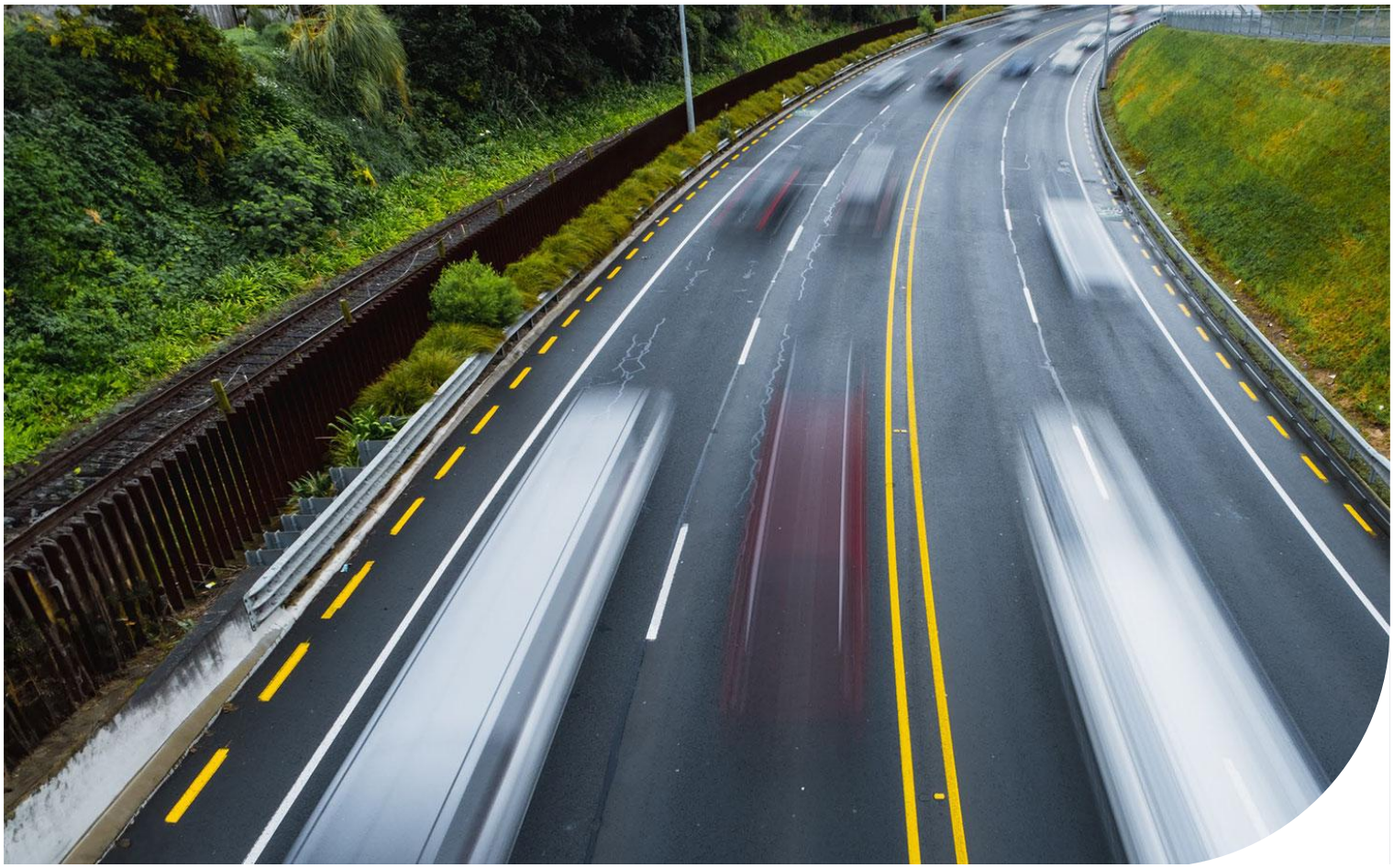

Assessment of Operational Noise Effects

Alternative to the Brynderwyn Hills - Brynderwyn Hills section

2 April 2026

Revision A

10722-PTA-2B0-PE-RPT-0015

NZ TRANSPORT AGENCY WAKA KOTAHI

Roads of National Significance

Te Kāwanatanga o Aotearoa
New Zealand Government

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Glossary of Acronyms and Abbreviations

The glossary of acronyms and abbreviations table in Volumes A and B of the Substantive Application applies to this report and should be referred to in addition to the acronyms and abbreviations below.

Acronym / Abbreviation	Term
CoRTN	Calculation of Road Traffic Noise
LN3	Epoxy-modified porous asphalt with a maximum chip size of 7mm. This surface will be laid 40mm deep. It is also sometimes called EPA7 40mm.
NZS 6806	New Zealand Standard 6806:2010 Acoustics – Road-traffic noise – New and altered roads
SMA	Stone Mastic Asphalt
WHO	World Health Organisation

Glossary of Defined Terms

The glossary of defined terms table in Volumes A and B of the Substantive Application applies to this report and should be referred to in addition to the defined terms below.

Term	Meaning
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
$L_{Aeq(24h)}$	The A-weighted noise level energy average noise level over a 24-hour period (midnight to midnight). This descriptor is used to assess traffic noise.
$L_{A10(18h)}$	The A-weighted noise level equalled or exceeded for 10% of the measurement period (i.e. 18 hours). This is commonly referred to as the average maximum noise level. This descriptor is used in CoRTN (refer to the Glossary of Acronyms and Abbreviations above).
$L_{A90(t)}$	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
Noise	A sound that is unwanted by, or distracting to, the receiver.
(t)	The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.

1. Introduction

1.1. Purpose and scope of this report

This report provides an assessment of the actual and potential operational noise effects associated with the Brynderwyn Hills section of the Alternative to the Brynderwyn Hills project (the Project).

This assessment forms part of a suite of technical assessments prepared for NZTA to inform the Substantive Application under the Fast-track Approvals Act 2024 (FTAA) for the Project. This report should be read in conjunction with Volume A of the Substantive Application.

The scope of this assessment includes the following:

- The **methodology** applied to preparing the assessment.
- A description of the **existing environment**.
- **Assessment** of the actual and potential **traffic noise effects** generated by the Project.
- **Conclusion** on the significance of effects.
- **Recommended mitigation and conditions** to manage and mitigate adverse effects.

1.2. Qualifications and Experience

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 was the expert witness on many Roads of National Significance, including State Highway 1 (SH1) East West Link, SH1 Northern Corridor Improvements, State Highway 16 Waterview Connections, SH1 MacKays to Peka Peka (Kāpiti Expressway) and SH1 Puhoi to Warkworth, all of which were designated through Boards of Inquiry. For each of these projects, my role involved 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.
- The SH1 Southern Corridor Improvements (Manukau to Papakura and Papakura to Drury), which involves considerable challenges due to high population density close to the road. The widening of the Southern Motorway, the busiest state highway in New Zealand, will affect a large number of people, both during construction and following completion. I am the lead acoustical consultant on these projects and am responsible for all works relating to noise and vibration effects, which includes 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. Various stages of the Project were consented through a mixture of conventional Council hearings and the Covid Fast Track process. I appeared as expert witness at the hearings and prepared the assessments for the Fast Track process.
- 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 noise and vibration effects on a number of the projects (Takaanini Level Crossings, North

(Strategic), North West (Strategic), Pukekohe, and Airport to Botany Rapid Transit), which involved everything from contributing to route selection to assessment and expert witness appearance at several of the combined Council hearings.

In addition to the above key projects, I have undertaken a large number of 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 and five Boards of Inquiry. I have also taken part in Environment Court mediation.

1.3. Code of Conduct

Although this Project is not being considered 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. I am satisfied that the matters which I address in this Operational Noise Assessment 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.

2. Assessment Methodology

This assessment addresses the actual and potential effects arising from the operational traffic noise from the Project, based on the following standards and guidelines:

- NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads (NZ 6806)[1],
- NZTA Guide to assessing road-traffic noise, V2.0, February 2024, and
- The UK Planning Guidance.

2.1. Performance standards

2.1.1. NZS 6806

NZS 6806 is the New Zealand road traffic noise standard. It provides a robust framework of determining potential impacts of noise and outlines a process to develop mitigation which responds to effects caused by the Project.

I briefly explain relevant terms and methodology of NZS 6806 below:

- **Assessment Positions** are described as Protected Premises and Facilities (PPFs). PPFs include dwellings (including those that have building consent but are not built yet), educational facilities and their playgrounds within 20 m 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 buildings are not known. However, we have provided noise level predictions over all areas surrounding the Proposed Designation – this provides necessary information to potential future developers.
  - 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 200 m from the edge of the closest traffic lane of the Project for rural areas, which the entire Project falls into. I have included every PPF that is within 200 m of the Proposed Designation boundary, to allow for any movement of the Project within the Proposed Designation area.
- **Clusters** are areas which combine PPFs that would benefit from the same mitigation (e.g. noise barrier). For this Project, given the large extent and sparse population, I have divided the alignment into four sectors as follows:
  - Sector 1 from the northern termination of the Project to north of the Brynderwyn Hills;
  - Sector 2 through the Brynderwyn Hills;
  - Sector 3 from south of the Brynderwyn Hills to State Highway 12 (SH12); and
  - Sector 4 from SH12 to the southern termination of the Project.
- Figure 2 showing these sectors is included in Section 0 of this report.
- **Design Year** is a year 10 to 20 years after opening of the Project. While it is currently unclear when the Project would open, I, together with the Project team, chose 2054 as the design year, to be most conservative.
- **Noise Criteria Categories** for PPFs to be assessed against are set out in NZS 6806 for ‘new’ and ‘altered’ roads.

A new road is any road which is to be constructed where no previously formed legal road existed. While most of the Project involves new roadways that would, strictly, fall under the above definition, I have applied the altered road criteria to parts of the Project where appropriate. The altered road criteria have

[1] The standard is referenced in the Whangārei District Plan Section NAV-R15.

been applied where the new road is within the acoustic influence of an existing major road (i.e. SH1). That occurs where the planned new road is generally within 100 metres of SH1 or SH12.

An altered road is any existing road where a horizontal or vertical change to the alignment is applied, and, in the case of this Project, any newly built road in the acoustic area of influence of an existing major road.

The Noise Criteria Categories are set out in Table 1 below.

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

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

The aim of an assessment in accordance with NZS 6806 is to achieve the most stringent noise criteria category at each PPF for future assessment scenarios with the implementation of the Best Practicable Option (BPO). The outcome determined by the 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 barriers) over building modification mitigation (e.g. glazing) as structural mitigation provides a benefit for the wider environment (including outdoor areas) while building modification only benefits the rooms that are being treated. 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 existing road layout[2] (i.e. the existing SH1 and SH12) and current traffic volume. This scenario enables the verification of the computer noise model with measured noise levels.
  - Future do-nothing scenario: consists of the current existing road layout as above, but with traffic volume at the Design Year (2054).
  - Future do-minimum scenario: consists of the proposed Project's Indicative Alignment and any current existing roads that are being altered by the Project, at the Design Year (2054), 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.
  - Future Project with mitigation: consists of the Project's Indicative Alignment at Design Year (2054) and any current existing roads that are being altered by the Project and includes mitigation that is designed specifically to reduce noise levels, e.g. noise barriers or low noise road surface.

2.1.2. 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 2 shows indicative subjective responses to explain how a sudden noise level change may be perceived.

The perception of these noise level changes generally applies to immediate changes in noise level. With a new road, while a new noise source is introduced, that will not be quite the same as a sudden change in

[2] Volume A, Appendix D – Drawing Package - Indicative General Arrangement Plans 0722-PTA-2B0-RD-DRG-0201 to 10722-PTA-200-RD-DRG-0205

level. While people may perceive smaller changes in traffic noise level over time, the subjective perception set out in the table below give a reasonable indication of overall perception.

Table 2: Noise level change compared with general subjective perception

Noise level change	General subjective perception
1–2 decibels	Insignificant change
3–4 decibels	Small 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 5,000 vehicles per day (vpd) to 10,000 vpd) 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 (e.g. from 5,000 to 50,000 vpd) would be required.

2.1.3. Qualitative assessment of traffic noise effects

In addition to the above assessment bases, others can also be used. These other bases are not part of NZS 6806 (which is the primary assessment basis), and they are not used universally across New Zealand. These other bases include:

- Disability Adjusted Life Years (DALYs),
- The number of people highly annoyed,
- The number of houses that receive noise levels above 50 dB $L_{Aeq(24h)}$, or
- Qualitative measures such as perceptions of change in noise level and/or characteristics.

To get a meaningful outcome for the first two measures, the sample size needs to be sufficiently large. The Project is in a sparsely populated area, and only 135 PPFs within 200 m of the Indicative Alignment have been identified. Therefore, I have not undertaken an assessment in relation to these measures.

However, in my opinion, points three and four are valid assessment options for this Project, and as such I have applied them to this assessment.

World Health Organisation

The World Health Organisation (WHO) recommends an external noise level of 50 dB $L_{Aeq(24h)}$ to avoid health effects.[3] I discuss the number of houses that receive noise levels above that level currently and in the future.

UK Planning Guidance

People react to noise depending on a large number of factors. These include their perception of a project, expectations as to what they feel they should hear in their environment, if they contribute to the noise (e.g. by driving on the road), and if the character or level of the noise causes them annoyance or a change in habits. The UK Planning Guidance[4] provides a table on how this effect could be described, shown in Table 3 below.

[3] WHO Environmental noise guidelines for the European region, 2018. Levels of 53 dB L_{den} and 45 dB L_{night} are set in the guidelines, which convert to a daily noise level of 50 dB $L_{Aeq(24h)}$.
[4] UK Planning Guidance, Paragraph: 005, ID: 30-005-20190722, dated 22 July 2019. https://www.gov.uk/guidance/noise--2

Table 3: Noise exposure hierarchy

Response to Project noise	Examples of outcome	Effect level
Not present	No effect	No observed effect
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No observed adverse effect
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed adverse effect
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant observed adverse effect
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress.	Unacceptable adverse effect

The above guidance is not specific to a certain noise level (i.e. the effect and responses may occur at different noise levels depending on the source noise). The guidance takes into account character, duration, and frequency of noise.

I consider that a noise level of 50 dB $L_{Aeq(24h)}$ would cause no adverse noise effects and not cause any change in behaviour. Noise levels up to 55 dB $L_{Aeq(24h)}$ would fall into the “present and not intrusive” category, causing no change to behaviour.

2.2. Desktop Assessment

2.2.1. Information Sources

We undertook a desktop assessment to obtain information and data relating to the existing noise environment within the Assessment Area using the following information sources:

- Project GIS viewer
- Google Maps and Google Street View
- Traffic volume information provided by the Project’s traffic specialists
- MobileRoad.com
- NZTA GIS viewer – road-traffic noise contours
- Kaipara District Plan
- Whangārei District Plan

We used the information from the above sources together with our knowledge of the Indicative Alignment and Assessment Area obtained from previous and current site visits to calculate existing ambient noise levels from road traffic. Generally, roads are the only consistent and predictable noise source in the assessment area. Other noise sources such as the existing quarry south of the Brynderwyn Hills may intermittently contribute to the noise environment depending on activity and wind direction. Rural noise sources only occur infrequently and are therefore not predictable.

In addition to discussing existing traffic noise levels, we also reviewed the surrounding land uses. Rural areas are quieter than urban ones, and night-time noise levels will be particularly quiet in rural areas at times. Other influences such as vegetation or water courses, also have an influence on the ambient noise levels and have been addressed where they have material effect on the environment.

2.2.2. 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.

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

For this assessment, we have used the software 'SoundPLAN' V9.1, which is an internationally recognised computer noise modelling programme. In summary, SoundPLAN uses a three-dimensional digital topographical terrain map of the Project area as its base. It also includes data for existing buildings and structures (including auxiliary buildings). We digitised road traffic noise sources into the model, with road lanes located on the terrain file. The model settings are described in Table 4.

Table 4: Road traffic noise modelling parameters

Parameter	Setting/source
Software	Sound Plan 9.1
Algorithm	Calculation of Road Traffic Noise (CoRTN)
Reflection	CoRTN
Conversion	$L_{A10(18h)}$ to $L_{Aeq(24h)}$ -3 dB
Ground absorption	1 (i.e. soft ground)
Receiver height	2m above height of each floor
Noise contour grid	2m height, 5 m resolution
Receivers and grid position	Free-field

The SoundPLAN model uses the calculation algorithms of the "Calculation of Road Traffic Noise"[5] methodology, which is referenced in 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, modelling results can be compared with the relevant criteria without further adjustment.

Based on the NZTA Guide[6] to Assessing road-traffic noise, February 2024, Table A1, we used the following road surface correction for the modelled road surface materials of the different scenarios:

- Chip seal (Grade 2/3) +6
- Stone mastic asphalt (SMA14) +2
- LN3 (e.g. EPA7 or PA7 40mm) -3

[5] Department of Transport Welsh Office ISBN 0 11 550847 3), including Annex 4 Additional Advice to CRTN Procedures (August 2008)
[6] https://www.nzta.govt.nz/assets/resources/guide-to-assessing-road-traffic-noise/docs/guide-to-assessing-road-traffic-noise.pdf

I understand that it is proposed to use a base road surface of chip seal (grade 2/3), which is what we have assumed for the do-minimum scenario (refer Section 2.1.1).

The proposed speed for the Project is 110 km/h, which has been included in the SoundPLAN model. Other roads have been modelled with their posted speed, and it has been assumed that this speed remains unchanged in the future.

The road parameters entered into the model are set out in Table 5. Traffic data was provided to us by the Projects Technical Advisory Design Team.

Table 5: Road parameters

Road Corridor	Existing 2024		No Project 2054		With Project 2054	
	AADT (vpd)	HCV (%)	AADT (vpd)	HCV (%)	AADT (vpd)	HCV (%)
Project Road (per direction)						
Northbound						
Southern termination to SH12 Interchange	N/A	N/A	N/A	N/A	8212	8
SH12 Interchange	N/A	N/A	N/A	N/A	5799	7
SH12 Interchange to northern termination	N/A	N/A	N/A	N/A	6840	7
Southbound						
Northern termination to SH12 Interchange	N/A	N/A	N/A	N/A	8305	7
SH12 Interchange	N/A	N/A	N/A	N/A	6983	7
SH12 Interchange to southern termination	N/A	N/A	N/A	N/A	9157	8
State Highway 1 (aggregated)						
Southern termination to Baldrock Road	9994	8.8	15843	7.4	3050	4.8
Baldrock Road to SH12	10623	8.2	17186	7.7	3077	5.2
SH12 to Waipu Gorge Road	7330	9.2	11312	7.4	213	8.9
Waipu Gorge Road to Glenmohr Road	7650	8.8	11312	7.4	694	4
Glenmohr Road to Brooks Road	8501	8.3	13067	6.9	1995	4
Brooks Road to Finlayson Brook Road	8958	8.4	13760	6.9	2730	4.8
Finlayson Brook Road to northern termination	9204	8.2	14110	6.8	3152	4.6
SH12	4519	9.2	7487	9.6	3199	4.3

The existing scenario of the model has been verified against the measured noise level (refer Section 3).

We have predicted noise levels for all PPFs, for all relevant scenarios (refer Section 2.1.1). The predicted noise levels for individual PPFs for the Indicative Alignment are contained in the tables in **Appendix B**, and the NZS 6806 noise criteria categories for the PPFs are shown as a graphic representation in **Appendix C.** 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 or outside the Assessment Area. We have included all PPFs within 200 metres of the Proposed Designation in our 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 **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 $L_{Aeq(24h)}$.

2.3. Field Assessment

We measured ambient sound levels at representative locations along the Proposed Designation in October and November 2025. The measurements consisted of:

- Short duration (15 minute) attended surveys at seven positions (undertaken in public spaces in front of dwellings in the Assessment Areas); and
- Long duration unattended data logging at two positions.

We installed one data logger at each of the two locations. The loggers continuously measured ambient sound levels over a multi-day period. The noise logger locations were Puriri Downs (Noise Logger A) and 3868 SH1, Waipu (Noise Logger B). I then used the noise survey results to determine the 24-hour sound levels at each location.

The location of the surveys is shown on Figure 1 below and the results of the surveys are further explained in Section 3.

Figure 1: Noise survey locations (from north to south)

2.4 Determination of PPF assessment basis

As discussed in Section 2.1.1, PPFs are assessed against different noise criteria depending on the effects that existing roads have on them. Where PPFs are within 100 m of the existing SH1 or SH12, I have assessed them against the altered road criteria in NZS 6806. Where they are more than 100 m from either of these roads, I have assessed them against the new road criteria in NZS 6806.

Figure 2 shows the PPFs assessed against the altered road criteria (yellow dots) and those assessed against the new road criteria (turquoise dots).

2.5 Alignment changes within the Proposed Designation

The Indicative Alignment within the Proposed Designation represents a possible alignment. This possible alignment has been developed for assessment purposes. It illustrates what the Project's final design might look like, and the effects generated by its construction and operation. The alignment that gets built including the design and placement of bridges, culverts, stormwater systems, soil disposal areas and landscaping, will be refined and confirmed during the detailed design stage. As a result, this assessment has anticipated impacts within the Proposed Designation, rather than just the Indicative Alignment. The proposed conditions establish outcome-based criteria that will ensure effects on the environment are adequately avoided, remedied or mitigated, regardless of the final design and construction methodology for the Project. As such, should the final alignment within the Proposed Designation change, the effects assessment, proposed mitigation and recommendations outlined in this report would remain appropriate.

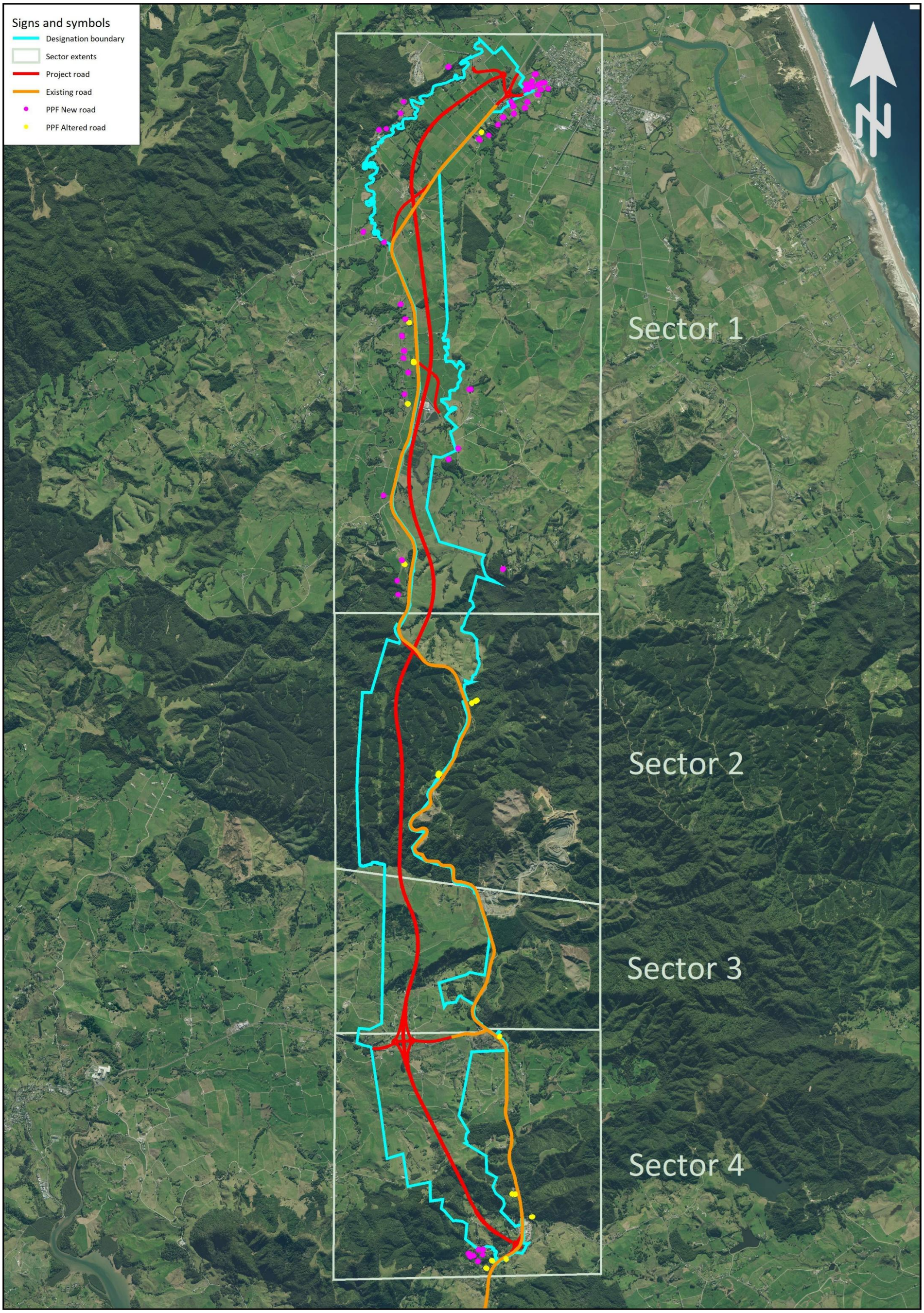


Figure 2: PPF Classification

3. Existing Environment

3.1. Noise survey details

The existing environment across the Proposed Designation is explained in detail in Part B of Volume A of the Substantive Application. The nature of the existing environment as it relates to operational noise is discussed here for the purposes of this assessment.

The results of the noise surveys (refer Section 3) are set out in Table 6. The noise survey locations are shown in Figure 1.

Table 6: Noise level survey results (from north to south)

ID	Location	Date/Start time	Duration (min:sec)	Measured noise level	Background sound level
				dB $L_{Aeq(T)}$	dB L_{A90}
MP1	SH12	20/10/25 14:14	15:02	69	46
MP2	The Braigh	20/10/25 17:23	10:01	63	51
A	Puriri Downs	20/10/25 15:42	10:01	48	45
		20 – 29/10/2025	8 days. Average 24h level expressed. Logger.	54	42
B	3868 SH1 Waipu	20/10/25 17:01	10:01	52	47
		21 – 28/10/2025	8 days. Average 24h level expressed. Logger.	52	42

The short duration survey results are intended to give context to the overall environment along the Project. These survey results have not been used to verify the computer model.

A summary of the surveys is attached in **Appendix A.**

3.2. Analysis of Data

In rural zones well removed from state highways, typical daytime noise levels range from 45 to 55 dB L_{Aeq}. However, for rural receivers within 500 m of high traffic volume state highways, the ambient noise levels are dominated by traffic noise. Beyond this distance, noise levels will likely be typical rural ambient noise levels dominated by various natural and man-made noise sources.

I used the SoundPLAN computer noise model to calculate the existing noise levels at all PPFs within 200 m of the Proposed Designation. The computer model of the existing situation includes the existing SH1 and SH12 as the only major roads in the vicinity of the Project.

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 7 below.

Table 7: Noise level survey results (from south to north)

Location	Measured noise level	Predicted noise level	Difference
	dB $L_{Aeq(T)}$	dB $L_{Aeq(T)}$	decibels
Puriri Downs	54	55	+2
3868 SH1 Waipu	52	57	+5

The results suggest that the computer model of the existing situation performs to an appropriate accuracy for the Puriri Downs survey site.

The difference at 3868 SH1 Waipu is 5 decibels. This is larger than would normally be expected. I reviewed the weather conditions at the time of the survey as well as the road surface actually present in the vicinity of the site. Both were within reasonable bounds to be able to predict the traffic noise levels accurately. Wind directions were generally distributed across most directions and therefore are not the reason for the lower measured than predicted noise levels. I could not check the actual traffic volume and mix during the time of the survey and have to rely on the available AADT data for 2025. There may have been variations in traffic make up and volume that may have affected the survey result.

Nevertheless, I consider that the model performs generally sufficiently to enable us to predict the existing noise levels at all PPFs without the need to measure existing noise levels at each building.

The prediction method used in New Zealand is CoRTN. The prediction uncertainty of this method relates to various aspects such as the variability of road surfaces and vehicle fleet, variation in road/tyre noise emissions within a road surface classification, terrain and other screening. The indicative 95% confidence level of predicted existing LAeq(24h) noise levels compared with measured noise levels between 50 and 150 m from the road, is ±3 decibels, and more than 150 m from the road, is ±4 decibels.

4. Assessment of Traffic Noise Effects

The Project introduces a new noise source into a currently greenfield area. While some of the existing PPFs are already significantly affected by traffic noise from the existing SH1, others are generally unaffected due to their remote location from existing major roads.

The Assessment Area is extensive. My assessment is based on the Indicative Alignment, which provides a significant buffer to the closest PPFs. Therefore, the effects of the Indicative Alignment are relatively limited. Where PPFs are closest to the Indicative Alignment, they are located in the vicinity of interchanges with existing major roads. These PPFs are already affected by traffic noise from existing roads.

For each sector, I have also undertaken a sensitivity assessment, should the Indicative Alignment move closer to the Proposed Designation. This approach ensures the potential traffic noise effects have been assessed, and appropriate mitigation recommended irrespective of where the final alignment is located within the Proposed Designation.

4.1. Sector 1

Sector 1 contains PPFs assessed against both New and Altered Road criteria. There are nine PPFs assessed against the Altered Road criteria and 59 PPFs assessed against the New Road criteria.

4.1.1. NZS 6806

I predict that those PPFs already affected by traffic noise from the existing SH1 and assessed against the Altered Road criteria, would generally experience a reduction in noise level with the Project in place. The main reason is that the road will move further away from the PPFs, adding distance and shielding. The existing SH1 will carry significantly lower traffic volumes (about 20% of the volume without the Project in place) which would result in a noise level reduction of about 7 to 8 decibels.

Some PPFs that are currently remote from the existing SH1 and are assessed against the New Road criteria are likely to experience a noise level increase from the new road. In some cases, that increase means the noise levels at those PPFs would be in a less stringent noise criteria category than without the Project. The effect of a change in category can be mitigated by using a lower noise road surface such as LN3 (EPA7 40 mm) (or similar).

The areas where I consider this mitigation should be implemented to reduce noise levels to be within Category A, include Ahuroa Road, 4476 SH1, 62 Ryan Road, 85 Millbrook Road, and 90 and 95 Glenmohr Road.

With LN3 used between CH9400 (northern termination) and CH10800 and CH13900 to CH16900, all PPFs would receive noise levels within the same, or a better, noise criteria category as they would be without the Project in place.

Only one PPF (12 Brooks Road) is predicted to receive a noise level at the low end of Category B (i.e. a noise level of 58 dB $L_{Aeq(24h)}$), which is still lower than the noise level if the Project was not going ahead.

4.1.2. Noise level change

With the proposed Project in place, all PPFs assessed against the Altered Road criteria would receive lower noise levels than would be the case without the Project. The reason is that the major road will move further away from the PPFs and the existing SH1 would be carrying only a fraction of the current traffic volume.

Those PPFs assessed against the New Road criteria would receive a range of noise level changes, from a significant reduction in noise level where the alignment moves further away from the PPFs and may be partially shielded by terrain, to significant (up to 9 dB) increases where the closest traffic lane of the Project moves closer and may lose terrain shielding.

The changes in noise level would be noticeable, both decreases and increases. However, the change in noise level will only result in a temporary effect given that people would get used to the “new” noise environment. The majority of PPFs would receive a (permanent) noise level reduction.

4.1.3. Noise exposure effects

With mitigation, there are a small number of PPFs (10 of the total 48 PPFs) where the noise levels with the Indicative Alignment would be above 55 dB $L_{Aeq(24h)}$. All of those PPFs already receive noise levels of that magnitude or higher, and I expect that people are habituated to these noise levels already and therefore would not be adversely affected by a continuation in noise levels.

Of the remaining PPFs, only one is predicted to a receive noise level above 55 dB $L_{Aeq(24h)}$ and a noise level increase. For this PPF (123 Ahuroa Road), the noise levels may be present and intrusive, causing a small change in behaviour at home. However, the noise levels are all at levels that would not cause adverse effects on sleep disturbance and generally would be reasonable in an outdoor setting.

Overall, I consider that the indicative alignment would not cause unreasonable adverse noise exposure effects to PPFs.

4.1.4. Sensitivity assessment

Should the alignment of the Project move close to the boundary either side of the Proposed Designation, predicted noise levels would potentially change. I would expect greatest potential effects if the Project were to move closest to PPFs that are assessed against the New Road criteria. This would include the area around The Braigh, close to the interim tie-in in Waipu, Tiria Lane, Glenmohr and Ryan Roads in Sector 1.

It is likely that the effects of such a move can be mitigated using low noise road surface (LN3 or LN5) or, in selected areas, barriers where they are effective. The need for mitigation will need to be determined at the time of detailed design. Given the undulating terrain in the Proposed Designation, any realignment of the Indicative Alignment may result in more or less terrain shielding, which in turn may result in more or less noise being received at the PPFs.

4.2. Sector 2

Sector 2 contains only three PPFs (4683, 4683A and 4800 SH1) which are all assessed against the Altered Road criteria.

4.2.1. NZS 6806

All three PPFs are predicted to receive significant noise level reductions with the Indicative Alignment. The road would move significantly further away from these houses and be shielded by terrain. I predict that the three PPFs will receive noise levels in Category A.

No mitigation will be required in this Sector.

4.2.2. Noise level change

With the proposed Project in place, the noise level reduction would be between 10 and 18 decibels (i.e. less than half the currently perceived traffic noise). This is because most of the traffic will move from the existing SH1 (to which these PPFs are exposed) onto the Project, which is further away.

The reduction in noise level will be a significant positive effect.

4.2.3. Noise exposure effects

All three PPFs are predicted to receive noise levels of 48 to 53 dB $L_{Aeq(24h)}$, 11 to 14 decibels below existing noise levels.

These levels would be considered Not Present or Present and Not Intrusive, and no change in behaviour would be expected. Overall, I consider the Project will have no adverse noise impact (and will in fact have a positive effect).

4.2.4. Sensitivity assessment

Should the alignment of the Project move close to the eastern boundary of the Proposed Designation, predicted noise levels could potentially change.

It is likely that the effects of such a move can be mitigated using low noise road surface (LN3 or LN5). The need for mitigation will need to be determined at the time of detailed design. Given the undulating terrain in the Proposed Designation, any realignment of the Indicative Alignment may result in more or less terrain shielding, which in turn may result in more or less noise being received at the PPFs.

4.3. Sector 3

Sector 3 contains no PPFs and is therefore not further assessed in this report.

4.4. Sector 4

Sector 4 contains PPFs assessed both against the New and Altered Road criteria. I have identified seven PPFs to be assessed against the New Road criteria and seven PPFs assessed against the Altered Road criteria.

4.4.1. NZS 6806

Five of the Altered Road PPFs are currently receiving noise levels in Category C and Category B from the existing road. With chip seal on the Indicative Alignment, all of the PPFs assessed against the New Road criteria are predicted to still receive noise levels in Category A. All of the PPFs assessed against the Altered Road criteria are predicted to receive noise levels in Category A also.

4.4.2. Noise level change

The PPFs assessed against the Altered Road criteria are predicted to receive significant noise level reductions as the road will move further away, and the existing SH1 will carry only a fraction of the current traffic volume.

The PPFs assessed against the New Road categories are predicted to receive noise level increases up to 10 decibels, though all still no higher than 57 dB $L_{Aeq(24h)}$ (i.e. Category A).

The changes in noise level will be clearly noticeable, both decreases and increases. However, the change in noise levels will only result in a temporary effect given that people would get used to the “new” noise environment.

4.4.3. Noise exposure effects

Most of the PPFs are predicted to receive noise levels below 55 dB $L_{Aeq(24h)}$ from the Project, four are predicted to receive noise levels of 56 or 57 dB $L_{Aeq(24h)}$ (marginally above 55 dB $L_{Aeq(24h)}$), and six are predicted to receive noise levels of 50 dB $L_{Aeq(24h)}$ or lower. For many of the Altered Road PPFs, the existing high noise level of up to 76 dB $L_{Aeq(24h)}$ would be significantly reduced, and residents would benefit significantly from this reduction. People in these houses would currently be used to much higher noise levels.

Therefore, I would consider the noise exposure effect being Present and Not Intrusive, not causing any observable adverse effect. Overall, the Project would have no adverse noise impact.

4.4.4. Sensitivity assessment

Should the alignment of the Project move close to the southern boundary of the Proposed Designation, predicted noise levels could potentially change, for instance in the EcoVillage to the south west of the SH1 / Baldrock Road intersection.

It is likely that the effects of such a move can be mitigated using better low noise road surface (LN3 or LN5). The need for mitigation will need to be determined at the time of detailed design. Given the undulating terrain in the Proposed Designation, any realignment of the indicative alignment may result in more or less terrain shielding, which in turn may result in more or less noise being received at the PPFs.

5. Recommended Mitigation

Based on the Indicative Alignment, we recommend the following mitigation:

LN3 (EPA7 40 mm) road surface from approximate chainages:

- CH9400 – CH10800
- CH13900 – CH16900

With this mitigation in place, the noise effects on all PPFs will be low, with many PPFs receiving an improvement over existing circumstances as the road would move further away. Given that the Indicative Alignment may move within the Proposed Designation, the mitigation measures should be confirmed at the time of detailed design to confirm the extent of low noise road surface. Any change in alignment may result in more or less terrain shielding, and different distances from the road to the PPFs, which in turn may result in amendments to the mitigation to achieve the proposed outcome.

6. Conclusion

The Project involves the construction of a new major road in a greenfield area, at varying distances to the existing SH1. Therefore, PPFs would be affected differently, depending on their current exposure to traffic noise. The assessment includes PPFs that are assessed against the criteria for New Roads and Altered Roads to take account of this.

The Indicative Alignment is located at a significant distance from most PPFs, however, this alignment may move within the Proposed Designation. While at present, mitigation in the form of low noise road surface LN3 is proposed for some sections of the Indicative Alignment, this will need to be reassessed when the detailed design has been completed, to ensure the outcome is similar to that achieved for the Indicative Alignment.

I consider that the choice of road surface will be the most appropriate mitigation measure for the entire Project as terrain makes barriers not a practicable mitigation option.

Overall, with the recommended mitigation, I consider that the Project can be operated within reasonable noise levels.

APPENDICES

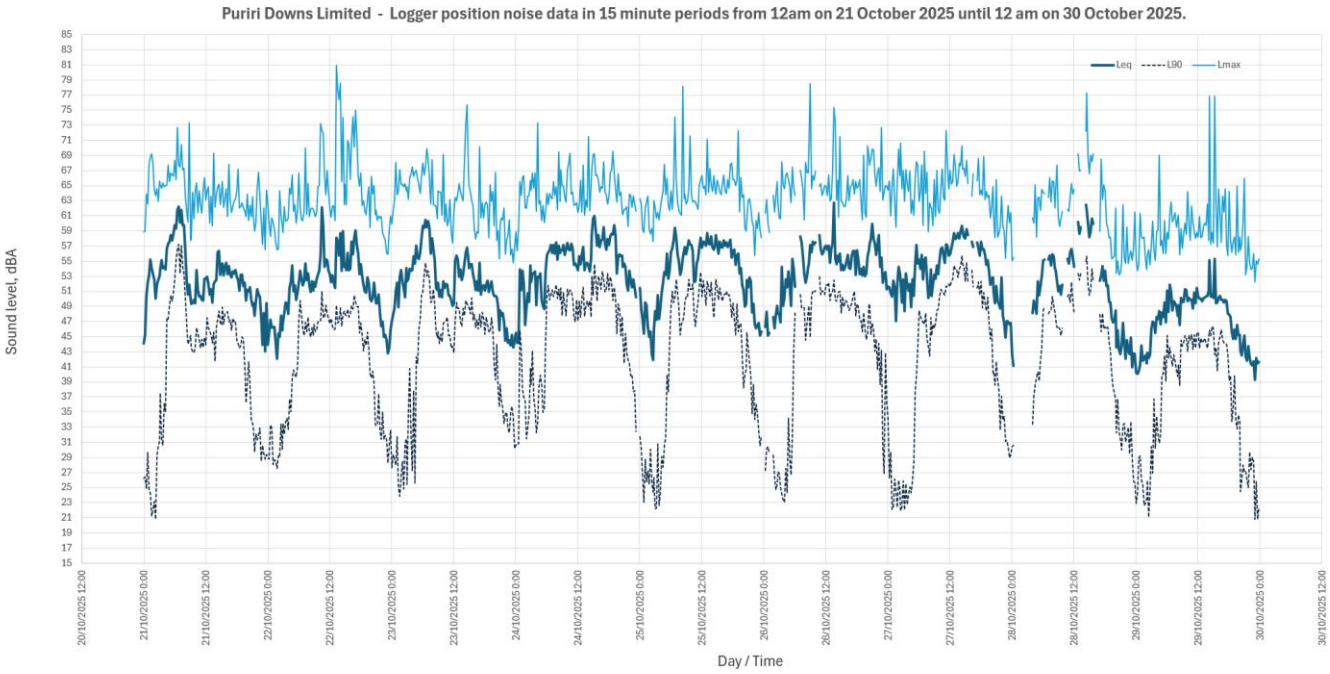
Appendix A

Noise Survey Summary Sheets

Date:	03 November 2025
File name:	I:\JOBS\2024\20241135\03 Survey Data & Measurements
Job number:	20241135
Job name:	Northland Corridor
Location:	Puriri Downs Limited, Northland
Measurement dates:	Tuesday 21 October 2025 to Thursday 30 October
Weather during measurement:	Rain periods occurred for a few days. The affected data has been removed from the data set before the analysis.

OVERVIEW SUMMARY SHEET

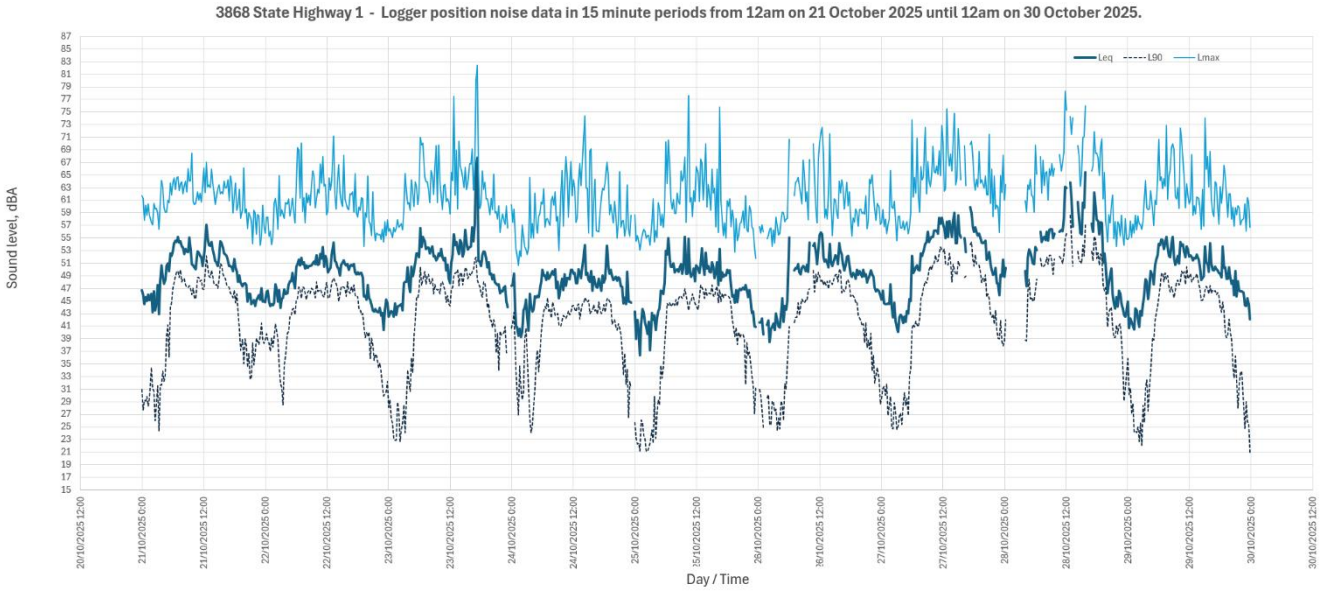
$L_{Aeq(24hr)}$	54 dB



Date:	03 November 2025
File name:	I:\JOBS\2024\20241135\03 Survey Data & Measurements
Job number:	20241135
Job name:	Northland Corridor
Location:	3868 SH1 Waipu, Northland
Measurement dates:	Tuesday 21 October 2025 to Thursday 30 October
Weather during measurement:	Rain periods occurred for a few days. The affected data has been removed from the data set before the analysis.

OVERVIEW SUMMARY SHEET

$L_{Aeq(24hr)}$	52 dB



Appendix B

Individual PPF predicted noise levels

Sector 1 – Altered Road

Address	Existing	Do Nothing	Do Minimum (2/3 Chip)	Mitigation Option (LN3 in parts)
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
3817 State Highway 1	62	66	55	49
Lot 1 DP 179379 State Highway 1	57	59	62	55
4212A State Highway 1	62	64	62	55
10 Brooks Road	65	67	60	60
4164 State Highway 1	68	70	60	60

Sector 1 – New Road

Address	Existing	Do Minimum (2/3 Chip)	Mitigation Option (LN3 in parts)
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
7 Finlayson Brook Road	63	56	56
3781 State Highway 1	55	54	47
3819 State Highway 1	55	53	47
3783 State Highway 1	55	53	47
3821 State Highway 1	60	55	49
90 Glenmohr Road	53	58	53
39 Tiria Lane	58	58	56
4068 State Highway 1	59	57	56
57 Tiria Lane	61	60	57
11 Tiria Lane	59	57	57
123 Ahuroa Road	48	60	57
159 Ahuroa Road	44	54	50
112 Ahuroa Road	47	58	54
36 Finlayson Brook Road	55	55	54
164 Ahuroa Road	48	56	53
8 Waipu Gorge Road	64	60	52
4482 State Highway 1	56	55	50
4476 State Highway 1	56	61	54
95 Glenmohr Road	53	58	54
4212 State Highway 1	59	60	55

Address	Existing	Do Minimum (2/3 Chip)	Mitigation Option (LN3 in parts)
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
4480 State Highway 1	53	55	50
57 The Braigh	46	52	45
69 The Braigh	45	52	44
9 Robert Bruce Place	44	51	44
232 Glenmohr Road	47	53	48
89A The Braigh	50	55	48
89 The Braigh	50	54	46
91 The Braigh	49	53	45
62 Ryan Road	52	58	55
54 The Braigh	44	48	41
44 The Braigh	45	49	43
64 The Braigh	43	53	46
39 The Braigh	42	48	42
60 The Braigh	45	50	44
85 Millbrook Road	50	60	54
48B The Braigh	41	52	44
58 The Braigh	44	53	45
48A The Braigh	43	50	44
33 Tiria Lane	58	56	56
12 Brooks Road	61	59	58
40 The Braigh	44	49	42
36 The Braigh	44	46	41
33 The Braigh	43	49	43

Sector 2 – Altered Road

Address	Existing	Do Nothing	Do Minimum (2/3 Chip)
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
4683 State Highway 1	65	67	49
4683A State Highway 1	61	62	46
4800 State Highway 1	62	64	54

Sector 4 – Altered Road

Address	Existing	Do Nothing	Do Minimum (2/3 Chip)
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
Lot 2 DP 196115 State Highway 1	67	69	52
2414B State Highway 1	72	74	48
2730 State Highway 1	76	78	49
2395 State Highway 1	70	72	46
2523B State Highway 1	60	62	35
2523A State Highway 1	70	72	35
33 Baldrock Road	63	65	48

Sector 4 – New Road

Address	Existing	Do Minimum (2/3 Chip)
	dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$
Lot 3 DP 196115 State Highway 1	49	57
Lot 5 DP 196115 State Highway 1	49	56
Lot 4 DP 196115 State Highway 1	48	55
Lot 7 DP 196115 State Highway 1	46	55
Lot 6 DP 196115 State Highway 1	51	55
Lot 1 DP 407949 State Highway 1	47	57
Lot 2 DP 407949 State Highway 1	46	56

Appendix C

Predicted noise level contours and PPF categories


ASSESSMENT AREA: A
NORTHLAND CORRIDOR - BRYNDERWYN HILLS SECTION
PPFS
Calculated 2020 Ambient Noise Level (dB LAeq(24h)) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.
Road
Contours (dB LAeq(24h))
55
60
65
70
Altered Road (dB LAeq(24h))
< 64
64 - 67
> 67
New Road (dB LAeq(24h))
< 57
57 - 64
> 64
85 Millbrook Road
112 Ahuroa Road
123 Ahuroa Road
164 Ahuroa Road
159 Ahuroa Road
48B The Braigh
48A The Braigh
60 The Braigh
40 The Braigh
36 The Braigh
58 The Braigh
64 The Braigh
54 The Braigh
33 The Braigh
39 The Braigh
9 Robert Bruce Place
89A The Braigh
57 The Braigh
89 The Braigh
69 The Braigh
3781 State Highway 1
91 The Braigh
3783 State Highway 1
3817 State Highway 1
3819 State Highway 1
3821 State Highway 1
N
0 62.5 125 250 375 500 625 750 875 Meters
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NZTA
Author:
katie.moore
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Projection: NZGD 2000 New Zealand Transverse Mercator
Map Rotation: 0°
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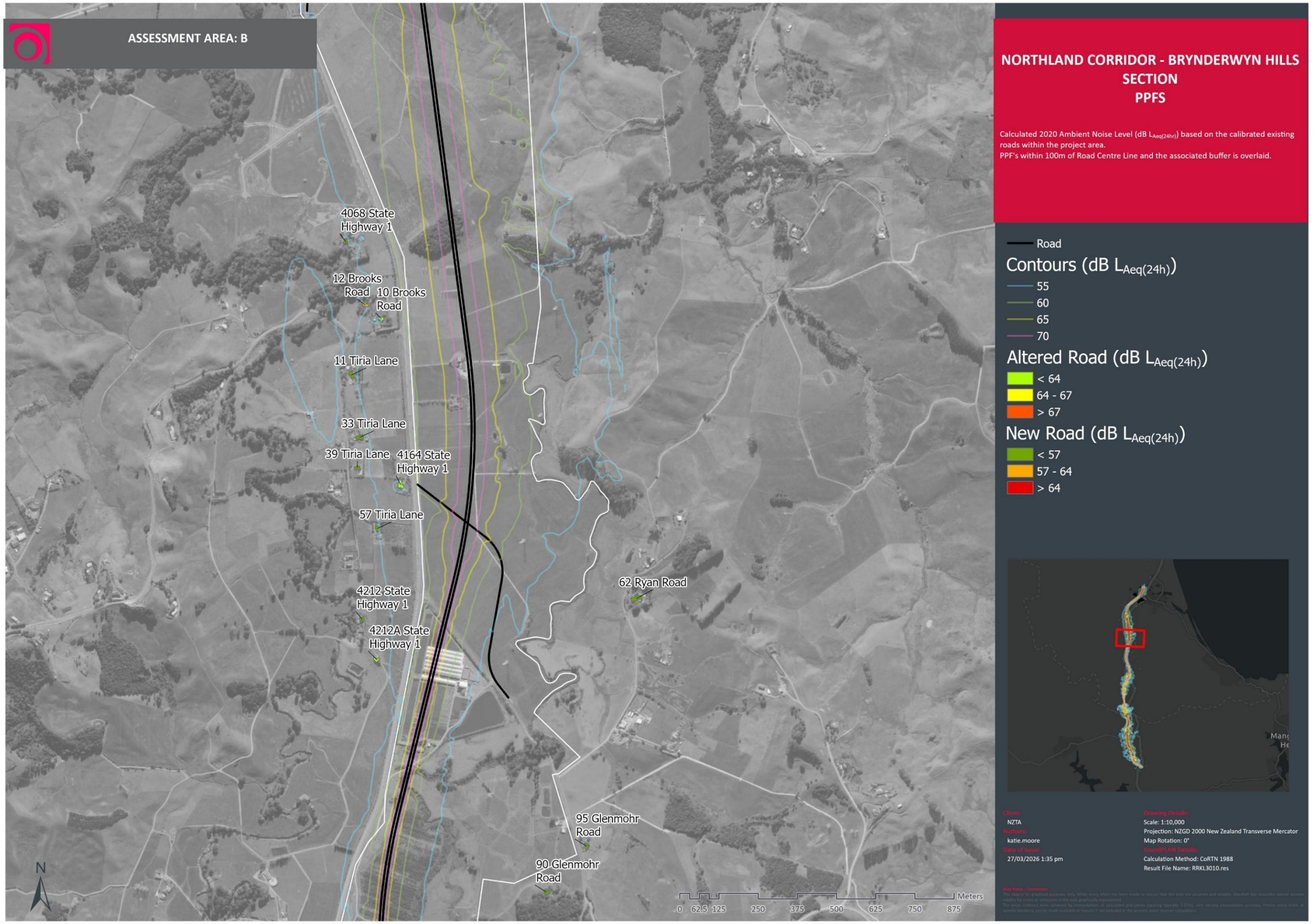
ASSESSMENT AREA: B
4068 State Highway 1
12 Brooks Road
10 Brooks Road
11 Tiria Lane
33 Tiria Lane
39 Tiria Lane
4164 State Highway 1
57 Tiria Lane
4212 State Highway 1
4212A State Highway 1
62 Ryan Road
95 Glenmohr Road
90 Glenmohr Road
N
0 62.5 125 250 375 500 625 750 875 Meters
NORTHLAND CORRIDOR - BRYNDERWYN HILLS SECTION
PPFS
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.
Road
Contours (dB $L_{Aeq(24h)}$)
55
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65
70
Altered Road (dB $L_{Aeq(24h)}$)
< 64
64 - 67
> 67
New Road (dB $L_{Aeq(24h)}$)
< 57
57 - 64
> 64
Client:
NZTA
Authors:
katie.moore
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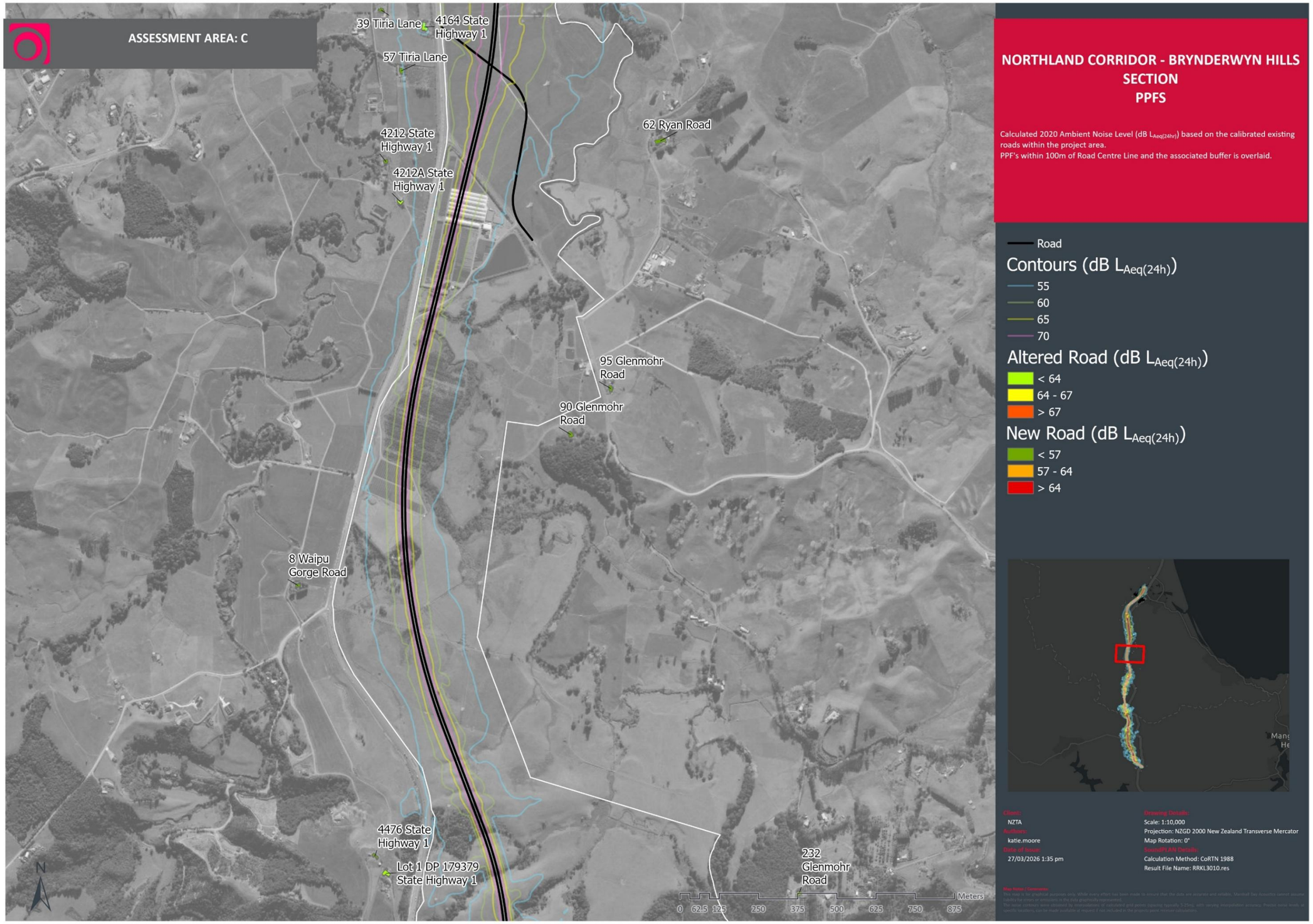
ASSESSMENT AREA: C
39 Tiria Lane
4164 State Highway 1
57 Tiria Lane
62 Ryan Road
4212 State Highway 1
4212A State Highway 1
95 Glenmohr Road
90 Glenmohr Road
8 Waipu Gorge Road
4476 State Highway 1
Lot 1 DP 179379 State Highway 1
232 Glenmohr Road
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0 62.5 125 250 375 500 625 750 875
Meters
NORTHLAND CORRIDOR - BRYNDERWYN HILLS SECTION
PPFS
Calculated 2020 Ambient Noise Level (dB LAeq(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.
Road
Contours (dB LAeq(24h))
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Altered Road (dB LAeq(24h))
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64 - 67
> 67
New Road (dB LAeq(24h))
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57 - 64
> 64
Client:
NZTA
Author:
katie.moore
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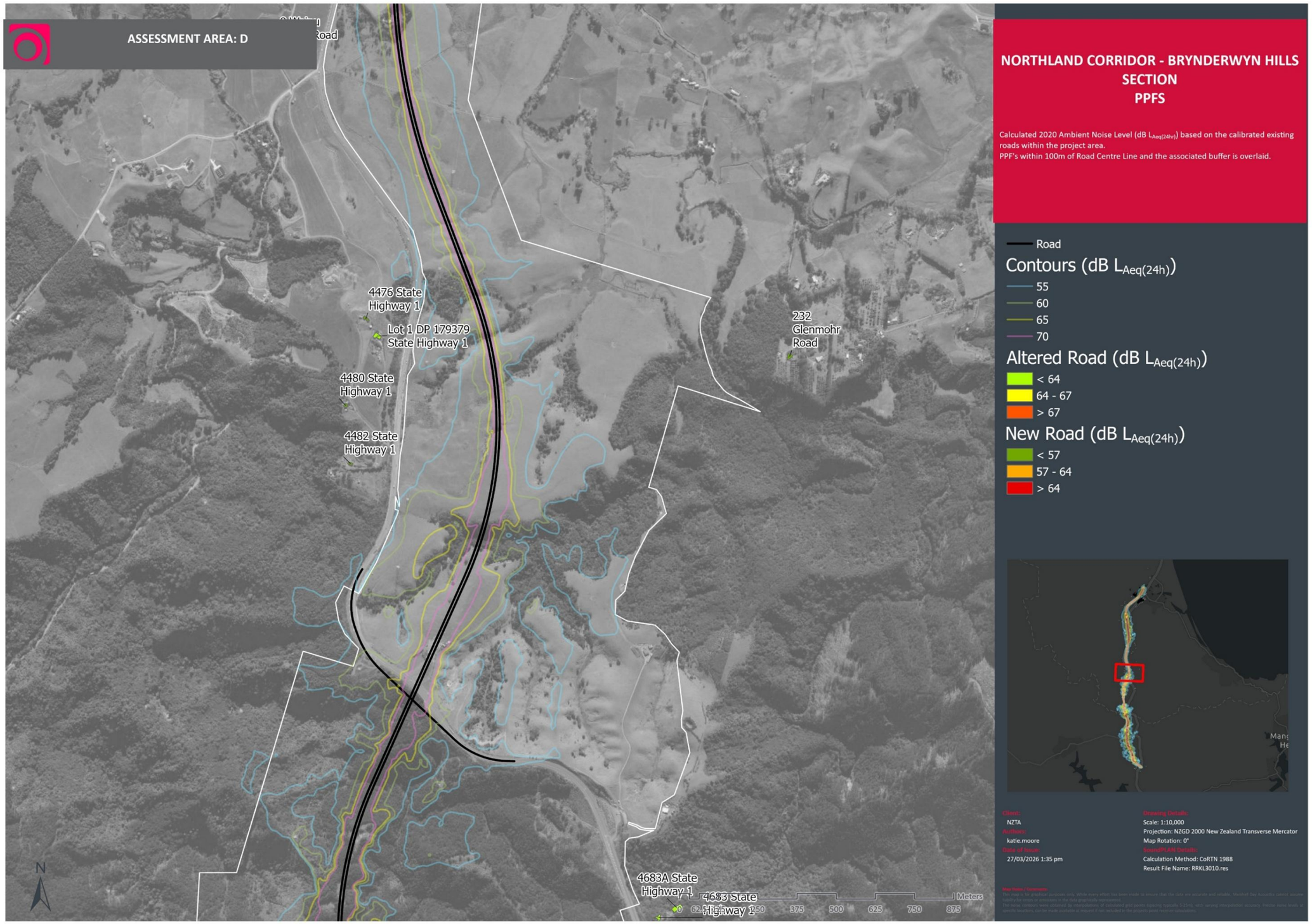
ASSESSMENT AREA: D
4476 State Highway 1
Lot 1 DP 179379 State Highway 1
4480 State Highway 1
4482 State Highway 1
232 Glenmohr Road
4683A State Highway 1
4683 State Highway 1
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125
250
375
500
625
750
875
NORTHLAND CORRIDOR - BRYNDERWYN HILLS SECTION
PPFS
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.
Road
Contours (dB $L_{Aeq(24h)}$)
55
60
65
70
Altered Road (dB $L_{Aeq(24h)}$)
< 64
64 - 67
> 67
New Road (dB $L_{Aeq(24h)}$)
< 57
57 - 64
> 64
Client:
NZTA
Author:
katie.moore
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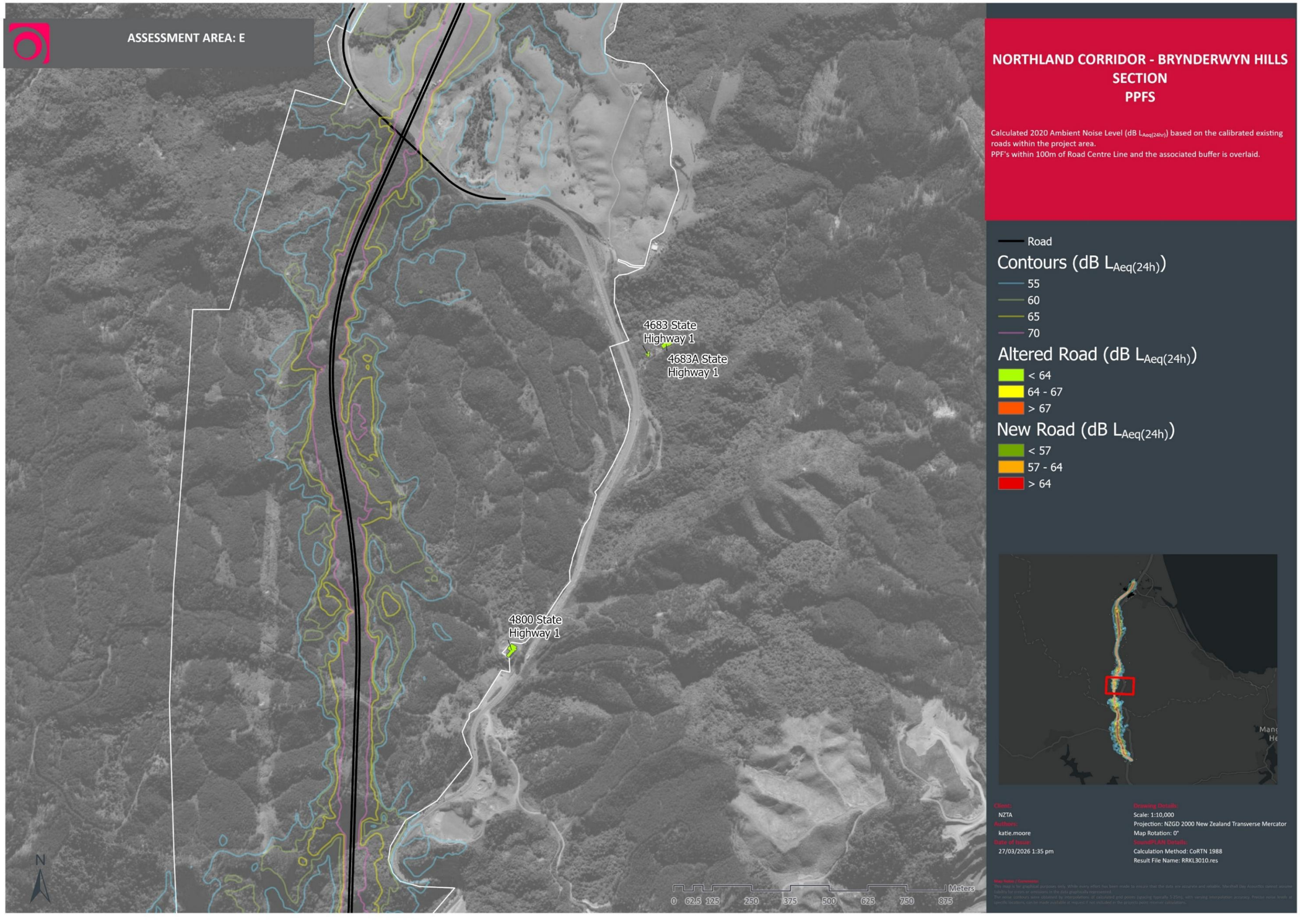
ASSESSMENT AREA: E
4683 State Highway 1
4683A State Highway 1
4800 State Highway 1
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Meters
NORTHLAND CORRIDOR - BRYNDERWYN HILLS SECTION
PPFS
Calculated 2020 Ambient Noise Level (dB $L_{Aeq(24hr)}$) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.
Road
Contours (dB $L_{Aeq(24h)}$)
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70
Altered Road (dB $L_{Aeq(24h)}$)
< 64
64 - 67
> 67
New Road (dB $L_{Aeq(24h)}$)
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57 - 64
> 64
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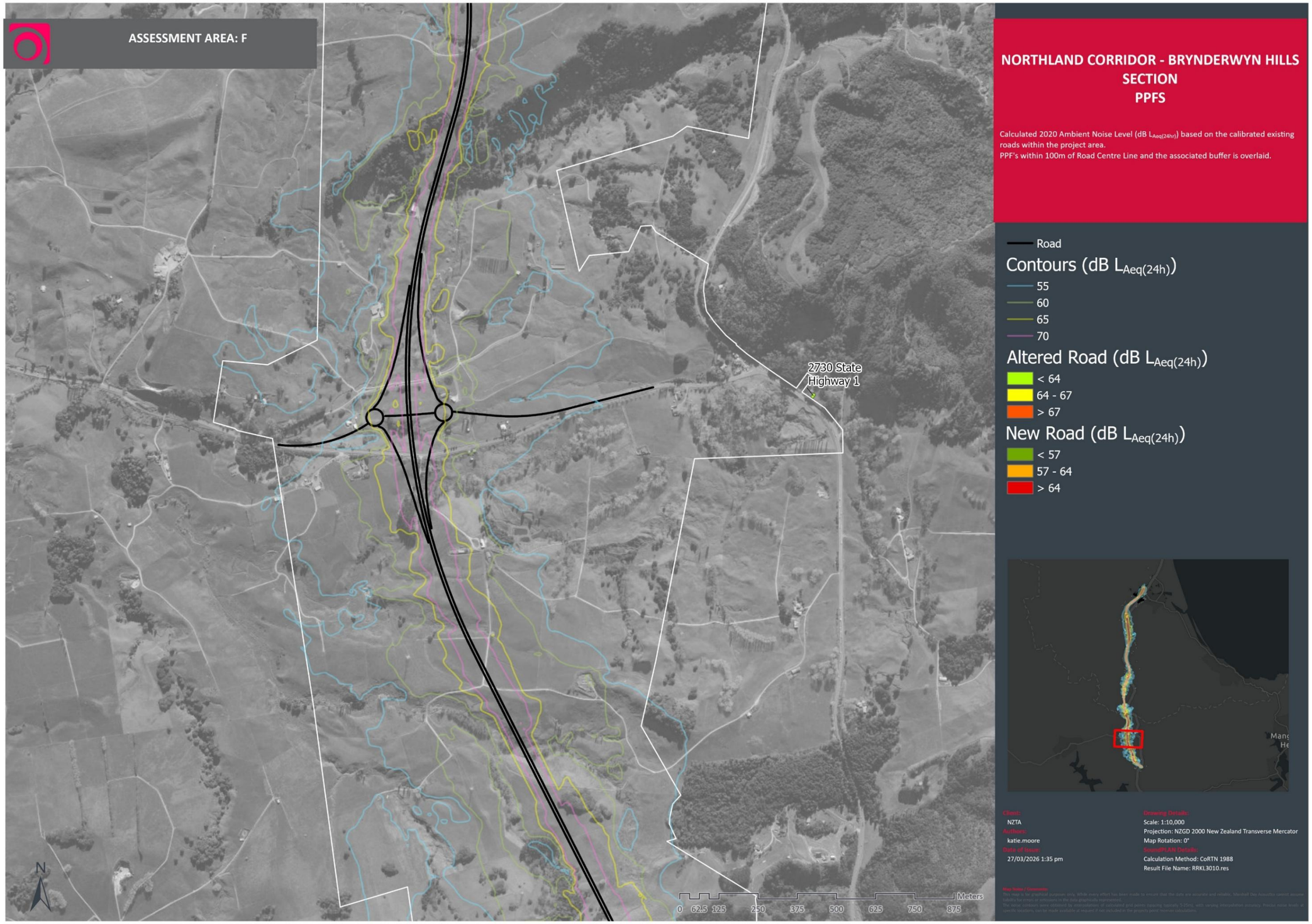
ASSESSMENT AREA: F
2730 State Highway 1
N
0 62.5 125 250 375 500 625 750 875
Meters
NORTHLAND CORRIDOR - BRYNDERWYN HILLS SECTION
PPFS
Calculated 2020 Ambient Noise Level (dB LAeq(24hr)) based on the calibrated existing roads within the project area.
PPF's within 100m of Road Centre Line and the associated buffer is overlaid.
Road
Contours (dB LAeq(24h))
55
60
65
70
Altered Road (dB LAeq(24h))
< 64
64 - 67
> 67
New Road (dB LAeq(24h))
< 57
57 - 64
> 64
Client:
NZTA
Author:
katie.moore
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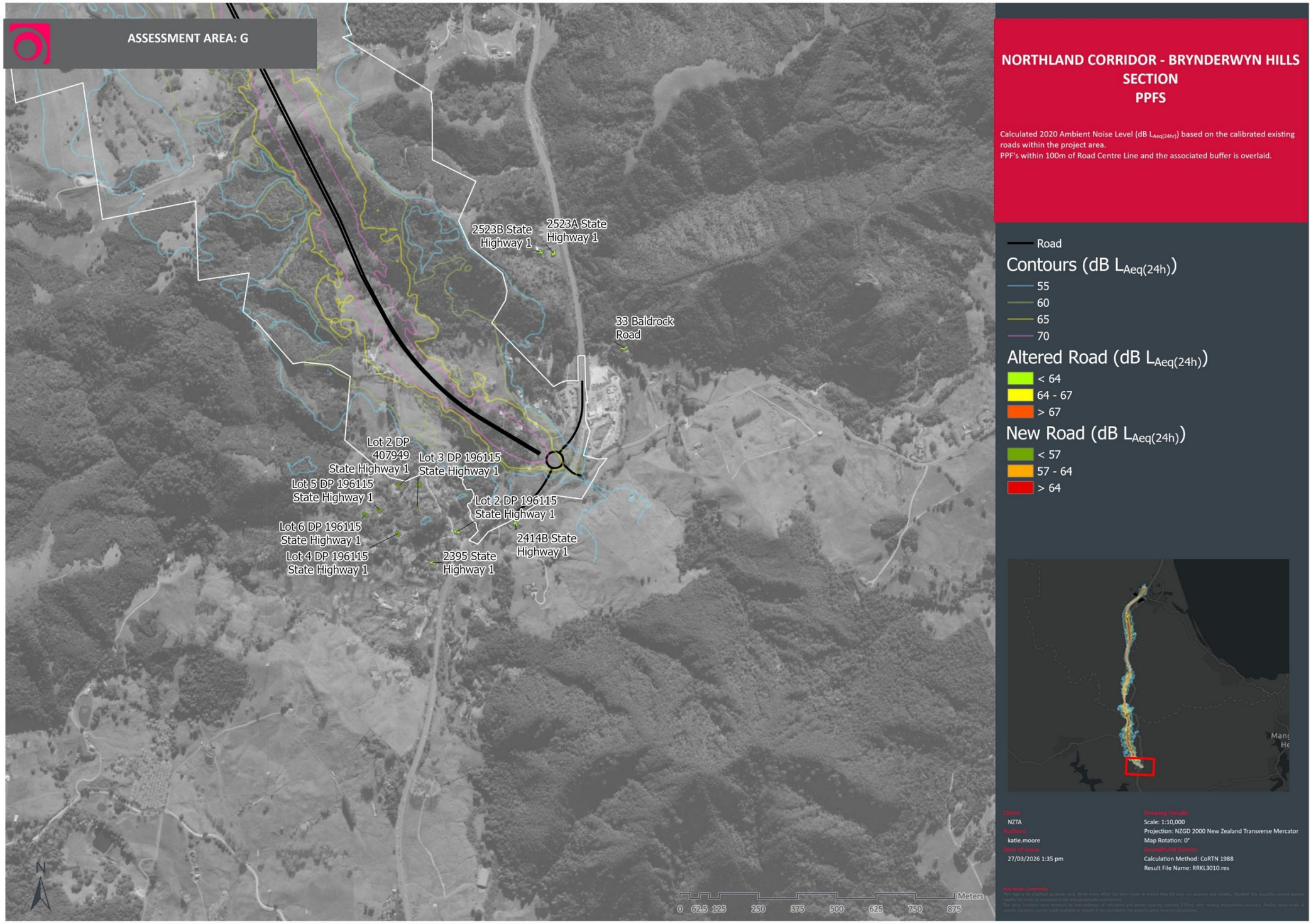
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2523A State Highway 1
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Lot 2 DP 407949
State Highway 1
Lot 3 DP 196115
State Highway 1
Lot 5 DP 196115
State Highway 1
Lot 2 DP 196115
State Highway 1
Lot 6 DP 196115
State Highway 1
Lot 4 DP 196115
State Highway 1
2395 State Highway 1
2414B State Highway 1
N
0 62.5 125 250 375 500 625 750 875
Meters
NORTHLAND CORRIDOR - BRYNDERWYN HILLS SECTION
PPFS
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.
Road
Contours (dB $L_{Aeq(24h)}$)
55
60
65
70
Altered Road (dB $L_{Aeq(24h)}$)
< 64
64 - 67
> 67
New Road (dB $L_{Aeq(24h)}$)
< 57
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> 64
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