

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
31 Riverhead Road, Kumeu (2)	GF	52.4	53.7	48.8
31 Riverhead Road, Kumeu (1)	GF	54.5	56.0	52.0
32 Riverhead Road, Kumeu	1.FL	59.1	65.3	61.8
33 Riverhead Road, Kumeu	1.FL	56.4	58.2	53.1
34 Riverhead Road, Kumeu	GF	56.9	63.1	59.7
35 Riverhead Road, Kumeu	GF	56.3	61.8	58.5
36 Riverhead Road, Kumeu	GF	57.2	63.6	58.1
37 Riverhead Road, Kumeu	GF	55.7	61.2	57.1
38 Riverhead Road, Kumeu	GF	57.1	63.4	55.2
39 Riverhead Road, Kumeu	GF	50.8	53.1	47.6
40 Riverhead Road, Kumeu	GF	54.3	60.0	48.1
41 Riverhead Road, Kumeu	GF	56.6	63.1	53.9
42 Riverhead Road, Kumeu	1.FL	55.1	59.8	50.1
43 Riverhead Road, Kumeu	GF	58.6	65.8	53.6
44 Riverhead Road, Kumeu	1.FL	59.3	65.9	53.2
45 Riverhead Road, Kumeu	1.FL	59.6	66.7	48.2
46 Riverhead Road, Kumeu	1.FL	58.1	64.4	49.5
47 Riverhead Road, Kumeu	GF	55.3	61.7	41.9
49 Riverhead Road, Kumeu	1.FL	56.5	62.5	44.5
51 Riverhead Road, Kumeu	GF	57.1	64.1	46.3
52 Riverhead Road, Kumeu	GF	57.1	63.7	47.5
53 Riverhead Road, Kumeu	GF	55.9	62.8	42.6
54 Riverhead Road, Kumeu	GF	56.6	63.5	38.7
56 Riverhead Road, Kumeu	GF	55.0	61.7	40.0
58 Riverhead Road, Kumeu	GF	50.2	56.4	39.8
21A Riverhead Road, Kumeu	1.FL	59.5	60.9	56.7
39A Riverhead Road, Kumeu	GF	55.8	61.5	56.8
529 State Highway 16, Kumeu	GF	65.1	64.0	53.2
551 State Highway 16, Kumeu	GF	61.1	60.1	49.6
573 State Highway 16, Kumeu	GF	65.7	64.6	53.7
583 State Highway 16, Kumeu	GF	59.8	58.8	47.9
587 State Highway 16, Kumeu	GF	67.9	66.8	58.0
601 State Highway 16, Kumeu	1.FL	68.5	67.5	57.6
623 State Highway 16, Kumeu	1.FL	68.0	67.1	59.4
631 State Highway 16, Kumeu	GF	70.1	69.2	59.4
641 State Highway 16, Kumeu (2)	GF	57.2	56.3	48.4
641 State Highway 16, Kumeu (1)	GF	61.2	60.3	51.5
643 State Highway 16, Kumeu	1.FL	70.5	69.6	59.8
647 State Highway 16, Kumeu	1.FL	70.0	69.1	60.3
665 State Highway 16, Kumeu	GF	69.8	68.9	62.4
677 State Highway 16, Kumeu	GF	68.7	68.6	62.9

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
693 State Highway 16, Kumeu	1.FL	62.0	62.2	53.0
695 State Highway 16, Kumeu	GF	65.4	65.3	53.4
631A State Highway 16, Kumeu	GF	61.5	60.7	51.7
4 Station Road, Huapai, Kumeu	GF	59.4	64.5	58.8
6 Station Road, Huapai, Kumeu	GF	56.1	58.4	52.7
8 Station Road, Huapai, Kumeu	GF	55.6	57.1	51.9
10 Station Road, Huapai, Kumeu	GF	53.6	54.9	49.9
12 Station Road, Huapai, Kumeu	GF	50.1	51.4	47.7
14 Station Road, Huapai, Kumeu	GF	49.7	51.3	47.3
20 Station Road, Huapai, Kumeu	GF	53.8	58.3	55.7
22 Station Road, Huapai, Kumeu	GF	58.7	63.9	62.6
24 Station Road, Huapai, Kumeu	GF	58.0	63.3	61.6
25 Station Road, Huapai, Kumeu	1.FL	61.8	67.6	56.3
26 Station Road, Huapai, Kumeu	GF	50.3	53.8	51.3
28 Station Road, Huapai, Kumeu	GF	50.0	51.7	48.5
30 Station Road, Huapai, Kumeu	GF	49.1	50.3	46.1
32 Station Road, Huapai, Kumeu	GF	49.4	50.5	45.9
34 Station Road, Huapai, Kumeu	GF	49.9	51.8	48.2
36 Station Road, Huapai, Kumeu	GF	50.3	53.8	49.6
38 Station Road, Huapai, Kumeu	GF	58.6	64.1	58.0
40 Station Road, Huapai, Kumeu (9)	GF	49.7	51.4	46.3
40 Station Road, Huapai, Kumeu (8)	GF	50.8	52.9	46.3
40 Station Road, Huapai, Kumeu (7)	GF	51.5	53.7	43.7
40 Station Road, Huapai, Kumeu (6)	GF	49.9	50.9	43.9
40 Station Road, Huapai, Kumeu (5)	GF	58.7	63.9	49.0
40 Station Road, Huapai, Kumeu (4)	GF	51.7	55.8	46.5
40 Station Road, Huapai, Kumeu (3)	GF	51.0	52.2	46.3
40 Station Road, Huapai, Kumeu (2)	GF	50.2	51.3	45.4
40 Station Road, Huapai, Kumeu (1)	GF	50.3	54.3	40.8
3 Sunny Crescent, Huapai, Kumeu	GF	51.5	51.8	40.7
4 Sunny Crescent, Huapai, Kumeu	GF	49.3	49.8	42.7
7 Sunny Crescent, Huapai, Kumeu	GF	50.8	51.1	41.4
8 Sunny Crescent, Huapai, Kumeu	GF	49.5	49.9	45.6
11 Sunny Crescent, Huapai, Kumeu	1.FL	51.9	52.1	43.6
12 Sunny Crescent, Huapai, Kumeu	GF	47.4	48.4	42.7
16 Sunny Crescent, Huapai, Kumeu	1.FL	52.5	53.4	49.0
20 Sunny Crescent, Huapai, Kumeu	GF	50.9	51.6	47.1
24 Sunny Crescent, Huapai, Kumeu	GF	51.2	51.8	46.9
28 Sunny Crescent, Huapai, Kumeu	GF	50.0	50.8	46.2
29 Sunny Crescent, Huapai, Kumeu	GF	48.3	49.4	42.8
32 Sunny Crescent, Huapai, Kumeu	GF	48.7	49.6	44.2

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
33 Sunny Crescent, Huapai, Kumeu	GF	50.2	50.7	42.3
36 Sunny Crescent, Huapai, Kumeu	GF	49.9	50.5	45.7
37 Sunny Crescent, Huapai, Kumeu	GF	48.7	49.5	42.4
41 Sunny Crescent, Huapai, Kumeu	GF	48.3	49.3	43.5
42 Sunny Crescent, Huapai, Kumeu	GF	47.6	48.5	42.3
45 Sunny Crescent, Huapai, Kumeu	1.FL	50.2	51.1	45.3
46 Sunny Crescent, Huapai, Kumeu	GF	49.6	50.3	43.7
49 Sunny Crescent, Huapai, Kumeu	GF	49.3	50.4	44.2
50 Sunny Crescent, Huapai, Kumeu	GF	48.1	49.4	42.3
53 Sunny Crescent, Huapai, Kumeu	GF	48.0	49.6	43.0
54 Sunny Crescent, Huapai, Kumeu	GF	47.2	48.4	41.1
57 Sunny Crescent, Huapai, Kumeu	GF	47.9	49.4	41.8
61 Sunny Crescent, Huapai, Kumeu	GF	47.6	49.2	42.4
3 Tapu Road, Huapai, Kumeu	GF	62.3	62.6	61.2
5 Tapu Road, Huapai, Kumeu	GF	51.9	52.7	48.8
7 Tapu Road, Huapai, Kumeu	GF	50.3	51.0	47.8
9 Tapu Road, Huapai, Kumeu	GF	63.4	63.7	62.1
10 Tapu Road, Huapai, Kumeu	GF	64.4	64.6	63.3
11 Tapu Road, Huapai, Kumeu	GF	65.2	65.5	62.1
12 Tapu Road, Huapai, Kumeu	GF	51.2	51.8	52.1
13 Tapu Road, Huapai, Kumeu	GF	64.6	64.8	57.5
14 Tapu Road, Huapai, Kumeu	GF	65.4	65.7	62.6
15 Tapu Road, Huapai, Kumeu	GF	63.0	63.3	53.2
16 Tapu Road, Huapai, Kumeu	GF	66.2	66.4	58.9
17 Tapu Road, Huapai, Kumeu	GF	64.9	65.1	53.7
18 Tapu Road, Huapai, Kumeu	1.FL	54.6	55.1	52.4
19 Tapu Road, Huapai, Kumeu	1.FL	64.6	64.8	47.8
20 Tapu Road, Huapai, Kumeu	1.FL	54.4	54.5	47.2
21 Tapu Road, Huapai, Kumeu	GF	62.6	62.9	48.3
22 Tapu Road, Huapai, Kumeu	1.FL	67.8	68.0	57.4
23 Tapu Road, Huapai, Kumeu	GF	63.8	64.1	49.1
24 Tapu Road, Huapai, Kumeu	GF	63.2	63.5	43.0
25 Tapu Road, Huapai, Kumeu	GF	63.4	63.6	48.4
26 Tapu Road, Huapai, Kumeu	1.FL	53.1	52.9	48.7
27 Tapu Road, Huapai, Kumeu	GF	63.8	64.0	48.3
28 Tapu Road, Huapai, Kumeu	1.FL	53.2	53.1	47.4
30 Tapu Road, Huapai, Kumeu	GF	64.2	64.5	49.3
32 Tapu Road, Huapai, Kumeu	1.FL	52.9	52.8	46.3
36 Tapu Road, Huapai, Kumeu	GF	62.5	62.7	43.8
38 Tapu Road, Huapai, Kumeu	1.FL	64.0	64.3	49.2
40 Tapu Road, Huapai, Kumeu	GF	63.6	63.8	48.2

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
42 Tapu Road, Huapai, Kumeu	GF	64.6	64.9	48.1
44 Tapu Road, Huapai, Kumeu	GF	61.4	61.6	42.9
16A Tapu Road, Huapai, Kumeu	GF	52.6	53.5	49.4
2 Tokay Place, Huapai, Kumeu	GF	49.5	50.5	43.3
3 Tokay Place, Huapai, Kumeu	GF	50.6	51.6	43.8
4 Tokay Place, Huapai, Kumeu	1.FL	51.9	52.5	45.3
5 Tokay Place, Huapai, Kumeu	GF	50.3	51.0	45.0
6 Tokay Place, Huapai, Kumeu	1.FL	49.7	50.9	43.8
7 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	43.2
8 Tokay Place, Huapai, Kumeu	1.FL	50.2	51.0	43.9
9 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	43.5
10 Tokay Place, Huapai, Kumeu	1.FL	48.7	50.1	42.7
11 Tokay Place, Huapai, Kumeu	1.FL	51.0	51.7	45.8
12 Tokay Place, Huapai, Kumeu	1.FL	49.1	50.1	43.4
15 Tokay Place, Huapai, Kumeu	1.FL	50.5	51.5	45.3
17 Tokay Place, Huapai, Kumeu	1.FL	53.0	53.6	48.0
19 Tokay Place, Huapai, Kumeu	GF	47.1	48.3	40.8
1 Trigg Road, Huapai, Kumeu	GF	59.6	62.1	55.5
2 Trigg Road, Huapai, Kumeu	1.FL	60.5	62.0	54.4
3 Trigg Road, Huapai, Kumeu	GF	58.4	61.6	49.1
4 Trigg Road, Huapai, Kumeu	GF	54.2	53.8	46.6
5 Trigg Road, Huapai, Kumeu	GF	58.2	63.7	46.9
6 Trigg Road, Huapai, Kumeu	1.FL	60.0	59.4	52.0
8 Trigg Road, Huapai, Kumeu	GF	54.9	59.0	46.5
10 Trigg Road, Huapai, Kumeu	GF	53.2	57.7	43.2
12 Trigg Road, Huapai, Kumeu	GF	53.8	57.9	44.5
14 Trigg Road, Huapai, Kumeu	1.FL	56.5	61.8	47.3
15 Trigg Road, Huapai, Kumeu	GF	56.7	62.1	43.2
16 Trigg Road, Huapai, Kumeu (2)	1.FL	56.6	61.9	44.7
16 Trigg Road, Huapai, Kumeu (1)	1.FL	55.0	55.1	46.2
17 Trigg Road, Huapai, Kumeu	GF	49.9	51.5	43.5
18 Trigg Road, Huapai, Kumeu	GF	54.0	58.9	40.8
19 Trigg Road, Huapai, Kumeu	GF	48.1	49.2	42.9
20 Trigg Road, Huapai, Kumeu	GF	55.4	61.0	41.0
21 Trigg Road, Huapai, Kumeu	1.FL	57.8	62.6	45.7
22 Trigg Road, Huapai, Kumeu	GF	55.8	61.5	41.3
23 Trigg Road, Huapai, Kumeu	1.FL	52.6	55.0	47.0
24 Trigg Road, Huapai, Kumeu (2)	GF	52.2	52.4	42.6
24 Trigg Road, Huapai, Kumeu (1)	GF	56.0	61.9	40.2
25 Trigg Road, Huapai, Kumeu	GF	54.9	59.1	43.0
26 Trigg Road, Huapai, Kumeu	GF	55.9	61.7	40.8

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
14A Trigg Road, Huapai, Kumeu	GF	57.5	63.9	43.1
17A Trigg Road, Huapai, Kumeu	GF	48.9	50.1	46.0
19A Trigg Road, Huapai, Kumeu	GF	48.9	50.0	44.7
23A Trigg Road, Huapai, Kumeu	GF	50.0	52.5	44.1
103 Vinistra Road, Huapai, Kumeu	GF	46.9	50.2	40.8
1 Vintners Close, Huapai, Kumeu	GF	55.7	60.3	45.7
2 Vintners Close, Huapai, Kumeu	GF	57.7	63.7	44.2
3 Vintners Close, Huapai, Kumeu	1.FL	54.2	54.6	50.7
4 Vintners Close, Huapai, Kumeu	GF	51.2	53.5	44.9
5 Vintners Close, Huapai, Kumeu	GF	52.2	52.8	49.3
6 Vintners Close, Huapai, Kumeu	1.FL	52.3	53.1	47.5
7 Vintners Close, Huapai, Kumeu	1.FL	55.4	56.1	52.4
8 Vintners Close, Huapai, Kumeu	1.FL	51.4	52.5	48.7
9 Vintners Close, Huapai, Kumeu	1.FL	52.9	53.7	49.6
22 Weza Lane, Kumeu	1.FL	55.5	56.7	51.6
24 Weza Lane, Kumeu	GF	53.9	55.1	49.7
26 Weza Lane, Kumeu	1.FL	55.3	56.6	51.3
28 Weza Lane, Kumeu	GF	52.6	53.9	48.8
32 Weza Lane, Kumeu	GF	53.8	55.1	50.0
34 Weza Lane, Kumeu	GF	51.7	53.0	47.7
36 Weza Lane, Kumeu	GF	52.2	53.8	48.6
38 Weza Lane, Kumeu	GF	51.7	53.3	47.3
40 Weza Lane, Kumeu	1.FL	53.3	55.3	49.0
42 Weza Lane, Kumeu	1.FL	52.7	54.3	47.6
44 Weza Lane, Kumeu	GF	46.4	48.8	41.9
45 Weza Lane, Kumeu	GF	50.7	52.4	45.5
65 Weza Lane, Kumeu	GF	52.2	54.0	46.2
69 Weza Lane, Kumeu	GF	46.8	51.2	40.8
22 Wookey Lane, Kumeu (2)	1.FL	52.8	52.2	43.9
22 Wookey Lane, Kumeu (1)	1.FL	52.6	52.0	43.7

1.3 NoR S3

1.3.1 Altered Road

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
24 Access Road, Kumeu	GF	59.9	64.8	37.3

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
1-23 Croatia Avenue, Huapai, Kumeu (9)	GF	48.4	49.8	38.6
1-23 Croatia Avenue, Huapai, Kumeu (8)	GF	47.9	49.4	38.0
1-23 Croatia Avenue, Huapai, Kumeu (7)	GF	50.3	50.6	41.1
1-23 Croatia Avenue, Huapai, Kumeu (2)	3.FL	54.7	57.5	42.5
107 Fred Taylor Drive, Whenuapai, Auckland	GF	51.9	56.5	36.8
107A Fred Taylor Drive, Whenuapai, Auckland	GF	52.4	57.0	37.1
38 Gilbransen Road, Kumeu	GF	49.6	49.0	32.2
42 Gilbransen Road, Kumeu	GF	51.2	50.6	34.1
44 Gilbransen Road, Kumeu	GF	56.3	55.5	38.3
47 Gilbransen Road, Kumeu (2)	1.FL	51.2	51.0	37.4
47 Gilbransen Road, Kumeu (1)	GF	58.1	57.2	43.3
47 Gilbransen Road, Kumeu (3)	GF	49.9	49.8	34.8
50 Gilbransen Road, Kumeu (2)	GF	62.6	61.6	48.0
50 Gilbransen Road, Kumeu (1)	GF	59.3	58.4	43.9
44A Gilbransen Road, Kumeu	GF	57.4	56.6	39.8
44B Gilbransen Road, Kumeu	GF	57.2	56.4	40.3
44C Gilbransen Road, Kumeu	GF	58.0	57.1	41.0
44D Gilbransen Road, Kumeu	GF	58.5	57.6	41.8
8 Grivelle Street, Kumeu (2)	GF	51.5	55.0	35.3
8 Grivelle Street, Kumeu (1)	GF	51.3	55.8	34.8
3 Lockyer Road, Kumeu	GF	51.0	50.5	33.6
5 Lockyer Road, Kumeu	GF	49.4	48.9	35.4
7 Lockyer Road, Kumeu	GF	50.1	49.6	34.7
9 Lockyer Road, Kumeu	GF	55.1	54.2	39.1
7 Main Road, Kumeu	GF	61.2	61.7	46.1
342 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	45.6
344 Main Road, Huapai, Kumeu	GF	62.4	62.3	42.7
346 Main Road, Huapai, Kumeu	GF	57.4	57.5	39.4
348 Main Road, Huapai, Kumeu	1.FL	66.0	65.8	45.9
350 Main Road, Huapai, Kumeu	1.FL	63.8	63.7	44.2
351 Main Road, Huapai, Kumeu	GF	65.6	65.4	48.6
352 Main Road, Huapai, Kumeu	GF	64.4	64.3	44.3
353 Main Road, Huapai, Kumeu	GF	65.9	65.7	48.3
354 Main Road, Huapai, Kumeu	GF	62.6	62.6	42.5
355 Main Road, Huapai, Kumeu	GF	64.4	64.2	42.8
356 Main Road, Huapai, Kumeu	GF	64.5	64.4	43.0
357 Main Road, Huapai, Kumeu	GF	65.7	65.5	44.6
358 Main Road, Huapai, Kumeu	GF	60.8	60.8	38.7
359 Main Road, Huapai, Kumeu	GF	65.0	64.8	44.8
360 Main Road, Huapai, Kumeu	1.FL	62.0	61.9	41.8

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
361 Main Road, Huapai, Kumeu	GF	62.9	62.8	45.6
362 Main Road, Huapai, Kumeu (2)	1.FL	65.9	65.8	42.4
362 Main Road, Huapai, Kumeu (1)	1.FL	62.3	62.2	42.1
364 Main Road, Huapai, Kumeu	GF	60.8	60.8	37.0
365 Main Road, Huapai, Kumeu	GF	61.8	61.7	47.5
366 Main Road, Huapai, Kumeu	GF	57.9	57.9	35.8
367 Main Road, Huapai, Kumeu	GF	65.1	65.0	47.7
368 Main Road, Huapai, Kumeu	GF	61.4	61.3	39.6
370 Main Road, Huapai, Kumeu	GF	61.4	61.4	38.3
372 Main Road, Huapai, Kumeu	GF	63.8	63.7	39.4
376 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	40.0
382 Main Road, Huapai, Kumeu	GF	66.7	66.5	39.5
395 Main Road, Huapai, Kumeu (2)	GF	59.2	59.6	37.3
395 Main Road, Huapai, Kumeu (1)	GF	56.2	57.1	35.3
399 Main Road, Huapai, Kumeu	GF	62.0	62.3	40.0
401 Main Road, Huapai, Kumeu	GF	61.1	61.4	41.7
405 Main Road, Huapai, Kumeu	GF	66.8	66.4	40.0
407 Main Road, Huapai, Kumeu	GF	67.5	66.9	43.6
407A Main Road, Huapai, Kumeu	1.FL	66.6	65.9	45.7
9 Matua Road, Huapai, Kumeu	GF	53.0	56.3	34.1
11 Matua Road, Huapai, Kumeu	GF	51.6	54.4	33.1
15 Matua Road, Huapai, Kumeu	GF	50.4	52.8	33.2
17 Matua Road, Huapai, Kumeu	GF	50.1	52.8	34.0
19 Matua Road, Huapai, Kumeu	GF	49.7	51.6	34.4
21 Matua Road, Huapai, Kumeu	1.FL	53.0	55.7	37.1
22 Matua Road, Huapai, Kumeu	GF	62.0	66.8	34.6
23 Matua Road, Huapai, Kumeu	1.FL	51.7	54.4	35.9
24 Matua Road, Huapai, Kumeu	GF	52.9	56.0	33.8
239 Matua Road, Kumeu	GF	55.0	54.3	42.9
392 Matua Road, Kumeu	GF	59.1	59.7	29.6
402 Matua Road, Kumeu	1.FL	62.4	64.9	41.7
411 Matua Road, Kumeu	GF	58.1	59.3	41.4
392B Matua Road, Kumeu	GF	59.7	60.0	27.3
5 Merlot Heights, Huapai, Kumeu	1.FL	53.1	54.8	39.1
7 Merlot Heights, Huapai, Kumeu	1.FL	54.2	55.7	39.5
9 Merlot Heights, Huapai, Kumeu	1.FL	54.4	55.7	39.3
11 Merlot Heights, Huapai, Kumeu	GF	49.1	50.3	34.4
17 Merlot Heights, Huapai, Kumeu	GF	48.3	49.7	33.3
11 Meryl Avenue, Kumeu	GF	53.2	52.6	40.8
30 Meryl Avenue, Kumeu (1)	GF	59.8	57.0	56.2
1 Oraha Road, Huapai, Kumeu	GF	52.9	53.5	36.3

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
3 Oraha Road, Huapai, Kumeu	GF	53.2	54.1	36.1
6 Oraha Road, Huapai, Kumeu	1.FL	56.0	61.2	38.3
8 Oraha Road, Huapai, Kumeu	GF	66.0	71.6	32.3
10 Oraha Road, Huapai, Kumeu	GF	61.3	66.9	34.9
12 Oraha Road, Huapai, Kumeu	GF	62.9	68.5	33.4
18 Oraha Road, Huapai, Kumeu	GF	59.5	65.0	33.4
20 Oraha Road, Huapai, Kumeu	GF	54.8	55.3	36.0
25 Oraha Road, Huapai, Kumeu	1.FL	65.0	70.1	37.5
27 Oraha Road, Huapai, Kumeu	GF	64.9	70.3	35.0
5-21 Oraha Road, Huapai, Kumeu	1.FL	64.0	66.7	42.8
529 State Highway 16, Kumeu	GF	65.1	64.0	44.0
551 State Highway 16, Kumeu	GF	61.1	60.1	40.6
573 State Highway 16, Kumeu	GF	65.7	64.6	41.0
583 State Highway 16, Kumeu	GF	59.8	58.8	39.3
587 State Highway 16, Kumeu	GF	67.9	66.8	44.8
601 State Highway 16, Kumeu	1.FL	68.5	67.5	44.8
623 State Highway 16, Kumeu	1.FL	68.0	67.1	45.9
631 State Highway 16, Kumeu	GF	70.1	69.2	45.0
641 State Highway 16, Kumeu (2)	GF	57.2	56.3	38.4
641 State Highway 16, Kumeu (1)	GF	61.2	60.3	40.8
643 State Highway 16, Kumeu	1.FL	70.5	69.6	45.4
647 State Highway 16, Kumeu	1.FL	70.0	69.1	44.4
665 State Highway 16, Kumeu	GF	69.8	68.9	44.0
677 State Highway 16, Kumeu	GF	68.7	68.6	38.5
631A State Highway 16, Kumeu	GF	61.5	60.7	41.2
4 Station Road, Huapai, Kumeu	GF	59.4	64.5	35.8
6 Station Road, Huapai, Kumeu	GF	56.1	58.4	35.4
8 Station Road, Huapai, Kumeu	GF	55.6	57.1	35.2
10 Station Road, Huapai, Kumeu	GF	53.6	54.9	34.9
12 Station Road, Huapai, Kumeu	GF	50.1	51.4	33.4
14 Station Road, Huapai, Kumeu	GF	49.7	51.3	33.5
20 Station Road, Huapai, Kumeu	GF	53.8	58.3	34.9
22 Station Road, Huapai, Kumeu	GF	58.7	63.9	36.8
4 Sunny Crescent, Huapai, Kumeu	GF	49.3	49.8	31.5
8 Sunny Crescent, Huapai, Kumeu	GF	49.5	49.9	31.9
12 Sunny Crescent, Huapai, Kumeu	GF	47.4	48.4	30.8
16 Sunny Crescent, Huapai, Kumeu	1.FL	52.5	53.4	35.3
20 Sunny Crescent, Huapai, Kumeu	GF	50.9	51.6	33.0
24 Sunny Crescent, Huapai, Kumeu	GF	51.2	51.8	32.3
28 Sunny Crescent, Huapai, Kumeu	GF	50.0	50.8	32.9
32 Sunny Crescent, Huapai, Kumeu	GF	48.7	49.6	32.8

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
36 Sunny Crescent, Huapai, Kumeu	GF	49.9	50.5	33.9
42 Sunny Crescent, Huapai, Kumeu	GF	47.6	48.5	32.2
45 Sunny Crescent, Huapai, Kumeu	1.FL	50.2	51.1	34.3
46 Sunny Crescent, Huapai, Kumeu	GF	49.6	50.3	34.5
3 Tapu Road, Huapai, Kumeu	GF	62.3	62.6	41.0
5 Tapu Road, Huapai, Kumeu	GF	51.9	52.7	34.1
7 Tapu Road, Huapai, Kumeu	GF	50.3	51.0	34.4
9 Tapu Road, Huapai, Kumeu	GF	63.4	63.7	38.7
10 Tapu Road, Huapai, Kumeu	GF	64.4	64.6	45.1
11 Tapu Road, Huapai, Kumeu	GF	65.2	65.5	36.9
12 Tapu Road, Huapai, Kumeu	GF	51.2	51.8	45.3
13 Tapu Road, Huapai, Kumeu	GF	64.6	64.8	35.6
14 Tapu Road, Huapai, Kumeu	GF	65.4	65.7	41.6
15 Tapu Road, Huapai, Kumeu	GF	63.0	63.3	34.1
16 Tapu Road, Huapai, Kumeu	GF	66.2	66.4	38.7
17 Tapu Road, Huapai, Kumeu	GF	64.9	65.1	32.9
18 Tapu Road, Huapai, Kumeu	1.FL	54.6	55.1	44.5
19 Tapu Road, Huapai, Kumeu	1.FL	64.6	64.8	33.9
20 Tapu Road, Huapai, Kumeu	1.FL	54.4	54.5	43.3
21 Tapu Road, Huapai, Kumeu	GF	62.6	62.9	31.2
22 Tapu Road, Huapai, Kumeu	1.FL	67.8	68.0	39.5
23 Tapu Road, Huapai, Kumeu	GF	63.8	64.1	31.3
24 Tapu Road, Huapai, Kumeu	GF	63.2	63.5	35.0
26 Tapu Road, Huapai, Kumeu	1.FL	53.1	52.9	40.2
28 Tapu Road, Huapai, Kumeu	1.FL	53.2	53.1	40.5
30 Tapu Road, Huapai, Kumeu	GF	64.2	64.5	32.5
32 Tapu Road, Huapai, Kumeu	1.FL	52.9	52.8	40.1
36 Tapu Road, Huapai, Kumeu	GF	62.5	62.7	32.4
38 Tapu Road, Huapai, Kumeu	1.FL	64.0	64.3	34.8
16A Tapu Road, Huapai, Kumeu	GF	52.6	53.5	39.9
2 Tokay Place, Huapai, Kumeu	GF	49.5	50.5	34.8
3 Tokay Place, Huapai, Kumeu	GF	50.6	51.6	35.4
4 Tokay Place, Huapai, Kumeu	1.FL	51.9	52.5	37.5
5 Tokay Place, Huapai, Kumeu	GF	50.3	51.0	34.7
6 Tokay Place, Huapai, Kumeu	1.FL	49.7	50.9	35.2
7 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	33.5
8 Tokay Place, Huapai, Kumeu	1.FL	50.2	51.0	35.7
9 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	33.4
10 Tokay Place, Huapai, Kumeu	1.FL	48.7	50.1	34.0
11 Tokay Place, Huapai, Kumeu	1.FL	51.0	51.7	36.4
12 Tokay Place, Huapai, Kumeu	1.FL	49.1	50.1	34.2

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
15 Tokay Place, Huapai, Kumeu	1.FL	50.5	51.5	36.2
17 Tokay Place, Huapai, Kumeu	1.FL	53.0	53.6	38.4
19 Tokay Place, Huapai, Kumeu	GF	47.1	48.3	31.8
1 Trigg Road, Huapai, Kumeu	GF	59.6	62.1	41.5
2 Trigg Road, Huapai, Kumeu	1.FL	60.5	62.0	43.5
3 Trigg Road, Huapai, Kumeu	GF	58.4	61.6	37.8
4 Trigg Road, Huapai, Kumeu	GF	54.2	53.8	37.5
5 Trigg Road, Huapai, Kumeu	GF	58.2	63.7	36.5
6 Trigg Road, Huapai, Kumeu	1.FL	60.0	59.4	42.6
8 Trigg Road, Huapai, Kumeu	GF	54.9	59.0	35.6
10 Trigg Road, Huapai, Kumeu	GF	53.2	57.7	35.5
12 Trigg Road, Huapai, Kumeu	GF	53.8	57.9	37.0
14 Trigg Road, Huapai, Kumeu	1.FL	56.5	61.8	38.0
14A Trigg Road, Huapai, Kumeu	GF	57.5	63.9	35.6
1 Vintners Close, Huapai, Kumeu	GF	55.7	60.3	34.8
2 Vintners Close, Huapai, Kumeu	GF	57.7	63.7	34.7
3 Vintners Close, Huapai, Kumeu	1.FL	54.2	54.6	38.0
4 Vintners Close, Huapai, Kumeu	GF	51.2	53.5	34.2
5 Vintners Close, Huapai, Kumeu	GF	52.2	52.8	35.2
6 Vintners Close, Huapai, Kumeu	1.FL	52.3	53.1	36.2
7 Vintners Close, Huapai, Kumeu	1.FL	55.4	56.1	37.9
8 Vintners Close, Huapai, Kumeu	1.FL	51.4	52.5	34.2
9 Vintners Close, Huapai, Kumeu	1.FL	52.9	53.7	36.2
2 Waina Drive, Kumeu	GF	51.0	50.9	35.1
22 Wookey Lane, Kumeu (2)	1.FL	52.8	52.2	39.1
22 Wookey Lane, Kumeu (1)	1.FL	52.6	52.0	38.8

1.3.2 New Road

PPF Address (NoR S3 New Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
23 Boord Crescent, Kumeu	GF	57.1	55.9	46.9
37 Boord Crescent, Kumeu	GF	58.4	57.0	46.4
51 Boord Crescent, Kumeu	GF	58.5	57.1	47.0
61 Boord Crescent, Kumeu	GF	52.8	51.9	37.0
62 Boord Crescent, Kumeu	GF	51.8	51.8	43.4
68 Boord Crescent, Kumeu (2)	1.FL	54.4	53.8	41.5
68 Boord Crescent, Kumeu (1)	GF	57.0	55.8	38.8
82 Boord Crescent, Kumeu	GF	48.5	49.8	44.4

PPF Address (NoR S3 New Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
88 Boord Crescent, Kumeu (2)	GF	52.2	51.9	40.2
88 Boord Crescent, Kumeu (1)	GF	55.4	54.4	37.5
96 Boord Crescent, Kumeu	1.FL	54.6	53.8	41.7
108 Boord Crescent, Kumeu	GF	51.6	51.3	41.8
186 Boord Crescent, Kumeu	GF	57.3	55.8	44.2
291 Boord Crescent, Kumeu	1.FL	54.4	54.2	39.2
293 Boord Crescent, Kumeu	1.FL	53.0	53.2	40.2
300 Boord Crescent, Kumeu	GF	53.1	53.1	40.1
51A Boord Crescent, Kumeu	GF	56.7	55.4	43.7
196 Fred Taylor Drive, Whenuapai, Auckland	GF	50.2	51.9	46.4
198 Fred Taylor Drive, Whenuapai, Auckland	1.FL	49.3	51.3	43.4
200 Fred Taylor Drive, Whenuapai, Auckland	GF	47.6	49.6	43.0
208 Fred Taylor Drive, Whenuapai, Auckland	GF	54.2	55.7	33.6
14 Joseph Dunstan Drive, Taupaki	GF	51.1	53.4	35.9
91 Joseph Dunstan Drive, Taupaki	GF	48.8	50.7	43.2
284 State Highway 16, Kumeu	GF	50.9	52.3	39.9
362 Taupaki Road, Taupaki	GF	62.4	64.7	33.3
364 Taupaki Road, Taupaki	GF	63.7	65.9	33.2
367 Taupaki Road, Taupaki	GF	56.5	58.8	35.8
370 Taupaki Road, Taupaki	GF	61.2	63.5	34.9
374 Taupaki Road, Taupaki	1.FL	51.5	53.8	44.8
375 Taupaki Road, Taupaki	GF	63.7	65.9	37.3
377 Taupaki Road, Taupaki	1.FL	51.8	54.1	40.1
405 Taupaki Road, Kumeu	GF	49.6	51.9	42.8
13 Trotting Course Drive, Kumeu	GF	54.5	56.7	48.2
15 Trotting Course Drive, Kumeu	GF	50.7	52.8	45.2
901 Waitakere Road, Kumeu	1.FL	55.9	58.5	46.7
906 Waitakere Road, Kumeu	GF	62.9	65.5	47.7
927 Waitakere Road, Kumeu	1.FL	59.5	61.9	44.3

1.4 NoR S4

PPF Address (NoR S4 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
24 Access Road, Kumeu	GF	59.9	64.8	57.8	57.8
26 Access Road, Kumeu (3)	GF	60.4	65.3	56.2	56.2
26 Access Road, Kumeu (1)	GF	51.8	55.6	48.0	48.0
27 Access Road, Kumeu (2)	GF	55.5	60.2	54.2	54.2
27 Access Road, Kumeu (1)	GF	52.4	54.5	44.9	44.9
40 Access Road, Kumeu	GF	61.3	66.3	56.7	56.7
44 Access Road, Kumeu	GF	60.7	65.7	56.3	56.3
60 Access Road, Kumeu	GF	60.0	64.9	56.1	56.1
64 Access Road, Kumeu	GF	62.0	67.0	58.0	58.0
95 Access Road, Kumeu (2)	GF	53.1	58.1	51.0	51.0
95 Access Road, Kumeu (1)	GF	56.2	61.5	55.3	55.3
116 Access Road, Kumeu (4)	1.FL	52.5	59.8	52.7	52.7
116 Access Road, Kumeu (3)	1.FL	47.1	54.2	47.0	47.0
116 Access Road, Kumeu (2)	GF	59.6	68.1	59.3	59.3
116 Access Road, Kumeu (1)	GF	55.0	63.0	55.3	55.3
121 Access Road, Kumeu (2)	GF	48.0	53.9	47.8	47.8
121 Access Road, Kumeu (1)	GF	49.0	56.3	49.8	49.8
161 Access Road, Kumeu	GF	55.3	63.5	58.1	58.1
162 Access Road, Kumeu	GF	52.1	60.2	53.6	53.6
165 Access Road, Kumeu	GF	50.3	58.3	52.8	52.8
171 Access Road, Kumeu	GF	56.8	65.1	59.2	59.2
174 Access Road, Kumeu	GF	54.4	62.5	56.3	56.3
175 Access Road, Kumeu	GF	48.9	56.5	50.7	50.7
176 Access Road, Kumeu (2)	GF	53.6	61.7	56.1	56.1
176 Access Road, Kumeu (1)	GF	51.8	59.6	53.6	53.6
181 Access Road, Kumeu	GF	54.9	63.2	56.3	56.3
184 Access Road, Kumeu (2)	1.FL	58.9	67.4	62.7	62.7
184 Access Road, Kumeu (1)	GF	57.9	66.3	62.4	62.4
199 Access Road, Kumeu	GF	52.9	60.8	53.4	53.4
211 Access Road, Kumeu	GF	53.3	61.3	54.2	54.2
218 Access Road, Kumeu	GF	55.3	63.7	60.5	60.5
233 Access Road, Kumeu	GF	50.6	58.4	55.6	55.6
236 Access Road, Kumeu	GF	52.8	60.2	58.2	58.2
127A Access Road, Kumeu	GF	52.0	59.6	53.5	53.5
127B Access Road, Kumeu	GF	49.6	57.3	50.8	50.8
64 Farrand Road, Kumeu	GF	47.4	54.4	48.3	48.3
8 Grivelle Street, Kumeu (2)	GF	51.5	55.0	47.9	47.9
8 Grivelle Street, Kumeu (1)	GF	51.3	55.8	48.8	48.8

PPF Address (NoR S4 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
150 Motu Road, Kumeu	1.FL	60.7	72.7	45.3	45.4
158 Motu Road, Kumeu	1.FL	55.6	65.9	47.7	47.9
164 Motu Road, Kumeu	1.FL	60.7	71.9	51.9	51.8
147 Station Road, Kumeu	GF	49.9	56.5	51.2	51.2
150 Station Road, Kumeu	GF	58.8	65.7	49.8	49.8
152 Station Road, Kumeu	GF	57.0	63.8	53.9	53.9
17 Tawa Road, Kumeu	GF	57.7	65.3	63.8	63.8
25 Tawa Road, Kumeu	1.FL	60.5	68.3	66.5	66.5
59 Tawa Road, Kumeu	GF	58.3	66.3	64.7	63.1
63 Tawa Road, Kumeu	GF	52.8	60.2	61.4	61.4
66 Tawa Road, Kumeu	GF	49.3	56.3	56.0	56.0
73 Tawa Road, Kumeu	GF	57.1	64.8	62.5	62.0
76 Tawa Road, Kumeu	GF	58.2	65.8	66.8	61.8
79 Tawa Road, Kumeu	GF	59.0	67.1	63.2	59.8
83 Tawa Road, Kumeu (2)	GF	51.0	57.6	48.9	48.6
83 Tawa Road, Kumeu (1)	GF	50.0	56.6	48.0	47.9
86 Tawa Road, Kumeu (2)	GF	54.6	62.3	56.5	55.8
86 Tawa Road, Kumeu (1)	GF	54.6	64.2	52.5	52.1

2 Appendix B: Noise Level Contours and NZS6806 Categories

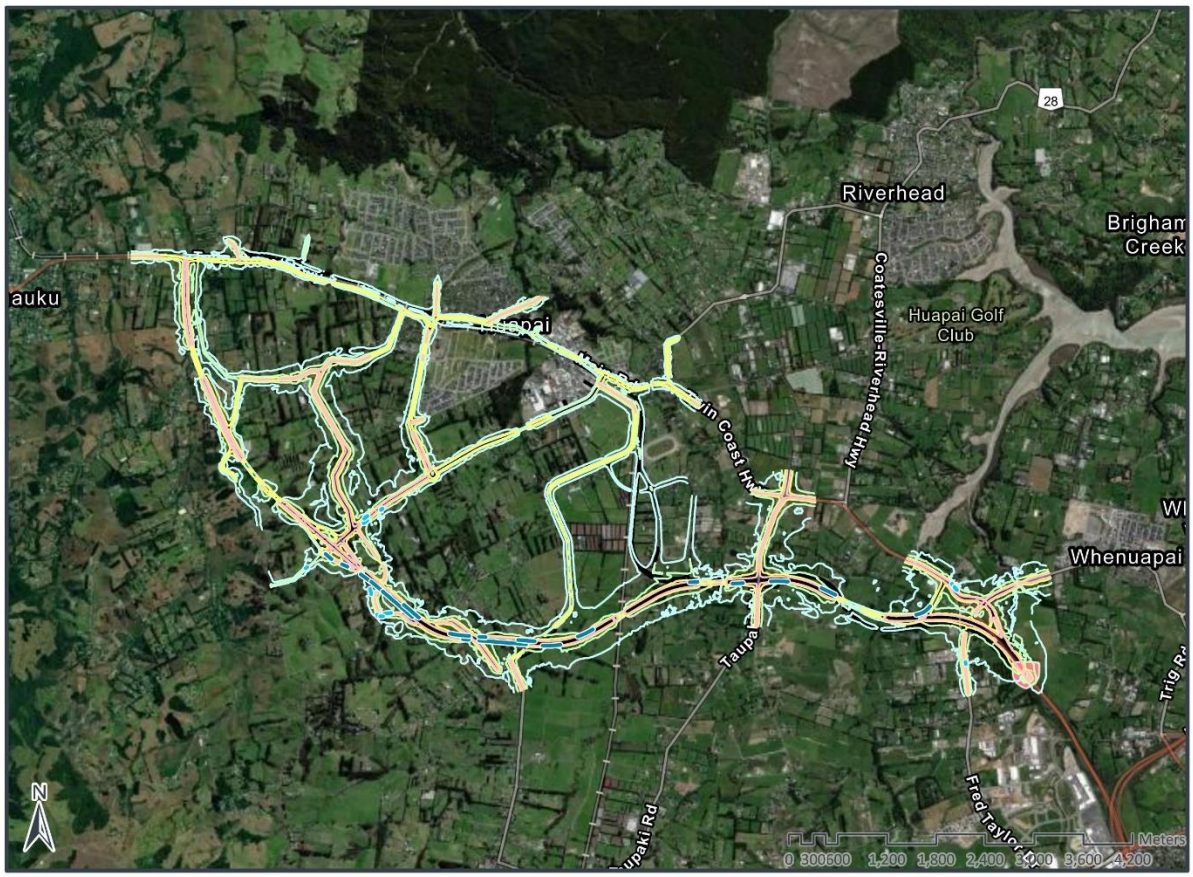
For all figures in this appendix, the following applies:

Situation	Description
Existing	current road layout and traffic volume
Do-nothing	current road layout and future traffic volume (2048+)
Do-minimum	future road layout of the Project of interest only, traffic volumes (2048+) assume that all Projects of the Nort Western Strategic Package have been implemented, but without specific noise mitigation. Where no mitigation option is proposed, the noise level contours shown represent the combined traffic noise from the Project road, all existing local roads and other North West Strategic Package roads in the vicinity.
Mitigation Option	the same as for the Do-minimum Situation but including noise mitigation in the form of barriers, where considered to be BPO. The noise level contours shown represent the combined traffic noise from the Project road including mitigation, all existing local roads and other North West Strategic Package roads in the vicinity.

The legend is shown on the next page.

NORTH WEST STRATEGIC PACKAGE

Overview Map



Map Legend

New Road (dB $L_{Aeq(24h)}$)
- < 57 Category A
- 57 - 64 Category B
- > 64 Category C

Altered Road (dB $L_{Aeq(24h)}$)
- < 64 Category A
- 64 - 67 Category B
- > 67 Category C

Noise wall
- At residence
- At ASH

Contours dB $L_{Aeq(24h)}$
- 55
- 60
- 65
- 70
- Project Road

2.1 NoR S1

NOR 1 ASH

Existing

Do-Nothing

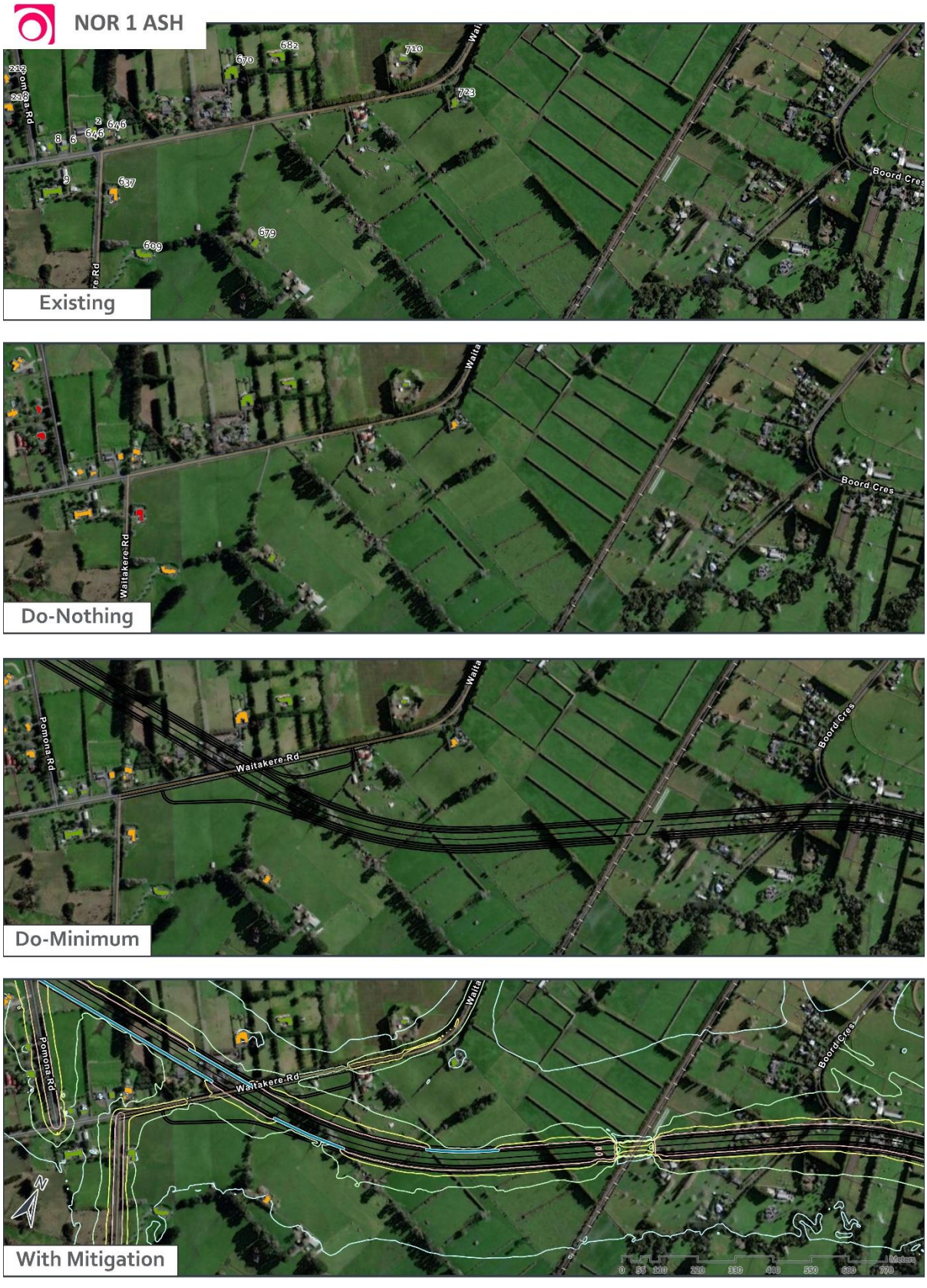
Do-Minimum

With Mitigation

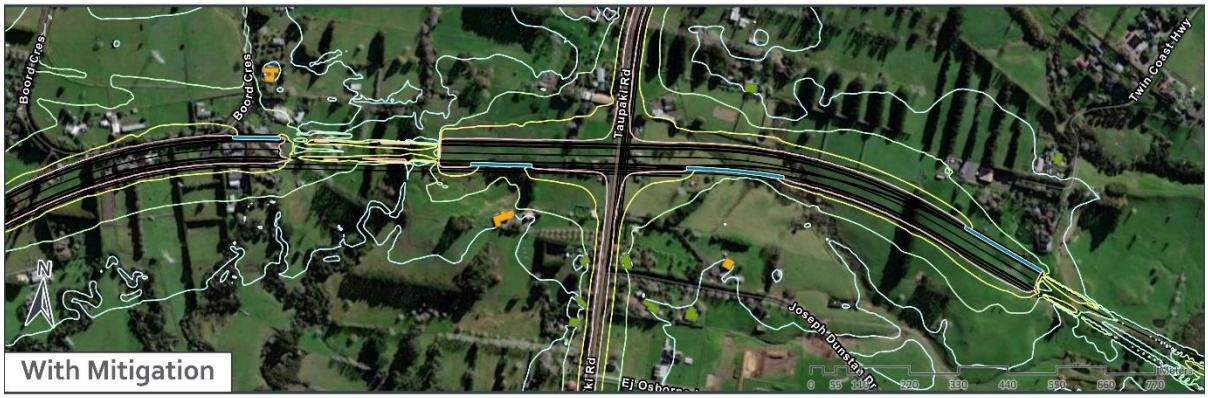
NOR 1 ASH

NOR 1 ASH

NOR 1 ASH



NOR 1 ASH



NOR 1 ASH

Existing

Do-Nothing

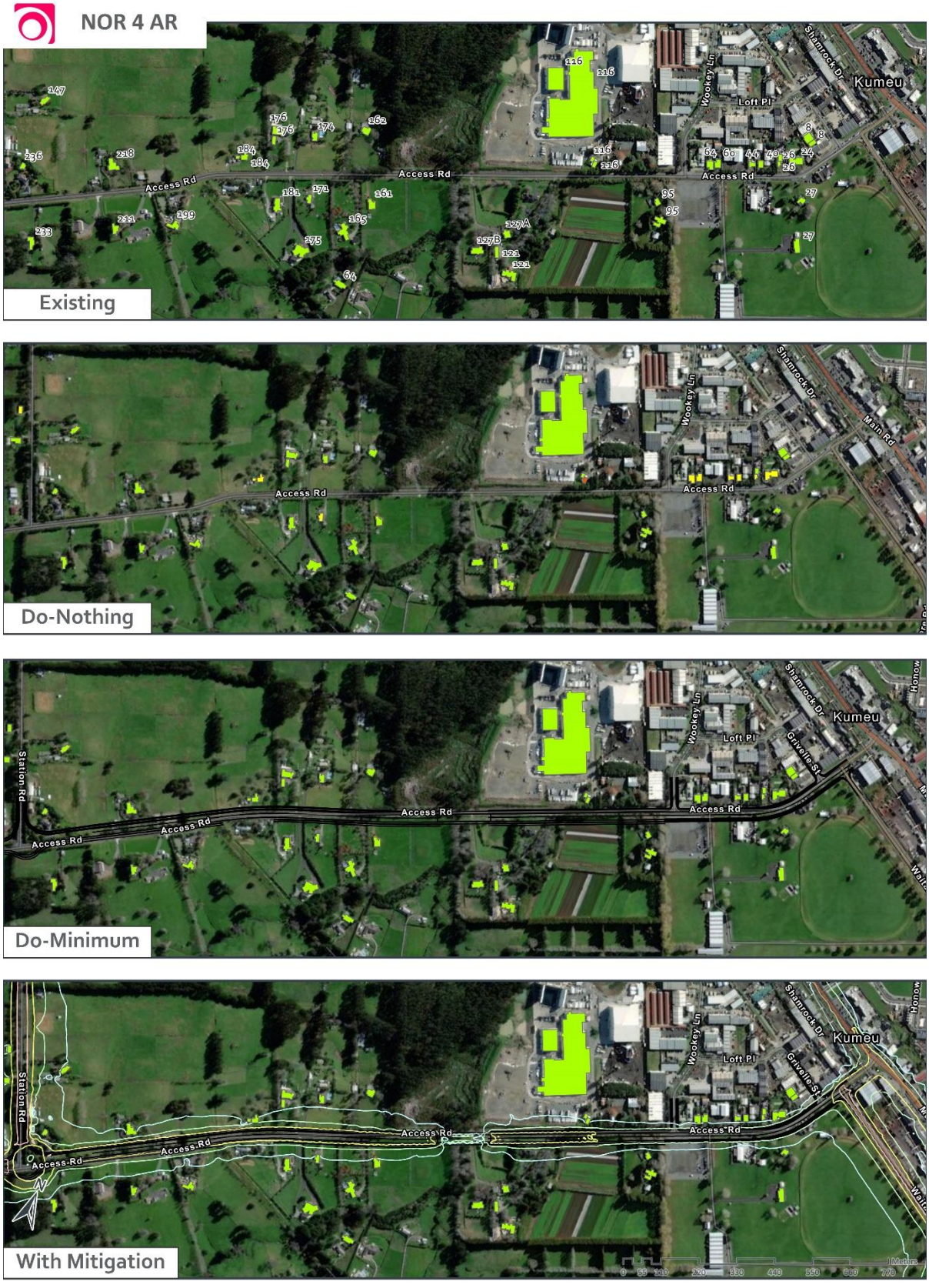
Do-Minimum

With Mitigation

2.2 NoR S2

2.3 NoR S3

2.4 NoR S4



NOR 4 AR