



**TE TUPU NGĀTAHI**  
SUPPORTING GROWTH

# Redhills Arterial Transport Network

## Assessment of Traffic Noise and Vibration Effects

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Version 1.0

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Responsibility	Name
Author	Jack Robinson, Shivam Jakhu
Reviewer	Rachel Foster, Claire Drewery
Approver	Bridget O'Leary

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# Table of Contents

<b>1</b>	<b>Executive Summary</b> .....	<b>1</b>
<b>2</b>	<b>Introduction</b> .....	<b>5</b>
	2.1 Purpose and Scope of Report.....	7
	2.2 Report Structure.....	8
<b>3</b>	<b>Assessment Criteria</b> .....	<b>9</b>
	3.1 Road Traffic Noise.....	9
	3.1.1 Protected premises and facilities .....	9
	3.1.2 NZS 6806 Noise Criteria .....	10
	3.1.3 Noise Prediction Scenarios .....	11
	3.1.4 Design Year .....	11
	3.1.5 Noise Mitigation .....	12
	3.1.6 Road Traffic Vibration .....	12
<b>4</b>	<b>Existing Ambient Noise Environment</b> .....	<b>13</b>
	4.1 Noise Monitoring Procedure.....	13
	4.2 Meteorological Conditions.....	13
	4.3 Data Analysis.....	13
<b>5</b>	<b>Assessment Methodology</b> .....	<b>15</b>
	5.1 Road Traffic Noise Model.....	15
	5.1.1 Traffic data.....	16
	5.1.2 Topography.....	16
	5.1.3 Buildings .....	17
	5.1.4 Road alignments .....	17
	5.1.5 Road surfaces.....	17
	5.1.6 Existing noise barriers.....	17
	5.2 Uncertainties and Limitations.....	18
	5.3 Potential Traffic Noise Mitigation Options .....	18
	5.3.1 Road surfaces.....	19
	5.3.2 Noise barriers .....	19
	5.3.3 Building modification .....	19
	5.4 Overview of Traffic Noise Effects .....	19
<b>6</b>	<b>Redhills Arterial Transport Network Overview</b> .....	<b>21</b>
<b>7</b>	<b>NoR 1: Redhills North-South Arterial Corridor</b> .....	<b>23</b>
	7.1 Project Corridor Features .....	23
	7.2 Existing and Likely Future Environment.....	23
	7.2.1 Planning context .....	23
	7.2.2 Noise Environment.....	24
	7.3 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects .....	24

7.3.1	Altered Roads .....	25
7.3.2	New Roads .....	26
<b>7.4</b>	<b>Conclusions.....</b>	<b>27</b>
<b>8</b>	<b>NoR 2b: Redhills East-West Arterial Corridor – Baker Lane.....</b>	<b>29</b>
<b>8.1</b>	<b>Project Corridor Features .....</b>	<b>29</b>
<b>8.2</b>	<b>Existing and Likely Future Environment.....</b>	<b>29</b>
8.2.1	Planning context .....	29
8.2.2	Noise Environment.....	30
<b>8.3</b>	<b>Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects .....</b>	<b>30</b>
8.3.1	Road Traffic Model Results Analysis .....	30
8.3.2	Assessment of Road Traffic Noise Effects.....	31
<b>8.4</b>	<b>Conclusions.....</b>	<b>31</b>
<b>9</b>	<b>NoR 2c: Redhills East-West Arterial Corridor – Remaining Connection.....</b>	<b>33</b>
<b>9.1</b>	<b>Project Corridor Features .....</b>	<b>33</b>
<b>9.2</b>	<b>Existing and Likely Future Environment.....</b>	<b>33</b>
9.2.1	Planning context .....	33
9.2.2	Noise Environment.....	33
<b>9.3</b>	<b>Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects .....</b>	<b>34</b>
9.3.1	Road Traffic Model Results Analysis .....	34
9.3.2	Assessment of Road Traffic Noise Effects.....	35
<b>9.4</b>	<b>Conclusions.....</b>	<b>35</b>
<b>10</b>	<b>Conclusion .....</b>	<b>36</b>

## Appendices

**Appendix 1: Assumptions**

**Appendix 2: Noise Monitoring Results**

**Appendix 3: Predicted Traffic Noise Levels**

**Appendix 4: Noise Contour Maps**

## Table of Figures

Figure 2-1: Redhills Arterial Transport Network – Overview of NoRs for Assessment .....	6
Figure 6-1: Redhills Arterial Transport Network – Overview of NoRs for Assessment .....	21
Figure 7-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads .....	26
Figure 8-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads .....	31
Figure 9-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads .....	35

## Table of Tables

Table 2-1: Redhills Arterial Transport Network – Notices of Requirement and Projects.....	7
Table 3-1: NZS 6806 noise criteria.....	10
Table 4-1: Summary of measured noise levels.....	14
Table 5-1: Road traffic noise modelling parameters.....	16
Table 5-2: Comparison of measured and predicted noise levels.....	18
Table 5-3: Noise level change compared with general subjective perception.....	20
Table 6-1: Summary of NoR's.....	22
Table 7-1: North-South Arterial Corridor Existing and Likely Future Environment.....	23
Table 7-2: NZS 6806 Assessment and Summary – Altered Roads.....	25
Table 7-3: NZS 6806 Assessment and Summary – New Roads.....	27
Table 8-1: Baker Lane Corridor Existing and Likely Future Environment.....	29
Table 8-2 NZS 6806 Assessment and Summary – Altered Roads.....	30
Table 9-1: Nixon Road Connection Existing and Likely Future Environment.....	33
Table 9-2: NZS 6806 Assessment and Summary – Altered Roads.....	34

## Abbreviations

Acronym / Term	Description
AADT	Annual Average Daily Traffic
AEE	Assessment of Effects on the Environment
AC	Auckland Council
AT	Auckland Transport
AUP: OP	Auckland Unitary Plan Operative in Part
BPO	Best Practicable Option
FTN	Frequent Transit Network
FUZ	Future Urban Zone
NoR	Notice of Requirement (under the Resource Management Act 1991)
PPF	Protected Premises and Facilities
RMA	Resource Management Act 1991
SH16	State Highway 16
SH18	State Highway 18
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Programme
Waka Kotahi	Waka Kotahi NZ Transport Agency

## Glossary of Acronyms / Terms

Acronym / Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Altered Road	<p>As defined in NZS 6806:2010 Section 1.5.2:</p> <ul style="list-style-type: none"> <li>• Subject to 1.5.4, an altered road means an existing road that is subject to the alterations of the horizontal or vertical alignment where at any assessment position at any one or more PPF meets criteria 1.5.2 (a) or (b).</li> </ul>
New Road	<p>As defined in NZS 6806:2010 Section 1.6:</p> <ul style="list-style-type: none"> <li>• A new road is any road which is to be constructed where no previously formed legal road existed. A new road excludes any existing road and any altered road but includes the formation of previously unformed legal road.</li> </ul>

# 1 Executive Summary

## ***Assessment undertaken***

This report provides an assessment of road traffic noise effects for the Redhills Arterial Transport Network.

The report contains a review of the relevant traffic noise criteria and discussion of the appropriate criteria and assessment methodology for the Projects. Predictions of road traffic noise were carried out using the method recommended in NZS 6806 in accordance with rule E25.6.33 of the Auckland Unitary Plan – Operative in Part (AUP:OP).

The assessment of effects undertaken was two-fold: in accordance with NZS 6806 and in relation to the predicted noise level changes comparing the future traffic noise levels with and without the Project.

As required by NZS 6806, the assessment methodology included the prediction of existing and future traffic noise levels, both without (Existing and Do Nothing scenarios) and with the Projects with no acoustic mitigation applied (Do Minimum scenario).

The Existing scenario represents the current road network with current traffic volumes, i.e. the existing environment as it is experienced now. The Do Nothing scenario represents the current road network with future traffic volumes, assuming a full build out of the area. The Do Minimum scenario represents the proposed future road network, incorporating NoRs 1 to 2c and other transport projects in the area. This scenario assumes a full build out of the area, and the transport infrastructure to enable the development. This is a realistic scenario at a point in time when all NoRs are operational.

Noise effects of road traffic on existing noise sensitive locations, referred to as Protected Premises and Facilities (PPFs) within NZS 6806, have been assessed. PPFs within a 100m radius have been assessed as all projects fall under urban areas as defined by Statistics New Zealand. Where project areas are considered Altered Roads, these have been assessed by comparing the predicted noise levels in the design year without the Projects (Do Nothing) with the predicted noise levels in the design year with the Projects (Do Minimum). Project areas considered to be New Roads have been assessed by comparing the predicted Existing noise levels with the Do Minimum predictions.

Each PPF has been assessed against Noise Criteria Categories as set out in NZS 6806, with Category A setting the most stringent external noise criteria and being the preferred category. Where this cannot practicably be achieved, then Category B is the next preferred with higher external noise criteria. Category C, an internal noise criterion, is the least preferred category and should only be applied where external noise levels cannot practicably be reduced any further. Where Category A noise levels can be achieved, no further mitigation is required.

All Altered Roads in the NoR's did not meet the definition of an Altered Road in accordance with NZS 6806 and as set out in Section 3.1. NZS 6806 therefore does not apply, and mitigation is not required for these NoR's. Mitigation was considered where New Roads are planned for NoR 1.

Since the projects will be built in the more distant future, this Best Practice Option (BPO) will be confirmed for all current PPFs, at the time of construction. The review, confirmation and refinement of the BPO will aim to achieve the same noise criteria categories as determined with the current BPO as presented in Appendix 1.



In addition to an assessment against the Noise Criteria Categories of NZS 6806, each Project is also assessed against the change in noise level without and with a new project, and a general subjective response is applied to the predicted change.

Residences or noise sensitive activities that are not yet built or do not have building consent, are not included in the modelling, however noise levels at the currently vacant land are provided in the noise contour maps within the Appendices and are indicative of the potential noise environment for that land.

Traffic from new or upgraded roading projects is not generally expected to create any vibration issues. The smooth and even surface typical of urban roads would likely generate no more than negligible traffic vibration impacts. Therefore, traffic vibration has not been assessed for the Projects.

### ***Assessment assumptions***

All predictions are based on traffic flows along New and Altered roads a significant time in the future (in the Design Year 2048). These traffic volumes rely on the urbanisation of the area and implementation of surrounding transport projects.

The traffic noise effects from the Projects assume that all NoRs are operational together, i.e. when the design year of NoR 1 is reached, NoRs 2a to 2c are also operational. No allowance was made for individual NoRs being implemented, or some NoRs not being implemented at all. This is due to two reasons; the transport models did not allow for these options, and the individual or combined assessment of NoRs would lead to a large number of combinations that could not all be assessed. Therefore, the decision was made to assess the furthest point in time, when all surrounding areas were developed to capacity and the associated roading network.

Development of the surrounding areas and urbanisation of the receiving environment over time will likely increase activity and associated ambient noise levels. Therefore, any significant change predicted in this assessment may not hold the same significance at the Design Year, due to the change in environment at the time of construction.

As such, the results are indicative of a possible future scenario, but effects cannot be definitively determined at this stage. Reassessment of the road traffic noise at PPFs covered in this report should be carried out nearer the time of construction to determine if the recommended BPO is still relevant at the time of construction.

### ***Results of assessment and recommended measures***

#### **NoR 1**

The Project involves a proposed new corridor including a new urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.

The Project consists of a combination of New and Altered Roads.

For the Altered Roads under the Existing scenario, predictions show a road traffic noise level range between 37 – 62 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A.

For the Altered Roads under the Do Nothing scenario, predictions show a road traffic noise level range between 39 – 64 dB  $L_{Aeq(24h)}$ , still with all PPFs in Category A.

For the Altered Roads under the Do Minimum scenario, predictions show a traffic noise level range between 41 – 63 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A. Changes in road traffic noise levels in this scenario compared to the Do Nothing scenario are due to changes in the flow of traffic around the Project area's road network, in addition to decreased acoustic shielding caused by the demolition of some PPFs for construction of the Project.

None of the altered roads within NoR 1 met the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation options were not considered further.

There is only one PPF located within NoR 1 that required assessment against the New Roads criteria, which was 27 Redhills Road. However, road traffic noise levels are predicted to be 47 dB  $L_{Aeq(24h)}$  at this PPF in the Do Minimum scenario, meaning that it falls under Category A and does not require further noise mitigation.

A noise level change of 12 dB is predicted between the Existing and Do Minimum scenarios at 27 Redhills Road, which could result in significant noise effects. However, ambient noise levels in the area are expected to increase as the area urbanises, therefore the noise level change may not be as noticeable at the time of construction. Furthermore, a noise barrier was considered at this PPF, however its performance would be compromised as access to the road would need to be maintained through a gap in the barrier.

## **NoR 2a**

NoR 2a involves a new road corridor extending from the Fred Taylor Drive and Dunlop Road intersection to the other proposed new road corridors towards the centre of the Project area, including an upgrade of the Fred Taylor Drive and Dunlop Road intersections.

No PPFs fall within the 100m assessment area around the current design within the NoR 2a designation boundary, therefore NoR 2a has not been considered further in this assessment.

## **NoR 2b**

The Project involves a new corridor including a new urban arterial transport corridor and upgrade of the Fred Taylor Drive and Baker Lane intersection.

Under the Existing scenario, predictions show a range of noise levels from 47 – 58 dB  $L_{Aeq(24h)}$ .

Under the Do Nothing scenario, predictions show a higher traffic noise level range between 50 – 62 dB  $L_{Aeq(24h)}$ , still with all PPFs in Category A. This increase in road traffic noise levels is due to the growth in road traffic throughout the Project area which would occur if construction of the project did not take place.

Under the Do Minimum scenario, predictions show a traffic noise level range between 49 – 60 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A. This overall reduction was due to changes in the flow of traffic around the Project area's surrounding road network.

None of the altered roads within NoR 2b met the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation options were not considered further.

**NoR 2c**

The Project involves a new corridor including a new urban arterial transport corridor and upgrade of Red Hills Road, Nixon Road and Nelson Road intersection.

Under the Existing scenario, predictions show a range of noise levels from 48 – 60 dB  $L_{Aeq(24h)}$ .

Under the Do Nothing scenario, predictions show a traffic noise level range between 54 – 66 dB  $L_{Aeq(24h)}$ , with all except one PPF in Category A.

Under the Do Minimum scenario, predictions show a traffic noise level range between 51 – 61 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A. Changes in road traffic noise levels in this scenario are due to changes in the flow of traffic around the Project area's road network, with a reduction in vehicle traffic predicted along Red Hills Road.

None of the altered roads within NoR 2c met the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation options were not considered further.

## 2 Introduction

This traffic noise assessment has been prepared to support Auckland Transport's (**AT's**) Notices of Requirement (**NoRs**) for the Redhills Arterial Transport Network (the **Project**). The NoRs are to designate land for future local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the future construction, operation and maintenance of the Project.

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part 2016 (**AUP:OP**) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

This report assesses the traffic noise effects of the Redhills Arterial Transport Network identified in Table 2-1 and Figure 2-1 below.

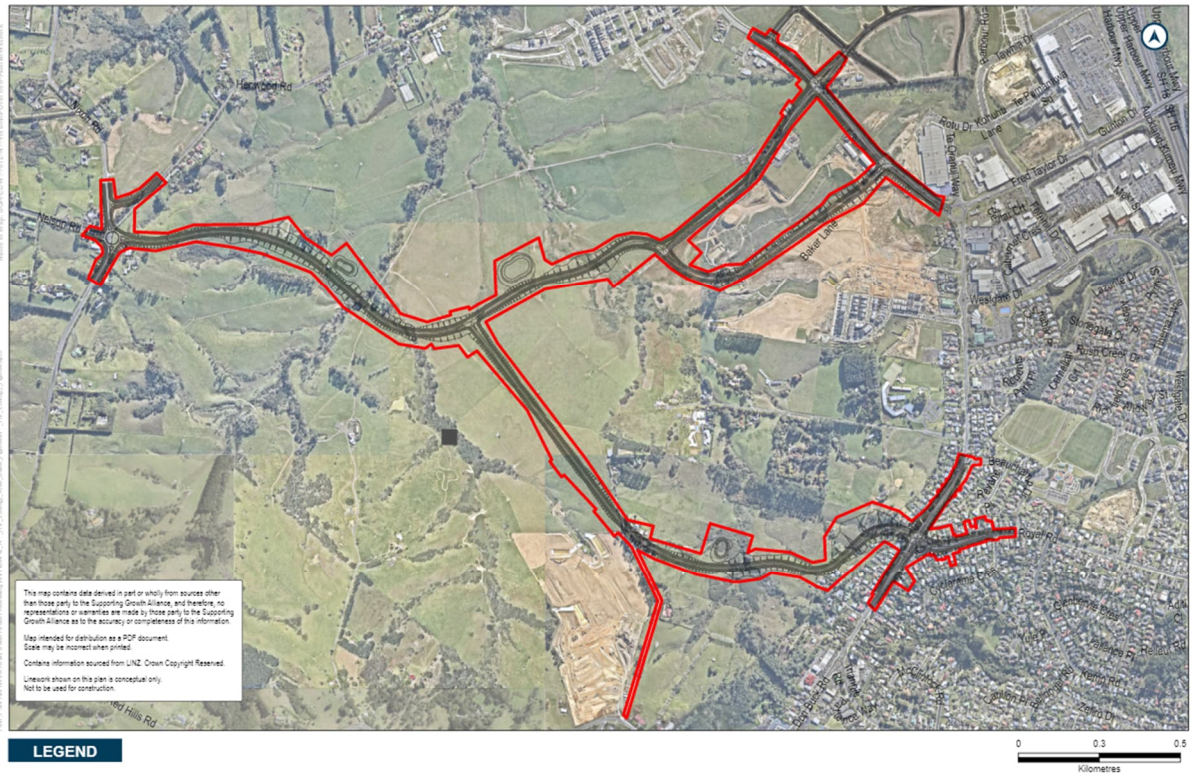
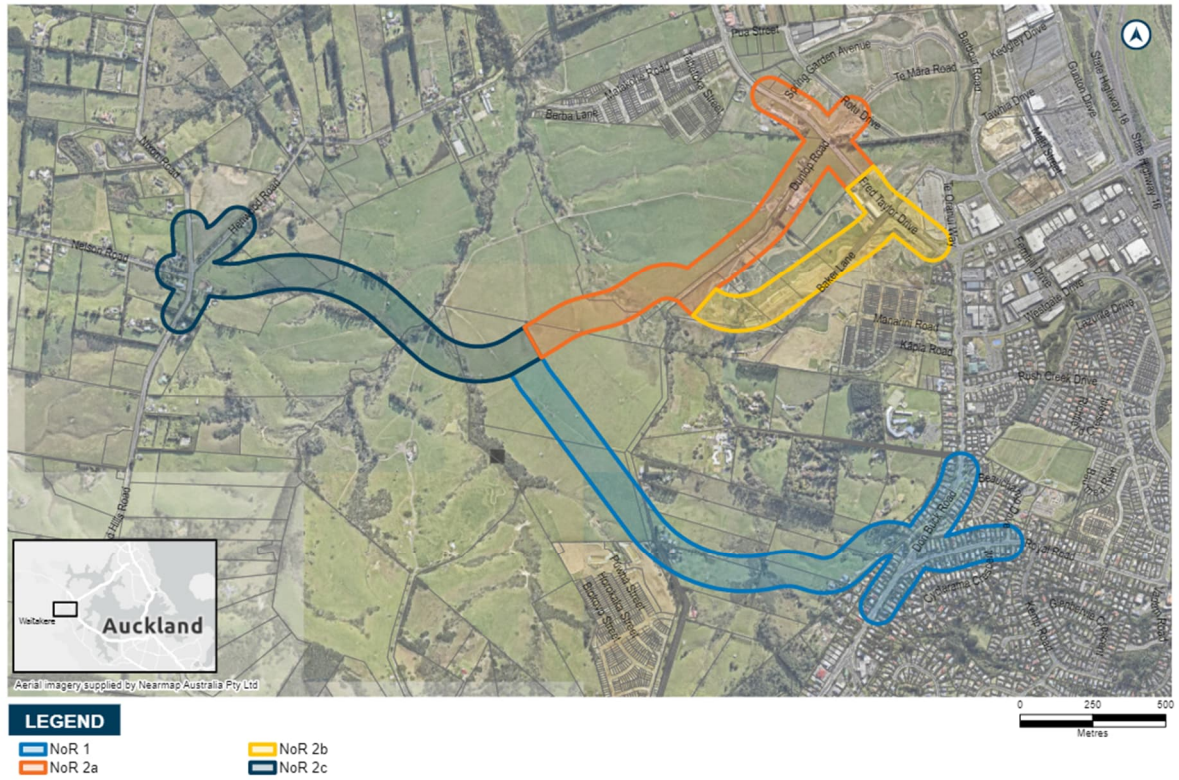


Figure 2-1: Redhills Arterial Transport Network – Overview of NoRs for Assessment

The Project consists of two new arterial corridors through the Project area, providing sufficient space for two-lanes for vehicles, new footpaths and dedicated cycleways on both sides of the road. The Project has been broken down into the following NoRs in Table 2-1 below. Refer to the main AEE for a more detailed project description.

**Table 2-1: Redhills Arterial Transport Network – Notices of Requirement and Projects**

Notice	Project
NoR1	Redhills North-South Arterial Corridor
NoR2a	Redhills East-West Arterial Corridor – Dunlop Road
NoR2b	Redhills East-West Arterial Corridor – Baker Lane
NoR2c	Redhills East-West Arterial Corridor – Remaining connection

To safely tie into the existing road network, the RPP includes the upgrade of existing intersections where the new corridors will connect, as follows:

Signalisation of the intersection at Don Buck Road and Royal Road (NoR1)

Signalisation of the intersection at Fred Taylor Drive and Dunlop Road (NoR 2a)

Signalisation of the intersection at Fred Taylor Drive and Baker Lane (NoR 2b)

A new roundabout at the intersection of Red Hills Road, Nixon Road and Nelson Road (NoR 2c).

This report has primarily considered the Project area as a whole, however results for each NoR have been independently presented. Where relevant, NoR1 is referred to as the N-S Project, and NoR2a, NoR2b and NoR2c are collectively referred to as the E-W Project.

## 2.1 Purpose and Scope of Report

The Supporting Growth Programme has identified the need for a new arterial transport network in Redhills to support the urban development of the area. This report has been prepared to support AT's notices of requirement (**NoRs**) for the Redhills Arterial Transport Network (the **Project**). The NoRs under the Resource Management Act (**RMA**) are to designate land to enable the future construction, maintenance and operation of the Project.

This report provides an assessment of traffic noise effects of the Project. This assessment has been prepared to inform the Assessment of Effects on the Environment (**AEE**) for the NoRs. Effects associated with construction noise and vibration are assessed against different standards and criteria and are discussed in a separate report.

The key matters addressed in this report are as follows:

Identify and describe the existing and likely future noise environment

Describe the actual and potential adverse noise effects of road traffic of the Project

Recommend measures as appropriate to avoid, remedy or mitigate potential adverse noise effects

Present an overall conclusion of the level of potential traffic noise effects of the Project after recommended measures are implemented.

## 2.2 Report Structure

This report is structured to reflect the key matters listed above in Section 2.1

To provide a clear assessment of each project, descriptions and assessments have been separated to reflect each of the notices sought.

## 3 Assessment Criteria

### 3.1 Road Traffic Noise

Rule E25.6.33 of the Auckland Unitary Plan (**AUP:OP**) requires that New Roads and Altered Roads which are within the scope of NZS 6806:2010<sup>1</sup> comply with the requirements of that standard. The assessment of all NoRs has used NZS 6806.

NZS 6806 provides criteria and an assessment method for road-traffic noise. The standard is a tool which provides performance targets and requires assessment of different options for noise mitigation (ranging from low-noise road surfaces and barriers to building modification mitigation). These options are subject to an integrated design process in which the costs and benefits are considered. The performance targets in NZS 6806 are set to achieve reasonable noise levels considering adverse health effects associated with noise on people and communities, the effects of relative changes in noise levels, and the potential benefits of New and Altered Roads. NZS 6806 is an appropriate tool to assess road traffic noise from the Projects as it provides a suitable and tested traffic noise assessment and mitigation methodology and includes relevant noise criteria.

NZS 6806 is not applicable to New and Altered Roads predicted to carry less than an Annual Average Daily Traffic (**AADT**) of 2000 at the design year, or where the change in noise level due to a project (i.e. the horizontal or vertical realignment of a road) does not reach certain thresholds of effects (e.g. a change of at least 3 dB for at least one PPF).

To be defined as an Altered Road in accordance with NZS 6806 the following must apply:

The Do Minimum noise environment would be greater than or equal to 64 dB  $L_{Aeq(24h)}$  and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 3 dB  $L_{Aeq(24h)}$  or more at the design year, when compared with the Do Nothing noise environment; or

The Do Minimum noise environment is greater than or equal to 68 dB  $L_{Aeq(24h)}$  and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 1 dB  $L_{Aeq(24h)}$  or more at the design year, when compared with the do-nothing noise environment.

#### 3.1.1 Protected premises and facilities

NZS 6806 requires noise effects to be assessed at noise sensitive locations within set distances of any project. These locations are known as protected premises and facilities (**PPFs**), and include existing houses, schools, marae and various other premises as defined in NZS 6806. Commercial and industrial premises do not fall within the definition of a PPF. Future (unbuilt) noise-sensitive premises are also not PPFs, unless they have already been granted building consent at the time of assessment.

The distances from the road within which properties are considered to be PPFs is set in the standard as:

Urban Areas – 100 metres from the edge of the nearside traffic lane

<sup>1</sup> New Zealand Standard 6806:2010 Acoustics – Road Traffic Noise



Rural Areas – 200 metres from the edge of the nearside traffic lane.

The Project extent falls within an Urban Area as defined by Statistics New Zealand<sup>2</sup> and therefore PPFs within 100 metres of the Project's road alignments have been assessed in this report. Buildings outside of these areas have not been assessed.

The assessment distance of 100 metres ensures the assessment is made at the most relevant receivers. Potential noise effects are still controlled at receivers further away by virtue of noise criteria applying at receivers nearest to the road.

### 3.1.2 NZS 6806 Noise Criteria

For each of the Projects the noise criteria as summarised in Table 3-1 below are applicable.

**Table 3-1: NZS 6806 noise criteria**

Category	Criterion	Altered Road	New Roads with a predicted traffic volume of 2000 to 75000 AADT at the design year
A	Primary	64 dB L <sub>Aeq(24h)</sub>	57 dB L <sub>Aeq(24h)</sub>
B	Secondary	67 dB L <sub>Aeq(24h)</sub>	64 dB L <sub>Aeq(24h)</sub>
C	Internal	40 dB L <sub>Aeq(24h)</sub>	40 dB L <sub>Aeq(24h)</sub>

The Project has both "Altered Roads" and "New Roads" as defined by NZS 6806. Altered Roads include Fred Taylor Drive, Don Buck Road and other ancillary roads that already exist and will be upgraded. Two new through roads are proposed to be built connecting Fred Taylor Drive to Redhill Road / Nixon Road Junction (the majority of the E-W Project) and connecting the E-W Project to Don Buck Road (N-S Project), both these new roads have been assessed as a "New Road" under NZS 6806.

Section 6.2 of NZS 6806 is therefore applicable to the Project where it states:

In certain circumstances it may be more appropriate to apply one of the sets of criteria to some assessment positions affected by a project, and another set of criteria to other assessment positions affected by the same project.

Such circumstances may include, but are not limited to:

An intersection between a new or altered road and an existing road

A 'tie-in', 'transition', or merger' where a new or altered road reconnects with an existing road

Where any PPFs are significantly affected by noise from another existing road in the vicinity.

Where PPFs are affected by noise from an existing road, mitigation is only required for road-traffic noise generated on the new or altered road.

<sup>2</sup> New Zealand: An Urban / Rural profile, Statistics New Zealand

For the Project, where the new road intersects with an existing road, all PPFs within 100m of the existing road will be assessed under the “Altered Road” criteria. PPFs located beyond this distance but still within 100m of the new road alignment will be subject to the “New Road” criteria.

### 3.1.3 Noise Prediction Scenarios

NZS 6806 specifies scenarios to be undertaken which include the following:

The “Existing noise environment”, which is the ambient noise levels at the date of assessment

A “Do Nothing” scenario, which represents the traffic noise levels at the PPFs at the design year assuming no alterations are made to the existing road

A “Do Minimum” scenario, which represents the traffic noise levels at the PPFs at the design year with the Project implemented, but without any specific noise mitigation. Road surfaces, safety barriers and other structures which are required for non-acoustic purposes may provide incidental noise mitigation and are included in this scenario

“Mitigation” scenarios, which represent the traffic noise levels at the PPFs at the design year with various specific noise mitigation options implemented with the aim of achieving the noise criteria categories.

The Do Nothing scenario includes the growth of the surrounding area without the Project but with other projects planned to be implemented by 2048. In practice, this would be an unrealistic scenario as the future growth at full build out at the design year (2048) could not occur without the existing rural transport network being upgraded to urban standards. We also understand that the current road network could not cope with the future traffic volumes, as these volumes would lead to link and intersection delays. Therefore, while the predictions suggest a significant increase in noise level in the Do Nothing scenario compared with the Existing scenario, this would not be a feasible option.

The Do Minimum scenario represents the proposed future road network, incorporating NoRs R1 to R2c and other transport projects in the area (refer to the discussion on Assessment Assumptions below). This scenario assumes a full build out of the area, and the transport infrastructure to enable the development. This is a realistic scenario at a point in time when all NoRs are operational. Considering the wider distribution of future traffic over an increased road network enabled by the NoRs, traffic volumes appear to reduce on individual roads when compared with the (theoretical) Do Nothing scenario.

### 3.1.4 Design Year

The criteria apply at a design year 10 to 20 years after the completion of a project. In this case the opening year for the Project has not yet been determined but the year 2048 has been selected as the design year for assessment purposes.

The decision to use 2048 as the design year was made in conjunction with the Project team on the basis of the available traffic modelling data and that it represents the most conservative year for assessment purposes that takes into account the traffic increase that will occur over time as the surrounding area develops.

We note that the traffic flows used in the Do Nothing and Do Minimum scenarios were modelled assuming other planned roading projects in the area are implemented. A full list of assumptions is included in Appendix 1.

Traffic volumes will likely change from current predictions with development intended for the Project area, and traffic noise will need to be reassessed nearer the time of detailed design and construction to confirm the recommended mitigation measures for the existing PPFs.

### 3.1.5 Noise Mitigation

NZS 6806 requires that noise mitigation options are assessed, and if practicable, noise levels within Category A should be achieved. If this is not practicable then mitigation should be assessed against Category B. However, if it is still not practicable to comply with categories A or B then mitigation should be implemented to ensure the internal criterion in Category C is achieved. Depending on the external noise level, building modification mitigation to achieve Category C could include ventilation and / or noise insulation improvements ranging from upgraded glazing through to new wall and ceiling linings. Building modification mitigation of Category C should only be implemented after the lowest practicable external noise level has been achieved. This means that structural mitigation such as road surface or barriers may also be implemented.

In circumstances where noise mitigation is warranted, NZS 6806 adopts a “Best Practicable Option” (BPO) approach. BPO considers the extent to which a mitigation option will achieve compliance with the relevant noise criteria and result in a noticeable noise reduction at assessment locations. The value-for-money of the option and the potential visual, shading and safety effects are also considered, amongst other things.

Where a requirement to consider mitigation measures is identified, NZS 6806 states that structural mitigation (low-noise road surfaces and noise barriers) should only be implemented if it achieves the following:

- An average reduction of at least 3 dB  $L_{Aeq(24h)}$  at relevant assessment positions of all PPFs which are part of a cluster; or
- A minimum reduction of 5 dB  $L_{Aeq(24h)}$  at any assessment position(s) for each PPF not in a cluster.

### 3.1.6 Road Traffic Vibration

Traffic vibration from new or upgraded roading projects is not generally expected to create issues. A key factor with new roads is the uniformity of the basecourse / pavement and the absence of near surface services. This is due to new or upgraded roads being designed to be smooth and even and avoiding vibration generated from passing traffic over uneven surfaces. Therefore, traffic vibration effects arising from operation of the Projects has not been assessed.

## 4 Existing Ambient Noise Environment

The criteria in NZS 6806 to assess road-traffic noise are not dependent on the existing noise levels. Measurements of existing levels are therefore not required for the assessment against that standard. However, an appreciation of the existing environment is required to assess the potential noise effects, regardless of compliance with any particular noise criteria.

Measurement results have also been used to verify the computer noise model for the existing environment, ensuring that predictions are accurate within the relevant tolerance.

### 4.1 Noise Monitoring Procedure

Noise survey equipment, meteorological conditions, data analysis and results are described below.

The noise monitoring was undertaken in general accordance with the relevant requirements of NZS 6801<sup>3</sup>, 6802<sup>4</sup> and 6806. This meant the results could adequately inform both the operational and construction noise assessments, whilst providing a robust baseline dataset for the Project.

A measurement position at 440 Don Buck Road was selected to represent an existing environment that is unlikely to change significantly up until the design year, and where road traffic is currently the controlling noise source. The measurement position was free-field to avoid reflections from buildings or extraneous factors which could influence the sound levels, where practicable. Measurement and calibration details required by NZS 6801 are held on file.

The unattended noise monitoring results can be found in Appendix 2. Monitoring was undertaken for approximately 7 days.

### 4.2 Meteorological Conditions

During the surveys, meteorological data was obtained from Auckland, Motat Ews (41351) weather station operated by NIWA. This is the closest station where data was available at an hourly resolution or less.

The meteorological data from this weather station was used to identify periods when conditions were likely to have been outside the meteorological restrictions given in NZS 6801, and therefore data measured during these periods has been excluded from the noise analysis.

### 4.3 Data Analysis

Road traffic was the dominant noise source, with birdsong clearly audible. There is a natural variation in the noise environment throughout the day, and often variations for the weekends. Each day's data was analysed, and abnormal events excluded. A summary of the measured noise levels is presented in Table 4-1. The  $L_{Aeq(24h)}$  was calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded.

<sup>3</sup> New Zealand Standard 6801:2008 Acoustics – Measurement of environmental sound

<sup>4</sup> New Zealand Standard 6802:2008 Acoustics – Environmental noise

The average  $L_{Aeq(24h)}$  for the unattended measurement period was 59 dB.

**Table 4-1: Summary of measured noise levels**

Date	dB $L_{Aeq(24h)}$
19/11/19 (Not full 24 hrs)	59
20/11/19	59
21/11/19	60
22/11/19	59
23/11/19	56
24/11/19	56
25/11/19	61
26/11/19	60
27/11/19	60
28/11/19 (Not full 24 hrs)	62

Close to Don Buck Road noise levels are dominated by traffic. The measurements show relatively high existing noise levels which are likely to remain similar in the future as little change is anticipated adjacent to Don Buck Road.

## 5 Assessment Methodology

Road traffic data provided for the Redhills Arterial Transport Network relies on the development and urbanisation of the local areas, as it forms part of the wider strategic transport network. Some projects will have a direct impact on the traffic flow.

The purpose of this assessment is to determine the future potential impacts to support the future growth within the area. Therefore, it has been assumed all transport infrastructure developments will be constructed by the design year 2048 as indicated in Section 3.1.3. It should be noted an urban speed reduction is expected in some sections of the transport model at the time of growth and at the Do Nothing scenario (design year without Project). This differs from the NZS 6806 standard where the Do Nothing scenario should include no alterations to the roads assessed. Therefore, in accordance with the standard, speed change has been applied at the Do Minimum scenario only. As noted previously, the Do Nothing scenario is a theoretical scenario for these Projects as the existing road network would not be able to accommodate the traffic volume expected from the full future development of the area.

NZS 6806 sets reasonable criteria for road-traffic noise levels, considering health issues associated with noise and other matters. It is considered that road-traffic noise levels in compliance with NZS 6806 Category A would generally result in acceptable noise effects. Achieving the Category B criteria may also give rise to acceptable noise effects when considered with regard to the existing environment.

To determine the potential change in noise level due to the Projects, the Do Minimum (design year with Project) scenario has been compared with the Do Nothing (design year without Project) scenario.

Under NZS 6806, PPFs do not include premises which are not yet built, other than those where building consent has already been obtained but not yet lapsed. No such premises that fall under this Category were known at the time of this assessment.

Although the NZS 6806 assessment does not consider sites unless they contain, or have building consent for, a PPF, the predicted noise levels shown in the noise contour maps in Appendix 4 are considered indicative of the noise environment at adjacent sites without a PPF, including the future urbanisation areas.

### 5.1 Road Traffic Noise Model

A computer noise modelling software SoundPLAN (V8.2) has been used to predict road traffic noise impacts. The road traffic noise modelling employs the “*Calculation of Road Traffic Noise*” (CoRTN) algorithm, as recommended in NZS 6806. The CoRTN methodology has been adjusted for New Zealand Road Surfaces in accordance with LTNZ Report No. 326<sup>5</sup> and the Waka Kotahi *Guide to state highway road surface noise*<sup>6</sup>. The model settings are described in Table 5-1 below.

<sup>5</sup> <https://www.nzta.govt.nz/assets/resources/research/reports/326/docs/326.pdf>

<sup>6</sup> <https://www.nzta.govt.nz/assets/resources/road-surface-noise/docs/nzta-surfaces-noise-guide-v1.0.pdf>

**Table 5-1: Road traffic noise modelling parameters**

Parameter	Setting / source
Software	Sound Plan 8.2
Algorithm	CoRTN
Reflection	CoRTN
Ground absorption	0.6 for urban areas; 1 for grassed areas
Receiver height	1.5 m above height of each floor
Noise contour grid	1.5 m height, 5 m resolution
Receivers and grid position	Free-field

The CoRTN algorithm gives results in  $L_{A10(18h)}$ . To convert these results to  $L_{Aeq(24h)}$  a minus 3 dB adjustment has been made. This adjustment has been implemented in the software in conjunction with the road surface adjustment detailed below.

The limitations and uncertainties of the prediction methodology, including input data, are discussed below.

### 5.1.1 Traffic data

All traffic data including AADT, percentage of heavy vehicles and posted speed limit has been sourced from the Project team and based on the SATURN model. The Existing scenario has been based on 2015 data as provided. Traffic volumes have to change significantly to affect noise levels to a meaningful degree. Therefore, using traffic data from 2015, which is the most up to date data, is appropriate to represent the existing circumstances. The change in traffic volume from 2015 to 2022 would amount to a less than 1 decibel change in noise level.

The CoRTN model has been developed based on 18-hour traffic data. However, in accordance with the requirements of NZS 6806, traffic data has been entered as the 24-hour daily traffic (AADT), which results in noise levels in the order of +0.2 dB higher than would have been calculated by CoRTN based on the 18-hour AADT. The CoRTN model assumes that traffic is free-flowing, it does not apply to interrupted vehicle flows, such as at intersection, and for low volume roads under 5,000 AADT.

### 5.1.2 Topography

Topographic contours for the Existing scenario have been provided from the Project team at a 1m resolution.

Contours for the Do Minimum scenario were obtained from the Project team for the assessment area and joined with the existing contours for the surrounding areas. Road gradients and screening have been determined from the contours.

### 5.1.3 Buildings

The footprints and heights for all buildings, building usage and all other structures within 200 metres of the roads have been obtained from the Project Team. The number of floors was determined assuming 2.8 m height per floor.

Noise levels were calculated at the centre of each façade, 1.5 m above each floor height with the noise levels stated being the highest of any façade.

Any buildings or structures within the designation boundaries for the Project have been removed from the model and not assessed for the Do Minimum scenario as they will be removed to provide for the Project.

### 5.1.4 Road alignments

Road alignments for existing roads were provided by the Project team as centrelines and widths for each carriageway section. Gradients have been calculated by SoundPLAN.

### 5.1.5 Road surfaces

Surfaces of existing roads in the Do Nothing scenario have been modelled as the current surfaces recorded by the Project team, which is Asphaltic Concrete (**AC-14**) in the majority of areas. For the Do Minimum scenario the road surface has also been modelled as AC-14 retaining the existing surface type on the altered roads and applied to the new roads, as advised by the Project team.

The procedure used to incorporate different road surfaces in the model is as follows:

In accordance with Transit Research Report 287, a minus 2 dB adjustment has been made for an asphaltic concrete road surface compared to CoRTN Surface corrections relative to asphaltic concrete (AC-10) have been made in accordance with LTNZ Research Report 326 and the Waka Kotahi Guide to state highway road surface noise. The combination of surface corrections for cars and heavy vehicles has been made using the equation in the Waka Kotahi Guide to state highway road surface noise The combined correction, including the adjustment from  $L_{A10(18h)}$  to  $L_{Aeq(24h)}$ , has been entered in the modelling software as a total road surface correction.

### 5.1.6 Existing noise barriers

Site visits were undertaken to determine if there are existing noise barriers along the Project. There were no noise barriers in the Project area.

Existing boundary fences of private properties have not been included in the noise model as their condition is unknown, they may not provide effective acoustic shielding and there is no certainty that these barriers will be retained by the property owners over time.

This means that for some properties, the predicted traffic noise levels may be slightly higher than would actually be experienced. However, the assessment process will identify properties which may need new noise barriers erected or existing fences upgraded to provide adequate attenuation, as part of the mitigation appraisal.

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Research Report 28. Traffic noise from uninterrupted traffic flows, Transit, 1994.



## 5.2 Uncertainties and Limitations

The predicted road traffic noise levels presented in the following sections are based on a road traffic noise model developed in accordance with NZS 6806 and relevant guidance. The accuracy of the model is largely dependent upon the limitations of the available input data as detailed above. Uncertainties in the modelled noise levels can occur for a number of reasons. Uncertainties are typically related to the effects of topographical screening, appropriateness of the traffic data in terms of volumes of light and heavy vehicles, speeds (observed vs posted) and road surface type.

As stated, the terrain model has been developed by the Project GIS team based on 1m vertical terrain resolution, which provides sufficient detail to accurately account for any acoustic shielding from localised topographical features.

The traffic data has been sourced from the Project Transport team and it is accepted that the forecasting of future traffic flows may not necessarily reflect the actual flows when the Design Year is reached. The sensitivity of the noise predictions to changes in traffic data is not as significant as the effects of topographical screening. For example, if all other factors of the traffic data remain unchanged (speed and % of heavy vehicles), then a doubling or halving of the traffic data will only result in a 3 dB change which is only just perceptible by most people. A change in traffic volume data by +25 % or -25% will result in a 1 dB change in predicted noise level, which would be imperceptible.

Nevertheless, an uncertainty remains which of the Projects will be implemented, at which time and in which combination. The assessment assumes that all NoRs are implemented and operational in the design year 2048. In the interim, some NoRs may be implemented earlier than others, which would have an effect on the traffic distribution across the network, and therefore affect the noise generation.

The accuracy of the model can be quoted to a reasonable degree based upon known validations of the CoRTN model and comparisons with the measured existing noise levels. Generally, road traffic noise levels are quoted with an accuracy within 2 dB. NZS 6806 states in Section 5.3.4.2 that “The difference between measured and predicted levels should not exceed  $\pm 2$  dB.”

Table 5-2 compares the measured data with the predicted noise levels. The predicted traffic noise levels are within the tolerance of NZS 6806 and therefore the existing model is appropriately accurate for the calculation of traffic noise levels for all scenarios.

**Table 5-2: Comparison of measured and predicted noise levels**

Address	Measured noise level, $L_{Aeq,24hr}$ , dB(A)	Predicted noise level, $L_{Aeq,24hr}$ , dB(A)	Difference, dB(A)	Notes
440 Don Buck Road	59.2	60.4	+1.2	Within tolerance

## 5.3 Potential Traffic Noise Mitigation Options

For those PPFs where the NZS 6806 Category A criterion is predicted to be exceeded, the effect of the mitigation options on road-traffic noise levels at each PPF were modelled.

Traffic noise mitigation measures can be broadly categorised into three methods: low noise road surfaces, traffic noise barriers, and building modification. The first two methods involve structural mitigation as described in NZS6806, whilst the third involves building modification mitigation.

### 5.3.1 Road surfaces

Noise mitigation measures with the largest influence on the generation of road traffic noise is the road surface material.

For this Project, the road surfaces implemented remain unchanged with and without construction of the Project, i.e. asphaltic concrete along Fred Taylor Drive and Don Buck Road, and chip seal along Red Hills Road. The new roads were modelled with asphaltic concrete road surface finish.

### 5.3.2 Noise barriers

If low-noise road surfaces do not provide the required level of noise mitigation, noise barriers may be considered alongside road surfaces. Generally, barriers will only mitigate noise if they block the line-of-sight between the noise source and receiver. They are most effective and provide the widest area of mitigation when placed immediately adjacent to traffic lanes. In order to provide the most effective noise level reduction, an acoustic barrier must be of solid material (i.e. have no gaps) and have a minimum surface weight of 15 kg/m<sup>2</sup> (e.g. 17mm ply sheeting, 9 mm fibre cement, concrete, earth bunds etc.).

We note that as per Section 3.1.5, NZS 6806 requires noise barriers to achieve:

An average reduction of at least 3 dB  $L_{Aeq(24h)}$  at relevant assessment positions of all PPFs which are part of a cluster; or

A minimum reduction of 5 dB  $L_{Aeq(24h)}$  at any assessment position(s) for each PPF not in a cluster.

For this Project, noise barriers were not proposed for any of the NoR's.

### 5.3.3 Building modification

NZS 6806 requires that structural mitigation, such as noise barriers and low-noise road surfaces, should be implemented in preference to building modification mitigation.

Building modification can potentially inconvenience residents and does not provide any protection to outdoor amenity. However, if low-noise road surfaces and noise barriers are not practicable or do not provide the required level of noise reduction, building modification to PPFs may be considered.

Depending on the level of reduction required, building modification measures may range from provision of mechanical ventilation only (to allow doors and windows to be closed), to the upgrade or replacement of windows, wall linings, floors and ceiling linings.

For this Project there are no Category C PPFs and therefore building modification is not considered further.

## 5.4 Overview of Traffic Noise Effects

Adverse noise effects as a result of high levels of traffic noise may include sleep disturbance, loss of concentration, annoyance, a reduction in speech intelligibility and reduced productivity. The effects are not restricted to PPFs but would also affect future residential and other noise-sensitive developments as well which are not included in the NZS 6806 definition of PPF. Where new noise sensitive developments are established in the vicinity of a road, their design should take account of the potential noise effects and care should be taken to avoid or minimise them.

The magnitude of effects will largely depend on noise levels received in noise-sensitive spaces within buildings, although there are also potential annoyance effects associated with a loss of amenity when high noise levels are received in outdoor living or recreation spaces.

The subjective perception can generally be correlated with the numerical change in noise level. A 3 dB change in noise level is just perceptible to the majority of people. A 10 dB increase in noise level is subjectively considered to be a doubling of loudness resulting in a significant impact.

**Table 5-3: Noise level change compared with general subjective perception**

Noise level change	General subjective perception
1 – 2 decibels	Insignificant change
3 – 4 decibels	Perceptible change
5 – 8 decibels	Noticeable change
9 – 11 decibels	Halving / doubling of loudness
> 11 decibels	More than halving / doubling of loudness

## 6 Redhills Arterial Transport Network Overview

An overview of the Redhills Arterial Transport Network is shown in Figure 6-1, with a brief summary of each of the Projects provided in Table 6-1.

It should be noted that NoR 2a contains no PPFs under the current design at the time of writing of this assessment, and therefore has not been considered further in this assessment. It is recommended that NoR 2a is re-assessed closer to the time of construction in the event that any PPFs are subsequently established within the assessment area for this NoR.

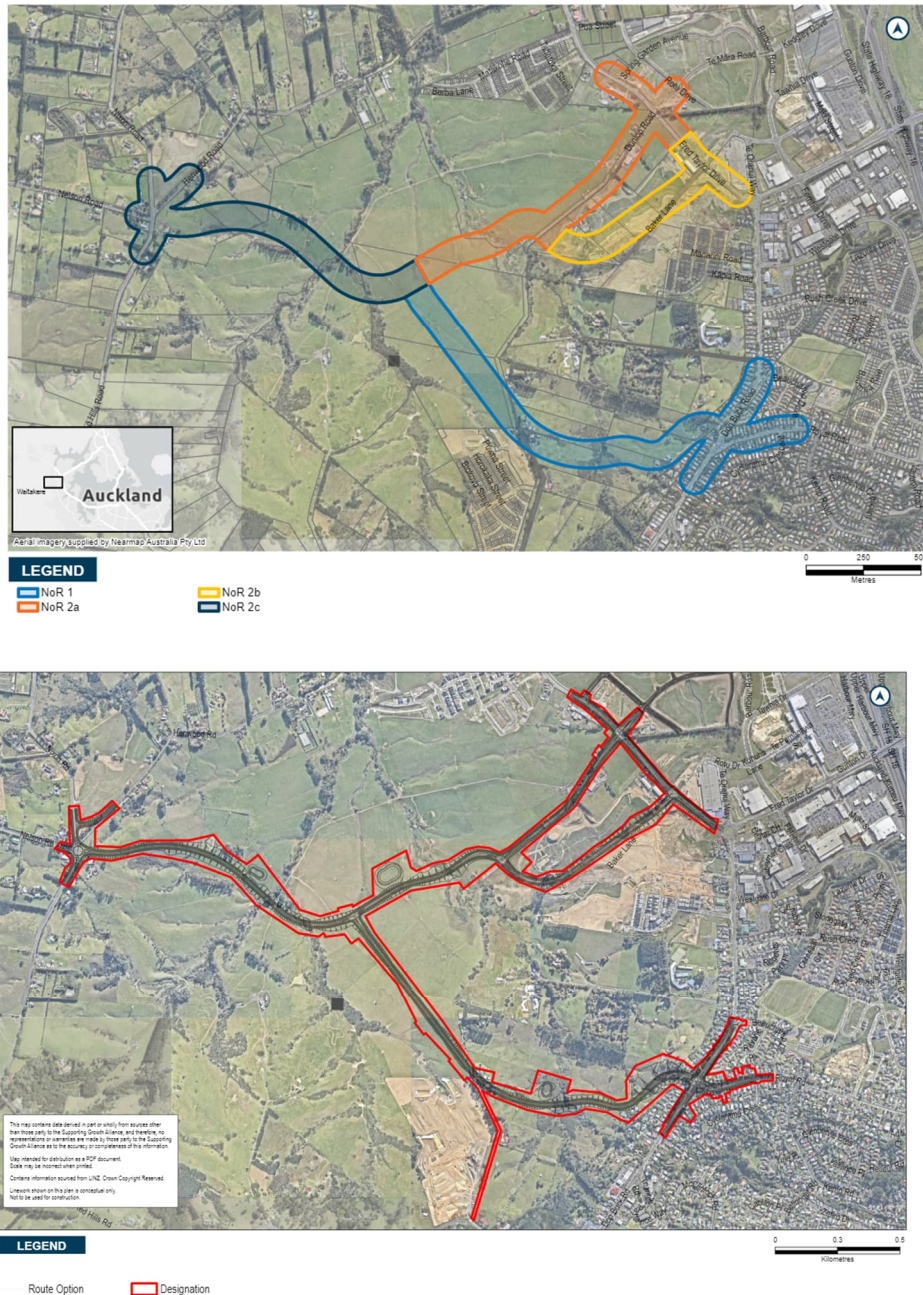


Figure 6-1: Redhills Arterial Transport Network – Overview of NoRs for Assessment

Table 6-1: Summary of NoR's

Corridor	NOR	Description	Requiring Authority
Redhills North-South Arterial Corridor	<b>NoR1</b>	New urban arterial transport corridor and upgrade of the Don Buck and Royal Road intersection.	Auckland Transport
Redhills East-West Arterial Corridor – Dunlop Road	<b>NoR2a</b>	New urban arterial transport corridor which intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR2c) at the intersection with the Redhills North-South arterial corridor.	Auckland Transport
Redhills East-West Arterial Corridor – Baker Lane	<b>NoR2b</b>	New urban arterial transport corridor which intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West corridor and Dunlop Road (NoR2a).	Auckland Transport
Redhills East-West Arterial Corridor – Remaining connection	<b>NoR2c</b>	New urban arterial transport corridor that intersects with the Redhills East-West Arterial Corridor – Dunlop Road intersection.  This includes the upgrade of the existing Red Hills Road / Nelson Road / Nixon Road intersection, and the existing Nixon Road / Henwood Road intersection.	Auckland Transport

## 7 NoR 1: Redhills North-South Arterial Corridor

### 7.1 Project Corridor Features

The Project extends between intersections with Don Buck Road and Royal Road in the south east, to Red Hills Road, Nixon Road and Nelson Road in the north west. An overview of the proposed design has been provided in Section 6.

Key features of the proposed new corridor include a new urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.

### 7.2 Existing and Likely Future Environment

#### 7.2.1 Planning context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 7-1 below provides a summary of the existing and likely future environment as it relates to the North-South Arterial Corridor within the RATN.

**Table 7-1: North-South Arterial Corridor Existing and Likely Future Environment**

Land use today	Zoning	Likelihood of Change for the environment <sup>8</sup>	Likely Future Environment <sup>9</sup>
Rural	Residential – Mixed Housing Suburban	High	Urban
	Residential – Mixed Housing Urban		
	Residential – Terrace Housing and Apartment Building Zone		
	Business – Local Centre Zone		
Residential	Business – Local Centre Zone	Moderate	Urban
	Residential – Mixed Housing Urban	Low	
	Residential – Terrace Housing and Apartment Building Zone		

<sup>8</sup> Based on AUP:OP zoning / policy direction

<sup>9</sup> Based on AUP:OP zoning / policy direction

Land use today	Zoning	Likelihood of Change for the environment <sup>8</sup>	Likely Future Environment <sup>9</sup>
Business	Business – Local Centre Zone	Low	Urban
Special Purpose	Special Purpose – School Zone	Low	Special Purpose

Please refer to the AEE for further information on the planning context.

### 7.2.2 Noise Environment

The Redhills Arterial Transport Network is currently located within an urban area (as defined by Statistics New Zealand) with few PPFs in close proximity to the proposed roads. The noise environment for most PPFs within the Project area is dominated by road traffic noise from vehicles on Don Buck Road, Royal Road, Fred Taylor Drive and the surrounding road network.

## 7.3 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, Do Minimum and Mitigation Option scenarios are shown in Appendix 3. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix 4. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

The traffic noise assessment for this NoR has been separated into the typology of Altered Road and New Road. Each PPF has been assessed against the relevant noise criteria of either a New or Altered Road, depending on the classification as described in Section 3.1.2.

Based on information provided by the Project team, the following residential buildings will be removed to make room for the Project alignment and have not been considered in the assessment:

2 Royal Road  
 4 Royal Road  
 6 Royal Road  
 23 Red Hills Road  
 1 Dunlop Road  
 1 Royal Road  
 25 Red Hills Road  
 443 Don Buck Road  
 445 Don Buck Road  
 456 Don Buck Road  
 458A Don Buck Road  
 460 Don Buck Road

## 7.3.1 Altered Roads

### 7.3.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the North-South Arterial Corridor upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 7-2.

**Table 7-2: NZS 6806 Assessment and Summary – Altered Roads**

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	169	169	169
Cat B	67 dB $L_{Aeq(24h)}$	0	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		<b>169</b>	<b>169</b>	<b>169</b>

Existing scenario predictions show the noise level within the Project area is between 37 – 62 dB  $L_{Aeq(24h)}$  with all PPFs in Category A.

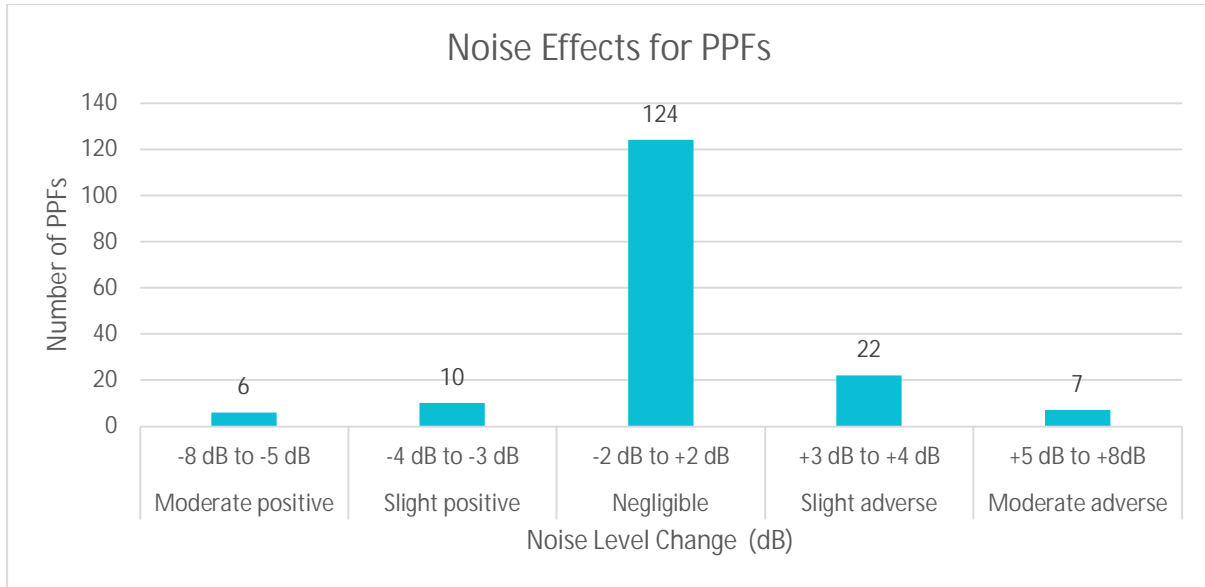
Under the Do Nothing scenario, predictions show a road traffic noise level range between 39 – 64 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A.

Under the Do Minimum scenario, predictions show a traffic noise level range between 41 – 63 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A.

### 7.3.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 7-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios.





**Figure 7-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads**

Noise levels are predicted to change by a negligible margin ( $\pm 2$  dB between the Do Nothing and Do Minimum scenario) at 124 out of 169 PPFs after implementation of the Project.

Predictions indicate that 22 PPFs will experience an increase in noise level of 3-4 dB, resulting in slight adverse effects. Seven PPFs will experience an increase in noise level of 5-8 dB, resulting in moderate adverse noise effects.

Increases in noise levels at these PPFs are due to the demolition of some houses which would otherwise provide acoustic shielding to PPFs behind.

Predictions indicate that 10 PPFs will experience a decrease in noise levels of 3-4 dB, resulting in slight positive effects, and that 6 PPFs will experience a decrease in noise levels of 5-8 dB, resulting in moderate positive effects.

Positive noise changes (both slight and moderate) are due to the overall reduction in noise levels on several sub-arterial roads such as Red Hills Road. The construction of the Project is predicted to redistribute traffic volumes across the surrounding proposed road network.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

### 7.3.2 New Roads

#### 7.3.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the new road, so the Existing and Do Minimum scenarios are compared. A summary of the results of the NZS 6806 assessment is shown in Table 7-3.

**Table 7-3: NZS 6806 Assessment and Summary – New Roads**

Category	Criteria	Number of PPFs	
		Existing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	1	1
Cat B	64 dB $L_{Aeq(24h)}$	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0
Total		1	1

There is only one PPF located within NoR 1 that is to be assessed against new road criteria (27 Redhills Road). A noise level of 47 dB  $L_{Aeq(24h)}$  is predicted at this PPF in the Do Minimum scenario. As a result, this PPF will fall in Category A for the Do Minimum Scenario, therefore mitigation measures were not investigated for this PPF.

### 7.3.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level has been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario noise levels can be compared at 27 Red Hills Road to determine the predicted noise level increase or decrease at the assessed PPF as a result of the Project.

A noise level increase of 12 dB is predicted between the Existing and Do Minimum scenarios at 27 Red Hills Road, resulting in significant adverse effects. This increase is due to the introduction of the new noise source near the PPF.

However, ambient noise levels in the area will likely increase as the area urbanises and therefore the change in noise level due to the Project will likely not be as noticeable at the time.

Also, implementation of a noise barrier was considered at this PPF, however its performance would be compromised since a gap would be required to maintain access from the road, which would compromise the barrier's performance since line of sight would still be maintained to the PPF from the road through the gap.

## 7.4 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Redhills North-South Arterial Corridor. The altered roads in this NoR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicates that noise level changes will be negligible for the majority of PPFs if the Project is constructed.

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that a noise level increase of 12 dB is predicted for the one PPF

located within this NoR, potentially resulting in significant adverse effects. However, ambient noise levels in the area will likely increase as the area urbanises and therefore the change in noise level due to the Project will likely not be as noticeable at the time. Also, a noise barrier was investigated but not considered practical due to the gap that would be required to maintain access to the property compromising the performance of the barrier.

## 8 NoR 2b: Redhills East-West Arterial Corridor – Baker Lane

### 8.1 Project Corridor Features

The Project extends between intersections with Fred Taylor Drive in the north east and connects to the proposed East-West Corridor in the central section of the Project Area. An overview of the proposed design has been provided in Section 6.

Key features of the proposed new corridor include a new urban arterial transport corridor and upgrade of the Fred Taylor Drive and Baker Lane intersection.

### 8.2 Existing and Likely Future Environment

#### 8.2.1 Planning context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the Baker Lane Corridor within the RATN.

**Table 8-1: Baker Lane Corridor Existing and Likely Future Environment**

Land use today	Zoning	Likelihood of Change for the environment <sup>10</sup>	Likely Future Environment <sup>11</sup>
Rural	Residential – Mixed Housing Urban	High	Urban
	Residential – Terraced Housing and Apartment Zone		
Business	Business – Mixed Use Zone	Low	Business
	Business – Light Industry		
Residential	Residential – Mixed Housing Urban	Low	Urban
	Residential – Terraced Housing and Apartment Zone		
Special Purpose	Special Purpose – School Zone	Low	Special Purpose

<sup>10</sup> Based on AUP:OP zoning / policy direction

<sup>11</sup> Based on AUP:OP zoning / policy direction

Please refer to the AEE for further information on the planning context.

### 8.2.2 Noise Environment

The Redhills East-West Arterial Corridor – Baker Lane is currently located within an urban area with no PPFs in close proximity to the proposed roads. The noise environment for PPFs within the Project area is dominated by road traffic noise from vehicles on Fred Taylor Drive and the surrounding road network.

## 8.3 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, Do Minimum and Mitigation Option scenarios are shown in Appendix 3. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix 4. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Each PPF has been assessed against the Altered Roads criteria in accordance with NZS 6806. Based on information provided by the Project team, the following residential building will be removed to make room for the Project alignment and have not been considered in the assessment:

68 Fred Taylor Drive

### 8.3.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the East-West Arterial Corridor – Baker Lane upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 8-2.

**Table 8-2 NZS 6806 Assessment and Summary – Altered Roads**

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB L <sub>Aeq(24h)</sub>	10	10	10
Cat B	67 dB L <sub>Aeq(24h)</sub>	0	0	0
Cat C	40 dB Internal L <sub>Aeq(24h)</sub>	0	0	0
Total		<b>10</b>	<b>10</b>	<b>10</b>

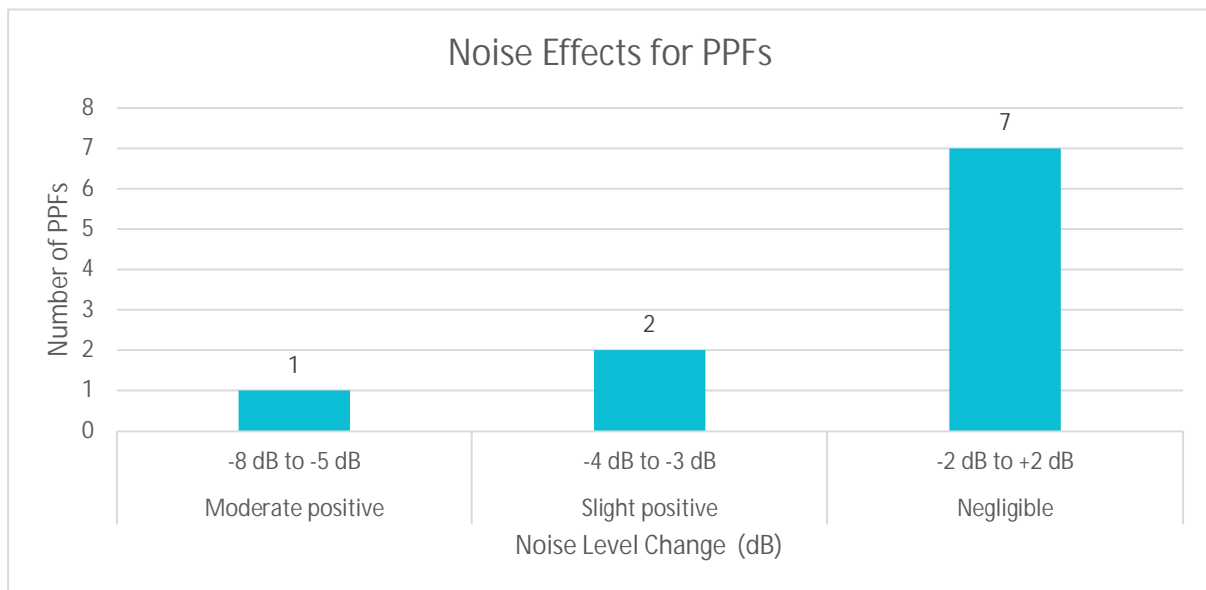
Existing scenario predictions show noise levels within the Project area are between 47 – 58 dB  $L_{Aeq(24h)}$  with all PPFs in Category A.

Under the Do Nothing scenario, predictions show a noise level range between 50 – 62 dB  $L_{Aeq(24h)}$ , still with all PPFs in Category A.

Under the Do Minimum scenario, predictions show a traffic noise level range between 49 – 60 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A.

### 8.3.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 8-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios.



**Figure 8-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads**

Noise levels are predicted to change by a negligible margin at 7 out of 10 PPFs after implementation of the Project.

Predictions indicate that 2 PPFs will experience a decrease in noise level of 3-4 dB, resulting in slight positive effects. 1 PPF will experience a decrease in noise level of 5-8 dB, resulting in moderate positive noise effects.

Positive noise changes (both slight and moderate) are due to the overall reduction in noise levels from Don Buck Road and Fred Taylor Drive, coming from the redistribution of traffic volumes across the surrounding proposed road network as a result of the Project.

## 8.4 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Redhills East-West Arterial Corridor – Baker Lane. The road did not meet the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation measures were not investigated further.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicates that most PPFs will experience a negligible change in noise levels, with three PPFs experiencing slight or moderate positive noise effects.

## 9 NoR 2c: Redhills East-West Arterial Corridor – Remaining Connection

### 9.1 Project Corridor Features

The Project extends between intersections with the proposed East-West Arterial Corridor – Dunlop Road in the central section of the Project Area, to the Red Hills Road, Nixon Road and Nelson Road intersection in the north west.

Key features of the proposed new corridor include a new urban arterial transport corridor and upgrade of Red Hills Road, Nixon Road and Nelson Road Intersection.

### 9.2 Existing and Likely Future Environment

#### 9.2.1 Planning context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 9-1 below provides a summary of the existing and likely future environment as it relates to the Nixon Road Connection within the RATN.

**Table 9-1: Nixon Road Connection Existing and Likely Future Environment**

Land use today	Zoning	Likelihood of Change for the environment <sup>12</sup>	Likely Future Environment <sup>13</sup>
Rural	Residential – Single House	High	Urban
	Residential – Mixed Housing Suburban		
	Residential – Mixed Housing Urban		
	Residential – Terraced Housing and Apartment Zone		

Please refer to the AEE for further information on the planning context.

#### 9.2.2 Noise Environment

The noise environment for PPFs within the Project area is dominated by road traffic noise from vehicles on Red Hills Road, Nixon Road and Nelson Road.

<sup>12</sup> Based on AUP:OP zoning / policy direction

<sup>13</sup> Based on AUP:OP zoning / policy direction



### 9.3 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, Do Minimum and Mitigation Option scenarios are shown in Appendix 3. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix 4. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Each PPF has been assessed against the Altered Road criteria in accordance with NZS 6806.

#### 9.3.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the East-West Arterial Corridor – Remaining Connection upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 9-2.

**Table 9-2: NZS 6806 Assessment and Summary – Altered Roads**

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	7	6	7
Cat B	67 dB $L_{Aeq(24h)}$	0	1	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		7	7	7

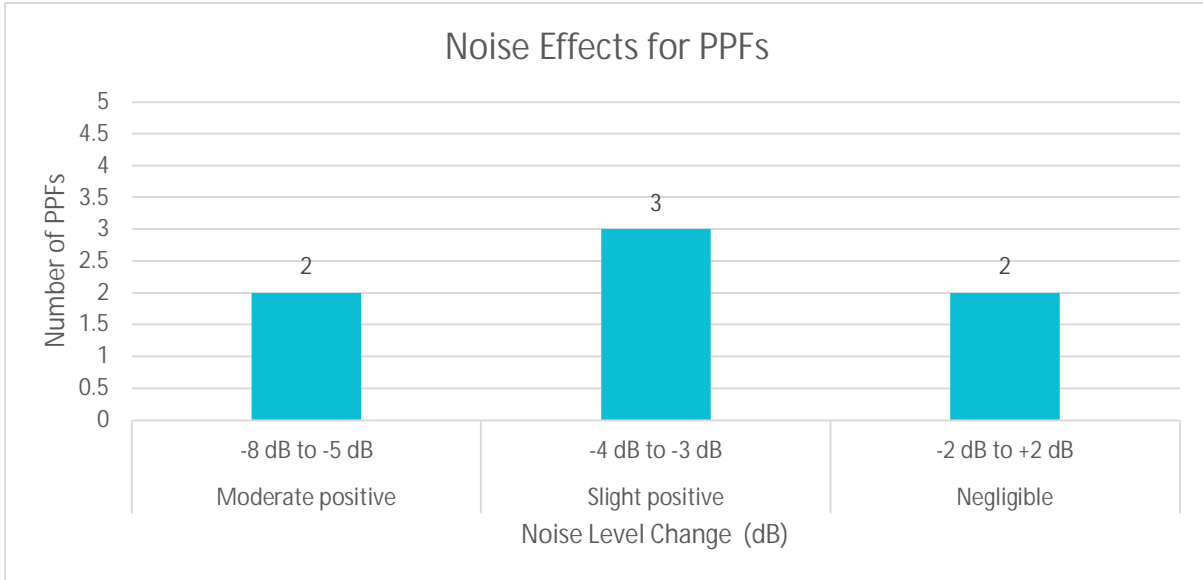
Existing scenario predictions show the noise level within the Project area is between 48 – 60 dB  $L_{Aeq(24h)}$  with all PPFs in Category A.

Under the Do Nothing scenario, predictions show a traffic noise level range between 54 – 66 dB  $L_{Aeq(24h)}$ , with all except one PPF in Category A. The increase in road traffic noise levels compared to the Existing scenario is due to the growth in road traffic throughout the Project area without the construction of the project.

Under the Do Minimum scenario, predictions show a traffic noise level range between 51 – 61 dB  $L_{Aeq(24h)}$ , with all PPFs in Category A. Changes in road traffic noise levels in this scenario are due to the redistribution of traffic around the Project area's road network, with a reduction in traffic volumes predicted along Red Hills Road.

### 9.3.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 9-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios.



**Figure 9-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads**

Noise levels are predicted to change by a negligible margin at 2 out of 7 PPFs after implementation of the Project.

Predictions indicate that 3 PPFs will experience a decrease in noise level of 3-4 dB, resulting in slight positive effects. 2 PPFs will experience a decrease in noise level of 5-8 dB, resulting in moderate positive noise effects.

Positive noise changes (both slight and moderate) are due to the overall reduction in noise levels on several sub-arterial roads such as Red Hills Road. The construction of the Project is predicted to redistribute traffic volumes across the surrounding proposed road network.

## 9.4 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Redhills East-West Arterial Corridor – Remaining Connection. The altered roads do not meet the definition of an Altered Road in accordance with NZS 6806, therefore mitigation measures were not investigated further.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicated that noise level changes will result in either slight or moderate positive noise effects at five PPFs, while two PPFs are expected to experience negligible noise level changes.

## 10 Conclusion

An assessment of traffic noise has been carried out for the Redhills Arterial Transport Network for New and Altered Roads based on NZS 6806 and the predicted change in noise level. To determine the change in noise level a comparison has been made between the predicted road traffic noise levels in the Existing (for New Roads) or Do Nothing (for Altered Roads) scenario (representative of the design year without the Project, assuming traffic from full area development on the existing road network) and Do Minimum scenario (with the Project implemented).

All existing PPFs within 100m of each alignment have been considered within the assessment. Buildings that are within the NoR designation boundaries have been removed from the Do Minimum scenario as they will not remain following the Project implementation.

For Altered Roads in NoR 1, the North-South Arterial Corridor upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. All PPFs will meet the Category A criterion for the Do Minimum scenario. The Standard therefore does not apply, and mitigation options do not need to be considered. Predictions indicate that 29 PPFs will experience either slight adverse or moderate adverse noise effects due to the Project when comparing the Do Nothing and Do Minimum scenarios, with 124 PPFs experiencing a negligible change in noise levels. Sixteen PPFs will experience either slight or moderate positive noise effects. PPFs which experience an adverse change in noise levels (both slight and moderate) are due to the effects of the demolition of dwellings providing shielding from noise to PPFs behind them.

For New Roads in NoR 1, the single PPF at 27 Red Hills Road will be in Category A. Ambient noise levels will likely increase as the area urbanises and therefore any change in noise level due to the Project may not be as noticeable at the time.

NoR 2a does not contain any PPFs that will remain after the construction of the Project and was therefore excluded from assessment. As a result, no further consideration for NoR 2a was given, however this should be re-assessed closer to the time of construction.

For NoR 2b, the East-West Arterial Corridor – Baker Lane upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. All PPFs will meet the Category A criterion for the Do Minimum scenario. The Standard therefore does not apply, and mitigation options do not need to be considered. Noise levels are predicted to decrease at three PPFs, which will experience either slight positive or moderate positive noise effects due to the Project when comparing the Do Nothing and Do Minimum scenarios, with seven PPFs experiencing a negligible change in noise levels.

This decrease in noise level is due to the redistribution of traffic around the Project area's existing road network, reducing road traffic along Fred Taylor Drive and Don Buck Road.

For NoR 2c, the East-West Arterial Corridor – Remaining Connection upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. All PPFs will meet the Category A criterion for the Do Minimum scenario. The Standard therefore does not apply, and mitigation options do not need to be considered. Predictions indicate that five PPFs will experience either slight positive or moderate positive noise effects due to the Project when comparing the Do Nothing and Do Minimum scenarios, with two PPFs experiencing a negligible change in noise levels.

All predictions are based on traffic flow along New and Altered Roads at the design year (2048). These traffic volumes are predicated on the anticipated urbanisation of the area and implementation of surrounding infrastructure projects. Development of the surrounding areas will likely increase activity and associated noise levels. Therefore, any changes predicted for the traffic noise effects related to these Projects are not likely to represent such a significant change at the time of construction due to the change in environment.

As such, the results are indicative of a possible future scenario, but effects cannot be definitively determined at this stage. Reassessment of the road traffic noise at current PPFs will be carried out nearer the time of construction to confirm that the recommended mitigation still represents the best practicable option. The review, confirmation and refinement of the BPO shall aim to achieve the same noise criteria categories as determined in this document.

Nevertheless, the predictions show that all PPFs across all Projects will receive levels within the Category A criteria in the Do Minimum scenario (with the implementation of the Project), which is the most stringent Category in NZS 6806 and represents the lowest design noise levels. Therefore, resulting noise levels will be reasonable in a residential context at the majority of PPFs assessed and no further noise mitigation is deemed necessary at this stage.

Traffic vibration from new or upgraded roading projects is not generally expected to create any vibration issues. Therefore, traffic vibration has not been assessed for the Projects.

## Appendix 1: Assumptions

Package	Project(s)	Existing	Do Nothing	Do Minimum
<b>Whenuapai Arterials</b>	Trig Road upgrade (NoR W1)	x	x	√
	Māmari Road upgrade (NoR W2)	x	x	√
	Brigham Creek Road upgrade (NoR W3)	x	x	√
	Spedding Road upgrade (NoR W4)	x	x	√
	Hobsonville Road upgrade (NoR W5)	x	x	√
<b>Redhills Arterials</b>	Fred Taylor Drive FTN upgrade	x	√	√
	Northside Drive East extension	x	√	√
	Don Buck Road FTN upgrade	x	√	√
	Royal Road FTN upgrade	x	√	√
<b>Riverhead Arterials</b>	Coatesville – Riverhead Highway upgrade	x	√	√
	Riverhead Road upgrade	x	√	√
<b>Strategic Projects</b>	Rapid Transit Corridor (RTC)	x	√	√
	Alternative State Highway (ASH)	x	√	√
	Brigham Creek Interchange	x	√	√
	Regional Active Mode Corridor (RAMC)	x	√	√
	SH16 Main Road upgrade	x	√	√
	Access Road upgrade	x	√	√
	Station Road upgrade	x	√	√
<b>Growth</b>	Land Use Assumptions	up to 2015	up to 2048+	up to 2048+

Key		
	√	Included
	x	Excluded
	*	Minimal Network Change

## Appendix 2: Noise Monitoring Results

# Noise Logger Report

440 Don Buck Road, Whenuapai



Item	Information
Logger Type	Svan
Serial number	20614
Address	440 Don Buck Road, Whenuapai
Location	440 Don Buck Road, Whenuapai
Facade / Free Field	Free field
Environment	road

## Measured noise levels

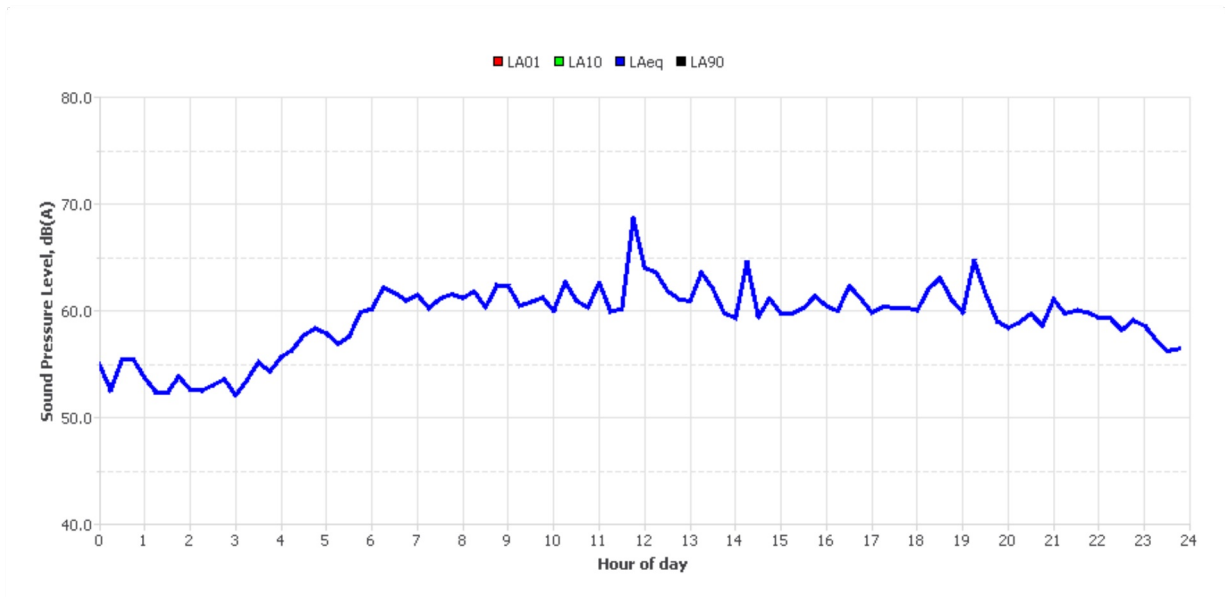
Logging Date	L <sub>Aeq</sub> Day	Eve	Night	ABL Day	Eve	Night	L <sub>Aeq</sub> ,15hr	L <sub>Aeq</sub> ,9hr
Tue Nov 19 2019	-	60	56	-	-	-	60	56
Wed Nov 20 2019	62	61	57	-	-	-	62	57
Thu Nov 21 2019	63	61	57	-	-	-	63	57
Fri Nov 22 2019	63	63	57	-	-	-	63	57
Sat Nov 23 2019	62	59	54	-	-	-	61	54
Sun Nov 24 2019	59	58	53	-	-	-	59	53
Mon Nov 25 2019	64	63	58	-	-	-	64	58
Tue Nov 26 2019	62	60	57	-	-	-	62	57
Wed Nov 27 2019	61	62	58	-	-	-	61	58
Thu Nov 28 2019	64	-	57	-	-	-	64	57
<b>Summary</b>	<b>62</b>	<b>61</b>	<b>57</b>	-	-	-	<b>62</b>	<b>57</b>

Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

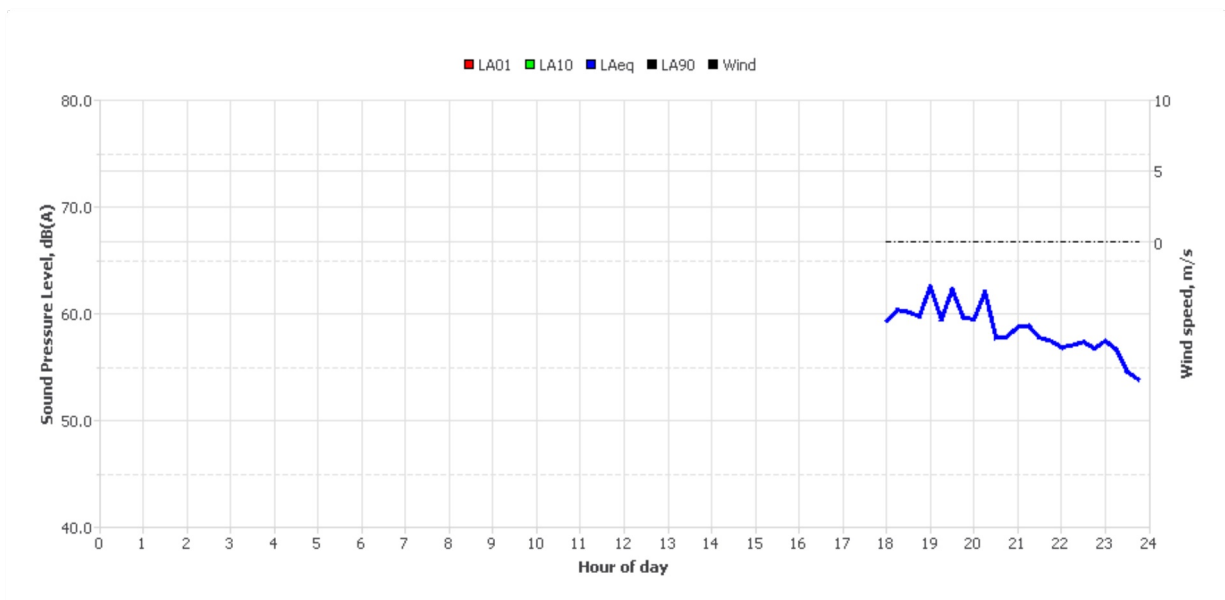
Logger Location	Logger Deployment Photo



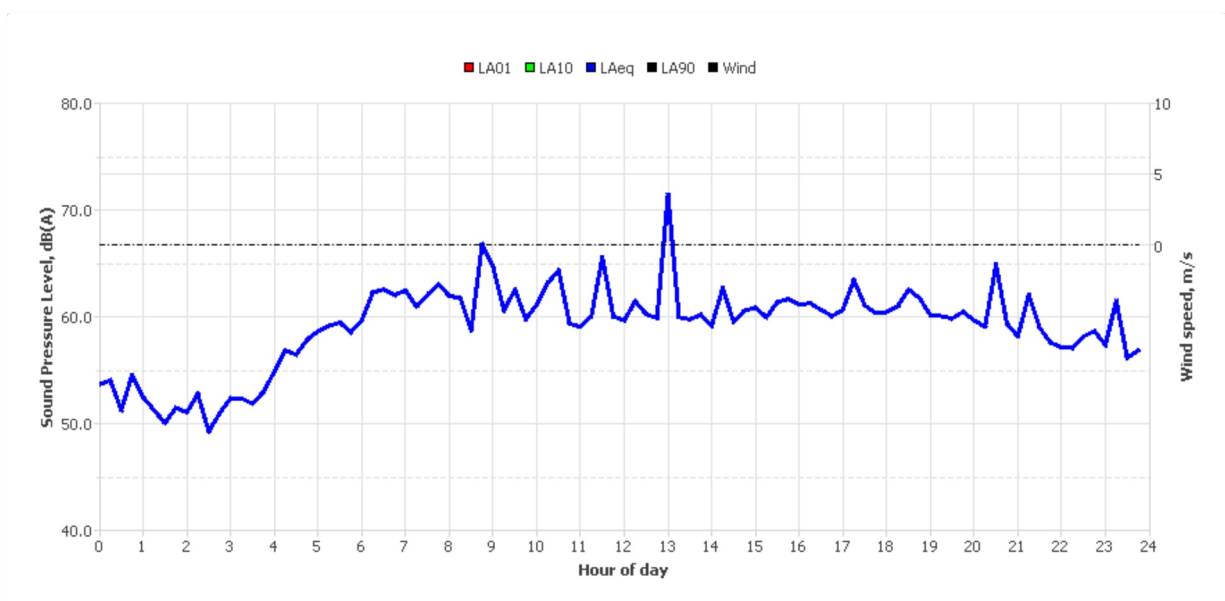
## Typical Day



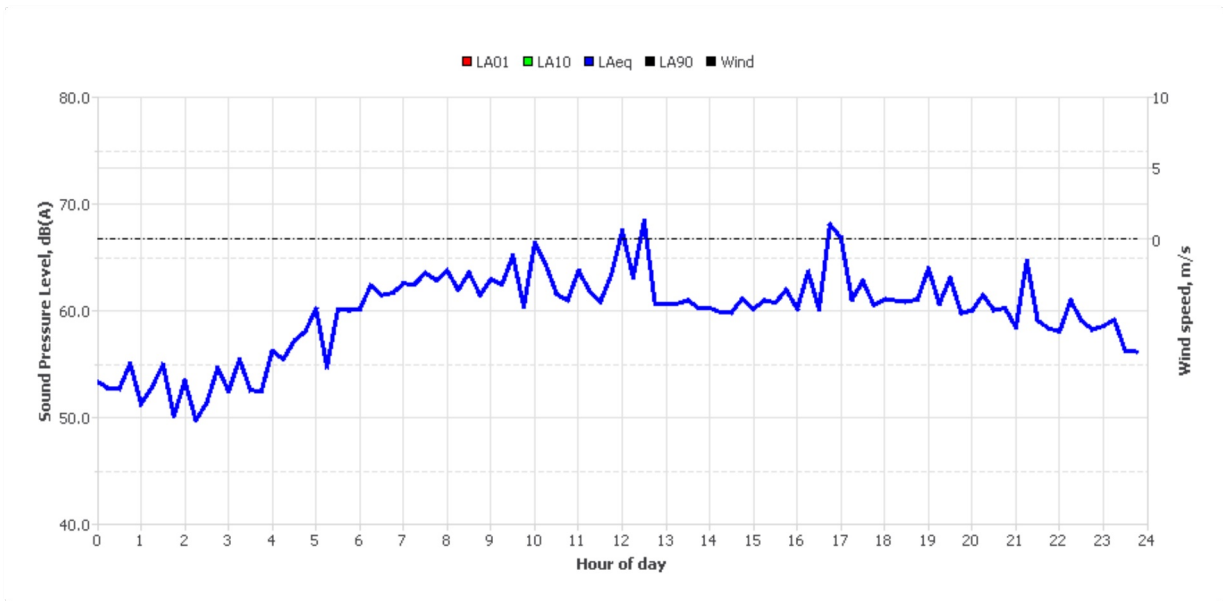
## Tuesday, 19 Nov 2019



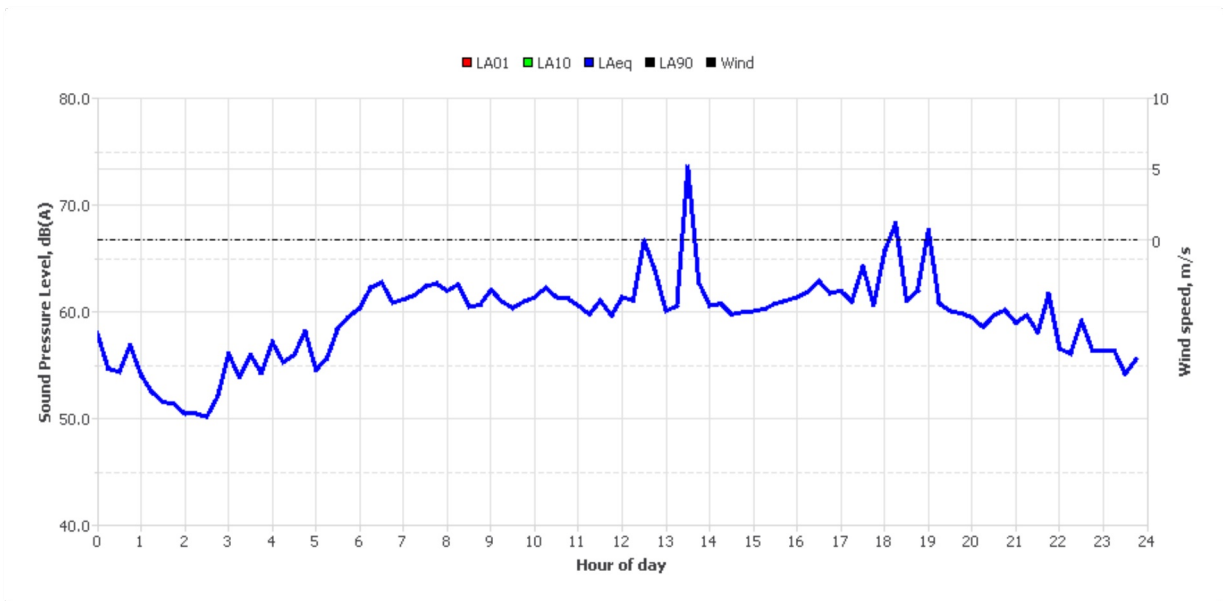
## Wednesday, 20 Nov 2019



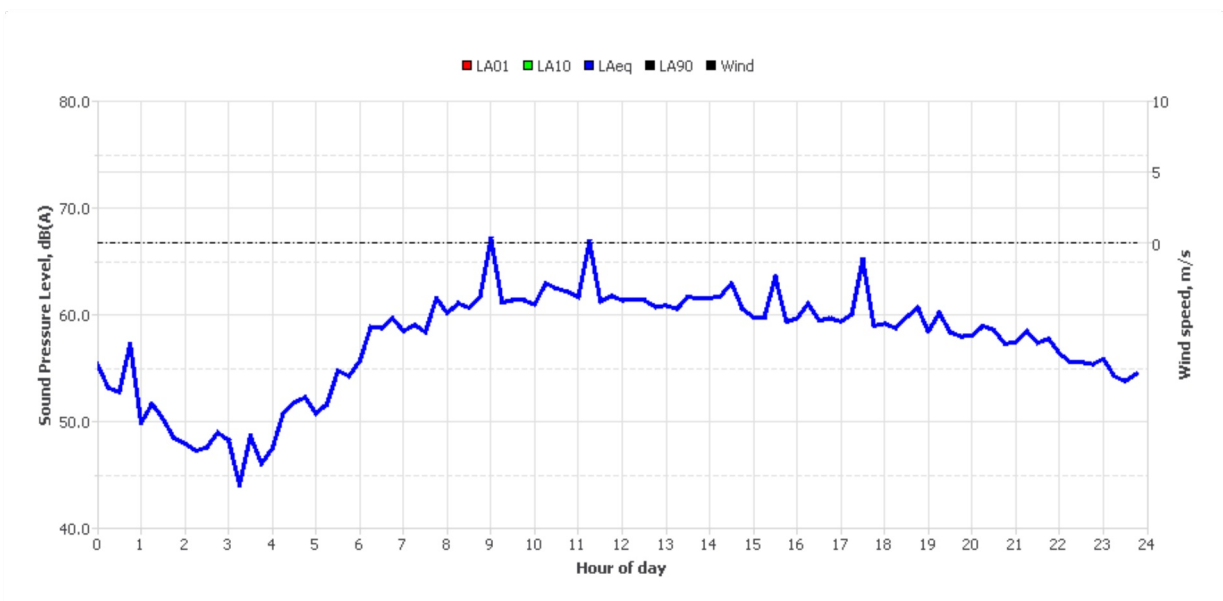
Thursday, 21 Nov 2019



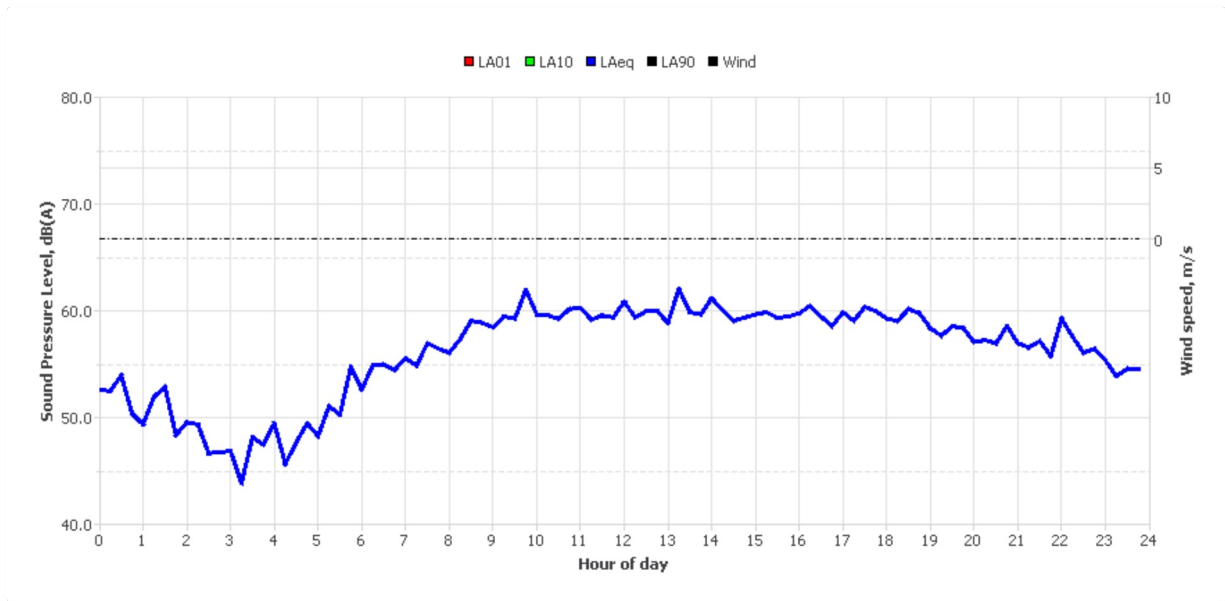
Friday, 22 Nov 2019



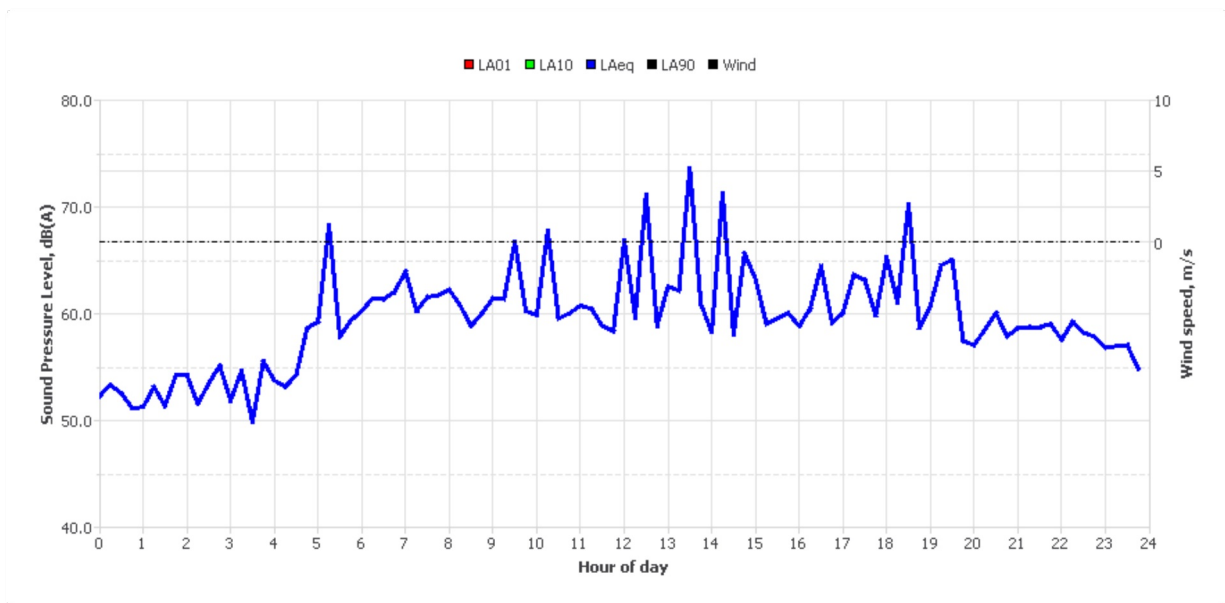
Saturday, 23 Nov 2019



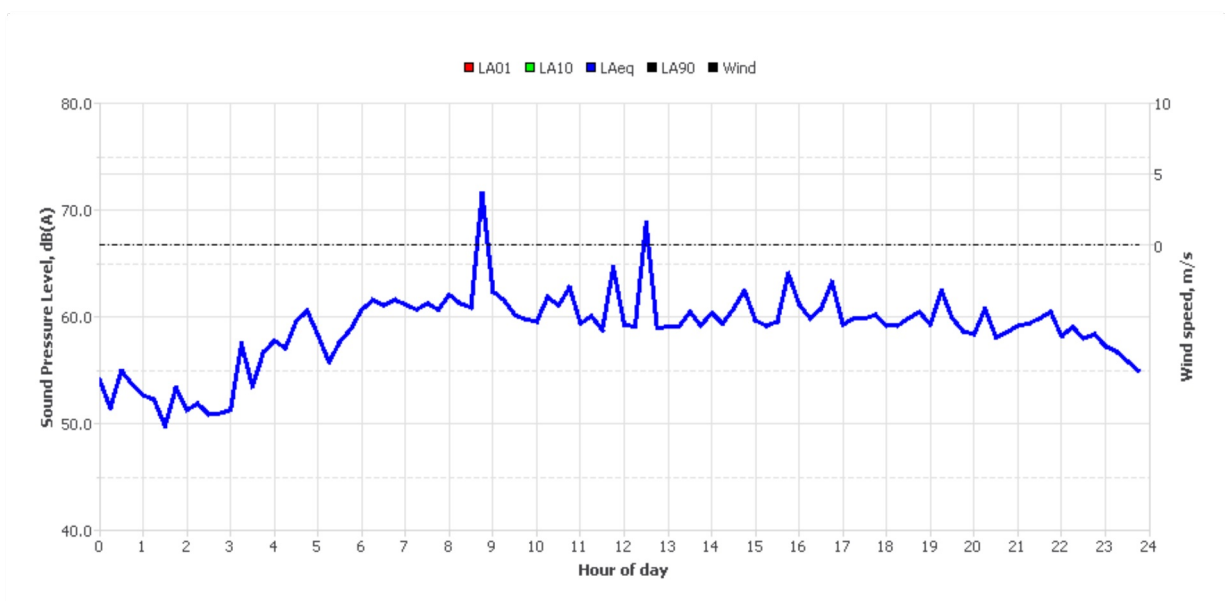
Sunday, 24 Nov 2019



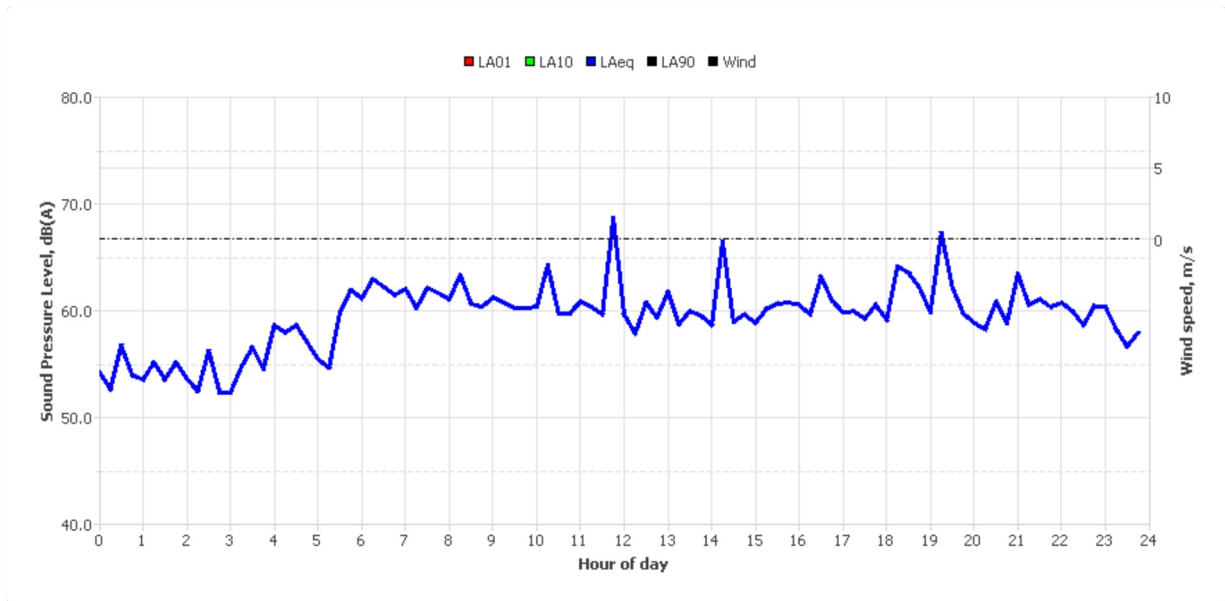
Monday, 25 Nov 2019



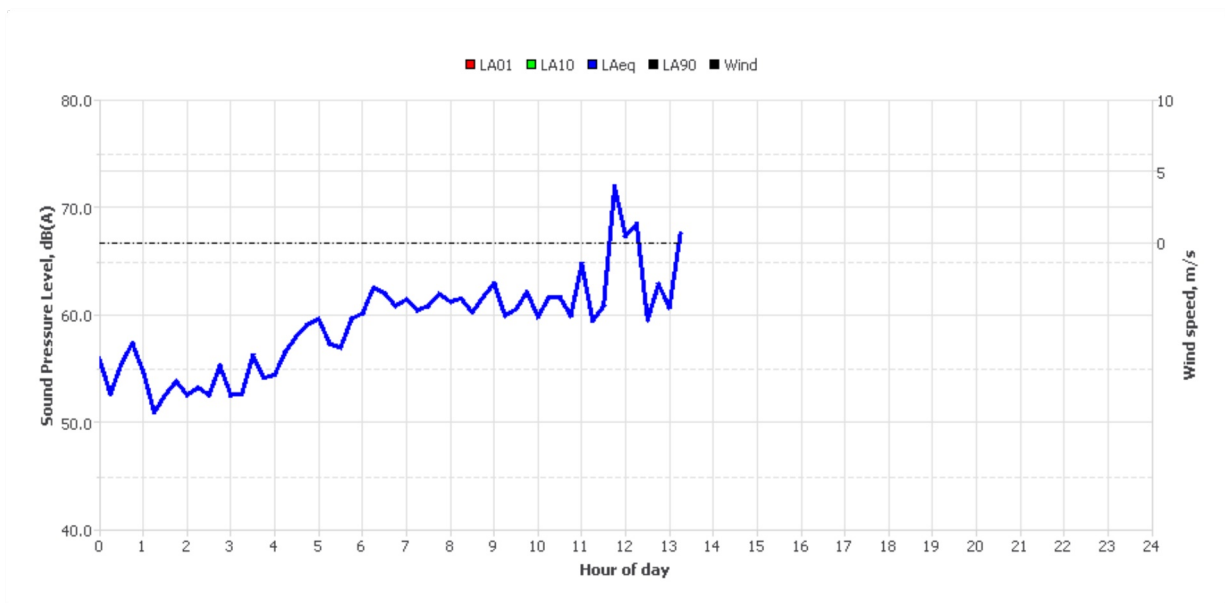
Tuesday, 26 Nov 2019



Wednesday, 27 Nov 2019



Thursday, 28 Nov 2019



## Appendix 3: Predicted Traffic Noise Levels

### KEY

Cat A	Cat B	Cat C
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### NoR 1 Altered Roads

Address	Existing	Do Nothing	Do Minimum
40 Royal Road	60	62	63
20A Belleaire Court	60	62	63
32 Royal Road	59	61	63
432 Don Buck Road	62	64	63
428 Don Buck Road	61	63	62
434 Don Buck Road	61	62	62
492 Don Buck Road	61	63	62
38 Royal Road	57	58	61
2/47, Royal Road	56	57	61
30 Royal Road	57	60	61
20 Belleaire Court	59	60	61
31 Royal Road	56	58	61
36 Royal Road	57	57	61
490 Don Buck Road	59	61	60
480 Don Buck Road	61	63	60
27 Royal Road	55	58	60
37 Royal Road	55	57	60
29 Royal Road	56	58	60
25 Royal Road	54	56	60
51 Royal Road	55	57	60
461 Don Buck Road	58	60	60
459 Don Buck Road	58	59	59
34 Royal Road	56	57	59
440, Don Buck Road	59	61	59
423 Don Buck Road	59	60	59
486 Don Buck Road	59	61	59
40A Royal Road	55	58	59
2/14, Royal Road	58	60	59
44 Royal Road	55	58	59
463 Don Buck Road	57	59	59
16 Royal Road	54	56	59
23 Royal Road	53	56	59
49 Royal Road	54	56	59
131A Hobsonville Road	57	59	59
422 Don Buck Road	58	59	58
417 Don Buck Road	57	58	57
45 Royal Road	53	54	57

41 Royal Road	53	54	57
39 Royal Road	53	54	57
131 Hobsonville Road	56	58	57
478 Don Buck Road	59	61	57
19 Luckens Road	56	58	57
465 Don Buck Road	55	57	57
415 Don Buck Road	56	57	56
22A Trig Road	56	58	56
484 Don Buck Road	56	58	56
1, 33 Cyclarama Crescent	52	54	56
442 Don Buck Road	58	60	56
18 Belleaire Court	55	57	56
473 Don Buck Road	54	56	56
479 Don Buck Road	54	56	56
1, 53 Kemp Road	45	47	56
469 Don Buck Road	55	56	55
145A Hobsonville Road	57	58	55
21 Royal Road	52	54	55
34A Trig Road	54	56	55
407 Don Buck Road	54	55	55
476 Don Buck Road	57	59	55
2/14, Royal Road	53	55	55
457 Don Buck Road	52	53	54
444 Don Buck Road	56	57	54
31 Beauchamp Drive	52	54	54
147F Hobsonville Road	55	57	54
464 Don Buck Road	54	56	54
3 Royal Road	51	53	54
2 Cyclarama Crescent	49	52	54
448A Don Buck Road	46	48	54
420 Don Buck Road	53	54	53
490 Don Buck Road	52	53	53
431 Don Buck Road	53	55	53
470 Don Buck Road	56	58	53
444A Don Buck Road	47	49	53
450A Don Buck Road	46	48	53
450 Don Buck Road	54	55	53
438 Don Buck Road	46	48	53
28 Beauchamp Drive	51	53	53
452 Don Buck Road	54	55	53
462 Don Buck Road	53	54	53
29 Cyril Crescent	48	50	53
472 Don Buck Road	57	59	53
17 Royal Road	47	50	52
5 Royal Road	52	54	52
436 Don Buck Road	46	47	52

21 Cyclarama Crescent	50	52	52
454 Don Buck Road	52	54	52
13 Royal Road	55	58	52
416 Don Buck Road	51	53	52
446 Don Buck Road	56	57	52
17 Cyclarama Crescent	49	51	52
11 Royal Road	54	57	52
15 Royal Road	49	51	51
27 Cyclarama Crescent	50	52	51
9 Royal Road	52	55	51
425 Don Buck Road	51	52	51
3A Royal Road	47	49	51
1/7, Royal Road	52	54	51
426 Don Buck Road	43	45	51
2/14, Royal Road	45	47	51
13 Cyclarama Crescent	47	49	51
474 Don Buck Road	53	54	50
21 Royal Road	46	48	50
2/28, Royal Road	43	48	50
433 Don Buck Road	50	52	50
21 Cyclarama Crescent	49	51	50
459 Don Buck Road	48	50	50
29 Cyclarama Crescent	48	49	50
129B Hobsonville Road	47	50	50
437 Don Buck Road	50	52	50
26 Beauchamp Drive	48	50	50
441 Don Buck Road	50	52	50
435 Don Buck Road	50	52	50
440, Don Buck Road	46	48	49
145B Hobsonville Road	53	55	49
451 Don Buck Road	47	50	49
9A Royal Road	49	50	49
23 Royal Road	46	48	49
1/7, Royal Road	48	50	49
426 Don Buck Road	44	46	49
2/14, Royal Road	47	49	49
29 Beauchamp Drive	47	49	49
1/31, Cyclarama Crescent	48	49	49
413 Don Buck Road	47	49	49
19 Cyclarama Crescent	46	48	48
31 Royal Road	43	46	48
475 Don Buck Road	46	49	48
2/33, Cyclarama Crescent	46	48	47
439 Don Buck Road	50	51	47
424 Don Buck Road	45	47	47
6 Beauchamp Drive	45	48	47

15 Cyclarama Crescent	42	45	47
27A Royal Road	43	45	47
477 Don Buck Road	47	48	47
3A Louise Place	45	47	46
3 Beauchamp Drive	43	46	46
4 Beauchamp Drive	42	44	46
37 Cyclarama Crescent	45	47	46
1/31, Cyclarama Crescent	45	46	46
3A Louise Place	44	47	46
41A, Cyclarama Crescent	45	47	46
476A Don Buck Road	45	47	46
11 Cyclarama Crescent	43	45	46
18 Reverie Place	43	47	45
20 Reverie Place	42	46	45
16 Reverie Place	43	47	45
13 Reverie Place	44	46	45
39 Cyclarama Crescent	44	46	45
8 Beauchamp Drive	43	46	45
3 Cyclarama Crescent	41	43	45
25 Beauchamp Drive	43	46	45
3/427 Don Buck Road	44	46	45
39 Cyclarama Crescent	44	46	45
23 Beauchamp Drive	43	45	44
11 Reverie Place	42	44	44
27 Beauchamp Drive	42	45	44
14 Reverie Place	42	45	44
43 Royal Road	40	42	44
15 Reverie Place	42	44	44
9 Cyclarama Crescent	41	43	44
7 Reverie Place	42	44	44
5 Cyclarama Crescent	40	42	44
6 Cyclarama Crescent	40	42	44
9 Reverie Place	42	44	43
3 Kemp Road	39	42	43
7 Cyclarama Crescent	40	42	43
3/427 Don Buck Road	41	43	42
4 Cyclarama Crescent	37	39	42
411 Don Buck Road	40	42	42
5 Kemp Road	38	40	42
421 Don Buck Road	40	42	41

## NoR 2 New Roads

Address	Existing	Do Minimum
27 Red Hills Road	35	47



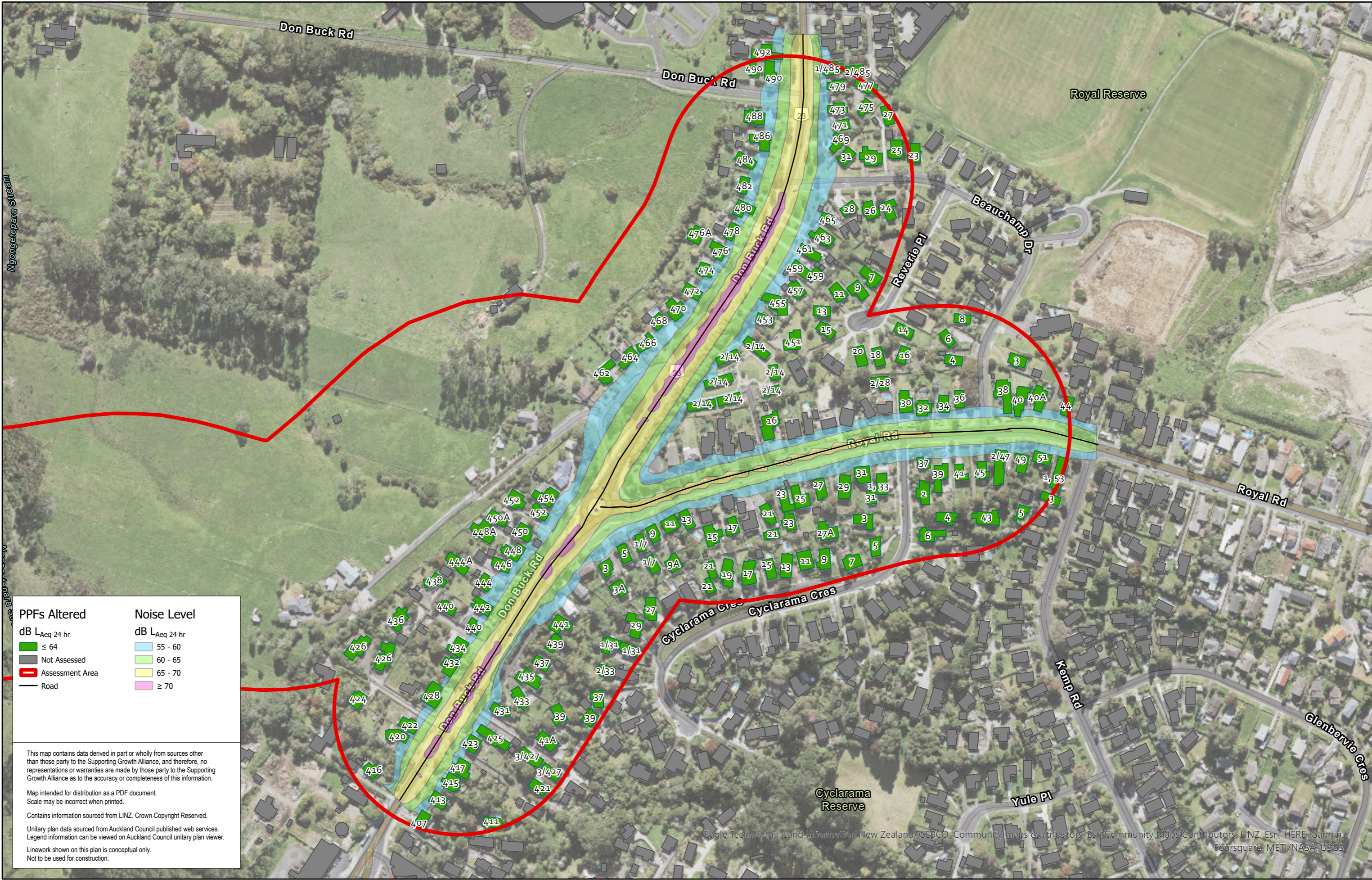
## NoR 2b Altered Roads

Address	Existing	Do Nothing	Do Minimum
554A Don Buck Road	50	53	52
554 Don Buck Road	47	52	49
552A Don Buck Road	50	55	52
558 Don Buck Road	52	53	56
556 Don Buck Road	47	50	49
560 Don Buck Road	55	58	59
562 Don Buck Road	57	61	59
552 Don Buck Road	53	61	55
552 Don Buck Road	58	62	60
54 Fred Taylor Drive	50	51	53

## NoR 2c Altered Roads

Address	Existing	Do Nothing	Do Minimum
7, 31 Nelson Road	59	64	58
307, Red Hills Road	58	64	59
315 Red Hills Road	60	66	61
319 Red Hills Road	48	54	54
8 Nelson Road	50	55	56
315 Red Hills Road	55	60	56
319 Red Hills Road	49	55	51

## Appendix 4: Noise Contour Maps



PPFs Altered		Noise Level	
dB LAeq 24 hr		dB LAeq 24 hr	
<span style="display:inline-block; width:10px; height:10px; background-color:blue; border:1px solid black;"></span>	≤ 64	<span style="display:inline-block; width:10px; height:10px; background-color:lightblue; border:1px solid black;"></span>	55 - 60
<span style="display:inline-block; width:10px; height:10px; background-color:grey; border:1px solid black;"></span>	Not Assessed	<span style="display:inline-block; width:10px; height:10px; background-color:lightgreen; border:1px solid black;"></span>	60 - 65
<span style="display:inline-block; width:10px; height:10px; border:2px solid red;"></span>	Assessment Area	<span style="display:inline-block; width:10px; height:10px; background-color:yellow; border:1px solid black;"></span>	65 - 70
<span style="display:inline-block; width:10px; height:10px; border-bottom:2px solid black;"></span>	Road	<span style="display:inline-block; width:10px; height:10px; background-color:pink; border:1px solid black;"></span>	≥ 70

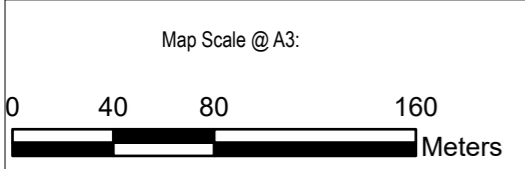
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Revision	Author	Verified	Approved	Date	Title:
1	Author	DRAFT	DRAFT	dd/mm/yyyy	

**Supporting Growth**  
Redhills - Existing Scenario - NoR 1

Working Plans of Te Tupu Ngatahi.  
For the purpose of INTERNAL workshops (not for wider distribution)

Client:	Supporting Growth
Project:	North West HIF

Discipline:	GIS
Drawing No:	SGA-NV-NW-013



**PPFs Altered**

dB LAeq 24 hr

- ≤ 64
- ≤ 57
- Not Assessed
- Assessment Area

**Noise Level**

dB LAeq 24 hr

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

— Road

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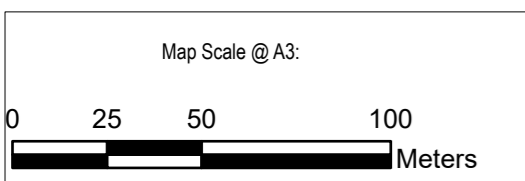
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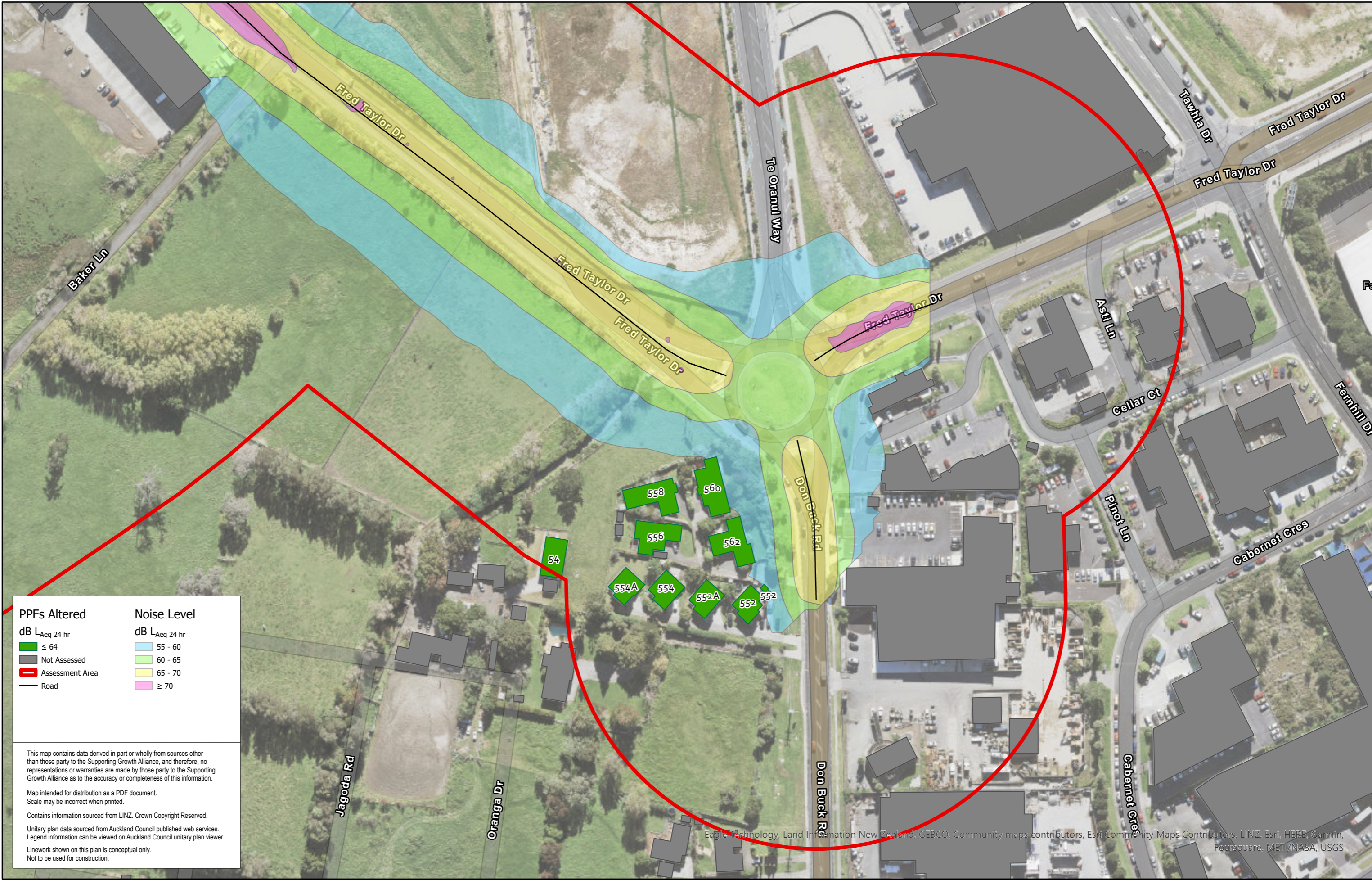
**Supporting Growth**

**Redhills - Existing Scenario - NoR 1**

Working Plans of Te Tupu Ngatahi.  
For the purpose of INTERNAL workshops (not for wider distribution)

Client:	Supporting Growth
Project:	North West HIF

Discipline:	GIS
Drawing No:	SGA-NV-NW-013



PPFs Altered		Noise Level	
dB LAeq 24 hr		dB LAeq 24 hr	
<span style="color: green;">■</span>	≤ 64	<span style="color: lightblue;">■</span>	55 - 60
<span style="color: grey;">■</span>	Not Assessed	<span style="color: lightgreen;">■</span>	60 - 65
<span style="border: 1px solid red; display: inline-block; width: 10px; height: 10px;"></span>	Assessment Area	<span style="color: yellow;">■</span>	65 - 70
<span style="color: black;">—</span>	Road	<span style="color: pink;">■</span>	≥ 70

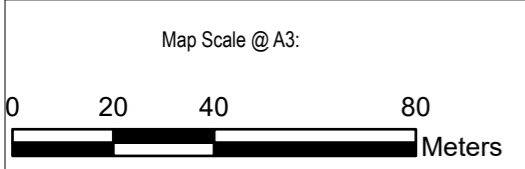
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1	Author	DRAFT	DRAFT	dd/mm/yyyy

**Supporting Growth**  
**Redhills - Existing Scenario - NoR 2b**

*Working Plans of Te Tupu Ngatahi.  
 For the purpose of INTERNAL workshops (not for wider distribution)*

Client:	Supporting Growth
Project:	North West HIF

Discipline:	GIS
Drawing No:	SSGA-NV-NW-013



PPFs Altered	Noise Level
dB LAeq 24 hr	dB LAeq 24 hr
█ ≤ 64	█ 55 - 60
█ Not Assessed	█ 60 - 65
█ Assessment Area	█ 65 - 70
█ Road	█ ≥ 70

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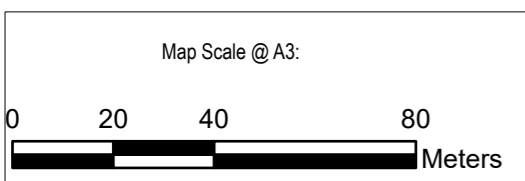
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1	Author	DRAFT	DRAFT	dd/mm/yyyy

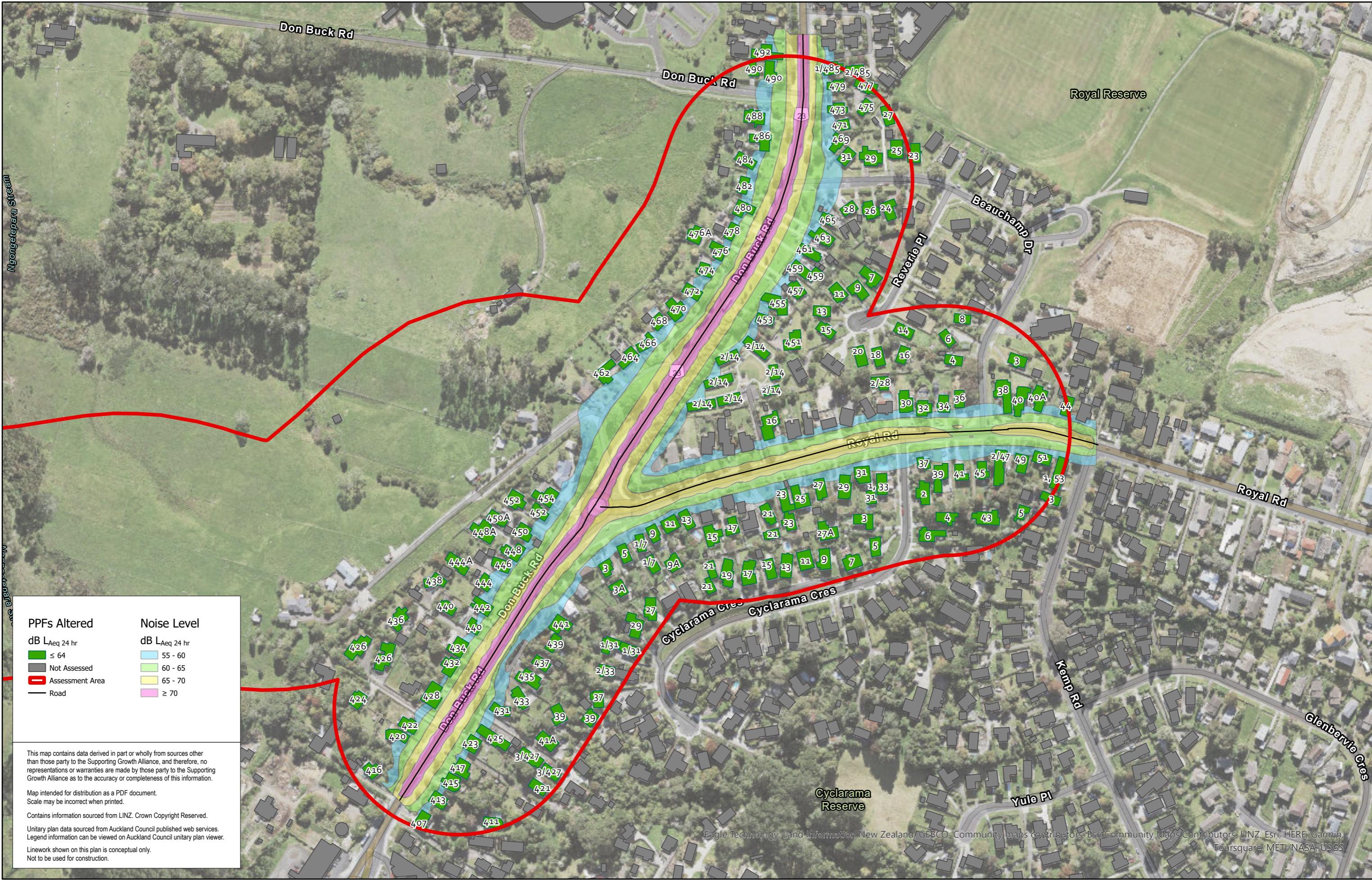
**Supporting Growth**  
**Redhills - Existing Scenario - NoR 2c**

*Working Plans of Te Tupu Ngatahi.  
 For the purpose of INTERNAL workshops (not for wider distribution)*

Client:	Supporting Growth
Project:	North West HIF



Discipline:	GIS
Drawing No:	SGA-NV-NW-013



**PPFs Altered**

dB LAeq 24 hr

- ≤ 64
- Not Assessed
- Assessment Area
- Road

**Noise Level**

dB LAeq 24 hr

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

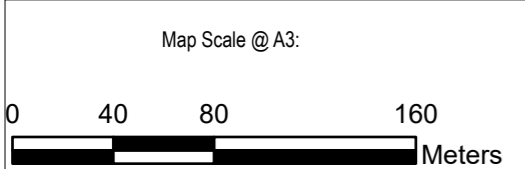
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**Supporting Growth**

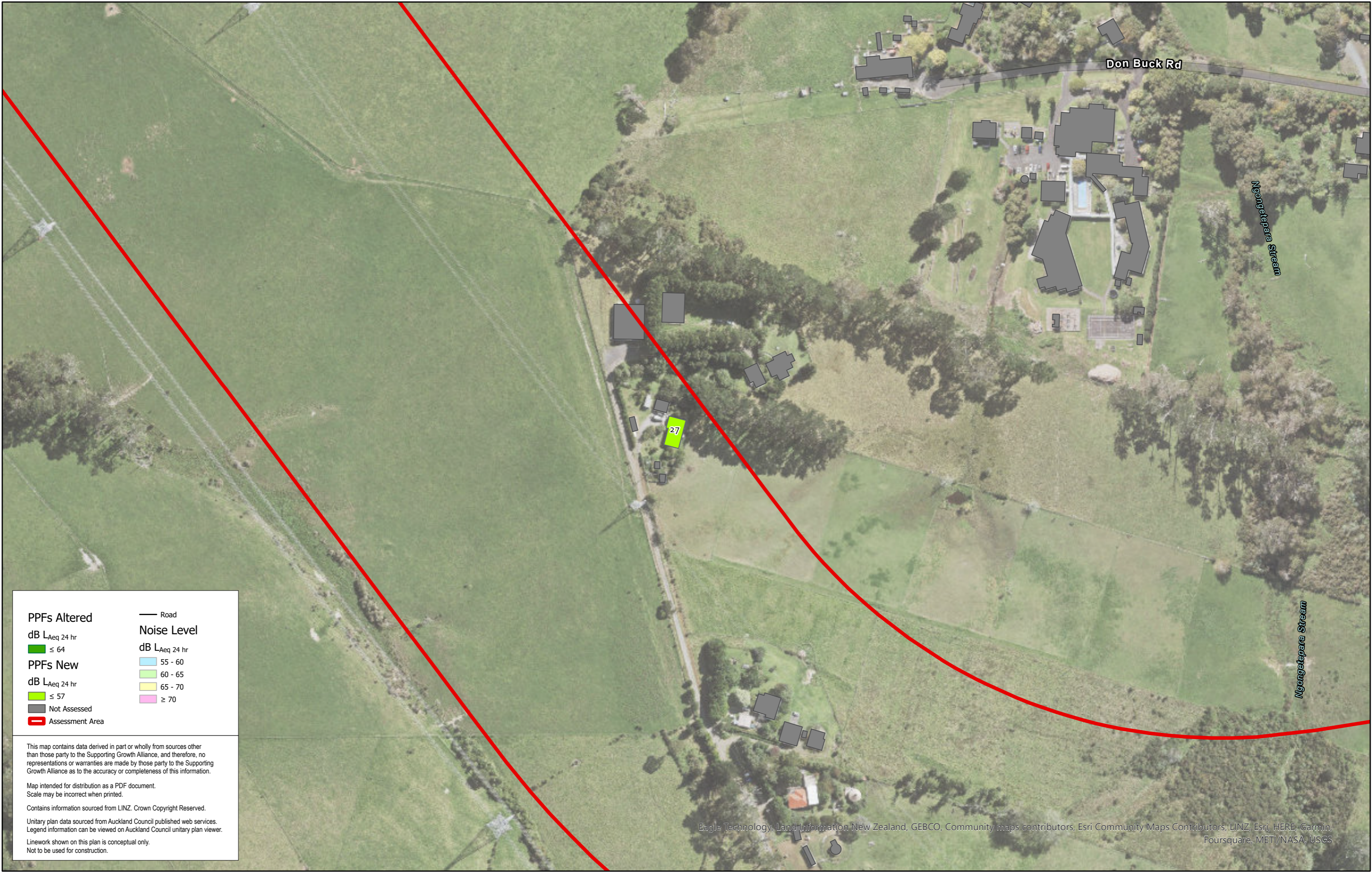
**Redhills - Do Nothing Scenario - NoR 1**

*Working Plans of Te Tupu Ngatahi.*  
*For the purpose of INTERNAL workshops (not for wider distribution)*

Client:	Supporting Growth
Project:	North West HIF

Discipline:	GIS
Drawing No:	SGA-NV-NW-013

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**PPFs Altered**

dB LAeq 24 hr

- ≤ 64

**PPFs New**

dB LAeq 24 hr

- ≤ 57

Not Assessed

Assessment Area

— Road

**Noise Level**

dB LAeq 24 hr

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

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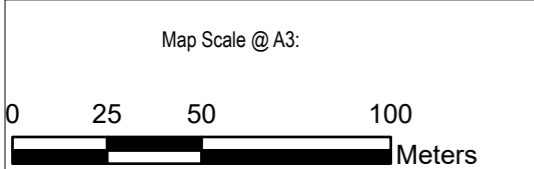
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1	Author	DRAFT	DRAFT	dd/mm/yyyy	

**Supporting Growth**

**Redhills - Do Nothing Scenario - NoR 1**

*Working Plans of Te Tupu Ngatahi.*  
*For the purpose of INTERNAL workshops (not for wider distribution)*

Client:	Supporting Growth
Project:	North West HIF



Discipline:	GIS
Drawing No:	SSGA-NV-NW-013





**PPFs Altered**

dB LAeq 24 hr

- ≤ 64
- Not Assessed
- Assessment Area
- Road

**Noise Level**

dB LAeq 24 hr

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

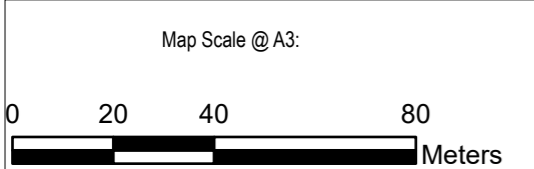
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**Supporting Growth**

**Redhills - Do Nothing Scenario - NoR 2b**

*Working Plans of Te Tupu Ngatahi.*  
*For the purpose of INTERNAL workshops (not for wider distribution)*

Client:	Supporting Growth
Project:	North West HIF

**TE TUPU NGĀTAHI**  
Supporting Growth

Discipline:	GIS
Drawing No:	SSGA-NV-NW-013



PPFs Altered	Noise Level
dB LAeq 24 hr	dB LAeq 24 hr
≤ 64	55 - 60
64 - 67	60 - 65
Not Assessed	65 - 70
Assessment Area	≥ 70
Road	

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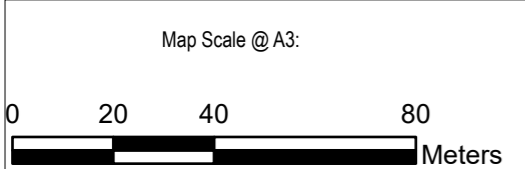
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**Supporting Growth**  
**Redhills - Do Nothing Scenario - NoR 2c**  
 Working Plans of Te Tupu Ngatahi.  
 For the purpose of INTERNAL workshops (not for wider distribution)

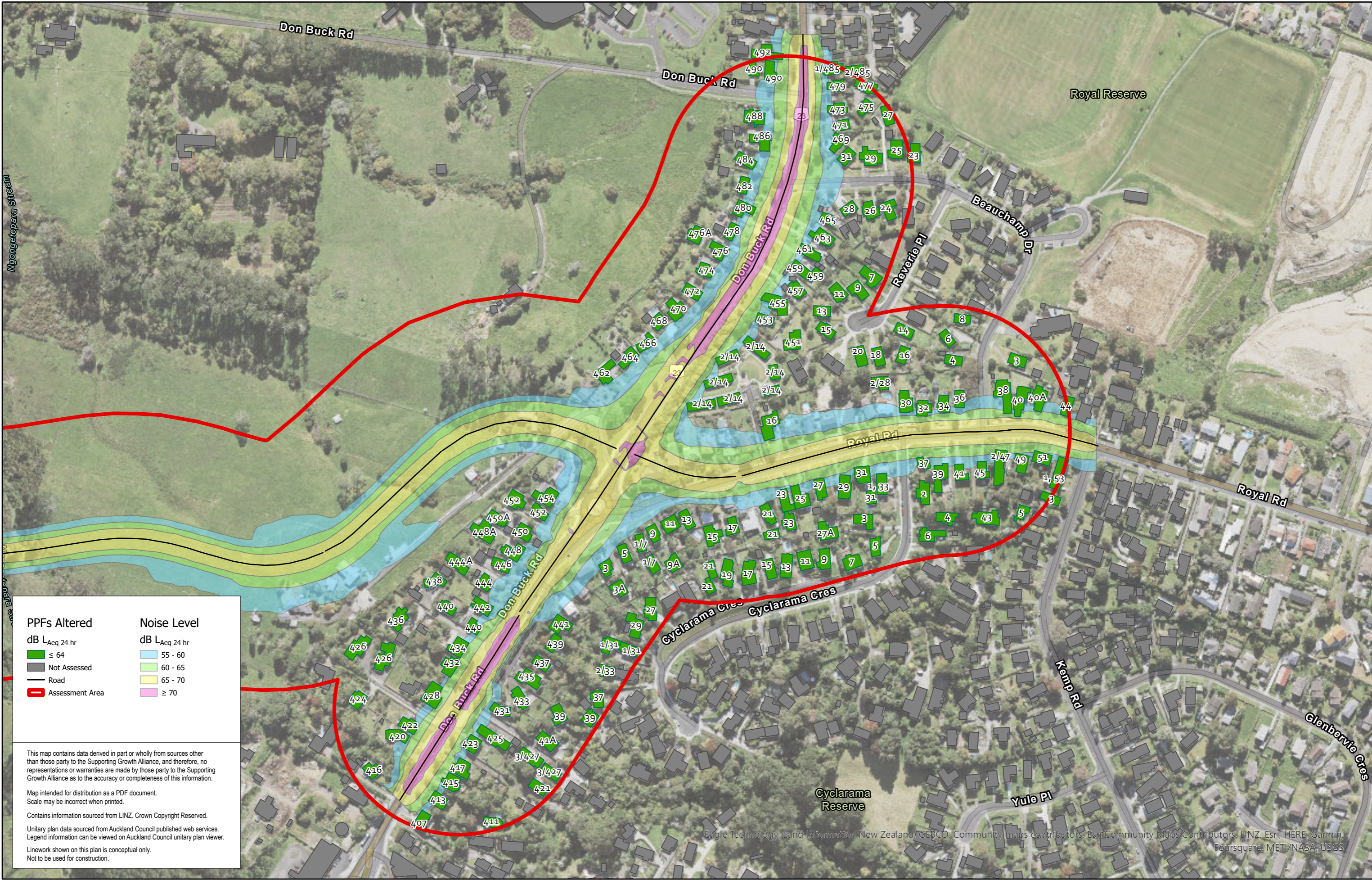
Client: **Supporting Growth**

Project: **North West HIF**



Discipline: **GIS**

Drawing No: **SGA-NV-NW-013**



**PPFs Altered**

dB LAeq 24 hr

- ≤ 64
- Not Assessed
- Road
- Assessment Area

**Noise Level**

dB LAeq 24 hr

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

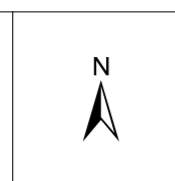
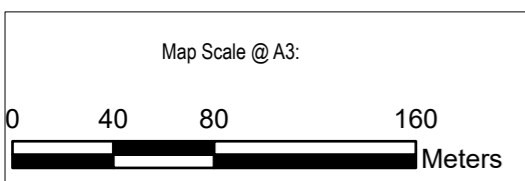
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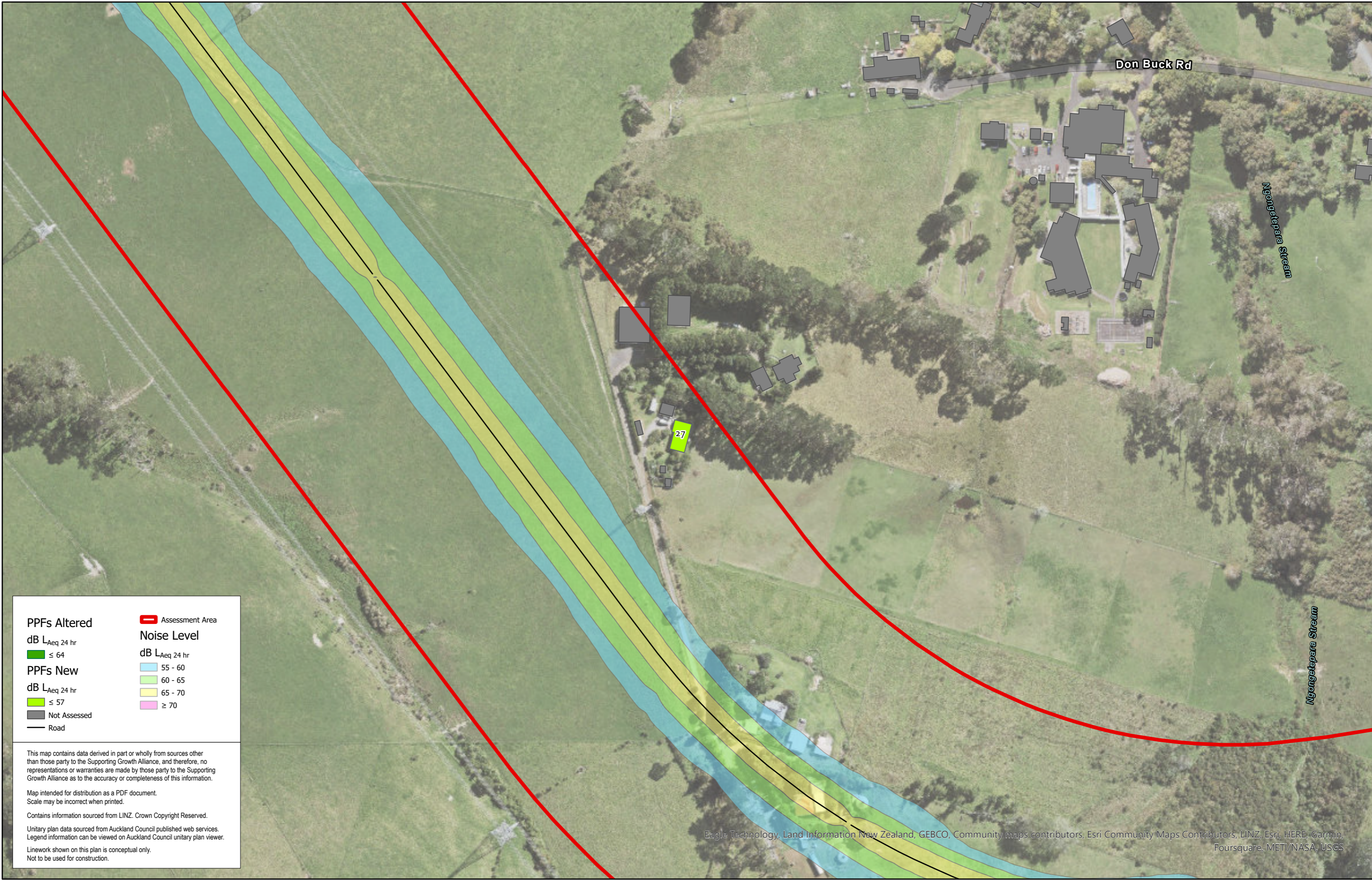
**Supporting Growth**

**Redhills - Do Minimum Scenario - NoR 1**

Working Plans of Te Tupu Ngatahi.  
For the purpose of INTERNAL workshops (not for wider distribution)

Client:	Supporting Growth
Project:	North West HIF

Discipline:	GIS
Drawing No:	SGA-NV-NW-013



**PPFs Altered**

dB LAeq 24 hr

- ≤ 64

**PPFs New**

dB LAeq 24 hr

- ≤ 57

Not Assessed

Road

**Assessment Area**

**Noise Level**

dB LAeq 24 hr

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

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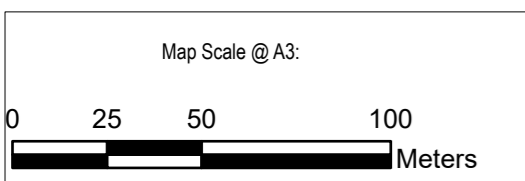
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**Supporting Growth**

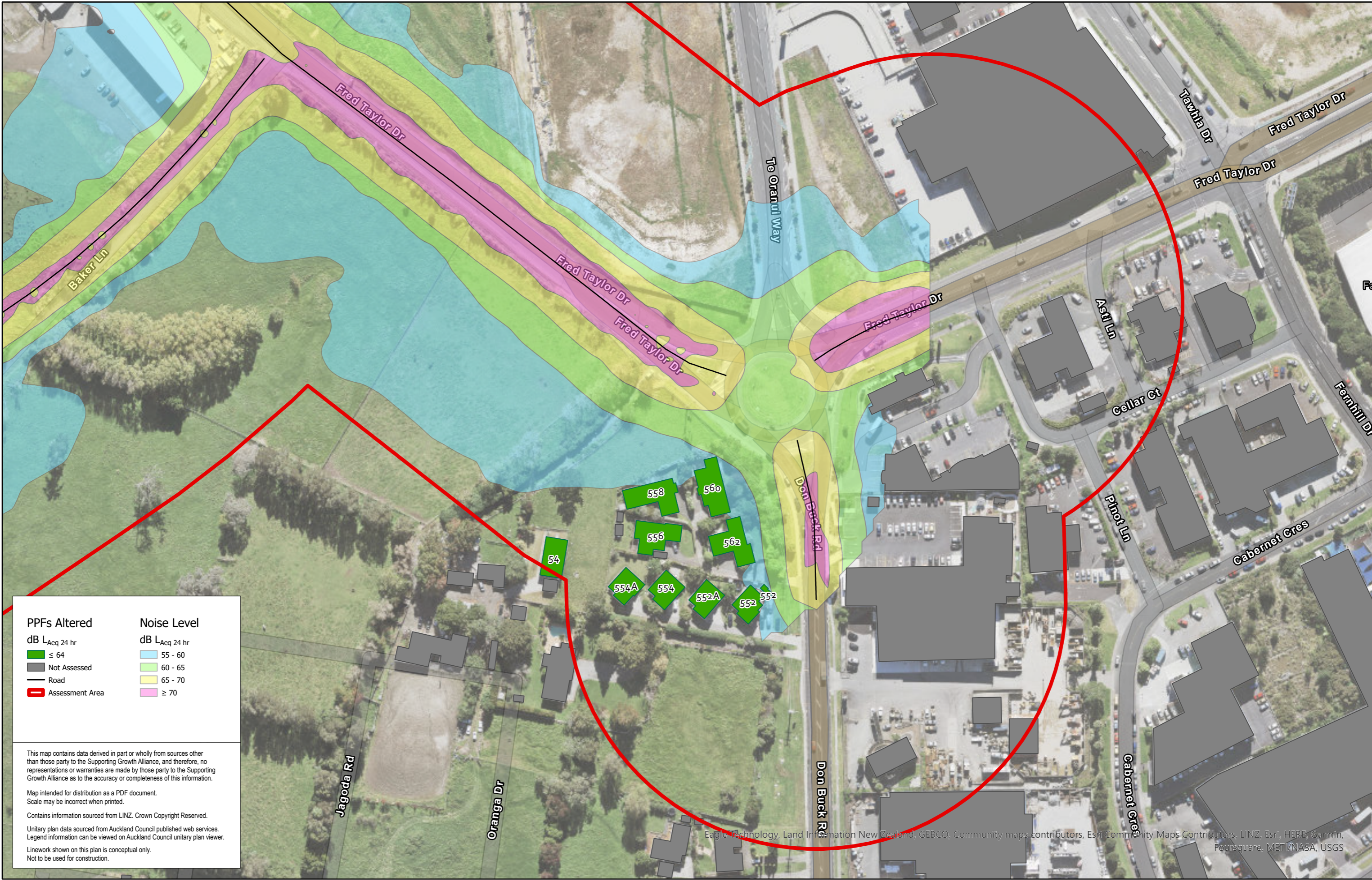
**Redhills - Do Minimum Scenario - NoR 1**

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Client:	Supporting Growth
Project:	North West HIF



Discipline:	GIS
Drawing No:	SGA-NV-NW-013



**PPFs Altered**

dB  $L_{Aeq}$  24 hr

- ≤ 64
- Not Assessed
- Road
- Assessment Area

**Noise Level**

dB  $L_{Aeq}$  24 hr

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

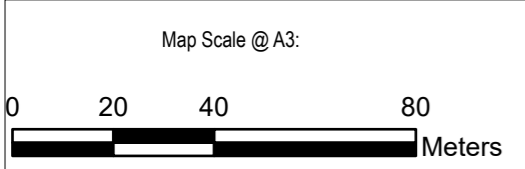
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**Supporting Growth**

**Redhills - Do Minimum Scenario - NoR 2b**

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Client:	Supporting Growth
Project:	North West HIF

Discipline:	GIS
Drawing No:	SGA-NV-NW-013



PPFs Altered	Noise Level
dB $L_{Aeq}$ 24 hr	dB $L_{Aeq}$ 24 hr
█ ≤ 64	█ 55 - 60
█ Not Assessed	█ 60 - 65
— Road	█ 65 - 70
▭ Assessment Area	█ ≥ 70

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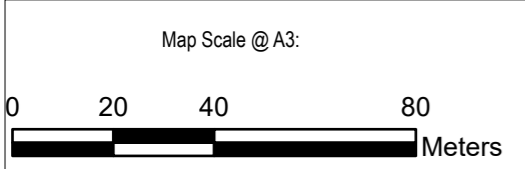
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**Supporting Growth**  
**Redhills - Do Minimum Scenario - NoR 2c**  
 Working Plans of Te Tupu Ngatahi.  
 For the purpose of INTERNAL workshops (not for wider distribution)

Client: **Supporting Growth**  
 Project: **North West HIF**



Discipline: **GIS**  
 Drawing No: **SGA-NV-NW-013**