

Drury Arterial Network Assessment of Traffic Noise and Vibration Effects

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Assessment of Traffic Noise and Vibration Effects

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1 Glossary of acronyms and defined terms

Table 1: Glossary of technical terms / acronyms

Acronym	Term
AADT	Annual Average Daily Traffic
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
AUPOIP	Auckland Unitary Plan Operative in Part
FTN	Frequent Transit Network
FUZ	Future Urban Zone
NIMT	North Island Main Trunk
NoR	Notice of Requirement (under the Resource Management Act 1991)
NZUP	New Zealand Upgrade Programme
PPF	Protected Premises and Facilities
SH1	State Highway 1
SH22	State Highway 22
Waka Kotahi	Waka Kotahi NZ Transport Agency

Table 2: Glossary of defined terms

Term	Meaning
Auckland Council	Means the unitary authority in the Auckland Region.
Altered Road	As defined in NZS 6806:2010 Section 1.5.2: 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).
Drury Package	Five Notices of Requirement for the Drury Arterial Network for Auckland Transport and Waka Kotahi NZ Transport Agency.
New Road	As defined in NZS 6806:2010 Section 1.6: 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.

2 Executive Summary

Assessment undertaken

This report provides an assessment of road traffic noise effects for the Drury Package covering five projects.

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:OIP).

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 projects.

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 (Do Minimum scenario). A detailed discussion is included in Section 5 of modelling inputs. Appendix 2

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. This is a theoretical scenario that would not occur in reality. We understand that; the current road network could not cope with the future traffic volumes, and future development in the area would not occur without the prior establishment of the new or upgraded roads (represented by the NoRs discussed in this report). 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 D1 to D5 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.

Of the five Projects, NoR D5 represents an “Altered” road under NZS6806 as defined in Glossary. NoRs D2 and D4 contain both “New” and “Altered” road sections. NoRs D1 and D3 do not fall under the provisions of NZS6806 because initial screening assessments indicate predicted noise levels do not exceed the threshold criteria of either $64 L_{Aeq(24hr)}$ with a greater than 3 dB increase when compared to the Do Nothing scenario, or $68 L_{Aeq(24hr)}$ with a greater than 1 dB increase when compared to the Do Nothing scenario. However these have been assessed based on the effects due to changes in noise levels.

Noise effects of road traffic on existing noise sensitive locations, referred to as Protected Properties and Facilities (PPFs) within NZS6806 and further defined in Section 4.1.1, has been assessed. PPFs within a 200m radius of the rural Project areas and 100m for the urban have been included. Where

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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 was 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 slightly higher external noise criteria. Category C, setting 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.

Mitigation options have been considered for the Projects where required under NZS 6806. The BPO mitigation has been determined separately for each project and is a combination of road surface material and barriers. The BPO mitigation formed the basis of determining the relevant Noise Criteria Category for each PPF. Since the projects will be built in the more distant future, this 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 3.

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 grid noise 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 flow 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 future scenarios (Do Nothing and Do Minimum) are based on road traffic data for the design year 2048 which assumes a full build out of growth in the Project areas and the implementation of surrounding transport projects such as, the Rail DBC Package (which includes three new rail stations, an additional rail track and active mode corridor), Mill Road Corridor and Pukekohe Expressway.

The traffic noise effects from the Projects assume that all NoRs are operational together, i.e. when the design year of NoR D1 is reached, NoRs D2 to D5 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 have 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

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areas were developed to capacity and the associated roading network. A full list of assumptions are included in Appendix 2.

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 mitigation (e.g. barriers) is still relevant at the time of construction.

Results of assessment and recommended measures

NoR D1

The Project involves the widening of SH22 and initial screening indicates this Project does not qualify as an Altered Road in accordance with NZS 6806.

Predicted noise level changes indicate all PPFs are generally expected to receive reduced noise levels in comparison to the Do Nothing (design year without Project) scenario due to SH22 changing from a rural state highway to an urban arterial road. This is mainly due to reduced traffic speeds applied at Do Minimum (design year with Project) in accordance with NZS 6806 and, together with the implementation of all proposed transport projects, will result in an overall positive effect.

Screening assessment indicates predicted noise levels due to the Project at all 18 PPFs will remain in Category A (below 64 dB $L_{Aeq(24hr)}$). Therefore, this Project does not qualify as an Altered Road in accordance with NZS 6806 and no mitigation is required.

Before construction commences, reassessment of the road traffic noise at PPFs covered in this report will be carried out to determine if the categories as set out in Appendix 3 are still achieved without mitigation and to determine BPO mitigation if required.

NoR D2

The Project consists of a combination of New and Altered roads as identified in Figure 8-4.

For the Altered road sections, with all roading projects in the area implemented, noise levels at all PPFs are predicted to experience a noise level decrease with the Project, with the majority PPFs predicted to experience a 1-3 dB reduction. 22 PPFs are predicted to experience a significant decrease in noise levels of 9dB or more. Decreases are due to the redistribution of traffic across the wider new network, the low noise road surface applied and, where applicable, the removal of the minor dwellings closest to the road at PPF addresses where there are multiple dwellings.

Predictions indicate noise levels at all PPFs for the Altered roads sections of the corridor will remain in Category A with predicted noise levels below 64 dB $L_{Aeq(24hr)}$ with mitigation of low noise road surface applied.

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For the New road section, noise level changes due to the Project range from 4 – 15 dB increase, which would be a noticeable to significant change.

However, predictions indicate noise levels at all but two PPFs will be within Category A and below the most stringent criterion of 57 dB $L_{Aeq(24hr)}$ with mitigation of low noise road surface in place. Two PPFs will remain in Category B even with mitigation in place. BPO considerations are set out in Section 8.2.2.1 for those PPFs, and no further mitigation has been found to be practicable. It is noted that the anticipated resultant noise levels of 45-60 dB $L_{Aeq(24h)}$ are appropriate for residential use and to be expected in urban residential environments.

Before construction commences, reassessment of the road traffic noise at PPFs within this report will be carried out to determine if mitigation recommended is still BPO to meet the categories as set out in Appendix 3. For the Altered road sections the PPFs are all Category A. For the New road sections, 13 are Category A and two in Category B.

NoR D3

The Project consists of the widening of Waihoehoe Road to a two-lane arterial with walking and cycling facilities, and the initial screening assessment indicates this Project does not qualify as an Altered Road in accordance with NZS 6806.

Predictions indicate that the majority of PPFs will experience noise level decreases due to the redistribution of traffic across the new network, and therefore have minor to moderate positive noise effects. One PPF is predicted to experience a significant noise level decrease of 9dB or more which will be a noticeable change and result in positive effects.

Noise levels due to the Project show that three PPFs will be in Category B and three will be in Category C with the remaining in Category A. Predictions show noise levels at the Category B PPFs will be above 64 dB $L_{Aeq(24hr)}$ but less than a 3 dB increase and Category C PPFs will be above 68 dB $L_{Aeq(24hr)}$ but less than a 1 dB increase when comparing the Do Nothing and Do Minimum scenarios, thus not meeting NZS 6806 Altered road criteria. Therefore, this Project does not qualify as an Altered road and no further mitigation is required.

Before construction commences, reassessment of the road traffic noise at PPFs within this report will be carried out to determine if the categories as set out in Appendix 3 are still achieved without mitigation and to determine BPO mitigation if required.

NoR D4

The Project consists of New and Altered road sections. The Altered road sections are identified in Figure 10-2 and Figure 10-3. There are 13 PPFs that have been assessed against the Altered road criteria, and 13 PPFs that have been assessed against the New road criteria of NZS 6806.

For the Altered road sections, noise levels at the 13 PPFs assessed are predicted to experience a negligible reduction of 1 dB to no change in noise level due to the Project when compared to the Do Nothing scenario, as noise from the existing roads is the dominant noise source. This change will not be noticeable. Any reduction is partially due to redistribution of traffic across the new network.

Two PPFs will remain in Category B and four in Category C. As noise at these PPFs are controlled by the existing road rather than the new road, no mitigation is required under NZS 6806. Furthermore, in

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accordance with NZS 6806, mitigation measures are not required if PPFs do not meet the Altered road threshold criteria when comparing the Do Nothing and Do Minimum scenarios. Predicted noise levels show this section of the Project is not an Altered Road as:

- a) Category B PPFs are above 64 dB $L_{Aeq(24hr)}$ but will experience less than a 3 dB increase; and
- b) Category C PPFs are above 68 dB $L_{Aeq(24hr)}$ but will experience less than a 1 dB increase.

For the New road sections, 12 of the 14 PPFs assessed are predicted to receive an increase in noise levels between 5 and 20 decibels, which is a noticeable to significant change. The reason for this increase is that the new road will introduce a noise source that is not currently present for these dwellings. The one remaining PPFs would receive a negligible change in noise level of up to 1 decibel only.

Predictions for the PPFs assessed against the New road criteria indicate noise levels at all but four PPFs can comply with the Category A criterion of 57 dB $L_{Aeq(24hr)}$ with mitigation of low noise road surface and 1.8m high localised barriers in place. Four PPFs will remain in Category B even with mitigation implemented due to being either a 2 storey building or on elevated terrain where localised barriers do not benefit. Overall, the noise levels predicted for the PPFs affected by the New road sections of the Project are reasonable for residential use, with levels ranging from 48 to 61 dB $L_{Aeq(24h)}$.

It should be noted, the area will change significantly over time, and the New road sections will be constructed at a time transport corridors are required to support the planned urban growth. That means that the ambient noise environment will be higher due to more intensive urban activity and the predicted noise level change from traffic noise will likely be less. Further, the predicted effects may not be experienced by current residents.

Before construction commences, reassessment of the road traffic noise at PPFs within this report will be carried out to determine if mitigation recommended is still BPO to meet the categories as set out in Appendix 3. For the Altered road sections seven PPFs are Category A, two in Category B and four in Category C. For the New road sections, 10 are Category A and four in Category B.

NoR D5

This Project consists of Altered roads for three sections of upgrades along Ponga Road (Rural), Ōpāheke Road (Rural) and Ōpāheke Road (Urban). The rural upgrades have been assessed separately to the urban upgrade due to the different assessment extent (200m vs 100m from the road edge).

Ponga Road (Rural) and Ōpāheke Road (Rural) sections

The majority of PPFs are predicted to experience positive minor effects due to noise level decreases which will just be noticeable. This decrease is generally due to traffic being redistributed across the new roading network. Only one PPF is predicted to experience a noise level increase of 7 dB, which will be a material change, due to the introduction of the Walker Road link in close proximity to the dwelling. However, the resultant noise level at this PPF of 59 dB $L_{Aeq(24h)}$ remains appropriate for residential use and not unexpected in an urban environment.

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With the exception of three Bellfield Estate PPFs, predictions indicate noise levels due to the Project along the rural upgrade sections at all PPFs, will remain in Category A and can comply with 64 dB $L_{Aeq(24hr)}$ with no mitigation required. No further mitigation has been assessed for the three Bellfield Estate PPFs because, in accordance with NZS 6806, mitigation measures are not required if PPFs will experience an increase in noise levels of less than 3dB when compared to the Do Nothing scenario.

Ōpāheke Road Urban section

This section of the Project includes the upgrade of the existing intersection (from signals to a roundabout) and includes walking and cycling facilities. The Project does not provide additional traffic lanes, and therefore, the increase in traffic volume would occur independently from the Project being progressed. Nevertheless, the assessment has been undertaken similarly to all other NoRs in this report, even though the traffic noise effects are not dependent on the Project.

For the Ōpāheke Road Urban upgrade, predictions indicate that due to the Project (i.e. intersection changes), Do Nothing noise levels are likely to be increased by 1-2 dB without the provision of mitigation. It is predicted that 27 PPFs would receive noise levels in Category C under the Do Minimum scenario, due to the increase in traffic volume over time. With the recommended Mitigation option 1 of low noise road surface asphaltic concrete AC-14 applied, the noise level at all but eight PPFs can be reduced to Category A, with noise levels at the 17 PPFs reduced from a Category C to B.

The recommended mitigation for the Ōpāheke Road urban upgrade will result in a positive and noticeable change in noise levels for the PPFs predicted to receive the highest noise levels, and ensure that noise levels will be reasonable for residential use.

Before construction commences for the Ponga Road and Ōpāheke Rural sections, reassessment of the road traffic noise at PPFs within this Project will be carried out to determine if the categories as set out in Appendix 3 are still achieved without mitigation and to determine BPO mitigation if required. For the Ōpāheke Road Urban section, the PPFs will be reassessed to determine if mitigation suggested are still BPO to meet the categories as set out in Appendix 3. For Ōpāheke Road Urban section of the Altered road, 93 PPFs are in Category A and 10 in Category B. 174 PPFs for Ponga Road and Ōpāheke Rural section are in Category A and three in Category B.

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3 Introduction

This report has been prepared for the Drury Arterial Network Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi) (the “Drury Package”). The NoRs are to designate land for future strategic transport corridors as part of the Supporting Growth Programme to enable the future construction, operation and maintenance of transport infrastructure in the Drury-Ōpāheke area of Auckland.

The Auckland Council Drury-Ōpāheke structure plan area is expected to grow over the next 30 years and is estimated to provide about 22,000 houses and about 12,000 jobs with a population of about 60,000. The Drury Package will provide route protection for the local arterials, which include walking, cycling and public transport (including the Frequent Transit Network (FTN)), needed to support the expected growth in Drury. This report assesses the traffic noise and vibration effects of the proposed Projects, that together comprise the Drury Package, as shown in Figure 3-1.

Table 3-1 Drury Package: Notices of Requirement and Projects

Notice	Project
NoR D1	Alteration to NZ Transport Agency designation 6707 - State Highway 22 (SH22) Upgrade
NoR D2	Jesmond to Waihoehoe West FTN Upgrade
NoR D3	Waihoehoe Road East Upgrade
NoR D4	Ōpāheke North-South FTN Arterial
NoR D5	Ponga Road and Ōpāheke Road Upgrade

The Drury Package has been developed through an alternatives assessment. Corridor alternatives and route refinements were assessed by a multi-disciplinary team against a programme wide Multi-Criteria Assessment. This assessment phase was completed in February 2020, and further design changes have been adopted through the Assessment of Environmental Effects (AEE) process for the Drury Package, in response to a range of construction and environmental considerations.

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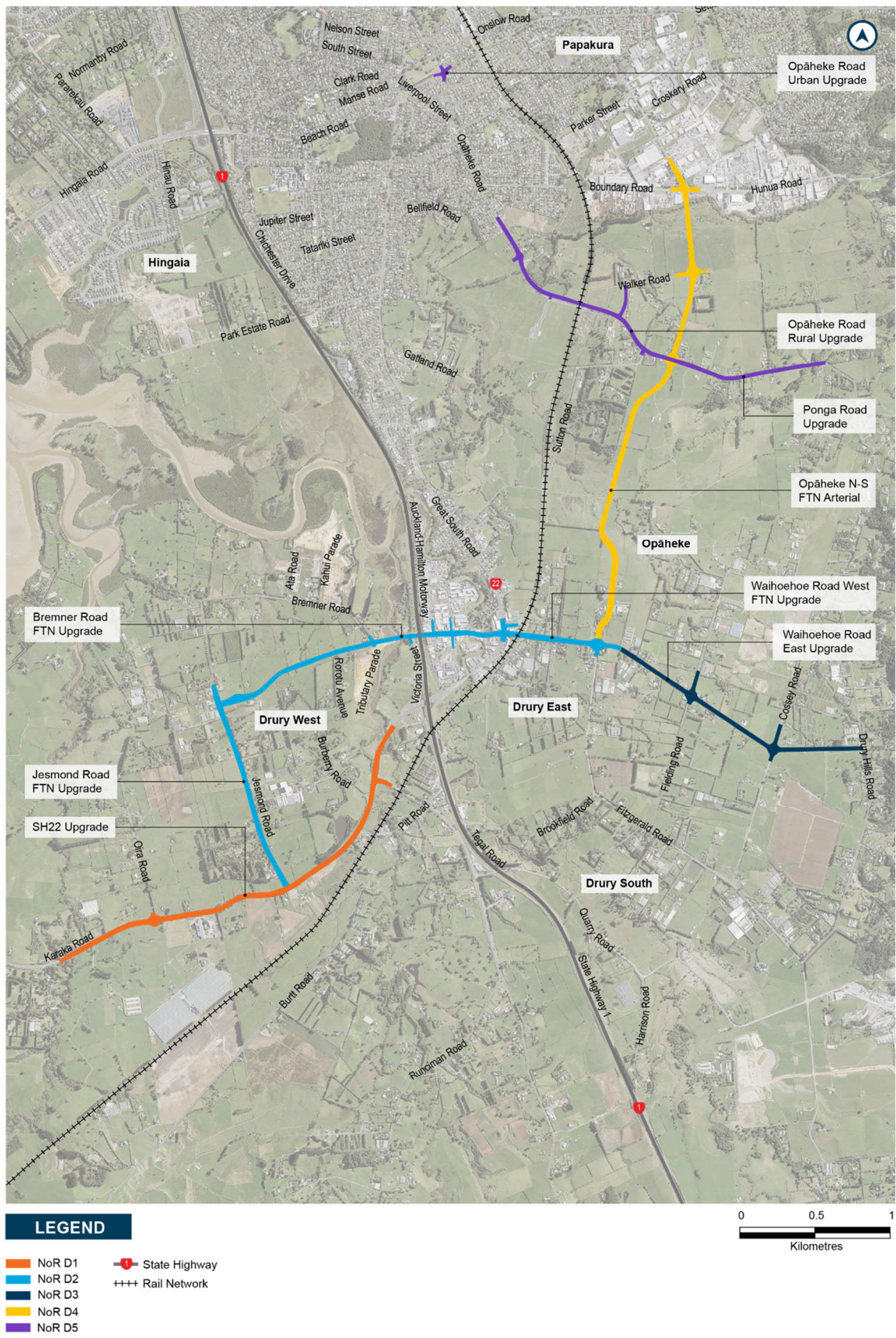


Figure 3-1 Drury Package Projects and Notices of Requirement

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3.1 Background

Auckland is New Zealand's largest city, home to approximately 1.65 million people. In 2017, Auckland attracted 36,800 new residents; more than the rest of the country combined. The Auckland Plan 2050 – Development Strategy signals that Auckland could grow by 720,000 people to reach 2.4 million over the next 30 years. This will generate demand for more than 400,000 additional homes and require land for 270,000 more jobs.¹ Most of this growth will go into existing urban areas. However, around a third will go into future urban zone (FUZ) as identified in the Auckland Unitary Plan: Operative in Part (AUPOIP). The FUZ areas are “greenfields”, that is, generally rural land identified to be urbanised over time.

The Supporting Growth Programme is a collaboration between AT and Waka Kotahi to plan transport investment in Auckland's future urban zoned areas over the next 10 to 30 years. AT and Waka Kotahi have partnered with Auckland Council, Manawhenua and KiwiRail Holdings Limited (KiwiRail) and are working closely with stakeholders and the community to develop the strategic transport network to support Auckland's growth areas.

The key objective of the Supporting Growth Programme is to protect land for future implementation of the required strategic transport corridors/infrastructure. As a form of route protection, designations will identify and appropriately protect the land necessary to enable the future construction, operation and maintenance of these required transport corridors/infrastructure. A designation is important as it provides certainty for the Requiring Authority that it can implement the work. It also provides property owners, businesses and the community with increased certainty regarding future infrastructure, so they can make informed decisions (if confirmed it will be identified in the AUPOIP). It can also significantly reduce long-term costs for local and central government and enable more effective land use and transport outcomes.

3.2 Drury Package

The Drury Package proposes an arterial network to support the expected future growth in Drury-Ōpāheke. The Drury Package comprises five separate projects which together form the Drury Arterial Network. The network includes provision for general traffic, walking and cycling, and frequent public transport. Overall, the Drury Package aims to improve connectivity within and through the Drury-Ōpāheke area, providing high quality, safe and attractive transport environments.

Each Project within the Drury Package will be designated separately as follows:

- **NoR D1:** Alteration to Waka Kotahi NZ Transport Agency designation 6707 - State Highway 22 (SH22) Upgrade
- **NoR D2:** Jesmond to Waihoehoe West FTN Upgrade
- **NoR D3:** Waihoehoe Road East Upgrade
- **NoR D4:** Ōpāheke North-South FTN Arterial (Ōpāheke N-S FTN Arterial)
- **NoR D5:** Ponga Road and Ōpāheke Road Upgrade

¹ Draft Auckland Plan 2050 Development Strategy: <https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/development-strategy/future-auckland/Pages/what-auckland-look-like-future.aspx>

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3.3 Purpose and Scope of this Report

This report provides an assessment of traffic noise effects associated with the operation of the Drury Package. This assessment has been prepared to inform the AEE for the NoRs.

The purpose of this report is to:

- Identify and describe the existing and likely future noise environment;
- Identify and describe the actual and potential traffic noise effects of the Projects;
- Recommend measures as appropriate to avoid, remedy or mitigate potential adverse noise effects; and
- Present an overall conclusion of the level of potential traffic noise effects of each of the Projects after recommended measures are implemented.

3.4 Report Structure

This report is structured to reflect the key matters listed above in Section 3.3.

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

3.5 Preparation for this Report

Two site visits were carried out for an overview of the Projects. One undertaken with the Project Team on 3rd March 2020 and another with Council representatives the following week to discuss and identify any potential issues.

A meeting with the road traffic team to determine the most practicable road traffic data for use within the assessment was also carried out and methodology agreed to be in line with wider Supporting Growth work.

4 Assessment Criteria

Chapter Summary

The Assessment Criteria for these Projects have been identified on the basis of the methodology outlined in NZS 6806:2010. In accordance with NZ 6806 Protected premises and facilities (PPFs) within 100 metres (in urban areas) and 200 metres (in rural areas) of the proposed transport corridors have been identified.

PPFs exclude commercial or industrial premises, and future (unbuilt) noise-sensitive premises, unless they have already been granted building consent.

The identified PPFs have been assessed against both the criteria of NZS 6806 and noise level changes and their perceived effects.

Noise Criteria Categories are 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 slightly higher external noise criteria. Category C, setting 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 would be required.

Traffic data for the design year of 2048 has been used for the Project assessments. Whilst 2048 data is not the most conservative scenario in terms of the traffic volume for every Project road, the data provides the most complete overview reflective of the development intended for the areas.

4.1 Road Traffic Noise

Waka Kotahi guidance² and Rule E25.6.33 of the Auckland Unitary Plan – Operative in Part (AUP OIP) require that New roads and Altered roads which are within the scope of NZS 6806:2010³ 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 a number 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 taking into account 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

² Guide to assessing road traffic noise using NZS 6806 for state highway asset improvement projects, August 2016 v1.1

³ New Zealand Standard 6806:2010 Acoustics - Road Traffic Noise

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(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).

4.1.1 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.

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

Most of the Project extents currently fall within a rural area as defined by Statistics New Zealand⁴ and most of the land is greenfield which is zoned as Future Urban under the AUP OIP. Therefore, it is appropriate for PPFs within 200 metres of the road Projects to be assessed in this report. The exception is for a section of NoR D5 which is in an urban area where a 100 metres radius has been assessed in accordance with NZS 6806. Outside of these areas there are no PPFs that require assessment and have not been considered.

These distances ensure 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.

4.1.2 NZS 6806 Noise Criteria

For these projects the noise criteria as summarised in Table 4-1 are applicable.

Table 4-1 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 _{Aeq} (24h)	57 dB L _{Aeq} (24h)
B	Secondary	67 dB L _{Aeq} (24h)	64 dB L _{Aeq} (24h)
C	Internal	40 dB L _{Aeq} (24h)	40 dB L _{Aeq} (24h)

The Projects within the Drury Package have both “Altered roads” and “New roads” as defined by NZS 6806:2010. These definitions have been included in the Glossary of this report.

NZ6806 Section 6.2 is therefore applicable to Projects in the Drury Package where it states:

6.2.1 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:

⁴ New Zealand: An Urban/Rural profile, Statistics New Zealand

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- (a) An intersection between a new or altered road and an existing road;
- (b) A 'tie-in', 'transition', or merger' where a new or altered road reconnects with an existing road; or
- (c) Where any PPFs are significantly affected by noise from another existing road in the vicinity.

6.2.2 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.

For these Projects, where a 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.

4.1.3 Design Year

The criteria apply to a design year 10 to 20 years after the completion of the Project road. In this case, the opening year has been not yet been determined. For these Projects, traffic modelling data for the year 2048 has been selected as the design year for assessment purposes for the following reasons:

- The design year traffic data incorporates and assumes all other projects (funded and otherwise) in the South Auckland area have been constructed; these projects directly influence traffic flow through the Drury and Ōpāheke Project areas.
- The 2048 design year, whilst not the most conservative scenario in terms of the traffic volume for every Project road, provides the most complete overview reflective of the development intended for the areas. If some projects do not go ahead then traffic flows within the Project alignment will likely change. Nearer the time of detailed design and construction, traffic noise will need to be reassessed.

The decision to use 2048 as the design year was made in conjunction with the Project team and further discussed in Section 5.A full list of assumptions included within the design year has been included in Appendix 2.

4.1.4 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. (Referred to as "Likely Future without Drury Projects" and "2048+ without Drury" within the Transport Assessment)
- 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. (Referred to as "Likely Future with Drury Projects" and "2048+ with Drury" within the Transport Assessment)
- "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 (such as Mill Road and Drury rail stations). This is

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a theoretical scenario that would not occur in reality. 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. 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 D1 to D5 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.

Network assumptions that are included or excluded from each scenario are summarised in Appendix 2.

4.1.5 Noise Mitigation

NZS 6806 requires that noise mitigation options are assessed, and if practicable, noise levels within category A (refer Table 4-1) 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.

Where a requirement to consider mitigation measures is identified, NZS 6806 states that structural mitigation should only be implemented if it achieves the following:

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

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.

4.2 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

Assessment of Traffic Noise and Vibration Effects

avoiding vibration generated from passing traffic over uneven surfaces. Therefore, traffic vibration effects arising from operation of the Projects has not been assessed.

5 Assessment Methodology

Chapter Summary

This Chapter sets out the assumptions and usage of the data within the Projects, and the methodology that is applied to the whole Drury Package. Modelling parameters include the traffic volume, 3D topographical data, buildings and other structures, and road parameters such as speed, gradient, road surface material and the traffic make up.

Traffic flow data for the design year 2048 incorporates other infrastructure projects within the wider strategic transport network developed for South Auckland. As such the 2048 design year will not be the most conservative scenario in terms of the traffic flow for every Project road, but provides a general overview reflective of the development intended for the areas.

Road traffic data provided for the Drury Package relies on the development and urbanisation of the local areas, as well as other funded projects going ahead throughout the Drury-Ōpāheke area, as it forms part of the wider strategic transport network. Some projects will have a direct impact on the traffic flow, such as the construction of the proposed Pukekohe Expressway which will change the flow through, SH22 (NoR D1), Jesmond Road and Bremner Road (sections of NoR D2).

It is unknown when these other projects within the Drury-Ōpāheke area will be completed, however 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 infrastructure developments will be constructed by the design year 2048 as indicated in Section 4.1.3. It should be noted an urban speed reduction is expected within 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, taking into account 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. At the time of this assessment only two development sites (Auranga in NoR D2 and Bellfield Estate in NoR D5) fall under this category and have been included within the 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 grid noise maps in 0 are considered indicative of the noise environment at adjacent sites without a PPF, including the future urbanisation areas.

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5.1 Road Traffic Noise Model

A computer noise modelling software SoundPLAN (V8.1) 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. 326⁵ and the Waka Kotahi *Guide to state highway road surface noise*⁶. The model settings are described in Table 5-1 below.

Table 5-1 Road traffic noise modelling parameters

Parameter	Setting/source
Software	Sound Plan 8.1
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 based on the Saturn Model. The existing scenario has been based on 2016 data as provided. Traffic modelling methodology and results are described in the Drury Arterial Network Transport Assessment⁷.

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.

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

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

⁷ Included within Volume 4 of the Drury Arterial Network Assessment of Effects on the Environment

Assessment of Traffic Noise and Vibration Effects

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. This assumption was verified by site observations and found to be generally correct.

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 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. These PPFs have been identified within each NoR assessment section.

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. Bridges were identified and entered appropriately into the noise model.

5.1.5 Road surfaces

Surfaces of existing roads have been modelled as the current surfaces recorded by the Project team, which is Two-coat Chipseal for the majority of the rural roads and Stone Mastic Asphalt (SMA-10) for SH22. For the Do Minimum scenario, the road surface has been modelled retaining the existing surface type and applied to the new road, 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 28⁸, a minus 2 dB adjustment has been made for an asphaltic concrete road surface compared to CoRTN.
- Surface corrections relative to Stone Mastic Asphalt (SMA-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

There are no existing noise barriers in the Project areas in the Drury Package.

⁸

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

Assessment of Traffic Noise and Vibration Effects

Existing boundary fences on private properties have not been included in the noise model as their condition is unknown and they may not provide effective acoustic shielding.

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

5.1.7 Bridges

All existing and new bridges have been configured to be 'self-screening' roads, which block the noise of the road passing under them.

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 model has been developed by the Project 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 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 is based on the assumption 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 ± 2 dB."

Long-term unattended noise monitoring was carried out at 235 Jesmond Road and 116 Waihoehoe Road as the sites were considered to be generally representative of the existing noise environment of the Project Areas (refer Section 6). Table 5-2 compares the measured data with the predicted noise levels. As noise measurements at 235 Jesmond Road will experience construction noise from the nearby Auranga development, which is not included within the model, the measurements are not considered appropriate to calibrate the model. However, from experience we consider that the

Assessment of Traffic Noise and Vibration Effects

predicted noise levels are in line with similar projects and are as expected for the traffic volume, speed and road surface for these Projects.

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 L _{Aeq} (24h), dB	Predicted L _{Aeq} (24h), dB	Difference	Comment
116 Waihoehoe Road	46.3	45.7	-0.6	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. Where NZS 6806 does not apply due to noise levels not reaching the required threshold to qualify as an Altered road, no mitigation options have been considered.

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 the Projects, the road surface has been assumed to remain unchanged, i.e. two-coat chip seal for all roads except SH22, which would have Stone Mastic Asphalt (SMA-10). Changing the road surface from Two-coat chip seal to Asphalted concrete (AC-14) for mitigation, would provide a noise level reduction of 4 dB.

5.3.2 Noise Barriers

If low-noise road surfaces do not provide the required level of noise mitigation, traffic 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/m² (e.g. 17mm ply sheeting, 9 mm fibre cement, concrete, earth bunds etc.).

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.

Assessment of Traffic Noise and Vibration Effects

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.

5.3.4 Maintenance of Structural Mitigation Measures

The effectiveness of the acoustic performance of noise mitigation measures will need to be maintained over time. NZS 6806 states that “structural mitigation measures should be designed in such a way that they retain the same noise-reduction properties up to the design year”.

This means that any barrier proposed for the Projects should not develop gaps or other openings or material failure. Any damage and vandalism to the barrier will need to be replaced, and asphalt surfaces should be maintained to be smooth and even, in order to achieve the same noise reducing qualities as following initial installation.

Maintenance of structural mitigation measures to the performance standards of NZS 6806 should be undertaken for the Projects in order to achieve the noise level reductions on which the noise level predictions are based.

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	• Possible effect
1 – 2 decibels	Insignificant change	Negligible
3 – 4 decibels	Perceptible change	Slight
5 – 8 decibels	Noticeable change	Moderate
9 – 11 decibels	Halving/doubling of loudness	Significant
> 11 decibels	More than halving/doubling of loudness	Serious / Adverse

6 Existing Ambient Noise Environment

Chapter Summary

Existing ambient noise environment

NZS 6806 road traffic assessment is not dependent on existing ambient noise levels, but noise monitoring was undertaken to provide a baseline for the assessment of effects and verification of the model. This monitoring was carried out in general accordance with the relevant requirements of NZS 6801, 6802, and 6806, regarding monitoring locations, procedure, analysis and reporting.

Long-term unattended noise monitoring was carried out at 235 Jesmond Road and 116 Waihoehoe Road (as the sites were considered to be representative of the existing noise environment of the Project Areas) over seven days with noise levels recorded ranging between 46 - 49 dB $L_{Aeq}(24hr)$. This is reflective of a rural 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 judge the potential noise effects, regardless of compliance with any particular noise criteria. In addition, measured noise levels are used to verify the computer noise model (refer Section 5.2)

6.1.1 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 6801⁹, 6802¹⁰ and 6806. This meant the results could adequately inform the operational and construction noise assessments, whilst providing a robust baseline dataset for the Project.

A measurement position at 235 Jesmond Road and 116 Waihoehoe Road was selected that was free-field to avoid reflections from buildings or extraneous factors which could influence the sound levels, where practicable. Measurement and verification details required by NZS 6801 are held on file.

The unattended noise monitoring location can be found in Appendix 3. Monitoring was undertaken for approximately 7 days.

6.1.2 Meteorological conditions

During the surveys, meteorological data was obtained from Auckland, Pukekohe Ews (2006) 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 data measured during these periods have been excluded from the noise analysis.

⁹ New Zealand Standard 6801:2008 Acoustics – Measurement of environmental sound

¹⁰ New Zealand Standard 6802:2008 Acoustics – Environmental noise

Assessment of Traffic Noise and Vibration Effects

6.1.3 Data analysis

The dominant noise sources at both measurement locations were birdsong and sounds from farm animals such as cows and sheep. Road traffic noise was audible in the distance for both locations. At 235 Jesmond Road, construction noise from the Auranga development was also audible.

There was 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 has been included in Table 6-1. The $L_{Aeq(24h)}$ was calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded.

The average $L_{Aeq(24h)}$ for the unattended measurement period was 49 dB at 235 Jesmond Road and 46 dB at 116 Waihoehoe Road.

Table 6-1: Summary of measured noise levels

Date	$L_{Aeq(24h)}$ (dB)	
	235 Jesmond Road	116 Waihoehoe Road
30/07/2020	49	46
31/07/2020	49	44
01/08/2020	48	44
02/08/2020	48	43
03/08/2020	48	46
04/08/2020	49	48
05/08/2020	49	49
06/08/2020 *	47	46

* Not a full 24 hours

Both sets of measurements are reflective of a rural environment where low noise levels are experienced with limited road traffic noise. This noise level is likely to change as the surrounding environment changes with urbanisation within the area.

Although no measurements were taken from an urban location, computer noise modelling of existing noise levels has been shown to be generally accurate (within +/- 2 dB) and effective, particularly in the vicinity of existing roads.

7 NoR D1: Alteration to Designation 6707 - State Highway 22 Upgrade

Chapter Summary

Noise effects of road traffic on PPFs have been assessed by comparing the predicted Do Nothing noise levels (assuming traffic from full area development on the existing road network) with the Do Minimum predicted noise levels in the design year with the Project without mitigation.

PPFs that are not yet built or do not have building consent are not included in the modelling, however noise levels across the currently vacant land are provided in the grid noise maps within the Appendices of this report and are indicative of the potential noise environment for that land.

NoR D1 consists of an existing road, and initial screening indicates this Project does not qualify as an Altered Road in accordance with NZS 6806.

NZS 6806 assessment predictions indicate all 18 PPFs will be in Category A and can comply with the 64 dB $L_{Aeq(24hr)}$ with no mitigation required.

Predictions indicate noise levels from NoR D1 are generally expected to be reduced in comparison to the Do Nothing scenario due to SH22 changing from a rural state highway to an urban arterial road with reduced road speeds. Note, the assessment applies speed reductions at the Do Minimum scenario in accordance with NZS 6806. This differs for the transport model where speed change is considered at the Do Nothing stage.

Before construction commences, reassessment of the road traffic noise at PPFs covered in this report will be carried out to determine if the categories as set out in Appendix 3 are still achieved without mitigation and to determine BPO mitigation if required.

7.1 Project Description

7.1.1 Project Overview

The State Highway 22 (SH22) Upgrade (NoR D1) consists of the widening of SH22 to a four-lane arterial with separated walking and cycling facilities. The Project extends approximately 3.08km from the State Highway 1 (SH1) Drury Interchange in the east, and the extent of the FUZ between Woodlyn Drive and Oira Road in the west. The intersections at Jesmond Road and Great South Road will be signalised and a roundabout is proposed at Oira Road. An overview of the concept design is provided in Figure 7-1.

As the surrounding area is urbanised over time and alternative routes are implemented (particularly the proposed Pukekohe Expressway), the function of SH22 will change from a rural state highway to provide an appropriate urban arterial connecting the growth areas of Drury West to the wider network and centres, including providing a frequent transport bus network. This is likely to include a reduction in the speed limit to 50kph. SH22 will improve future connectivity to the proposed Drury West train station which currently forms part of the New Zealand Upgrade Programme (NZUP) project.



Figure 7-1 Overview of SH 22 Arterial Upgrade

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade include the following:

- Widening of SH22 from its current general width of 20m to enable a 30m wide four-lane road with separated walking and cycling facilities
- Localised widening around the existing intersections to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Demolition and reconstruction of the existing Ngakoroa Stream Bridge
- Proposed new and extended culverts
- Three proposed stormwater wetlands
- Batter slopes and retaining to enable widening of the corridor, and associated cut and fill activities
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, bridge works area, the re-grade of driveways and construction traffic manoeuvring
- Likely posted speed of 50km/h (reduced from the current posted speed of 60km/hr from Drury/SH1 interchange and Burberry Road and 80 km/hr from Burberry Road to the south western extent of Project).

7.2 Assessment of Road Traffic Noise Effects and Measures to Mitigate Potential Adverse Effects

Predicted road-traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum are shown in Appendix 2. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red. Where a property has multiple dwellings per address, only the most affected PPF is represented in the tables and maps.

Grid noise maps showing indicative levels across a 200m 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.

In accordance with NZS 6806, NoR D1 is not considered an Altered road as the anticipated changes in noise levels due to the Project do not meet relevant thresholds. However, an NZS 6806 screening assessment was carried out to determine this, which is presented below. Based on the proposed designation boundary, 102 Karaka Road and 458 Karaka Road will be removed to make room for the Project alignment and have not been considered in the assessment.

The Transport model data showed a speed change was applied under the Do Nothing scenario to include safety consideration of the urban growth predicted around the area – before the Project is implemented. As defined within NZS 6806, the Do Nothing scenario is the assessment at design year assuming no alterations are made to the existing road. This assessment has therefore been carried out in accordance with NZS 6806 and the proposed speed change has been applied at the Do Minimum scenario which differs from the Transport model.

The Transport modelling also showed that there is a traffic volume decrease under the Do Nothing scenario when compared to the Existing scenario. This is due to the assumption within the Transport

Assessment of Traffic Noise and Vibration Effects

model that the Pukekohe Expressway will be operational at Design year which provides an alternative route and reduces traffic flows on SH22.

7.2.1 Road Traffic Noise Model Results Analysis

A summary of the NZS 6806 assessment for NoR D1 is shown in Table 7-1. Predictions are based on SH22 retaining the low noise road surface of SMA-10.

Table 7-1 NZS 6806 Assessment and Summary – Altered Roads – NoR D1

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB L _{Aeq} (24h)	16	17	18
Cat B	67 dB L _{Aeq} (24h)	2	1	0
Cat C	40 dB Internal L _{Aeq} (24h)	0	0	0
Total		18	18	18

Existing scenario predictions show the noise levels within the NoR D1 project area range between 47 – 66 dB L_{Aeq}(24hr).

Under the Do Nothing scenario, the predicted traffic noise levels range between 46 - 65 dB L_{Aeq}(24hr).

For the Do Minimum scenario, predicted traffic noise levels show a general decrease with a range of 43 – 63 dB L_{Aeq}(24hr) with all PPFs in Category A. As all PPFs are predicted to receive noise below 64 dB L_{Aeq}(24hr), this Project does not qualify as an Altered road under NZS 6806 and no mitigation options are required.

7.2.2 Assessment of Traffic Noise Effects

The effect of noise level changes has also been considered. The Do Nothing scenario (Project design year traffic flow without Project) and Do Minimum scenario (Project design year traffic flow with Project) can be compared to determine the predicted noise level increase or decrease as a result of the Project for the PPFs.

Figure 7-2 shows the noise level change in the Design year compared to the Do Nothing scenario.

Assessment of Traffic Noise and Vibration Effects

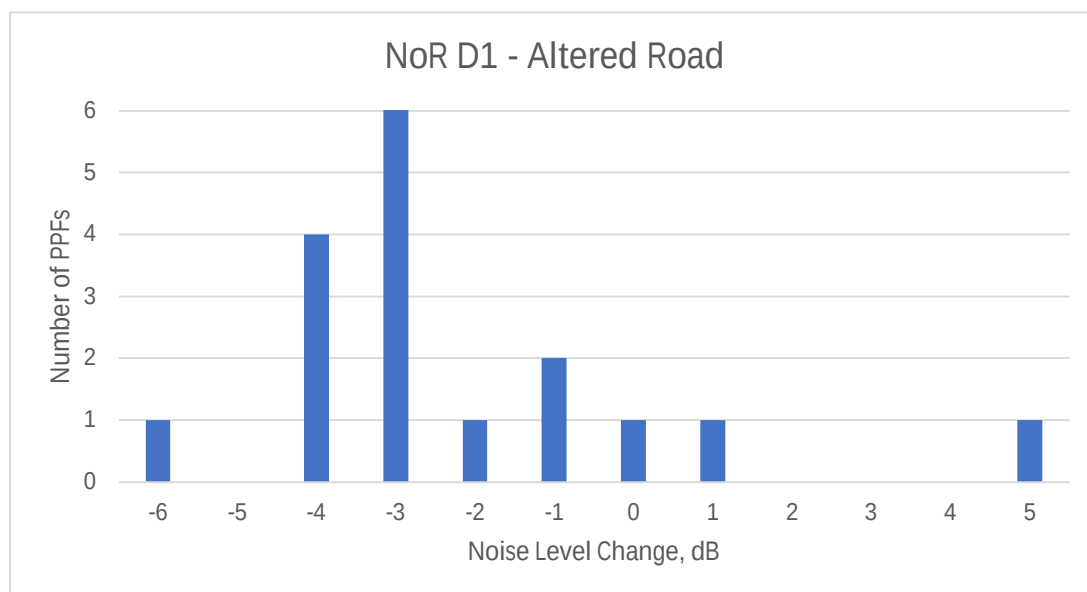


Figure 7-2 Noise Change Assessment – Do Nothing Vs Do Minimum – NoR D1

Despite a slight traffic volume increase when comparing the Do Nothing and Do Minimum scenarios, the noise reductions, all PPFs but three are predicted to receive noise level reductions, with 11 PPFs receiving noticeable to significant reductions. This is as a result of SH22 changing from a rural state highway to an urban arterial road with reduced road speeds.

One PPF which is predicted to experience a noticeable increase in noise level of 5 dB when compared to the Do Nothing scenario due to the change in proximity of the new alignment.

7.2.3 Conclusion

An assessment of traffic noise has been carried out based on NZS 6806 and change in traffic noise levels due to the Project (assuming all other Projects are also implemented as well as other transport projects in the area). All existing PPFs within 200m of the alignment have been considered within the assessment. PPFs that are within the designation boundary and listed in Section 7.2 have been not been included in the assessment as they will be removed to provide for the Project.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and with the Project (Do minimum scenario) has indicated that noise levels will generally be lower as a result of the Project. This is as a result of SH22 changing from a rural state highway to an urban arterial road with reduced road speeds (noting that the NZS 6806 assessment differs from the transport model assumptions of when a speed reduction was applicable) All PPFs will move to or remain in Category A, with predicted noise levels below 64 dB $L_{Aeq}(24hr)$ and no mitigation measures are required.

Before construction commences, reassessment of the road traffic noise at PPFs covered in this report will be carried out to determine if the categories as set out in Appendix 3 are still achieved without mitigation and to determine BPO mitigation if required.

8 NoR D2: Jesmond to Waihoehoe West FTN Upgrade

Chapter Summary

The assessment was carried out in two parts for the Altered road and New road along Jesmond to Bremner Road Link. The other sections of NoR D2 were assessed as Altered roads.

Noise effects of road traffic on Altered road PPFs have been assessed by comparing the predicted Do Nothing noise levels (assuming traffic from full area development on the existing road network) with the predicted noise levels in the design year with the Project with mitigation. For New roads, PPFs have been assessed by comparing the existing noise levels with the predicted noise levels in the design year with the Project with mitigation. A summary of the noise effects on PPFs have been provided.

PPFs that are not yet built or do not have building consent are not included in the modelling, however noise levels across the currently vacant land are provided in the grid noise maps within the Appendices and are indicative of the potential noise environment for that Land. Parts of Stage 2 of the Auranga Development have been included as they have building consent.

For Altered roads predictions indicate noise levels due the Project at all PPFs will remain in or move to Category A with predicted noise levels below 64 dB $L_{Aeq(24hr)}$ with mitigation of low noise road surface applied.

Noise level changes due to the Project (and surrounding transportation projects resulting in redistribution of traffic across the network) is expected to result in positive effects with noise level decreases at all existing PPFs.

For New roads, predictions indicate noise levels at all but two PPFs will be within Category A and below 57 dB $L_{Aeq(24hr)}$ with mitigation of low noise road surface in place. The remaining two PPFs are predicted to receive noise levels that are within Category B, and no practicable mitigation beyond the low noise road surface has been identified.

Noise increases due to the Project will be significant for PPFs assessed under the New Road criteria, however it is considered the resultant noise levels of 45-60 dB $L_{Aeq(24h)}$ are appropriate for residential use.

Low noise road surface (asphaltic concrete) is recommended for the entire NoR D2 to mitigate traffic noise levels. However, before construction commences, reassessment of the road traffic noise at PPFs within this Project will be carried out to determine if mitigation recommended are still BPO to meet the categories as set out in Appendix 3. For the altered sections of roads the PPFs are all Category A. For the New road sections, 13 are Category A and two in Category B.

8.1 Project Description

The Jesmond to Waihoehoe West FTN Project (NoR D2) includes, an approximately 4.1km long four-lane FTN arterial route along Jesmond Road, through a new greenfields link between Jesmond Road and the existing Bremner Road, Bremner Road, Norrie Road and Waihoehoe Road West. It primarily involves upgrading and widening existing transport corridors with the exception of the new link between Jesmond Road and the existing Bremner Road and the new bridge connection over Hingaia

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Stream. The functional intent of the Project is to provide an appropriate urban arterial connecting the growth areas of Drury West to the wider network and centres, including providing a frequent transport bus network. Generally, a 30m wide transport corridor will be provided with two general traffic lanes, two bus lanes and separated walking and cycling facilities on both sides of the road corridor. The urban arterials will have a likely speed limit of 50kph.

For assessment purposes, the Project has been separated into three sections, as shown in Figure 8-1, including:

- Jesmond Road FTN Upgrade;
- Bremner Road FTN Upgrade (including the Jesmond to Bremner link through the Auranga Development, Bremner Road and Norrie Road); and
- Waihoehoe Road West FTN Upgrade including the Great South Road intersection.

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade common to each Project section include the following:

- A typically 30m wide road with four lanes and separated walking and cycling facilities
- Localised widening around the existing intersections to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Batter slopes and retaining to enable widening of the corridor and/or wetland construction, and associated cut and fill activities
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, bridge works area, the re-grade of driveways and construction traffic manoeuvring.

Further details of each Project section are provided below.

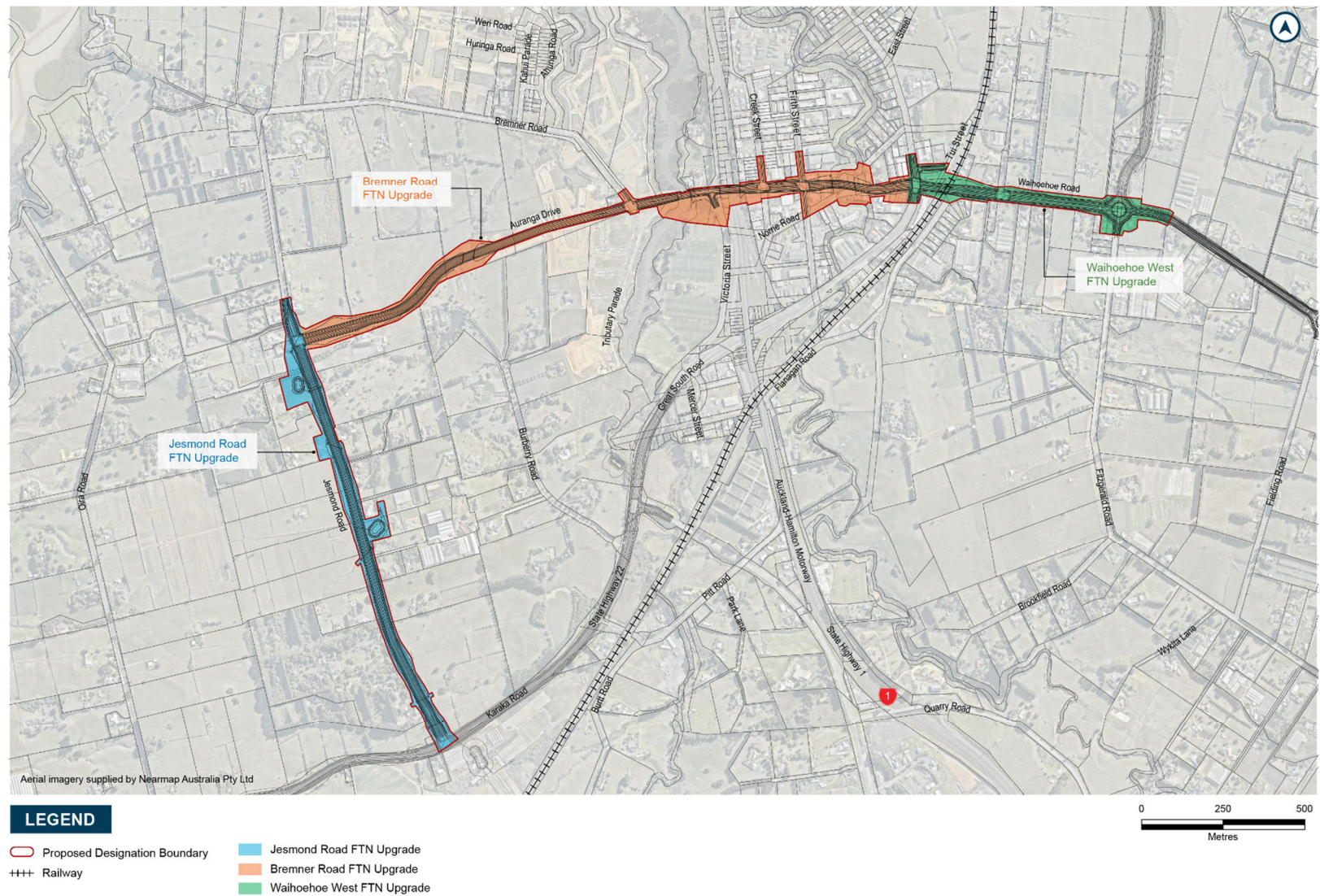


Figure 8-1 Overview of NoR D2

8.1.1 Jesmond Road FTN Upgrade Section

8.1.1.1 Section Overview

The Jesmond Road corridor provides greater accessibility via a north-south link that connects Bremner Road to the proposed Drury West Station and town centre, forming a key public transport and active mode spine through Drury West. An overview of the proposed design is provided in Figure 8-2.

In addition to those listed above, the key features of the Jesmond Road section include:

- Signalised intersections at SH22 and the new Jesmond to Bremner Link
- New and extended pipe culverts for cross drainage
- Two stormwater wetlands.



Figure 8-2 Overview of Jesmond Road Section

8.1.2 Bremner Road Section

8.1.2.1 Section Overview

The Bremner Road FTN Upgrade section extends from Jesmond Road in the west, approximately 1.98km to the end of Norrie Road in the east. This section involves the construction of a new road from Jesmond Road to the existing Bremner Road referred to as the “Jesmond to Bremner Link” and widening, and direct connection via a new bridge over Hingaia Stream, of Bremner Road and Norrie Road to enable the four-lane FTN arterial. The functional intent of this section provides greater east-west accessibility that connects Jesmond Road to Great South Road and town centre, forming a key public transport and active mode spine.

An overview of the concept design is provided in Figure 8-3.

In addition to those listed above, the key features of the Bremner Road FTN Upgrade section include:

- Signalised intersections on Bremner Road with Auranga Road 1, Creek Street and Firth Street
- Between Jesmond and Bremner Roads (Jesmond to Bremner Link):
 - A new road from Jesmond Road to an unnamed stream at the Auranga Development.
 - Forming of two additional lanes for the FTN within the Auranga “Road 1” from the unnamed stream to Bremner Road)
- A new bridge over an unnamed stream within the Jesmond to Bremner Link
- Reconstruction and widening of the two existing bridges crossing Ngakoroa Stream and SH1
- A new bridge connection from Bremner Road to Norrie Road across Hingaia Stream
- Removal of Norrie Road Bridge and closure of Norrie Road west
- Removal of access to Bremner Road from Creek Street (south).

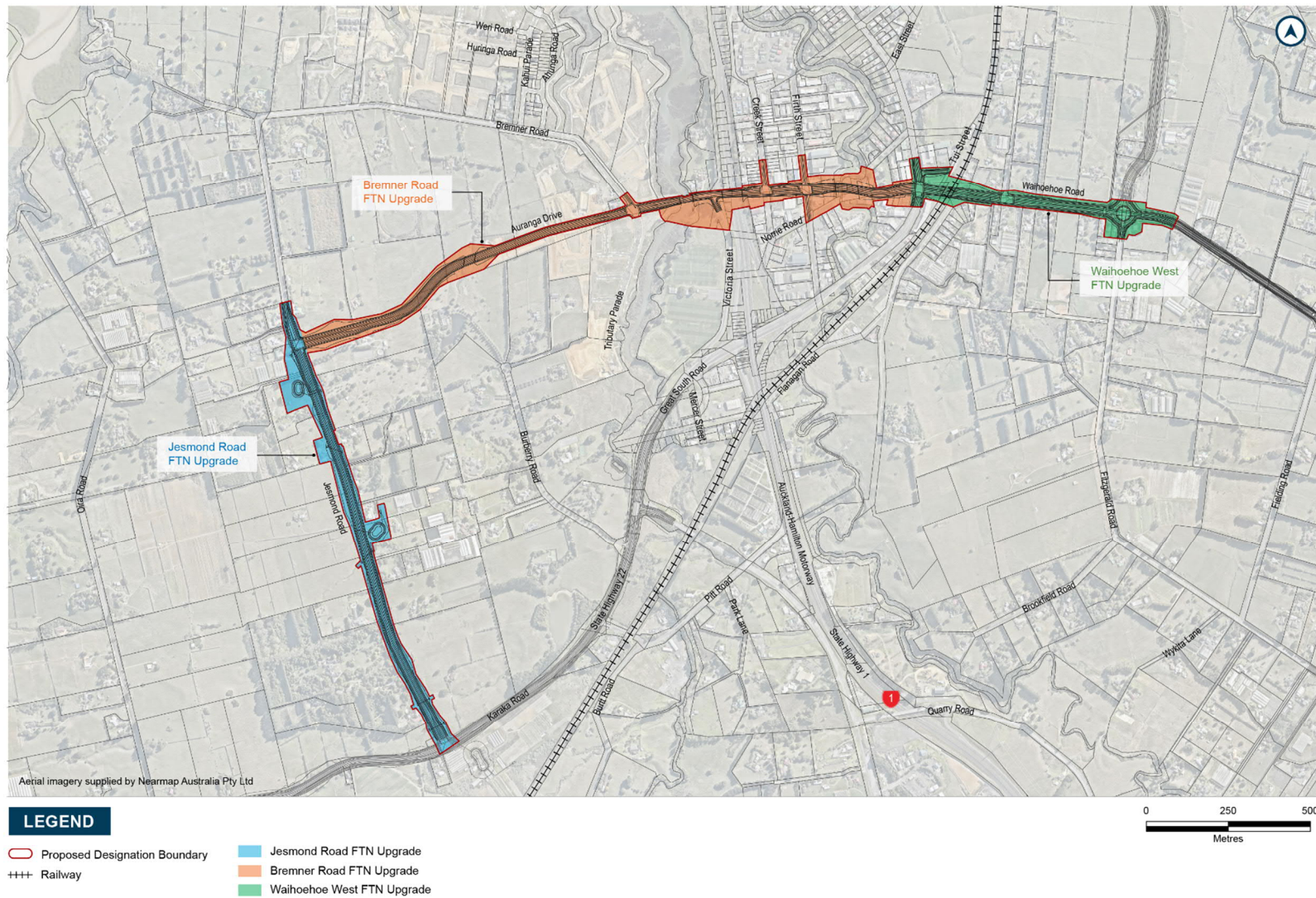


Figure 8-3 Overview of Bremner Road Section

8.1.2.2 Specific Features of this section

The existing Bremner Road sits north of the proposed Jesmond and Bremner Link alignment, joining into the main alignment before the Ngakoroa Stream bridge. Only PPFs within 200m of the new alignment have been considered, which is consistent with NZS 6806, as no Project works are expected along the existing northern part of Bremner Road.

NoR D2 consists of New roads and Altered roads as per NZS 6806. Figure 8-4 below identifies the sections of the Project assessed as New roads (highlighted red) or as Altered roads (highlighted blue).

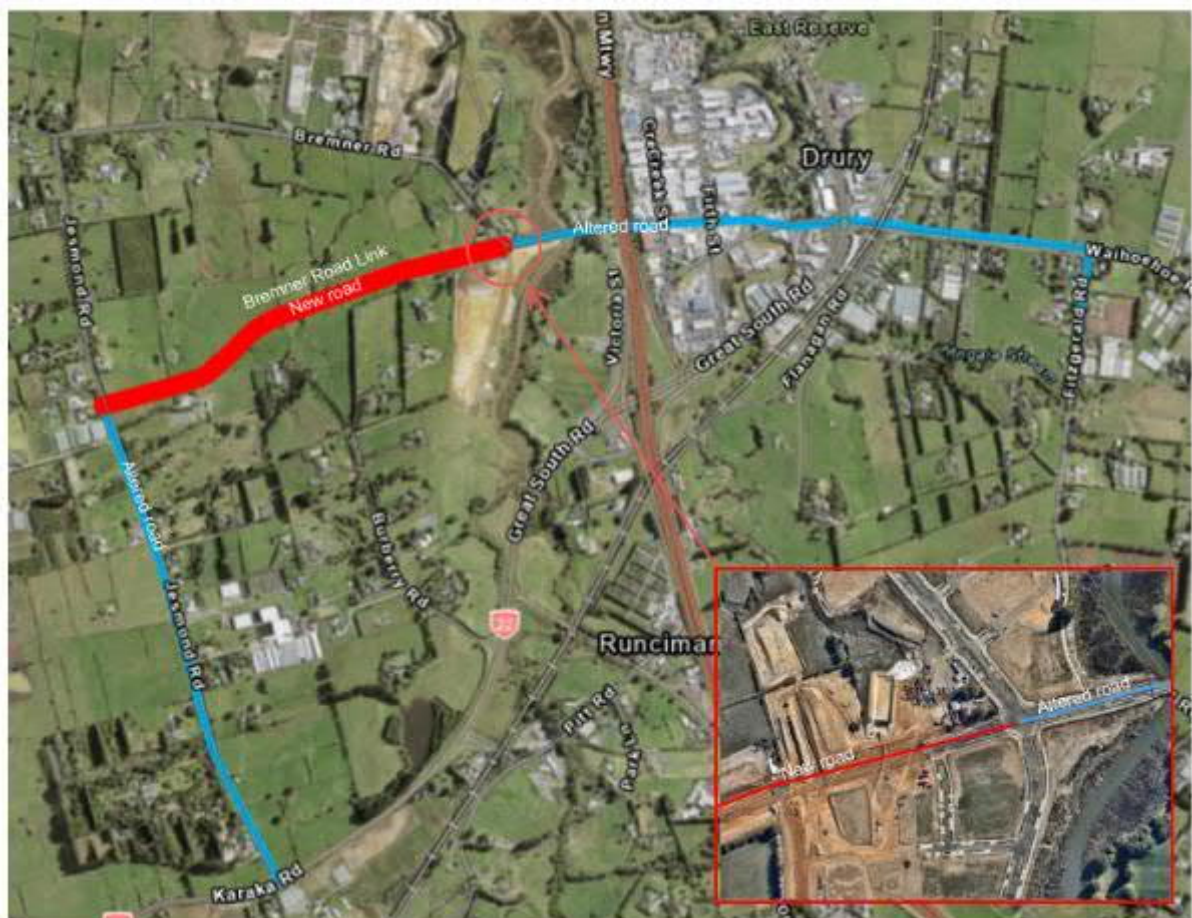


Figure 8-4 Jesmond to Bremner Link through Drury 1 Precinct showing northern section of Bremner Road which is not part of the Project and sections assessed under New Road or Altered Road

Detailed masterplans for the Auranga are not currently available for all stages of the development but designs for an area within Stage 2 that has building consent show single storey buildings. Developments that do not have building consent have not been included within the assessment, such as a proposed day care at 132 Jesmond Road. However, noise level contours show the estimated noise level over currently vacant land which would assist any future development when determining appropriate insulation or siting of dwellings or other noise sensitive facilities.

It is understood that Auranga will be building a 28m wide road along the centre of the project alignment from the intersection of the existing Bremner Road towards the eastern side of the stream,

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The Auranga road will be built with a large berm on the northern side so that it can be upgraded by the Project in the future. The 28m wide section of the Bremner Link is not yet built and will serve only the development after completion (without the Project), and as such traffic flow volumes are expected to be extremely low and no traffic noise assessment has been carried out by the Auranga Development. Therefore, we have considered traffic noise from this section of road against the New road criteria in line with the rest of the Jesmond to Bremner Link proposed for the Project.

The part of Bremner Road to be upgraded runs through an industrial area, and there is a church within this area, adjacent to the designation boundary. Whilst churches are not considered PPFs as part of the NZS 6806 assessments, changes in noise levels will likely be perceptible to the occupants.

8.1.3 Waihoehoe Road West FTN Upgrade Section

8.1.3.1 Section Overview

The Waihoehoe Road West FTN Upgrade section extends from Great South Road in the west, approximately 800m east to just past Fitzgerald Road in the east and involves widening the existing two-lane rural road to enable the four-lane FTN arterial. The functional intent for the section provides a strategic east-west link between strategic north-south and east-west corridors (Norrie Road, Great South Road and the Ōpāheke N-S FTN Arterial) that connects Waihoehoe Road to the Drury Central Station (and associated park and ride facilities) and town centre, forming a key public transport and active mode spine through Drury West. An overview of the concept design is provided in Figure 8-5.



Figure 8-5 Overview of Waihoehoe Road West Section

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In addition to those listed above, the key features of the Waihoehoe Road West Project section include:

- Realignment of Tui Street to Great South Road
- Upgraded and signalised intersection at Great South Road
- Reconstruction of the bridge crossing the NIMT rail line
- Relocation of the Waikato 1 watermain. The point of re-location to be agreed with Watercare at future detailed design

8.2 Assessment of Road Traffic Noise Effects and Measures to Mitigate Potential Adverse Effects

The traffic noise assessment for NoR D2 has been separated into the typology of Altered road and New Road instead of the three separate sections of roads described in Section 8.1 above. Each PPF was assessed against the relevant noise criteria of either a New or Altered road, depending on the classification as described in Section 4.1.2.2.

Predicted road-traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix 2. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red. Where a property has multiple dwellings per address, only the most affected PPF is represented in the tables and maps.

Grid noise maps showing indicative levels across a 200m 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.

Based on the indicative designation boundary maps, the following residential buildings will be removed to make room for the Project alignment, and have not been considered in the assessment:

- 1 Fitzgerald Road
- 6 Fitzgerald Road
- 41 Jesmond Road
- 188 Jesmond Road
- 18 Waihoehoe Road
- 115 Waihoehoe Road

8.2.1 Altered Roads

8.2.1.1 Road Traffic Noise Model Results Analysis

Jesmond Road, Waihoehoe Road West and part of the existing Bremner Road where it joins the designation area were assessed as Altered roads.

Where a PPF is within both 100m of a New road and Altered road, these have been considered as part of the Altered road criteria.

A summary of the NZS 6806 assessment for NoR D2 is shown in Table 8-1.

Assessment of Traffic Noise and Vibration Effects

Table 8-1 NZS 6806 Assessment and Summary – Altered Roads – NoR D2

Category	Criteria	Number of PPFs			
		Existing	Do Nothing	Do Minimum	With Mitigation
Cat A	64 dB L _{Aeq} (24h)	67	51	60	69
Cat B	67 dB L _{Aeq} (24h)	2	8	5	0
Cat C	40 dB Internal L _{Aeq} (24h)	0	10	4	0
Total		69	69	69	69

Existing scenario predictions show the noise level within the Project area is between 43 – 66 dB L_{Aeq}(24hr) with two PPFs in Category B and the remainder within Category A.

Under the Do Nothing scenario, predictions show a higher traffic noise level range between 50 – 72 dB L_{Aeq}(24hr) with ten PPFs in Category C and eight PPFs into Category B due to an increase in traffic volumes.

The Do Minimum scenario showed a slightly lower predicted range compared to the Do Nothing scenario of 46 – 68 dB L_{Aeq}(24hr) due to the reduced traffic speed from 80 km/h to 50 km/h with four PPFs remaining in Category C and five PPFs in Category B. In accordance with NZS 6806, mitigation options should be considered for the 10 PPFs that are predicted to receive noise levels within Category B and C.

A mitigation option of applying asphalted concrete (AC-14) to all Altered roads was assessed which is predicted to reduce all PPFs to Category A. This is the recommended mitigation option for the Altered roads within NoR D2.

8.2.1.2 Assessment of Traffic Noise Effects

In addition to assessing effects due to absolute noise levels, the effect of road noise changes has also been addressed. The Do Nothing scenario (Project design year traffic flow without Project) and Mitigation Option scenario (project design year traffic flow with Project and mitigation applied) can be compared to determine the predicted noise level increase or decrease as a result of the Project for the Altered road PPFs.

The following Figure 8-6 shows the noise level change in the Design year for all Altered road PPFs.

Assessment of Traffic Noise and Vibration Effects

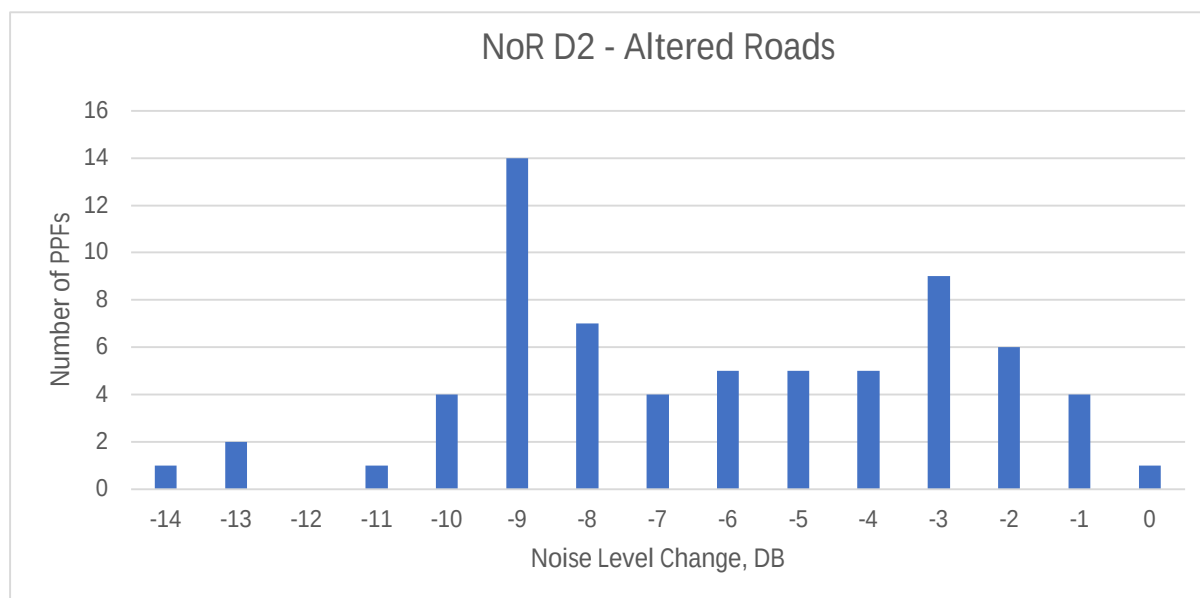


Figure 8-6 Noise Change Assessment – Do Nothing Vs Project with Mitigation – NoR D2 Altered Roads

All PPFs are predicted to receive noise level reductions, with 57 PPFs receiving noticeable to significant reductions, and 11 PPFs are predicted to experience 1 – 2 dB decrease which is negligible and not perceptible. This is a result of reduced road speeds with slightly reduced traffic flow along Jesmond Road and significantly reduced traffic flow along Bremner Road when compared to the Do Nothing scenario.

Significant noise level decreases (9 dB decrease or more) are experienced at 22 PPFs as a result of the Project with the mitigation applied and where applicable, the removal of minor dwellings closest to the road at PPF addresses with multiple dwellings (the remaining dwelling is located further from the road). Of the 22 PPFs, three of the PPFs along Bremner Road are predicted to experience a 14 dB and 13 dB decrease respectively due to the significant reduction in traffic volumes with the Project (and all other Projects of the Drury package) implemented, mitigation measure of low road surface applied and the new road alignment resulting in the road being elevated above the receiver level. These changes would be noticeable and would result in significant positive effects for those PPFs.

8.2.2 New Roads

8.2.2.1 Road Traffic Noise Model Results Analysis

Jesmond to Bremner Road Link was assessed as a New road. The alignment is proposed to traverse currently rural land, that will be redeveloped in the future. The proposed roads are intended to provide for the future urbanisation. This assessment discusses the existing PPFs with the understanding that they may not be relevant at the time the roads are constructed. Building consent for Stage 2 of the Auranga development has been granted and building masterplans for these works have been included within the assessment of this Project.

In accordance with NZS6806, there is no Do Nothing scenario for the New road, so the existing and Do Minimum scenarios are compared.

Assessment of Traffic Noise and Vibration Effects

Table 8-2 NZS 6806 Assessment and Summary – New Roads – NoR D2

Category	Criteria	Number of PPFs		With Mitigation
		Existing	Do Minimum	
Cat A	57 dB $L_{Aeq(24h)}$	15	11	13
Cat B	64 dB $L_{Aeq(24h)}$	0	3	2
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	1	0
Total		15	15	15

Existing scenario predictions show the noise level within the project area is between 38- 47 dB $L_{Aeq(24hr)}$ with all PPFs in Category A.

The Do Minimum scenario shows increased noise levels with a predicted range of 50 – 65 dB $L_{Aeq(24hr)}$ with one PPF changing to Category C and three PPFs in Category B. It is generally expected that a new road in a rural area will increase the ambient noise levels.

A mitigation option of installing Asphaltic concrete mixes (AC-14) for the whole new road alignment has been considered. This option would reduce noise levels at all PPFs with a direct line of sight to the new alignment by 4-6 dB resulting in all but two PPF (at 6 Auranga Stage 2 development and 235 Jesmond Road) receiving noise levels within Category A. This is the recommended BPO mitigation option for the New Roads within NoR D2.

Noise levels at 6 Auranga Stage 2 development (actual address unknown) is predicted to be 1 dB higher than the Category A criterion of 57 dB $L_{Aeq(24hr)}$. At present, the topography of the land around this development is unclear and 1.8m local barriers may not provide additional benefit at this location. However, a 1 dB higher noise level would not be noticeable and would not materially change the effects on the PPF.

Noise levels at the PPF at 235 Jesmond Road are predicted to be reduced from Category C to Category B by installing Asphaltic concrete (AC-14) on the road. Additional mitigation such as a 1.8m high localised barrier has been considered but it would not be effective at this property due to its elevated position above the alignment. To bring the noise levels down to Category A at this PPF, a 6m high local barrier is required. This is not considered to be the BPO as a 6m high barrier is not in keeping with a residential environment, there is potential for visual and shading effects, and the costs compared with the practicability of reducing noise levels at this particular PPF. Therefore, no additional mitigation beyond the application of Asphaltic concrete mixes is recommended for this PPF.

8.2.2.2 Assessment of Traffic Noise Effects

The following Figure 8-7 shows the noise level change in the Design year for all New road PPFs.

Assessment of Traffic Noise and Vibration Effects

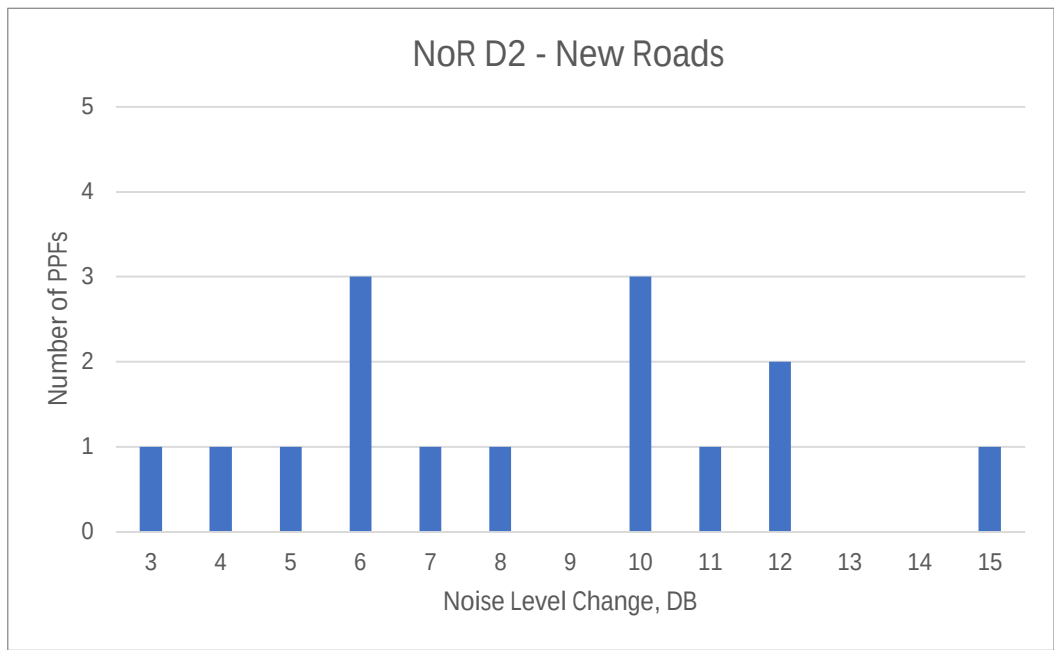


Figure 8-7 Noise Change Assessment – Existing Vs Project with Mitigation – NoR D2 New Roads

All PPFs are predicted to experience a noise level increase of 3 dB or more, with 12 PPFs predicted to experience a 6 – 15 dB increase due to the Project. These are significant changes and will be clearly noticeable. Noise level increases of 10 dB and higher will be perceived as a doubling of loudness at least. In addition, the new road will introduce a noise source that is not currently present for these dwellings.

Such noise increase will be significant to the residents, if they still reside in the area at the time of the road opening. Nevertheless, the resultant noise levels of 45 – 60 dB $L_{Aeq(24h)}$ are appropriate for residential use and not unexpected in an urban environment.

It is noted that 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. This is not applicable for any PPFs included as part of the Auranga development.

8.2.3 Conclusion

An assessment of traffic noise has been carried out for New and Altered roads based on NZS 6806 and the predicted change in noise levels.

All existing PPFs within 200m of the alignment have been considered within the assessment. PPFs that are within the proposed designation area and listed in Section 8.2 have been removed from the Do Minimum scenario as they will be removed to provide for the Project.

For Altered roads, 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, and all other Projects in the Drury package) has indicated that

Assessment of Traffic Noise and Vibration Effects

noise levels will decrease at all PPFs as a result of the Project and overall network improvements. All PPFs remain in the most stringent Category A with predicted noise levels below 64 dB $L_{Aeq(24hr)}$ for Altered roads with mitigation applied.

For New roads all but two PPFs remain in Category A with noise levels below 57 dB $L_{Aeq(24h)}$ with mitigation applied. Noise increases due to the Project will be significant for PPFs assessed under the New Road criteria as the new road introduces a noise source into a currently quiet rural environment. However, it is considered the resultant noise levels of 45-60 dB $L_{Aeq(24h)}$ are appropriate for residential use and not unexpected in an urban environment

Mitigation in the form of low-noise road surface material (Asphaltic concrete) is recommended for both the Altered roads and New road alignments along Jesmond Road, Bremner Road, Bremner Road Link and Waihoehoe Road West. However, before construction commences, reassessment of the road traffic noise at PPFs within this Project will be carried out to determine if mitigation recommended is still BPO to meet the categories as set out in Appendix 3. For the altered sections of roads the PPFs are all Category A. For the New road sections, 13 are Category A and two in Category B.

9 NoR D3: Waihoehoe Road East Upgrade

Chapter Summary

Noise effects of road traffic on PPFs have been assessed by comparing the predicted Do Nothing noise levels (assuming traffic from full area development on the existing road network), with the predicted noise levels in the design year with the Project with and mitigation in place.

PPFs that are not yet built or do not have building consent are not included in the modelling, however noise levels across the currently vacant land is provided in the grid noise maps within the Appendices and are indicative of the potential noise environment for that land.

NoR D3 consists of an existing road, and initial screening indicates this Project does not qualify as an Altered Road in accordance with NZS 6806.

The majority of PPFs will experience minor to significant positive effects with noise level decreases ranging between 2 – 15 dB due to the redistribution of traffic across the new network. One PPF is predicted to experience a 1 dB increase which will be a negligible change. Three PPFs will receive noise levels in Category B and three in Category C but are predicted to still experience a positive change in noise level with a 1-5 dB reduction when compared to the Do Nothing scenario.

NZS 6806 predictions indicate noise levels due the Project at all but three PPF will be in Category A. Predictions show noise levels at the Category B PPFs are above 64 dB $L_{Aeq}(24hr)$ but less than a 3 dB increase and Category C PPFs are above 68 dB $L_{Aeq}(24hr)$ but receive less than 1dB increase when compared to the Do Nothing, therefore this Project does not qualify as an Altered road under NZS 6806 and no further mitigation options are required.

The three Category C PPFs are 115 Waihoehoe Road, 1 Fitzgerald Road and 6 Fitzgerald Road and these PPFs have been identified as buildings to be removed to make room for the Project alignment in NoR D2. Therefore, it is unlikely that these PPFs will be present at the time of Project operation.

Before construction commences, reassessment of the road traffic noise at PPFs within this report will be carried out to determine if the categories as set out in Appendix 3 are still achieved without mitigation and to determine BPO mitigation if required.

9.1 Project Description

9.1.1 Project Overview

The Waihoehoe Road East Upgrade (NoR D3) consists of the widening of Waihoehoe Road to a two-lane arterial with walking and cycling facilities from the proposed intersection with Ōpāheke North-South Arterial in the east, to Drury Hills Road in the east. The functional intent of the Project is to provide strategic east-west connectivity between the strategic north-south corridors (Great South Road, the Ōpāheke N-S FTN Upgrade (NoR D4) and Mill Road), providing multi-modal access to the wider network for the planned growth area as well as providing access to the existing Drury township and proposed rail station (an NZUP project).

Assessment of Traffic Noise and Vibration Effects

The eastern extent of the Project will tie into the future Mill Road corridor which forms a separate NZUP project. The intersection with Ōpāheke North-South is proposed to be signalised, but this work forms part of NoR D2. Roundabouts are proposed at the intersections with Appleby Road and Cossey Road. The road will be an urban arterial with a likely reduced speed limit of 50kph. An overview of the proposed design is provided in Figure 9-1.

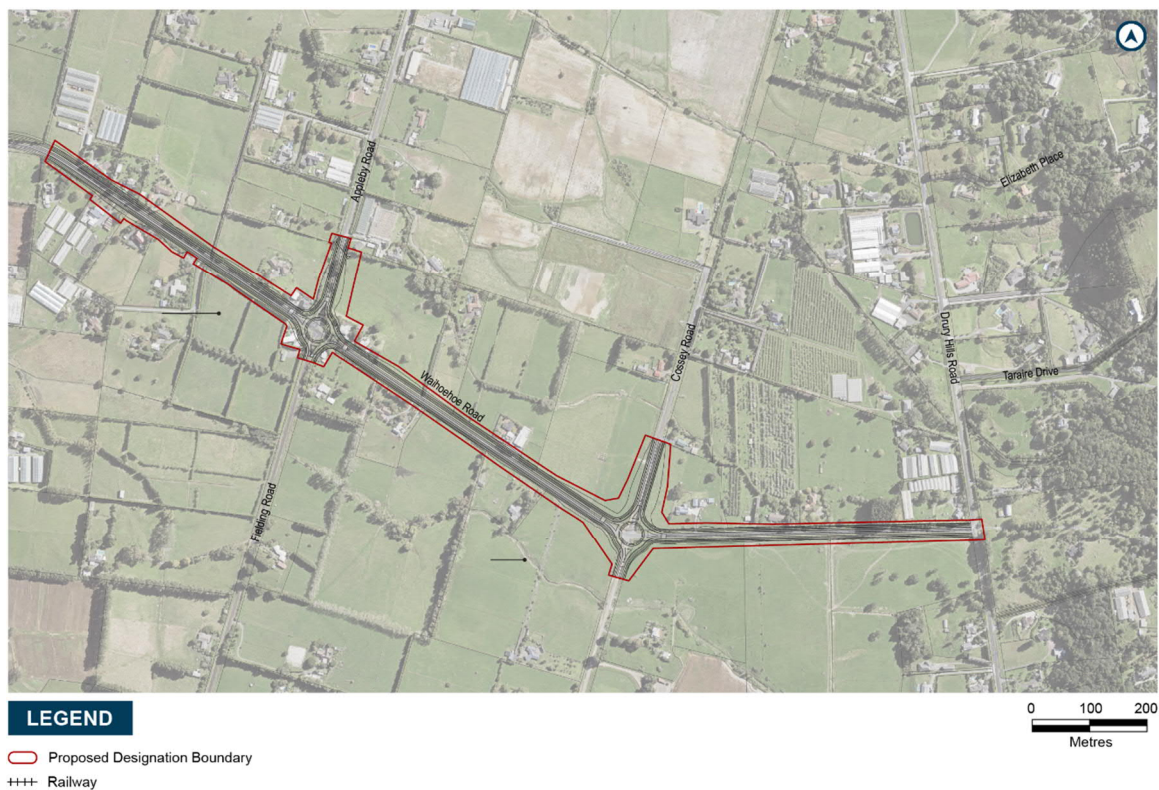


Figure 9-1 Overview of Waihoehoe Road East Upgrade

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade include the following:

- Widening of Waihoehoe Road from its current general width of 20m to enable a 24m wide two-lane cross-section including separated walking and cycling facilities
- Localised widening around the existing intersections to accommodate for the two proposed roundabouts
- Batter slopes to enable widening of the corridor, and associated cut and fill activities.
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, the re-grade of driveways and construction traffic manoeuvring.

Assessment of Traffic Noise and Vibration Effects

9.2 Assessment of Road Traffic Noise Effects and Measures to Mitigate Potential Adverse Effects

In accordance with NZS 6806, NoR D3 is not considered an Altered road as change in noise levels due to the Project do not meet relevant thresholds). However, an NZS 6806 screening assessment was carried out to determine this, which is presented below.

For this Project, changes to the road lanes are minimal and only occur at intersections. This (along with NoR D5) is different to the other designations assessed in this report, where widening is undertaken to accommodate the increase in traffic volume that will occur due to the intensified use of the area. For NoR D3, the increase in traffic volume would occur irrespective of the proposed works, which generally provide for walking and cycling facilities rather than additional traffic lanes. Therefore, while the assessment follows the same format as the other designations, the effects discussed are not strictly due to the Project.

Predicted road-traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix 2. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red. Where a property has multiple dwellings per address, only the most affected PPF is represented in the tables and maps.

Grid noise maps showing indicative levels across a 200m 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.

Based on the proposed designation boundary, the following residential buildings will be removed to make room for the Project alignment, and have not been considered in the assessment:

- 2 Appleby Road
- 188 Waihoehoe Road
- 272 Waihoehoe Road
- 251 Waihoehoe Road
- 26A Fielding Road

9.2.1 Road Traffic Noise Model Results Analysis

A summary of the initial NZS 6806 screening assessment for NoR D3 is shown in Table 9-1.

Table 9-1 NZS 6806 Screening Assessment and Summary – Altered Roads – NoR D3

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq}(24h)$	34	20	30
Cat B	67 dB $L_{Aeq}(24h)$	2	7	3
Cat C	40 dB Internal $L_{Aeq}(24h)$	0	9	3
Total		36	36	36

Existing scenario predictions show the noise levels within the project area is between 44 – 65 dB $L_{Aeq}(24hr)$ with two PPFs within Category B and the remainder in Category A.

Assessment of Traffic Noise and Vibration Effects

Under the Do Nothing scenario, predictions show an elevated traffic noise level range between 50 – 72 dB LAeq(24hr) with nine PPFs in Category C and seven PPFs in Category B due to an increase in traffic volumes assuming a full development build of the surrounding area and resultant traffic on the existing road network.

The Do Minimum scenario showed a slightly lower predicted range of 46 – 70 dB LAeq(24hr), due to the anticipated redistribution of traffic on the new road network. Only three PPFs remain in Category B and three PPFs remain in Category C. Predictions show noise levels at the Category B PPFs are above 64 dB LAeq(24hr) but receive less than a 3 dB increase when compared to the Do Nothing scenario, and Category C PPFs are above 68 dB LAeq(24hr) but receive less than 1dB increase when compared to the Do Nothing scenario. Therefore, this Project does not qualify as an Altered road under NZS 6806 and no further mitigation options are required.

Although no mitigation options are required to be considered in accordance with NZS 6806 it is good practice to consider mitigation at any Category C PPFs. The three Category C PPFs are 115 Waihoehoe Road, 1 Fitzgerald Road and 6 Fitzgerald Road. These PPFs have been identified as buildings to be removed to make room for the Project alignment in NoR D2. It is therefore unlikely that these PPFs will be present at the time of Project operation and no additional mitigation measures have been considered.

9.2.2 Assessment of Traffic Noise Effects

The effect of road noise changes has also been addressed. The Do Nothing scenario (Project design year traffic flow without Project) and Do Minimum scenario (Project design year traffic flow with Project) can be compared to determine the predicted noise level increase or decrease as a result of the Project for the PPFs.

The following Figure 9-2 shows the noise level change in the Design year for all PPFs.

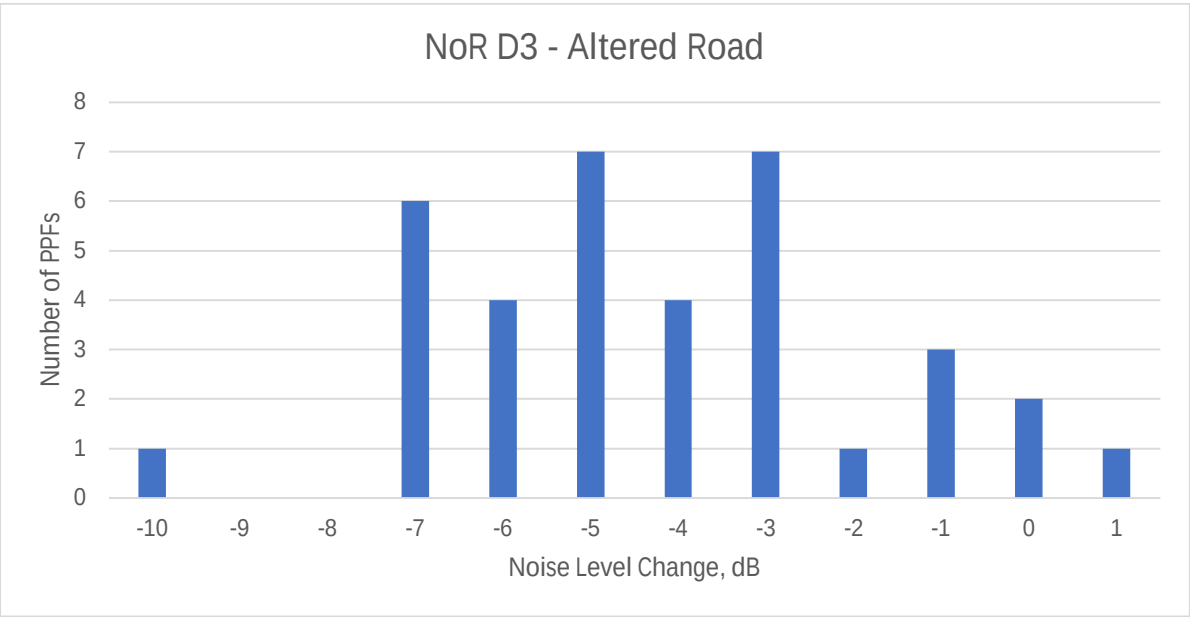


Figure 9-2 Noise Change Assessment – Do Nothing Vs Do Minimum – NoR D3

Assessment of Traffic Noise and Vibration Effects

All but one PPF are predicted to receive noise level reductions, with the majority of PPFs receiving noticeable to significant reductions. One PPF is predicted to experience a 1 dB increase which is negligible and not perceptible.

Significant noise level decreases (9 dB decrease or more) are experienced at one PPF (at 185 Waihoehoe Road) as a result a combination of the:

- reduced traffic volumes (14000 AADT for Do Nothing to 6700 AADT for Do Minimum, which is due to the assumption that the entire Drury network has been completed and traffic is distributed across the new network;
- reduced traffic speeds (80 km/h to 50 km/h) along Waihoehoe Road and
- topography of the area resulting in the PPF being slightly lower than road height.

These changes would be clearly noticeable and would result in positive effects for those PPFs.

It should be noted that all predictions along Project roads are based on assumptions of future traffic flow at a significant time in the future (2048). These traffic volumes rely on the urbanisation of the area. As such, even though modelling shows noise levels are likely to be similar or lower with the proposed Projects in place, the results are only indicative of a possible future scenario as the timeline of project implementation is uncertain. It is not possible to determine with certainty at this stage what the impact will be when the Projects are first built. Development of the surrounding areas will likely increase activity and associated noise levels. The future urban environment will also include a range of other noise sources, including new houses, a town centre and community facilities.

9.2.3 Conclusion

An assessment of traffic noise has been carried out based on NZS 6806 and the predicted change in noise level.

All existing PPFs within 200m of the alignment have been considered within this assessment. PPFs that are within the designation area and listed Section 9.2 have been removed from the Do Minimum Scenario as they will be removed to provide for the Project.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project, and all other Projects in the Drury package) and the Do Minimum scenario (representative of the design year with the Project) has indicated that noise levels will generally be noticeably lower than the Do Nothing as a result of the Project and overall network improvements, and predictions indicate that three PPFs will receive noise levels in Category B and three in Category C. As predictions show noise levels at the Category B PPFs are above 64 dB $L_{Aeq(24hr)}$ but represent a less than 3 dB increase and Category C PPFs are above 68 dB $L_{Aeq(24hr)}$ but receive less than 1dB increase when compared to the Do Nothing scenario, this Project does not qualify as an Altered road under NZS 6806 and no further assessment or mitigation options are required. However, before construction commences, reassessment of the road traffic noise at the PPFs within this report will be carried out to determine if the categories as set out in Appendix 3 are still achieved without mitigation and to determine BPO mitigation if required.

The majority of PPFs will experience minor to significant noise level reductions resulting in positive effects for the PPFs with the Project implemented, due to the reduced traffic flow.

10 NoR D4: Ōpāheke North-South FTN Arterial

Chapter Summary

Noise effects of road traffic on Altered road PPFs have been assessed by comparing the predicted Do Nothing noise levels (assuming traffic from full area development on the existing road network) with the predicted noise levels in the design year with the Project with mitigation. For New roads, PPFs have been assessed by comparing the existing noise levels with the predicted noise levels in the design year with the Project with mitigation.

PPFs that are not yet built or do not have building consent are not included in the modelling. However, noise levels across the currently vacant land are provided in the grid noise maps within the Appendices and are indicative of the potential noise environment for that land.

NoR D4 consists of a New road with existing (Altered) road sections at tie ins along Waihoehoe Road and Ponga Road.

NZS 6806 assessment for the New roads indicate noise levels at all but four PPFs can comply with the Category A criterion of 57 dB $L_{Aeq(24hr)}$ with mitigation of low noise road surface and 1.8m high localised barriers in place. Four PPFs will remain in Category B even with mitigation implemented due to being either a 2-storey building or on elevated terrain where localised barriers do not benefit.

For the New road sections, 12 of the 14 PPFs assessed are predicted to receive noise level increases between 5 and 20 decibels, which is a significant change. The reason is that the new road will introduce a noise source that is not currently present for these dwellings. Even with mitigation measures in place, this noise increase will be significant to the residents, if they still reside in the area at the time of road opening. However, as noise levels are generally at or below 57 dB $L_{Aeq(24h)}$ with mitigation in place, noise levels are reasonable for residential use.

PPFs within 100m of an existing road are assessed under the Altered road criteria, and there are 13 PPFs which fall within these criteria.

A negligible noise change of 1 dB decrease is predicted at the majority of PPFs due to the redistribution of traffic across the new network, which will not be noticeable.

Of the 13 PPFs, two PPFs will remain in Category B and four in Category C. As noise at these PPFs are controlled by the existing road rather than the new road, and predictions show noise levels at the Category B PPFs are above 64 dB $L_{Aeq(24hr)}$ but less than a 3 dB increase, and Category C PPFs are above 68 dB $L_{Aeq(24hr)}$ but less than a 1 dB increase when comparing the Do Nothing and Do Minimum scenarios, no mitigation is required under NZS 6806.

However, before construction commences, reassessment of the road traffic noise at PPFs within this Project will be carried out to determine if mitigation recommended is still BPO to meet the categories as set out in Appendix 3. For the altered sections of roads, seven PPFs are Category A, two in Category B and four in category C. For the New road sections, nine are Category A and four in Category B.

Even with mitigation measures in place for the New road PPFs, some would experience noise increases that would be significant to the residents, if they still reside in the area at the time of road

Assessment of Traffic Noise and Vibration Effects

opening. However, overall, the resultant noise levels within NoR D4 are considered appropriate for residential use.

10.1 Project Description

10.1.1 Project Overview

The Ōpāheke North-South FTN Arterial is a new 30m four-lane FTN arterial with separated walking and cycling facilities between Hunua Road in the north and Waihoehoe Road in the south. The road will be an urban arterial with a likely speed limit of 50 kph. The functional intent of the Project from a transport perspective is to increase connectivity and provide for good people-movement and public transport function through the FUZ. The Project will also support SH1, Great South Road and the proposed Mill Road corridor by providing a new corridor which will cater more to local north-south trips in Drury.

The road traverses greenfields zoned FUZ, crossing approximately seven streams (or tributaries of streams) and areas of flood plain, providing a new north-south connection between Drury and Papakura. The intersection with Hunua/Boundary Roads will be signalised, and roundabouts are proposed at Ōpāheke Road / Ponga Road, Walker Road and Waihoehoe Road. The intersection at Waihoehoe Road is not included in this project extent (it is included within NoR D2). An overview of the proposed design is provided in Figure 10-1.

Assessment of Traffic Noise and Vibration Effects

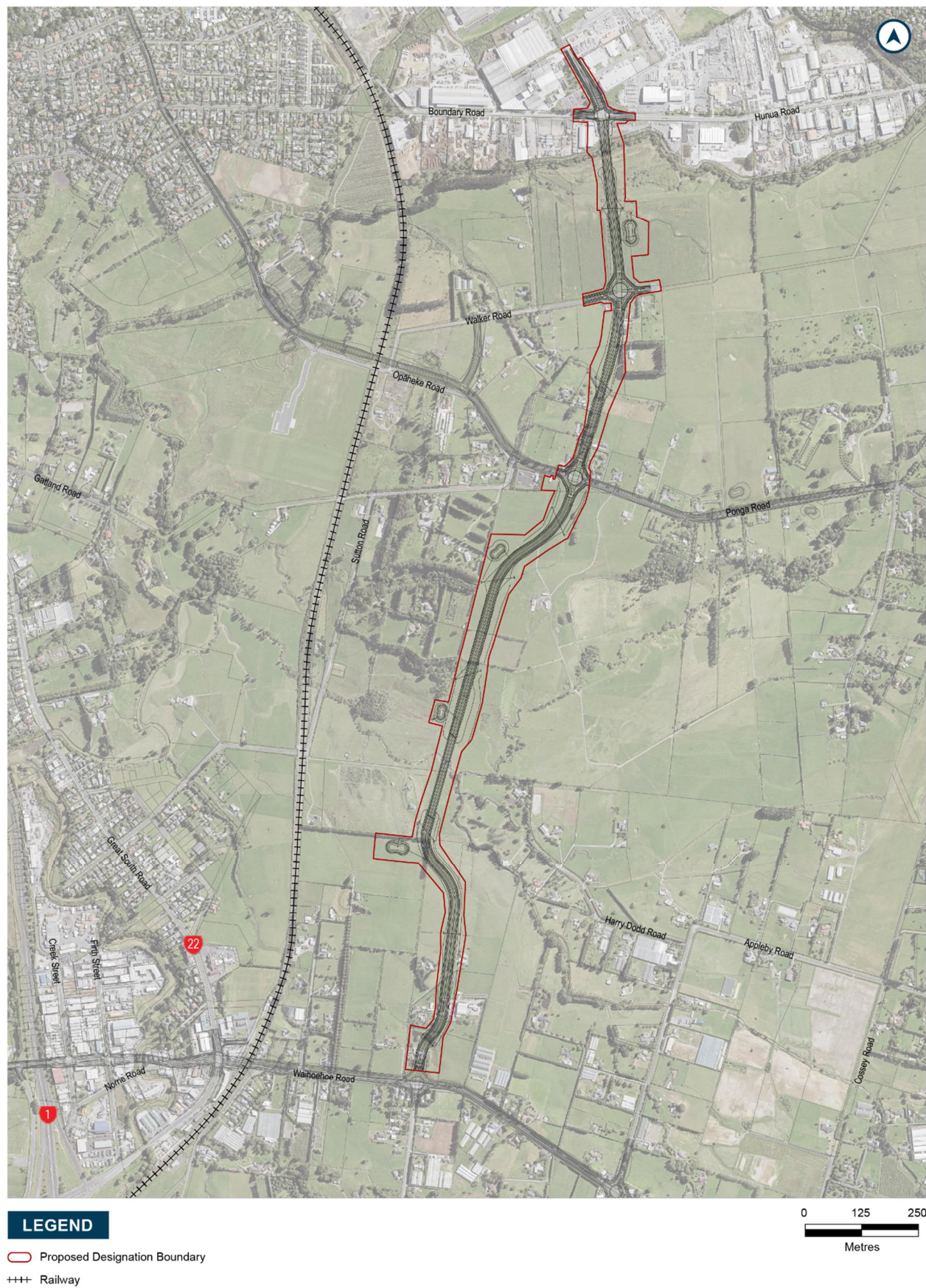


Figure 10-1 Overview of Ōpāheke N-S FTN Arterial Upgrade

Assessment of Traffic Noise and Vibration Effects

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposal include the following:

- A new road to enable a 30m wide four-lane cross section including bus lanes and separate walking and cycling facilities
- Localised widening around intersections with existing roads to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Two proposed bridges over Waipokapū Stream (approximately 120m) and Waihoehoe Stream and floodplain (approximately 265m).

10.2 Assessment of Road Traffic Noise Effects and Measures to Mitigate Potential Adverse Effects

The proposed Ōpāheke North-South FTN Arterial will tie into existing roads. At the southern extent it will tie into Waihoehoe Road / Fitzgerald Road which is within NoR D2, further north at Ponga Road / Ōpāheke Road which is also within NoR D5, and at the northern extent at Hunua/Boundary Roads.

The intersection with Hunua and Boundary Roads is zoned light industrial under the AUPOIP and does not contain PPFs.

As identified in Section 4.1.2, where new roads intersect the existing roads, all PPFs within 100m of the existing road will be assessed under the Altered road criteria. The following Figure 10-2 and Figure 10-3 show where the Altered road criteria are applied along the intersections of Ponga Road and Waihoehoe Road.

The green areas show the 100m boundary from an existing road and red line indicates the 200m boundary for NZS 6806 assessment. All PPFs within the green shaded areas will be assessed under the Altered road criteria.

Assessment of Traffic Noise and Vibration Effects



Figure 10-2 NoR D4 PPFs within 100m of an Existing road – Ponga Road

Assessment of Traffic Noise and Vibration Effects



Figure 10-3 NoR D4 PPFs within 100m of an Existing road – Waihoehoe Road

Predicted road-traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix 2. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red. Where a property has multiple dwellings per address, only the most affected PPF is represented in the tables and maps.

Grid noise maps showing indicative levels across a 200 m 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.

Oyster Capital Ltd has an unconditional agreement to purchase 116, 132 and 140 Waihoehoe Road. It has been confirmed in writing that they will remove all existing dwellings on the properties before the development is started and before construction commences of the transport corridor. Therefore, the PPFs on these properties have not been included in the assessment.

Based on the proposed designation boundary, the following residential buildings will be removed to make room for the Project alignment, and have not been considered in the assessment:

- 111 Walker Road
- 6 Ponga Road (Minor Dwelling)

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- 68 Ponga Road (Minor Dwelling)
- 128 Waihoehoe Road
- 136 Waihoehoe Road

10.2.1 New Road

Thirteen PPFs are located within 200 m of the new road and 100 m of the existing road. As such these were assessed under the Altered road criteria and are discussed in Section 10.2.2. Only the PPFs within the area assessed against the New road criteria will be presented in this section.

10.2.1.1 Road Traffic Noise Model Results Analysis

Table 10-1 NZS 6806 Assessment and Summary – New Roads – NoR D4

Category	Criteria	Number of PPFs			
		Existing	Do Minimum	Mitigation Option 1	Mitigation Option 2
Cat A	57 dB $L_{Aeq(24h)}$	14	7	10	10
Cat B	64 dB $L_{Aeq(24h)}$	0	6	4	4
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	1	0	0
Total		14	14	14	14

Existing scenario predictions show the noise level within the Project Area is between 39 – 55 dB $L_{Aeq(24hr)}$ with all PPFs in Category A.

The Do Minimum scenario shows a higher predicted range of 51 – 65 dB $L_{Aeq(24hr)}$ with six PPFs showing category change from Category A to Category B and one PPF into Category C. These seven PPFs are predicted to receive noise levels that exceed 57 dB $L_{Aeq(24hr)}$, with a 3 dB or more increase. In accordance with NZS 6806, mitigation options should be considered to reduce all PPF's for New Roads to Category A.

Two mitigation options have been considered to reduce noise levels at PPFs. The options comprise of low noise road surface and localised barriers.

With Mitigation option 1, consisting of asphaltic concrete AC-14 road surface, noise levels range between 48 – 61 dB $L_{Aeq(24h)}$ which is typically 4 dB lower than the Do Minimum scenario. Four PPFs remain in Category B with this option.

With Mitigation option 2 applied, the noise levels are predicted to range between 48 – 61 dB $L_{Aeq(24h)}$. This option provides both low noise road surface and localised solutions to PPFs that were identified as Category B and C for the Do Minimum scenario. With this mitigation option four PPFs remain in Category B. Three of these Category B PPFs are 2 storey high dwellings and one Category B PPF at 36 Ponga Road is elevated above the Project alignment and as such 1.8 m local barriers are ineffective for 1st floor levels. To bring these four Category B PPFs into Category A, 6 m high local barriers would be required which are not considered to be BPO as the height of the proposed barriers is not in keeping with a residential environment, the potential for visual and shading effects, and the costs compared with the practicability of reducing noise levels at these particular properties.

The two storey Category B PPFs are located at the following address:

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- 6 Ponga Road
- 68 Ponga Road
- 201 Sutton Road

Predicted noise levels with Mitigation option 2 in place are 2 dB above the most stringent Category A criterion of 57 dB $L_{Aeq(24hr)}$ for 68 Ponga Road, 36 Ponga Road and 201 Sutton Road, whilst 6 Ponga Road is predicted 4 dB above the most stringent criterion for New roads.

The total combined length of all the 1.8 m barriers modelled is approximately 56 m, however barriers can be designed to represent a boundary fence arrangement that can be integrated with the residential character of the receiving environment. Local barrier locations have been considered with openings for current driveway access.

Mitigation Option 2, consisting of low road noise surfaces and a localised 1.8 m barrier (for 68 Ponga Road, 36 Ponga Road and 201 Sutton Road and 6 Ponga Road) is considered to be the BPO for noise mitigation in terms of overall noise reduction, localised solution and cost benefit.

10.2.1.2 Assessment of Traffic Noise Effects

The following Figure 10-4 shows the noise level change in the Design year for all New road PPFs.

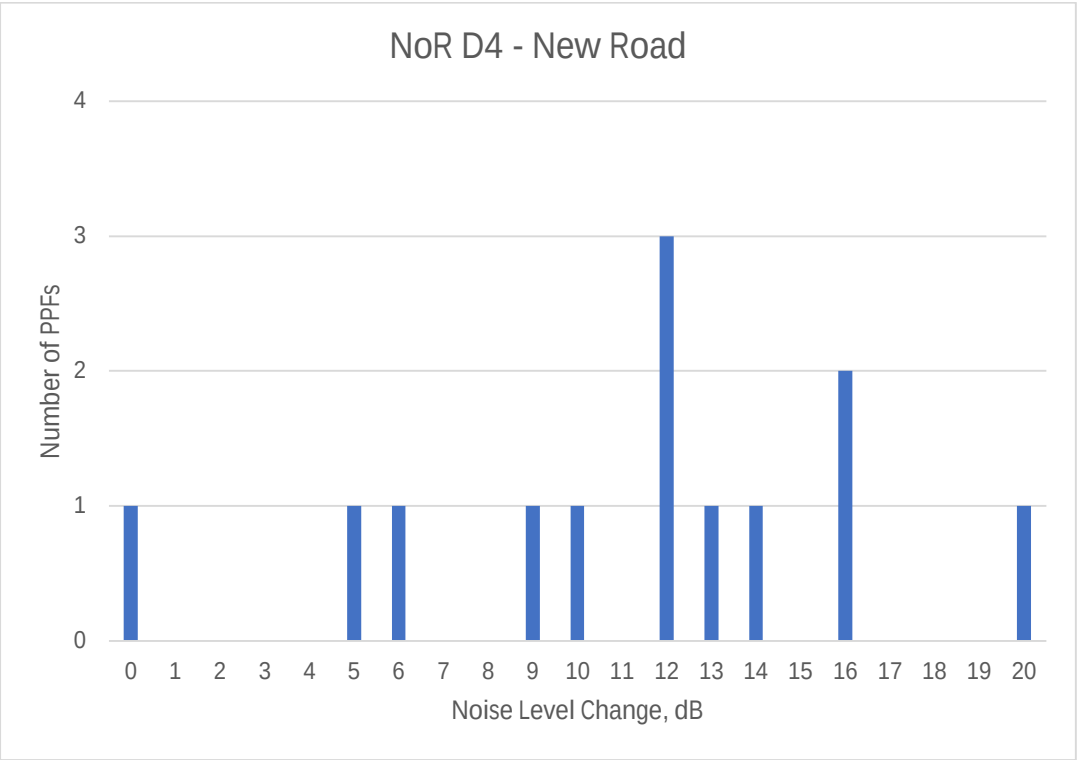


Figure 10-4 Noise Change Assessment – Existing Vs Project with Mitigation Option 2 – NoR D4 New road

In addition to assessing effects due to absolute noise levels, the effect of road noise changes has also been addressed in this section. The Existing scenario (Existing traffic flows on existing road without

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Project) and BPO Mitigation Option scenario (project design year traffic flow with Project and mitigation applied) can be compared to determine the predicted noise level increase or decrease as a result of the Project for the New Road PPFs.

The subjective perception of changes in noise level 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.

12 of the 14 PPFs are predicted to experience an increased noise level of 5 dB or more when compared to the Existing scenario due to the development of the new road. The highest predicted noise increase of 19 dB is at 201 Sutton Road, with mitigation in place. 10 PPF's in total are predicted to experience a noise level increase of between 9 dB (which will be perceived as a doubling of loudness) to 20 dB (which would be perceived as a quadrupling in loudness).

The new road will introduce a noise source that is not currently present for these PPF, and the existing environment is a low sound rural environment. Even with mitigation measures in place, this noise increase will be significant to the residents, if they still reside in the area at the time of road opening. However, the resultant noise levels at these PPFs of 59 – 61 dB $L_{Aeq(24h)}$ are appropriate for residential use and not unexpected in an urban environment

It should be noted, the area will change significantly over time, and the new road would be constructed at a time when development requires the transport corridors. That means that the ambient noise environment will be higher due to more intensive activity and the noise level change will likely be less. The predicted effects may not be experienced by current residents.

10.2.2 Altered roads

10.2.2.1 Road Traffic Noise Model Results Analysis

13 PPFs are located within 200 m of the new road and 100m of the existing road. As such these were assessed under the Altered road criteria in the context of a New road assessment.

A summary of the NZS 6806 assessment for Altered roads in NoR D4 is shown in Table 10-2.

Table 10-2 NZS 6806 Assessment and Summary – Altered Roads – NoR D4

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	10	6	7
Cat B	67 dB $L_{Aeq(24h)}$	3	3	2
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	4	4
Total		13	13	13

Existing scenario predictions show the noise level within the Altered road project area is between 54-66 dB $L_{Aeq(24hr)}$ with three PPF in Category B and the remaining PPFs in Category A.

Under the Do Nothing scenario, predictions show a higher traffic noise levels range between 58 – 72 dB $L_{Aeq(24hr)}$ with four PPFs in Category C and three PPFs in Category B due to an increase in traffic

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volumes (assuming all traffic from all developments is accommodated on the existing roading network).

The Do Minimum scenario shows a predicted range of 58 – 71 dB $L_{Aeq(24hr)}$ similar to the Do Nothing scenario, with the two PPFs remaining in Category B and four PPFs in Category C. As noise at these PPFs is controlled by the existing road rather than the new road and as such no mitigation is required in accordance with NZS 6806. Additionally, predictions indicate this section of existing roads does not qualify as an Altered Road in accordance with NZS 6806,

Additional BPO mitigation measures have not been considered for the four Category C PPFs. Three of the four Category C PPFs (115 Waihoehoe Road, 1 Fitzgerald Road and 6 Fitzgerald Road) have been identified as buildings to be removed to make room for the Project alignment in NoR D2. Therefore, it is unlikely that these PPFs will be present at the time of Project operation. The predicted noise level at the other Category C PPFs (101 Waihoehoe Road) are controlled by NoR D2 and addressed in relation to that assessment.

10.2.2.2 Assessment of Traffic Noise Effects

The following Figure 10-5 shows the noise level change in the Design year for all Altered road PPFs.

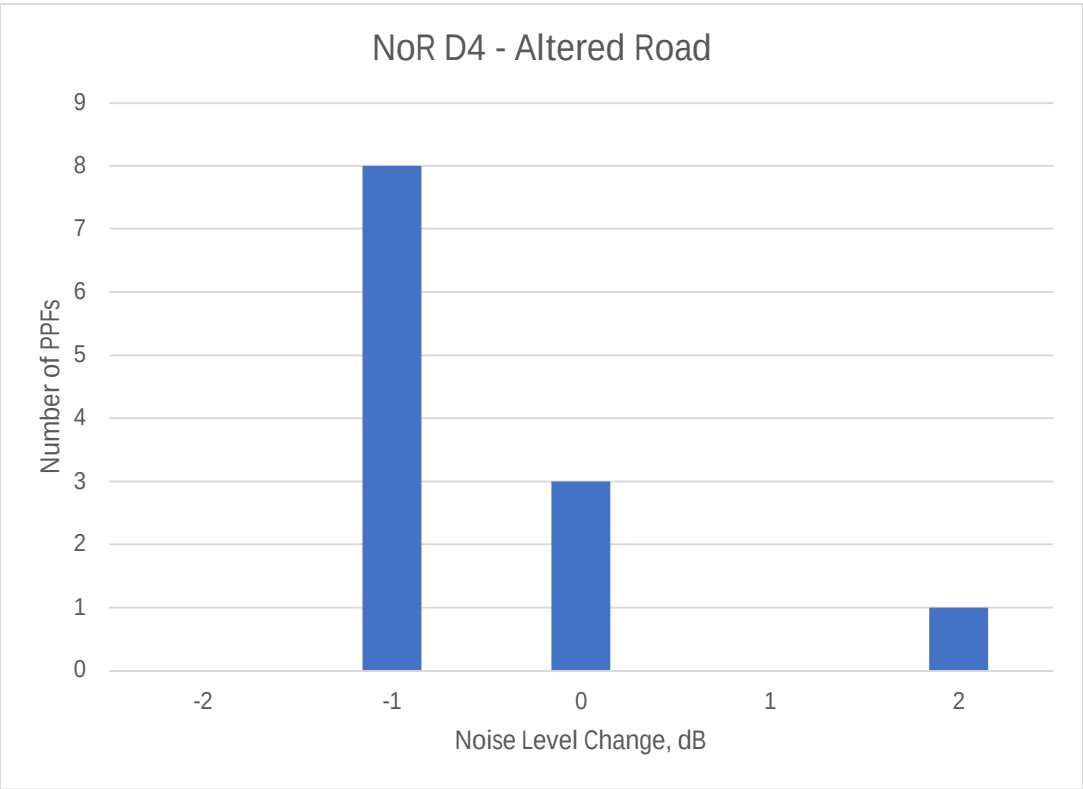


Figure 10-5 Noise Change Assessment – Do Nothing Vs Do Minimum – NoR D4 Altered Road

All PPFs are predicted to have a negligible to no change in noise level compared to the Do Nothing scenario as traffic on the existing road is the dominant noise source. This change will not be noticeable.

Assessment of Traffic Noise and Vibration Effects

10.2.3 Conclusion

An assessment of traffic noise has been carried out for New roads and Altered roads based on NZS 6806 and change in noise level.

All existing PPFs within 200 m of the alignment have been considered within the assessment. PPFs that are within the designation boundary and listed in Section 10.2 have been removed from the Do Minimum Scenario as they will be removed to provide for the Project.

For New roads, a comparison of the predicted road traffic noise levels in the existing scenario (representative of the design year without the Project, but including other transportation projects in the area) and Do Minimum scenario (representative of the design year with the Project and all other Projects in the Drury package) has indicated that noise levels will increase at all PPFs as a result of the Project, generally by a significant margin as a new road is introduced into an existing low noise rural environment. However, the area will change significantly over time, and the new road would be constructed at a time when development requires the transport corridors. That means that the ambient noise environment will be higher due to more intensive activity and the noise level change will likely be less. The predicted effects may not be experienced by current residents as PPFs are removed for redevelopment (urban growth).

All PPFs assessed under the New roads criteria can remain in Category A, with the exception of four PPFs, with predicted noise levels below 57 dB $L_{Aeq(24hr)}$ with low noise road surface and localised barriers mitigation implemented. The four PPFs will remain in Category B due being either a 2 storey building or on an elevated terrain. Before construction commences, reassessment of the road traffic noise at PPFs within this report will be carried out to determine if mitigation recommended is still BPO to meet the categories as set out in Appendix 3. For the altered sections of roads, seven PPFs are Category A, two in Category B and four in category C. For the New road sections, ten are Category A and four in Category B.

Noise levels at PPFs assessed under the Altered roads criteria are not influenced by the New road and their categories remain unchanged with two PPFs remaining in Category B and four PPFs in Category C. There are negligible to no noise level changes predicted and the anticipated changes will not be noticeable

11 NoR D5: Ponga and Ōpāheke Road Upgrade

Chapter Summary

Noise effects of road traffic on PPFs have been assessed by comparing the predicted Do Nothing noise levels (assuming traffic from full area development on the existing road network) with the predicted noise levels in the design year with the Project with and without mitigation.

PPFs that are not yet built or do not have building consent are not included in the modelling, however noise levels across the currently vacant land are provided in the grid noise maps within the Appendices and are indicative of the potential noise environment for that land. Bellfield Estate has been included as a PPF.

NoR D5 consists of three sections of Altered road, as shown in Figure 11.1 below.

NZS 6806 predictions indicate noise levels due to the Project along Ponga Road and Ōpāheke Road Rural upgrade sections at all PPFs, with the exception of 3 PPFs at Bellfield Estate PPFs, will remain in or move to Category A and can comply with the most stringent criterion of 64 dB $L_{Aeq}(24hr)$ with no mitigation required. The three PPFs in Bellfield Estate are predicted to receive noise levels in Category B and a noise level increase of less than 3dB. Therefore, these sections of the NoR would not fall under the Altered road definition and no mitigation has been assessed for these sections of the Project.

For the Ōpāheke Road Urban upgrade, predictions indicate noise levels due to the Project are likely to elevate Do Nothing noise levels by 1-2 dB, with 27 PPFs in Category C under the Do Minimum scenario. With Mitigation option 1 of low noise road surface asphaltic concrete AC-14 applied, the noise level at all but 10 PPFs can be reduced to Category A, with the noise level at nine PPFs reduced from a Category C to B. No further mitigation has been found to be practicable.

However, before construction commences, reassessment of the road traffic noise at PPFs within this report will be carried out to determine if mitigation recommended is still BPO to meet the categories as set out in Appendix 3. For Ōpāheke Road Urban section of the Altered road, 92 PPFs are all Category A and nine in Category B.

Noise levels at PPFs with mitigation applied will reduce, and PPFs will experience a noticeable positive change.

11.1 Project Description

As the Drury-Ōpāheke area is urbanised it is proposed to upgrade a 4.15km section of Ponga Road and Ōpāheke Road, from Great South Road in the north, to Jack Paterson Road and the future Mill Road corridor (which forms a separate NZUP project) in the southeast, to a two-lane arterial with separated walking and cycling facilities. The functional intent of the Project is a multimodal corridor that provides access to the proposed Mill Road corridor, FUZ in Papakura and employment areas to the north. The Project has been separated into three sections as shown in Figure 11-1:

- Ponga Road Upgrade: from Ōpāheke Road to Jack Paterson Road
- Ōpāheke Road Rural Upgrade: from the northern extent of the FUZ to Ponga Road

Assessment of Traffic Noise and Vibration Effects

- Ōpāheke Road Urban Upgrade: north of the FUZ
 - While the overall plan for the urban area of Ōpāheke Road is to upgrade the walking and cycling facilities from Ōpāheke Road Rural Upgrade in the south to Great South Road, Papakura in the north, generally, the upgrade can fit within the existing road reserve, therefore only the areas affecting land outside the existing road reserve are proposed to be designated.

For the Ponga Road and the Ōpāheke Road Rural upgrade sections it is proposed to widen the existing roads to 24m wide two-lane urban arterials with separated walking and cycling facilities. As the Ōpāheke Road urban section is an existing and constrained urban environment, it is proposed to upgrade the existing road to a 20m wide two-lane urban arterial with separated walking and cycling facilities.

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade common to each Project section include the following:

- A typically 24m or 20m wide road with two lanes and separated walking and cycling facilities
- Likely posted speed of 50kph
- Localised widening around the existing intersections to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Batter slopes and retaining to enable widening of the corridor and/or wetland construction, and associated cut and fill activities
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, bridge works area, the re-grade of driveways and construction traffic manoeuvring

Further details of each Project section are provided below.

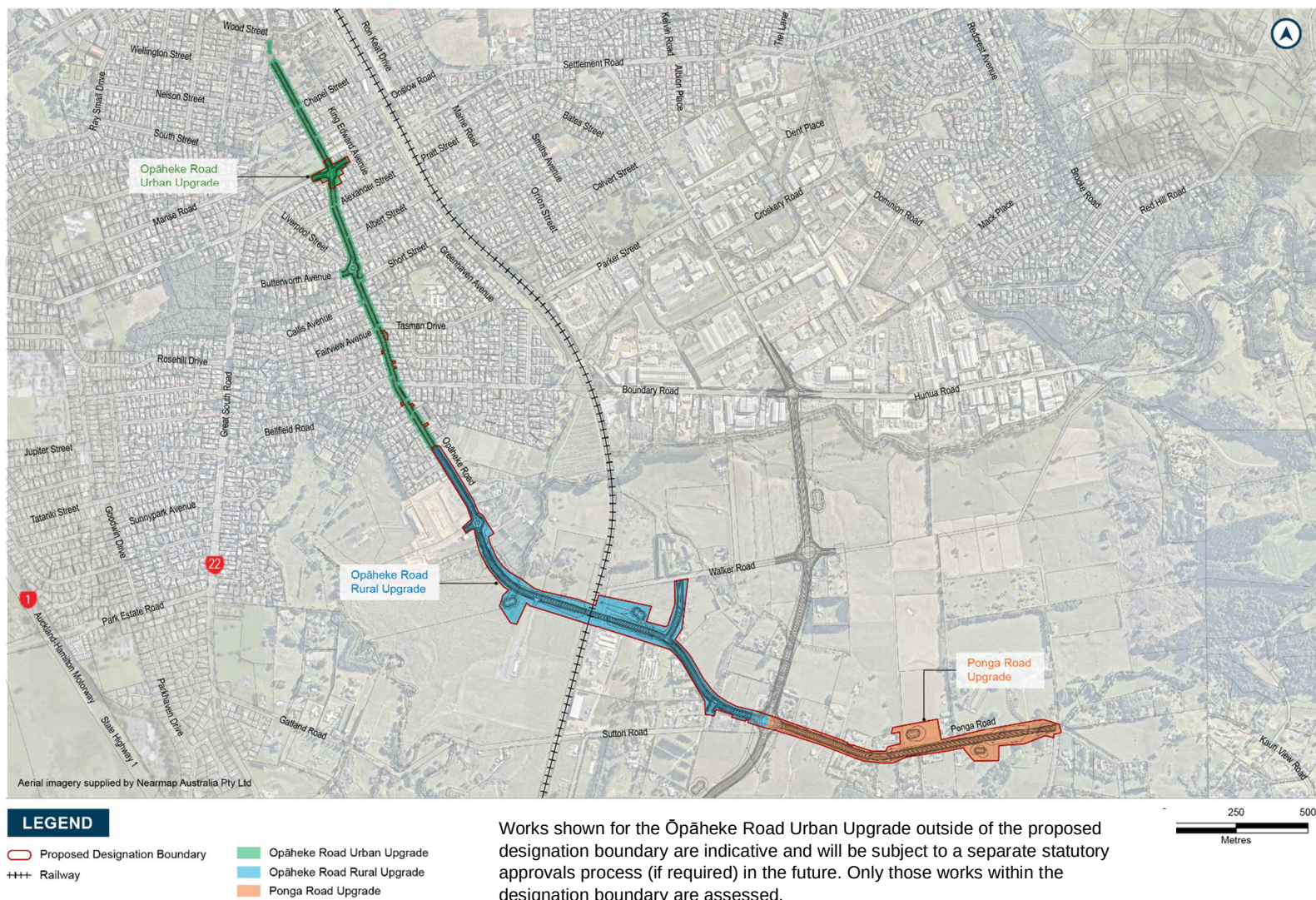


Figure 11-1 Overview of NoR D5

11.1.1 Ponga Road Upgrade Section

11.1.1.1 Section Overview

The Ponga Road Upgrade section is a 1km long upgrade extending from the proposed intersection with Ōpāheke North-South FTN Arterial in the west, to Jack Paterson Road in the east. In the future Ponga Road will tie into the proposed Mill Road corridor which forms a separate NZUP project. An overview of the concept design is provided in Figure 11-2

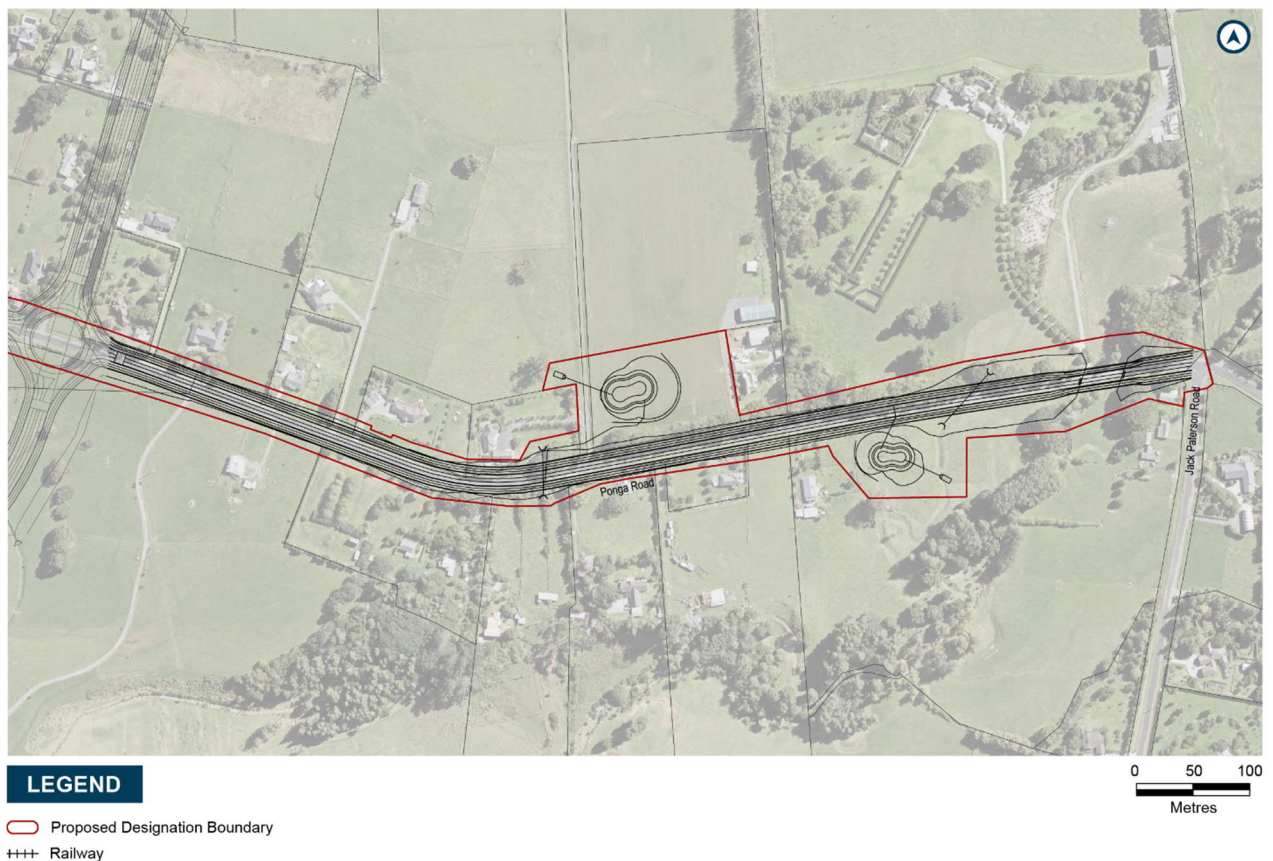


Figure 11-2 Overview of Ponga Road Upgrade Section

In addition to those listed above, the key features of the Ponga Road Project section include:

- Roundabout tying into the proposed Ōpāheke N-S FTN Arterial (NoR D4) and Ōpāheke Road Rural Upgrade section
- A bridge over Mangapū Stream.

11.1.2 Ōpāheke Road Rural Upgrade section

11.1.2.1 Section Overview

It is proposed to widen, and realign a portion of, the existing road within the Ōpāheke Road Rural Upgrade section to a 24m urban arterial. The Ōpāheke Road Rural Upgrade section extends 1.6km from the extent of the FUZ in the north to Ponga Road in the south. An overview of the concept design is provided in Figure 11-3.

Assessment of Traffic Noise and Vibration Effects



Figure 11-3 Overview of Ōpāheke Road Rural Section

In addition to those listed above, the key features of the Ōpāheke Road Rural Upgrade section include:

- Roundabouts at Bellfield Estate and Ōpāheke N-S FTN Arterial / Ponga Road
- Realignment of a section of Ōpāheke Road and grade separation of the NIMT to avoid the Waikato 1 watermain and Ōpāheke Sports Fields and to allow the bridge to be constructed offline
- New road connection to Walker Road (and closure of a section of the existing Ōpāheke Road – replaced by the new NIMT bridge)

Two walking and cycling bridges adjoining each side of the existing Ōtūwairoa Stream road bridge.

11.1.3 Ōpāheke Road Urban Upgrade section

11.1.3.1 Section Overview

While the overall plan for the urban area of Ōpāheke Road is to upgrade the walking and cycling facilities from Ōpāheke Road Rural Upgrade in the south to Great South Road, Papakura in the north, only the areas affecting land outside the existing road reserve are proposed to be designated and assessed as part of this assessment. The Ōpāheke Road Urban Upgrade section of NoR D5 includes the regrading of nine driveways along Ōpāheke Road and the upgrade of the Ōpāheke Road /

Assessment of Traffic Noise and Vibration Effects

Settlement Road intersection to a roundabout. An overview of the proposed designation areas is provided in Figure 11-4.



Figure 11-4 Overview of Ōpāheke Road Urban Section

The key features of the Ōpāheke Road Urban Upgrade section include:

- Upgrade of the Ōpāheke Road / Settlement Road intersection to a roundabout to provide for separated walking and cycling facilities, including crossing facilities
- Re-grade of nine driveways.

11.2 Assessment of Road Traffic Noise Effects and Measures to Mitigate Potential Adverse Effects

The Ponga Road and Ōpāheke Road sections have been assessed together as both are considered Altered roads in a rural environment (i.e. the assessment extent from the road is 200m). Bellfield Estate along Ōpāheke Road is currently under construction and masterplan designs have been incorporated into the assessment of this Project.

Ōpāheke Road Urban Upgrade section has been assessed separately as an Altered road in accordance with NZS 6806 as this part of the designation is located in an urban environment (100m assessment extent) and is a separate area to the Ponga Road and Ōpāheke Road Rural sections.

Assessment of Traffic Noise and Vibration Effects

For this Project, changes to the road lanes are minimal and only occur at intersections with an additional Walker Road Link. Along with NoR D3, this is different to the other designations assessed in this report, where widening is undertaken to accommodate the increase in traffic volume that will occur due to the intensified use of the area. For NoR D5 (as for NoR D3), the increase in traffic volume would occur irrespective of the proposed works, that generally provide for walking and cycling facilities rather than additional traffic lanes. Therefore, while the assessment follows the same format as the other designations, the effects discussed are not strictly due to the Project.

Of further note, although Walker Road Link is a New Road, the three PPFs along this link is situated within 100m of an existing road. Therefore, these PPFs have also been considered under the Altered road criteria.

Predicted road-traffic noise levels at all PPFs for the Existing, Do Nothing and Do Minimum scenarios are shown in Appendix 2. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red. Where a property has multiple dwellings per address, only the most affected PPF is represented in the tables and maps.

Grid noise maps showing indicative levels across a 200m radius for rural and 100m radius for urban land 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.

Based on the indicative designation boundary maps, the following residential buildings will be demolished to make room for the Project alignment, and have not been considered in the assessment:

- 17 Settlement Road
- 21A Settlement Road
- 18 Ōpāheke Road
- 215 Ponga Road

11.2.1 Road Traffic Noise Model Results Analysis

11.2.1.1 Ponga Road and Ōpāheke Road Rural Upgrade

Table 11-1 NZS 6806 Assessment and Summary – Altered Roads Rural Section – NoR D5

Category	Criteria	Number of PPFs		
		Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq}(24h)$	167	144	174
Cat B	67 dB $L_{Aeq}(24h)$	10	15	3
Cat C	40 dB Internal $L_{Aeq}(24h)$	0	18	0
Total		177	177	177

Existing scenario predictions show the existing traffic noise level within the Project area is between 40 – 66 dB $L_{Aeq}(24hr)$ with 10 PPFs in Category B and the remainder in Category A.

Assessment of Traffic Noise and Vibration Effects

Under the Do Nothing scenario, predictions shows traffic noise levels range between 43 – 70 dB $L_{Aeq(24hr)}$ with 18 PPFs in Category C and 15 PPFs in Category B due to an increase in traffic volumes, assuming a full development build of the surrounding area and resultant traffic on the existing road network.

The Do Minimum scenario showed a slightly lower predicted range of 40- 65 dB $L_{Aeq(24hr)}$ with all but three PPFs in Category A due to reduced traffic volumes. The three PPFs in Category B are located at the new Bellfield development with noise levels predicted to marginally exceed the most stringent Category A criteria by less than 1dB. These PPFs are predicted to experience a 5 dB reduction in noise level when compared to the Do Nothing scenario which is a significant positive effect. In accordance with NZS 6806, as all PPFs that are predicted to receive noise levels greater than 64 dB $L_{Aeq(24hr)}$ will experience an increase in noise levels of less than 3dB when compared to the existing scenario, this section of the Project does not fall into the thresholds of an Altered road, and mitigation measures have not been considered.

11.2.1.2 Ōpāheke Road Urban Upgrade Section

Table 11-2 NZS 6806 Assessment and Summary – Altered Roads Urban Section – NoR D5

Category	Criteria	Number of PPFs				
		Existing	Do Nothing	Do Minimum	Mitigation Option 1	Mitigation Option 2
Cat A	64 dB $L_{Aeq(24h)}$	66	80	63	93	102
Cat B	67 dB $L_{Aeq(24h)}$	16	8	13	10	1
Cat C	40 dB Internal $L_{Aeq(24h)}$	21	15	27	0	0
Total		103	103	103	103	103

Existing scenario predictions show the existing traffic noise level within this project area is between 52 – 72 dB $L_{Aeq(24hr)}$ with 66 PPFs in Category A, 16 PPFs in Category B and 21 in Category C.

Under the Do Nothing scenario, predictions show slightly lower traffic noise levels, due to lower traffic volumes assuming other transportation projects in the area are operational, range between 49 – 71 dB $L_{Aeq(24hr)}$ with 15 PPFs remaining in Category C and eight PPFs into Category B

The Do Minimum scenario shows a slightly elevated range of 52 – 72 $L_{Aeq(24hr)}$ with 63 PPFs in Category A, 13 in Category B and 27 in Category C. Ten PPFs changed from a Category A to Category B, five PPFs changed from Category A to Category C, and five Category B PPFs changed to Category C due to the new intersection and increased traffic flow. As such in accordance with NZS 6806 mitigation options should be considered to reduce all PPFs to Category A.

Mitigation options of low noise road surface and localised barriers have been considered to reduce predicted noise levels at PPFs to Category A.

With Mitigation option 1, consisting of asphaltic concrete AC-14 road surface along the intersection, noise levels range between 46 – 67 dB $L_{Aeq(24h)}$ which is typically 5 dB lower than the Do Minimum scenario. 10 of the 27 Category C PPFs are moved to Category B with this option, with the remaining Category C PPFs moved to Category A. All of the 10 Category B PPFs are in Category C under the

Assessment of Traffic Noise and Vibration Effects

existing scenario but a 4-6 dB decrease in noise level is predicted with this mitigation option. No PPF would remain in Category C.

Mitigation option 2 consists of both low noise road surface AC-14 and localised 1.8m high barriers to PPFs that were identified as Category B and C for the Do Minimum scenario. With this mitigation applied, the noise levels are predicted to range between 46 – 65 dB $L_{Aeq(24h)}$, which provides a noise level decrease range between 5-9 dB from the Do Minimum scenario. One PPF remains in Category B with this option with all others in Category A. To bring the remaining Category B PPF at 1/17 Settlement Road into Category A 2.5 m high local barriers would be required which are not considered to be BPO as the height of the proposed barriers is not in keeping with a residential environment, the potential for visual and shading effects, and the costs compared with the practicability of reducing noise levels at this particular property. This PPF is slight elevated above ground level therefore a 1.8m high barrier provides little benefit.

Although Mitigation Option 2 provides the largest overall reduction at all PPFs, bringing all but one PPF into Category A, this option is not considered BPO by the Project team when factoring in the visual amenity and cost compared to practicability of additional barrier to provide an extra 2 dB decrease when compared to Mitigation Option 1.

Whilst 10 PPFs remaining in Category B with Mitigation Option 1, all PPF noise levels are predicted to be reduced by 4 dB or more when compared to the Do Nothing Scenario. This decrease will be a noticeable improvement compared to the Do Nothing environment.

Mitigation Option 1 is considered the BPO.

11.2.2 Assessment of Traffic Noise Effects

11.2.2.1 Ponga Road and Ōpāheke Road Rural Upgrade sections

The Do Nothing scenario and Do Minimum scenario have been compared to determine the predicted noise level increase or decrease as a result of the Project for the PPFs. Both scenarios are based on assumptions set out in Section 4.1.4.

The subjective perception of changes in noise level 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.

The following Figure 11-5 shows the noise level change in the Design year for Altered road PPFs along Ponga Road and Ōpāheke Road Rural Upgrade sections.

Assessment of Traffic Noise and Vibration Effects

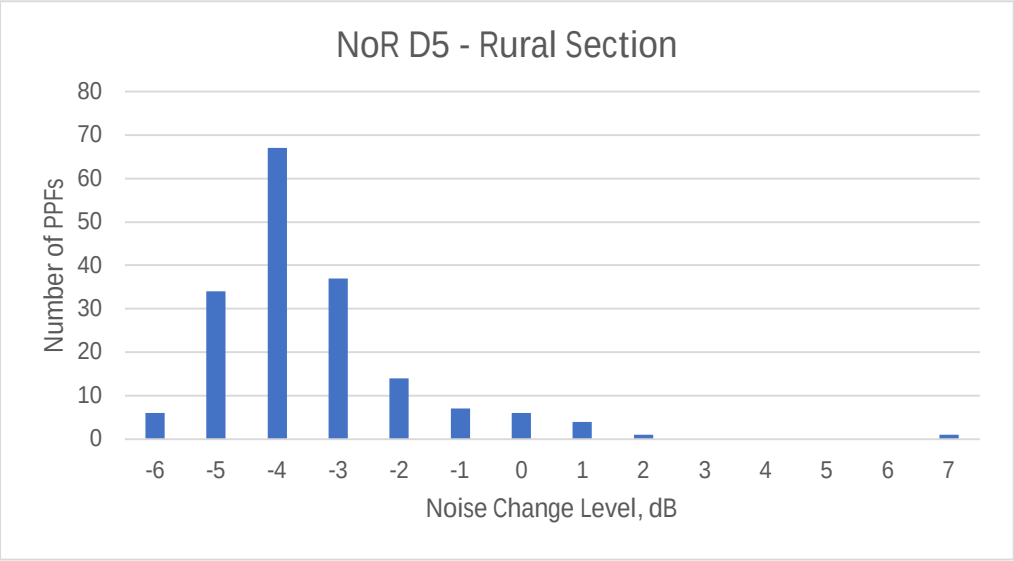


Figure 11-5 Noise Change Assessment – Do Nothing Vs Do Minimum – NoR D5 – Ponga Road and Ōpāheke Road Rural Upgrade sections

One PPF at 216 Ōpāheke Road is predicted to experience a noise level increase of 7 dB due to the close proximity to the new Walker Road link. This will be perceived as a clearly noticeable increase in noise level. This noise increase will be significant to the residents, if they still reside in the area at the time of road opening. However, the resultant noise level of 59 dB $L_{Aeq(24h)}$ is appropriate for residential use and not unexpected in an urban environment.

It should be noted, the area will change significantly over time, and the new road would be constructed at a time when development requires the transport corridors. That means that the ambient noise environment will be higher due to more intensive activity and the noise level change will likely be less. The predicted effects may not be experienced by current residents.

Noise levels at the majority of PPFs are generally expected to decrease as a result of re-alignment and reduced traffic flows and speeds along the Ponga Road and Ōpāheke Road, and the redistribution of traffic across the new network.

11.2.2.2 Ōpāheke Road Urban Upgrade

The following Figure 11-6 shows the noise level change in the Design year for Altered road PPFs along the Ōpāheke Road Urban Upgrade section.

Assessment of Traffic Noise and Vibration Effects

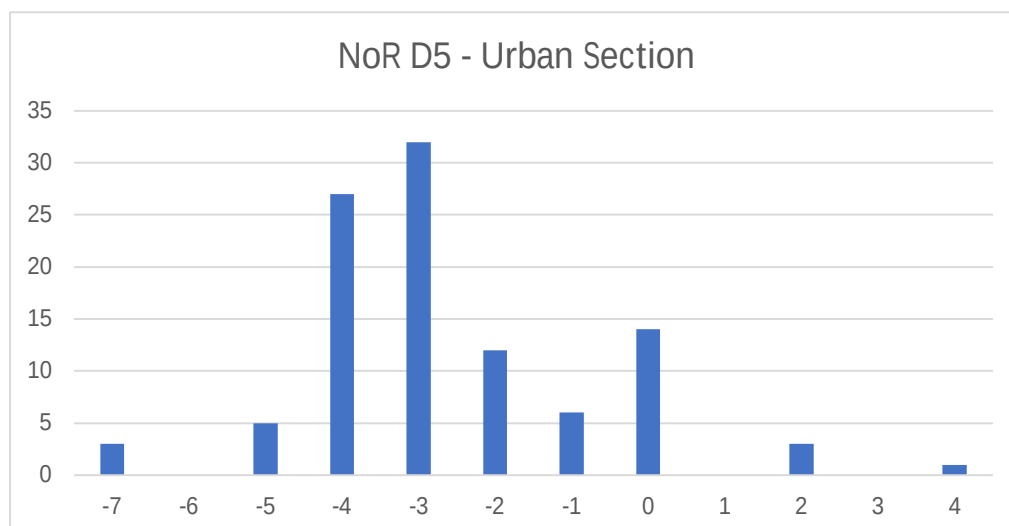


Figure 11-6 Noise Change Assessment – Do Nothing Vs Project with Mitigation Option 1 – NoR D5 - Ōpāheke Road Urban Upgrade

All but one PPF are predicted to experience no change or a negligible to moderate noise level reduction, with mitigation option 1 applied, when compared to the Do Nothing Scenario. The majority of PPFs are predicted to experience a 2 – 4 dB decrease due to the Project and the completion of the surrounding roading network, which is a slight reduction and will be a positive change for the existing residents.

One PPF at 21 Settlement Road is predicted to experience a 4 dB noise level increase due to the Project's roundabout reduced proximity to the property, increased traffic flow and removal of a property nearest to the intersection due to the Project which previously provided shielding at this PPF. This change will be noticeable but the resultant noise level of 58 dB $L_{Aeq(24h)}$ is appropriate for residential use and not unexpected in an urban environment.

11.2.3 Conclusion

An assessment of traffic noise has been carried out for Altered roads based on NZS 6806 and the change in noise level.

All existing PPFs within 200m of the alignment in the rural environment and 100m in the urban environment have been considered within the assessment. Buildings that are within the designation area and listed in Section 11.2 have been removed from the Do Minimum Scenario as they will be removed to provide for the Project.

For the Ponga Road and Ōpāheke Road Rural Sections, 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, and overall network improvements) has indicated that noise levels will generally decrease at most PPFs.

The Project does not provide for additional traffic lanes, and therefore, the change in traffic volume would occur independently from the project being progressed. All PPFs, with the exception of three, can remain in Category A with predicted noise levels below 64 dB $L_{Aeq(24hr)}$ with no mitigation required.

Assessment of Traffic Noise and Vibration Effects

The three category B PPFs are existing 2 storey Category B PPFs with marginal exceedance of the most stringent Category A criteria.

For the Ōpāheke Road Urban section, a comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and with the Project (Do Minimum scenario with Mitigation option 1 applied) has indicated that noise levels can be reduced to bring all but nine PPFs into Category A. Noise levels at these 10 PPFs will be reduced and they will change from existing Category C to Category B with mitigation option 1 applied. However, before construction commences, reassessment of the road traffic noise at PPFs within this report will be carried out to determine if mitigation suggested is still BPO to meet the categories as set out in Appendix 3. For Ōpāheke Road Urban section of the Altered road, 93 PPFs are all Category A and nine in Category B.

The majority of PPFs will experience a significant reduction in noise due to traffic distribution across the new network which will be a noticeable positive change.

12 Conclusion

An assessment of traffic noise has been carried out for Drury Package for New and Altered roads based on NZS 6806 and the predicted change in noise level.

All existing PPFs within 200m of the alignment in rural environments and 100m for urban environments of each alignment have been considered within the assessment. Buildings that are within the NoR areas have been removed from the Do Minimum Scenario as they will not remain following the Project implementation, as informed by the Project Team.

A comparison of the predicted road traffic noise levels in the Do Nothing 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 and all other Drury Package projects implemented) has indicated that noise levels will generally decrease at the majority of PPFs with a few noise level increases at some PPFs as a result of the Projects, the main reason being the redistribution of traffic across the new network. Some NoRs do not fulfil the requirements of an Altered road in accordance with NZS 6806, and only an assessment of effects based on noise level change was undertaken.

All PPFs for NoR D1 remain in Category A with predicted noise levels below 64 dB $L_{Aeq(24hr)}$ without mitigation required. This NoR does not fall within the requirements of an Altered road.

For NoR D2, all Altered road PPFs remain in the most stringent Category A with noise levels below 64 dB $L_{Aeq(24hr)}$ with mitigation applied. For New road all but two PPFs remains in Category A with noise levels below 57 dB $L_{Aeq(24hr)}$ with mitigation applied. Mitigation in the form of low-noise road surface is required for both the Altered roads and New road alignment along Jesmond Road, Bremner Road, Bremner Road Link and Waihoehoe Road West.

For NoR D3, noise levels due the Project at all but six PPFs will be in Category A, with three PPFs in Category B and three PPFs in Category C. Predictions show noise levels at the Category B PPFs are above 64 dB $L_{Aeq(24hr)}$ but less than a 3 dB increase and Category C PPFs are above 68 dB $L_{Aeq(24hr)}$ but less than a 1 dB increase when comparing the Do Nothing and Do Minimum scenarios, therefore this Project does not qualify as an Altered road under NZS 6806 and no further mitigation is required.

For NoR D4, noise levels at all but four PPFs assessed under the New roads criteria can comply with the Category A criterion of 57 dB $L_{Aeq(24hr)}$ with mitigation of low noise road surface and 1.8m high localised barriers in place. Four PPFs will remain in Category B even with mitigation implemented due to being either a 2 storey building or on an elevated terrain where localised barriers do not benefit. PPFs assessed under the Altered roads criteria will remain in their existing categories with three PPFs remaining in Category B.

For NoR D5 rural upgrades, noise levels at all PPFs, with the exception of three Bellfield Estate PPFs, will remain or move to Category A and can comply with the most stringent criteria of 64 dB $L_{Aeq(24hr)}$ with no mitigation required. These parts of the Project do not fall within the definition of an Altered road as all PPFs that are predicted to receive noise levels greater than 64 dB $L_{Aeq(24hr)}$ will experience an increase in noise levels of less than 3dB when compared to the Do Nothing scenario. For NoR D5 Urban upgrade, noise levels at all but 10 PPF will be in Category A and can comply with 64 dB $L_{Aeq(24hr)}$ with mitigation of a localised section of low road surfaces applied.

Assessment of Traffic Noise and Vibration Effects

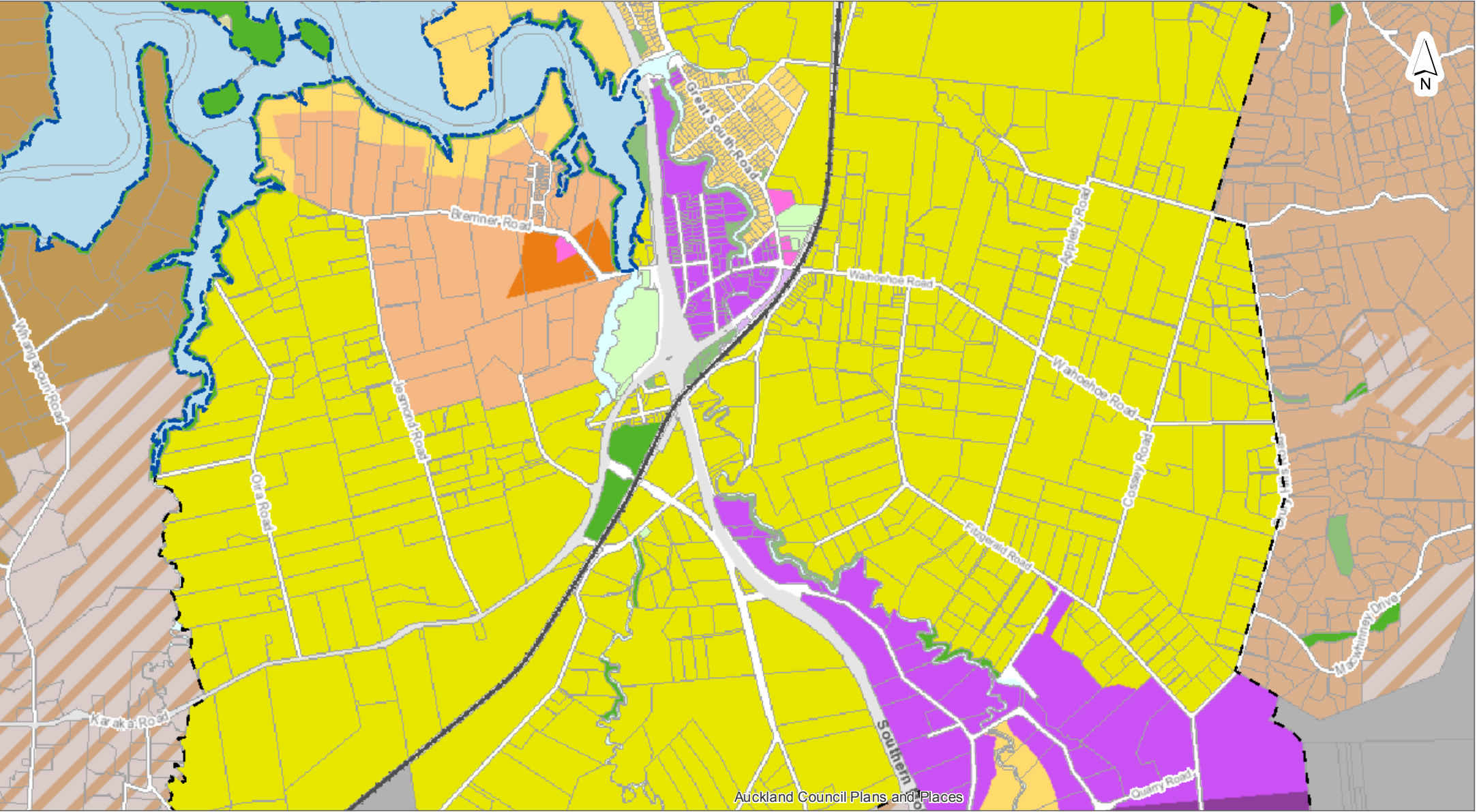
All predictions are based on traffic flow along New and Altered roads at the design year (2048). These traffic volumes are predicated on the anticipated urbanisation of the area and implementation of surrounding infrastructure projects. Development of the surrounding areas will likely increase activity 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 scape.

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 mitigation determined still represents the best practicable option at the time. The review, confirmation and refinement of the BPO shall aim to achieve the same noise criteria categories as determined with the current BPO.

Nevertheless, the predictions show that most PPFs (with the exception of 69 PPFs) would receive noise levels within Category A without mitigation, which is the most stringent category and represents the lowest noise levels. Therefore, resulting noise levels will be reasonable in a residential context. Where PPFs are in Category B or C with Project implemented, these PPFs are predicted to experience no change or a decrease of noise level resulting in an overall positive effect. These Category B and C PPFs are generally part of the Projects where the existing roads do not qualify under the Altered road criteria and no mitigation measures were proposed. However, these PPFs tend to be assessed within more than one Project due to the scope of each assessment areas. Hence with all designation Projects implemented, mitigation measures will be applied to these PPFs reducing the predicted noise levels.

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. Auckland Unitary Plan Zones



Auckland Council Plans and Places

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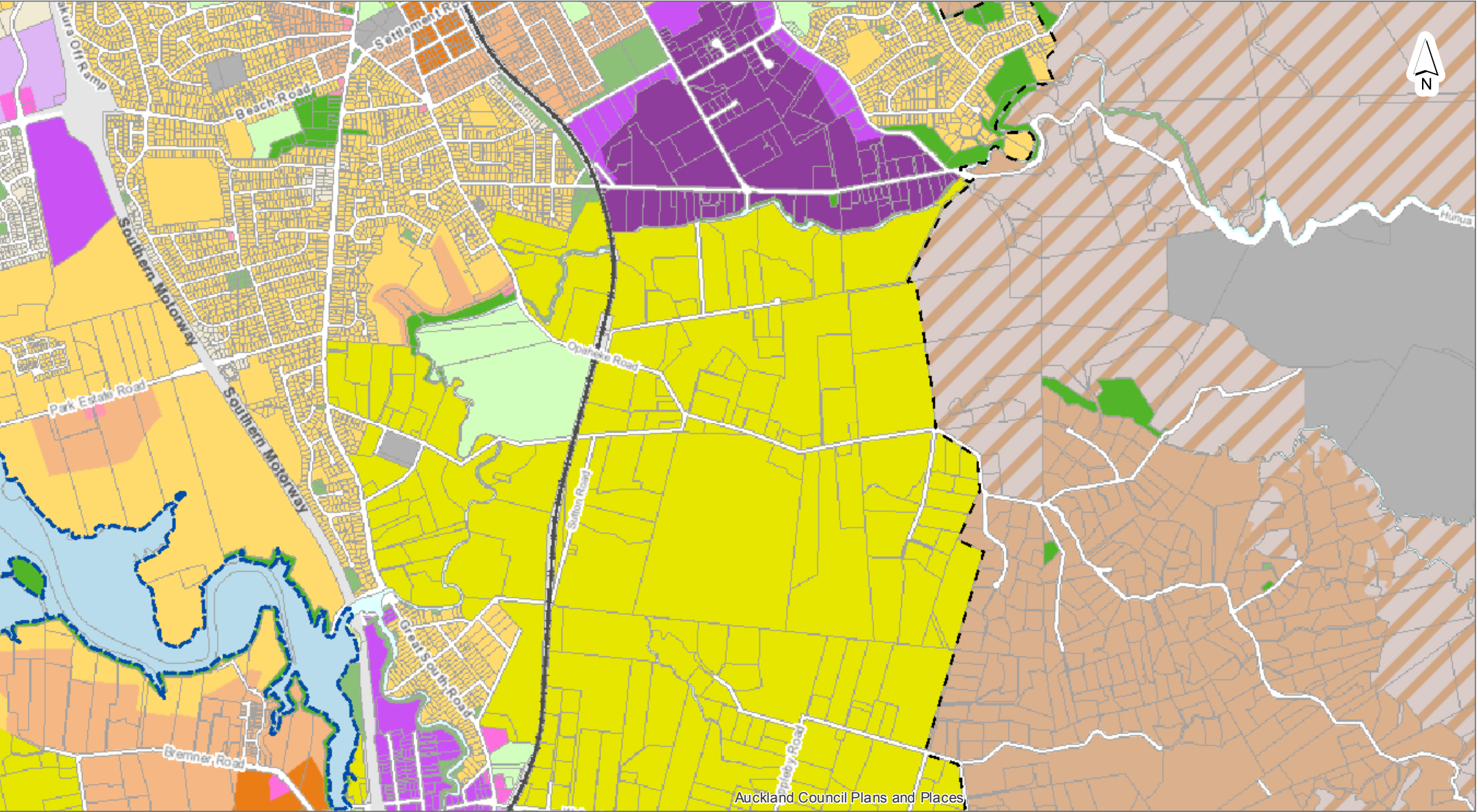
AUP Designation

0 160 320 480
Meters

Scale @ A4
= 1:25,000

Date Printed:
18/08/2020





Auckland Council Plans and Places

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AUP Designation

0 160 320 480
Meters

Scale @ A4
= 1:25,000

Date Printed:
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Information**Indicative Coastline (i)**

— Indicative Coastline (i)

Rural Urban Boundary (RUB)

— Rural Urban Boundary (RUB)

Place Names**Place Name Search**

Place Name Search

Railway Lines**Railway (25,000)**

— Railway (25,000)

Roads**Roads (25,000)**

Roads (25,000)

Parcels

□ Parcels

Property Boundaries

Property Boundaries

Zones

-  Residential - Large Lot Zone
-  Residential - Rural and Coastal Settlement Zone
-  Residential - Single House Zone
-  Residential - Mixed Housing Suburban Zone

-  Residential - Mixed Housing Urban Zone
-  Residential - Terrace Housing and Apartment Buildings Zone
-  Open Space - Conservation Zone
-  Open Space - Informal Recreation Zone
-  Open Space - Sport and Active Recreation Zone
-  Open Space - Civic Spaces Zone
-  Open Space - Community Zone
-  Business - City Centre Zone
-  Business - Metropolitan Centre Zone
-  Business - Town Centre Zone
-  Business - Local Centre Zone
-  Business - Neighbourhood Centre Zone
-  Business - Mixed Use Zone
-  Business - General Business Zone
-  Business - Business Park Zone
-  Business - Heavy Industry Zone
-  Business - Light Industry Zone
-  Future Urban Zone
-  Green Infrastructure Corridor (Operative in some Special Housing Areas)
-  Rural - Rural Production Zone
-  Rural - Mixed Rural Zone

-  Rural - Rural Coastal Zone
-  Rural - Rural Conservation Zone
-  Rural - Countryside Living Zone
-  Rural - Waitakere Foothills Zone
-  Rural - Waitakere Ranges Zone
-  Strategic Transport Corridor Zone
-  Special Purpose Zone
-  Coastal - General Coastal Marine Zone [rcp]
-  Coastal - Marina Zone [rcp/dp]
-  Coastal - Mooring Zone [rcp]
-  Coastal - Minor Port Zone [rcp/dp]
-  Coastal - Ferry Terminal Zone [rcp/dp]
-  Coastal - Defence Zone [rcp]
-  Coastal - Coastal Transition Zone
-  Water [i]
-  Hauraki Gulf Islands
-  Road [i]

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Legend

Date Printed:
18/08/2020

Appendix 2. Traffic Network Assumptions

Package	Project(s)	Existing	Do Nothing	Do Minimum
Rail DBC package	Additional rail capacity between Pukekohe and Papakura (and associated grade separations at road/rail crossings)	x	√	√
	New rail stations at Drury Central, Drury West and Paerata	x	√	√
		x	√	√
	Regional north-south cycle route between Drury and Pukekohe, with grade-separated active mode crossings of SH1 and NIMT	x	√	√
South Strategic DBC package	Mill Road Corridor – a new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South	x	√	√
		x	√	√
	New Pukekohe Expressway – alternative route to SH22 between SH1 (east of proposed Drury South interchange) and Pukekohe (to the north-eastern connection to Pukekohe Ring Road)	x	√	√
	New arterial connections to the Proposed Pukekohe Expressway	x	√	√
	FTN on Porchester / Mahia / Roscommon Roads and Great South Road from Drury to Manukau	x	√	√
		x	√	√
SH1 Papakura-to-Bombay	Stage 1 of the P2B project includes an upgrade to the existing Drury interchange, which connects to and is interdependent with the SH22 upgrade project. The Interchange upgrade will also need to provide for proposed rail upgrades (see Table 1-3). There is also a direct inter-relationship with the Bremner Upgrade/FTN project, as P2B will necessitate an upgrade/replacement of the existing Bremner Road crossing of SH1.	x	√	√
SH22 Drury-to-Paerata (Safe Network Programme)	The Safe Network Programme is in the funding application process for short-term safety improvements in the SH22 area. Parts of this programme are being prioritised including a roundabout at the intersection of SH22 and Glenbrook Road, and the recently completed right-turn bay into Jesmond Road.	x	√	√
	Longer term upgrades on SH22 between SH1 and Oira Road are being looked at by SGA as part of this Drury Local package. These upgrades are proposed to improve safety, amenity and capacity along the route to enable urbanisation of the area and are envisaged to ultimately be supplemented by a new route in the long term (the proposed Pukekohe Expressway).	x	√	√
Drury Strategic Transport Network	State Highway 22 Arterial Upgrade (NoR D1)	x	√	x
	Jesmond to Waihoehoe East FTN Arterial upgrade (NoR D2)	x	√	x
	Waihoehoe Road East Arterial Upgrade (NoR D3)	x	√	*
	Opāheke North-South FTN Arterial (NoR D4)	x	√	x
	Ponga Road / Opāheke Road Arterial Upgrade (NoR D5)	x	√	*
Collector Network	Indicative New Collector Roads	x	√	√
Growth	Land Use Assumptions	up to 2016	up to 2048+	up to 2048+

Key	
√	Included
x	Excluded
*	Minimal Network Change

Appendix 3. Predicted Traffic Noise Levels (Table)

KEY

Cat A	Cat B	Cat C
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NoR D1

NOR D1 - Altered Road			
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)
200 Karaka Road	65	64	63
160 Karaka Road	64	63	62
435 Karaka Road	67	65	61
332A Karaka Road	63	61	61
458 Karaka Road	64	62	59
370 Karaka Road	63	61	58
462 Karaka Road	61	59	57
5 Burberry Road	58	56	57
351 Karaka Road	61	59	56
7 Woodlyn Drive	61	59	56
411 Karaka Road	61	59	55
250 Karaka Road	57	56	53
373 Karaka Road	58	56	53
41 Jesmond Road	60	59	53
15 Burberry Road	47	46	51
415 Karaka Road	55	53	50
14 Burberry Road	52	51	47
18 Burberry Road	47	47	43

NoR D2

NOR D2 - Altered Road				
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation, dB L _{Aeq} (24hr)
101 Waihoehoe Road	66	72	68	64
97 Waihoehoe Road	64	71	68	63
28 Waihoehoe Road	62	64	68	63
144 Bremner Road	54	64	68	63
5 Fitzgerald Road	63	67	65	64
3 Fitzgerald Road	62	66	65	64
81 Waihoehoe Road	62	68	65	61
45 Waihoehoe Road	62	66	65	61
71 Waihoehoe Road	63	69	65	60
31 Waihoehoe Road	66	68	64	59
15 Fitzgerald Road	60	65	63	62
160 Karaka Road	63	63	63	62

Assessment of Traffic Noise and Vibration Effects

NOR D2 - Altered Road				
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation, dB L _{Aeq} (24hr)
201 Jesmond Road (front)	59	68	63	58
125 Jesmond Road	58	68	63	58
5 Auranga Stage 2 Lot	48	58	63	58
28 Fitzgerald Road	59	63	62	60
171 Waihoehoe Road	62	68	62	50
64 Jesmond Road	58	65	61	56
44 Waihoehoe Road	56	62	61	56
169 Jesmond Road	58	68	61	55
9 Fitzgerald Road (front)	58	62	60	59
8 Flanagan Road	60	63	60	56
256 Jesmond Road	54	62	60	56
281 Jesmond Road	60	70	59	59
136 Waihoehoe Road	57	64	59	55
67 Waihoehoe Road	56	61	59	55
288 Jesmond Road	56	66	58	57
112 Waihoehoe Road	55	61	58	54
35 Waihoehoe Road	55	57	58	54
7 Fitzgerald Road	53	58	57	53
119 Jesmond Road	53	61	57	52
84 Jesmond Road	53	60	57	52
201 Jesmond Road (back)	53	61	57	51
2 Cameron Place	58	59	56	56
18 Kath Henry Lane	52	57	56	52
85 Jesmond Road	53	60	56	51
41 Jesmond Road	59	59	55	53
20 Flanagan Road	51	55	55	51
16 Flanagan Road	53	55	55	51
132 Waihoehoe Road	53	59	55	50
224 Jesmond Road	49	58	55	50
14 Cameron Place	48	55	54	53
160 Jesmond Road	51	58	54	49
3 Tui Street	49	53	54	49
131 Jesmond Road	50	58	54	48
31 Bremner Road	55	66	53	53
9 Fitzgerald Road (back)	50	55	53	50
22 Flanagan Road	50	53	53	49
24 Flanagan Road	49	52	53	49
188 Jesmond Road	48	57	53	48
121 Jesmond Road	50	57	53	48
37 Bremner Road	55	66	52	52
6 Cameron Place	53	54	52	51
12 Cameron Place	46	53	52	51
36 Flanagan Road	48	51	52	50

Assessment of Traffic Noise and Vibration Effects

NOR D2 - Altered Road				
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation, dB L _{Aeq} (24hr)
21 Fitzgerald Road	52	56	52	49
32 Flanagan Road	48	51	52	49
28 Flanagan Road	47	51	52	49
238 Jesmond Road	46	55	52	47
262 Jesmond Road	45	53	52	47
4 Cameron Place	53	53	51	50
8 Cameron Place	49	52	50	50
296 Jesmond Road	49	57	50	49
113 Fitzgerald Road	49	54	50	46
177 Jesmond Road	47	54	50	45
33 Bremner Road	43	53	49	48
280 Jesmond Road	47	56	49	47
86 Fitzgerald Road	45	51	47	42
10 Cameron Place	44	50	46	46

NOR - D2 New Roads			
Address	Existing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation, dB L _{Aeq} (24hr)
235 Jesmond Road	45	65	60
6 Auranga Stage 2 Lot	46	63	58
341 Jesmond Road	44	60	54
7 Auranga Stage 2 Lot	41	58	53
8 Auranga Stage 2 Lot	41	57	51
38 Burberry Road	40	57	51
9 Auranga Stage 2 Lot	41	56	51
4 Auranga Stage 2 Lot	47	55	53
3 Auranga Stage 2 Lot	46	54	52
13 Auranga Stage 2 Lot	40	54	48
1 Auranga Stage 2 Lot	46	52	51
12 Auranga Stage 2 Lot	40	51	46
10 Auranga Stage 2 Lot	45	51	48
11 Auranga Stage 2 Lot	42	50	46
2 Auranga Stage 2 Lot	38	50	45

Assessment of Traffic Noise and Vibration Effects

NoR D3

NOR D3 - Altered Road				
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation, dB L _{Aeq} (24hr)
168 Waihoehoe Road	64	72	67	65
1 Fitzgerald Road	65	70	69	64
6 Fitzgerald Road	64	71	68	64
115 Waihoehoe Road	65	71	70	64
432 Waihoehoe Road	61	68	63	63
412 Waihoehoe Road	60	67	63	63
201 Waihoehoe Road	62	71	64	63
460 Waihoehoe Road	58	67	62	62
5 Fitzgerald Road	63	67	67	62
31 Appleby Road	56	69	62	62
3 Fitzgerald Road	63	66	66	62
28 Fitzgerald Road	60	65	64	60
10 Appleby Road	59	65	60	60
26 Fielding Road	55	58	59	59
211 Waihoehoe Road	58	66	59	59
251 Waihoehoe Road	55	61	59	59
196 Waihoehoe Road	56	63	57	57
336 Waihoehoe Road	58	60	57	57
136 Waihoehoe Road	57	64	61	57
185 Waihoehoe Road	62	68	58	56
297 Waihoehoe Road	59	61	58	56
45 Cossey Road	51	57	54	54
319 Waihoehoe Road	57	59	54	54
37 Appleby Road	50	59	53	53
34 Appleby Road	51	60	53	53
171 Waihoehoe Road	60	68	62	53
54 Appleby Road	49	59	52	52
64 Appleby Road	49	58	51	51
340 Drury Hills Road	46	54	50	50
233 Waihoehoe Road	53	59	54	50
49 Appleby Road	48	56	50	50
304 Waihoehoe Road	49	55	50	50
221 Cossey Road	46	52	49	49
65 Appleby Road	50	52	48	48
244 Cossey Road	46	51	47	48
249 Cossey Road	44	50	47	47

Assessment of Traffic Noise and Vibration Effects

NoR D4

NOR D4 - New Road				
Address	Existing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation Option 1, dB L _{Aeq} (24hr)	Mitigation Option 2, dB L _{Aeq} (24hr)
6 Ponga Road	44	65	61	61
36 Ponga Road	47	64	59	59
68 Ponga Road	46	63	59	59
201 Sutton Road	39	63	59	59
105 Walker Road	40	59	56	56
285 Sutton Road	41	58	54	54
115 Walker Road	39	57	54	54
2 Ponga Road	47	56	53	53
106 Harry Dodd Road	39	53	49	49
249 Sutton Road	40	55	52	52
237 Sutton Road	41	55	51	51
95 Walker Road	45	53	50	50
94 Ponga Road	48	51	48	48
112 Waihoehoe Road	55	59	56	56

NOR D4 - Altered Road			
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)
101 Waihoehoe Road	66	72	71
115 Waihoehoe Road	65	71	70
6 Fitzgerald Road	64	71	70
1 Fitzgerald Road	65	70	69
5 Fitzgerald Road	63	67	66
3 Fitzgerald Road	63	66	66
28 Fitzgerald Road	59	65	64
48 Ponga Road	57	62	64
97 Waihoehoe Road	58	63	63
28 Ponga Road	54	58	58
7 Fitzgerald Road	60	64	63
70 Ponga Road	58	61	60
61 Ponga Road	57	61	60

Assessment of Traffic Noise and Vibration Effects

NoR D5

NOR D5 – Altered Road – Ponga Road and Opāheke Road Rural			
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)
Bellfield unit 32	66	70	65
Bellfield unit 98	66	70	65
Bellfield unit 99	66	70	65
Bellfield unit 11	64	68	64
Bellfield unit 12	65	69	64
Bellfield unit 13	65	69	64
Bellfield unit 14	65	69	64
Bellfield unit 15	65	69	64
Bellfield unit 16	65	70	64
Bellfield unit 17	66	70	64
Bellfield unit 18	66	70	64
117 Ponga Road (Front)	59	62	63
145 Ponga Road	59	62	63
211 Opaheke Road	60	61	63
76C Opaheke Road	64	68	63
78A Opaheke Road	64	68	63
78B Opaheke Road	64	68	63
78C Opaheke Road	64	68	63
78D Opaheke Road	64	68	63
80 Opaheke Road	64	67	63
86 Opaheke Road	64	68	63
89 Opaheke Road	63	65	63
Bellfield unit 10	64	67	63
1 Lorelei Place	62	66	62
2 Snowden Place	62	64	62
2/82 Opaheke Road	62	66	62
216 Opaheke Road (Back)	46	62	62
74D Opaheke Road	63	67	62
76A Opaheke Road	63	67	62
76B Opaheke Road	63	68	62
87 Opaheke Road	62	64	62
88 Opaheke Road	63	66	62
95 Opaheke Road	63	67	62
48 Ponga Road	59	62	61
74B Opaheke Road	62	66	61
74C Opaheke Road	62	67	61
91 Opaheke Road	61	65	61
93 Opaheke Road	61	65	61
114 Opaheke Road (front)	60	64	60
174 Ponga Road	59	60	60
2 Lorelei Place	61	65	60
61 Ponga Road	58	61	60
74A Opaheke Road	61	65	60

Assessment of Traffic Noise and Vibration Effects

NOR D5 – Altered Road – Ponga Road and Opāheke Road Rural			
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)
95 Walker Road	45	59	60
97 Opaheke Road	61	64	60
110 Walker Road	55	62	59
120 Walker Road	42	58	59
122 Opaheke Road	61	63	59
216 Opaheke Road (Front)	48	52	59
70 Ponga Road	58	61	59
74 Ponga Road	59	62	59
Bellfield unit 9	60	62	59
1 Snowden Place	59	62	58
120 Ponga Road	57	60	58
215 Ponga Road	55	58	58
Bellfield unit 8	59	61	58
Bellfield unit 7	58	60	57
101 Ponga Road	54	57	56
106 Opaheke Road	57	60	56
231 Opaheke Road	58	61	56
72 Opaheke Road	58	61	56
81 Opaheke Road	57	61	56
Bellfield unit 5	57	59	56
Bellfield unit 6	58	60	56
101 Ponga Road	54	57	55
126 Ponga Road	57	60	55
235 Opaheke Road	58	61	55
28 Ponga Road	56	58	55
Bellfield unit 33	56	59	55
Bellfield unit 4	56	58	55
117 Ponga Road (Back)	52	55	54
Bellfield unit 2	55	57	54
Bellfield unit 3	56	57	54
109 Ponga Road	52	54	53
Bellfield unit 1	54	56	53
125 Ponga Road	50	53	52
221 Ponga Road	49	52	52
3 Snowden Place	53	55	52
300 Sutton Road	54	57	52
114 Opaheke Road (Back)	50	53	50
13 Lorelei Place	51	54	50
15 Lorelei Place	51	55	50
174 Opaheke Road	50	52	50
86A Opaheke Road	51	55	50
94 Ponga Road	48	51	50
Bellfield unit 88	52	53	50
Bellfield unit 89	52	53	50
Bellfield unit 90	52	53	50

Assessment of Traffic Noise and Vibration Effects

NOR D5 – Altered Road – Ponga Road and Opāheke Road Rural			
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)
Bellfield unit 91	52	53	50
156 Opaheke Road	48	49	49
18 Tautaiiao Lane	50	53	49
20 Tautaiiao Lane	50	53	49
22 Tautaiiao Lane	50	53	49
233 Ponga Road	46	49	49
24 Tautaiiao Lane	50	53	49
3 Lorelei Place	50	53	49
4 Lorelei Place	50	53	49
5 Lorelei Place	50	53	49
5 Snowden Place	50	52	49
6 Tautaiiao Lane	50	53	49
Bellfield unit 86	51	52	49
Bellfield unit 87	51	52	49
282 Sutton Road	48	51	48
68 Ponga Road	48	51	48
86B Opaheke Road	49	53	48
Bellfield unit 34	49	52	48
Bellfield Unit 35	49	52	48
Bellfield unit 85	50	51	48
19 Lorelei Place	47	51	47
36 Ponga Road	47	50	47
84A Opaheke Road	48	51	47
84B Opaheke Road	48	50	47
84D Opaheke Road	48	51	47
Bellfield unit 80	48	49	47
Bellfield unit 81	48	49	47
Bellfield unit 82	48	49	47
Bellfield unit 83	49	49	47
Bellfield unit 84	49	50	47
1/82 Opaheke Road	48	51	46
6 Lorelei Place	47	50	46
6 Snowden Place	47	50	46
7 Boundary Road	48	51	46
84C Opaheke Road	47	50	46
95 Walker Road	45	49	46
Bellfield Unit 31	48	49	46
Bellfield unit 77	47	48	46
Bellfield unit 78	48	48	46
Bellfield unit 79	48	49	46
11 Leatham Crescent	46	49	45
11 Lorelei Place	47	50	45
13 Leatham Crescent	45	49	45
14 Snowden Place	46	48	45
16 Lorelei Place	46	48	45
235 Opaheke Road (Back)	47	49	45

Assessment of Traffic Noise and Vibration Effects

NOR D5 – Altered Road – Ponga Road and Opāheke Road Rural			
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)
34 Lorelei Place	46	49	45
4 Snowden Place	45	49	45
Bellfield Unit 29	46	49	45
Bellfield unit 30	46	49	45
10 Lorelei Place	45	48	44
10 Tautaiiao Lane	45	49	44
11 Boundary Road	45	48	44
12 Lorelei Place	44	46	44
12 Tautaiiao Lane	45	49	44
14 Lorelei Place	45	47	44
14 Tautaiiao Lane	45	49	44
16 Tautaiiao Lane	45	49	44
17 Leatham Crescent	45	48	44
17 Lorelei Place	45	48	44
8 Snowden Place	46	48	44
9 Boundary Road	45	47	44
18 Lorelei Place	44	47	43
19 Boundary Road	45	47	43
7 Lorelei Place	44	47	43
7 Snowden Place	44	47	43
10 Snowden Place	43	45	42
11A Boundary Road	44	46	42
15 Leatham Crescent	43	46	42
2/19 Boundary Road	43	46	42
24 Lorelei Place	43	46	42
30 Lorelei Place	42	46	42
32 Lorelei Place	42	46	42
8 Lorelei Place	43	46	42
9 Lorelei Place	43	46	42
1/19 Boundary Road	42	45	41
20 Lorelei Place	42	45	41
22 Lorelei Place	41	45	41
5 Leatham Crescent	42	44	41
7 Leatham Crescent	41	44	41
9 Leatham Crescent	42	45	41
12 Snowden Place	41	44	40
17 Boundary Road	41	44	40
2 Tautaiiao Lane	41	44	40
28 Lorelei Place	41	44	40
4 Tautaiiao Lane	41	44	40
8 Tautaiiao Lane	41	44	40
26 Lorelei Place	40	43	39

Assessment of Traffic Noise and Vibration Effects

NOR D5 - Altered Road – Opāheke Road Urban					
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation Option 1, dB L _{Aeq} (24hr)	Mitigation Option 2, dB L _{Aeq} (24hr)
1/17 King Edward Road	72	70	72	67	62
1/17 Settlement Road	72	71	72	67	65
29 Settlement Road	72	70	72	67	63
3/16 Settlement Road	72	70	72	66	63
2/16 Settlement Road	72	70	72	66	63
2/14 Settlement Road	71	69	71	65	63
3/7 Settlement Road	71	69	71	65	64
4/7 Settlement Road	71	69	71	65	64
1/14 Settlement road	71	69	70	65	63
20 Opaheke Road	69	65	70	65	63
1/11 Settlement Road	71	69	71	64	63
1/27 Settlement Road	71	68	71	64	62
1/16 Settlement Road	71	68	70	64	63
1/9 Settlement Road	70	68	70	64	63
3/19 Opaheke Road	68	64	70	64	64
2/23 Settlement Road	72	69	69	64	63
19 Korakora Lane	67	64	69	64	59
1/18 King Edward Avenue	70	68	70	63	63
1/19 Opaheke Road	67	63	69	63	63
25 Settlement Road	70	67	68	63	63
2/27 Settlement Road	68	66	68	63	62
3/18 King Edward Avenue	67	65	67	62	62
4/18 King Edward Avenue	67	65	67	62	62
5/18 King Edward Avenue	67	65	67	62	62
13 Settlement Road	68	66	68	61	61
1/15 Settlement Road	68	65	68	61	61
12 Opaheke Road	66	63	68	61	61
2/12 Alexander Street	67	62	68	61	61
2 Onslow Road	66	62	68	61	61
1/21 Opaheke Road	66	61	68	61	61
1/9 Alexander Street	66	61	67	61	60
19 King Edward Avenue	67	64	67	60	60
1 Onslow Road	65	61	67	60	60
1/11 Alexander Street	65	60	67	60	60
2/11 Alexander Street	65	60	67	60	60
22 Opaheke Road	65	60	67	60	60
1/12 Alexander Street	65	60	66	60	59
20A Opaheke Road	62	57	66	59	59
1/23 Opaheke Road	64	58	65	58	58
21 Settlement Road	58	54	65	58	57

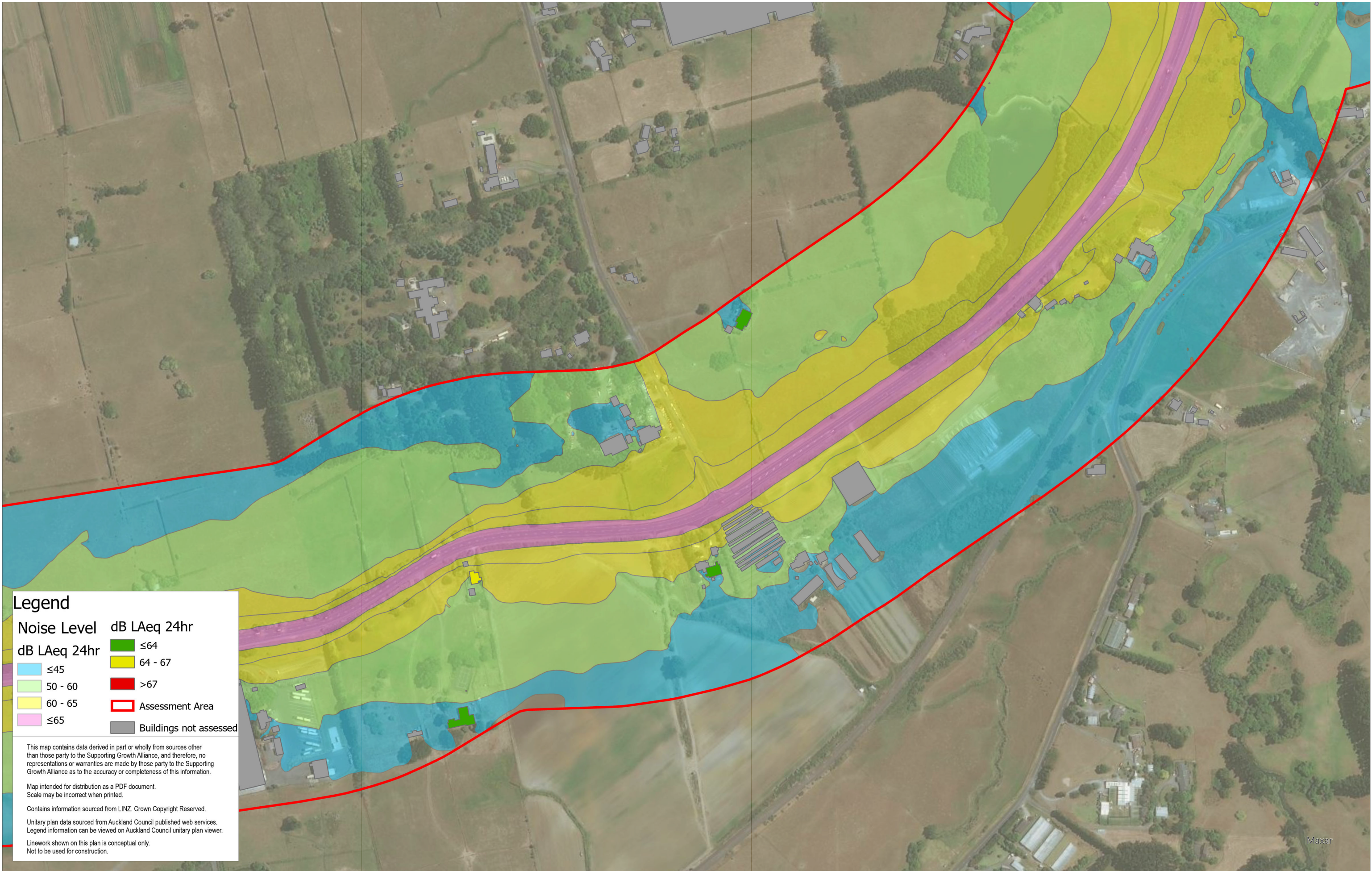
Assessment of Traffic Noise and Vibration Effects

NOR D5 - Altered Road – Opāheke Road Urban					
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation Option 1, dB L _{Aeq} (24hr)	Mitigation Option 2, dB L _{Aeq} (24hr)
2/18 King Edward Avenue	64	62	64	58	58
20B Settlement Road	64	61	64	58	58
15 Opaheke Road	62	58	63	56	56
4/19 Opaheke Road	58	56	63	56	56
1/22 King Edward Avenue	62	59	62	56	56
17 Korakora Lane	61	59	61	56	56
3/14 Alexander Street	57	53	62	55	55
2/9 Settlement Road	60	58	60	55	54
1/23 Settlement Road	57	54	61	54	54
15 Korakora Lane	59	57	59	54	54
13 Korakora Lane	59	57	59	54	54
1/14 Alexander Street	58	55	59	54	54
2/15 Settlement Road	59	56	59	53	53
11 Korakora Lane	58	56	58	53	53
2/23 Opaheke Road	59	53	60	52	52
1/16 King Edward Avenue	58	56	58	52	52
2/14 Alexander Street	53	50	58	52	51
9 Korakora Lane	57	55	57	52	52
3 Korakora Lane	57	55	57	52	52
2/22 King Edward Avenue	59	54	59	51	51
1/21 King Edward Avenue	58	55	58	51	51
8A Alexander Street	57	53	58	51	52
2/11 Settlement Road	57	55	57	51	51
5 Korakora Lane	56	55	56	51	51
7 Korakora Lane	56	55	56	51	51
1 Korakora Lane	56	54	56	51	51
1/7 Settlement Road	58	55	58	50	50
1/14 King Edward Avenue	58	54	58	50	49
3/13 Alexander Street	57	52	58	50	50
2/9 Alexander Street	56	51	57	50	50
3/11 Settlement Road	56	54	56	50	50
3/16 King Edward Avenue	59	57	55	50	50
4/16 King Edward Avenue	59	57	55	50	50
5/16 King Edward Avenue	59	57	55	50	50
13A Settlement Road	56	53	56	49	49
1/13 King Edward Avenue	56	52	56	49	49

Assessment of Traffic Noise and Vibration Effects

NOR D5 - Altered Road – Opāheke Road Urban					
Address	Existing, dB L _{Aeq} (24hr)	Do Nothing, dB L _{Aeq} (24hr)	Do Minimum, dB L _{Aeq} (24hr)	Mitigation Option 1, dB L _{Aeq} (24hr)	Mitigation Option 2, dB L _{Aeq} (24hr)
2/21 King Edward Avenue	56	53	55	49	49
16B Alexander Street	54	51	54	49	49
24 King Edward Avenue	55	52	55	48	48
1/23 King Edward Avenue	55	51	55	48	48
1/3 Onslow Road	55	51	55	48	48
1/13 Alexander Street	54	50	55	48	48
2/13 Alexander street	54	50	55	48	48
1/15 Alexander Street	54	50	55	48	48
2/15 Alexander Street	54	50	55	48	48
3/12 Alexander Street	54	50	55	48	48
2/23 King Edward Avenue	53	51	54	48	49
2/21 Opaheke Road	53	51	54	48	48
16 Alexander Street	52	50	53	48	48
1/6 Alexander Street	54	49	55	47	47
2/14 King Edward Avenue	54	51	54	47	47
3/14 King Edward Avenue	54	51	54	47	47
1/25 King Edward Avenue	53	50	53	47	47
3/6 Alexander Street	52	50	53	47	47
8 Alexander Street	52	50	53	47	48
2/16 King Edward Avenue	52	50	52	47	47
1/16 Alexander Street	52	50	52	47	47
1/17 Alexander Street	53	49	53	46	47
4 Alexander Street	52	50	52	46	46
2/6 Alexander Street	51	49	52	46	46
2/19 Opaheke Road	58	56	63	56	56
8B Alexander Street	52	50	53	47	48
3/9 Settlement road	60	58	60	55	54

Appendix 4. Predicted Traffic Noise Levels Maps



Legend

Noise Level	dB LAeq 24hr
≤45	≤64
50 - 60	64 - 67
60 - 65	>67
≤65	Assessment Area
	Buildings not assessed

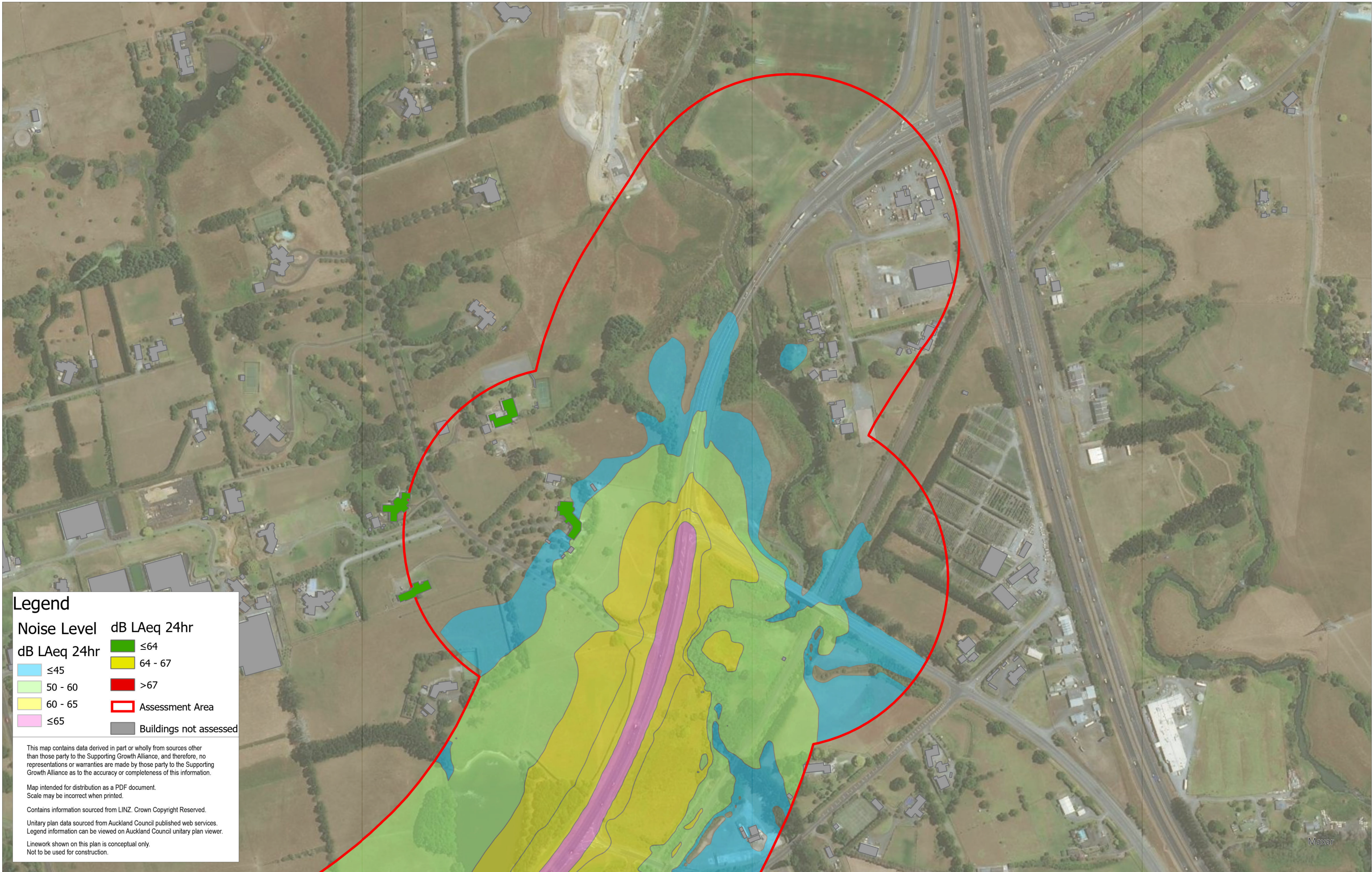
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Legend

Noise Level dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

>67

Assessment Area

Buildings not assessed

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Map Scale @ A3:1:4,000

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Kilometres

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

Supporting Growth

NoR D1 - Existing Road Traffic Noise

Working Plans of Te Tupu Ngatahi.

For the purpose of INTERNAL workshops (not for wider distribution)

Client:

Supporting Growth

Project:

Drury Package

TE TUPU NGĀTAHI

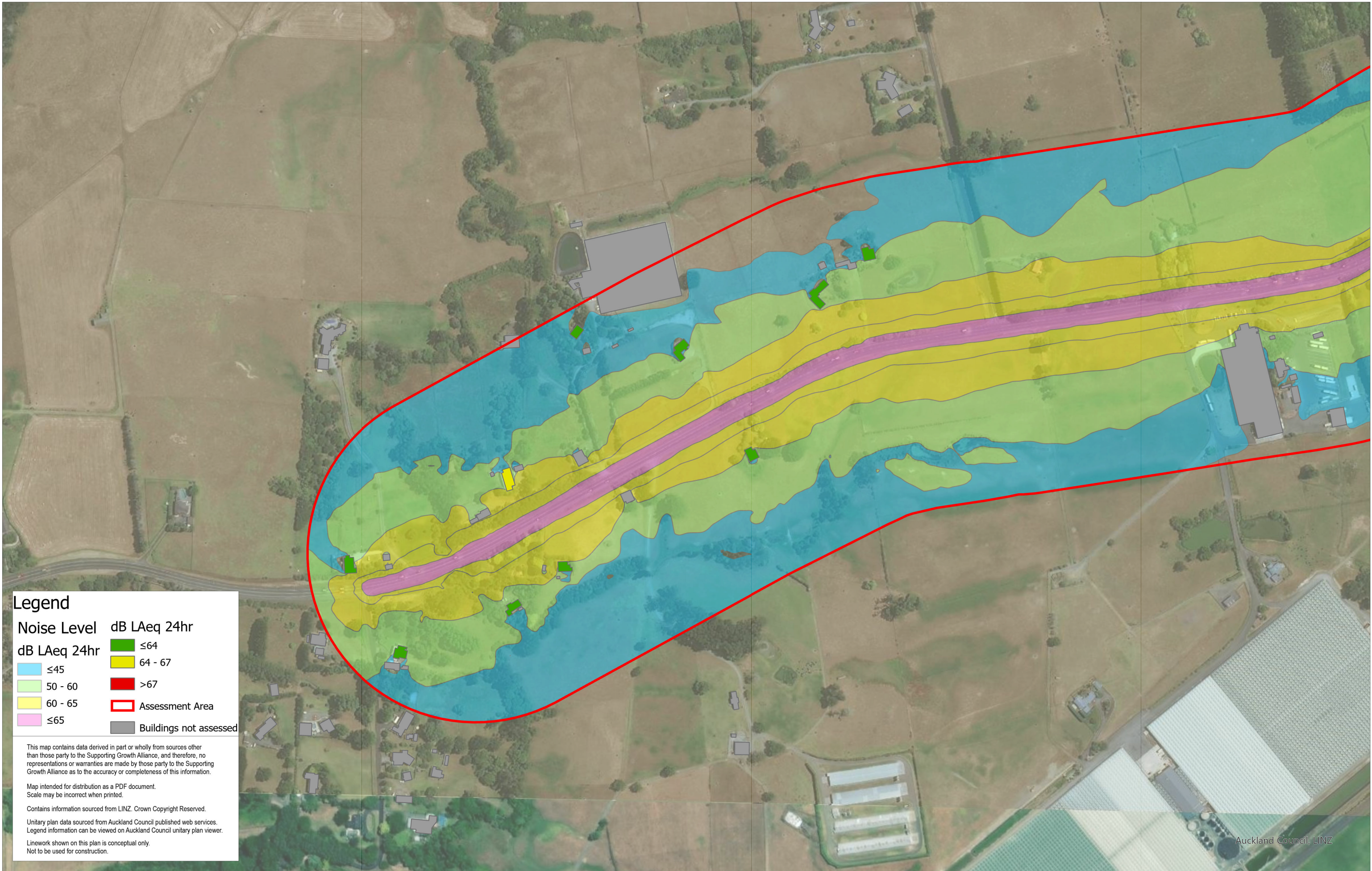
Supporting Growth

Discipline:

GIS

Drawing No:

SGA-XX-XX- 102



Legend

Noise Level dB LAeq 24hr

≤45	≤64
50 - 60	64 - 67
60 - 65	>67
≤65	Assessment Area
	Buildings not assessed

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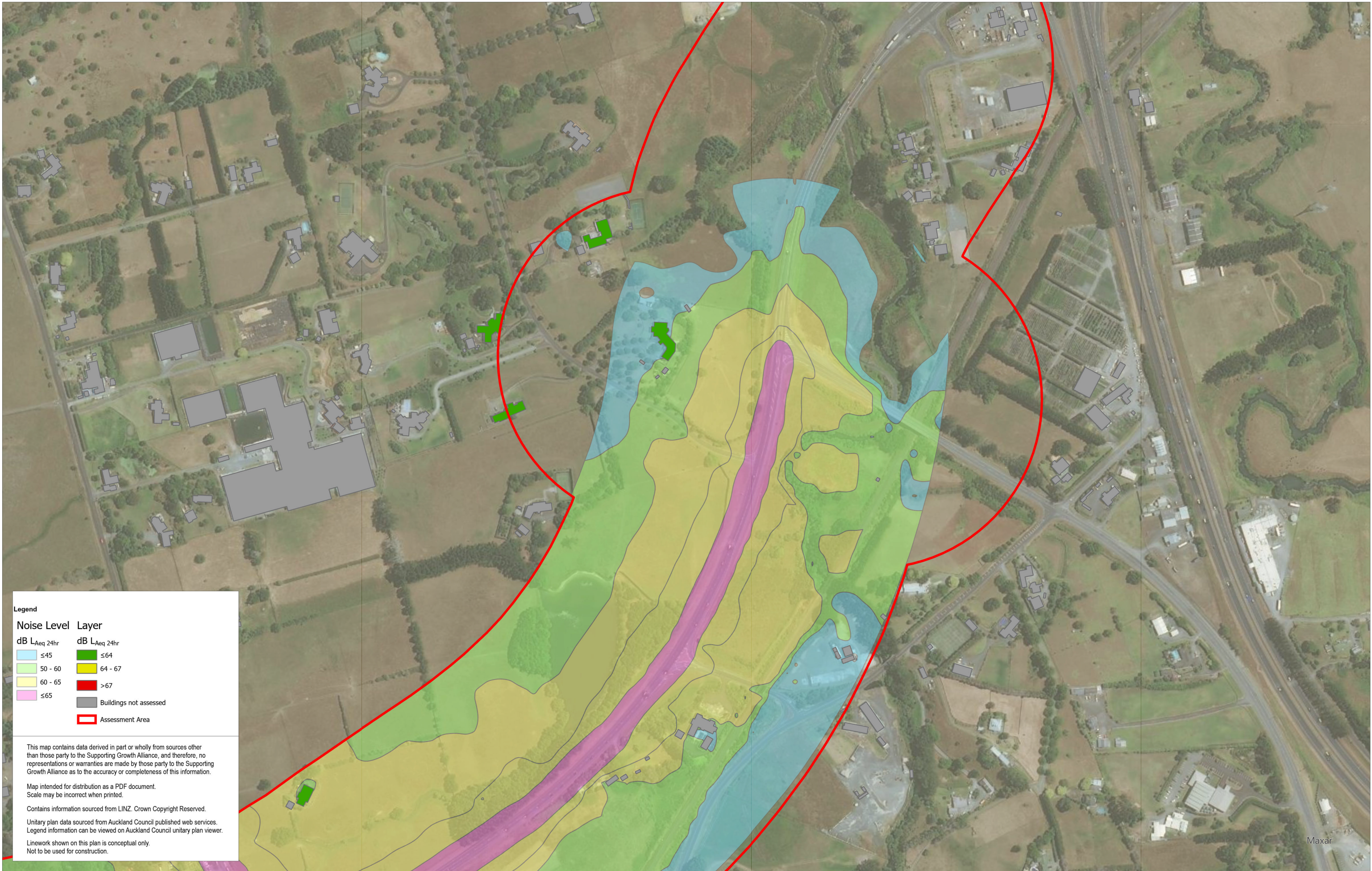
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Auckland Council, LINZ



Legend

Noise Level	Layer
dB L _{Aeq} 24hr	dB L _{Aeq} 24hr
≤45	≤64
50 - 60	64 - 67
60 - 65	>67
≤65	Buildings not assessed
	Assessment Area

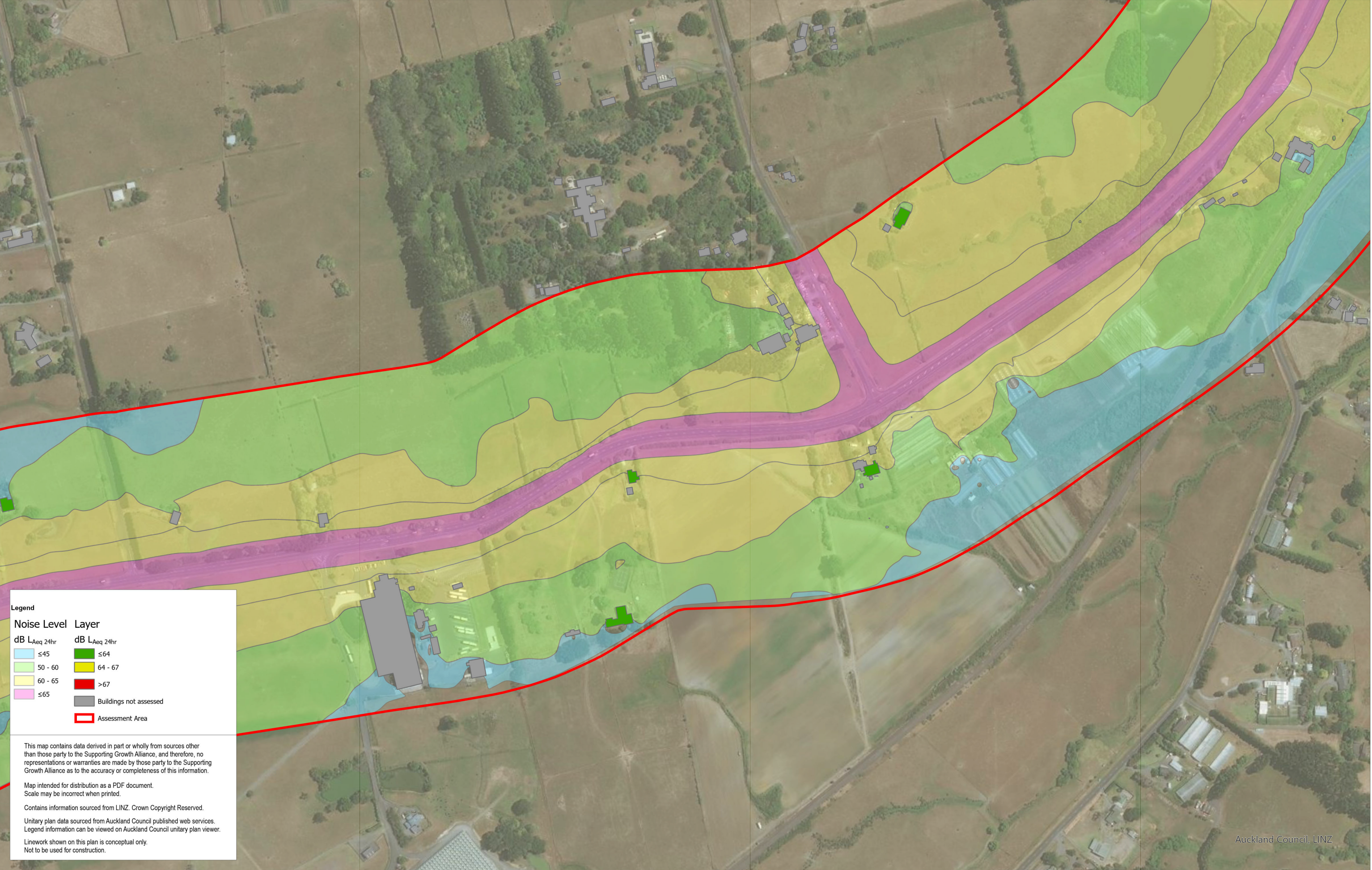
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Legend

Noise Level	Layer
dB L _{Aeq} 24hr	dB L _{Aeq} 24hr
≤45	≤64
50 - 60	64 - 67
60 - 65	>67
≤65	
	Buildings not assessed
	Assessment Area

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Legend

Noise Level	Layer
dB L _{Aeq} 24hr	dB L _{Aeq} 24hr
≤45	≤64
50 - 60	64 - 67
60 - 65	>67
≤65	
	Buildings not assessed
	Assessment Area

This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.

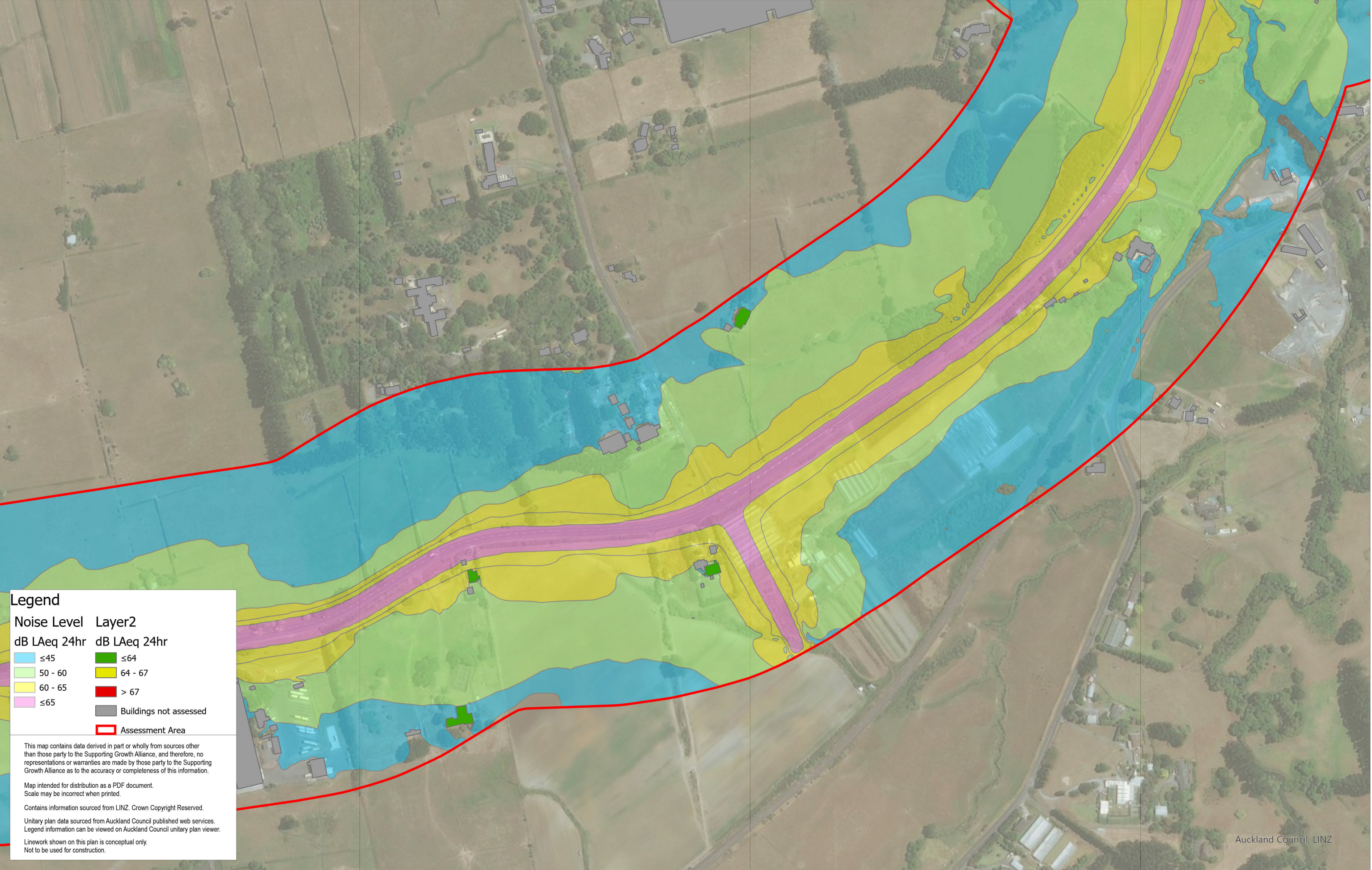
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Linework shown on this plan is conceptual only.
Not to be used for construction.

Auckland Council, LINZ



Legend

Noise Level Layer2

dB LAeq 24hr dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

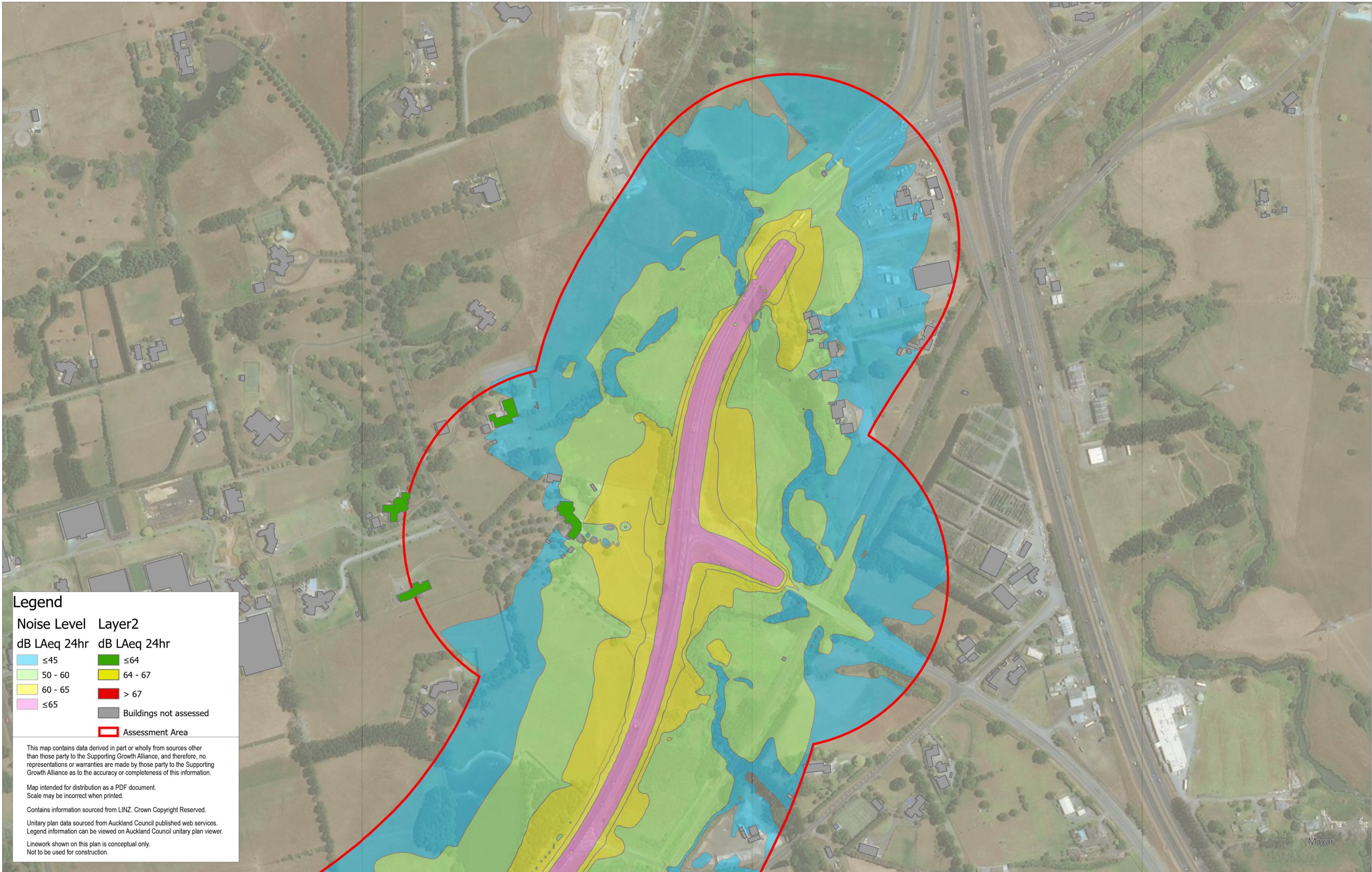
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.

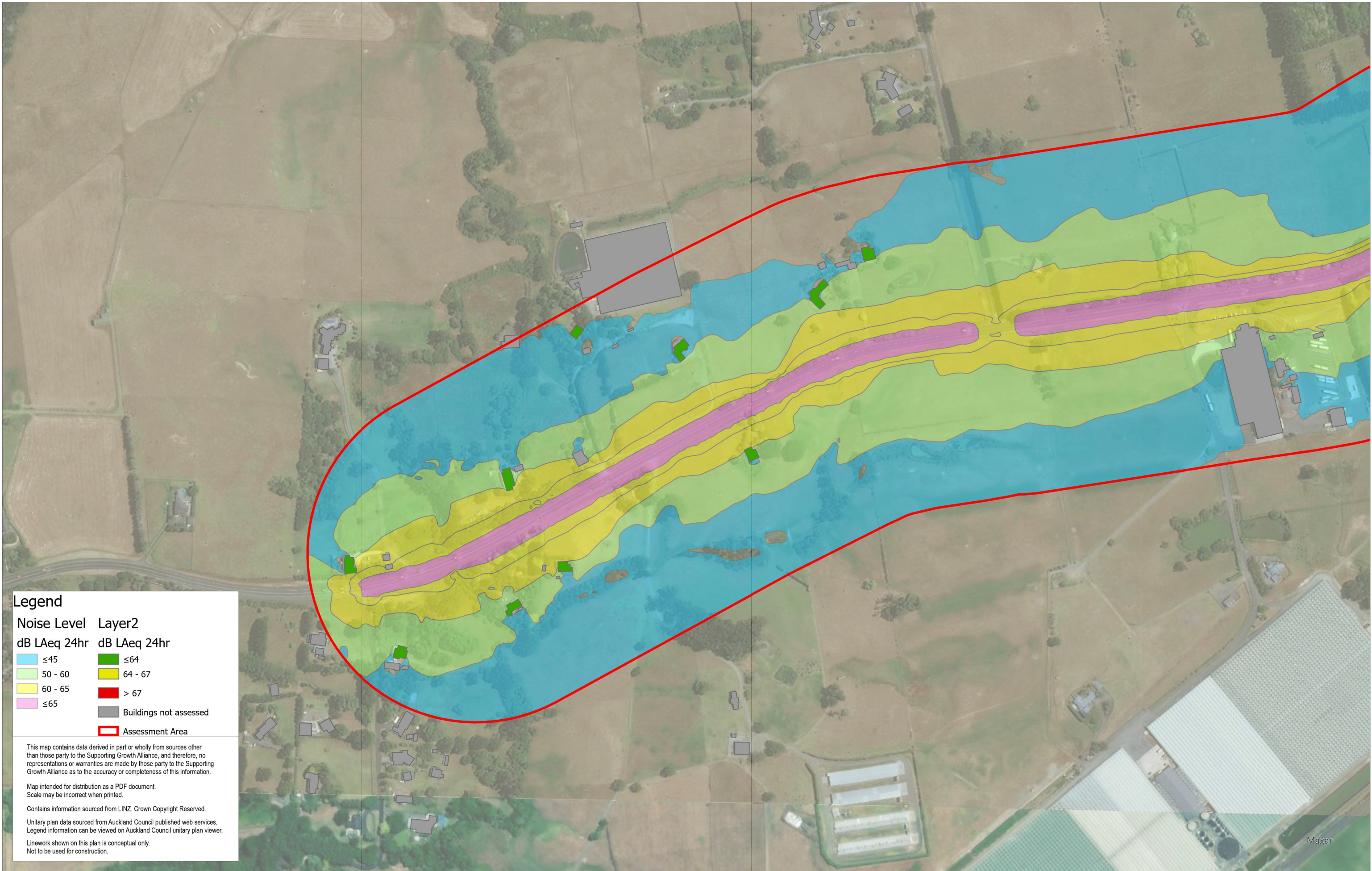
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.

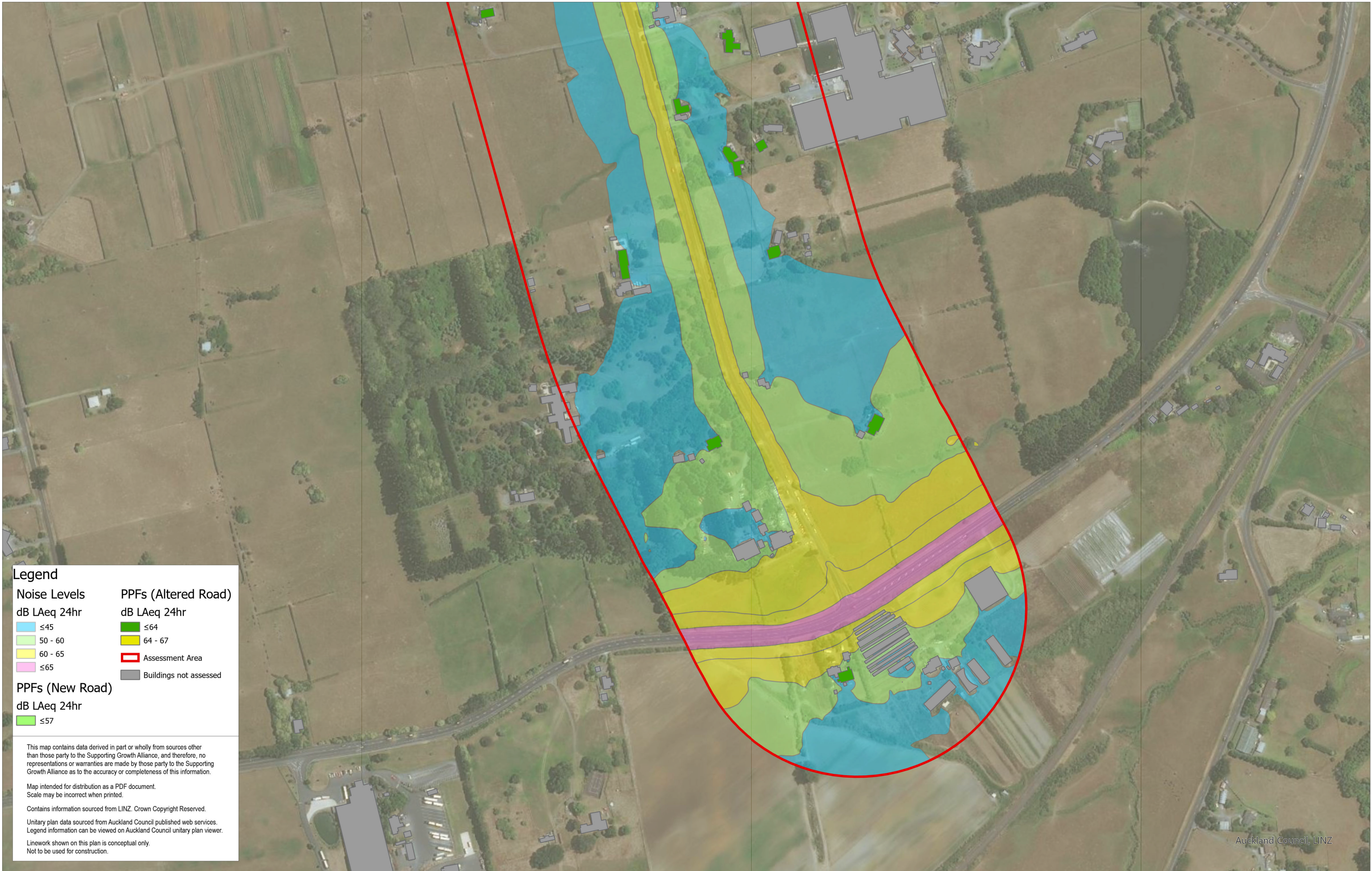
Contains information sourced from LINZ. Crown Copyright Reserved.

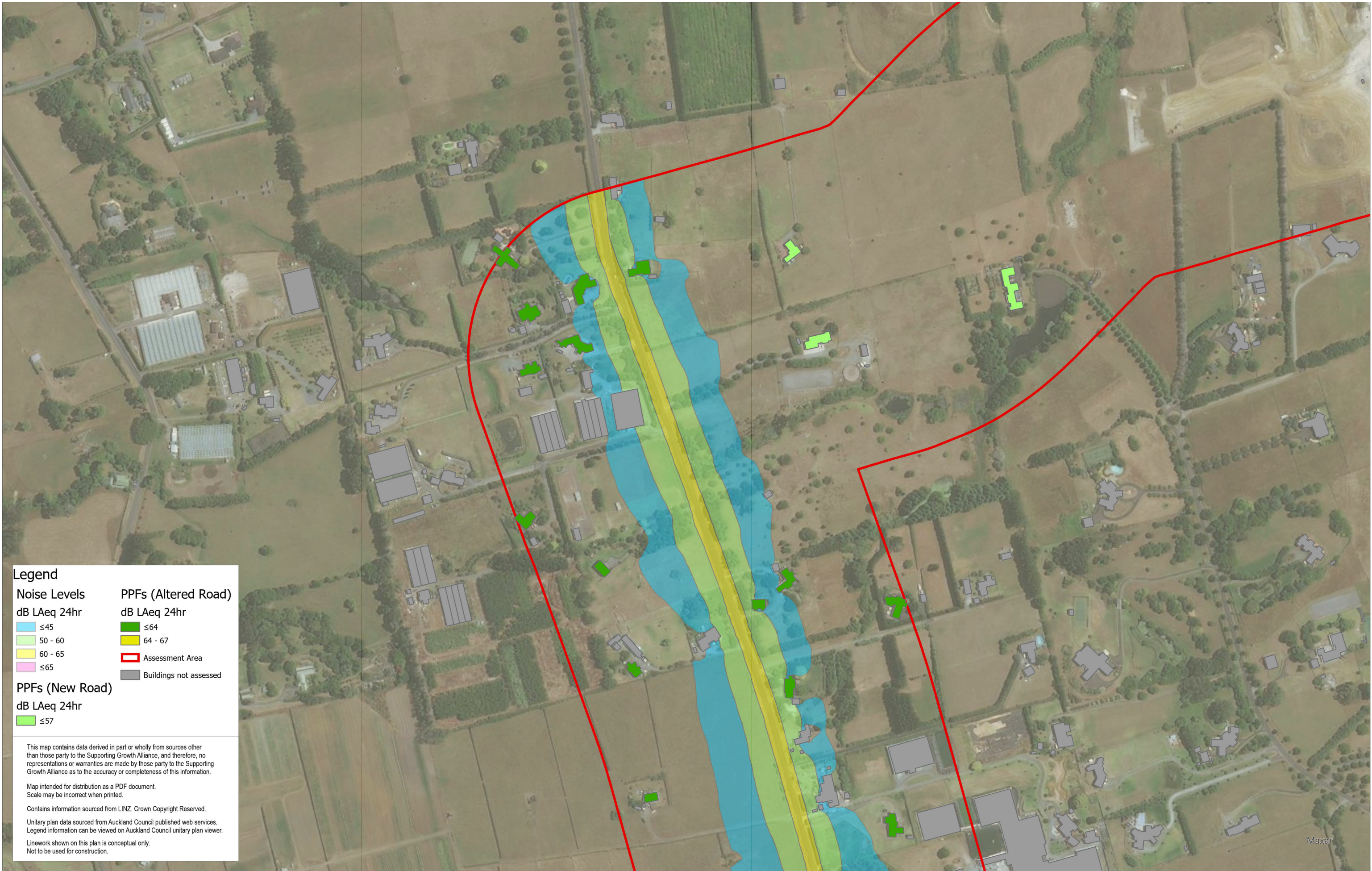
Unitary plan data sourced from Auckland Council published web services.
Legend information can be viewed on Auckland Council unitary plan viewer.

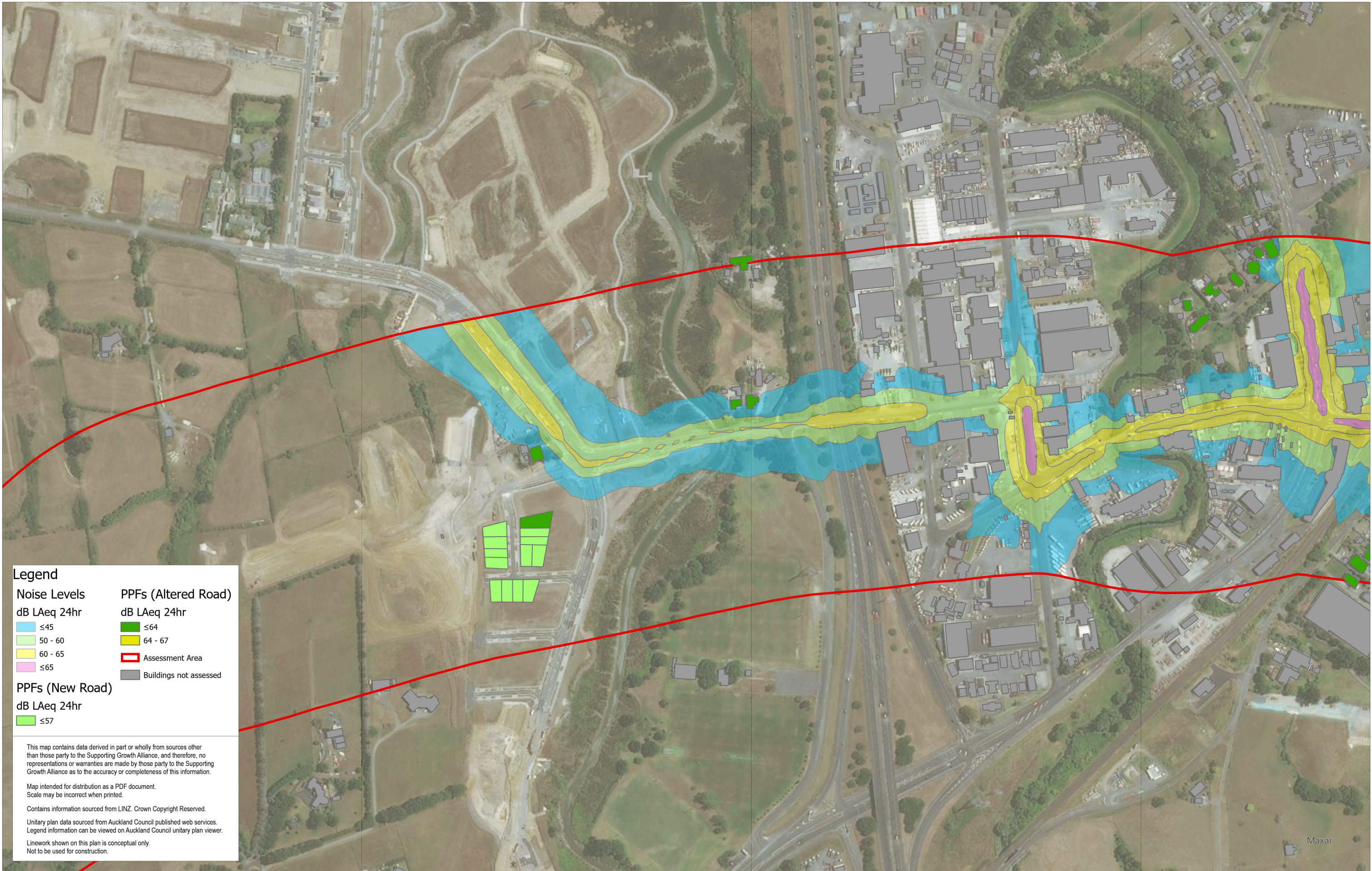
Linework shown on this plan is conceptual only.
Not to be used for construction.

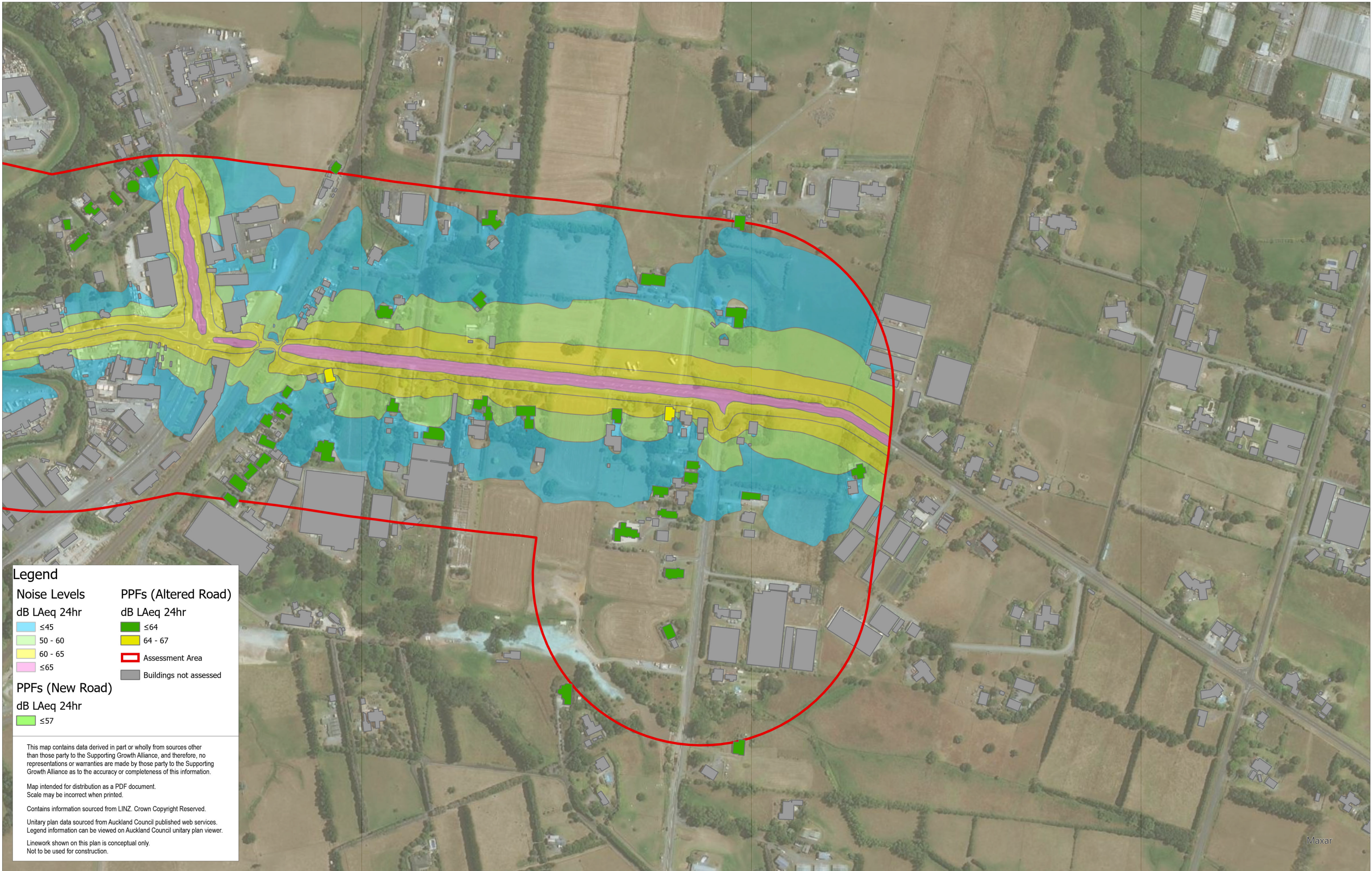












Legend

Noise Levels
dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

PPFs (Altered Road)
dB LAeq 24hr

≤64

64 - 67

Assessment Area

Buildings not assessed

PPFs (New Road)
dB LAeq 24hr

≤57

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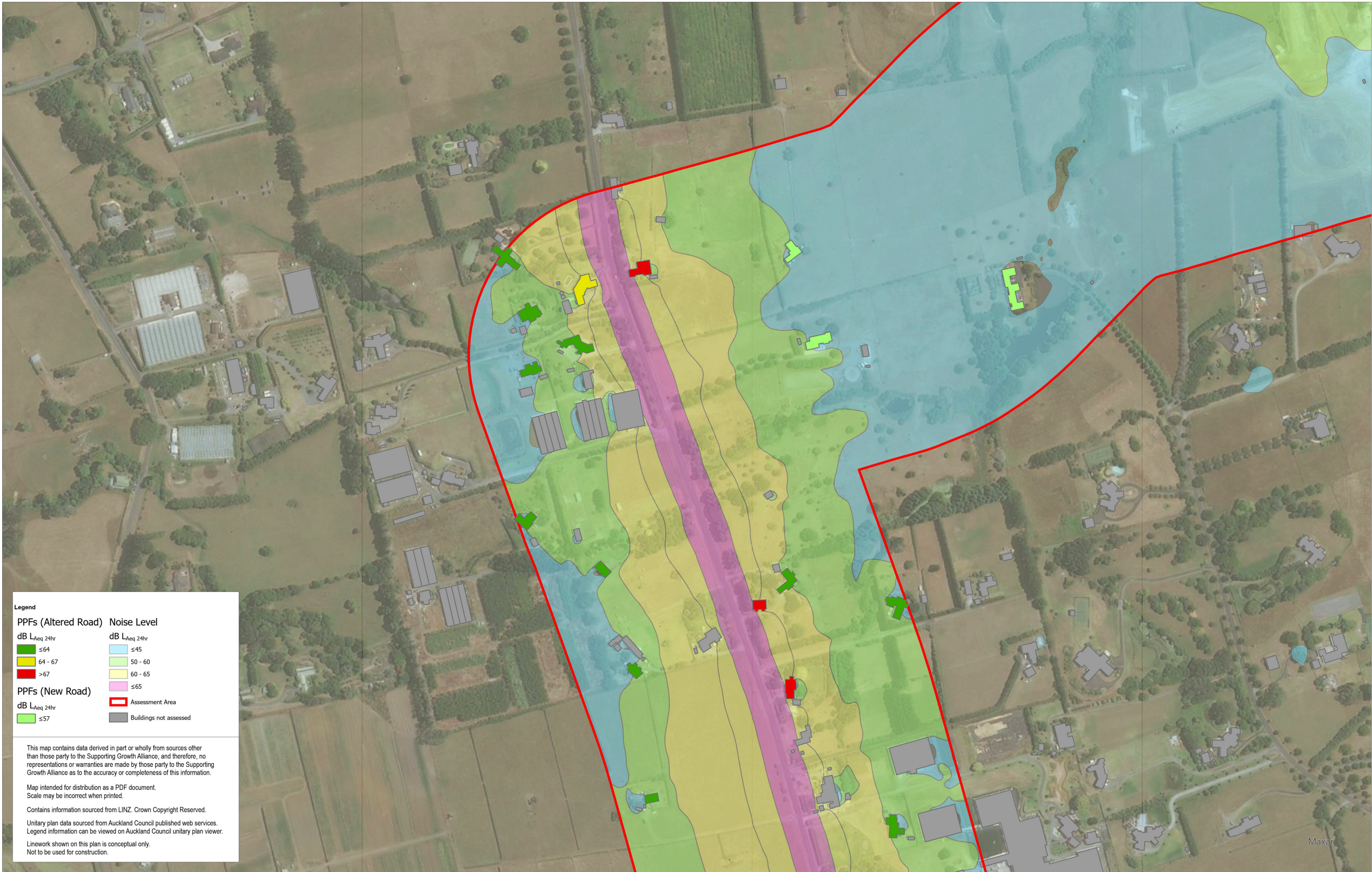
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Linework shown on this plan is conceptual only.
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Legend

PPFs (Altered Road) Noise Level

dB L_{Aeq} 24hr

≤64

64 - 67

>67

PPFs (New Road)

dB L_{Aeq} 24hr

≤57

Assessment Area

Buildings not assessed

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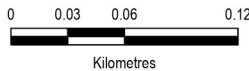
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Map Scale @ A3:1:4,000



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

Title:

Supporting Growth

NoR D2 - Do Nothing Road Traffic Noise

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

Client:

Supporting Growth

Project:

Drury Package

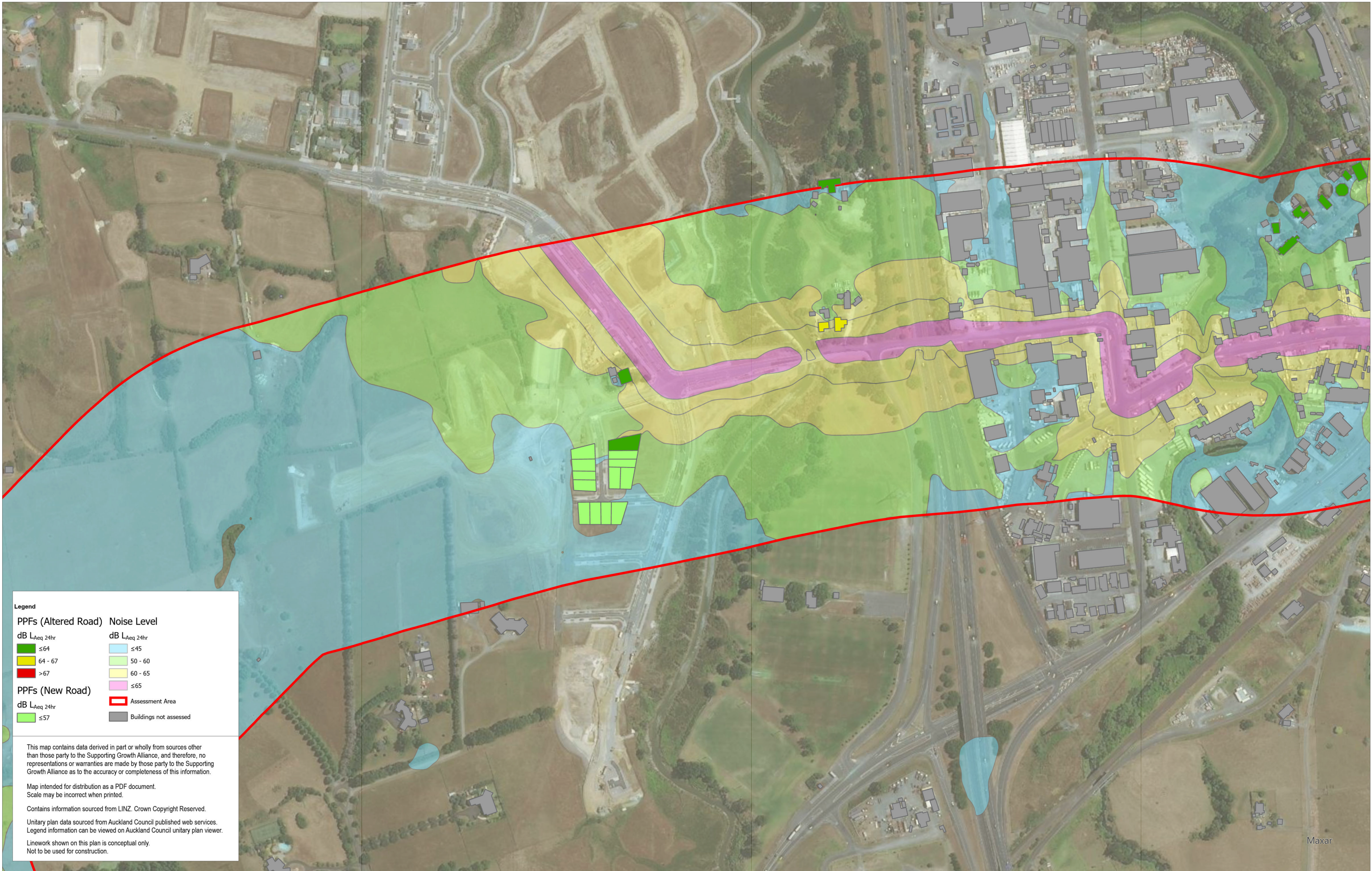


Discipline:

GIS

Drawing No:

SGA-XX-XX- 115



Legend

PPFs (Altered Road) Noise Level

dB L_{Aeq} 24hr

≤64	≤45
64 - 67	50 - 60
>67	60 - 65
	≤65

PPFs (New Road)

dB L_{Aeq} 24hr

≤57

Assessment Area

Buildings not assessed

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Legend

PPFs (Altered Road) Noise Level

dB L_{Aeq} 24hr

- ≤64
- 64 - 67
- >67

PPFs (New Road)

dB L_{Aeq} 24hr

- ≤57

dB L_{Aeq} 24hr

- ≤45
- 50 - 60
- 60 - 65
- ≤65

Assessment Area

Buildings not assessed

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Legend

PPFs (Altered Road)

dB LAeq 24hr

≤64

64 - 67

>67

Noise Level

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

PPFs (New Road)

dB LAeq 24hr

≤57

57 - 64

Assessment Area

Buildings not assessed

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Legend

PPFs (Altered Road)

dB LAeq 24hr

≤64

64 - 67

>67

PPFs (New Road)

dB LAeq 24hr

≤57

57 - 64

Noise Level

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

Assessment Area

Buildings not assessed

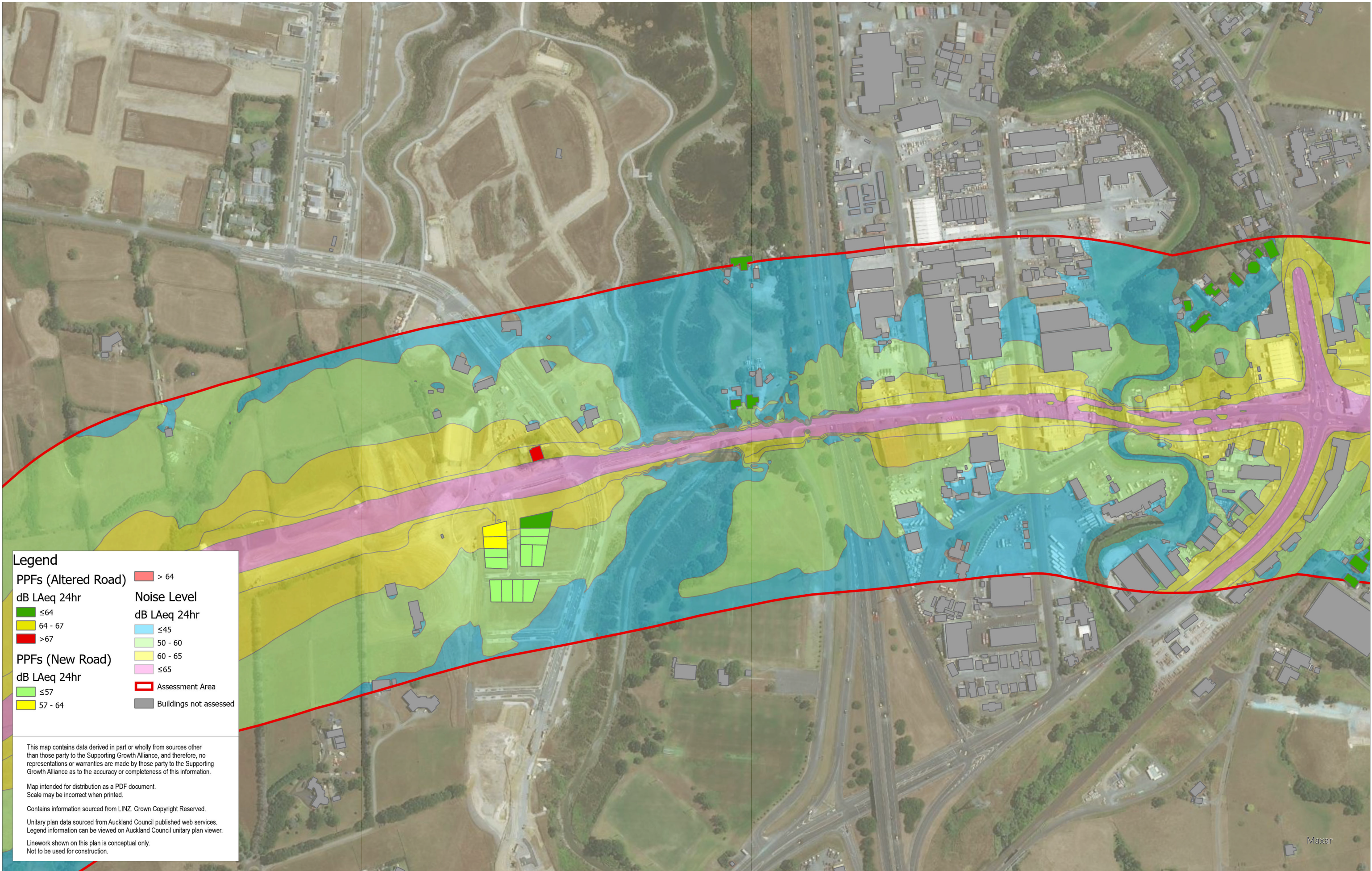
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Legend

PPFs (Altered Road)

dB LAeq 24hr

<=64

64 - 67

>67

Noise Level

dB LAeq 24hr

<=45

50 - 60

60 - 65

<=65

Assessment Area

Buildings not assessed

PPFs (New Road)

dB LAeq 24hr

<=57

57 - 64

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Legend

PPFs (Altered Road)

dB LAeq 24hr

- ≤64
- 64 - 67
- >67

PPFs (New Road)

dB LAeq 24hr

- ≤57
- 57 - 64

Noise Level

dB LAeq 24hr

- ≤45
- 50 - 60
- 60 - 65
- ≤65

Assessment Area

Buildings not assessed

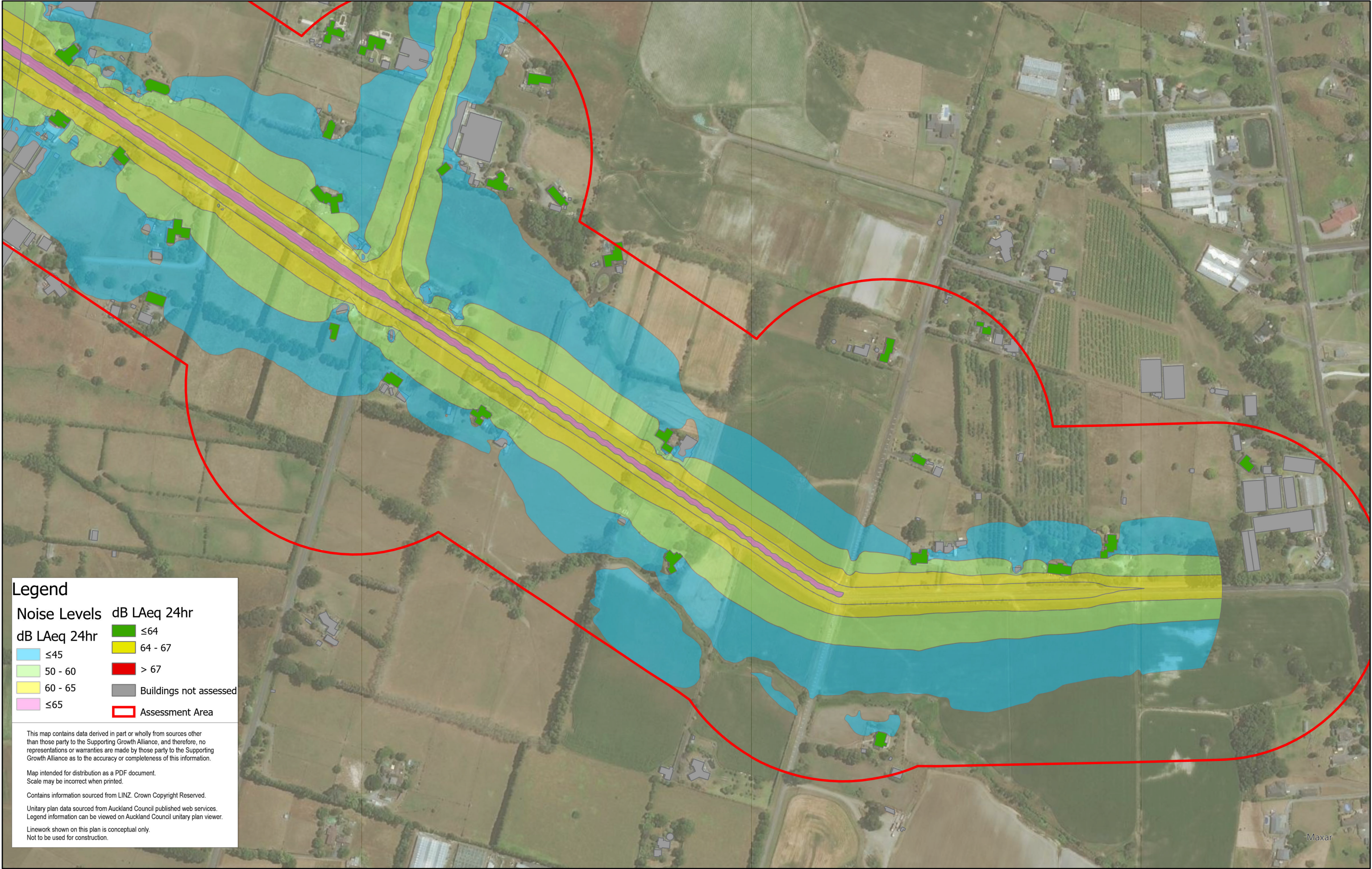
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Legend

Noise Levels dB LAeq 24hr

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

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Map Scale @ A3:

Kilometres

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

Title:

Supporting Growth

NoR D3 - Existing Road Traffic Noise

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

Client:

Supporting Growth

Project:

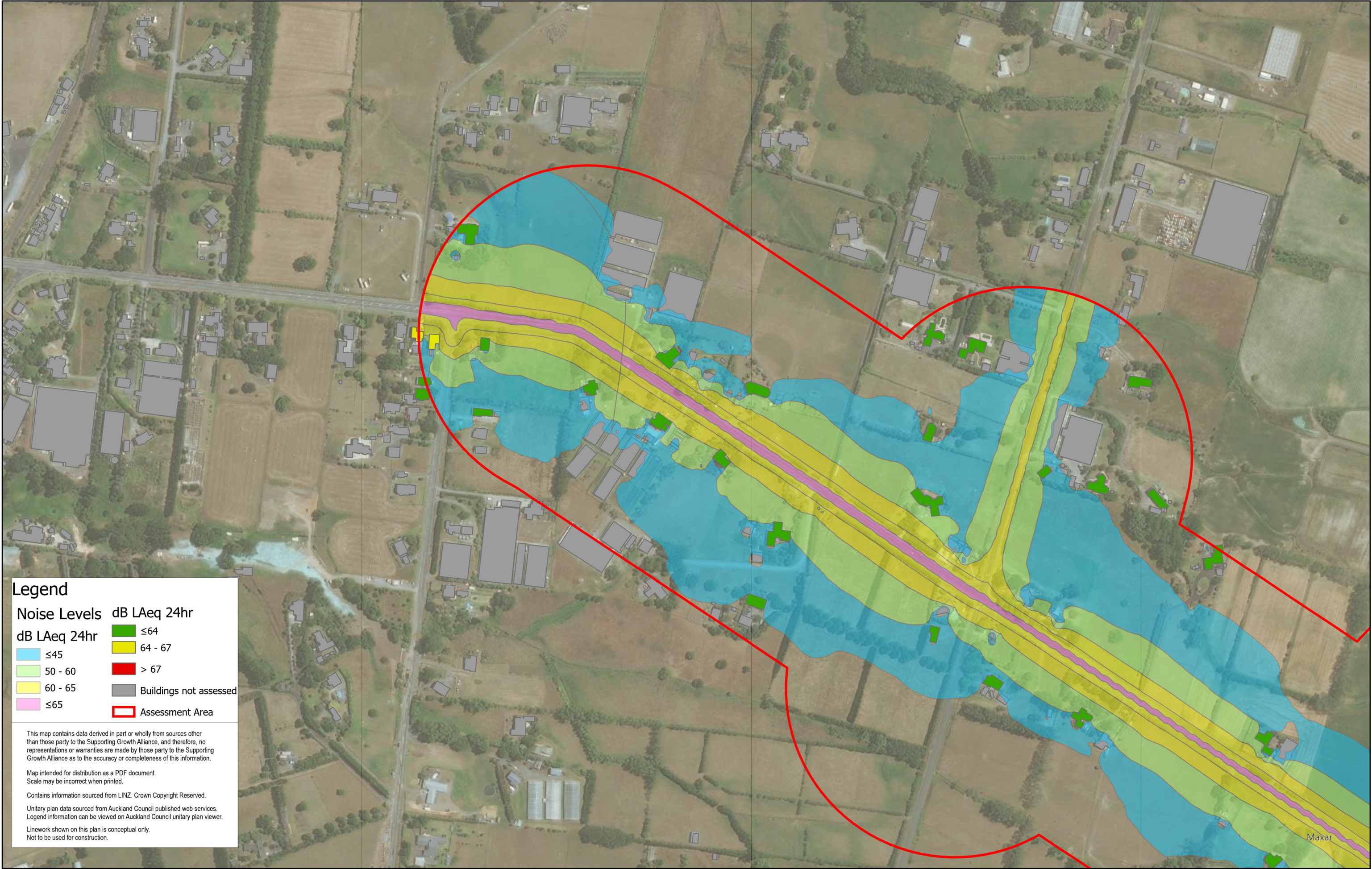
Drury Package

Discipline:

GIS

Drawing No:

SGA-XX-XX- 122



Legend

Noise Levels dB LAeq 24hr

≤45	≤64
50 - 60	64 - 67
60 - 65	> 67
≤65	Buildings not assessed
	Assessment Area

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Map Scale @ A3:



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1	Author	DRAFT	DRAFT	dd/mm/yyyy

Supporting Growth

NoR D3 - Existing Road Traffic Noise

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

Client: **Supporting Growth**

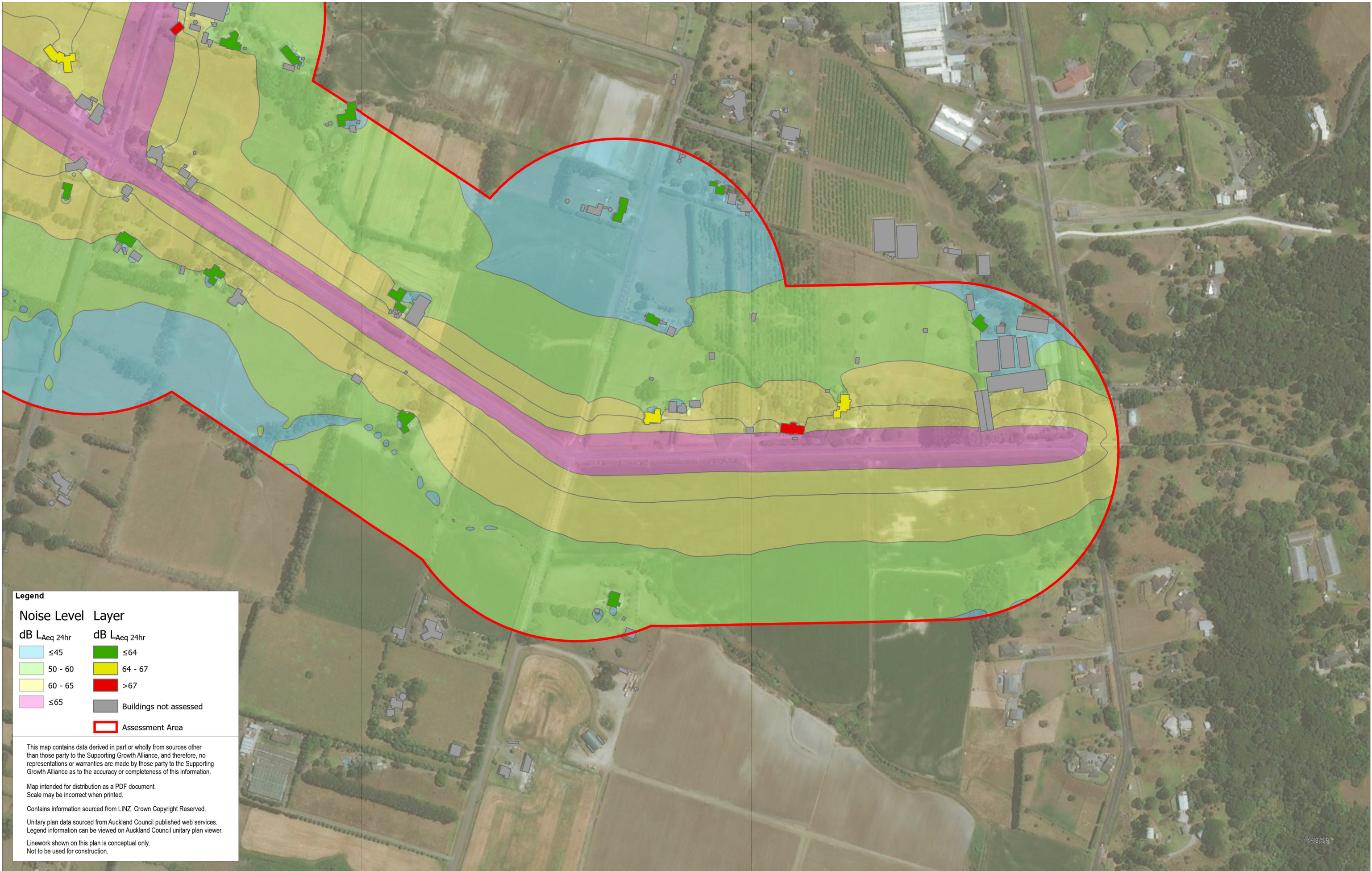
Project: **Drury Package**



Discipline: **GIS**

Drawing No: **SGA-XX-XX- 123**





Legend

Noise Level

dB L_{Aeq} 24hr

≤45

50 - 60

60 - 65

≤65

Layer

dB L_{Aeq} 24hr

≤64

64 - 67

>67

Buildings not assessed

Assessment Area

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Legend

PPFs

dB LAeq 24hr

≤64

64 - 67

> 67

Buildings not assessed

NZS 6806 Assessment Area

Noise Level, dB LAeq

≤45

50 - 60

60 - 65

≤65

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Map Scale @ A3:

Kilometres

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

Supporting Growth

NoR D4 - Existing Road Traffic Noise

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

Client:

Supporting Growth

Project:

Drury Package

Discipline:

GIS

Drawing No:

SGA-XX-XX- 128



Legend

PPFs

dB LAeq 24hr

≤64

64 - 67

> 67

Buildings not assessed

NZS 6806 Assessment Area

Noise Level, dB LAeq

≤45

50 - 60

60 - 65

≤65

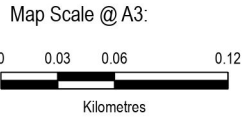
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Revision	Author	Verified	Approved	Date
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Title:

Supporting Growth

NoR D4 - Existing Road Traffic Noise

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

Client:

Supporting Growth

Project:

Drury Package



Discipline:

GIS

Drawing No:

SGA-XX-XX- 129





Legend

PPFs

dB LAeq 24hr

≤64

64 - 67

> 67

Buildings not assessed

NZS 6806 Assessment Area

Noise Level, dB LAeq

≤45

50 - 60

60 - 65

≤65

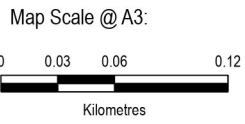
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Revision	Author	Verified	Approved	Date
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Title:

Supporting Growth

NoR D4 - Existing Road Traffic Noise

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

Client:

Supporting Growth

Project:

Drury Package



Discipline:

GIS

Drawing No:

SGA-XX-XX- 131



- Legend**
- Noise Level PPFs**
- | dB LAeq 24hr | dB LAeq 24hr |
|--------------|------------------------|
| ≤45 | ≤64 |
| 50 - 60 | 64 - 67 |
| 60 - 65 | ≤67 |
| ≤65 | Buildings not assessed |
| | Assessment Area |

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Auckland Council, LINZ

Map Scale @ A3:1:4,000 0 0.03 0.06 0.12 Kilometres		Revision	Author	Verified	Approved	Date	Title: Supporting Growth NoR D4 - Do Nothing Road Traffic Noise Working Plans of Te Tupu Ngatahi. For the purpose of INTERNAL workshops (not for wider distribution)	Client: Supporting Growth		Discipline: GIS
								Project: Drury Package		Drawing No: SGA-XX-XX- 132
		1	Author	DRAFT	DRAFT	dd/mm/yyyy				









Legend

PPFs Altered Road
dB LAeq 24hr
≤64
64 - 67
> 67

PPFs New Road
dB LAeq 24hr
≤57

Noise Level dB LAeq
≤45
50 - 60
60 - 65
≤65

Buildings not assessed
Assessment Area

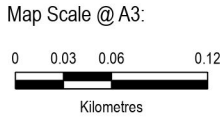
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Revision	Author	Verified	Approved	Date
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Supporting Growth

NoR D4 - Do Min Road Traffic Noise

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

Client: **Supporting Growth**

Project: **Drury Package**



Discipline: **GIS**

Drawing No: **SGA-XX-XX- 136**



Legend

PPFs Altered Road
dB LAeq 24hr

≤64

64 - 67

> 67

PPFs New Road
dB LAeq 24hr

≤57

Noise Level dB LAeq

≤45

50 - 60

60 - 65

≤65

Buildings not assessed

Assessment Area

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Auckland Council, LINZ



Legend

PPFs Altered Road
dB LAeq 24hr

≤64

64 - 67

> 67

PPFs New Road
dB LAeq 24hr

≤57

57 - 64

> 64

Noise Level dB LAeq

≤45

50 - 60

60 - 65

≤65

Buildings not assessed

Assessment Area

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Legend

PPFs Altered Road

dB LAeq 24hr

≤64

64 - 67

> 67

PPFs New Road

dB LAeq 24hr

≤57

57 - 64

> 64

Noise Level dB LAeq

≤45

50 - 60

60 - 65

≤65

Buildings not assessed

Assessment Area

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Map Scale @ A3:
0 0.03 0.06 0.12
Kilometres

N

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

Supporting Growth

NoR D4 - Do Min Road Traffic Noise

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

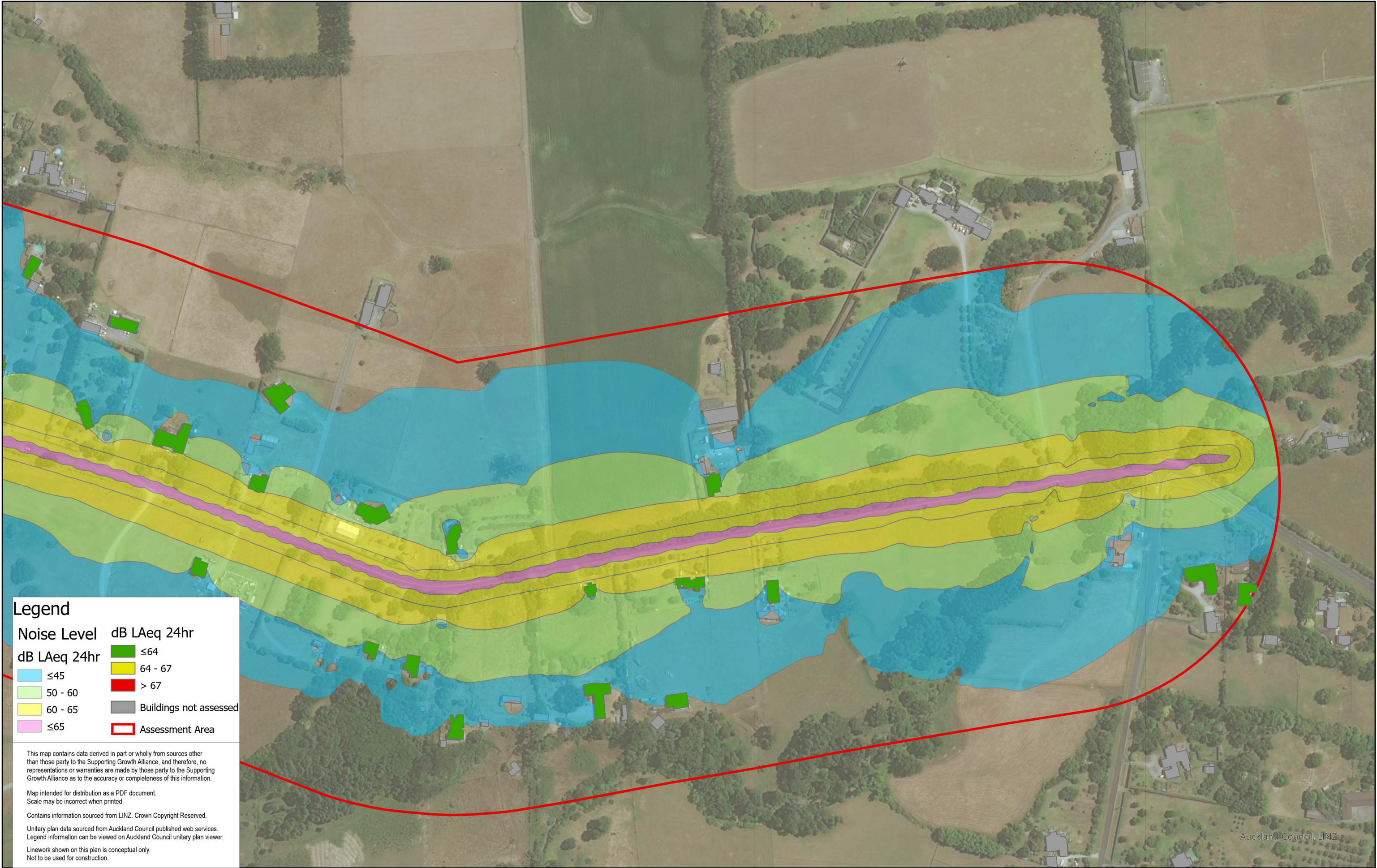
Client:
Supporting Growth

Project:
Drury Package

TE TUPU NGĀTAHI
Supporting Growth

Discipline:
GIS

Drawing No:
SGA-XX-XX- 139



Legend

Noise Level dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

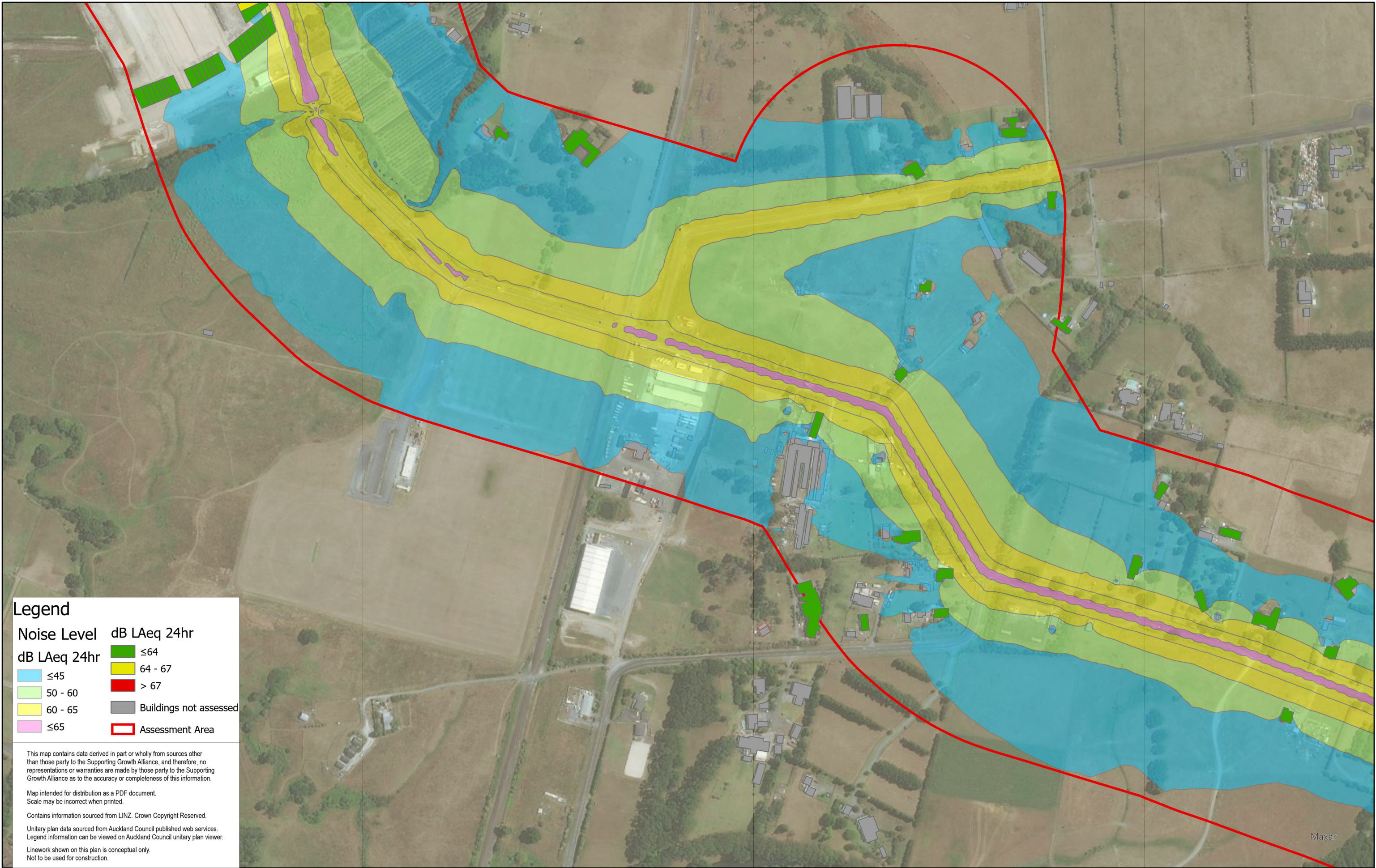
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Legend

Noise Level

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

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Map Scale @ A3:
0 0.03 0.06 0.12
Kilometres

N

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

Title:

Supporting Growth

NoR D5 - Existing Road Traffic Noise

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

Client:

Supporting Growth

Project:

Drury Package

TE TUPU NGĀTAHI
Supporting Growth

Discipline:

GIS

Drawing No:

SGA-XX-XX- 141



Legend

Noise Level dB LAeq 24hr

≤45	≤64
50 - 60	64 - 67
60 - 65	> 67
≤65	Buildings not assessed
	Assessment Area

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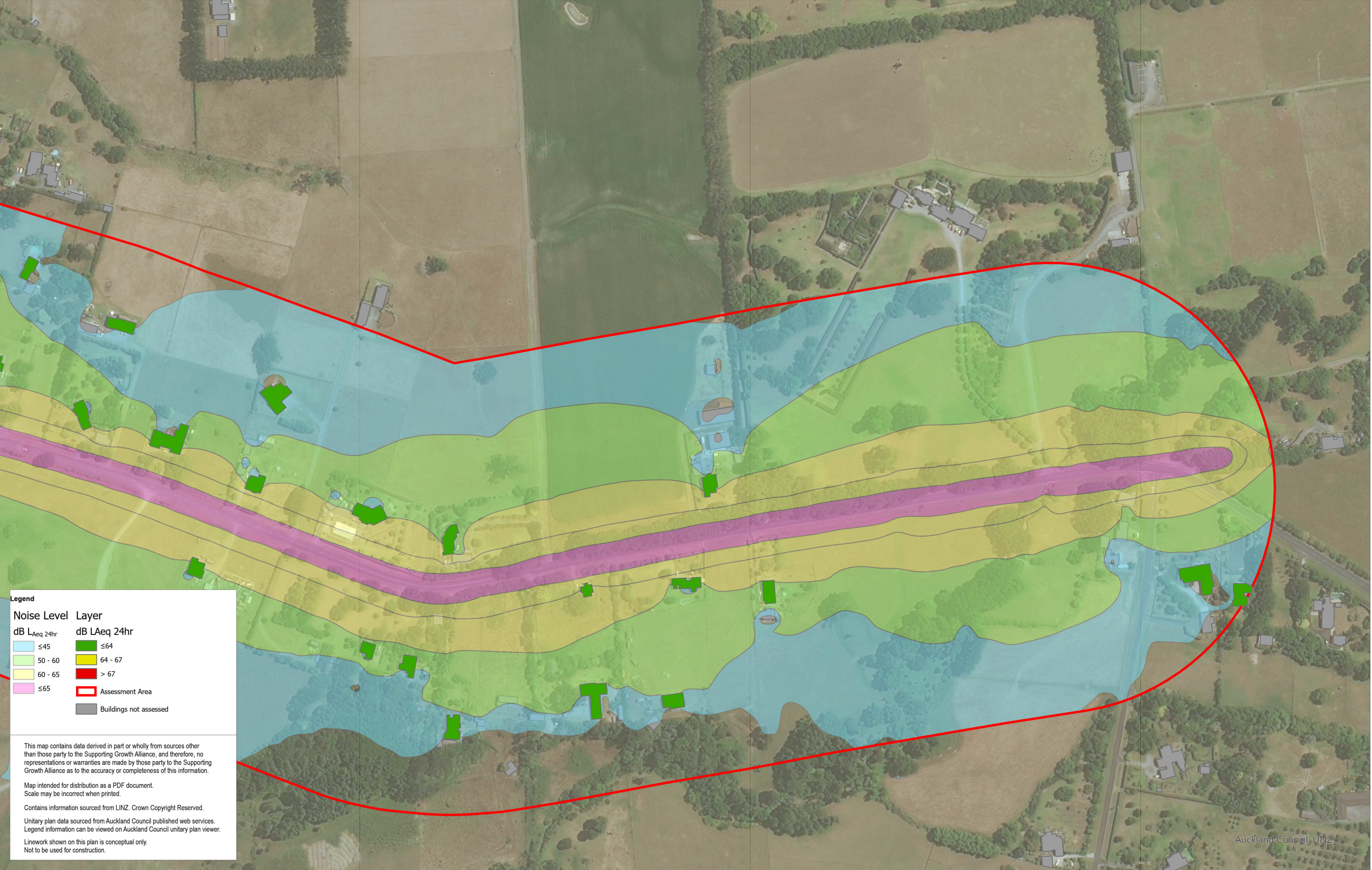
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Legend

Noise Level	Layer
≤45	≤64
50 - 60	64 - 67
60 - 65	> 67
≤65	Assessment Area
	Buildings not assessed

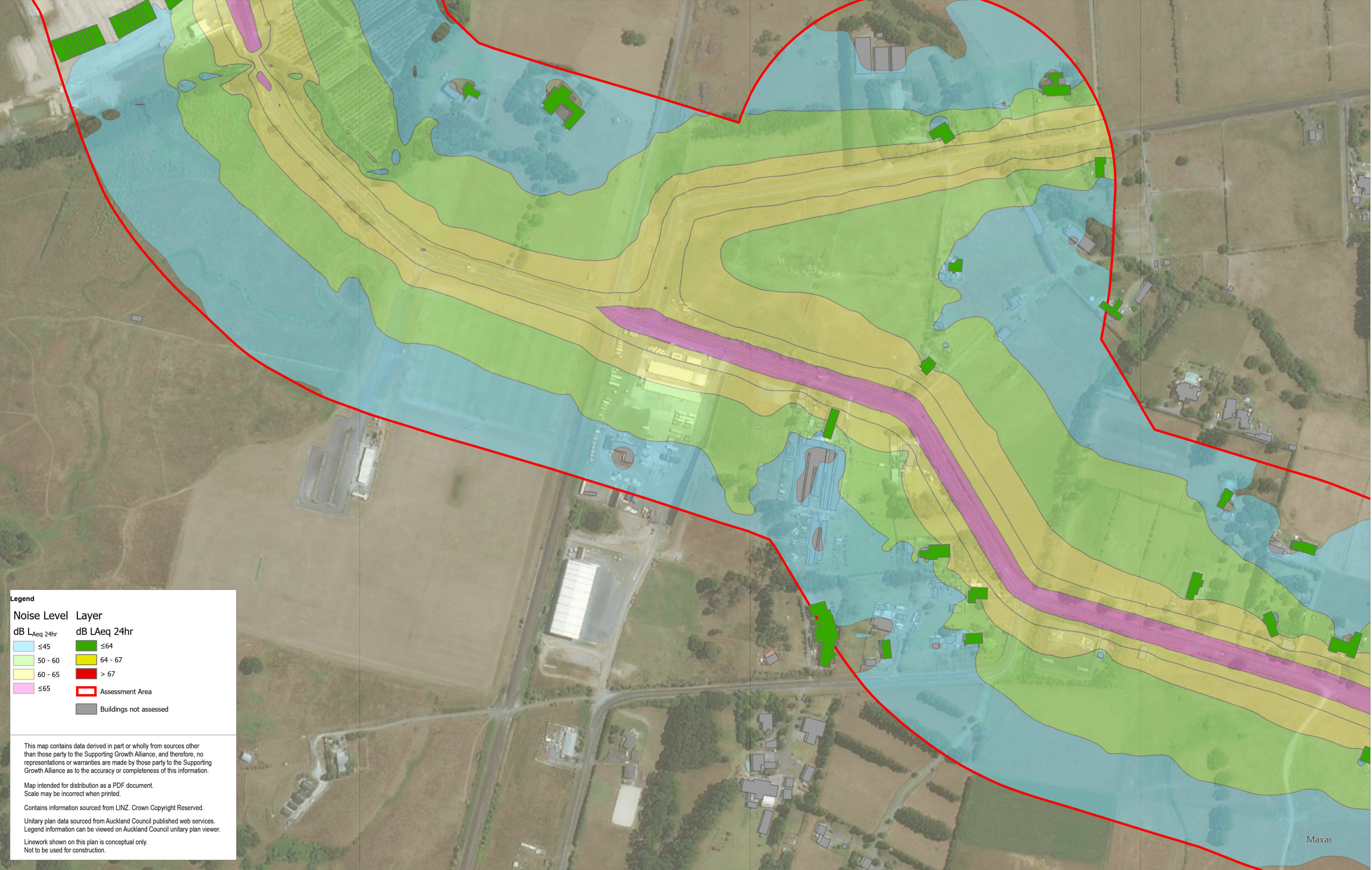
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Legend

Noise Level

dB L_{Aeq} 24hr

≤45

50 - 60

60 - 65

≤65

Layer

dB LAeq 24hr

≤64

64 - 67

> 67

Assessment Area

Buildings not assessed

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Legend

Noise Level	Layer
dB LAeq 24hr	dB LAeq 24hr
≤45	≤64
50 - 60	64 - 67
60 - 65	> 67
≤65	Assessment Area
	Buildings not assessed

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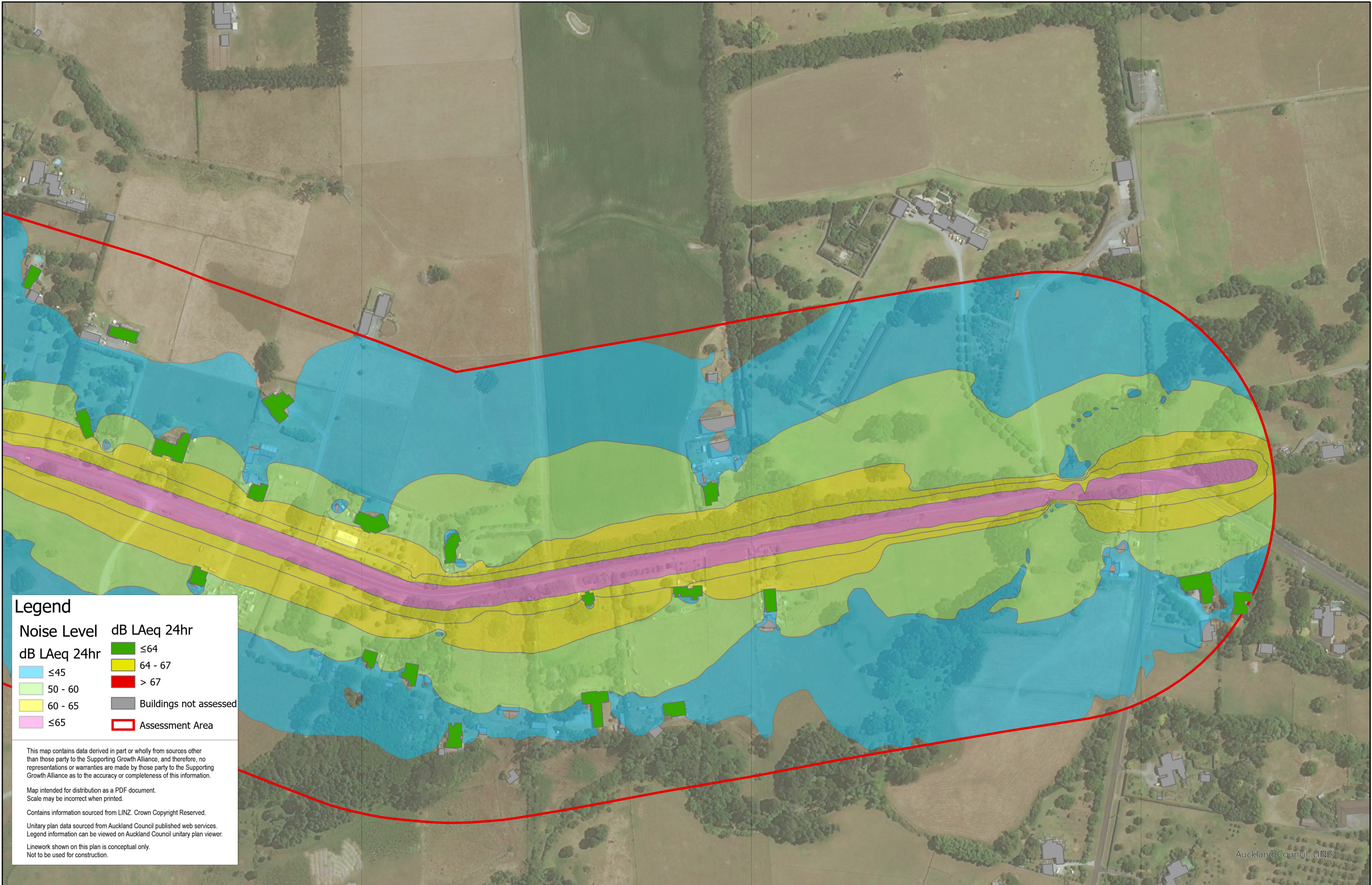
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Auckland Council LINZ





Legend

Noise Level

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

dB LAeq 24hr

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

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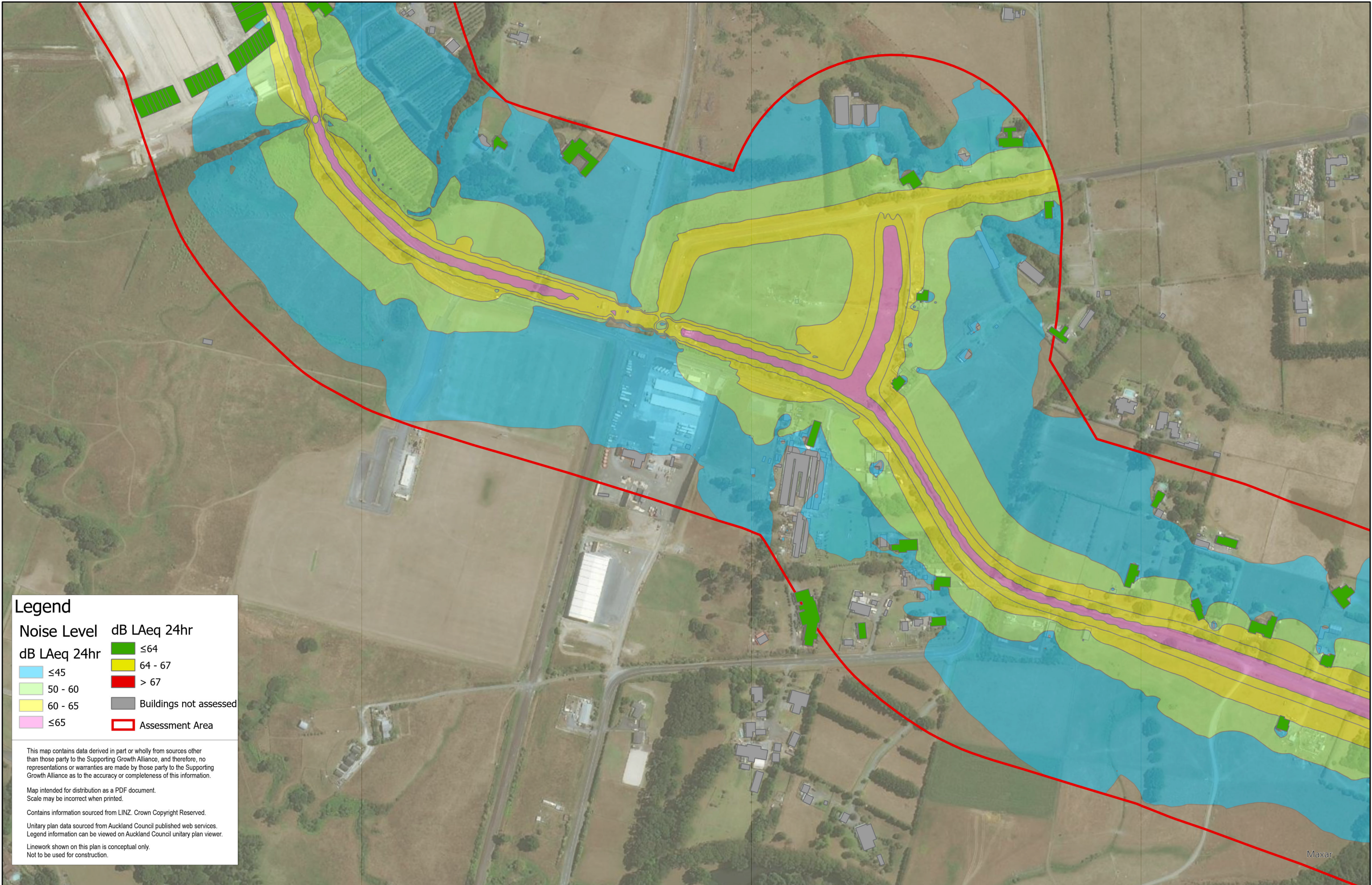
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Legend

Noise Level dB LAeq 24hr

≤45	≤64
50 - 60	64 - 67
60 - 65	> 67
≤65	Buildings not assessed
	Assessment Area

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Legend

Noise Level

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

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Legend

Noise Level dB LAeq 24hr

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

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Map Scale @ A3:



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

Title:

Supporting Growth

NoR D5 - Do Minimum Road Traffic Noise

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

Client:

Supporting Growth

Project:

Drury Package



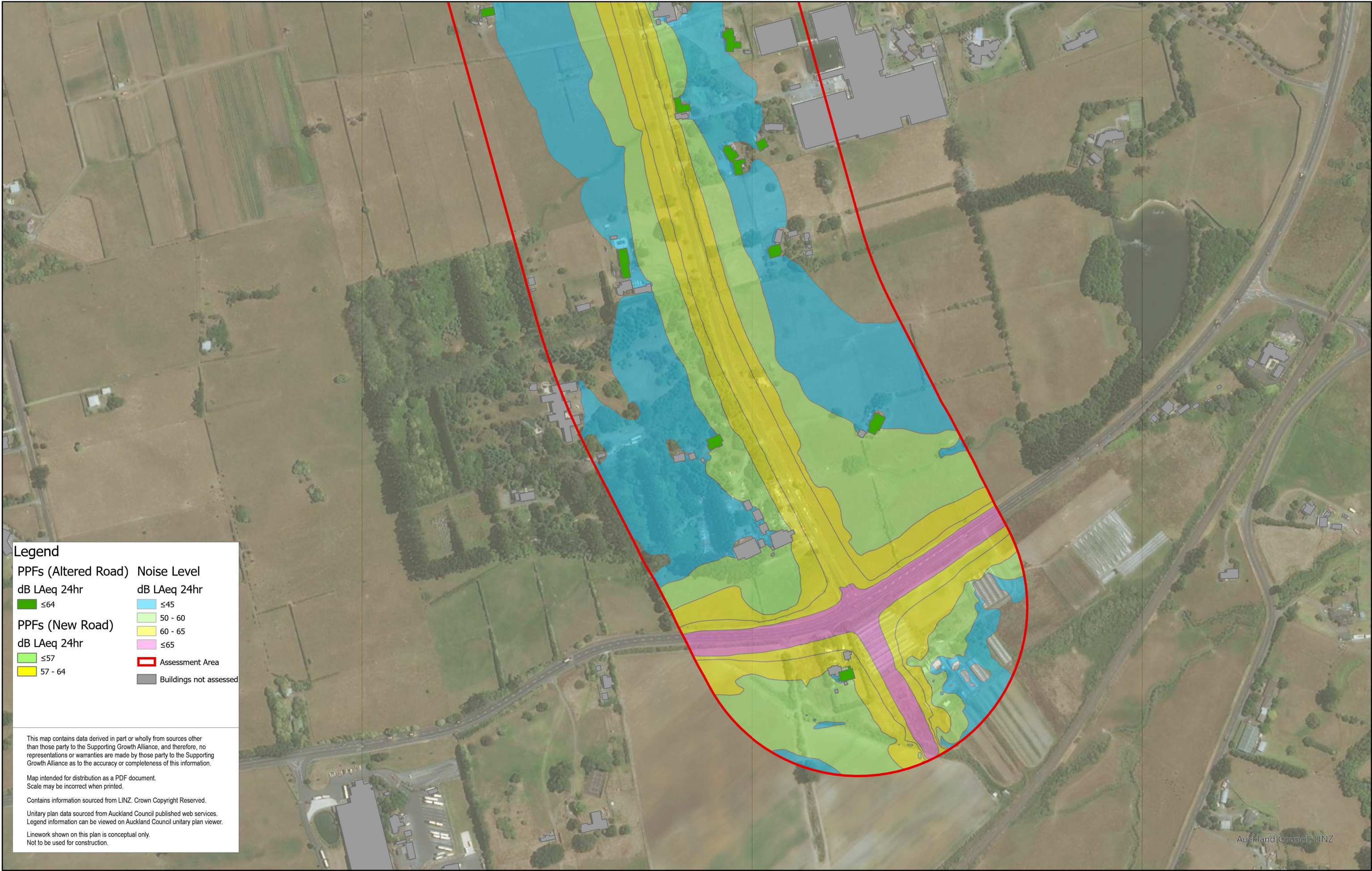
Discipline:

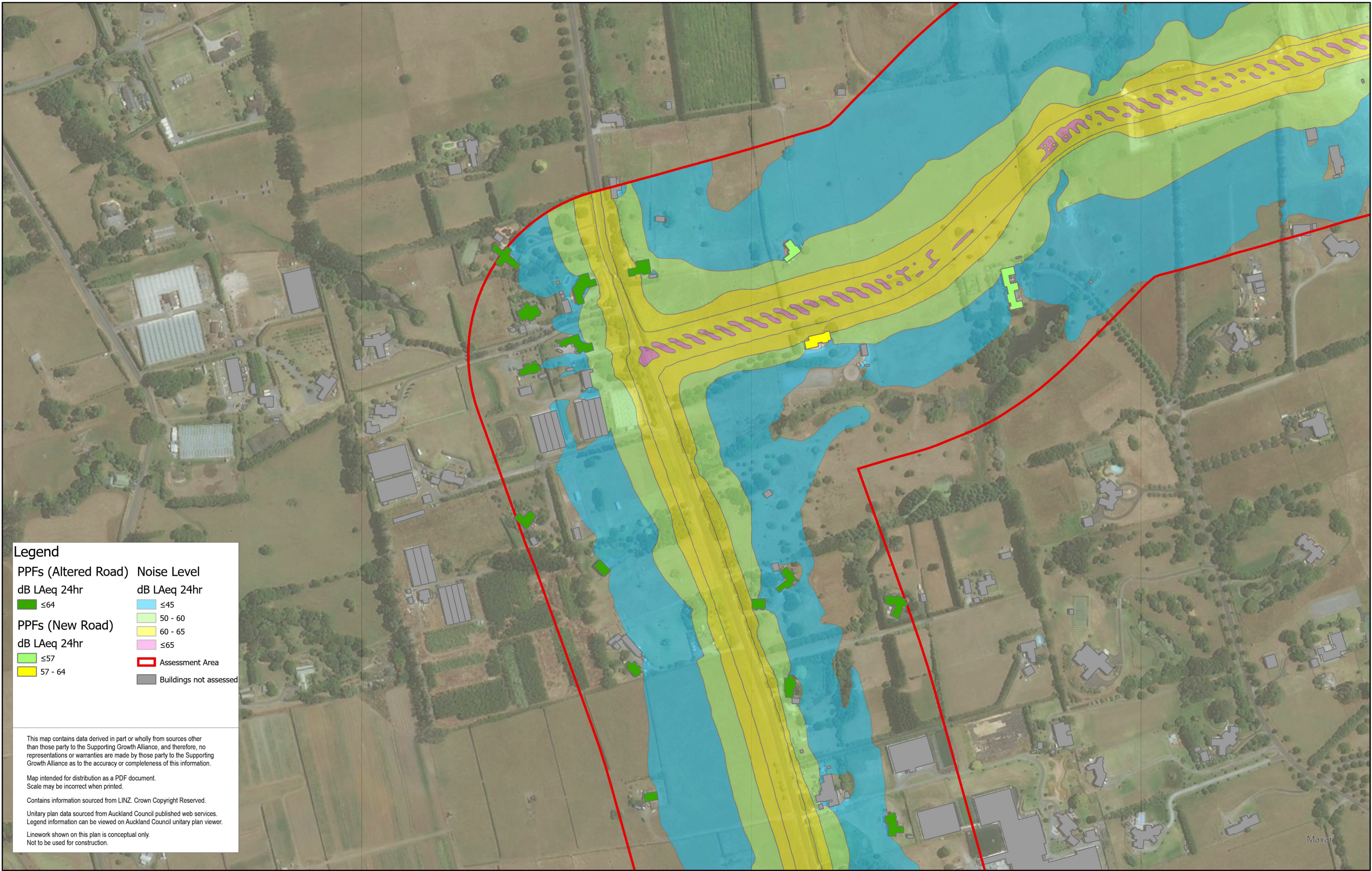
GIS

Drawing No:

SGA-XX-XX- 151

Appendix 5. Mitigation Options Maps





Legend

PPFs (Altered Road)

dB LAeq 24hr

≤64

PPFs (New Road)

dB LAeq 24hr

≤57

57 - 64

Noise Level

dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

Assessment Area

Buildings not assessed

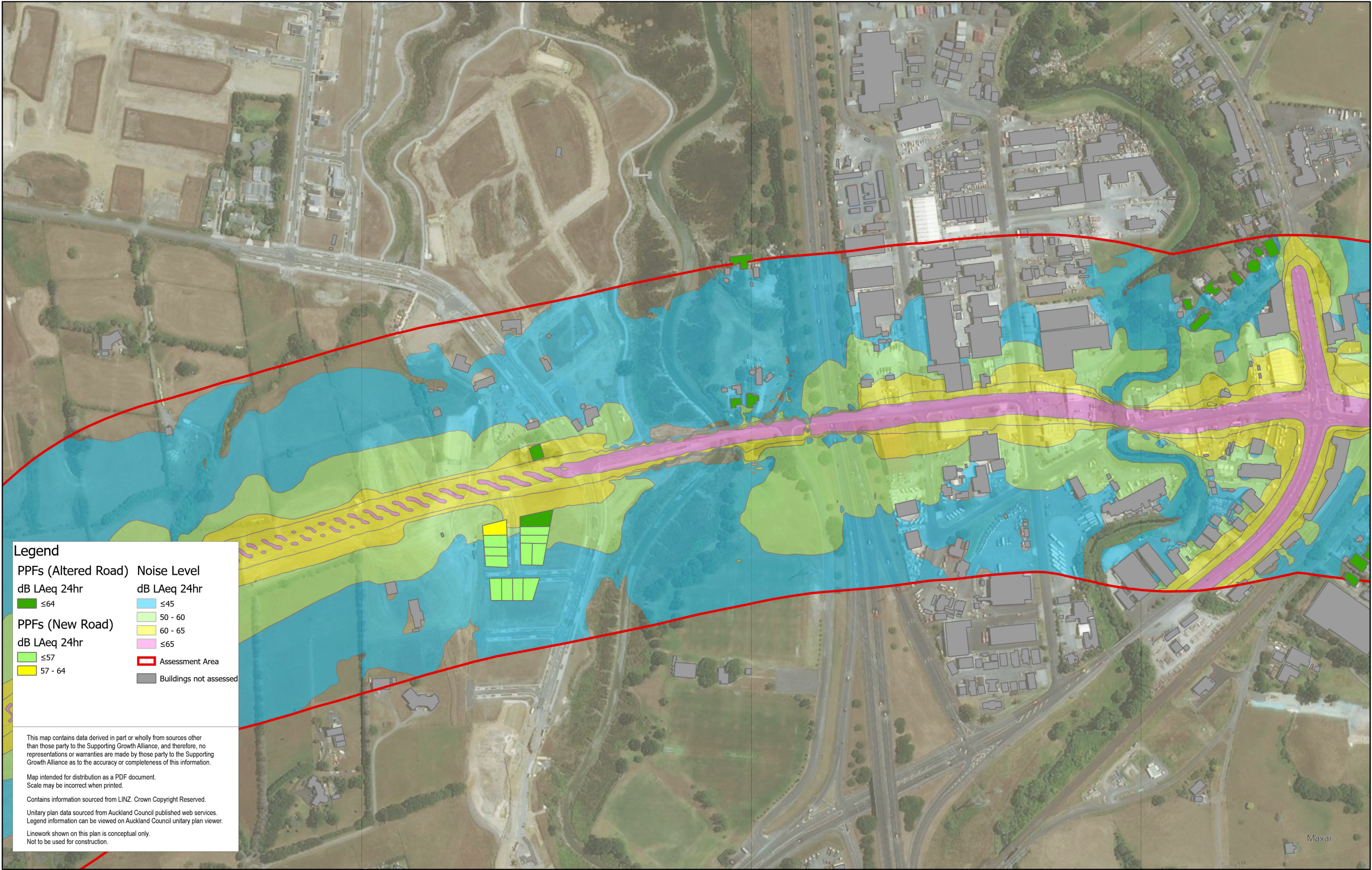
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Legend

PPFs (Altered Road) Noise Level
dB LAeq 24hr

PPFs (New Road) Noise Level
dB LAeq 24hr

Noise Level
dB LAeq 24hr

Assessment Area

Buildings not assessed

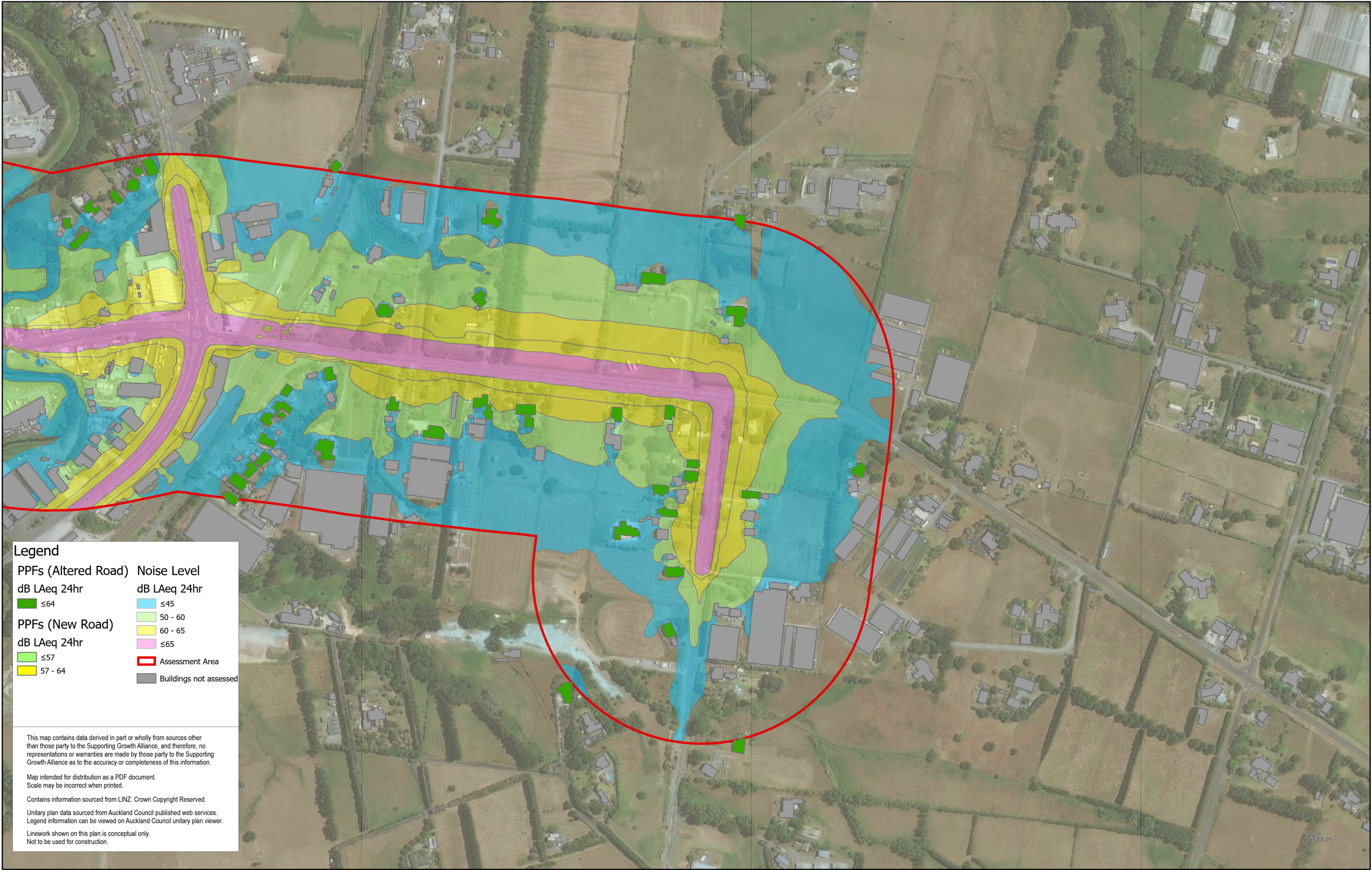
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Legend

PPFs (Altered Road) Noise Level
dB LAeq 24hr

PPFs (New Road) Noise Level
dB LAeq 24hr

≤64
≤57
50 - 60
60 - 65
≤65

Assessment Area
Buildings not assessed

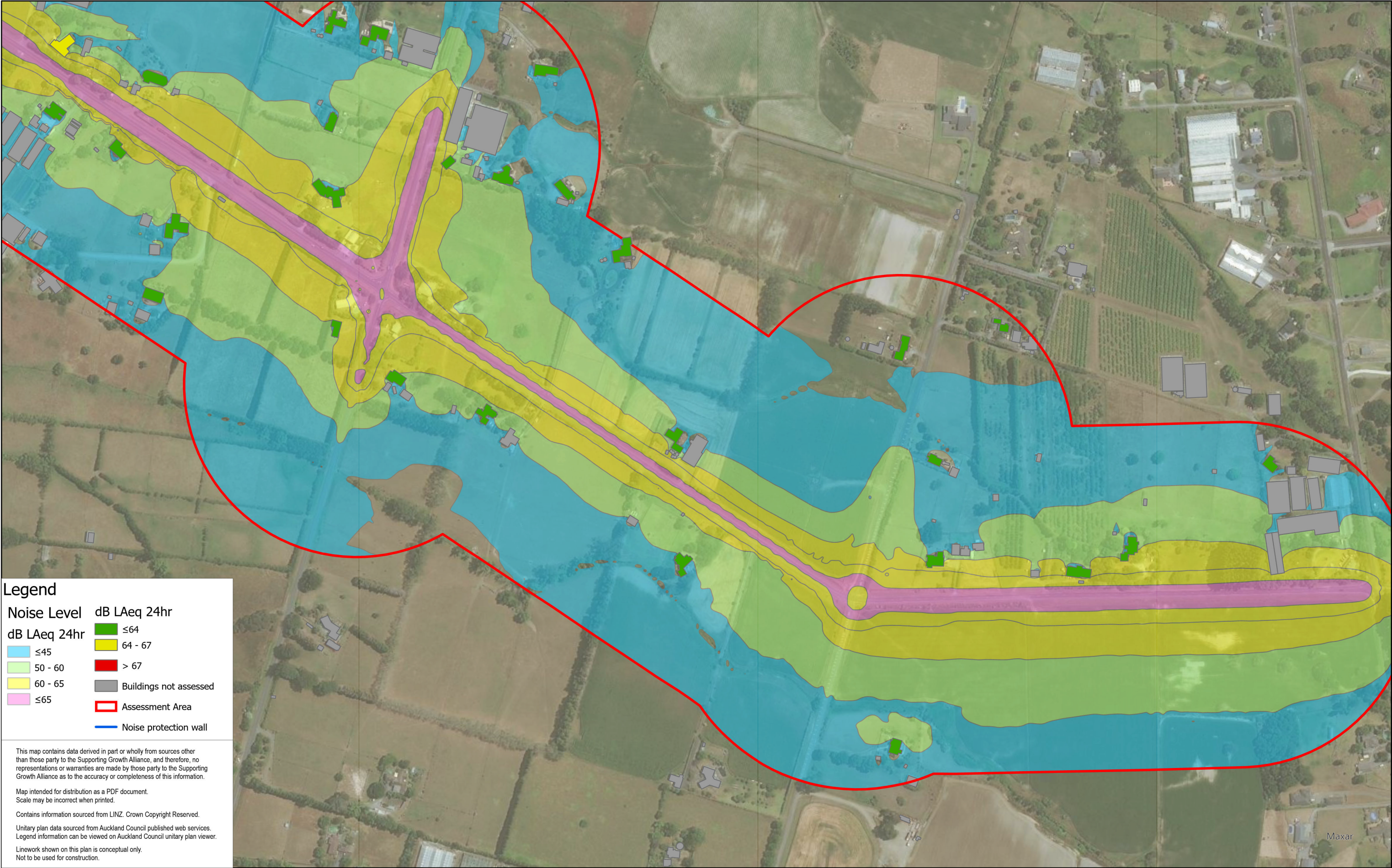
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.

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Legend

Noise Level dB LAeq 24hr

dB LAeq 24hr

- ≤45
- 50 - 60
- 60 - 65
- ≤65

dB LAeq 24hr

- ≤64
- 64 - 67
- > 67

Buildings not assessed

Assessment Area

Noise protection wall

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Map Scale @ A3:

0 0.03 0.06 0.12

Kilometres

N

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

Supporting Growth

NoR D3 - Future Mitigated Road Traffic Noise

Working Plans of Te Tupu Ngatahi.

For the purpose of INTERNAL workshops (not for wider distribution)

Client: **Supporting Growth**

Project: **Drury Package**

Discipline: **GIS**

Drawing No: **SGA-XX-XX- 205**



Legend

Noise Level	dB LAeq 24hr
≤45	≤64
50 - 60	64 - 67
60 - 65	> 67
≤65	Buildings not assessed
	Assessment Area
	Noise protection wall

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Legend

PPFs New Road

dB LAeq 24hr

≤57

57 - 64

> 64

PPFs Altered Road

dB LAeq 24hr

≤64

64 - 67

> 67

Noise Level, dB LAeq

≤45

50 - 60

60 - 65

≤65

Buildings not assessed

Assessment Area

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Auckland Council, LINZ

Map Scale @ A3:

0

0.03

0.06

0.12

Kilometres

N

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

Title:

Supporting Growth

NoR D4 - Mitigation 1 Road Traffic Noise

Working Plans of Te Tupu Ngatahi.

For the purpose of INTERNAL workshops (not for wider distribution)

Client:

Supporting Growth

Project:

Drury Package

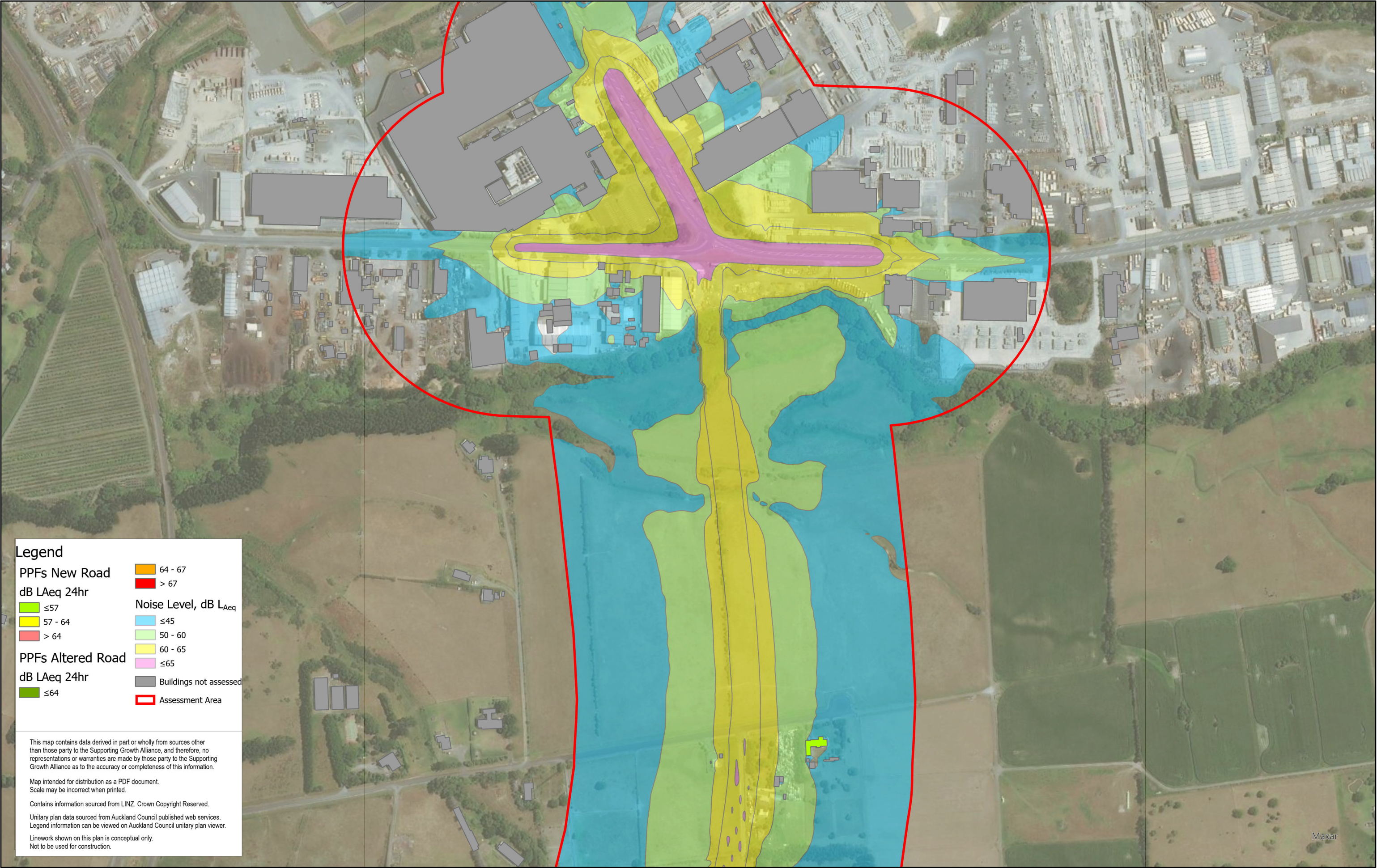
 **TE TUPU NGĀTAHI**
Supporting Growth

Discipline:

GIS

Drawing No:

SGA-XX-XX- 207



Legend

PPFs New Road

dB LAeq 24hr

≤57

57 - 64

> 64

64 - 67

> 67

PPFs Altered Road

dB LAeq 24hr

≤64

Noise Level, dB LAeq

≤45

50 - 60

60 - 65

≤65

Buildings not assessed

Assessment Area

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Legend

PPFs New Road

dB LAeq 24hr

≤57

57 - 64

> 64

PPFs Altered Road

dB LAeq 24hr

≤64

64 - 67

> 67

Noise Level, dB LAeq

≤45

50 - 60

60 - 65

≤65

Buildings not assessed

Assessment Area

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Legend

PPFs New Road

dB LAeq 24hr

≤57

57 - 64

> 64

PPFs Altered Road

dB LAeq 24hr

≤64

64 - 67

> 67

Noise Level, dB LAeq

≤45

50 - 60

60 - 65

≤65

Buildings not assessed

Assessment Area

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Legend

PPFs New Road
dB LAeq 24hr

≤57

57 - 64

> 64

PPFs Altered Road
dB LAeq 24hr

≤64

64 - 67

> 67

Noise Level
dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

Noise Walls

Buildings not assessed

Assessment Area

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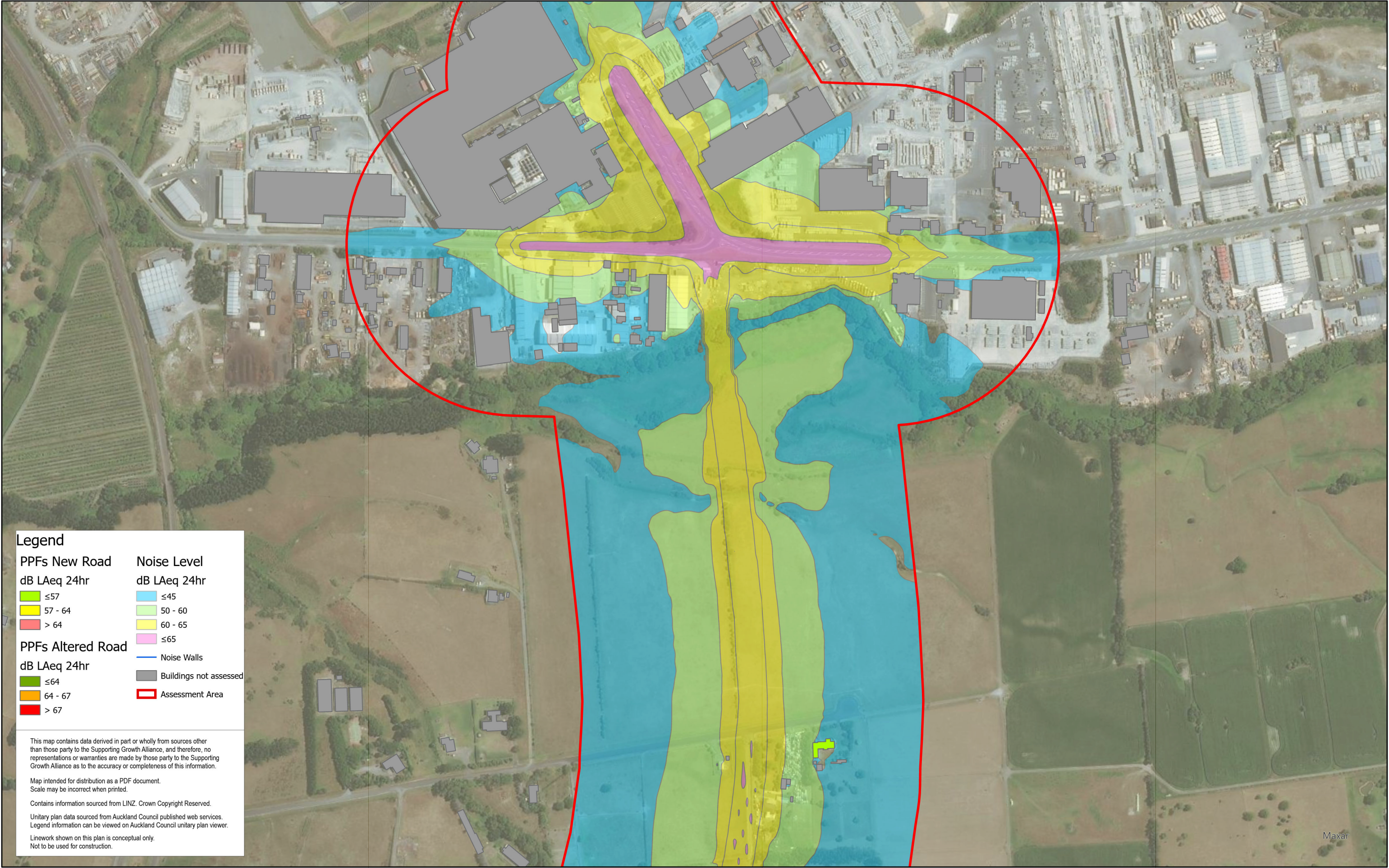
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Legend

PPFs New Road
dB LAeq 24hr

- ≤57
- 57 - 64
- > 64

PPFs Altered Road
dB LAeq 24hr

- ≤64
- 64 - 67
- > 67

Noise Level
dB LAeq 24hr

- ≤45
- 50 - 60
- 60 - 65
- ≤65

— Noise Walls

■ Buildings not assessed

▭ Assessment Area

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Legend

PPFs New Road
dB LAeq 24hr

- ≤57
- 57 - 64
- > 64

PPFs Altered Road
dB LAeq 24hr

- ≤64
- 64 - 67
- > 67

Noise Level
dB LAeq 24hr

- ≤45
- 50 - 60
- 60 - 65
- ≤65

— Noise Walls

▭ Buildings not assessed

▭ Assessment Area

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Legend

PPFs New Road
dB LAeq 24hr

≤57

57 - 64

> 64

PPFs Altered Road
dB LAeq 24hr

≤64

64 - 67

> 67

Noise Level
dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

Noise Walls

Buildings not assessed

Assessment Area

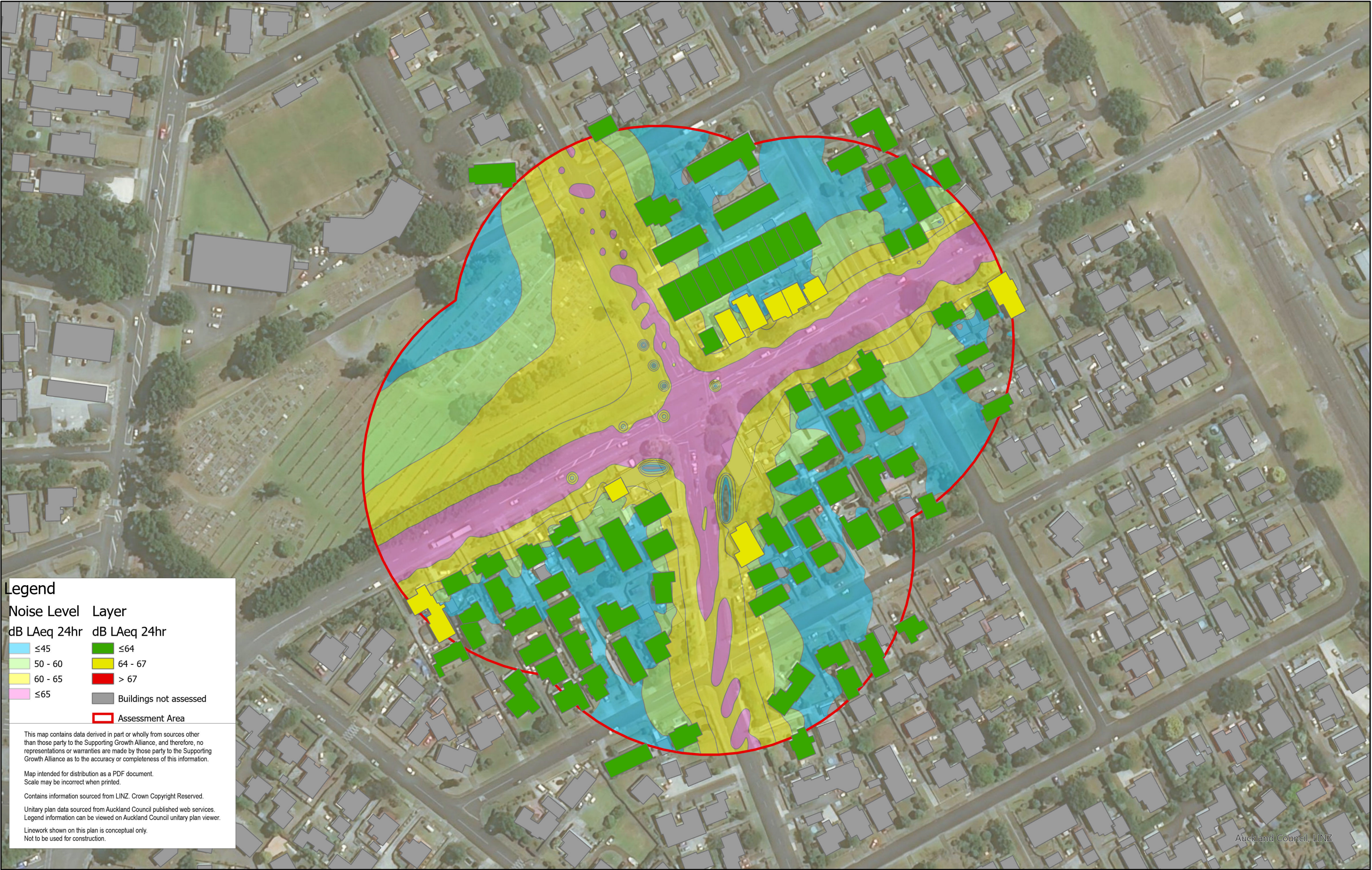
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Legend

Noise Level
dB LAeq 24hr

Layer
dB LAeq 24hr

≤45

50 - 60

60 - 65

≤65

≤64

64 - 67

> 67

Buildings not assessed

Assessment Area

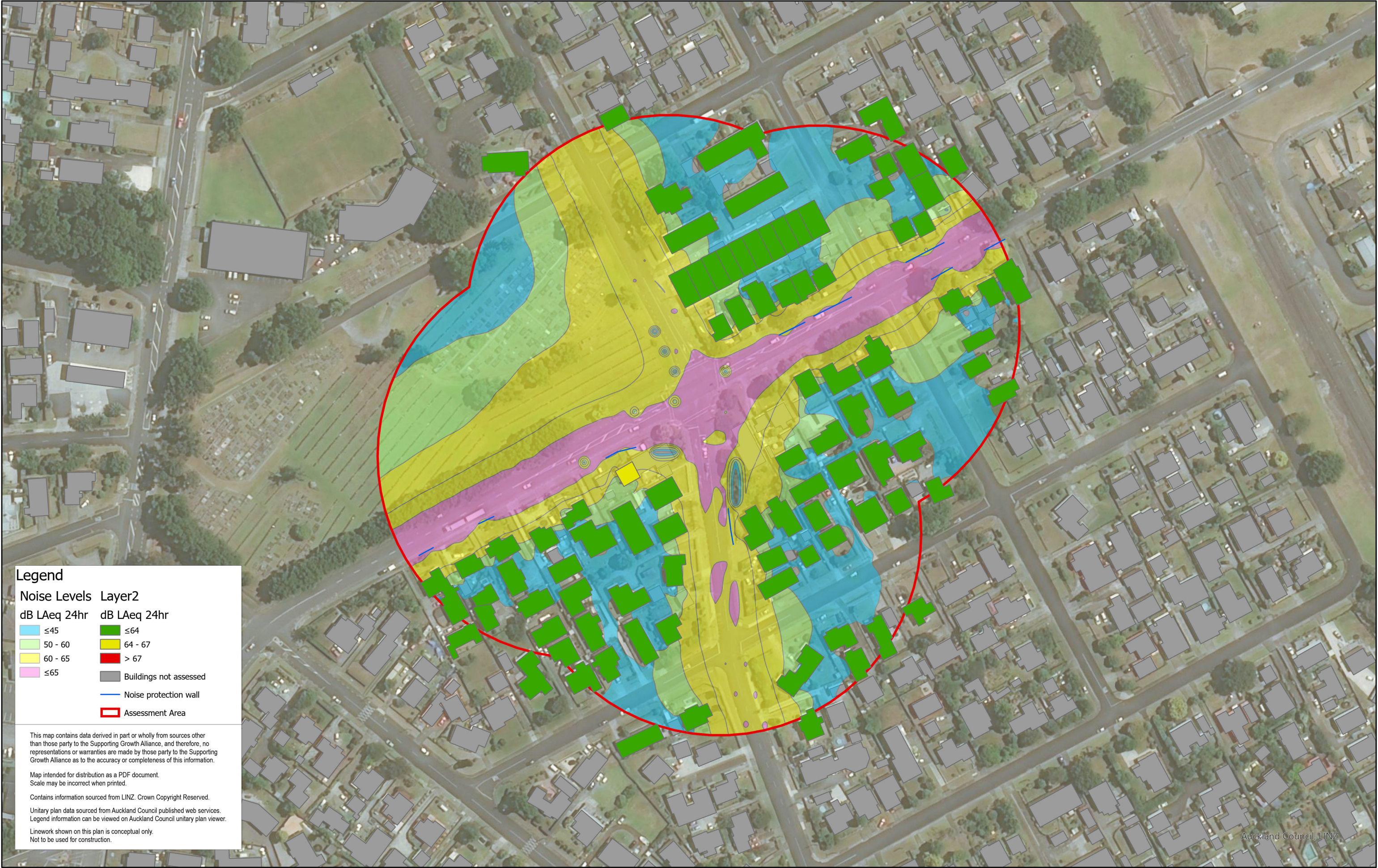
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Legend

Noise Levels **Layer2**

dB LAeq 24hr **dB LAeq 24hr**

≤45	≤64
50 - 60	64 - 67
60 - 65	> 67
≤65	

Buildings not assessed

Noise protection wall

Assessment Area

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