NZ TRANSPORT AGENCY
WAKA KOTAHI

TE ARA HAUĀURU NORTHWEST BUSWAY

ASSESSMENT OF OPERATIONAL NOISE AND VIBRATION EFFECTS

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15 DECEMBER 2025

New Zealand Government

Qualifications and experience of the author

My name is Siiri Wilkening. I am an acoustics consultant, and a Director of Marshall Day Acoustics Ltd (MDA). MDA is a specialist acoustics consultancy of about 100 professional acoustics consultants, founded in 1981, with offices in New Zealand, Australia, Hong Kong/China, and France. I have worked at MDA for 27 years.

I hold a Master's degree in Engineering (Land Improvement and Environmental Protection) (University of Rostock, Germany). I have nearly 30 years' experience as an acoustics consultant and am a Fellow of the Acoustical Society of New Zealand. I am also a member of the Resource Management Law Association and the Institute of Directors (New Zealand).

My experience relevant to this application includes:

- I have been an expert witness on many Roads of National Significance, including State Highway 1 (SH1) East West Link, SH1 Northern Corridor Improvements, State Highway 16 (SH16) Waterview Connections, SH1 MacKays to Peka Peka (Kāpiti Expressway) and SH1 Pūhoi to Warkworth, all of which were designated through Boards of Inquiry. For each of these projects, my role involved assessing all aspects of acoustics, noise and vibration effects from construction and traffic and (where relevant) underwater effects, and I presented expert evidence at the hearings.
- I was the lead acoustical consultant on the SH1 Southern Corridor Improvements (Manukau to Papakura and Papakura to Drury) projects. These projects involved considerable challenges due the high population density close to the road. The widening of the Southern Motorway, the busiest state highway in New Zealand, affected a large number of people, both during construction and following completion. I was responsible for all works relating to noise and vibration effects. This included ambient noise level surveys, computer noise modelling, extensive meetings and engagement with residents and Council, noise mitigation design and the formulation of noise management plans. The various stages were consented through a mixture of conventional Council hearings and the Covid-19 Fast-track consenting pathway. I appeared as expert witness at the Council hearings and prepared the assessments for the Fast-track application.
- I was engaged as principal acoustic consultant of the Te Tupu Ngātahi Supporting Growth Alliance, with a programme providing for the planning and consenting of transport infrastructure (active modes, rapid transit and roading) for the growth areas surrounding Auckland, with projects extending from Warkworth in the north to Drury and Pukekohe in the south to Huapai in the West. My role was to provide oversight and peer reviews of the assessments. The role changed to include the assessment of a number of the projects (Takaanini Level Crossings, North (Strategic), North West (Strategic), Pukekohe, and Airport to Botany Rapid Transit), which involved everything from route selection to assessment and expert witness appearance at several of the combined Council hearings.

I have undertaken many acoustic assessments for a variety of projects ranging from transportation and power generation to educational facilities, residential and commercial subdivisions, mining and plan changes. I have appeared as an expert witness at many Council hearings, before numerous Environment Courts, the Arbitration Court and five Boards of Inquiry. I have also taken part in Environment Court mediation.

Although this matter is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this report are within my area of expertise, except where I state that I am relying on information provided by another person or expert. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

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Acronyms, definitions and abbreviations

Term	Definition
AEE	Assessment of Environmental Effects
AUP	Auckland Unitary Plan
BPO	Best Practicable Option
CoRTN	Calculation of Road Traffic Noise, Department of Transport, Welsh Office, 1988
dB	Decibel
FTAA	Fast-track Approvals Act 2024
Indicative Design	The indicative design of the Project within the Project Area as shown on the Indicative Design drawings in Part 6 that will be confirmed during detailed design
km/h	Kilometres/hour
NZS 6806	New Zealand Standards 6806:2010 Acoustics – Road-traffic noise – New and altered roads
NZTA	New Zealand Transport Agency Waka Kotahi
PA	Public address
Project	Te Ara Hauāuru Northwest Rapid Transit
Project Area	The Proposed Designation and the extent of the coastal occupation permits sought
Proposed Designation	The area defined by the Proposed Designation boundary as shown on the Proposed Designation Plans in Part 6
PPF	Protected Premise and Facility in accordance with NZS 6806:2010
SEL	Sound Exposure Level
SH1	State Highway 1
SH16	State Highway 16
SH18	State Highway 18
SMA	Stone Mastic Asphalt
vpd	Vehicles per day
WX1	Western Express

1. Introduction

1.1 Purpose and scope of this report

This technical assessment has been prepared to inform a substantive application for the Northwest Rapid Transit Project (the Project) under the Fast-Track Approvals Act 2024 (FTAA). It forms part of a suite of specialist reports that collectively support the applications for statutory approvals.

The purpose of this report is to evaluate the actual and potential effects of the Project on the environment in relation to operational noise and vibration. This report addresses the following matters:

- Actual and potential effects of operational noise and vibration;
- Assessment of operational noise effects from the busway and the combined noise level of the busway and State Highway 16 (SH16), on sensitive receivers along the corridor; and
- Potential mitigation options for residual noise effects.

The assessment considers the operational phase of the Project, identifying any adverse effects and assessing their significance. Construction noise and vibration effects are addressed separately (refer to the Assessment of Construction Noise and Vibration Effects report). I have recommended measures to avoid, remedy, or mitigate identified effects where I consider necessary.

This report should be read alongside the Substantive Application including the Assessment of Environmental Effects (AEE) in Part 4, which contains further details on the context of the Project. The Substantive Application also contains a description of works to be authorised and the typical construction methodologies that will be used to implement this work which are included in Part 2. I have reviewed this and have considered them as part of my assessment of effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

Where this report states that I have undertaken the assessment and reached conclusions, I also rely on the work of others within my team at Marshall Day Acoustics (MDA), particularly in relation to traffic noise modelling and survey work.

1.2 Prediction of operational noise from the Project

1.2.1 Traffic noise – busway only

Traffic noise is assessed using the prediction algorithms of Calculation of Road Traffic Noise (CoRTN). CoRTN has some limitations that are relevant in the assessment of operational noise from the busway:

- Heavy vehicles should not be more than 20% of the overall traffic make up. In the case of the busway, heavy vehicles would make up 100% of the vehicles;
- The heavy vehicle classification includes a variety of heavy vehicle types such as large trucks, buses, and trucks and trailers. The busway will only carry electric buses, which can be considerably quieter than the average heavy vehicle; and
- The traffic volume should be above 1,000 vehicles per day (vpd) and more than 50 vehicles per hour. I based my predictions on the bus volumes provided by the Project's traffic experts. The busway will, at most, carry 1,250vpd between Westgate and Rosebank. For the remainder of the busway between Rosebank and the city centre, bus volumes will be less than 1,000vpd, ranging from 700 to 950vpd. At these volumes, vehicles are not perceived as a traffic line source but as individual vehicles where each passing is a distinct event.

These limitations mean that CoRTN is not able to accurately describe the traffic noise from the busway. As a result, I have applied some adjustments to the data used in the algorithm to obtain a more accurate approximation of the noise levels from the busway as follows:

- First, I calculated the expected daily noise level based on noise level data from an NZTA research project into the noise levels of electric buses:[1]
  - For that project, I measured controlled drive-by noise levels of single-decker six-wheeler electric buses on a dense asphalt surface on the Cornerstone Drive, Albany (i.e. a similar surface to that proposed for the busway);
  - As the buses during the control measurements only travelled up to 50km/h and the buses on this busway will operate at up to 80km/h, I adjusted the measured noise level by 1.6 dB to account for the faster speed;
  - I then calculated the 24-hour L_{Aeq} noise level at 10 metres from the edge of the busway, based on the Sound Exposure Level (SEL) of a single bus pass (obtained from the measurements above), adjusting for the 24-hour period and the relevant number of daily bus passes (i.e. between 700 and 1,250vpd). This calculation gave the estimated daily noise level from bus passes at 10m from the edge of the busway;
- Second, in the computer noise model, I modelled a busway with the proposed daily bus numbers and calculated a noise level at 10m from the edge of the busway, which I could compare to the noise level derived from the process above. Then I adjusted the model parameters (specifically, the road surface correction) until I achieved the daily noise level result from the process above. I used this model input to predict busway noise in conjunction with SH16 noise levels as discussed in Section 1.2.2 below.

The above process introduces uncertainties to the modelling over and above the normal uncertainties related to traffic noise predictions. These additional uncertainties are generally due to the original controlled noise level measurement on which the predictions are based, such as:

- The bus type: the measurement was for a single decker six-wheeler bus. Other buses may have lower noise levels (e.g. if they have less wheels) or higher noise levels (e.g. double deckers, as they are heavier);
- The road surface: the surface on which the original measurements were undertaken was a dense asphalt of good quality. I consider that it is comparable to the surface that will be used for the busway; and
- The speed: the controlled measurements were for lower speeds only, up to 50km/h. I had to adjust the noise level to account for the higher 80km/h speed on the busway.

However, given the limitations of CoRTN, I consider that the resulting noise levels are the best available information and a close approximation of the actual busway noise that can be expected from the Project in the future.

The above process provided us with daily bus noise levels at 10 metres from the busway (assuming flat ground) as follows:

- 700 buses per day 56 dB $L_{Aeq(24h)}$
- 950 buses per day 57 dB $L_{Aeq(24h)}$
- 1,250 buses per day 59 dB $L_{Aeq(24h)}$

It is important to note that even if the bus noise levels as determined above were 10 decibels higher, the outcome of this assessment would not change.

1.2.2 Traffic noise – busway and SH16

The Project is somewhat different from other roading projects as the proposed new busway will not add to the noise environment controlled by SH16. The reason is that the busway noise is significantly more than 10 decibels lower than the traffic noise from SH16. This means that busway noise does not add to the overall noise level experienced at receivers along the route.

Therefore, the busway has no adverse operational noise effects in and of itself. However, the location of the Project means that some existing traffic noise barriers will need to be removed, houses will be demolished,

[1] https://nzta.govt.nz/resources/research/reports/703

and terrain will need to be formed, so the houses that remain may receive increased traffic noise levels from SH16.

I have approached this issue by acknowledging that the change in traffic noise effects would be due to the implementation of the Project (rather than due to traffic on the Project itself).

Accordingly, I then predicted traffic noise from the existing roads (SH16 and major local roads) in addition to the busway.

1.2.3 Bus noise – stations only

I understand that the busway will carry electric buses only. This reflects the fleet of electric buses already being used for the WX1 service, which will use this busway as it is constructed. Electric buses are quieter than diesel buses at low speeds. The reason is that at low speeds, engine noise is the controlling noise source. Electric buses do not have engines that generate high noise levels.

Research undertaken on behalf of NZTA[2] showed that at low speeds, as would be present at the proposed bus stations, electric buses are 7 to 8 decibels quieter than diesel buses. This means that, given the proposed stations are located adjacent to SH16 and other major roads, electric buses at low speeds would have no impact on the overall noise level. Bus noise from stations would be more than 10 decibels below the traffic noise from SH16. This means that station noise does not add to the overall noise level experienced at receivers adjacent to the stations.

Local feeder buses associated with the busway stations may be diesel buses. Therefore, I have focused my assessment on the local bus platforms that are part of the proposed busway stations. Diesel buses can generate high noise levels, particularly when accelerating from full stop, i.e. leaving stations. For that reason, I have assessed both ambient average (L_{Aeq}) levels and maximum (L_{AFmax}) noise levels that may cause sleep disturbance during night-time.

Where local buses use bus stops on existing public roads, I have not assessed them as they are part of the existing environment already and/or do not require authorisation to use those existing roads.

1.3 Performance standards

1.3.1 Traffic noise (excluding stations)

1.3.1.1 Relevance of NZS 6806 to the Project

I have applied the provisions of NZS 6806 ‘Acoustics – Road-traffic noise – New and altered roads’ (NZS 6806) as guidance.

NZS 6806 applies to traffic noise assessments where a project falls within its thresholds. Traffic noise generation from the busway does not reach these thresholds because:

- Traffic volumes on the busway will be below 2,000vpd; and
- Traffic noise levels from the busway at Protected Premises and Facilities (PPFs) will not increase by:
  - 3 dB or more where the noise level at the Design Year is 64 dB $L_{Aeq(24h)}$ or more, or
  - 1 dB or more where the noise level at the Design Year is 68 dB $L_{Aeq(24h)}$ or more.

However, NZS 6806 provides a robust framework of determining, and process to develop, mitigation which responds to effects caused by the Project.

For this Project, while the busway will not result in adverse noise effects on neighbouring PPFs, the construction of the Project may result in more traffic noise from SH16 or other major roads being received at these PPFs. I have assessed these effects and recommend, where practicable, mitigation measures where the noise level increase would reach the thresholds of NZS 6806 set out above.

[2] https://www.nzta.govt.nz/assets/resources/research/reports/703/703-investigation-of-the-external-noise-emitted-from-electric-buses-in-new-zealand.pdf

1.3.1.2 NZS 6806 terminology

Other relevant terms of NZS 6806 are briefly explained below:

- **Assessment Positions** are described as 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, I have provided noise level predictions over vacant land.
  - Other types of businesses are not PPFs as they are not considered noise sensitive and are often noise generators in their own right.
- **Assessment Area** is the area 100m from the edge of the new busway for urban areas, which the entire Project falls into. However, I have only assessed PPFs that are on the same side of SH16 as the busway. The reason is that dwellings on the other side of the road will not be affected by the removal of buildings or earthworks due to the Project.
- **Clusters** are areas which combine PPFs that would benefit from the same mitigation (e.g. noise barrier). For this Project, given the potential long implementation period and the length of the busway, I have split the busway into sectors around each of the stations but have not divided the sectors any further.
- **Design Year** is a year 10 to 20 years after opening of the Project. While it is currently unclear when the Project would open and it may open in stages, I chose 2051 as the design year.
- **Noise Criteria** Categories are set out in NZS 6806 for 'new' and 'altered' roads. This Project is an altered road as the busway will be located immediately beside the existing SH16, a high noise route that controls the environment. The Noise Criteria Categories are set out in Table 1-1 below.

Table 1-1: Traffic noise criteria categories in accordance with NZS 6806

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

The aim is to achieve the lowest practicably achievable noise criteria category at each PPF for future assessment scenarios. The outcome depends on the Best Practicable Option (BPO) test, by progressively applying the noise criteria categories to determine which can practicably be achieved. NZS 6806 is clear that preference is to be given to structural mitigation (e.g. noise barrier) over building modification mitigation (e.g. glazing). 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 to assess and compare. NZS 6806 includes the following scenarios:
  - Existing noise environment: consists of the current road layout and traffic volume. For this Project the existing scenario includes SH16 and major roads crossing it such as Te Atatū Road or Royal Road. This scenario enables the verification of the computer noise model with measured noise levels.
  - Future do-nothing scenario: consists of the existing roads as above, but with traffic volume at the Design Year (2051).
  - Future do-minimum scenario: consists of the existing roads as per the above scenarios and the busway, at the Design Year (2051), 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 is proposed as the "base" road surface (as is the case for the busway, with Stone Mastic Asphalt (SMA) or similar surfacing proposed), this road surface is also included in the do-minimum scenario. Where existing traffic noise barriers (e.g. at SH16) or

buildings have been removed due to the Project, no new mitigation has been included in this scenario.

- Future Project with mitigation: consists of the do-minimum scenario and includes mitigation that is designed specifically to reduce noise levels, e.g. by replacing noise barriers that had to be removed for the construction of the Project.

1.3.2 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. Table 1-2 shows indicative subjective responses to explain how a sudden noise level change may be perceived. From experience, I have found that the subjective perception of a noise level change can be translated into an effect, which is generally based on people's annoyance reaction to noise level changes, which may depend on their perception of the Project.

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 a busway is added to an existing major road. Table 1-2 shows that normally a noise level change of at least 3 decibels is needed to be perceptible. Busway noise will not even result in a 1 decibel change compared with the existing SH16 traffic noise, and the removal of buildings results in some clearly noticeable changes.

Table 1-2: Noise level change compared with general subjective perception

Noise level change	General subjective perception
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

Noise is measured on a logarithmic scale, meaning that a doubling in traffic volume (e.g. from 10,000vpd to 20,000vpd) results in a noise level increase of 3 decibels, a just-perceptible change. To achieve a noise level change of 10 dB, a ten-fold increase or decrease of traffic volume would be required. To put this into context, the busway has about 1/100th of the traffic volume compared to SH16 and therefore has no effect on the overall noise level.

1.3.3 Station noise

There are seven bus stations proposed as part of the Project. While the vehicle noise from buses using the busway is covered by the assessment criteria set out in Section 1.3.1 above, other noise sources associated with the stations, such as from public address (PA) systems, do not fall under the provisions of NZS 6806. As a guide, I have assessed station noise against the relevant underlying zoning noise rules of the Auckland Unitary Plan – Operative in Part (AUP).

The stations are located in various zones, and the AUP noise limits applicable to these zones in relation to neighbouring zones are set out in Table 1-3 below.

Table 1-3: AUP noise limits for station locations

Station and zone	Receiving zone	AUP section	Assessment location	Noise limits	
Brigham Creek Rarawaru station and Park and Ride Future Urban	Future Urban	E25.6.3.1	Notional boundary	Mon – Sat 7am – 10pm	55 dB L_{Aeq}
				Sun 9am – 6pm	55 dB L_{Aeq}
				All other times	45 dB L_{Aeq} 75 dB L_{AFmax}
Westgate Te Waiarohia station		E25.6.8.1	Receiving building façade	7am – 11pm	65 dB L_{Aeq}

Station and zone	Receiving zone	AUP section	Assessment location	Noise limits	
Business – Metropolitan Centre	Business – Metropolitan Centre			11pm – 7am	55 dB L_{Aeq} 65 dB L_{eq} at 63 Hz 60 dB L_{eq} at 125 Hz 75 dB L_{AFmax}
	Business – General Business	E25.6.6.1	Receiving site boundary	At all times	65 dB L_{Aeq}
Royal Road Mānutewhau station Residential – Mixed Housing Urban	Residential – Mixed Housing Urban	E25.6.2.1	Receiving site boundary	Mon – Sat 7am – 10pm	50 dB L_{Aeq}
				Sun 9am – 6pm	50 dB L_{Aeq}
				All other times	40 dB L_{Aeq} 75 dB L_{AFmax}
Lincoln Road Wai o Pareira station Business – Light Industry	Business – Light Industry	E25.6.5.1	Receiving site boundary	At all times	65 dB L_{Aeq}
	Residential – Single House	E25.6.19.1	Receiving site boundary	Mon – Sat 7am – 10pm	55 dB L_{Aeq}
				Sun 9am – 6pm	55 dB L_{Aeq}
				All other times	45 dB L_{Aeq} 60 dB L_{eq} at 63 Hz 55 dB L_{eq} at 125 Hz 75 dB L_{AFmax}
Te Atatū Ōrangihina station Open Space – Informal Recreation Residential – Mixed Housing Urban	Residential – Mixed Housing Urban	E25.6.2.1	Receiving site boundary	Mon – Sat 7am – 10pm	50 dB L_{Aeq}
				Sun 9am – 6pm	50 dB L_{Aeq}
				All other times	40 dB L_{Aeq} 75 dB L_{AFmax}
Point Chevalier station Business – Town Centre	Business – Town Centre	E25.6.8.1	Receiving building façade	7am – 11pm	65 dB L_{Aeq}
				11pm – 7am	55 dB L_{Aeq} 65 dB L_{eq} at 63 Hz 60 dB L_{eq} at 125 Hz 75 dB L_{AFmax}
Western Springs station Residential – Mixed Housing Urban	Residential – Mixed Housing Urban	E25.6.2.1	Receiving site boundary	Mon – Sat 7am – 10pm	50 dB L_{Aeq}
				Sun 9am – 6pm	50 dB L_{Aeq}
				All other times	40 dB L_{Aeq} 75 dB L_{AFmax}

1.3.4 Vibration

Traffic vibration is usually only generated when heavy vehicles (e.g. buses) drive over bumps or dips in the road. I have determined the road traffic vibration risk by reviewing data of heavy vehicles travelling on existing roads with a range of surface conditions. For a newly sealed pavement, as is the case for the busway, the risk contour is less than 2 metres from the road edge. There will be no receivers outside the Proposed Designation this close to the busway traffic lane edge. Therefore, I do not consider that traffic vibration needs to be assessed for the Project.

In any event, vibration that may be caused by buses on the newly formed busway will be well below the levels at which buildings could be damaged, even buildings that may be sensitive to vibration such as listed historic budlings with sensitive features such as plaster mouldings. Historic buildings close to the Indicative Design are:

- The Auckland Savings Bank at approximately 33 metres from the closest busway edge, which would carry about 700 buses per day. Comparatively, the building is 8 metres from Great North Road, which carries more than 2,000 heavy vehicles per day.
- The Ambassador Theatre (inside the Proposed Designation) which is immediately abutting the Indicative Design. The busway alignment is currently proposed to be at a level similar to that of SH16. Since the busway will be newly constructed with smooth surface, there should be no perceptible traffic vibration at

the building part that may be retained (if any). Great North Road is about 9 metres from the building façade.

In either case, I consider that any vibration (if it were perceptible at all) would be well below any level that could cause even cosmetic damage, and therefore, no further discussion is required.

1.4 Road parameters

Road traffic noise predictions rely on a number of factors that are entered into a computer noise model. Each factor has varying influence on the calculation outcome. I introduce the most important aspects below:

- Road surface corrections are set out in the NZTA 'Guide to assessing road traffic noise' (V2.0, Feb 2024), Table A1 in the Appendix. I understand that the road surface will be SMA or a similarly smooth asphalt surface, with a road surface correction of 0. I have further adjusted these corrections by -3 dB to make the conversion from $L_{A10(18h)}$ to $L_{Aeq(24h)}$. $L_{Aeq(24h)}$ is the descriptor used to assess road traffic noise (refer to Table 1-1).
- Speed on the busway is proposed to be up to 80km/h, which I have modelled. I modelled other roads with their posted speed (e.g. SH16 at 80km/h or 100km/h depending on area, and 50km/h on other local roads) and have assumed that these speeds will remain unchanged in the future. Speed has a comparatively small influence on the calculation results.
- Other road parameters that have a noticeable effect on traffic noise are the composition of traffic (heavy versus light vehicles), and the gradient. On the busway, the percentage of heavy vehicles is 100% - the busway noise emissions have been corrected as described in Section 1.2.1. On other roads I have entered the percentage of heavy vehicles provided by the transport specialist. The gradient is automatically calculated by the modelling software based on the terrain entered.

1.5 Computer noise modelling

The propagation of road traffic noise is affected by multiple factors, including:

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

I used the software 'SoundPLAN', which is an internationally recognised computer noise modelling programme. In summary, SoundPLAN uses a three-dimensional digital topographical terrain map of the area as its base. Existing buildings and structures (including auxiliary buildings) within the assessment areas (refer Section 1.3.1.2) are included. Road traffic noise sources are input into the model, with road lanes located on the terrain file. I also included the Indicative Design in the model.

The SoundPLAN model uses the calculation algorithms of the CoRTN methodology which is referenced in Section 5.3.2 of NZS 6806. The calculation algorithms take account of all the factors set out above, including relevant atmospheric and ground conditions within appropriate parameters. The adjustments for New Zealand road conditions, specifically road surface types, are also included in the model. Therefore, once verified with noise measurements, modelling results can be compared with the relevant criteria without further adjustment. I have discussed the limitations of CoRTN in Section 1.2.1 above.

I have predicted noise levels for all PPFs, for all relevant scenarios. The NZS 6806 noise criteria categories for the PPFs are shown as a graphic representation in Appendix C with the predicted noise levels for individual PPFs contained in the tables in Appendix B. In both appendices, the colour coding is used:

- Category A buildings are shown in green;
- Category B buildings are shown in orange; and
- Category C buildings are shown in red.

Any buildings not shown in these three colours on the figures are not PPFs, e.g. garages, sheds or business premises, or are buildings inside the Proposed Designation area or outside the assessment area. I have included all PPFs within 100 metres of the Indicative Design in the assessment area.

Noise contour plans are a useful tool to obtain a graphical overview of a wider area including currently vacant land that may be developed in the future. The noise 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 to each PPF, the receiver noise levels in the tables should be used (refer to Appendix B).

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

2. Receiving environment

The Project will be located adjacent to SH16 for its entire alignment. This means that the existing noise environment is already highly affected by traffic noise.

There are some locations where the SH16 traffic noise is mitigated by noise barriers. Between Royal Road and Te Atatū, SH16 has substantial noise barriers that were installed as part of the Waterview Connection and SH16 widening works. These barriers provide good noise reduction for the houses behind. East of the causeway, a noise barrier along SH16 extends from 1102 Great North Road in Point Chevalier to the Western Springs Garden Community Hall, and adjacent to Ivanhoe Road in Grey Lynn.

The existing noise environment provides a baseline for assessing noise effects. Effects can be assessed by quantifying the noise levels that people could experience due to the implementation of a project. The change in noise environment can then be discussed in relation to people's ability to perceive the change (refer Section 1.3.2). In addition, measured noise levels for the existing environment are used to verify the computer noise model.

2.1 Surveys

I measured ambient sound levels at representative locations along the Proposed Designation in April and May 2025. The measurements consisted of:

- Short duration (15 minute) attended surveys at seven positions (undertaken on the footpath in front of dwellings outside the Proposed Designation boundary); and
- Long duration unattended data logging at three positions.

Data loggers that continuously measured ambient sound levels over a multi-day period were installed at three locations (78 Trig Road, 332 Triangle Road, and 37 Cooper Street). I then used the noise survey results to determine the 24-hour sound levels at each location. All noise survey results are set out in Table 2-1.

The short duration survey results are intended to give context to the overall environment along the Proposed Designation. They fill in the gaps between the logger surveys and indicate if certain environments are affected by SH16 traffic or not. These survey results have not been used to verify the computer model.

A summary of the surveys is attached in Appendix A. The location of the surveys is shown in Figure 2-1.

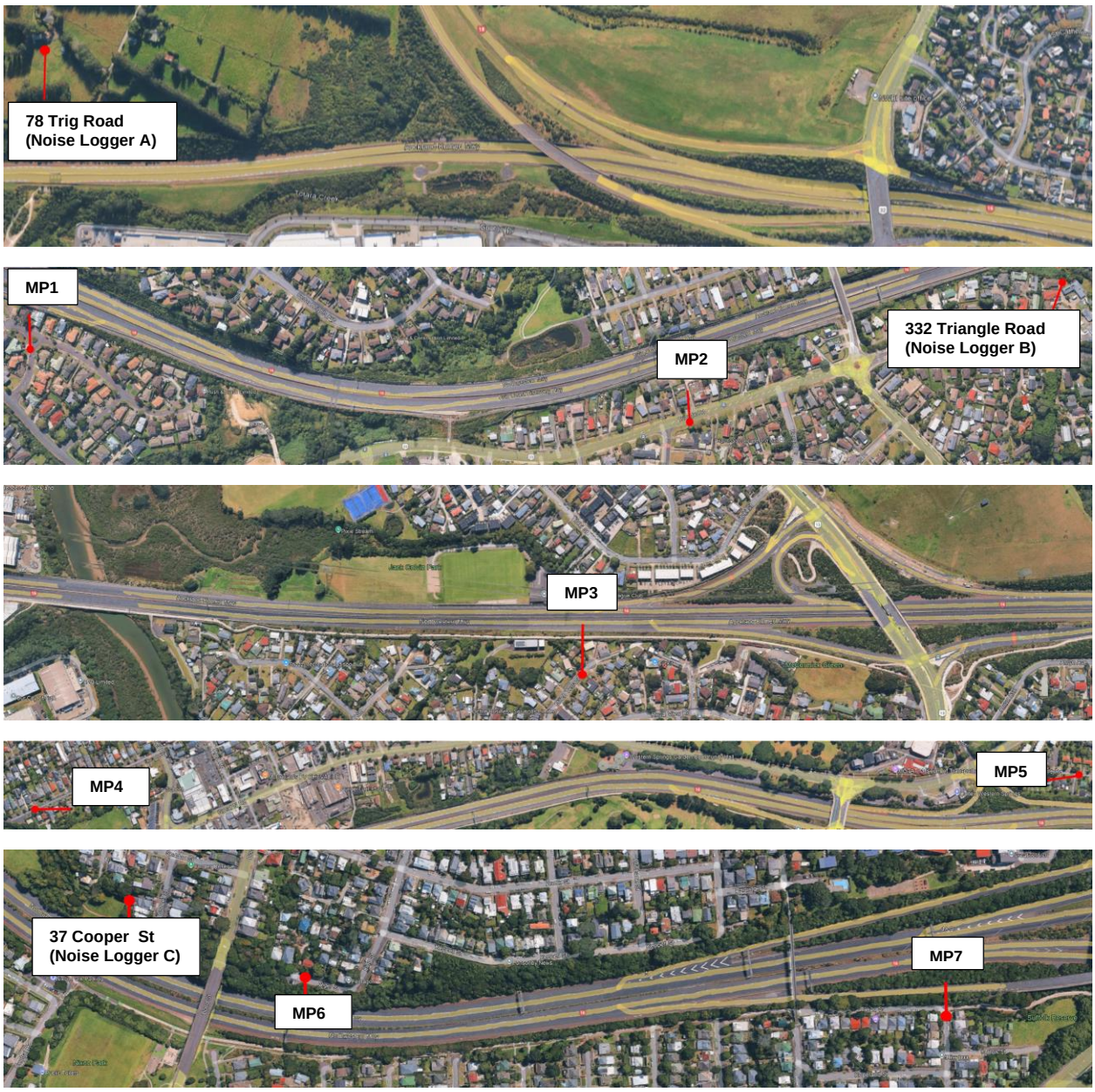


Figure 2-1: Noise survey locations (from west to east)

Table 2-1: Noise level survey results (from west to east)

ID	Location	Date/Start time	Duration	Measured noise levels	Background sound level
				dB $L_{Aeq(T)}$	dB L_{A90}
Logger A	78 Trig Rd	29 April to 7 May 2025	8 days	54	46
Logger B	332 Triangle Rd	29 April to 7 May 2025	8 days	65	57
Logger C	37 Cooper St	29 April to 7 May 2025	8 days	59	54
MP1	6 Kasia Cl	7 May 2025, 11.25am	15 min	51	48
MP2	2A Doone Pl	7 May 2025, 11.51am	15 min	65	55
MP3	9 Milich Tce	7 May 2025, 1.13pm	15 min	59	55
MP4	43 Montrose St	7 May 2025, 1.58pm	15 min	56	53
MP5	35 Ivanhoe Rd	7 May 2025, 2.42pm	15 min	56	52
MP6	8 Niger St	14 May 2025, 10.33am	15 min	61	58
MP7	68 Virginia Ave West	14 May 2025, 11.05am	15 min	56	53

Overall, dwellings adjacent to the Proposed Designation are next to a major transport corridor which controls the noise environment and receive continuous traffic noise from SH16. Background sound levels at these dwellings are generally high (above 50 dB L_{A90}), and ambient noise levels are in the mid-50 to mid-60 dB L_{Aeq}.

2.2 Modelling

I used a computer noise model to calculate the existing noise levels at all PPFs within 100 metres of the Indicative Design. The computer model of the existing situation includes the existing SH16 and all major local roads.

I used the measured sound levels to verify the results from the computer noise model for the existing situation. While both the measurements and modelling are subject to uncertainty, the measured and the modelled noise levels of the existing situation generally align as shown in Table 2-2 below.

Table 2-2: Noise level survey results (from west to east)

Location	Measured noise level	Predicted noise level	Difference
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	decibels
78 Trig Road	54	54	±0
332 Triangle Road	65	68	+3
37 Cooper Street	59	61	+2

The results suggest that the computer model of the existing situation generally performs to an appropriate accuracy, which enables us to use the model to predict the existing noise levels at all PPFs without the need to measure existing noise levels at each building.

3. Assessment of effects

3.1 Whole of Project

Changes in traffic noise level due to the busway are in the imperceptible range. This is because the busway carries small traffic volumes compared with SH16 and major local roads.

To put this into context, a similar situation can also be observed next to the Northern Busway, which is comparable to this Project. The Northern Busway operates a mixture of diesel and electric buses, at up to 80 km/h and on a dense asphalt surface, adjacent to a major state highway, State Highway 1 (SH1). Individual buses passing do not affect the overall noise environment and are often inaudible over the State highway traffic noise. This will also be the case for the Project.

The removal of buildings and some existing noise barriers to make way for the Project will result in a noticeable noise level increase for some of the houses that are currently behind those buildings or barriers, due to increased exposure to noise from SH16. This is the do-minimum scenario in accordance with NZS 6806, and the resulting noise level changes are recorded in Appendix B.

However, the Project will reinstate some noise barriers removed due to the Project or install new noise barriers in some locations to mitigate increased exposure to the traffic noise levels from SH16. With these barriers, I predicted the traffic noise levels to test if the barriers perform appropriately. This is the mitigation option scenario, and the resulting noise increases are recorded in Appendix B.

Given the large number of PPFs, I have divided the Proposed Designation into sectors. These sectors are described in the sections below. The sectors do not follow the proposed designation areas but relate to receivers that are in a similar geographic area and would benefit from similar mitigation in that area.

In my assessment of operational noise effects for each sector, I have focused on:

- The noise levels without the Project – the do-nothing scenario – as the base comparison; and
- The noise levels with the Project and with recommended mitigation.

I have assessed overall traffic noise levels and designed mitigation such that, as far as practicable, traffic noise levels are generally similar to the noise levels that would exist if the Project did not go ahead.

3.2 Brigham Creek Rarawaru to Te Whau River

3.2.1 Busway between Brigham Creek and Te Whau River

I have divided the section of busway between Brigham Creek and Te Whau River into four sectors as follows:

- Sector 1 – western extent of the Proposed Designation to Kuaha Road;
- Sector 2 – Kuaha Road to Ginders Drive;
- Sector 3 – Lincoln Park Avenue to Huruhuru Creek; and
- Sector 4 – Lincoln Road station to Te Whau River.

Predicted noise levels for each sector are set out in Appendix B and noise level contour plans in Appendix C.

A number of buildings as well as some existing noise barriers may need to be removed for the construction of the Project. Those dwellings that remain and are within 100 metres of the Indicative Design and on the same side of SH16 as the busway, are PPFs. Since most of these PPFs are at reasonable distances from SH16, noise levels will generally not change perceptibly (refer to Table 1-2). There are a few exceptions where houses would be exposed to noise emanating from SH16 following the removal of buildings in the Proposed Designation and the change in noise levels will be clearly noticeable.

3.2.1.1 Sector 1

Figure 3-1 shows the extent of Sector 1, and the PPFs assessed (highlighted in turquoise). The Proposed Designation boundary is shown in red.

Figure 3-1: Sector 1 and assessed PPFs

There are no PPFs to consider in the northern part of Sector 1. Any sensitive buildings are more than 150m from the Indicative Design and therefore outside the assessment area. There are no existing traffic noise barriers in this area. Noise level contours show that the busway will not noticeably affect the noise levels for these houses.

South of Westgate there are a large number of newly constructed multi-storey dwellings immediately beside SH16. There is only limited space, with the busway taking up the remainder of the buffer between SH16 and the façades. The dwellings currently have 2-metre-high timber fences providing some noise shielding for the ground floor, but there is no noise protection for the upper floor(s). The timber fences are not affected by the Project.

The noise level predictions show that noise levels would remain generally the same at the PPFs within the Sector 1 assessment area without and with the Project. There are some minor changes in noise levels by less than 1 dB at all PPFs. The changes are too small to be noticeable.

I recommend no mitigation in this area due to the negligible effects.

3.2.1.2 Sector 2

Figure 3-2 shows the extent of Sector 2, and the PPFs assessed.

Figure 3-2: Sector 2 and assessed PPFs

This sector contains Royal Road School to the north of Royal Road, and dwellings south of Royal Road.

Any dwellings between SH16 and the school are inside the Proposed Designation and will be removed. This leaves the school exposed to SH16 and station noise. I have recommended that a 2m high barrier is installed along the eastern school boundary to mitigate these effects.

South of Royal Road, along the offramp and SH16, are existing noise barriers that were installed as part of the SH16 upgrade works. I understand that these barriers can be retained. My predictions show that with these existing noise barriers, all PPFs will receive noise levels that are similar to, or slightly lower than, without the Project. The largest noise level increase is 3 dB at Ginders Drive where houses inside the Proposed Designation will be removed, exposing PPFs behind to slightly higher noise levels. The difference arising as a result of noise emanating from the busway will be insignificant.

I do not recommend any mitigation beyond the new noise barrier for Royal Road School for this sector. With the retention of the existing noise barriers, noise levels will remain similar, and the Project does not add to the overall noise environment.

3.2.1.3 Sector 3

Figure 3-3 shows the extent of Sector 3, and the PPFs assessed.

Figure 3-3: Sector 3 and assessed PPFs

All PPFs in this sector are dwellings. They are generally on the far side of Triangle Road, with intervening houses towards SH16 removed.

An existing noise barrier with varying heights of 3 metres to 4.5 metres is already installed along SH16 in this area. The existing barrier terminates in front of the property at 37 Huruhuru Road before resuming flush with the southern side of the bridge over Huruhuru Road. I understand that this noise barrier can generally be retained. The only area where the noise barrier will need to be removed is either side of Huruhuru Road where the busway will need to pass under the existing bridge. I have modelled the partial removal of the existing barrier near Huruhuru Road bridge and removal of the houses inside the Proposed Designation and found that many PPFs would receive high traffic noise levels (in Category C) from SH16 in conjunction with noticeable noise level increases up to 6 dB.

If the barrier could be increased in height to 5 metres across the extent (but allowing for the Huruhuru Road bridge gap), then most PPFs would receive similar noise levels to those without the Project.

One PPF would still receive a noticeable noise level increase of about 4 dB even with a higher barrier, due to the Huruhuru Road bridge gap. I recommend that this should be resolved during detailed design, with possible barrier placement or alternative mitigation (e.g. building modification mitigation) where this is appropriate.

In addition, I recommend that the existing barrier be increased in height to 5 metres to provide additional noise mitigation for traffic on SH16 following the removal of intervening houses.

3.2.1.4 Sector 4

Figure 3-4 shows the extent of Sector 4, and the PPFs assessed.

Figure 3-4: Sector 4 and assessed PPFs

All PPFs in this sector are dwellings. There is an existing noise barrier along SH16 which was installed as part of the Waterview Connection project. I understand that the barrier can be retained for its entirety west of Te Atatū Road. East of Te Atatū Road is a noise bund with a small barrier on top, which will need to be partially or fully removed.

I have predicted noise levels with the retention of the existing noise barrier and removal of the noise bund and find that some PPFs would receive a noticeable (3-4 dB) noise level increase as well as high noise levels within Category C.

If the existing barrier was increased in height to 4m from about 26 Royal View Road to its western termination at the bridge, all PPFs are predicted to receive noise levels that are generally lower than those if the Project was not to be implemented.

I recommend that the existing noise barrier is upgraded to provide for the extra height and achieve a positive noise outcome.

3.2.2 Brigham Creek Rarawaru station

Brigham Creek Rarawaru station is relatively remote from sensitive receivers, with closest dwellings at 127 to 141 Fred Taylor Drive more than 250 metres from the busway and about 50 metres from the station access road.

About 830 local buses would visit the station over a 24-hour period. At 50 metre distance, the daily noise level would be 48 dB $L_{Aeq(24h)}$. At night-time, noise levels will be between 5 and 15 dB lower than the daily noise level (due to lower bus volumes), and during the day, noise levels would be about 2-3 dB higher. All of these noise levels will comply with the relevant noise limits of 55 and 45 dB L_{Aeq} during daytime and night-time respectively. Buses leaving the station (i.e. accelerating from being stationary) will be able to comply with the night-time L_{max} noise limit of 75 dB due to the large distance between the station and the houses.

Should a PA system be installed, this can be designed to be fully compliant with the relevant noise limits and will likely be inaudible.

Station noise will be insignificant at the closest houses given the impact of SH16.

3.2.3 Westgate Te Waiarohia station

There are no sensitive receivers around Westgate Te Waiarohia station. The closest dwelling is at 11 Hobsonville Road, across SH16 and the State Highway 18 (SH18) ramps, at more than 400 metres from the closest station location, which will be unaffected by the Project.

3.2.4 Royal Road Mānutewhau station

The Royal Road Mānutewhau station is adjacent to Royal Road School, with local buses entering the station level with Royal Road, while the busway station will be lower and well shielded. The local buses would enter the station adjacent to the school building closest to Royal Road and immediately turn towards the station. The platforms are about 50 metres from this building.

As the school is not occupied at night-time, the night-time noise limits of 40 dB L_{Aeq} and 75 dB L_{AFmax} are not relevant.

I understand it is anticipated that close to 500 local buses will pass through this station each day. The predicted daytime noise level at the closest school building is 47 dB L_{Aeq} which complies with the daytime noise limit of 50 dB L_{Aeq}.

Any PA system can be designed to readily comply with the relevant noise limits.

Overall, I consider that the operation of the station would not result in adverse effects on the operation of the school.

3.2.5 Lincoln Road Wai o Pareira station

The Lincoln Road Wai o Pareira station is relatively remote from dwellings, about 170 metres and 220 metres from closest dwellings at 366 and 357 Triangle Road respectively. At these distances, I predict compliance with the relevant noise limits at any dwellings, irrespective of their zoning.

The station access is off Triangle Road, opposite dwellings at 357 to 365 Triangle Road. I understand that about 1,135 local buses may pass through this station each day. I predict a 24-hour noise level of 47 dB $L_{Aeq(24h)}$ which would translate into noise levels 5 to 15 decibels lower at night-time due to reduced bus numbers. As the buses would turn off the public road away from the houses, I predict that noise levels on the station site will be able to comply with the relevant night-time noise limit of 45 dB L_{Aeq} at the houses.

Any PA system can be designed to readily comply with the relevant noise limits.

I consider that noise from the operation of the station will not adversely affect houses in the vicinity, given how remote the closest houses are. The station would be largely inaudible over local and SH16 traffic noise.

3.2.6 Te Atatū Ōrangihina station

Te Atatū Ōrangihina station allows for direct access to the busway from Royal View Road. In addition, it provides for a local station, accessed from the corner of Te Atatū Road and Royal View Road, and via a new local bus bridge across SH16.

The closest sensitive receivers are the dwellings opposite the busway entry (i.e. 75 and 77 Royal View Road) and opposite the local bus station entrance (i.e. 91 and 93 Royal View Road), all at about 25 metres distance. Other houses in the vicinity are 309 to 313 Te Atatū Road at about 40 and more metres distance.

I understand just over 400 local buses are expected daily at this station. I predict that buses entering the site will be able to readily comply with the day and night-time noise limits of 50 dB and 40 dB L_{Aeq} respectively.

Given that the closest station platform is more than 50 metres from the closest houses, I predict that the relevant night-time noise limit of 75 dB L_{AFmax} can also be complied with, with a margin of safety.

Any PA system can be designed to readily comply with the relevant noise limits.

I consider that noise from the operation of the station will not adversely affect houses in the vicinity.

3.2.7 Sensitivity testing of Indicative Design

The Proposed Designation is in most instances relatively narrow and does not allow for significant changes to the Indicative Design. However, at the western end, up to the SH18 ramps, there is sufficient space to move the busway to the eastern side of SH16. Should this occur, I consider that there would be no additional noise issues given that the closest dwellings are more than 100 metres from the Proposed Designation boundary.

Small horizontal or vertical alignment changes to the busway within the Proposed Designation would not result in noticeable noise level changes. In any event, the busway itself does not add to the overall noise level, as discussed in Section 1.2.2. My predictions already take into account the fact that all buildings inside the Proposed Designation will be removed, which results in a reduction of shielding of noise emanating from SH16 to the PPFs outside the Proposed Designation.

Should the Indicative Design move such that existing noise barriers would need to be removed that have been assumed to be retained in this assessment, then alternative barriers may need to be designed at the time of detailed design. The Proposed Designation conditions allow for this investigation.

3.3 Waterview Interchange (east of causeway) to Ian McKinnon Drive

3.3.1 Busway between Waterview Interchange and Ian McKinnon Drive

I have divided the section of busway between the causeway and Ian McKinnon Drive into two sectors as follows:

- Sector 5 – east of the Waterview Interchange to Motions Road; and
- Sector 6 – Motions Road to the eastern termination of the Project.

Predicted noise levels for each sector are set out in Appendix B and noise level contours in Appendix C.

Since a number of buildings as well as some existing noise barriers may need to be removed for the construction of the Project, the next closest dwellings are the relevant PPFs. Since most of these are at reasonable distances from SH16, noise levels will generally not change significantly (refer Table 1-2). There are a few exceptions where dwellings would be exposed to noise emanating from SH16 following the removal of buildings in the Proposed Designation and the change in noise levels will be noticeable.

3.3.1.1 Sector 5

Figure 3-5 shows the extent of Sector 5 and the PPFs assessed. The PPFs are shown in turquoise outline to the north of SH16.

Figure 3-5: Sector 5 and assessed PPFs

Between the causeway and Montrose Street (i.e. the Waterview Interchange), existing traffic lanes will be reallocated to east and west bound one-way bus lanes. The changes in traffic lanes will not result in any change in traffic noise levels.

The two-way new busway will only commence at about 42A Montrose Street (approximately where the PPFs are shown on Figure 3-5 above). For that reason, I have included only PPFs that are within 100 metres of where the new busway will start.

There are existing noise barriers starting around 1102 Great North Road and extending to about 1012 Great North Road. Most of these barriers can be retained. However, where the barrier extends into the busway alignment (at 1102 Great North Road and 1038 Great North Road) the barriers will need to be partially removed.

Barrier and building removal will result in significant noise level increases for some dwellings of up to 9 dB. I have tested different barrier locations and heights, and recommend that the existing barriers be retained as far as practicable and, in part, upgraded:

- At 1102 Great North Road, I recommend a height increase by 1 metre for the section of barrier along the site boundary; and
- At 1042 Great North Road, I recommend that a 2.5m high barrier be installed along the eastern site boundary.

With these upgrades, most PPFs would receive noise levels that are similar to those predicted if the Project does not go ahead, with noise level changes ranging from -1 dB to +1 dB. These changes would generally be imperceptible (refer to Table 1-2).

Some dwellings may need to be investigated for building modification, such as 1042 Great North Road, which cannot practicably be protected with a barrier.

SH16 will be slightly realigned towards the south to accommodate the busway through Point Chevalier. All traffic lanes will be within the existing designation. The existing noise barrier in the vicinity of 34B Sutherland Road and 12 Novar Place can be relocated within NZTA's existing designation slightly to the south. The adjustment to SH16 and the noise barrier location will result in no noticeable change in traffic noise level experienced at these dwellings.

As part of the Project, a new bus bridge is proposed to be constructed to the east of Carrington Road. This bridge would carry southbound local and local bus traffic, while the existing Carrington Road bridge would carry northbound local and local bus traffic. Houses on Sutherland Road will be removed, leaving 6 and 6A Sutherland Road more exposed to traffic on Carrington Road. Both houses are single storey, and any traffic noise from the existing and new Carrington Road bridges can be mitigated by installing a 2.5 metre high boundary fence along the western site boundary. North of SH16, the bridge will have no noticeable impact on houses outside the designation, and no further mitigation will be required.

3.3.1.2 Sector 6

Figure 3-6 shows the extent of Sector 6 and the PPFs assessed.

Figure 3-6: Sector 6 and assessed PPFs

This sector has an existing noise barrier in the vicinity of Ivanhoe Road. However, I understand that this barrier will need to be removed for the construction of the Project and that the most appropriate location to replace this noise wall would be north of the busway. I have tested an equivalent height (i.e. 3 metres) and

length barrier north of the busway. In addition, a new barrier could be installed along the Proposed Designation boundary in front of the dwellings at 1 Tay Street. This barrier could be located along the edge of the park. This location is at an elevation similar to the dwellings, and therefore more effective than a barrier at the (lower) busway elevation.

With these barriers in place, all PPFs in Grey Lynn (west of the Arch Hill Reserve) would receive the same or slightly lower noise levels than if the Project does not go ahead.

In the Arch Hill area (east of the Arch Hill Reserve), from Commercial Road east, the terrain raises quickly away from SH16. This means that all PPFs are well elevated above SH16. For that reason, past projects have not implemented noise barriers in this area. Barriers are not effective here as they would not be able to break line-of-sight between the houses and the road. This is also the case with this Project: most PPFs in this area would receive noise levels that are similar to, or at times lower than, a circumstance without the Project. However, a small number would receive noticeable noise level increases. These are PPFs that currently have houses between them and SH16 inside the Proposed Designation, and those houses will be removed. There is no practicable way of providing alternative shielding. The PPFs where this is the case are: 34, 35 and 37 King Street, 2A and B Home Street and 2 and 4 Partridge Street.

Building modification may be investigated for these PPFs if detailed design confirms that external noise levels below Category C cannot be achieved.

3.3.2 Point Chevalier station

The Point Chevalier station is located between SH16 and the Point Chevalier town centre, i.e. a high noise environment in either direction. There are no noise sensitive receivers in the area. Local buses will continue to use existing local roads (i.e. Great North Road and Point Chevalier Road) and therefore will not need to be assessed as they use public roads.

The electric buses on the busway at the station will not cause elevated noise levels at low speeds and therefore would not add to the overall noise environment.

The relevant noise limits of 65 dB and 55 dB L_{Aeq} day and night-time respectively can be readily complied with.

Given that there are no sensitive receivers in the area, I consider that the station option will have no adverse effects.

3.3.3 Western Springs station

Western Springs station does not include local bus platforms. Local buses will continue to use Great North Road and therefore are not part of this assessment as they use existing roads.

The busway station is about 40 metres from the closet residential receivers at 744 Great North Road and 10-12 Ivanhoe Road. The busway will be elevated in this location, leading onto the bridge across the SH16 ramps. The electric buses on the busway at the station do not cause elevated noise levels at low speeds and therefore would not add to the overall noise environment.

The relevant noise limits of 50 dB and 40 dB L_{Aeq} day and night-time respectively can be readily complied with by buses on the busway.

Given that the existing traffic noise levels from SH16 are well within the 60 and 70 dBA, station noise will be largely inaudible and cause no adverse effects.

3.3.4 Sensitivity testing of Indicative Design

The Proposed Designation is in most instances relatively narrow and does not allow for significant movement of the Indicative Design. Small horizontal or vertical alignment changes of the busway within the Proposed Designation would not result in noticeable noise level changes. In any event, the busway itself does not add to the overall noise level, as discussed in Section 1.2.2. My predictions already take into account the fact that all buildings inside the Proposed Designation will be removed, which results in a reduction of shielding of noise emanating from SH16 to the PPFs outside the Proposed Designation.

Should the Indicative Design move such that existing noise barriers would now need to be removed that were assumed to be retained, then alternative barriers may need to be designed at the time of detailed design. The Proposed Designation conditions allow for this investigation.

4. Recommended measures to avoid, remedy or mitigate effects

4.1 Road noise mitigation options

There are three general methods that can be used to control traffic noise generation or propagation. These are:

- Selecting noise reducing road surface material, e.g. smooth asphalt surface vs chip seal. For the Project, the proposed surface is SMA or a similar dense asphalt surface.
- Installing traffic noise barriers. For the Project, this is recommended where existing noise barriers are affected by the busway and would need to be removed and therefore reinstated in a different location.
- Upgrading building envelopes (building modification mitigation), e.g. by upgrading glazing, insulation or seals around doors and windows, and installing alternative ventilation options so that windows and doors can remain closed.

The acoustic performance of noise mitigation measures, i.e. the effectiveness and extent of noise level reduction, needs to be maintained over time. NZS 6806 states that “structural mitigation measures should be designed in such a way that they retain the same noise-reduction properties up to the design year”. This means that to achieve the same noise reducing qualities as at initial installation any barriers proposed should not develop gaps or other openings and road surface materials should, as far as practicable, be maintained to retain their smoothness.

4.2 Structural mitigation considered

I have assessed potential structural mitigation, i.e. barriers and road surface material, along the Project alignment.

Across the Project, a smooth asphalt surface (e.g. SMA or Asphaltic Concrete) is proposed to be used.

Existing noise barriers along SH16 will be retained as far as practicable. In some areas I recommend that an increase in height is investigated:

- Sector 3 Lincoln Road: increase in height from 3 to 4.5 metres currently to 5 metres height;
- Sector 4 Te Atatū: increase in height from 3 metres currently to 4 metres height from about 26 Royal View Road to the western termination of the existing noise wall; and
- Sector 5 Point Chevalier: increase in height by 1 metre at 1102 Great North Road.

In addition, some new barriers are recommended where there are no barriers currently, or where existing barriers may need to be removed to make space for the Project, specifically at:

- Royal Road School site boundary (Sector 2) – 2 metre high barrier;
- 6 and 6A Sutherland Road (Sector 5) – 2.5 metre high barrier along the western site boundary;
- 1042 Great North Road eastern site boundary (Sector 5) – 2.5 metre high barrier; and
- Ivanhoe Road and 1 Tay Street (Sector 6) – 3 metre high barrier.

All of barriers will need to be reevaluated and confirmed during detailed design to ensure that the BPO mitigation is implemented.

4.3 Building modification mitigation considered

As noted repeatedly, bus traffic on the Project itself does not result in noticeable noise level changes at any PPF. Many PPFs are already affected by high traffic noise levels within Category C, from traffic on SH16.

Nevertheless, due to the removal of intervening buildings and the removal of some noise barriers to provide space for the Project, a small number of PPFs should be investigated for building modification mitigation if:

- They receive noise levels within Category C and
- Experience a noise level increase of 1 decibel or more when the Project is in place.

With the Indicative Design assessed, that would mean the following PPFs would be investigated for building modification mitigation as summarised in Table 4-1.

Table 4-1: PPFs to be investigated for building modification mitigation

Sector	Address	Current predicted noise level increase (dB)
3	301 Triangle Road	4
3	305 Triangle Road	1
3	307 Triangle Road	1
3	10 Waimumu Road	2
5	1028 Great North Road	1
5	1042 Great North Road	4
5	1046 Great North Road	2
5	1086 Great North Road	1
5	1090B Great North Road	1
5	1102J Great North Road	2
6	2A Home Street	2
6	2B Home Street	2
6	34 King Street	3
6	35 King Street	1
6	37 King Street	2
6	2 Partridge Street	3
6	4 Partridge Street	3

5. Conclusion

The Project itself will not result in any change in traffic noise levels received at any of the PPFs. Any changes to noise levels will be due to the loss of shielding when buildings and existing noise barriers inside the Proposed Designation are removed to allow for the construction of the Project, and houses are now exposed to traffic noise from SH16. This change to noise levels is an indirect result of the Project.

I have predicted traffic noise levels from the operation of the busway and, to address the indirect effect of building removal, recommended upgrades to existing noise barriers (where they can be retained) and some new noise barriers, to achieve similar outcomes for PPFs as if the Project was not to go ahead.

For a small number of PPFs, building modification mitigation may need to be investigated since there appear to be no practicable options to provide effective barriers. This is the case where noise levels would increase by 1 dB or more and noise levels would be in Category C.

Overall, the predicted changes in road traffic noise due to the Project implementation are small, ranging from +2 to -2 dB for the vast majority of PPFs.

Stations can be designed and operated to not cause adverse additional noise effects on neighbouring sensitive receivers.

Appendix A. Noise survey summaries

Location: 78 Trig Road, Whenuapai

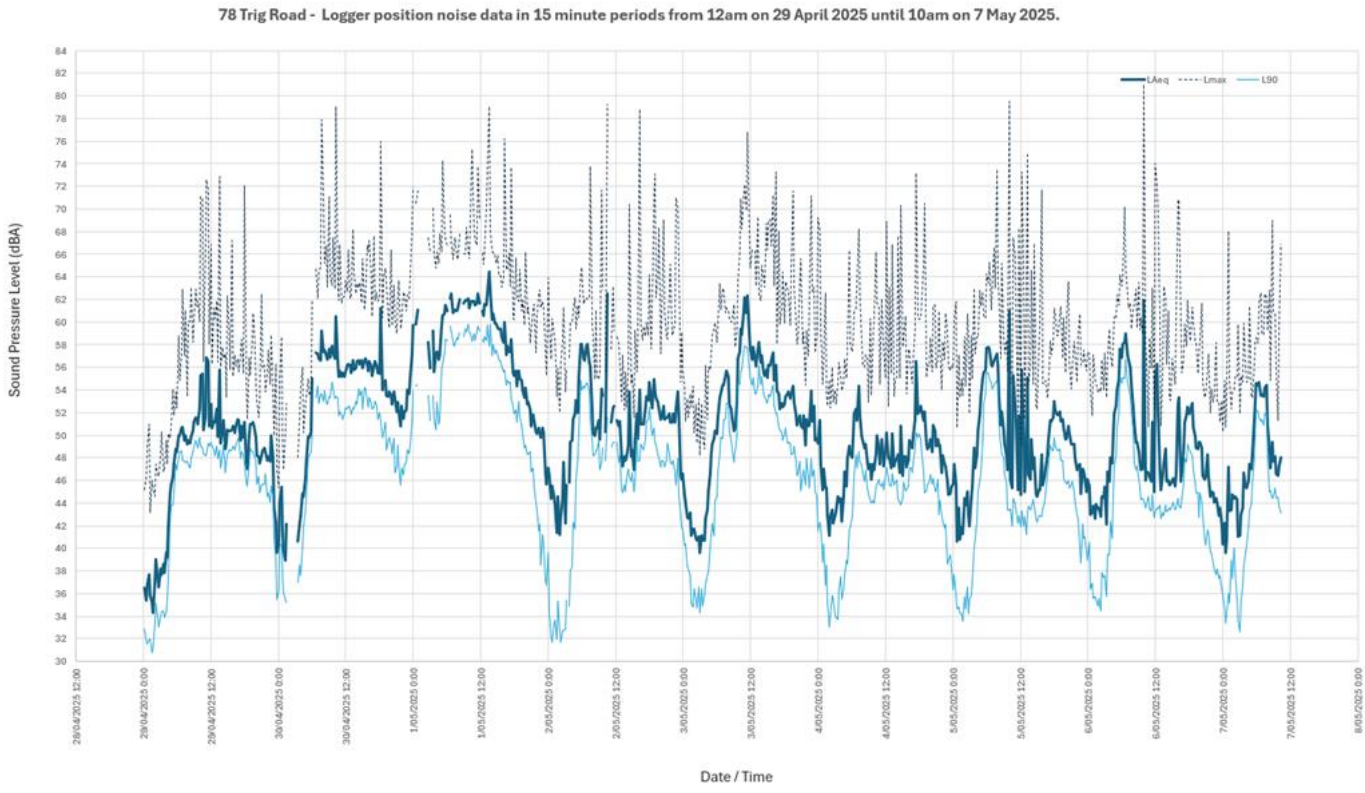
Measurement dates: Tuesday 29 April 2025 to Wednesday 07 May 2025

Weather during measurement: Rain for a few hours on different days. The affected data has been removed from the data set before the analysis.

Noise Level, dB		L_{Aeq}	L_{A90}	L_{Amax}
Day (0700-1800)	Lowest	50	46	50
	Average	54	50	74
	Highest	57	58	81
Evening (1800-2200)	Lowest	49	45	62
	Average	51	47	68
	Highest	55	49	76
Night (2200-0700)	Lowest	45	43	50
	Average	50	46	66
	Highest	59	55	74
	$L_{Aeq(24h)}$	**54 dB**		

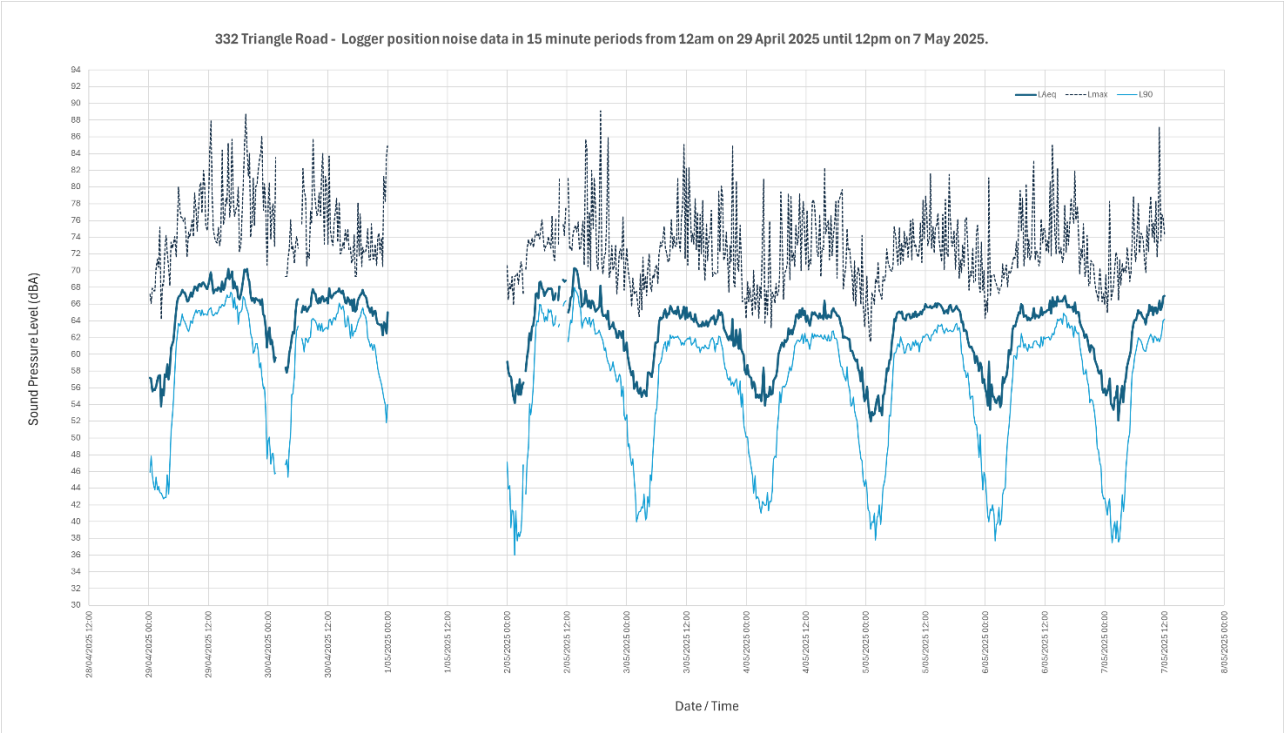
Location: 332 Triangle Road, Massey

Measurement dates: Tuesday 29 April 2025 to Wednesday 07 May 2025



Weather during measurement:	Rain for a few hours on different days. The affected data has been removed from the data set before the analysis.
Notes:	The data on 1 May was 10 decibels above every other measurement day. While adverse weather was excluded, other extraneous sources would have been recorded during that day. Therefore, 1 May has been excluded from the survey.

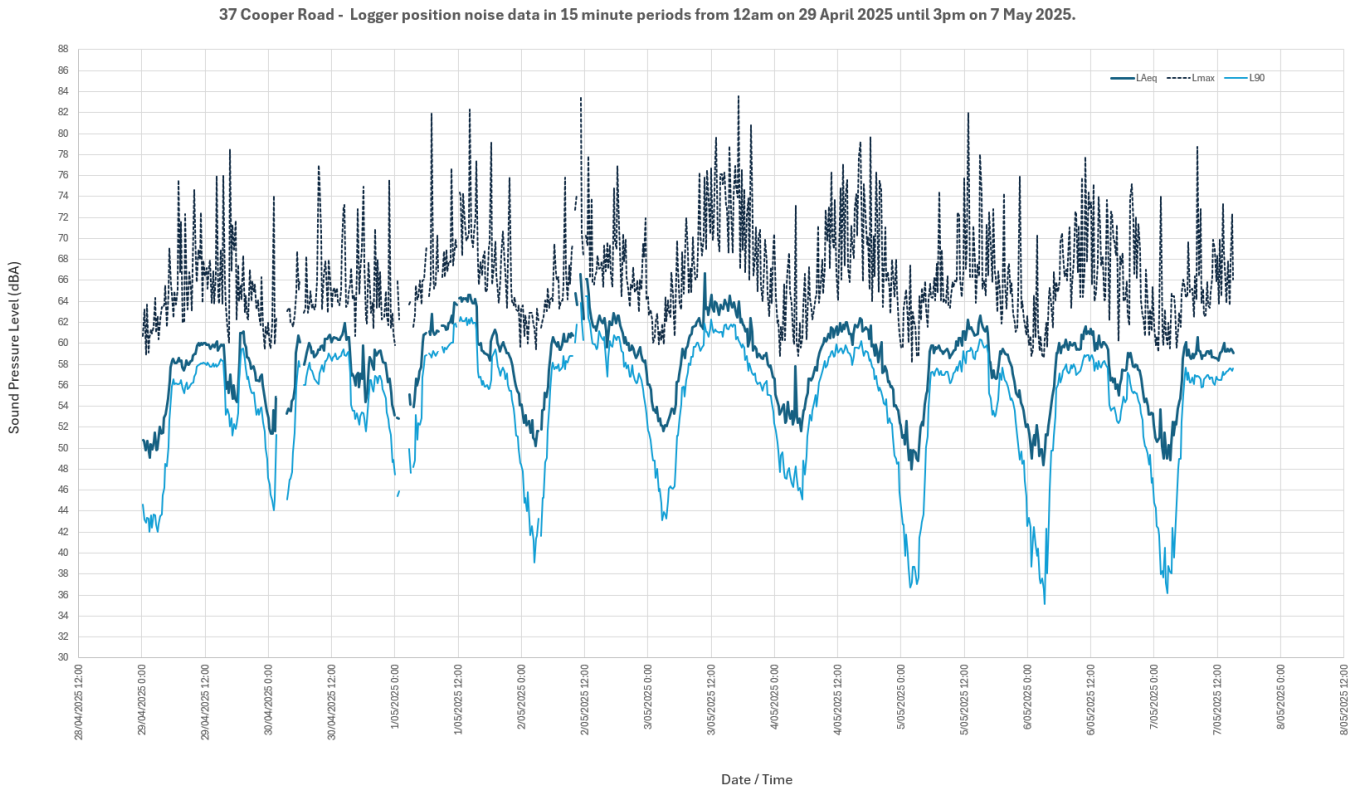
Noise Level, dB		L_{Aeq}	L_{A90}	L_{Amax}
Day (0700-1800)	Lowest	64	61	82
	Average	67	63	88
	Highest	71	65	95
Evening (1800-2200)	Lowest	63	58	67
	Average	64	30	80
	Highest	68	64	90
Night (2200-0700)	Lowest	58	50	62
	Average	62	55	82
	Highest	71	60	91
	$L_{Aeq(24h)}$ **65 dB**			



Location:	37 Cooper Street, Arch Hill
Measurement dates:	Tuesday 29 April 2025 to Wednesday 07 May 2025

Weather during measurement: Rain for a few hours on different days. The affected data has been removed from the data set before the analysis.

Noise Level, dB		L_{Aeq}	L_{A90}	L_{Amax}
Day (0700-1800)	Lowest	59	57	63
	Average	61	58	78
	Highest	62	61	84
Evening (1800-2200)	Lowest	58	55	68
	Average	59	56	76
	Highest	60	58	81
Night (2200-0700)	Lowest	55	51	68
	Average	56	52	74
	Highest	58	54	82
	$L_{Aeq(24h)}$	**59 dB**		



Appendix B. Predicted noise levels

The colours in the following tables represent the noise criteria categories of NZS 6806 (refer Table 1-1):

- Green – Category A;
- Orange – Category B; and
- Red – Category C.

The predicted noise levels are rounded to the nearest full number.

The scenarios represent the following:

- Existing – current noise levels based on existing traffic volumes;
- Do Nothing scenario – future noise levels based on 2051 traffic volumes, no Project;
- Do Minimum scenario – future noise levels based on 2051 traffic volumes, with Project; and
- Mitigation option – recommended mitigation option (i.e. barriers).

B.1 Sector 1

SPID	Address	Existing	Do Nothing	Do Minimum
Sector 1		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192174	1 Dotterel Pl	54	56	56
192171	2 Dotterel Pl	56	58	58
192320	3 Dotterel Pl	55	57	57
192302	4 Dotterel Pl	55	57	57
192321	5 Dotterel Pl	55	57	57
192303	6 Dotterel Pl	56	58	58
192322	7 Dotterel Pl	55	57	57
192169	8 Dotterel Pl	57	59	59
192185	9 Dotterel Pl	55	57	57
192166	10 Dotterel Pl	57	59	59
192323	11 Dotterel Pl	55	57	57
192288	12 Dotterel Pl	57	59	59
192324	13 Dotterel Pl	55	57	57
192287	14 Dotterel Pl	57	59	59
192325	15 Dotterel Pl	55	57	57
192286	16 Dotterel Pl	57	60	60
192326	17 Dotterel Pl	55	57	57
192285	18 Dotterel Pl	58	60	60
192186	19 Dotterel Pl	59	61	62
192284	20 Dotterel Pl	58	60	60
192168	21 Dotterel Pl	70	73	73
192283	22 Dotterel Pl	58	60	60
192299	23 Dotterel Pl	71	73	74
192298	25 Dotterel Pl	71	74	74
192300	27 Dotterel Pl	71	73	74
192301	29 Dotterel Pl	71	74	74
192296	31 Dotterel Pl	71	73	74
192297	33 Dotterel Pl	71	73	74
192294	35 Dotterel Pl	71	73	74

SPID	Address	Existing	Do Nothing	Do Minimum
Sector 1		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192295	37 Dotterel Pl	71	73	74
192293	39 Dotterel Pl	71	73	74
192292	41 Dotterel Pl	71	73	74
192291	43 Dotterel Pl	70	73	73
192395	9 Kuaha Rd	65	67	66
192378	11 Kuaha Rd	58	60	60
192410	13 Kuaha Rd	58	60	60
192411	15 Kuaha Rd	58	60	60
192412	17 Kuaha Rd	56	58	58
192413	19 Kuaha Rd	56	58	58
192418	21 Kuaha Rd	57	59	59
192417	23 Kuaha Rd	57	59	59
192416	25 Kuaha Rd	57	59	59
192415	27 Kuaha Rd	55	57	57
192414	29 Kuaha Rd	55	57	58
192379	31 Kuaha Rd	56	58	58
192346	4 Parkwood Ave	58	60	60
192327	5 Parkwood Ave	57	59	59
192347	6 Parkwood Ave	58	60	60
192329	7 Parkwood Ave	57	59	60
192348	8 Parkwood Ave	59	61	61
192330	9 Parkwood Ave	57	59	59
192349	10 Parkwood Ave	60	62	62
192331	11 Parkwood Ave	57	59	59
192350	12 Parkwood Ave	61	63	63
192332	13 Parkwood Ave	57	59	59
192351	14 Parkwood Ave	62	64	64
192187	15 Parkwood Ave	57	59	59
192190	16 Parkwood Ave	63	65	65
192328	17 Parkwood Ave	58	60	60
192352	18 Parkwood Ave	57	59	59
192333	19 Parkwood Ave	57	59	59
192353	20 Parkwood Ave	57	59	59
192188	21 Parkwood Ave	57	59	59
192354	22 Parkwood Ave	57	59	59
192337	23 Parkwood Ave	57	59	59
192355	24 Parkwood Ave	57	59	59
192335	25 Parkwood Ave	58	60	60
192356	26 Parkwood Ave	57	59	60
192336	27 Parkwood Ave	61	63	63
192357	28 Parkwood Ave	59	61	62
192334	29 Parkwood Ave	60	62	63
192358	30 Parkwood Ave	61	63	63
192172	31 Parkwood Ave	72	74	74

SPID	Address	Existing	Do Nothing	Do Minimum
Sector 1		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192191	32 Parkwood Ave	65	67	67
192305	33 Parkwood Ave	72	74	74
192359	34 Parkwood Ave	62	64	65
192306	35 Parkwood Ave	72	74	74
192360	36 Parkwood Ave	63	65	65
192307	37 Parkwood Ave	72	74	74
192361	38 Parkwood Ave	63	65	65
192308	39 Parkwood Ave	72	74	74
192362	40 Parkwood Ave	63	65	66
192309	41 Parkwood Ave	72	74	74
192363	42 Parkwood Ave	64	66	66
192304	43 Parkwood Ave	72	74	75
192364	44 Parkwood Ave	65	67	67
192365	46 Parkwood Ave	65	67	67
192366	48 Parkwood Ave	66	68	68
192192	50 Parkwood Ave	67	69	69
192310	52 Parkwood Ave	72	74	74
192311	54 Parkwood Ave	72	74	75
192312	56 Parkwood Ave	72	74	75
192313	58 Parkwood Ave	72	75	75
192314	60 Parkwood Ave	73	75	75
192315	62 Parkwood Ave	73	75	75
192316	64 Parkwood Ave	73	75	75
192317	66 Parkwood Ave	73	75	75
192173	68 Parkwood Ave	73	75	75
192398	1 Puihi Cres	65	67	67
192405	2 Puihi Cres	58	60	60
192396	3 Puihi Cres	65	67	67
192407	4 Puihi Cres	59	61	61
192397	5 Puihi Cres	66	68	68
192406	6 Puihi Cres	59	61	61
192373	7 Puihi Cres	66	68	68
192408	8 Puihi Cres	61	63	63
192399	9 Puihi Cres	67	69	69
192376	10 Puihi Cres	61	63	63
192402	11 Puihi Cres	68	70	70
192409	12 Puihi Cres	62	64	64
192401	13 Puihi Cres	68	70	70
192377	14 Puihi Cres	66	68	67
192374	15 Puihi Cres	69	71	71
192427	16 Puihi Cres	72	74	74
192400	17 Puihi Cres	69	71	71
192419	18 Puihi Cres	68	70	71
192404	19 Puihi Cres	69	71	71

SPID	Address	Existing	Do Nothing	Do Minimum
Sector 1		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192420	20 Puihi Cres	68	70	70
192375	21 Puihi Cres	70	72	72
192425	22 Puihi Cres	67	69	69
192403	23 Puihi Cres	75	76	77
192426	24 Puihi Cres	65	67	67
192441	25 Puihi Cres	75	76	77
192421	26 Puihi Cres	63	65	65
192439	27 Puihi Cres	70	72	72
192422	28 Puihi Cres	62	64	64
192438	29 Puihi Cres	69	71	71
192423	30 Puihi Cres	62	63	63
192437	31 Puihi Cres	68	69	70
192424	32 Puihi Cres	61	63	63
192436	33 Puihi Cres	66	68	68
192380	34 Puihi Cres	60	62	62
192435	35 Puihi Cres	64	66	66
192434	37 Puihi Cres	62	64	64
192381	39 Puihi Cres	60	62	62
192440	41 Puihi Cres	58	60	60
192433	43 Puihi Cres	58	60	60
192432	45 Puihi Cres	57	59	59
192431	47 Puihi Cres	57	59	59
192430	49 Puihi Cres	57	58	59
192429	51 Puihi Cres	57	58	59
192428	53 Puihi Cres	56	58	58
192442	55 Puihi Cres	56	58	58
192382	1 Tieke Ln	60	61	62
192444	3 Tieke Ln	60	62	62
192445	5 Tieke Ln	60	62	63
192446	7 Tieke Ln	60	62	63
192447	9 Tieke Ln	61	63	63
192443	11 Tieke Ln	61	63	63
192455	13 Tieke Ln	61	63	64
192449	15 Tieke Ln	62	64	64
192450	17 Tieke Ln	62	64	65
192451	19 Tieke Ln	62	64	65
192452	21 Tieke Ln	63	65	65
192456	23 Tieke Ln	64	65	66
192457	25 Tieke Ln	65	67	67
192453	27 Tieke Ln	66	68	68
192454	29 Tieke Ln	67	69	69
192448	31 Tieke Ln	69	70	71
192383	33 Tieke Ln	75	76	77
192152	1/28 Westgate Dr	62	64	64

SPID	Address	Existing	Do Nothing	Do Minimum
Sector 1		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192194	2/28 Westgate Dr	60	62	62
192195	3/28 Westgate Dr	58	60	61
192196	4/28 Westgate Dr	57	59	60
192197	5/28 Westgate Dr	56	58	59
192193	6/28 Westgate Dr	56	58	58
192176	7/28 Westgate Dr	63	65	65
192184	8/28 Westgate Dr	64	66	65
192180	9/28 Westgate Dr	64	66	66
192183	10/28 Westgate Dr	64	66	66
192179	11/28 Westgate Dr	65	67	66
192182	12/28 Westgate Dr	65	67	66
192178	13/28 Westgate Dr	65	68	66
192181	14/28 Westgate Dr	66	68	66
192177	15/28 Westgate Dr	66	68	66
192151	16/28 Westgate Dr	70	72	71
192198	17/28 Westgate Dr	70	73	72
192199	18/28 Westgate Dr	70	72	72
192200	19/28 Westgate Dr	70	72	73
192201	20/28 Westgate Dr	70	72	73
192202	21/28 Westgate Dr	70	72	73
192203	22/28 Westgate Dr	70	72	73
192204	23/28 Westgate Dr	70	72	73
192206	24/28 Westgate Dr	70	72	73
192153	25/28 Westgate Dr	70	72	73
192205	26/28 Westgate Dr	69	72	73
192208	27/28 Westgate Dr	56	58	58
192154	28/28 Westgate Dr	55	58	58
192210	29/28 Westgate Dr	56	58	58
192211	30/28 Westgate Dr	56	58	58
192209	31/28 Westgate Dr	56	58	57
192207	32/28 Westgate Dr	55	58	57
192215	33/28 Westgate Dr	55	58	57
192214	34/28 Westgate Dr	55	57	57
192213	35/28 Westgate Dr	55	57	57
192212	36/28 Westgate Dr	55	57	57
192155	37/28 Westgate Dr	55	57	57
192227	1/30A Westgate Dr	55	57	57
192233	1/30B Westgate Dr	55	57	58
192228	2/30A Westgate Dr	54	56	56
192158	2/30B Westgate Dr	55	57	58
192229	3/30A Westgate Dr	54	56	56
192237	3/30B Westgate Dr	55	58	58
192230	4/30A Westgate Dr	54	56	56
192236	4/30B Westgate Dr	55	58	59

SPID	Address	Existing	Do Nothing	Do Minimum
Sector 1		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192231	5/30A Westgate Dr	54	57	57
192235	5/30B Westgate Dr	56	58	59
192157	6/30A Westgate Dr	55	57	57
192234	6/30B Westgate Dr	57	59	59
192226	7/30A Westgate Dr	55	57	57
192232	7/30B Westgate Dr	57	59	59
192240	2/32A Westgate Dr	54	56	56
192225	2/32B Westgate Dr	71	73	74
192241	3/32A Westgate Dr	54	56	56
192224	3/32B Westgate Dr	71	73	74
192242	4/32A Westgate Dr	54	56	56
192223	4/32B Westgate Dr	71	73	74
192243	5/32A Westgate Dr	54	56	56
192222	5/32B Westgate Dr	71	73	74
192244	6/32A Westgate Dr	54	56	56
192221	6/32B Westgate Dr	71	73	74
192245	7/32A Westgate Dr	54	56	56
192220	7/32B Westgate Dr	71	73	74
192246	8/32A Westgate Dr	54	56	57
192219	8/32B Westgate Dr	71	73	74
192159	9/32A Westgate Dr	54	57	57
192218	9/32B Westgate Dr	71	73	74
192238	1/32A Westgate Dr	54	56	56
192156	1/32B Westgate Dr	70	73	73
192239	10/32A Westgate Dr	56	58	58
192217	10/32B Westgate Dr	71	73	74
192216	11/32B Westgate Dr	71	73	74
192247	1/36 Westgate Dr	55	58	58
192249	2/36 Westgate Dr	55	58	58
192250	3/36 Westgate Dr	56	58	58
192160	4/36 Westgate Dr	56	58	58
192248	5/36 Westgate Dr	56	58	58
192270	6/36 Westgate Dr	56	58	59
192271	7/36 Westgate Dr	56	58	58
192272	8/36 Westgate Dr	56	58	58
192274	9/36 Westgate Dr	55	58	57
192273	10/36 Westgate Dr	55	57	57
192164	11/36 Westgate Dr	55	57	57
192275	12/36 Westgate Dr	56	58	59
192278	13/36 Westgate Dr	56	58	58
192281	14/36 Westgate Dr	54	56	57
192279	15/36 Westgate Dr	54	56	57
192277	16/36 Westgate Dr	54	56	57
192280	17/36 Westgate Dr	58	60	61

SPID	Address	Existing	Do Nothing	Do Minimum
Sector 1		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192282	18/36 Westgate Dr	58	60	61
192165	19/36 Westgate Dr	57	59	61
192276	20/36 Westgate Dr	57	59	61
192163	21/36 Westgate Dr	72	74	74
192266	22/36 Westgate Dr	72	74	74
192265	23/36 Westgate Dr	72	74	74
192268	24/36 Westgate Dr	72	74	74
192269	25/36 Westgate Dr	72	74	74
192267	26/36 Westgate Dr	72	74	74
192162	27/36 Westgate Dr	72	74	74
192264	28/36 Westgate Dr	72	74	74
192263	29/36 Westgate Dr	72	74	75
192262	30/36 Westgate Dr	72	74	75
192260	31/36 Westgate Dr	72	74	75
192261	32/36 Westgate Dr	72	74	75
192259	33/36 Westgate Dr	72	74	75
192252	34/36 Westgate Dr	56	59	59
192255	35/36 Westgate Dr	55	57	57
192254	36/36 Westgate Dr	55	57	58
192253	37/36 Westgate Dr	55	57	57
192257	38/36 Westgate Dr	55	57	57
192256	39/36 Westgate Dr	54	57	57
192258	40/36 Westgate Dr	54	57	57
192161	41/36 Westgate Dr	54	57	57
192251	42/36 Westgate Dr	54	57	57
192289	38A Westgate Dr	57	60	60
192290	38B Westgate Dr	57	59	59
192167	38C Westgate Dr	56	59	59
192170	38D Westgate Dr	55	57	57
192318	40 Westgate Dr	56	58	58
192175	42A Westgate Dr	54	56	56
192319	42B Westgate Dr	57	59	59

B.2 Sector 2

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 2		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
130704	25 Bonny Cres	65	67	67	67
130882	1 Chloe Pl	64	65	65	65
130893	3 Ginders Dr	62	64	63	63
130892	5 Ginders Dr	62	64	64	63
130877	7 Ginders Dr	59	60	60	60
130968	9 Ginders Dr	59	60	60	60
130969	11 Ginders Dr	62	63	66	64
130973	13 Ginders Dr	60	62	66	64
130982	19 Ginders Dr	60	62	64	62
130983	21 Ginders Dr	60	62	64	62
130971	23 Ginders Dr	60	62	64	62
130981	25 Ginders Dr	57	59	59	59
130903	26 Ginders Dr	61	63	70	65
130984	27 Ginders Dr	58	60	61	60
130902	28 Ginders Dr	61	62	65	63
130970	29 Ginders Dr	60	62	65	62
130904	30 Ginders Dr	60	62	69	65
130986	31 Ginders Dr	60	62	65	62
130985	33 Ginders Dr	60	61	61	61
130987	35 Ginders Dr	62	64	64	64
130901	37 Ginders Dr	62	64	65	64
130900	39 Ginders Dr	63	65	70	66
130670	5A Helleur Rd	67	68	68	68
130876	1 Kasia Cl	58	60	58	58
130873	2 Kasia Cl	59	61	61	60
130878	3 Kasia Cl	59	61	60	59
130879	4 Kasia Cl	59	61	60	60
130891	5 Kasia Cl	61	63	62	62
130890	6 Kasia Cl	62	64	62	62
130889	8 Kasia Cl	63	64	63	63
130885	10 Kasia Cl	59	61	61	61
130886	12 Kasia Cl	62	63	64	64
130980	7 Makora Rd	56	58	58	58
130872	1/30 Makora Rd	63	65	64	64
130871	32 Makora Rd	63	65	65	65
130874	33 Makora Rd	57	59	58	58
130875	33A Makora Rd	58	60	59	59
130870	34 Makora Rd	63	65	65	65
130869	36 Makora Rd	64	66	66	66
130880	37 Makora Rd	61	62	62	62
130867	38 Makora Rd	65	66	66	66
192498	38 Makora Rd	60	62	62	62

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 2		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
130881	39 Makora Rd	61	63	62	63
130868	40 Makora Rd	65	66	66	66
130671	42 Makora Rd	66	67	67	67
130664	46 Makora Rd	67	69	68	68
130665	48 Makora Rd	68	69	69	69
130666	48B Makora Rd	68	70	69	69
130667	1/52 Makora Rd	69	71	70	70
192497	2/52 Makora Rd	65	67	64	64
130681	54 Makora Rd	71	74	72	72
192496	1/54 Makora Rd	64	66	64	64
130662	58 Makora Rd	71	73	71	71
130661	60 Makora Rd	70	73	71	71
130682	62 Makora Rd	70	72	70	70
130660	64 Makora Rd	71	73	71	71
130978	4 Marbella Dr	55	57	56	56
130979	5 Marbella Dr	56	58	59	58
130977	6 Marbella Dr	56	58	58	57
130976	7 Marbella Dr	59	60	63	61
130975	8 Marbella Dr	56	58	59	58
130972	10 Marbella Dr	59	61	64	62
130687	112 Royal Rd (School)	69	71	71	70
130688	113 Royal Rd (School)	69	71	70	70
130689	114 Royal Rd (School)	62	64	67	63
130691	115 Royal Rd (School)	65	67	70	67
130695	116 Royal Rd (School)	58	60	61	60

B.3 Sector 3

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 3		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
131085	2 Doone Pl	64	65	70	65
109298	3 Doone Pl	63	65	66	65
109295	5 Doone Pl	60	61	63	62
131089	6 Doone Pl	63	65	67	65
192506	1A Doone Pl	65	67	71	67
131091	1B Doone Pl	65	67	71	67
109289	2 Exotic Pl	68	70	73	70
109254	3 Exotic Pl	68	70	72	69
109297	1/3 Doone Pl	63	64	67	65
109290	4 Exotic Pl	58	59	63	59
109288	6 Exotic Pl	58	60	63	60
109335	86 Keegan Dr	61	62	65	64
109337	88 Keegan Dr	59	60	63	61
109339	90 Keegan Dr	58	59	61	60
109342	94 Keegan Dr	58	59	63	62
109806	105 Keegan Dr	57	58	61	59
131014	107 Keegan Dr	57	58	61	60
109355	109 Keegan Dr	60	62	67	65
192533	217 Triangle Rd	67	69	71	69
109257	223 Triangle Rd	66	68	71	68
109259	225 Triangle Rd	63	65	67	65
109258	227 Triangle Rd	62	64	67	64
109253	229 Triangle Rd	65	67	70	68
109255	231 Triangle Rd	65	66	70	67
109287	235 Triangle Rd	63	65	70	66
109296	237 Triangle Rd	64	66	70	66
131084	269 Triangle Rd	64	65	71	67
109328	271 Triangle Rd	62	63	66	64
109334	273 Triangle Rd	63	65	70	66
109340	275 Triangle Rd	63	64	70	66
109343	277 Triangle Rd	60	62	68	65
109344	279 Triangle Rd	60	61	67	65
131015	281 Triangle Rd	60	61	67	65
109789	295 Triangle Rd	60	61	67	65
109791	297 Triangle Rd	57	58	61	61
109792	297 Triangle Rd	61	62	68	66
109788	301 Triangle Rd	63	64	69	68
146816	304 Triangle Rd	63	65	70	66
146759	305 Triangle Rd	65	66	70	68
146760	307 Triangle Rd	66	67	70	68
146813	308 Triangle Rd	69	71	73	70
146762	311 Triangle Rd	66	68	71	69

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 3		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
146812	312 Triangle Rd	67	69	72	70
146763	313 Triangle Rd	66	68	70	68
146815	314 Triangle Rd	62	64	65	64
146814	316 Triangle Rd	59	60	61	60
146808	318 Triangle Rd	61	63	63	63
146810	320 Triangle Rd	67	69	69	68
146811	322 Triangle Rd	65	66	67	66
146829	324 Triangle Rd	67	70	72	70
146833	332 Triangle Rd	71	74	73	71
146809	334 Triangle Rd	66	68	67	67
146831	334 Triangle Rd	68	70	70	69
109784	10 Waimumu Rd	65	66	69	68
109783	12 Waimumu Rd	64	65	68	67
192511	14D Waimumu Rd	65	66	69	67
109774	23 Waimumu Rd	63	64	67	66

B.4 Sector 4

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 4		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
154032	1 Alwyn Ave	62	62	64	63
146373	3 Alwyn Ave	63	63	66	64
146483	5 Alwyn Ave	64	65	66	65
154031	5 Alwyn Ave	64	65	67	65
192577	1/7 Alwyn Ave	68	69	70	69
192578	2/7 Alwyn Ave	64	65	66	65
154030	3/7 Alwyn Ave	63	64	65	64
146370	9 Alwyn Ave	68	69	69	69
150732	11 Alwyn Ave	67	68	68	68
146482	11A Alwyn Ave	66	67	67	67
150731	13 Alwyn Ave	61	62	62	62
146479	15 Alwyn Ave	62	63	63	63
150727	17 Alwyn Ave	62	63	63	63
146478	19 Alwyn Ave	63	64	64	64
150725	21 Alwyn Ave	62	63	63	63
192579	23 Alwyn Ave	62	63	63	63
150724	23A Alwyn Ave	62	63	63	63
146532	25 Alwyn Ave	56	58	58	58
150722	38 Alwyn Ave	74	76	76	76
146475	40 Alwyn Ave	72	73	73	73
146476	40 Alwyn Ave	63	64	64	64
150723	42 Alwyn Ave	70	71	71	71
192675	44A Alwyn Ave	64	65	65	65
192676	44B Alwyn Ave	63	65	64	64
192677	44C Alwyn Ave	71	73	73	73
146477	44D Alwyn Ave	72	74	74	74
150752	46 Alwyn Ave	68	69	69	69
192674	46A Alwyn Ave	60	61	61	61
150751	48 Alwyn Ave	68	69	69	69
154037	2 Bridge Ave	63	64	65	64
146381	2A Bridge Ave	71	71	71	70
146487	4 Bridge Ave	62	63	65	63
154028	5 Bridge Ave	65	66	66	66
146480	9 Bridge Ave	59	60	60	60
135011	131 Flanshaw Rd	60	62	62	61
164118	133 Flanshaw Rd	58	60	60	60
135111	135 Flanshaw Rd	59	60	61	60
135012	137 Flanshaw Rd	61	62	62	62
135016	139A Flanshaw Rd	62	63	65	63
164120	139B Flanshaw Rd	64	66	67	64
164121	139B Flanshaw Rd	59	61	61	60
149343	2/6 Harding Ave	56	57	58	57

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 4		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192568	3/6 Harding Ave	58	59	59	59
135046	2 Marewa St	60	61	62	61
135047	1/4 Marewa St	60	61	63	61
135048	6 Marewa St	60	62	63	61
135089	8 Marewa St	59	60	61	60
135091	8A Marewa St	61	62	64	61
164109	10 Marewa St	60	61	62	61
135049	10A Marewa St	58	59	59	59
135009	10B Marewa St	61	63	63	62
134993	12 Marewa St	62	63	65	62
135092	12A Marewa St	61	63	64	62
135094	14 Marewa St	63	65	66	64
164110	16 Marewa St	66	68	69	67
134999	18 Marewa St	63	64	65	63
135108	20 Marewa St	62	63	65	63
192515	20 Marewa St	65	67	68	66
135112	22 Marewa St	64	65	66	64
146407	4 McCormick Rd	63	64	64	63
146406	4A McCormick Rd	61	62	62	62
142922	1 Milich Tce	57	58	59	58
143758	2A Milich Tce	61	62	63	62
192523	2B Milich Tce	61	63	63	62
192524	2C Milich Tce	61	63	64	62
192525	2D Milich Tce	61	63	64	62
192526	2E Milich Tce	63	64	65	64
192527	1/3 Milich Tce	64	65	65	65
192528	2/3 Milich Tce	64	65	65	65
192529	3/3 Milich Tce	64	65	65	65
146430	4/3 Milich Tce	64	65	65	65
192530	5/3 Milich Tce	64	65	65	65
192531	6/3 Milich Tce	64	65	65	65
192532	7/3 Milich Tce	64	65	65	65
142925	8/3 Milich Tce	63	64	64	63
146458	4 Milich Tce	61	63	65	62
146431	5 Milich Tce	62	63	63	63
146438	7 Milich Tce	62	63	65	63
146433	9 Milich Tce	65	66	65	65
134994	10 Paton Ave	63	65	66	64
134995	12 Paton Ave	62	64	65	63
164086	15 Paton Ave	61	63	63	63
164085	1/17 Paton Ave	62	63	64	63
143757	19 Paton Ave	61	62	63	62
143755	19A Paton Ave	62	63	64	63
143754	21 Paton Ave	61	63	64	62

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 4		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
135027	23 Paton Ave	61	62	64	62
143752	25A Paton Ave	67	69	71	68
143753	25B Paton Ave	65	67	68	66
135026	25C Paton Ave	64	66	67	65
155253	16 Royal View Rd	60	62	62	62
155252	18 Royal View Rd	60	61	61	61
143751	20 Royal View Rd	60	62	62	62
135022	1/20 Royal View Rd	61	62	63	62
135020	22 Royal View Rd	61	63	64	62
135023	22 Royal View Rd	60	61	62	61
135018	24 Royal View Rd	61	62	63	62
135019	24 Royal View Rd	62	63	64	62
192520	1/28 Royal View Rd	58	59	59	59
143734	2/28 Royal View Rd	61	62	63	61
143736	34 Royal View Rd	59	61	61	60
143726	36 Royal View Rd	59	60	61	60
143737	36 Royal View Rd	59	61	62	61
146444	38 Royal View Rd	58	59	60	59
192521	40A Royal View Rd	63	64	64	63
192522	40B Royal View Rd	63	64	64	63
142938	46 Royal View Rd	65	66	66	65
142927	48 Royal View Rd	61	62	62	62
142933	50 Royal View Rd	63	64	63	63
142934	52 Royal View Rd	62	63	62	62
142943	52A Royal View Rd	62	63	64	63
146408	54 Royal View Rd	60	61	61	60
112524	1/56 Royal View Rd	61	62	61	62
192535	2/56 Royal View Rd	60	61	61	61
112520	58 Royal View Rd	62	63	63	63
146399	60 Royal View Rd	64	65	65	64
192545	1/61 Royal View Rd	61	62	62	61
146398	62 Royal View Rd	62	64	64	64
146422	63 Royal View Rd	60	61	61	61
112525	65 Royal View Rd	60	62	61	61
112517	66A Royal View Rd	63	64	64	64
192537	66B Royal View Rd	63	64	64	64
192538	66C Royal View Rd	65	66	66	66
192539	66D Royal View Rd	64	65	65	65
192540	66E Royal View Rd	65	67	65	66
192708	1/67 Royal View Rd	62	63	63	62
112526	6/67 Royal View Rd	60	61	61	61
192550	7/67 Royal View Rd	60	61	61	61
192551	8/67 Royal View Rd	62	63	63	63
192552	9/67 Royal View Rd	62	63	63	63

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 4		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192553	10/67 Royal View Rd	62	63	63	62
112516	68 Royal View Rd	63	64	64	64
192554	1/69 Royal View Rd	60	61	61	61
192555	2/69 Royal View Rd	57	58	58	58
146509	3/69 Royal View Rd	57	59	59	59
192556	1/71 Royal View Rd	60	61	62	61
112527	2/71 Royal View Rd	58	59	59	59
112528	73 Royal View Rd	60	62	63	61
112529	73 Royal View Rd	58	59	60	59
192563	1/77 Royal View Rd	61	62	64	61
192564	2/77 Royal View Rd	59	60	63	60
112501	3/77 Royal View Rd	59	60	62	60
192566	1/79 Royal View Rd	60	61	64	61
146493	2/79 Royal View Rd	59	60	61	60
112500	81 Royal View Rd	60	61	65	61
112499	81A Royal View Rd	58	59	61	59
146494	83 Royal View Rd	60	61	64	60
192570	83A Royal View Rd	58	59	59	59
192571	1/85 Royal View Rd	63	64	67	63
192572	2/85 Royal View Rd	62	63	66	63
192573	3/85 Royal View Rd	60	61	62	61
192574	4/85 Royal View Rd	60	61	62	61
192575	5/85 Royal View Rd	60	61	62	61
192576	6/85 Royal View Rd	61	61	62	61
149341	7/85 Royal View Rd	61	61	62	61
149340	87 Royal View Rd	61	62	65	62
154038	311 Te Atatu Rd	71	71	71	71
146488	313 Te Atatu Rd	74	74	74	74
149347	340 Te Atatu Rd	59	60	61	60
112502	1/45 Vera Rd	60	61	61	61
192673	2/45 Vera Rd	60	61	61	61
192672	3/45 Vera Rd	59	60	60	60
192671	4/45 Vera Rd	59	60	60	59
192670	5/45 Vera Rd	58	59	59	59
192669	6/45 Vera Rd	58	59	59	59
192668	7/45 Vera Rd	58	59	59	59
146502	8/45 Vera Rd	58	59	59	59
192667	9/45 Vera Rd	58	59	59	59
146389	47 Vera Rd	57	58	58	58
146384	49 Vera Rd	61	62	63	61
192559	49A Vera Rd	60	61	63	61
192560	49B Vera Rd	60	61	62	61
192561	49C Vera Rd	60	61	62	61
192558	49D Vera Rd	60	61	62	61

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 4		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
146413	58 Vera Rd	57	58	58	58
112531	60 Vera Rd	59	60	60	60
112532	60A Vera Rd	58	59	59	59
146411	1/62 Vera Rd	61	62	63	62
192557	2/62 Vera Rd	60	61	62	61

B.5 Sector 5

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 5		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
192049	1010 Great North Rd	60	61	64	62
192050	1010A Great North Rd	62	63	65	63
192000	1012 Great North Rd	61	62	63	62
191998	1012A Great North Rd	64	65	68	65
192011	1014 Great North Rd	62	63	66	63
191999	1014A Great North Rd	64	65	67	65
192014	1016 Great North Rd	63	64	68	64
126213	1018 Great North Rd	63	64	68	64
126206	1020 Great North Rd	62	63	68	64
126205	1022 Great North Rd	60	61	63	62
126215	1024 Great North Rd	64	65	69	65
126194	1028 Great North Rd	65	66	69	66
126195	1028 Great North Rd	68	69	73	70
126190	1032 Great North Rd	59	60	65	63
126189	1040 Great North Rd	62	63	69	66
126187	1042 Great North Rd	65	65	74	70
126186	1046 Great North Rd	65	66	72	68
126180	1048 Great North Rd	62	63	65	64
126183	1052 Great North Rd	64	64	68	65
126184	1054A Great North Rd	64	65	70	67
126240	1056 Great North Rd	64	64	68	66
126241	1058 Great North Rd	64	64	68	66
126239	1060 Great North Rd	63	64	68	66
126238	1062 Great North Rd	63	64	67	65
126236	1064 Great North Rd	63	64	67	65
126237	1066 Great North Rd	63	64	67	66
126218	1072 Great North Rd	64	65	68	66
192635	1086 Great North Rd	66	67	69	68
126261	1088 Great North Rd	65	66	68	67
192638	1090A Great North Rd	64	65	68	66
192639	1090B Great North Rd	66	67	69	68
192640	1090C Great North Rd	66	66	69	67
192637	1092A Great North Rd	62	62	64	63
192642	1092B Great North Rd	64	65	67	65
192641	1092C Great North Rd	65	66	68	66
192634	1100 Great North Rd	64	65	67	66
126268	1102 Great North Rd	65	66	69	67
126360	1102H Great North Rd	65	66	73	66
192636	1102I Great North Rd	65	66	73	67
126216	1102J Great North Rd	68	69	74	71
119519	1255 Great North Rd	66	67	68	68
115250	2 Montrose St	58	59	59	59

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 5		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
115252	2 Montrose St	62	63	63	63
115253	2 Montrose St	62	63	63	63
115255	2 Montrose St	62	63	63	63
119516	2 Montrose St	63	64	64	63
119517	2 Montrose St	62	63	63	62
119518	2 Montrose St	59	60	60	60
115261	26 Montrose St	60	61	61	61
115264	28 Montrose St	63	64	64	64
115266	30 Montrose St	64	65	65	65
115267	32 Montrose St	63	65	65	65
115272	34 Montrose St	63	64	64	64
115273	36 Montrose St	63	64	64	64
115288	37 Montrose St	65	66	66	66
115283	38 Montrose St	61	62	62	62
115285	39 Montrose St	65	66	66	66
115282	40 Montrose St	64	65	65	65
115297	41 Montrose St	66	67	67	67
115287	42 Montrose St	66	67	67	67
115281	42A Montrose St	65	66	66	66
115299	43 Montrose St	67	68	68	68
115286	44 Montrose St	66	68	68	68
115284	46 Montrose St	68	69	69	69
119520	22-24 Pt Chevalier Rd	72	74	74	74
119576	6 Sutherland Rd	61	62	63	59
119577	6A Sutherland Rd	63	64	73	67
119574	8 Sutherland Rd	60	61	63	62
119575	8A Sutherland Rd	62	63	70	67
119572	10 Sutherland Rd	59	60	60	59
119573	10A Sutherland Rd	62	63	64	64
119544	12 Sutherland Rd	60	61	61	60
119545	12A Sutherland Rd	63	64	64	64
119549	14 Sutherland Rd	63	64	62	62
119546	14A Sutherland Rd	64	65	65	65
119548	1/14 Sutherland Rd	62	62	61	61

B.6 Sector 6

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 6		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
171914	35 Alexander St	70	71	71	71
171916	37 Alexander St	72	73	73	73
171258	30 Bond St	60	61	61	61
171261	32 Bond St	62	63	63	63
171243	33 Bond St	58	59	59	59
171260	34 Bond St	64	65	65	65
171239	35 Bond St	60	60	60	60
171262	36 Bond St	66	66	66	66
171240	37 Bond St	62	62	62	62
171263	38 Bond St	66	66	67	67
171242	39 Bond St	65	66	64	64
171264	40 Bond St	72	72	71	71
171241	41 Bond St	70	71	68	68
171836	48 Bright St	70	71	71	71
171917	50 Bright St	71	72	72	72
171840	61 Bright St	69	69	69	69
171839	63 Bright St	69	70	70	70
171828	17 Brisbane St	63	64	63	63
171934	21 Brisbane St	74	74	69	69
171932	22 Brisbane St	67	68	64	64
171275	29 Commercial Rd	65	66	64	65
171276	31 Commercial Rd	67	67	66	66
168418	32 Commercial Rd	69	70	64	64
171277	33 Commercial Rd	70	70	68	68
168417	34 Commercial Rd	71	72	66	66
171278	35 Commercial Rd	71	71	68	68
171279	37 Commercial Rd	72	72	69	69
168401	39 Commercial Rd	74	75	68	69
168405	33 Cooper St	70	71	66	66
168407	37 Cooper St	69	69	62	62
171251	38 Cooper St	64	65	63	63
192704	39 Cooper St	67	68	62	62
171253	40 Cooper St	61	62	60	60
168402	41 Cooper St	69	70	63	63
171252	42 Cooper St	65	66	64	64
168403	43 Cooper St	75	75	66	66
171255	44 Cooper St	62	63	61	61
171254	46 Cooper St	65	65	63	63
171256	48 Cooper St	68	69	66	66
171257	50 Cooper St	71	72	66	66
157921	1 Copeland St	67	68	66	66
157935	3 Copeland St	68	68	66	66

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 6		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
157937	5 Copeland St	68	69	67	67
170181	9 Copeland St	69	70	68	68
170171	11 Copeland St	68	68	66	66
170170	13 Copeland St	68	68	66	66
170169	15 Copeland St	65	65	64	64
168518	398 Great North Rd	67	67	65	65
168602	400-402 Great North Rd	71	72	72	72
168595	13/430 Great North Rd	58	58	58	58
192703	14/430 Great North Rd	58	59	58	58
168597	15/430 Great North Rd	58	59	59	59
192702	16/430 Great North Rd	54	55	55	55
192701	17/432 Great North Rd	54	55	55	55
168599	444 Great North Rd	73	74	74	74
183998	456 Great North Rd	72	72	72	72
182427	736 Great North Rd	68	69	65	65
182426	744 Great North Rd	70	70	67	68
170148	57 Haslett St	63	64	63	63
170147	59 Haslett St	66	67	67	67
170144	61 Haslett St	69	70	69	70
170137	63 Haslett St	69	70	70	70
170138	64 Haslett St	68	69	69	69
170133	65 Haslett St	76	77	76	76
170139	66 Haslett St	68	69	69	69
170135	68 Haslett St	68	69	69	69
170134	70 Haslett St	70	71	70	71
171830	72 Haslett St	72	72	72	72
171829	74A Haslett St	75	76	75	76
171835	74B Haslett St	76	77	77	77
171751	1 Home St	62	62	63	64
171756	2 Home St	66	67	67	68
171757	2A Home St	65	66	66	68
171759	2B Home St	66	67	66	69
171752	3 Home St	63	64	64	64
171755	4 Home St	66	66	67	67
171741	5 Home St	62	63	63	63
171754	6 Home St	65	66	66	66
171742	7 Home St	62	63	63	63
171827	8 Home St	65	66	65	65
171931	8 Home St	61	62	60	60
171740	9 Home St	63	63	63	63
171739	9A Home St	63	63	63	63
171935	10 Home St	66	67	64	64
171937	10 Home St	63	64	60	60
171936	12 Home St	73	73	72	72

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 6		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
171938	12 Home St	62	63	60	60
171080	14 Home St	60	61	60	60
171079	16 Home St	62	63	63	63
171078	18 Home St	64	65	64	64
171074	20 Home St	60	61	60	60
171088	24 Home St	61	62	62	62
171100	26 Home St	59	60	60	60
171098	28 Home St	62	63	63	63
171105	30 Home St	64	65	65	65
171106	32 Home St	62	63	63	63
171114	34 Home St	60	61	61	61
171115	36 Home St	59	60	60	60
171153	38 Home St	59	60	60	60
171152	40 Home St	59	59	59	59
171182	50D Home St	60	61	60	60
171181	50E Home St	60	60	59	59
171175	50F Home St	60	60	60	60
182384	10 Ivanhoe Rd	66	67	62	62
192654	12 Ivanhoe Rd	66	66	62	63
182392	14 Ivanhoe Rd	66	67	63	63
192653	16 Ivanhoe Rd	66	67	63	63
182390	18 Ivanhoe Rd	66	66	62	62
192652	20 Ivanhoe Rd	66	66	62	62
185503	42 Ivanhoe Rd	64	65	64	64
185504	44 Ivanhoe Rd	65	66	64	64
185440	46 Ivanhoe Rd	62	63	63	63
185507	48 Ivanhoe Rd	65	65	64	64
185514	50 Ivanhoe Rd	64	65	65	65
185516	52 Ivanhoe Rd	65	66	65	65
185401	54 Ivanhoe Rd	65	66	65	65
185400	56 Ivanhoe Rd	65	66	65	65
185399	58 Ivanhoe Rd	65	65	65	65
185395	60 Ivanhoe Rd	65	65	65	65
185391	64 Ivanhoe Rd	64	65	66	65
185383	66 Ivanhoe Rd	64	65	65	64
185381	68 Ivanhoe Rd	63	63	66	64
185325	74 Ivanhoe Rd	64	64	67	65
185326	76 Ivanhoe Rd	64	65	67	65
185327	76 Ivanhoe Rd	59	59	60	59
185332	78 Ivanhoe Rd	65	65	68	65
184129	80 Ivanhoe Rd	62	62	65	63
184130	82 Ivanhoe Rd	62	63	65	63
184145	84 Ivanhoe Rd	64	65	68	65
184138	86 Ivanhoe Rd	64	65	68	65

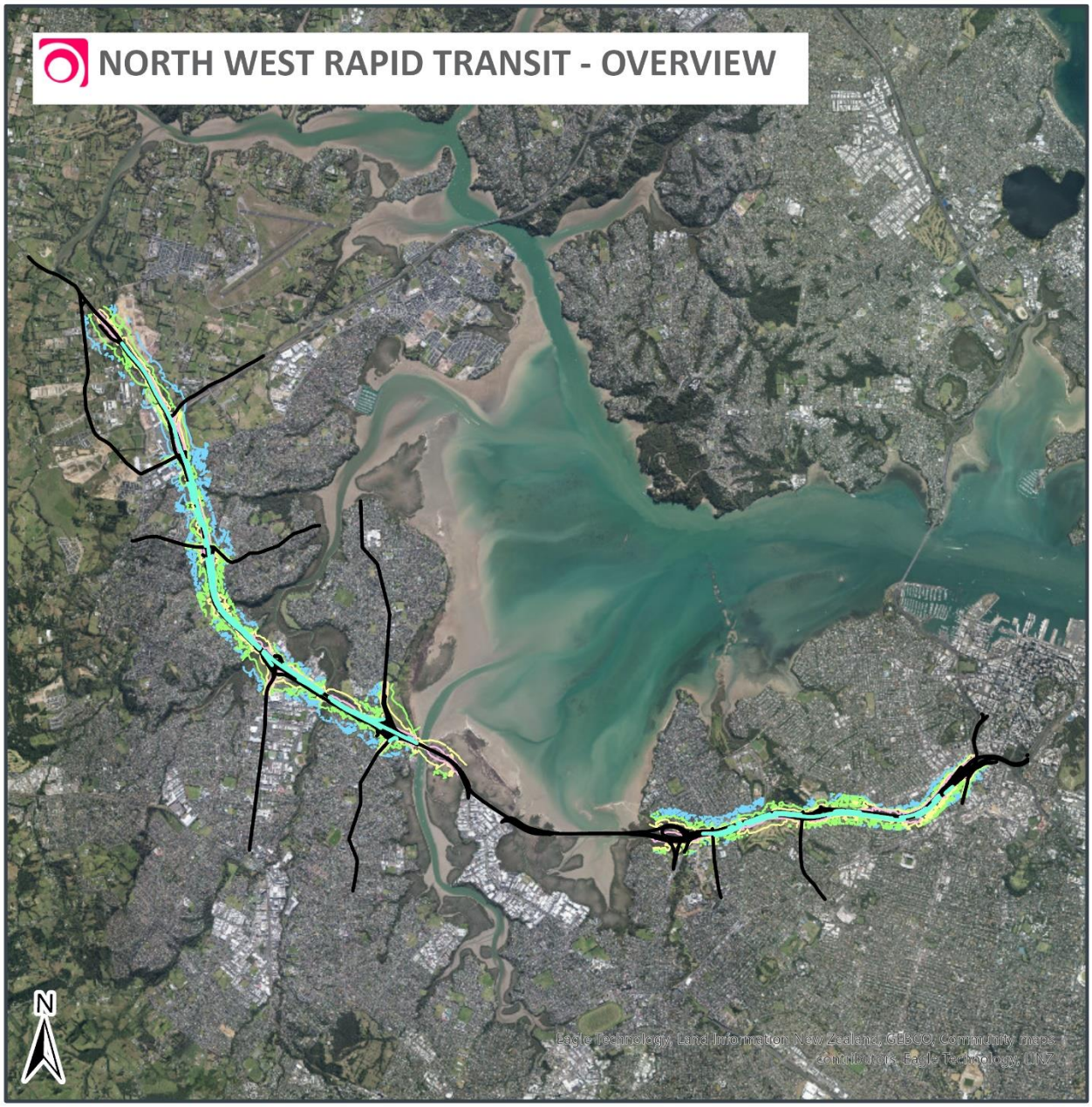
SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 6		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
184153	86 Ivanhoe Rd	62	63	64	63
184137	88 Ivanhoe Rd	65	65	68	65
184155	88 Ivanhoe Rd	60	61	62	60
184134	90 Ivanhoe Rd	64	65	67	64
171824	3 Keppell St	75	76	71	71
171825	5 Keppell St	73	73	65	65
171826	7 Keppell St	75	75	70	70
171929	9 Keppell St	76	77	70	70
171930	11 Keppell St	76	76	70	70
171933	15 Keppell St	75	76	73	73
171940	17 Keppell St	74	75	72	72
171075	21 Keppell St	74	74	73	73
171071	23 Keppell St	75	76	75	75
171072	25 Keppell St	75	75	75	75
171070	27 Keppell St	74	75	74	74
171069	29 Keppell St	73	74	74	74
171068	31 Keppell St	74	75	75	75
171067	33 Keppell St	74	75	74	74
171103	35 Keppell St	73	74	74	74
171102	37 Keppell St	72	73	73	73
171104	39 Keppell St	72	72	73	73
192706	41 Keppell St	71	72	72	72
171109	42A Keppell St	73	74	74	74
171108	42B Keppell St	76	76	76	76
171110	43 Keppell St	71	71	72	72
171111	45 Keppell St	69	70	70	70
171112	47 Keppell St	68	69	69	69
171139	20 King St	58	59	59	59
171149	22 King St	59	60	60	60
171148	24 King St	60	60	61	61
171144	25 King St	57	58	58	58
171185	25A King St	58	59	58	58
171147	26 King St	64	64	64	64
171186	27 King St	62	63	62	62
171155	28 King St	69	70	70	70
171145	29 King St	65	66	65	65
171156	30 King St	69	70	70	70
171146	31 King St	69	70	70	70
171158	32 King St	73	73	74	74
171163	33 King St	68	69	70	69
171159	34 King St	72	73	76	76
171162	35 King St	69	69	71	71
171161	37 King St	73	73	75	75
171761	8 Kirk St	60	61	60	60

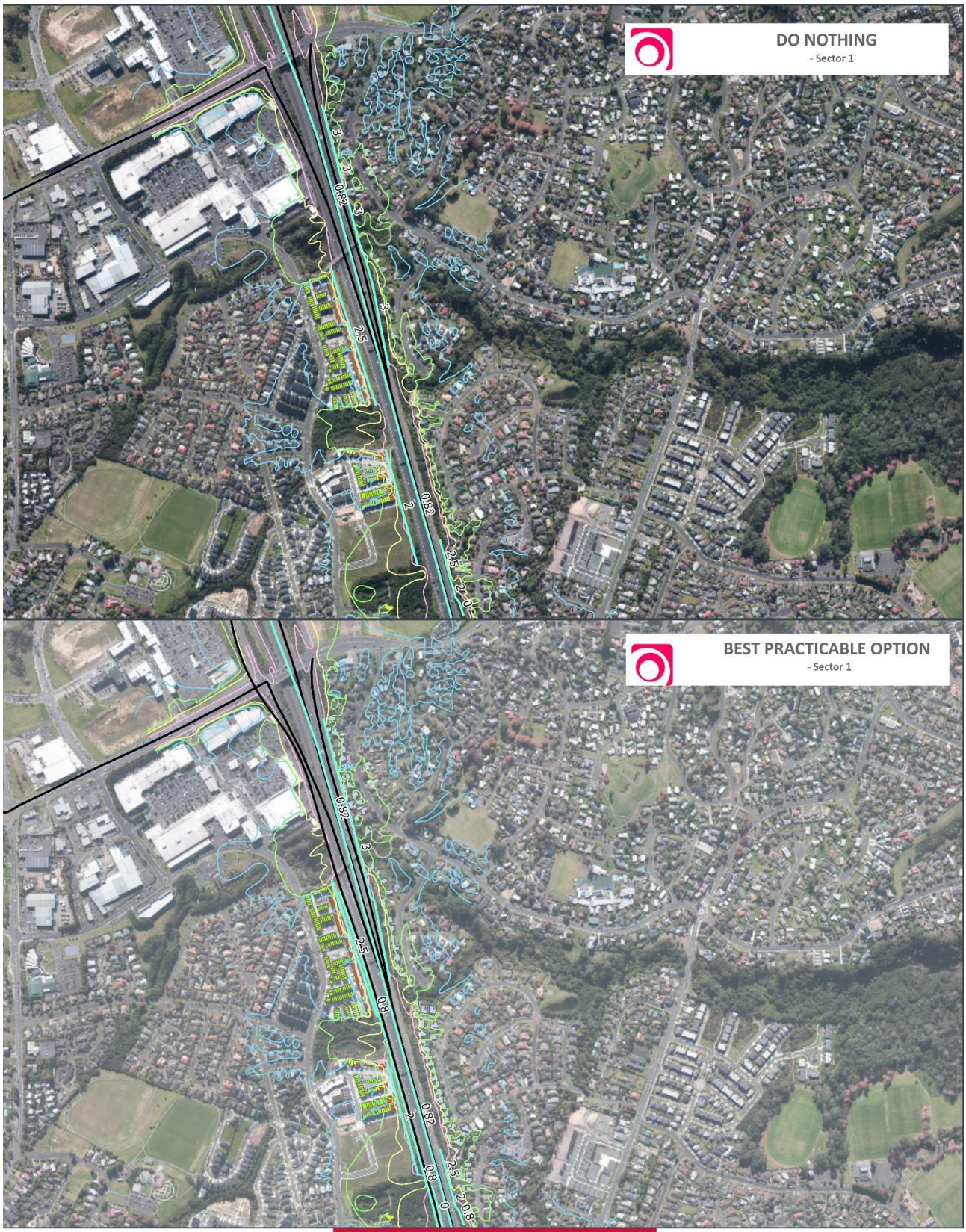
SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 6		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
171785	21 Kirk St	74	75	72	72
171822	17 Monmouth St (School)	72	72	72	72
171823	17 Monmouth St (School)	74	75	75	75
171170	2 Niger St	70	71	69	69
171171	4 Niger St	71	72	69	68
171174	3/4 Niger St	64	64	64	64
171267	4/4 Niger St	63	64	63	63
171266	5/4 Niger St	60	60	59	59
171173	6/4 Niger St	62	63	61	61
171172	7/4 Niger St	64	64	63	63
171168	8/4 Niger St	61	62	61	61
171167	9/4 Niger St	59	60	60	60
171166	10/4 Niger St	67	68	66	66
171169	8 Niger St	71	72	70	69
171165	10 Niger St	73	73	72	72
171164	12 Niger St	73	73	73	73
171783	2 Partridge St	65	66	66	69
171782	4 Partridge St	65	66	68	68
171788	5 Partridge St	74	74	74	74
171778	6 Partridge St	67	68	68	68
171796	7 Partridge St	74	75	75	75
171777	8 Partridge St	64	64	64	64
171795	9 Partridge St	74	75	74	74
157878	6 Piwakawaka St	67	68	67	68
171087	11 Potatau St	61	62	62	62
171086	13 Potatau St	61	61	61	61
171073	15 Potatau St	62	62	62	62
171077	26 Potatau St	63	63	63	63
171076	28 Potatau St	66	66	66	66
171939	30 Potatau St	75	76	75	75
168404	2 Seddon St	64	64	62	62
168415	4 Seddon St	65	66	63	63
168416	6 Seddon St	66	66	63	63
168400	8 Seddon St	62	62	61	61
185371	3 Shirley Rd	63	64	64	64
185409	4 Shirley Rd	62	63	64	63
192665	3/6 Shirley Rd	61	61	62	61
192660	3/8 Shirley Rd	60	61	61	61
185402	4/8 Shirley Rd	62	63	63	63
157903	9 Suffolk St	62	63	61	61
157905	11 Suffolk St	62	63	62	62
157906	13 Suffolk St	61	62	61	62
157891	14 Suffolk St	61	62	60	60
157907	15 Suffolk St	63	64	64	64

SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 6		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
157914	17 Suffolk St	62	63	63	63
157893	20 Suffolk St	65	66	64	64
157892	22 Suffolk St	65	66	65	65
157897	24 Suffolk St	65	65	64	64
157936	2 Takau St	69	70	69	69
157938	4 Takau St	68	69	68	68
157939	6 Takau St	69	70	68	68
157941	8 Takau St	68	69	68	68
157942	10 Takau St	68	69	68	68
157943	12 Takau St	68	69	68	68
157945	14 Takau St	70	71	70	70
157946	16 Takau St	73	74	73	73
170136	18 Takau St	74	75	75	75
157947	20 Takau St	75	75	75	75
184125	1 Tay St	65	66	67	65
184123	1A Tay St	66	66	68	65
184126	1B Tay St	66	66	68	65
184127	1C Tay St	67	68	69	66
184124	3 Tay St	62	63	66	64
182398	78 Tuarangi Rd	63	64	62	62
192651	80 Tuarangi Rd	63	64	62	62
192650	82 Tuarangi Rd	63	64	62	62
182397	84 Tuarangi Rd	64	64	62	62
182419	86 Tuarangi Rd	64	64	62	62
182420	88 Tuarangi Rd	67	68	64	64
157918	58 Virginia Ave West	62	63	62	62
157919	60 Virginia Ave West	64	65	63	63
157920	62 Virginia Ave West	64	65	63	63
157922	64 Virginia Ave West	63	64	62	62
157909	65 Virginia Ave West	65	66	64	65
157923	66 Virginia Ave West	64	65	63	63
157912	67 Virginia Ave West	62	63	63	63
157913	67 Virginia Ave West	59	60	60	60
157917	67 Virginia Ave West	63	64	62	62
157934	68 Virginia Ave West	67	68	67	67
157915	69 Virginia Ave West	63	64	62	62
157916	71 Virginia Ave West	65	66	65	65
171791	10 Waima St	60	61	61	61
171779	11 Waima St	64	65	65	65
171792	12 Waima St	61	62	62	62
171793	14 Waima St	70	71	71	71
171794	14 Waima St	68	69	69	69
171790	15 Waima St	69	69	69	69
185478	1 Wexford Rd	62	63	61	61

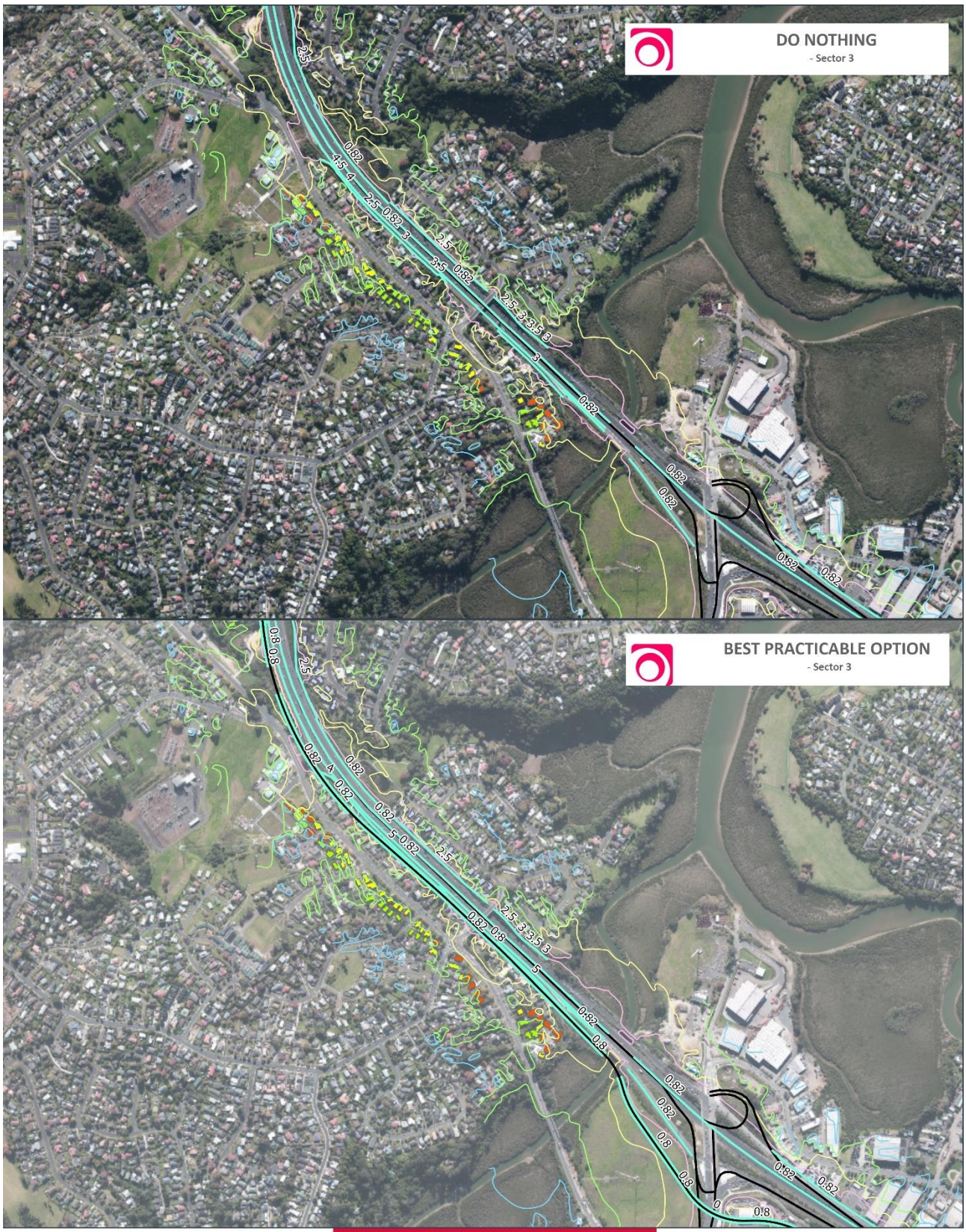
SP ID	Address	Existing	Do Nothing	Do Minimum	Mitigation option
Sector 6		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
185449	2 Wexford Rd	62	63	62	62
185480	3 Wexford Rd	63	63	62	62
185487	4 Wexford Rd	62	63	63	62
185492	5 Wexford Rd	63	64	63	63
185489	8 Wexford Rd	66	66	64	64
185493	9 Wexford Rd	66	67	64	64

Appendix C. Noise level contour plans




DO NOTHING
- Sector 1
BEST PRACTICABLE OPTION
- Sector 1
N
0 45 90 180 270 360 450 540 630 Meters
NORTH WEST RAPID TRANSIT- NZS6806 CATEGORIES
Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.


DO NOTHING
- Sector 2
BEST PRACTICABLE OPTION
- Sector 2
N
0 45 90 180 270 360 450 540 630 Meters
NORTH WEST RAPID TRANSIT- NZS6806 CATEGORIES
Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.


DO NOTHING
- Sector 3
BEST PRACTICABLE OPTION
- Sector 3
N
0 45 90 180 270 360 450 540 630 Meters
NORTH WEST RAPID TRANSIT- NZS6806 CATEGORIES
Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.

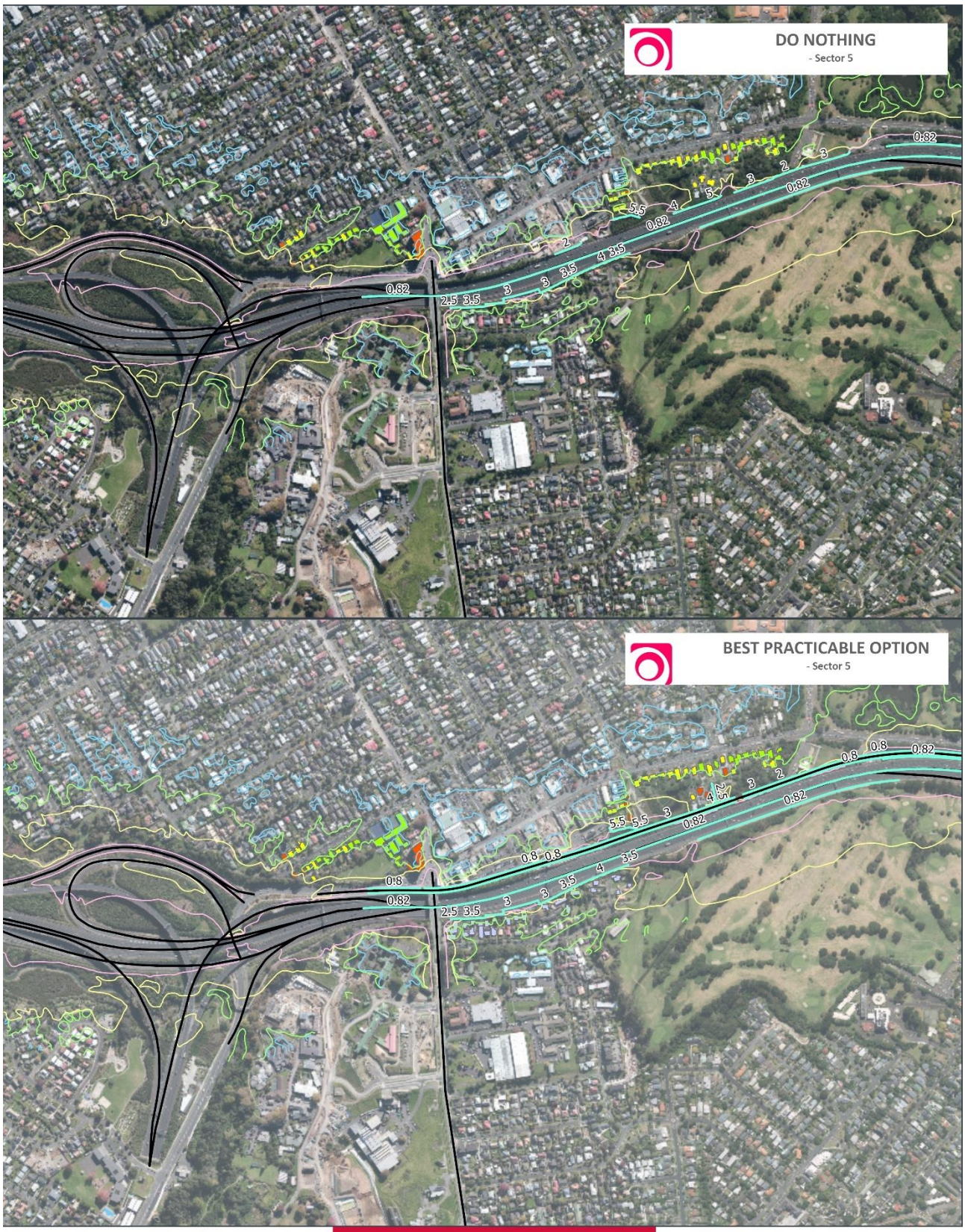
N

0 45 90 180 270 360 450 540 630 Meters

NORTH WEST RAPID TRANSIT- NZS6806 CATEGORIES

Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.

Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot accept liability for errors or omissions in the data graphically represented.
The noise contours produced by SoundPLAN are for graphical purposes only. The noise contours are generated by interpolations of calculated grid points typically by 5 dB, with varying interpolation accuracy. Therefore, the calculated noise level at a given point may differ from that implied by the noise contours when its noise interpolates between two noise contour lines. It is not recommended that high resolution noise level predictions are based on noise contour interpolation.

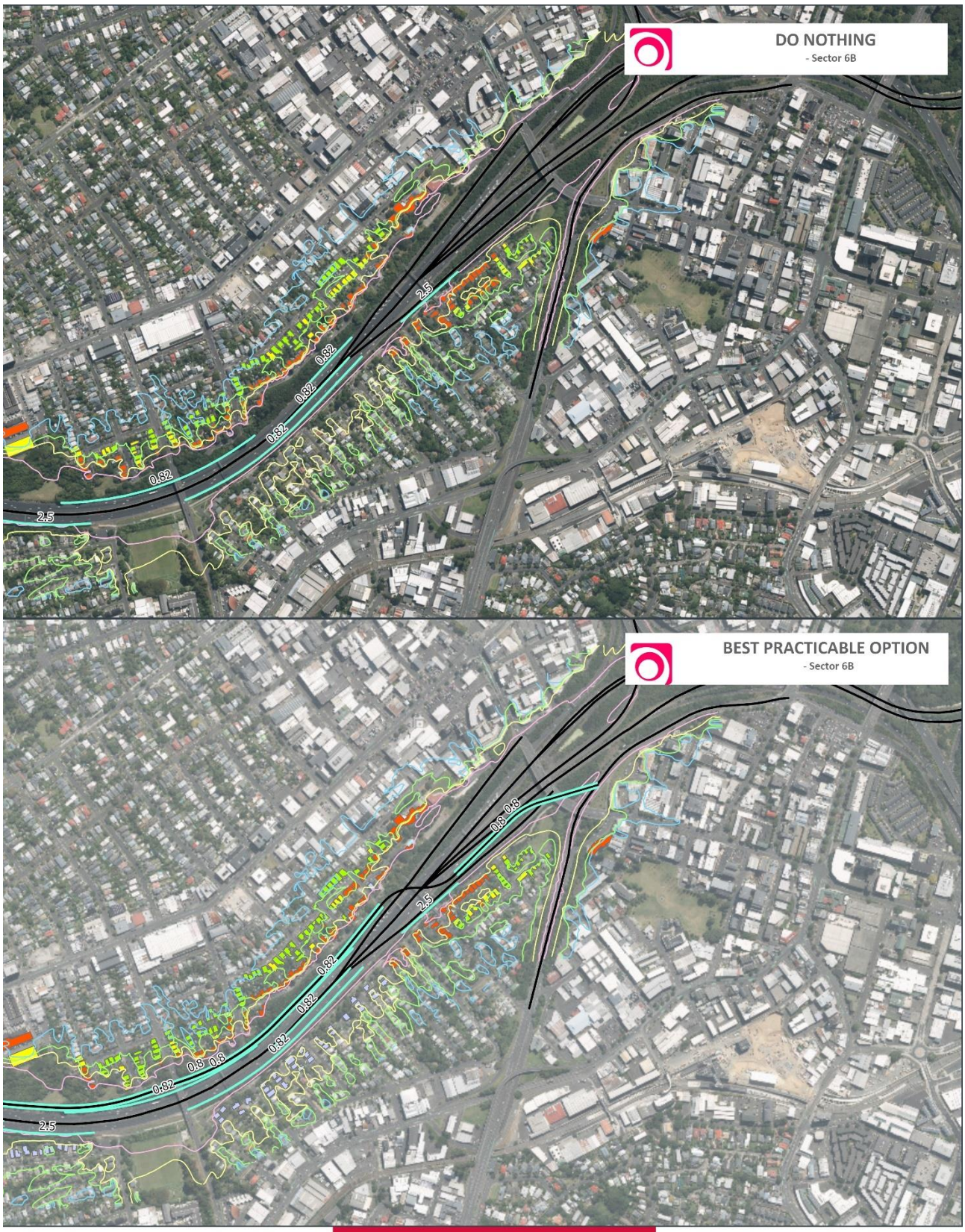

DO NOTHING
- Sector 5
BEST PRACTICABLE OPTION
- Sector 5
N
0 40 80 160 240 320 400 480 560 Meters
NORTH WEST RAPID TRANSIT- NZS6806 CATEGORIES
Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.

N

0 40 80 160 240 320 400 480 560 Meters

NORTH WEST RAPID TRANSIT- NZS6806 CATEGORIES

Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.


DO NOTHING
- Sector 6B
2.5
0.82
0.82
0.82
0.82
2.5
BEST PRACTICABLE OPTION
- Sector 6B
0.8
0.8
2.5
0.82
0.82
0.82
0.8
0.8
0.82
2.5
N
0 40 80 160 240 320 400 480 560
Meters
NORTH WEST RAPID TRANSIT- NZS6806 CATEGORIES
Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.