TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Pukekohe Transport Network
# Assessment of Operational Noise Effects

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WAKA KOTAHI
NZ TRANSPORT AGENCY

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## Document Status

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# Glossary of Defined Terms and Acronyms

| Acronym/Term | Description |
|---|---|
| **AC14** | Asphaltic concrete |
| **AEE** | Assessment of Effects on the Environment report |
| **AT** | Auckland Transport |
| **AUP:OP** | Auckland Unitary Plan: Operative in Part |
| **A-weighting** | A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds.<br>Sound levels using an "A" frequency weighting are expressed as dB $L_A$. Alternative ways of expressing A-weighted decibels are dBA or dB(A). |
| **BPO** | Best Practicable Option as defined in Section 2 of the Resource Management Act 1991 |
| **dB** | Decibel. The unit of sound level. |
| **FUZ** | Future Urban Zone |
| **$L_{A90}$** | The A-weighted sound level exceeded for 90 % of the measurement period, measured in dB. Commonly referred to as the background noise level. |
| **$L_{Aeq}$** | The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB. |
| **$L_{Aeq(24h)}$** | The $L_{Aeq}$ sound level averaged over a 24-hour period from midnight to midnight. |
| **$L_{Amax}$** | The A-weighted maximum sound level. The highest sound level which occurs during the measurement period. Usually measured with a fast time–weighting i.e. $L_{AFmax}$ |
| **MDRS** | Medium Density Residential Standards |
| **N/A** | Not Applicable |
| **NIMT** | North Island Main Trunk |
| **NPS:UD** | National Policy Statement on Urban Development |
| **Noise** | A subjective term used to describe sound that is unwanted by, or distracting to, the receiver. |
| **NoR** | Notice of Requirement |
| **NZS 6801** | New Zealand Standard NZS 6801:2008 *Acoustics – Measurement of environmental sound* |
| **NZS 6802** | New Zealand Standard NZS 6802:2008 *Acoustics - Environmental Noise* |
| **NZS 6806** | New Zealand Standard NZS 6806:2010 *Acoustics - Road-traffic noise - New and altered roads* |
| **PA10** | Open graded porous asphalt |
| **PPF** | Protected Premises and Facilities |

| Acronym/Term | Description |
|---|---|
| **Pukekohe Transport Network** | Comprising the following new or upgraded transport corridors:<br>NoR 1: Drury West Arterial<br>NoR 2: Drury – Pukekohe Link<br>NoR 3: Paerata Connections<br>NoR 4: Pukekohe North- East Arterial<br>NoR 5: Pukekohe South-East Arterial<br>NoR 6: Pukekohe South- West Upgrade<br>NoR 7: Pukekohe North-West Arterial<br>NoR 8 (AC) and (WD): Pukekohe East Road and Mill Road Upgrade |
| **RMA** | Resource Management Act 1991 |
| **SH1** | State Highway 1 |
| **SH22** | State Highway 22 |
| **Te Tupu Ngātahi** | Te Tupu Ngātahi Supporting Growth |
| **Waka Kotahi** | Waka Kotahi New Zealand Transport Agency |

# Executive Summary

***Assessment undertaken***

This report assesses the operational traffic noise from the nine Notices of Requirement (NoRs) for the Pukekohe Transport Network against relevant standards and guidelines. Where necessary, we have investigated and recommended mitigation.

Road traffic noise for any new or altered roads has been assessed against NZS 6806 and other relevant guidance, including the Waka Kotahi "Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects". In addition, we have assessed the change in noise level due to the Projects.

Active mode transport, i.e. walking and cycling, does not generate noise levels high enough to affect the ambient noise environment, particularly where the facilities are adjacent to busy roads, and has therefore not been assessed in this report.

The Projects will result in a redistribution of traffic across the wider area. This has been taken into consideration when assessing the individual Projects.

## NoR 1 – Drury West Arterial

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

Ambient noise levels are likely to increase as the area urbanises, so the changes in noise levels due to the Project may not be as noticeable at the time.

Some Protected Premises and Facilities (PPFs) may not exist anymore at the time of road construction particularly given NoR 1 is within the FUZ signalling future urban development. Therefore, the predicted effects may not be experienced by current residents.

The PPFs near NoR 1 have been assessed against the Altered roads criteria in accordance with NZS 6806. All PPFs are predicted to achieve Category A noise levels under the Do-minimum scenario.

With other roads in the vicinity (including other NoRs of the Pukekohe Transport Network) noise levels are predicted to remain similar or reduce at the majority of PPFs.

***Conclusion***

The operational noise effects of NoR 1 are predicted to have no material effect on PPFs in its vicinity and no mitigation is required.

## NoR 2 – Drury-Pukekohe Link

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

NoR 2 provides for a new state highway. The Project will have a significant effect on the environment as it consists new and upgraded roads in an area currently relatively unaffected by traffic noise. However, the North Island Main Trunk (NIMT) has an effect on the ambient noise level. Some of the neighbouring sites are within the Future Urban Zone (FUZ) which will be developed in the future. The urban growth will result in a significant increase in noise level as traffic flows will utilise NoR 2 as well as the connecting projects in the Pukekohe Transport Network.

The Project involves both New and Altered roads. Low noise road surface is already part of the base design of the road. Mitigation options in the form of barriers have been tested. Prior to construction, the BPO mitigation beyond the use of low noise road surface will be determined to achieve the noise criteria categories at PPFs as set out in the conditions. While the vast majority of PPFs are predicted to receive noise levels in Category A (47 of the total 61), 14 PPFs are still predicted to receive noise levels in Category B.

***Conclusion***

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a significant character change of the area.

The BPO mitigation will be determined at the time of detailed design. However, with the use of low noise road surface as required by the conditions, overall noise levels can be controlled to be within a reasonable range.

## NoR 3 – Paerata Connections

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

The two PPFs in NoR 3 have been assessed against the New road criteria under NZS 6806. Both PPFs are predicted to receive noise levels in Category A in the Do-minimum scenario and no mitigation is required.

With other roads nearby (including other NoRs of the Pukekohe Transport Network) noise levels are predicted to increase by 5-6 dB.

***Conclusion***

No mitigation is required for NoR 3. The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a character change of the area.

## NoR 4 – Pukekohe North-East Arterial

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

PPFs near NoR 4 have been assessed against the New and Altered roads criteria under NZS 6806. The altered roads section does not meet the definition of an Altered Road under NZS 6806; therefore mitigation does not need to be considered further under the Standard. All PPFs in the New section of road meet the Category A noise criterion, therefore mitigation does not need to be considered further for the New Road section under the standard.

With other roads in the vicinity (including other NoRs of the Pukekohe Transport Network) noise levels are predicted to remain similar or reduce at almost all PPFs.

***Conclusion***

NoR 4 is predicted to have no material effect on PPFs in its vicinity and no mitigation is required.

## NoR 5 – Pukekohe South-East Arterial

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

PPFs near NoR 5 have been assessed against the New and Altered roads criteria under NZS 6806. The altered road section does not meet the definition of an Altered Road under NZS 6806, therefore mitigation does not need to be considered further under the Standard. All PPFs in the New roads section of NoR 5 meet the Category A noise criterion, therefore mitigation does not need to be considered further under the standard.

With other roads in the vicinity (including other NoRs of the Pukekohe Transport Network) noise levels are predicted to remain similar or reduce at almost all PPFs.

***Conclusion***

NoR 5 is predicted to have no material effect on PPFs in its vicinity and no mitigation is required.

## NoR 6 – Pukekohe South-West Upgrade

The areas proposed to be designated by NoR 6 are for an active mode upgrade of existing roads in an existing urban area. Active mode transport, i.e. walking and cycling, does not generate noise levels high enough to affect the ambient noise environment, particularly where the facilities are adjacent to busy roads. NoR 6 is not predicted to bring about any changes to traffic noise generated on or near the sections of roads that are proposed to be designated, therefore, traffic noise has not been assessed for this NoR.

## NoR 7 – Pukekohe North-West Arterial

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

PPFs near NoR 7 have been assessed against the New and Altered roads criteria under NZS 6806. The altered roads section does not meet the definition of an Altered Road under NZS 6806, therefore mitigation does not need to be considered further under the Standard. All PPFs in the New section of road meet the Category A noise criterion, therefore mitigation does not need to be considered further for the New road section under the standard.

With other roads in the vicinity (including other NoRs of the Pukekohe Transport Network), noise levels are predicted to remain similar or increase slightly for some PPFs for Altered roads, and to increase for all PPFs for New roads.

***Conclusion***

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a character change of the area. No mitigation is required.

## NoR 8 (AC) and NoR 8 (WDC) - Mill Road and Pukekohe East Road Upgrades

NoR 8 - Mill Road and Pukekohe East Road Upgrade includes works within Auckland Council and Waikato District Council and is referred to as one transport project, despite being submitted as two separate NoRs.

The upgrade of active mode transport, i.e. walking and cycling (a shared path) on Pukekohe East Road will not generate noise levels high enough to affect the ambient noise environment, particularly as the facilities are adjacent to a busy road. Therefore, this section of NoR 8 has not been assessed in this report.

***Results of assessment and recommended measures – Mill Road***

The proposed upgrade to Mill Road will have a limited effect on the environment. The existing road is a relatively busy road in a rural environment that controls the existing noise environment. The road runs along the boundary between Auckland and the Waikato District, with the widening proposed towards the south, generally into Waikato District.

The Project is an Altered Road. The upgrade in road surface for the widened road results in an improvement in noise environment for existing PPFs, with most PPFs receiving noise levels in Category A. Additional mitigation was tested in the form of barriers for four individual houses, reducing noise levels all PPFs to be within Category A and (for two PPFs) Category B. Prior to construction, the BPO mitigation will be determined to achieve the noise criteria categories at all PPFs as set out in the conditions.

The Project with mitigation is predicted to generally cause no change to the environment, and for four PPFs, result in a perceptible to noticeable noise level reduction.

***Conclusion***

The proposed Mill Road upgrade is predicted to have a slight positive effect on some PPFs, with the majority not receiving any change in noise level. The proposed upgraded road surface will provide sufficient noise level reduction to counteract the increase in traffic volume in the future. Mitigation in the form of barriers at four houses, where effective, will further reduce noise levels.

# 1 Introduction

This operational noise assessment has been prepared for the Pukekohe Transport Network Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors to enable the future construction, operation and maintenance of transport infrastructure in Pukekohe, Auckland. The Pukekohe Transport Network is summarised in section 2.

This report addresses the operational (traffic) noise effects of the Pukekohe Transport Network identified in section 2.

Refer to the main Assessment of Effects on the Environment (AEE) for a more detailed project description.

## 1.1 Purpose and Scope of this Report

This operational noise assessment forms part of the suite of technical reports prepared to support the AEE for the Pukekohe Transport Network. Its purpose is to inform the AEE that accompanies the Pukekohe Transport Network NoRs for AT and Waka Kotahi.

This report considers the actual and potential effects associated with the operation of the Pukekohe Transport Network on the existing and likely future environment as it relates to operational noise effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

1. Identify and describe the ambient noise environment of the Pukekohe Transport Network area;
2. Identify and describe the actual and potential traffic noise effects of each Project corridor within the Pukekohe Transport Network;
3. Recommend measures as appropriate to avoid, remedy or mitigate actual and potential traffic noise effects (including any conditions/management plan required) for each Project corridor within the Pukekohe Transport Network; and
4. Present an overall conclusion of the level of actual and potential traffic noise effects for each Project corridor within the Pukekohe Transport Network after recommended measures are implemented.

## 1.2 Report Structure

The report is structured as follows:

- Project overview with a summary of the Pukekohe Transport Network Projects in section 2;
- Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines in section 3;
- The assessment methodology used to determine the traffic noise effects and implement mitigation measures for the Projects in section 4;
- Identification and description of the existing and likely future noise environment in section 5;

- Description of the actual and potential traffic noise effects of the Project, including recommended measures to avoid or mitigate those potential adverse effects, in section 6;
- Overall conclusion of the level of potential adverse traffic noise effects of the Project after recommended measures are implemented in section 7.

Description of the actual and potential construction noise and vibration effects of the Projects are contained in the Construction Noise and Vibration Assessment Report.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Pukekohe Transport Network as a whole and each NoR. These have been reviewed by the authors of this report and have been considered as part of this assessment of traffic noise effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

# 2 Pukekohe Transport Network Overview

The Pukekohe Project comprises nine NoRs through Pukekohe, Paerata and Drury. A concept design has been undertaken for the NoRs. The design will be further refined through future phases of the Project and will be undertaken within the scope of the designation conditions and future resource consent conditions. The detailed design of the Project will be undertaken prior to construction and reflected in the Outline Plan(s) which will be submitted to Council as set out in s176A of the RMA.

The Pukekohe Transport Network encompasses eight transport projects for the Pukekohe, Paerata and Drury West areas. Auckland Transport has lodged six Notices of Requirement with Auckland Council and Waka Kotahi has lodged two Notices of Requirement with Auckland Council and one with Waikato District Council. The Pukekohe Transport Network includes provision for improved walking and cycling, public transport, and general traffic connections.

For the purposes of this assessment, Mill Road and Pukekohe East Road Upgrade (that includes works within Auckland Council and Waikato District Council) is referred to as one transport project, despite being submitted as two separate NoRs. The matters relevant to each jurisdictional area are addressed through this assessment.

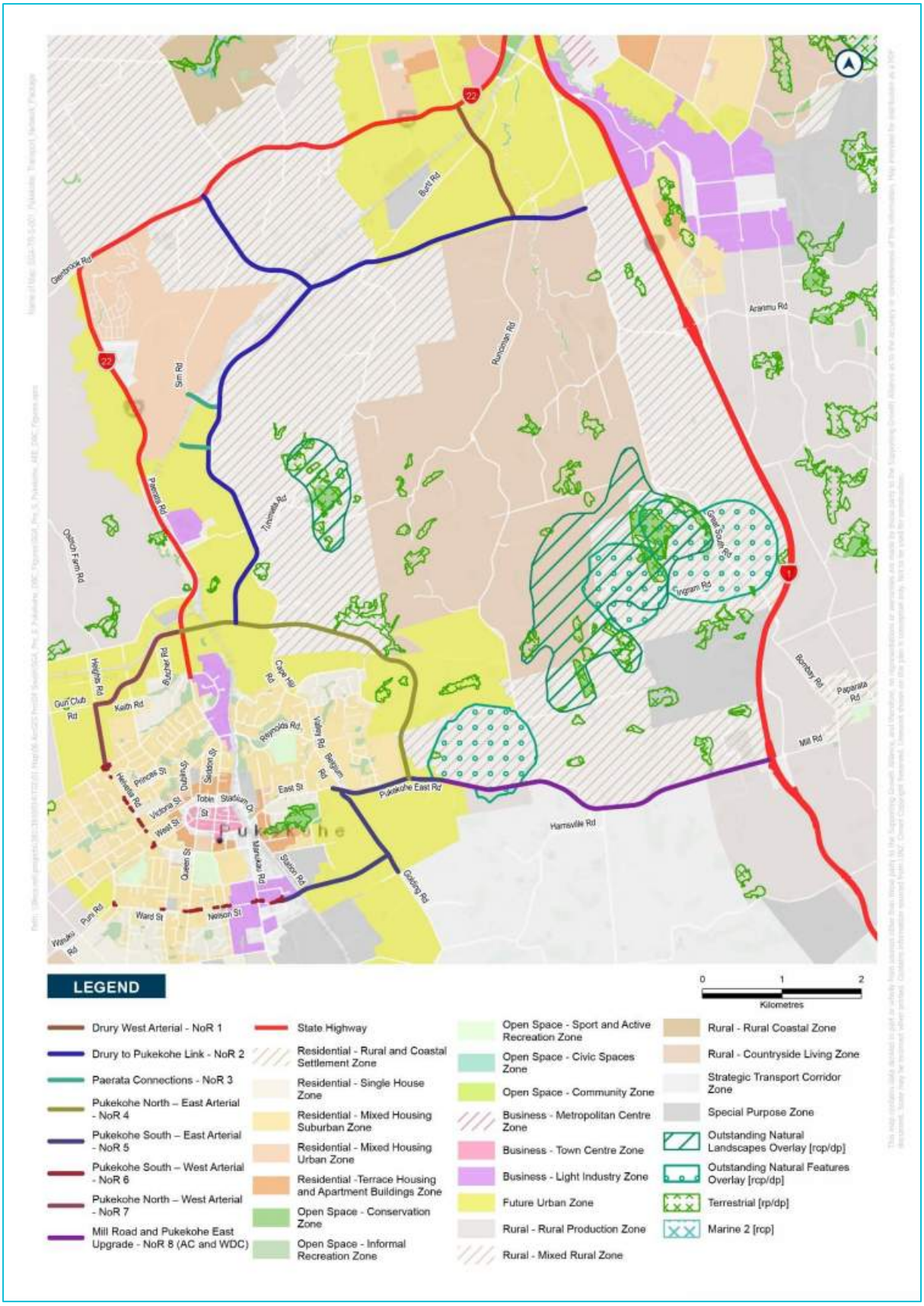


**Figure 2-1: Pukekohe Transport Network**

**Table 2-1 Pukekohe Package Project Summary**

| NoR | Project | Requiring Authority | Description |
|---|---|---|---|
| 1 | **Drury West Arterial** | AT | • NoR 1 is a 1.6km new transport corridor extending south from the intersection of SH22 and Jesmond Road to the proposed Drury to Pukekohe Link (NoR 2).<br>• It connects Drury West Town Centre, Drury West Rail Station and provides access to the strategic transport network including SH1 and SH22. It connects with Burtt Road and to Runciman Road in the south.<br>• This new transport corridor improves local connectivity in Drury West and the wider area to centres, employment and rail stations.<br>• Between SH22 and Burtt Road, the proposed cross section is a four lane arterial 30m wide. This includes two lanes for PT and walking and cycling facilities on both sides of the corridor.<br>• South of Burtt Road a two lane arterial with a 24m wide cross section is proposed with two lanes for general traffic and walking and cycling facilities on both sides of the corridor.<br>• Three new bridges are proposed over existing NIMT rail line, and two tributaries of the Ngakoroa Stream. |
| 2 | **Drury-Pukekohe Link** | Waka Kotahi | NoR 2 provides a north south strategic corridor with two general traffic lanes proposed and active transport facilities on one side of the corridor. The total length of the NoR is 10.6km.<br>NoR 2 is split into the following four segments. |
| | South Drury Connection segment | Waka Kotahi | • South Drury Connection segment provides a new connection extending from Great South Road in the east at the proposed SH1 Drury South Interchange (a proposed Waka Kotahi SH1 project). The alignment is along the edge of the FUZ to Burtt Road in the west.<br>• It provides a strategic connection improving local access in Drury West, provides resilience in the transport network supporting SH22 and SH1, provides direct connectivity to the proposed Drury South Interchange and supports the proposed strategic active modes corridor.<br>• A 24m wide cross section is proposed with two lanes for general traffic, with walking and cycling on one side of the corridor.<br>• Three new bridges are proposed over tributaries of the Ngakoroa Stream. |
| | SH22 Connection segment | Waka Kotahi | • Connecting with the South Drury Connection and Drury-Paerata Link segments, this connection provides a strategic connection between State Highway 1 and State Highway 22. |

| NoR | Project | Requiring Authority | Description |
|---|---|---|---|
| | | | • It improves access between Drury West and Paerata, provides resilience in the transport network supporting SH22 and SH1, provides direct connectivity to the proposed Drury South Interchange and supports the proposed strategic active modes corridor.<br>• It includes new transport corridor and a partial upgrade of Sim Road (north).<br>• A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on one side of the corridor.<br>• Two new bridges are proposed over the Oria Creek and NIMT. |
| | Drury-Paerata Link segment | Waka Kotahi | • Drury-Paerata Link segment is a new corridor connecting the segments of South Drury Connection, SH22 Connection and Paerata Arterial. This segment extends from an intersection with Burtt Road in the north, to the Paerata Arterial segment in the south.<br>• It provides connectivity between Drury and Paerata providing a strategic connection between two areas of future urban development.<br>• A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on one side of the corridor.<br>• Two bridges are proposed over tributaries of the Oira Creek. |
| | Paerata Arterial segment | Waka Kotahi | • Paerata Arterial segment is located along the eastern edge of Paerata FUZ. It connects with Paerata Connections NoR 3 at the northern extent and to the proposed Pukekohe North East Arterial NoR 4 at its southern extent.<br>• It includes an upgrade of part of Sim Road (south), Tuhimata Road and a new section of transport corridor.<br>• It increases connectivity to Paerata FUZ, Paerata Rail Station and Pukekohe Town Centre.<br>• A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on one or both sides of the corridor. No bridges are proposed. |
| 3 | **Paerata Connections** | AT | • The Paerata Connections provide two connections from the existing Sim Road (south) proposed to be upgraded by NoR 2 to the Paerata Rail Station and Paerata Rise development.<br>• The connections provide the primary east-west connections for all modes in Paerata.<br>• NoR 3 has includes two segments:<br>• **Sim to Sim Connection segment** provides a new connection of approximately 400m between the two extents of Sim Road over the railway (NIMT).<br>• **Paerata Rail Station Connection segment** provides a new transport corridor approximately 330m in length between the Paerata Rail Station (KiwiRail designation 6311 currently under construction) and NoR 2. |

| NoR | Project | Requiring Authority | Description |
|---|---|---|---|
| | | | • A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on both sides of the corridor.<br>• One bridge is proposed over the NIMT to connect the two extents of Sim Road for the Sim to Sim Connection segment. |
| 4 | **Pukekohe North-East Arterial** | AT | • The Pukekohe North-East Arterial is an approximately 4km new transport corridor from SH22 in the northwest connecting to Pukekohe East Road in the south east.<br>• It connects the strategic corridors at SH22 (at the northern extent of the Pukekohe North West Arterial NoR 7), the Drury to Pukekohe Link NoR 2 and Pukekohe East Road proposed to be upgraded by NoR 5 and NoR 8.<br>• Its primary function is for general traffic, freight, an active mode links between future neighbourhoods and alleviating traffic on existing roads at Cape Hill Road and Valley Road.<br>• A 24m wide cross section is proposed with 2 lanes for general traffic and walking and cycling proposed on both or one side of the corridor.<br>• Seven bridges are proposed over the Whangapouri Creek, the NIMT, and other unnamed streams and tributaries. |
| 5 | **Pukekohe South-East Arterial** | AT | • The Pukekohe South-East Arterial upgrades part of Pukekohe East Road, Golding Road and provides a new connection between Golding Road (from north of Royal Doulton Drive) and across Station Road and the NIMT to the existing industrial development on Crosbie Road to Svendsen Road.<br>• It is a primary east-west connection to assist in redirecting general traffic and freight away from the Pukekohe town centre to provide additional resilience to the wider network.<br>• A 24m wide cross section is proposed with two lanes for general traffic with walking and cycling on the southern side of the corridor on Pukekohe East Road and on both sides for the remainder of the corridor.<br>• One bridge is proposed crossing Station Road and the NIMT. |
| 6 | **Pukekohe South-West Upgrade** | AT | • Pukekohe South West Upgrade involves the re-allocation of road space within the existing road corridor for a bi-directional cycle way and footpath upgrade. The proposed designation is limited to specific intersections and driveways to safely accommodate active mode facilities. The existing road reserve is to be utilised where possible retaining a 20m wide cross section with 2 lane general traffic, walking on both sides and a bi-directional cycleway on one side of the corridor. |

| NoR | Project | Requiring Authority | Description |
|---|---|---|---|
| 7 | **Pukekohe North-West Arterial** | AT | • Pukekohe North-West Arterial provides a connection between Helvetia Road in the southwest and SH22 in the northeast. It upgrades part of Helvetia Road, utilises part of Keith Road (a paper road), and forms a new connection between Beatty Road and Butcher Road to SH22 – connecting to the Pukekohe North East Arterial NoR 4.<br>• It provides an alternative connection for all modes travelling north to south in west Pukekohe assisting in redirection of general traffic away from the town centre and provides additional resilience to the wider network. A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on both sides of the corridor. |
| 8 (AC)<br>And<br>8 (WDC) | **Mill Road and Pukekohe East Road Upgrade** | Waka Kotahi | • NoR 8 upgrades Mill Road (Bombay) in the east and Pukekohe East Road in the west.<br>• It provides an important strategic connection between Auckland and Waikato and from SH1 to Pukekohe urban areas for traffic and freight, with a major rural active mode connection. Harrisville Road plays a significant role in distributing traffic from further south into Waikato.<br>• Mill Road is proposed to be upgraded to four lanes (2.1 kms) from SH1 in the east to Harrisville Road in the west. It has a 30m wide cross section with four lanes for general traffic, with walking and cycling on the southern side.<br>• Pukekohe East Road is proposed to be upgraded (3.4 kms) for walking and cycling facilities on the southern side from Harrisville Road in the east to NoR 5 in the west. |

# 3 Performance standards

New designations are sought for the Pukekohe Transport Network for all NoRs, two by Waka Kotahi and six by Auckland Transport. We have reviewed a variety of criteria and standards and have recommended the operational performance standards that in our opinion should apply to all Projects irrespective of the requiring authority implementing it.

## 3.1 Noise

### 3.1.1 Guidelines and Standards reviewed

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

- Auckland Unitary Plan Operative in Part (AUP:OP), specifically rule E25.6.33 relating to transport noise and referencing NZ 6806;
- NZS 6806:2010 Acoustics – Road-traffic Noise – New and altered roads;
- Waka Kotahi "Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects" (**Guide**), V1.1, August 2016;
- Proposed Waikato District Plan – Decisions Version; and
- Operative Waikato District Plan.

Neither the Operative (OWDP) nor the Proposed (PWDP) Waikato District Plans contain any rules or criteria in relation to traffic noise. However, the OWDP in Part 9 Transportation, Section 9.2.4 states: *"The plan provides that along nominated National or District Arterial Routes or Collector Roads in rural and coastal areas a 20 metre 'front yard' will apply. This set back will in most cases achieve a distance between moving vehicles and houses which will attenuate noise to within the accepted 75 dBA nuisance threshold for residential activities. Where new roads are proposed, particularly 'arterial' or 'national' routes, the need to address the effects of noise can be built into the design and avoided or mitigated by such works as earth mounding, walls or fencing."*

The PWDP Transportation Rules in Part 2 state in TRPT-R5 "Operation, maintenance and minor upgrading of existing public roads, State Highways and associated road network activities" that matters of discretion relate to: *"(b) adverse operational effects, particularly on residential or other sensitive land uses, including effects of vibration, noise, glare and vehicle emissions"*.

We recommend applying the requirements of NZS 6806.

For all designations, we recommend that the additional information provided in the Guide is applied to these projects. The Guide describes how NZS 6806 should be implemented. While it describes some Waka Kotahi specific processes, such as the use of a Waka Kotahi internal matrix of project discipline feedback when determining the Best Practicable Option (BPO) for noise mitigation, the methodology and process set out in the Guide are considered best practice and should be applied to all Projects that involve new or altered roads. Overall, the Guide provides background on how to implement NZS 6806, and is therefore a useful complimentary document to the Standard.

### 3.1.2 Road traffic noise

Road traffic noise is assessed in accordance with NZS 6806. This Standard has been adopted by Waka Kotahi and is also required by the AUP:OP rule E25.6.33.

We consider the intent of NZS 6806 is to provide a pragmatic approach to the use of noise mitigation. This approach includes the requirement that a roading project needs to have a noticeable noise effect before mitigation is considered, and that any mitigation needs to achieve a noticeable reduction in noise level.

NZS 6806 applies to traffic noise assessments where a project falls within its thresholds. The Standard and its thresholds are briefly explained below.

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

  We note that:

  - Areas earmarked for future residential development are not PPFs as the location and specific type of the receiving buildings are not known. There is a shared responsibility of noise mitigation. The road controlling authority will provide the mitigation that is under its control (low noise road surface and where efficient and appropriate in relation to urban design barriers). Developers moving next to known major transport routes should provide appropriate siting, orientation and insulation of dwellings to take account of the traffic noise levels. To provide information for any future developers, noise level predictions over vacant land have been provided.
  - Businesses are not PPFs as they are not considered noise sensitive and are often noise generators in their own right. This includes any potential future businesses that may be established through a Structure Plan.
- **Assessment Extent** is 100m from the edge of the new carriageway for urban areas and 200m for rural areas, in accordance with NZS 6806. Urban areas are defined by Statistics NZ and are independent from the underlying zoning. Different parts of the projects are in Urban and Rural areas as indicted in Figure 3-1, with the green colour representing the Rural area while the orange and purple colours (showing more intensive settlements) represent Urban areas within the Project. Overall, the majority of NoRs are located in the Rural area, with a 200m assessment extent.

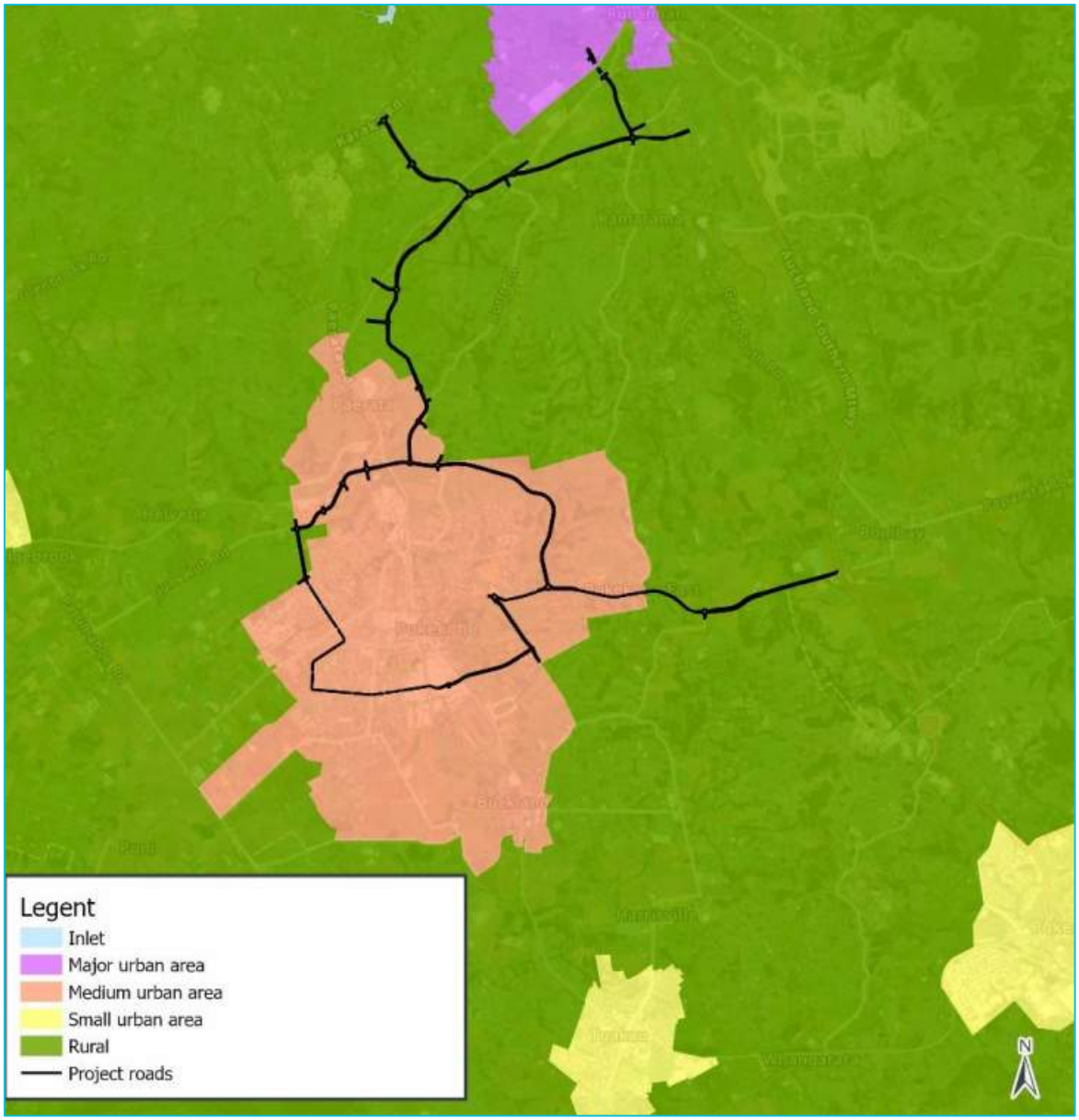


**Figure 3-1: Urban/Rural classification by Statistics NZ**

- **Assessment Areas** are areas which combine PPFs that would benefit from the same mitigation (e.g. barrier). For these Projects, given the potential long implementation period, we have prepared an overview of proposed mitigation for each of the NoRs rather than dividing the areas further.
- **Design Year** is a year 10 to 20 years after opening of the Project. Since there are a number of NoRs assessed, without a defined implementation year, we chose the scenario with the latest traffic data available. The traffic data assumes that the area is developed to its fullest potential. The design year for this scenario is 2048+.
- **Noise Criteria Categories** are set out in the Standard for 'new' and 'altered' roads. The Pukekohe Transport Network includes both new and altered roads, depending on the location of the proposed alignments. Where the New Road Projects listed below intersect with an existing road, all PPFs within 100m of the existing road are assessed against the "Altered Road" criteria. PPFs located beyond this distance but still within 100m of the new road alignment are subject to the "New Road" criteria. The Noise Criteria Categories are set out in Table 3-1 below.

**Table 3-1: Traffic noise criteria categories**

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

The applicable category at any PPF depends on the BPO test, by progressively applying the noise criteria categories to determine which can practicably be achieved. NZS 6806 is clear that preference is to be given to structural mitigation over building modification mitigation. NZS 6806 also requires that the lowest external noise level is achieved with practicable structural mitigation, before considering building modification to mitigate residual internal noise levels.
The above noise criteria categories represent a pragmatic approach to traffic noise, acknowledging that most people affected by traffic noise contribute to it and that there is an interrelatedness of residential use and roads enabling transport to and from the residential developments.

- **Assessment Scenarios** are the various operational scenarios that we assess and compare. The Standard includes the following scenarios:

  - Existing noise environment: consists of the current road layout and traffic volume (for the Pukekohe Transport Network Projects we sourced traffic data to be as current as practical ranging from 2015 to 2021, while excluding data that was significantly affected by Covid restrictions). (Note that a significant change in traffic volume is required to affect a noticeable change in traffic noise – refer Section 3.1.3)
  - Future Do-nothing scenario: This scenario only applies to altered roads, though we also predicted these noise levels for new roads. It consists of the existing roads as for the existing noise environment, with traffic volume at the design year 2048. This scenario assumes that the full development of all surrounding areas has occurred, and traffic volumes have increased because of that development, but that traffic can only use the existing roads.
  - Future Do-minimum scenario: consists of all proposed transport corridors (the Pukekohe Transport Network NoRs) at the design year 2048, **without any specific noise mitigation**. This scenario means that the only barriers included are solid safety barriers, which are required for reasons other than noise mitigation. Where a low noise road surface such as AC14 or PA10 30mm is proposed as the “base” road surface, this is also included in the Do-minimum scenario. Other roads that are not proposed to be altered by the Project (e.g. those crossing or connecting with the Projects) are not included in the assessment.
  - Future Project with mitigation: consists of the proposed Project roads at the design year 2048, and **includes mitigation** that is designed specifically to reduce noise levels.

- **Mitigation Requirements** are set out in the Standard based on the BPO. Mitigation is split into structural (road surface, barriers, bunds) and building modification mitigation (improvement of building façades and ventilation, after the implementation of any structural mitigation, generally only considered for PPFs receiving noise levels within Category C). Any mitigation should achieve a noticeable noise level reduction of an average of 3 decibels within each assessment area or 5 decibels for standalone PPFs.

### 3.1.3 Subjective perception of noise level changes

The subjective impression of changes in noise can generally be correlated with the numerical change in noise level. While every person reacts differently to noise level changes, research shows a general correlation between noise level changes and subjective responses. Table 3-2 shows indicative subjective responses to explain the noise level changes discussed in this report.

The perception of these noise level changes generally applies to immediate changes in noise level, so may be slightly differently when applied to more gradual changes as would be the case for a new road. However, people may subjectively have an annoyance reaction to a greater or lesser degree, depending on their perception of the Project.

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

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

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

While for the assessment in accordance with NZS 6806 only the Project roads are included, when discussing the effect on people, in relation to the change in noise level, the surrounding road network was included in the noise predictions. This provides a more realistic representation of the level of effects, particularly for a suite of Projects that are proposed for a similar geographic region which influence each other and the wider environment.

## 3.2 Vibration

The AUP:OP or Waikato District Plan do not contain applicable vibration criteria for transport infrastructure. However, Waka Kotahi references the Norwegian Standard NS 8176.E:2005 in its reverse sensitivity guidelines.

### 3.2.1 Norwegian Standard NS 8176.E:2005

The Norwegian Standard NS 8176.E:2005 specifically addresses transportation vibration, both in relation to road and rail. The Standard's criteria (shown in Table 3-3 below) are based on studies of vibration annoyance in residences, and it provides guideline values for four vibration "classes".

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

The appropriate class for new infrastructure is considered to be Class C, which is the *"recommended limit value … in connection with the planning and building of new transport infrastructures"*.[2] According to the Section B.3.3 of the Standard, at this level of vibration "about 15% of the affected persons in Class C dwellings can be expected to be disturbed by vibration" and this is deemed by the Standard to be acceptable.

**Table 3-3: Human response criteria for transport sources in NS 8176.E:2005**

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

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

### 3.2.2 Road traffic vibration

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

For a newly sealed pavement, the risk contour is less than 2 metres from the road edge. There will be no receivers this close to any traffic lane edge. Therefore, we do not consider that traffic vibration needs to be assessed for this Project.

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

# 4 Assessment Methodology

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

- The noise criteria categories of NZS 6806; and
- Noise effects (both positive and adverse) through determination of noise level changes.

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

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

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

The assessment in accordance with NZS 6806 is undertaken for the Project road only, excluding other roads in the area. The reason is that the only effects that can be mitigated by a project are those of the roads that are directly affected by that project, i.e. excluding other roads that may contribute to the overall noise levels but are not being changed by a project.

On the other hand, the assessment of traffic noise change takes account of all major roads in the vicinity of the Project road. In this instance, the traffic noise levels that may be experienced at PPFs from all traffic in the area is assessed to gain a good understanding if:

- A Project road has an effect on the overall noise level received at individual PPFs; and
- The change in noise level assuming all NoRs have been implemented (refer Section 4.2 below).

This means that the change in noise level takes account of the cumulative effect of all existing and future roads being used.

## 4.1 Preparation for this Report

Work undertaken for this Report commenced in January 2023. In summary, the preparation for this report has included:

- Review of information from other experts, namely traffic, construction, design and planning amongst others;
- A site visit of all NoRs on 26 January 2023;
- Ambient noise level surveys in the Project areas (refer section 4.4)
- Computer noise modelling of traffic noise levels from road traffic; and
- A review of findings from a workshop with the Project technical specialists on 22 March 2022.

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

## 4.2 Assumptions

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

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

The assessment of the Do-nothing scenario (refer Section 3.1.2) is that the surrounding environment is fully developed, but without any changes to the transport corridors. We understand from the traffic specialists that a sensitivity factor is included in these traffic volumes that do not allow for impractically high traffic volumes on existing roads. The assumption is that peak traffic would occur for more hours of the day.

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

**Table 4-1: Buildings inside designation (not assessed)**

| NoR | Address |
|---|---|
| 1 | 600, 584 Burtt Road<br>785, 787, 791, 792 Runciman Road |
| 2 | 375 Burtt Road<br>301A and B Cape Hill Road<br>11 Crown Road<br>1238, 1242 Great South Road<br>21,22 Ngakoroa Road<br>777, 785, 787, 791,792 Runciman Road<br>77, 319 B-E, 412 Sim Road |
| 3 | 319 A and B, 325, 398 Sim Road |
| 4 | 81A, 81B, 87 Pukekohe East Road<br>1201 Paerata Road<br>35 Grace James Road<br>208, 219 Cape Hill Road |
| 5 | 1 Belgium Road<br>8 Pukekohe East Road<br>2, 97, 101, 107 Golding Road<br>10 Austen Place<br>35 Crosbie Road |

| NoR | Address |
|---|---|
| 6 | N/A |
| 7 | 2 Birdwood Road<br>224 Heights Road<br>130 Helvetia Road<br>36 Butcher Road<br>157 Beatty Road |
| 8 | 28, 87, 155, 182 Mill Road<br>306 Pukekohe East Road |

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

## 4.3 Assessment basis

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

- **New and altered roads**: New roads are proposed in NoRs 1 and 3 and altered roads (or a combination of new and altered roads) are proposed for NoRs 2, 4, 5, 6, 7, and 8. All these NoRs are assessed against NZS 6806 and in relation to the change in noise levels.
- **Walking and Cycling**: Most NoRs allow for some form of active mode transport, i.e. walking and cycling. Walking and cycling facilities do not cause any significant noise levels that would be consistently noticeable adjacent to the integrated major transport corridors that they are located at. Therefore no specific operational noise assessment of walking and cycling facilities was undertaken.

## 4.4 Existing noise environment

The existing noise environment provides a baseline for assessing noise effects. Effects can be assessed by quantifying the noise levels and noise level changes that people would experience due to the implementation of a project. The change in noise environment can be interpreted in relation to subjective responses of people (refer section 3.1.3). In addition, measured noise levels are used to verify the computer noise model.

The existing noise environments for all NoRs are controlled by traffic on existing major roads and the NIMT (either close by or distant) and natural sounds.

### 4.4.1 Surveys

We undertook long duration noise level surveys in the vicinity of the Projects in March and April 2023. The location of the surveys is shown in

Figure 4-1. Summary information for each survey location is shown in Appendix C.


**Figure 4-1: Noise survey locations**

All noise level survey results are shown in Table 4-2.

**Table 4-2: Noise survey results**

| Meas. Position | Location | NoR | Ambient noise level | Background noise level |
|---|---|---|---|---|
| | | | dB $L_{Aeq(24h)}$ | dB $L_{A90}$ |
| **MP1** | 319E Sim Road | NoR 2 | 51 | 38 |
| **MP2** | 77 Sim Road | NoR 2 | 51 | 41 |
| **MP3** | 785 Runciman Road | NoR 2 | 61 | 41 |
| **MP4** | 257 Pukekohe East Road | NoR 8 | 65 | 49 |
| **MP5** | 39 Grace James Road | NoR 4 | 41 | 32 |
| **MP6** | 35-39 Crosbie Road | NoR 4 | 56 | 40 |

### 4.4.2 Modelling

In addition to measuring the noise levels at a number of representative locations close to the Projects, computer noise modelling enables the prediction of existing noise levels at all PPFs. The model of the existing situation reflects the roads as they currently are, including the current posted speed limits.

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

The number of PPFs for each NoR are shown in Table 4-3.

**Table 4-3: Number of PPFs in each NoR**

| NoR | Number of PPFs |
|---|---|
| 1 | 13 |
| 2 | 61 |
| 3 | 2 |
| 4 | 23 |
| 5 | 35 |
| 6 | n/a |
| 7 | 5 |
| 8 | 23 |

## 4.5 Computer noise modelling

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

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

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

We used the software SoundPLAN V8.2, which is an internationally recognised computer noise modelling programme. SoundPLAN uses a three-dimensional digital topographical terrain map of the area as its base. In addition, we entered data into the model for existing buildings, proposed earthworks edges and ground absorption within the assessment area. We digitised road traffic noise sources, with road lanes located on the terrain file, for the existing/Do-nothing scenarios and the Do-minimum scenario.

The model settings are described in Table 4-4.

**Table 4-4: Road traffic noise modelling parameters**

| Parameter | Setting/source |
|---|---|
| Software | SoundPLAN V8.2 |
| Algorithm | CoRTN |
| Reflection | CoRTN |
| Ground absorption | 0.6 for urban areas; 1 for rural areas |
| Receiver height | 1.5 m above height of each floor |
| Noise contour grid | 1.5 m, 5 m resolution |
| Receivers and grid position | Free-field |

The SoundPLAN model implements the calculation algorithms of the “Calculation of Road Traffic Noise” methodology which is referenced in NZS 6806 in Section 3.1.2.

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

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

### 4.5.1 Model verification

The accuracy of the computer model needs to be verified. We used the measurement results set out in section 4.4.1 to verify that the computer model operates within satisfactory tolerances.

**Table 4-5: Computer noise model verification**

| Measurement position | Location | Measured Level | Predicted Level | Difference | Comment |
|---|---|---|---|---|---|
| | | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ | decibels | |
| MP1 | 319E Sim Road | 51 | 32 | -19 | The location is remote from roads but close to the NIMT, which shows in the measured results, but not in the predicted traffic noise levels. |
| MP2 | 77 Sim Road | 48 | 44 | -4 | The location is influenced by the NIMT, which shows in the measured results, but not in the predicted traffic noise levels. |
| MP3 | 785 Runciman Road | 61 | 64 | +3 | |
| MP4 | 257 Pukekohe East Road | 65 | 68 | +3 | |
| MP5 | 39 Grace James Road | 41 | 29 | -12 | Measurement location is far from local roads, and Grace James Road has a relatively low AADT (<1000 with a low-noise road surface) hence the low predicted noise level. The dominant noise sources in the measurement were from farming equipment and foliage near the measurement location, which are not considered for the traffic noise predictions. |
| MP6 | 35-39 Crosbie Road | 56 | 58 | +2 | Within tolerance. |

A comparison of the measured and predicted levels shows that there is generally good agreement between measured and predicted levels for locations where traffic is the controlling noise source (MP 3, 4 and 6). Where other sources such as the NIMT have a significant effect on the ambient noise levels, there is a larger difference between predicted (traffic) noise levels and measured ambient noise levels.

### 4.5.2 Individual receiver noise levels

We have assessed noise effects at all PPFs. We have included predicted noise levels for all PPFs, for all scenarios, in the tables in Appendix **Error! Reference source not found.**. The locations of these dwellings are shown in the drawings in Appendix 0.

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

### 4.5.3 Noise contour plans

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

Noise contour plans are contained in drawings in Appendix 0. These plans show interpolated noise level bands at 5 decibel intervals from 55 dB to 70 dB $L_{Aeq(24h)}$.

## 4.6 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 several reasons and are typically related to the effects of the input data such as topographical screening, traffic details (e.g. light vs heavy vehicles), speeds (observed vs posted) and road surface type.

The terrain model was developed by using LIDAR points for the wider area from LINZ and inserting the Project terrain data provided by the Project GIS team based on 1m vertical terrain resolution. This methodology provides sufficient detail to accurately account for any acoustic shielding from localised topographical features.

The traffic data was provided by the Project Transport team. Forecasting of future traffic flows may not necessarily reflect the actual flows when the Design Year is reached. However, as discussed in section 3.1.3, the sensitivity of the noise predictions to changes in traffic data is not as significant as the effects of topographical screening.

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

## 4.7 Assessment of operational vibration

As noted in section 3.2.2, vibration from well-constructed and maintained roads is not an issue that causes adverse effects. As such vibration effects are not anticipated and we have therefore not assessed road traffic vibration further.

## 4.8 Measures to Avoid, Remedy or Mitigate Road Noise Effects

Traffic on the road generates noise that may require mitigation. The below noise mitigation measures have been applied to the NoRs as required and are described in more detail for each NoR in section 6.

There are broadly three mitigation options that can be applied to manage road traffic noise, and are discussed in NZS 6806:

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

NZS 6806 states:

> *The noise criteria are intended to address the adverse effects of road-traffic noise on people. Land-use planning is the preferred method of avoiding these effects. Where this is impracticable, the Standard sets out procedures and methods of the prediction, measurement and assessment, and guidelines for mitigation of road-traffic noise in accordance with the duty to adopt the best practicable option.*[3]

This indicates that NZS 6806 deals with the residual noise effects after land-use planning has been implemented (or where it has been omitted in the planning stage).

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

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

- the road controlling authority through the use of low noise road surface materials in suburban and urban areas, and
- the developers through appropriate placement, orientation and design of noise sensitive activities to achieve reasonable internal and, as far as practicable, external noise levels.

[3] NZS 6806, Section 1.1.1

To assist with appropriate development, noise level contours are provided in Appendix 0.

This Project seeks route protection for the NoRs, which will be implemented in the medium to distant future within an environment that may have changed. Therefore, mitigation has been tested as follows:

- Low noise road surface is the base surface for all NoRs. Low noise road surface is required to be implemented by the conditions.
- Barriers have been tested where effective for existing PPFs. The resulting noise criteria categories required to be achieved by the conditions take these barriers into consideration. However, barriers are not specified in the conditions. The reason is that integration with the future environment can better be determined at the detailed design stage when the receiving environment is known. This will be done during detailed design when the BPO mitigation is determined.
- Nevertheless, the requirement to achieve the relevant noise criteria category means that mitigation in addition to the use of low noise road surface (i.e. barriers) will need to be determined.

# 5 Existing and Future Receiving Environment

## 5.1 Planning and Land Use Context

The assessment of effects needs to consider both the existing environment and the likely future receiving environment at the time at which effects will likely occur. It is anticipated the Pukekohe Transport Network projects will be constructed between 10 – 25 years from now, meaning the receiving environment will differ significantly from what is present today.

In relation to traffic noise, the assessment of effects and design of mitigation relates to any PPFs existing at the time of consenting (refer section 3.1.2). Any future sensitive developments will need to share the responsibility of providing a suitable noise environment for future residents. This is discussed later in the report.

There are existing rural and urban zonings in the study area, as well as large areas of future urban zoning (FUZ) which will influence the likely receiving environment for assessment purposes. The majority of the Pukekohe Transport Network will be constructed and will operate within (or immediately adjacent to) areas currently zoned as FUZ. The remainder will be constructed and operated within the existing urban or rural environment or planned environment (i.e. what can be built under the existing AUP:OP live zones). However, greater intensification is anticipated in the residential zones, centre zones (and future centres), in line with the National Policy Statement on Urban Development (NPS:UD) and Medium Density Residential Standards (MDRS) -noting that the policy context may shift prior to construction.

All areas of the FUZ have a high likelihood of change in planning and land use context. It is anticipated that the likelihood of change in the following areas / zones is low:

- Current residential areas/zones, including Single House, Mixed Housing Suburban, Mixed Housing Urban, Terrace and Apartment Buildings, and Large Lot zones. noting Auckland Council Plan Change 78 responding to the NPS:UD as mentioned above is in progress. Existing residential zoning is only relevant to NoR 6 – which is not assessed further in this report as it is a low noise generating active mode upgrade of existing roads.
- Current business areas/zones, including Light Industry, Mixed Use, General Business, Neighbourhood Centre, Local Centre, Town Centre, Heavy Industrial zones. Business zones are only relevant to the southern most part of NoR 5.
- Current open space areas/zones, including Informal Recreation, Community, Sport and Active Recreation, Conservation zones – only relevant to NoR 8 where there is conservation zone (esplanade reserve).
- Current rural areas which are not FUZ zoned, including Countryside Living zone – this is relevant to parts of NoR 2 and NoR 4.

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

## 5.2 Existing and Future Noise Environment

The Pukekohe Transport Network covers a large area with a variety of ambient noise environments.

In the existing noise environment, areas surrounding NoRs that will provide for upgrades of existing roads are affected by traffic noise from these roads, while areas surrounding NoRs providing for new

roads generally have lower ambient noise levels. Where new roads connect with existing infrastructure, noise levels are also elevated.

Ambient noise levels away from current roads are relatively low at less than 55 dB $L_{Aeq(24h)}$. For some areas, the NIMT has the greatest impact on the ambient noise levels, rather than road traffic noise. Close to existing major roads such as SH22, SH1 and Mill Road, traffic noise is the controlling noise source.

In the likely future noise environment, the intensification of FUZ land will result in increased noise levels both from urban activities and increased traffic. It is likely that the character of the environment will change significantly with the future development, from rural to urban.

# 6 Assessment of Operational Noise Effects

## 6.1 NoR 1 – Drury West Arterial

NoR 1 provides a new connection between SH22 and NoR 2 – Drury to Pukekohe Link with AT being the requiring authority.

We note that all of the roads in this NoR have been assumed to be surfaced with asphaltic concrete (which is a good low noise road surface) in the Do-minimum scenario. This means that the main noise mitigation measure is already implemented with the Do-minimum scenario, limiting the requirement for further noise mitigation through noise barriers or building modification mitigation.

### 6.1.1 NZS 6806 Assessment

NoR 1 has been assessed against the Altered road criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area. A total of 13 PPFs have been assessed.

NoR 1 falls in both the urban and rural areas, as defined by Stats NZ, therefore for some sections PPFs within 100m of the road edge were assessed, and for other sections PPFs within 200m of the road edge were assessed. Figure 6-1 shows the urban (green) and rural (orange) areas, along with the assessment area used (light green line).


**Figure 6-1 Urban and rural areas - NoR 1 – Drury West Arterial**

No PPFs were assessed against the New road criteria, as all PPFs outside the proposed designation boundary that were in the Stats NZ urban area were within 100m of an existing road (Karaka Road), and all PPFs outside the designation boundary that were in the Stats NZ rural area were within 200m of an existing road (Burtt Road and Runciman Road).

Currently, all PPFs receive noise levels within Category A. This is due to the low traffic flows along Burtt Road and Runciman Road, and distance of PPFs within the assessment area from SH22.

The traffic volume in the Do-nothing scenario (without the Projects) is proposed to increase significantly, resulting in an average 5 decibel noise level increase for most PPFs, and therefore resulting in noise levels in less stringent noise criteria categories at some PPFs.

With the construction of the Project and considering only Project roads without surrounding roads, all PPFs are within Category A due to the implementation of a low-noise road surface (asphaltic concrete), even with a predicted increase in traffic volumes. This means that the road does not meet

the definition of an Altered road under NZS 6806. Therefore, the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project.

A summary of the results of the noise predictions is presented in Table 6-1.

**Table 6-1 Summary of NZS 6806 assessment – NoR 1, Altered roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 13 | 0 | 0 |
| Do-nothing (without Pukekohe Projects) | 12 | 1 | 0 |
| Do-minimum (without specific noise mitigation[4]) | 13 | 0 | 0 |

### 6.1.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and Do-minimum scenarios.

Traffic flows on SH22, Burtt Road and Runciman Road are predicted to be lower with the implementation of the Pukekohe Projects compared to the Do-nothing scenario. Noise increases are also limited due to implementation of a low-noise road surface (asphaltic concrete).

Noise levels for most PPFs will remain similar or reduce. One PPF is predicted to receive a 3 dB increase in noise level between the Do-nothing and Do-minimum scenario, which would be just perceptibly louder. The increase in noise is due to the increased traffic flows along SH22, Burtt Road and Runciman Road.

Figure 6-2 shows the distribution of noise level changes when comparing the Do-nothing and Do-minimum scenarios.

[4] Low noise road surface (asphaltic concrete) has been included in the do-minimum scenario

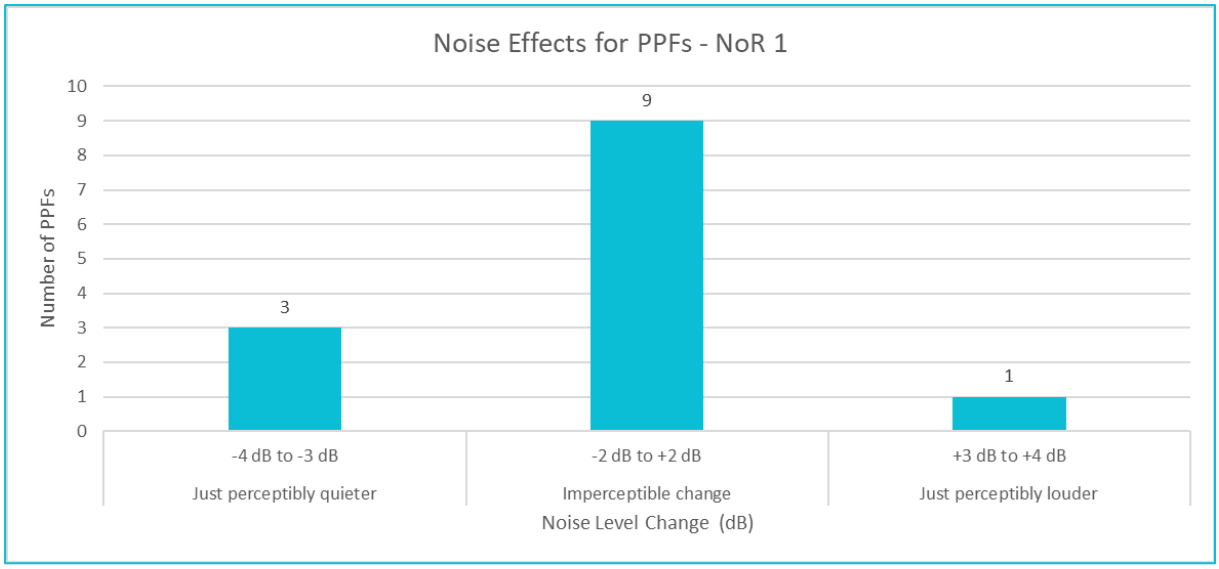


**Figure 6-2: Change in noise level - NoR1 Drury West Arterial**

### 6.1.3 Summary

The PPFs assessed for NoR 1 have been assessed against the Altered roads criteria in accordance with NZS 6806. All PPFs are predicted to achieve Category A noise levels under the Do-minimum scenario, and do not require consideration of further noise mitigation under the Standard.

With other roads in the vicinity (including other NoRs of the Pukekohe Projects) noise levels are predicted to remain similar or reduce at the majority of PPFs.

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a character change of the area.

Some PPFs may not exist anymore at the time of road construction particularly given NoR 1 is within the FUZ signalling future urban development. Therefore, the predicted effects may not be experienced by current residents.

## 6.2 NoR 2 – Drury-Pukekohe Link

NoR 2 provides for a new state highway connecting Great South Road (and SH1) with Pukekohe North East Arterial (NoR 4). The alignment extends over a significant distance, some 11 km of new or upgraded road in total.

The road has been assumed to be surfaced with PA10 30mm, an open graded porous asphalt that is a good low noise road surface. This means that the main noise mitigation measure is already implemented with the Do-minimum scenario, limiting additional noise mitigation to barriers or building modification mitigation.

### 6.2.1 NZS 6806 Assessment

The Drury to Pukekohe Link NoR 2 consists of new and altered roads. The majority of PPFs have been assessed against the New road criteria (refer Section 3.1.2) as they are either in rural areas

away from major roads, or are close to minor roads that carry very little traffic. In either instance, the existing ambient noise levels at these PPFs are low and warrant the use of the New road criteria.

The only PPFs assessed against the Altered road criteria are in the vicinity of Karaka Road, which carries some 15,000 vehicles per day at present. These PPFs will be affected only by the upgrade of Sim Road (SH22 Connection segment of NoR 2) which carries comparatively low traffic volumes.

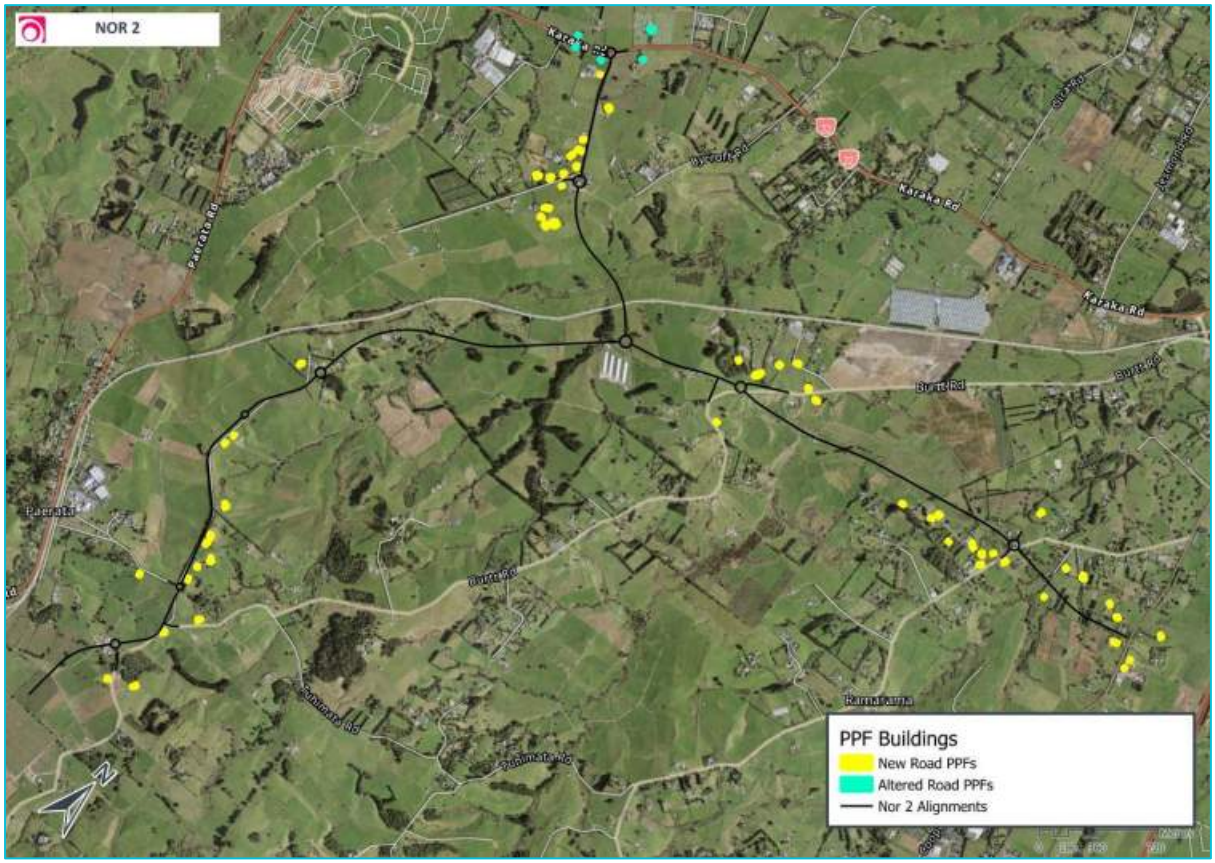


**Figure 6-3: PPFs assessed against the New and Altered road criteria**

### 6.2.1.1 Altered Road

There are five PPFs assessed against the Altered road criteria.

NoR 2 borders two FUZ areas, one at its northern end at Drury and one towards the south at Paerata and Pukekohe, both on the northbound side of the alignment. Development in the area is anticipated to increase the traffic volumes and therefore noise levels.

Nevertheless, traffic from roads within the proposed designation does not generate high noise levels at the small number of PPFs assessed under the Altered Road criteria, with all of them predicted to receive noise levels in Category A for all scenarios. Therefore, no mitigation is required or recommended.

The number of PPFs assessed against the Altered road criteria is summarised in Table 6-2, and figures showing the location of the PPFs are included in Appendix 0.

**Table 6-2: Summary of NZS 6806 assessment – NoR 2, Altered Road**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 5 | 0 | 0 |
| Do-nothing (without Pukekohe Projects) | 5 | 0 | 0 |
| Do-minimum[5] (without specific noise mitigation) | 5 | 0 | 0 |

#### 6.2.1.2 New Road

Most PPFs have been assessed against the New road criteria as the road traverses greenfield rural areas remote from manmade noise sources.

At present, all 59 PPFs assessed against the New road criteria receive noise levels within Category A. The exception is 397 Burtt Road, 334 Cape Hill Road and 744 Runciman Road, they are predicted to receive a noise level in Category B. The reason is that the dwelling is very close to the existing road, and even though traffic volumes on the road are very low, the close distance results in a predicted noise level of 58 to 62 dB $L_{Aeq(24h)}$.

With the Project in place and the future development in the area, significant noise level increases are anticipated. While the vast majority (43 of the 59 PPFs) are still predicted to receive noise levels in Category A, 16 PPFs are predicted to receive noise levels in Category B, and no PPFs are predicted to receive a noise level in Category C.

We have tested potential traffic noise mitigation options in the form of 2m high noise barriers either at the boundary or at the road edge. The tested barriers took into consideration access requirements for the sites they protect. These mitigation options are not exhaustive. In the future, during detailed design, the BPO mitigation measures will be determined in accordance with the recommended conditions. At that time, any mitigation measure beyond the use of low noise road surface will be investigated to determine the BPO to achieve the noise criteria categories of the PPFs set out in the conditions.

Not all barriers achieve sufficient or effective noise reductions. Where a barrier is ineffective, they have not been included in the potential mitigation. Only one noise barrier at the property boundary of 72 Sim Road can change the noise level received by the dwelling from Category B to Category A.

With barriers in place, 44 PPFs are predicted to receive noise levels in Category A. Fifteen PPFs[6] are still predicted to receive noise levels in Category B. Where barriers may be practicable for existing PPFs, these will be assessed at the time of detailed design to determine if they represent the BPO. At that time, the location and height of any barriers will be determined, and a noise mitigation plan prepared in accordance with the conditions.

[5] PA10 30mm open graded porous asphalt (low noise road surface) is included in the do-minimum scenario.

[6] 334 Cape Hill Rd, 1236 Great South Road, 744, 767 and 775 Runciman Road, 12, 54, 60, 393, 393A, 465, 469, 481 and 491 Sim Road.

Before construction commences, reassessment of the road traffic noise at PPFs identified as requiring mitigation will be carried out to determine what mitigation represents the BPO to meet the categories as set out in Appendix **Error! Reference source not found.**.

The number of PPFs assessed against the Altered road criteria is summarised in Table 6-2, and figures showing the location of the PPFs are included in Appendix 0.

**Table 6-3: Summary of NZS 6806 assessment – NoR 2, New Road**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 56 | 3 | 0 |
| Do-minimum[7] (without specific mitigation) | 43 | 16 | 0 |
| Mitigation option – 2m barriers | 44 | 15 | 0 |

## 6.2.2 Change in noise level

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

### 6.2.2.1 Altered Road

For the PPFs assessed against the Altered road criteria, we predict an average noise level increase from the existing to Do-nothing scenario of less than 2 dB. With the Project in place, noise levels are predicted to remain similar or reduce slightly for most PPFs. Overall, the Project has little impact on these PPFs.

Figure 6-4 shows the number of PPFs assessed against the Altered road criteria in each of the change in noise level bands discussed in Table 3-2. This shows clearly that noise levels will remain similar with or without the Project. This comparison includes traffic on existing local roads as they will affect the noise environment and are therefore important when assessing potential noise level changes in the area.

[7] PA10 30mm open graded porous asphalt (low noise road surface) is included in the do-minimum scenario.

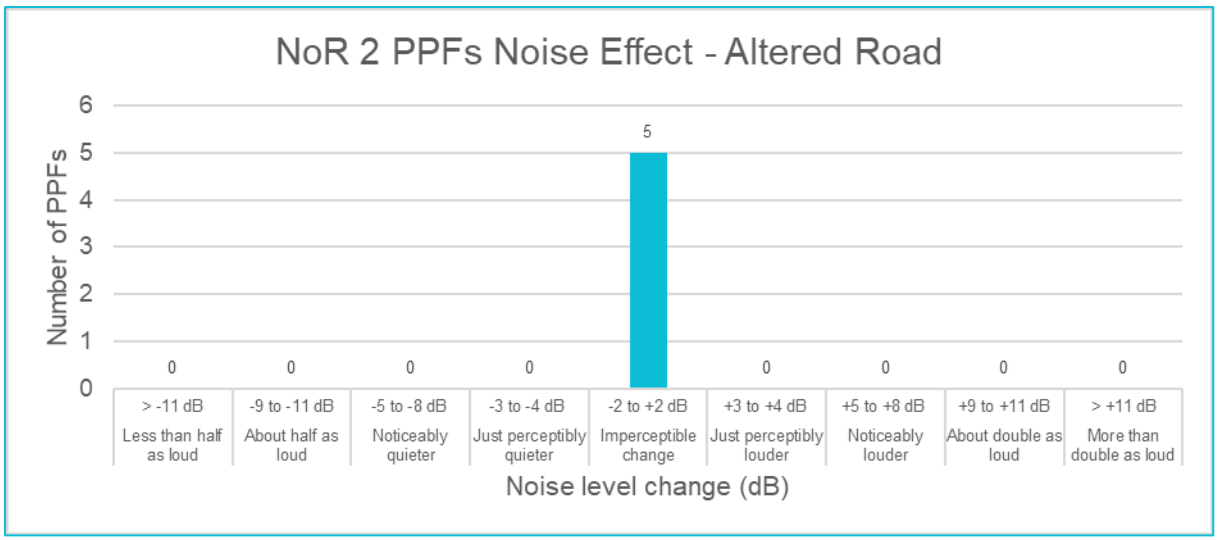


**Figure 6-4: Change in noise level – NoR 2 Altered Road**

### 6.2.2.2 New Road

As would be expected, the introduction of a major noise source (a new state highway) into a currently low noise environment is predicted to result in a significant change in noise level and character for most PPFs. This is confirmed when assessing the noise level changes comparing the existing with the Do-minimum scenario.

The Project upgrades Sim Road, which will form part of the wider transport network connecting with other NoRs of the package. This is predicted to lead to a traffic volume increase from virtually no traffic (less than 50 AADT on Sim Road (north) currently) to over 9,500 AADT, resulting in a noise level increase of more than 20 decibels at some PPFs (e.g. 83, 94 and 491 Sim Road). While this effect is not specifically due to the Project, it shows that traffic flows are able to traverse the area in a much different way than currently. The development of FUZ areas in the future will result in additional traffic that will utilise the transport corridors of the Pukekohe Transport Network.

With potential mitigation (e.g. barriers) in place, traffic noise levels are still predicted to change by up to 21 decibels. Note that existing ambient noise levels in the area are affected by the NIMT and are therefore not as low as predicted in our traffic noise model (refer Table 4-5).

Figure 6-5 shows the number of PPFs assessed against the New road criteria in each of the change in noise level bands discussed in Table 3-2, comparing the existing with the noise levels with the Project (with potential mitigation) in place. This shows that noise levels increase significantly with the implementation of the Pukekohe projects when the area is developed in the future. This comparison includes traffic on existing local roads as they will affect the noise environment and are therefore important when assessing potential noise level changes in the area.

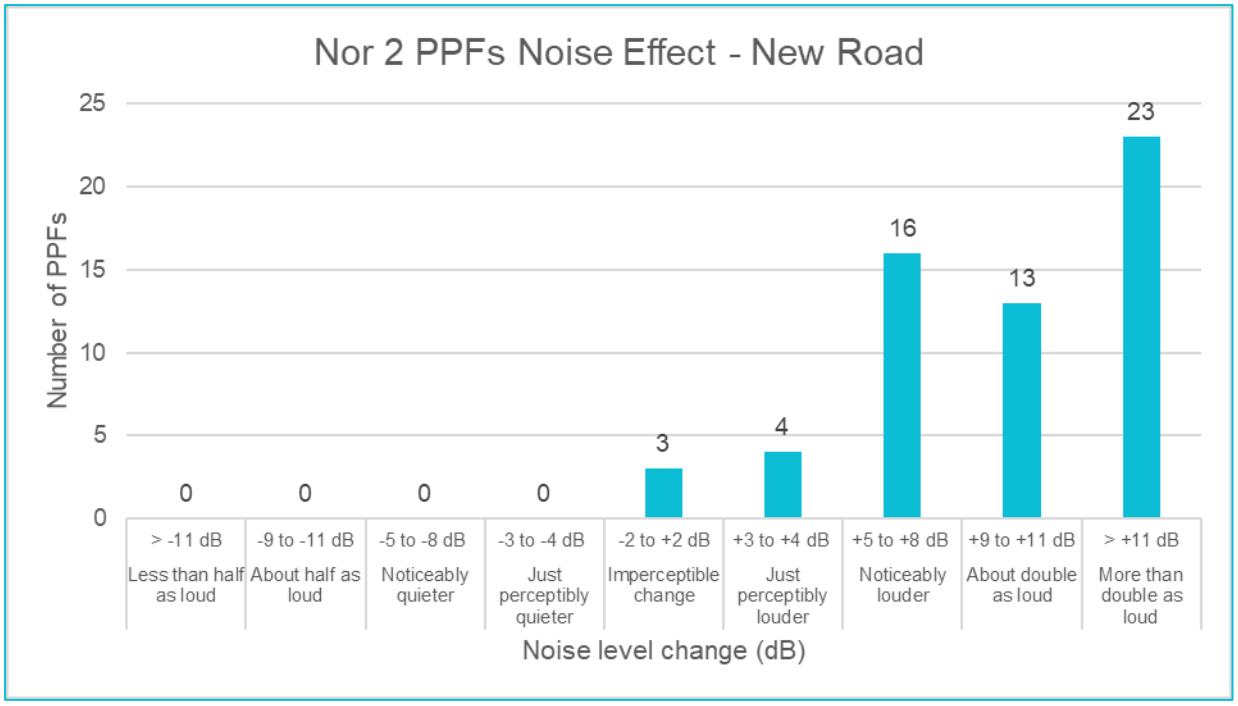


**Figure 6-5: Change in noise level – NoR 2 New Road**

### 6.2.3 Summary

The Drury to Pukekohe Link NoR 2 will have a significant effect on the environment. Currently, some of the area is relatively unaffected by traffic noise, with SH22 at a significant distance and at times shielded by terrain. However, the NIMT has an effect on the ambient noise level. The road will traverse current greenfield areas that in the future will be developed where they are in the FUZ. This will result in a significant increase in noise level as traffic flows are enabled by NoR2 as well as the connecting NoRs 1, 3, and 4.

The Project involves both New and Altered roads. While the vast majority of PPFs are predicted to receive noise levels in Category A (49 of the total 64), 15 PPFs are still predicted to receive noise levels in Category B, with mitigation beyond the use of low noise road surface in place. Mitigation may take the form of barriers (where they are effective) and the BPO mitigation will be determined at detailed design. Low noise road surface is already part of the base design of the road.

Before construction commences, reassessment of the road traffic noise at PPFs identified as requiring mitigation will be carried out to determine the mitigation that constitutes the BPO to meet the categories as set out in Appendix **Error! Reference source not found.**.

Irrespective of mitigation, a number of PPFs are predicted to receive significant traffic noise level increases, however, note that the NIMT has an influence on the ambient noise environment that is not reflected in the computer noise model. This can be seen in the survey results in Table 4-2. Therefore, the increase in noise level may not be as pronounced as predicted.

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a significant character change of the area. That means that the ambient noise environment in areas with FUZ will be higher due to more intensive urban activity and the predicted noise level change from traffic noise will likely be less.

## 6.3 NoR 3 – Paerata Connections

Paerata Connections NoR 3 provides new connections between NoR 2 and the Paerata Rail Station and urban development areas with AT being the requiring authority. The assessment areas for NoR 3 and NoR 2 overlap where they intersect at Sim Road in the east.

We note that all of the roads in this NoR have been assumed to be surfaced with asphaltic concrete (which is a good low noise road surface) in the Do-minimum scenario. This means that the main noise mitigation measure is already implemented with the Do-minimum scenario, limiting the requirement for further noise mitigation through noise barriers or building modification mitigation.

### 6.3.1 NZS 6806 Assessment

NoR 3 has been assessed against the New road criteria (refer Section 3.1.2), despite the Project roads falling within 200m of Sim Road (south) (an existing road). This is because traffic flows along Sim Road (south) are very low (under 600 in both the Existing and Do-nothing scenarios), and traffic noise from Sim Road (south) does not dominate the noise environment in the surrounding area.

As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

A total of two PPFs have been assessed. The entirety of NoR 3 falls within the rural area (as defined by Stats NZ), meaning that PPFs within 200m of the road edges of the proposed new alignment were assessed.

Currently, the two PPFs receive noise levels within Category A. This is due to low traffic flows along Sim Road (south).

With the construction of the Project, and considering only NoR 3 Project roads without surrounding roads, all PPFs fall within Category A due to implementation of a low-noise road surface (asphaltic concrete) even though there is a predicted increase in traffic volumes.

Noise levels range from 37 to 46 dB $L_{Aeq(24h)}$ in the Do-minimum scenario. No mitigation for NoR 3 is required.

Note that some PPFs may not exist anymore at the time of construction of the Project; in particular, those located within the FUZ.

A summary of the noise prediction results is presented in Table 6-4.

**Table 6-4 Summary of NZS 6806 assessment – NoR 3, New roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 2 | 0 | 0 |
| Do-minimum | 2 | 0 | 0 |

### 6.3.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project by comparing the Existing and the Do-minimum scenarios.

The Pukekohe Projects will enable higher traffic flows in the surrounding area (in particular increased traffic flows along Sim Road (south) through NoR 2), however noise increases are limited due to implementation of a low-noise road surface (asphaltic concrete) along Sim Road (south).

With other roads nearby (including other NoRs of the Pukekohe Projects) noise levels are predicted to increase by 4-6 dB at the two PPFs.

Figure 6-6 shows the distribution of noise level changes when comparing the Existing and Do Minimum scenarios.

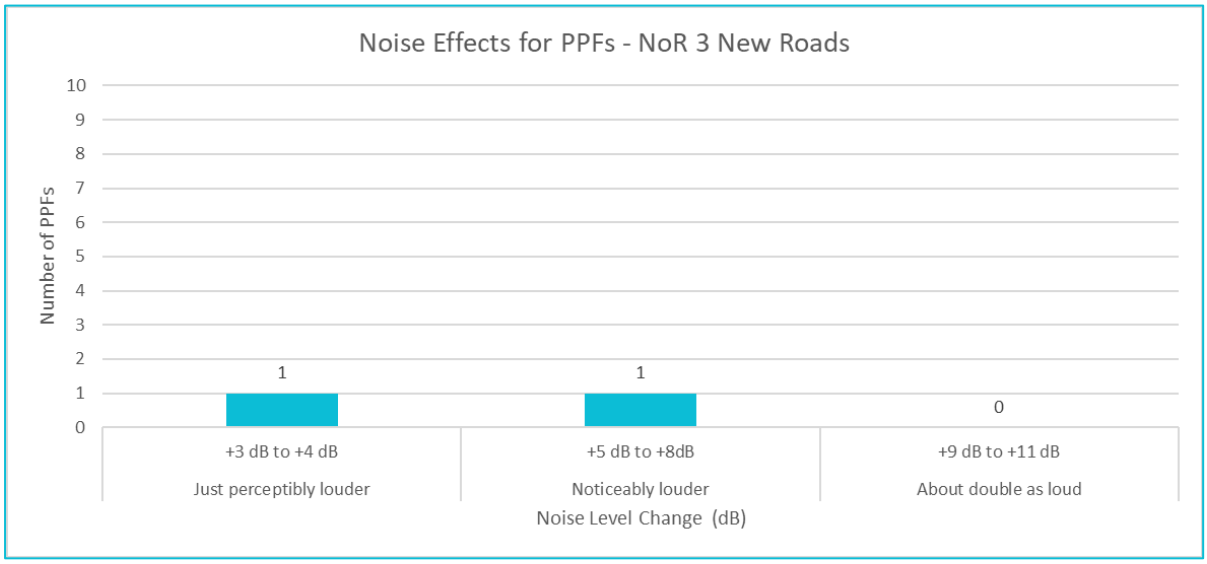


**Figure 6-6: Change in noise level - NoR3**

### 6.3.3 Summary

The PPFs assessed for NoR 3 have been assessed against the New road criteria under NZS 6806. Both PPFs are predicted to receive noise levels in Category A in the Do-minimum scenario and do not require consideration of further noise mitigation under the Standard.

With other roads nearby (including other NoRs of the Pukekohe Projects) noise levels are predicted to increase by 4-6 dB.

Although the PPFs are predicted to receive traffic noise level increases, we note that the NIMT has an influence on the ambient noise environment that is not reflected in the computer noise model. This can be seen in the survey results in Table 4-2. Therefore, the increase in noise level may not be as noticeable at the time.

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a character change of the area.

Some PPFs may not exist anymore at the time of road construction particularly given NoR 3 is within the FUZ signalling future urban development. Therefore, the predicted effects may not be experienced by current residents.

## 6.4 NoR 4 – Pukekohe North-East Arterial

NoR 4 is a new transport corridor connecting at SH22 in the northern extent and Pukekohe East Road at the southern extent. AT is the requiring authority. The assessment areas for NoR 4 overlaps with those of NoR 2, NoR 5 and NoR 7 at their intersections.

We note that all of the roads in this NoR have been assumed to be surfaced with asphaltic concrete (which is a good low noise road surface) in the Do-minimum scenario. This means that the main noise mitigation measure is already implemented with the Do-minimum scenario, limiting the requirement for further noise mitigation through noise barriers or building modification mitigation.

### 6.4.1 NZS 6806 Assessment

NoR 4 falls within both urban and rural areas (as defined by Stats NZ), therefore for urban sections PPFs within 100m of the road edge were assessed, and for rural sections PPFs within 200m of the road edge were assessed.

This NoR contains both new and altered roads. There are 24 PPFs, of which two have been assessed against the New road criteria and 22 against the Altered road criteria.

Figure 6-7 shows the urban (green) and rural (orange) areas as well as the PPFs assessed against Altered (blue) and New (yellow) roads criteria, along with the assessment area used.

**Figure 6-7 Urban and rural areas - NoR 4**

### 6.4.1.1 Altered Road

PPFs within 100m of existing roads in urban areas and within 200m in rural areas have been assessed against the Altered roads criteria (refer Section 3.1.2). The assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area. Currently, most PPFs receive noise levels within Category A. This is due to low traffic flows in the surrounding road network.

The traffic volume in the Do-nothing scenario is proposed to increase significantly, resulting in an average 4 decibel noise level increase for most PPFs.

With the construction of the Project, and considering only NoR 4 Project roads without surrounding roads, all PPFs fall within Category A. This is due to a number of factors including redistribution of traffic through the surrounding road network, reduction of speed limits around surrounding roads, and implementation of low-noise road surfaces (asphaltic concrete). The road does not meet the definition of an Altered road in accordance with NZS 6806, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project.

A summary of the results of the noise predictions is presented in Table 6-5.

**Table 6-5 Summary of NZS 6806 assessment - NoR 4, Altered roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 14 | 4 | 3 |
| Do-nothing | 9 | 5 | 7 |
| Do-minimum | 21 | 0 | 0 |

### 6.4.1.2 New Road

Where NoR 4 diverges from the existing roads and traverses green field areas, the New road criteria have been used to assess noise levels. Here, the Existing (from existing local roads) and Do-minimum scenarios (NoR 4 roads only) are compared.

Noise levels range from 50 to 51 dB $L_{Aeq(24h)}$ in the Do Minimum scenario with both PPFs in Category A. No mitigation for the New roads section of NoR 4 is required.

A summary of the results of the noise predictions is presented in Table 6-6.

**Table 6-6 Summary of NZS 6806 assessment – NoR4, New roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 2 | 0 | 0 |
| Do-minimum | 2 | 0 | 0 |

## 6.4.2 Change in noise level

### 6.4.2.1 Altered Road

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do-minimum scenarios.

The Pukekohe Projects will enable lower traffic flows along SH22 and Pukekohe East Road. Further noise reductions are brought about by lowering of the speed limit along surrounding roads and implementation of a low-noise road surface (asphaltic concrete).

Noise levels will remain similar or reduce at all PPFs.

Figure 6-8 shows the distribution of the noise level changes when comparing the Do-nothing and Do-minimum scenarios.

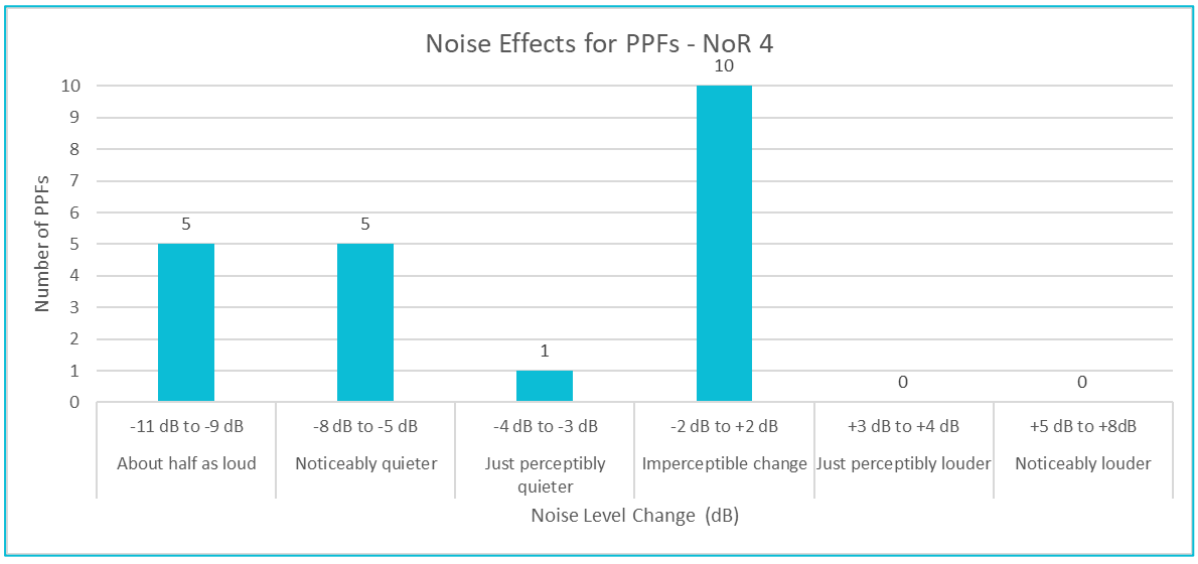


**Figure 6-8: Change in noise level – NoR 4 Altered roads**

### 6.4.2.2 New Road

When comparing the Existing and Do-minimum scenarios, the introduction of a new noise source generally would result in a doubling in perceived traffic noise at PPFs assessed against the New roads criteria in this NoR. These PPFs are not currently exposed to high levels of traffic noise, meaning that introduction of a new road in the area leads to large noise level increases.

Figure 6-9 shows the distribution of the noise level changes when comparing the Existing and Do-minimum scenarios.

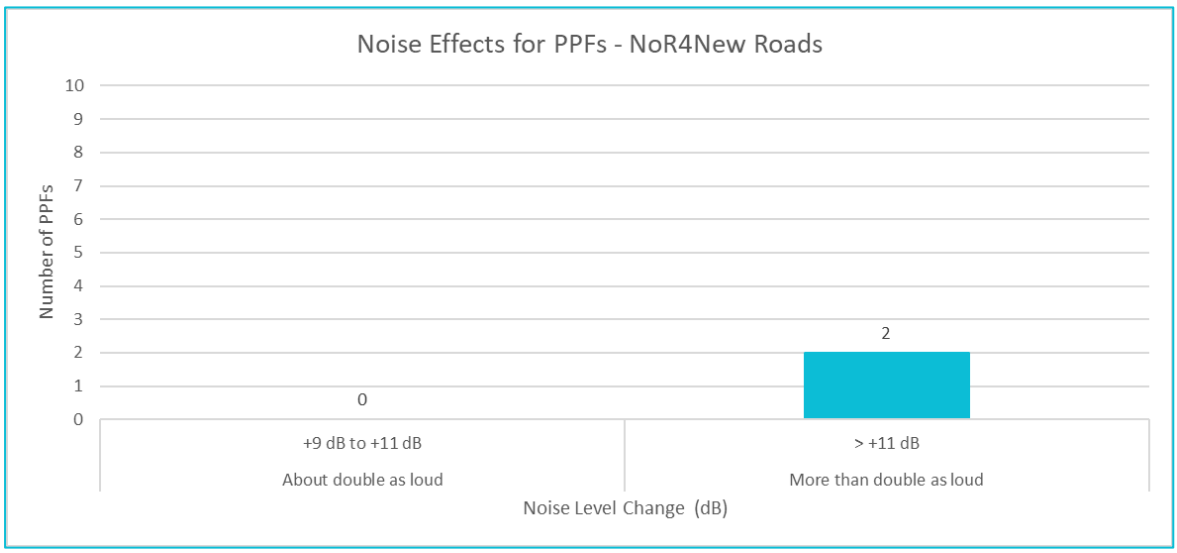


**Figure 6-9: Change in noise level – NoR 4 New roads**

### 6.4.3 Summary

PPFs assessed for NoR 4 have been assessed against the New and Altered roads criteria under NZS 6806. The altered road section does not meet the definition of an Altered road under NZS 6806, therefore mitigation does not need to be considered further under the Standard. All PPFs in the new section of road meet the Category A noise criterion, therefore mitigation does not need to be considered further for the New road section under the standard.

With other roads in the vicinity (including other NoRs of the Pukekohe Projects) noise levels are predicted to remain similar or reduce at almost all PPFs. Where there are noise level increases, this will be due to the introduction of the new road to the area.

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a character change of the area.

Some PPFs may not exist anymore at the time of road construction particularly given NoR 4 is within the FUZ signalling future urban development. Therefore, the predicted effects may not be experienced by current residents.

## 6.5 NoR 5 – Pukekohe South-East Arterial

Pukekohe South-East Arterial NoR 5 upgrades Pukekohe East Road, Golding Road and provides a new connection to the existing urban area. AT is the requiring authority. The assessment areas for NoR 5 and NoR 4 overlap at their intersection.

We note that all of the roads except for Golding Road in this NoR have been assumed to be surfaced with asphaltic concrete (which is a good low noise road surface) in the Do-minimum scenario. This means that the main noise mitigation measure is already implemented with the Do-minimum scenario,

limiting the requirement for further noise mitigation through noise barriers or building modification mitigation.

### 6.5.1 NZS 6806 Assessment

Almost all of NoR 5 falls within the urban area (as defined by Stats NZ), meaning that PPFs within 100m of the road edges of the proposed new alignment were assessed.

The Pukekohe East Road section of this NoR was not included in the Do-minimum situation calculations, as the only works planned along this section are upgrades to walking and cycling facilities which will involve no changes to the horizontal or vertical alignment of the road. As stated in section 4.3, footpaths and cycleways do not create significant noise and have not been taken into account in the calculations. Therefore, the noise levels for the Do-minimum scenario for some PPFs are significantly reduced compared to the Do-nothing scenario (where noise along Pukekohe East Road was considered in the calculations).

Figure 6-10 shows the urban (green) and rural (orange) areas as well as the PPFs assessed against Altered (blue) and New (yellow) roads criteria, along with the assessment area used.


**Figure 6-10 Urban and rural areas – NoR 5**

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

There are a total of 35 PPFs, of which seven have been assessed against the New road criteria and 28 against the Altered road criteria.3.2.2

### 6.5.1.1 Altered Road

PPFs within 100 m of existing roads have been assessed against the Altered roads criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

There are currently 4 PPFs in Category C and two PPFs in Category B. This is due to the high traffic flows along Pukekohe East Road.

The traffic volume in the Do-nothing scenario (without the Pukekohe Projects) is proposed to increase significantly, resulting in an average 4 decibel noise level increase for most PPFs.

With the construction of the Project, and considering only NoR 5 Project roads without surrounding roads, all PPFs fall within Category A. This is due to a number of factors including redistribution of traffic through the surrounding road network, reduction of speed limits around surrounding roads, and implementation of low-noise road surfaces (asphaltic concrete) where required. Therefore, the road does not meet the definition of an Altered road under NZS 6806, meaning that the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project.

A summary of the results of the noise predictions is presented in Table 6-7.

**Table 6-7 Summary of NZS 6806 assessment – NoR 5, Altered roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 22 | 2 | 4 |
| Do-nothing | 17 | 1 | 10 |
| Do-minimum | 28 | 0 | 0 |

#### 6.5.1.2 New Road

Where NoR 5 diverges from existing roads and traverses green field areas, the New road criteria have been used to assess noise levels. Here, the Existing (from existing local roads) and Do-minimum scenarios (NoR 5 roads only) are compared.

Noise levels range from 41 to 49 dB $L_{Aeq(24h)}$ in the Do-minimum scenario and all PPFs are in Category A. No mitigation for the New roads section of NoR 5 is required.

A summary of the results of the noise predictions is presented in Table 6-8.

**Table 6-8 Summary of NZS 6806 assessment – NoR 5, New roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 7 | 0 | 0 |
| Do-minimum | 7 | 0 | 0 |

### 6.5.2 Change in noise level

#### 6.5.2.1 Altered Road

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do-minimum scenarios.

The Pukekohe Projects will enable lower traffic flows along Pukekohe East Road, Golding Road and Svendsen Road. Further noise reductions are brought about by lowering of the speed limit along surrounding roads and implementation of a low-noise road surface (asphaltic concrete).

Noise levels for all PPFs will remain similar or reduce.

Figure 6-11 shows the distribution of the noise level changes when comparing the Do-nothing and Do-minimum scenarios.

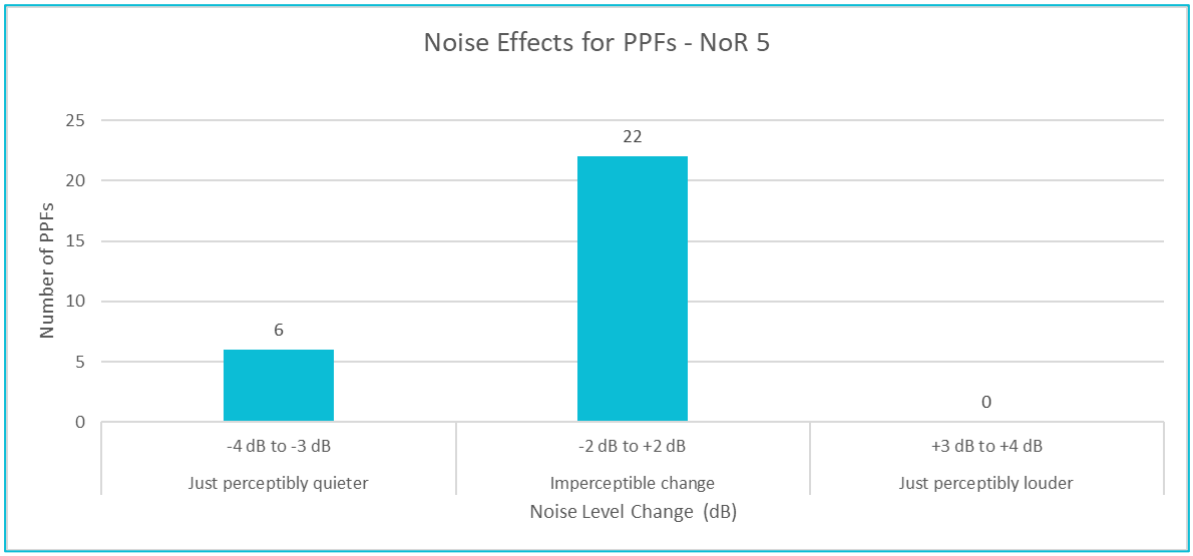


**Figure 6-11: Change in noise level – NoR 5 Altered roads**

### 6.5.2.2 New Road

PPFs in this NoR are not currently exposed to high levels of traffic noise. This means that the introduction of a new road in the area would lead to noticeable noise level increases. When comparing the Existing and Do-minimum scenarios, the introduction of a new noise source would result in noticeably louder traffic noise at two PPFs and approximately a doubling in traffic noise at two other PPFs in this NoR.

Figure 6-12 shows the distribution of the noise level changes when comparing the Existing and Do-minimum scenarios.

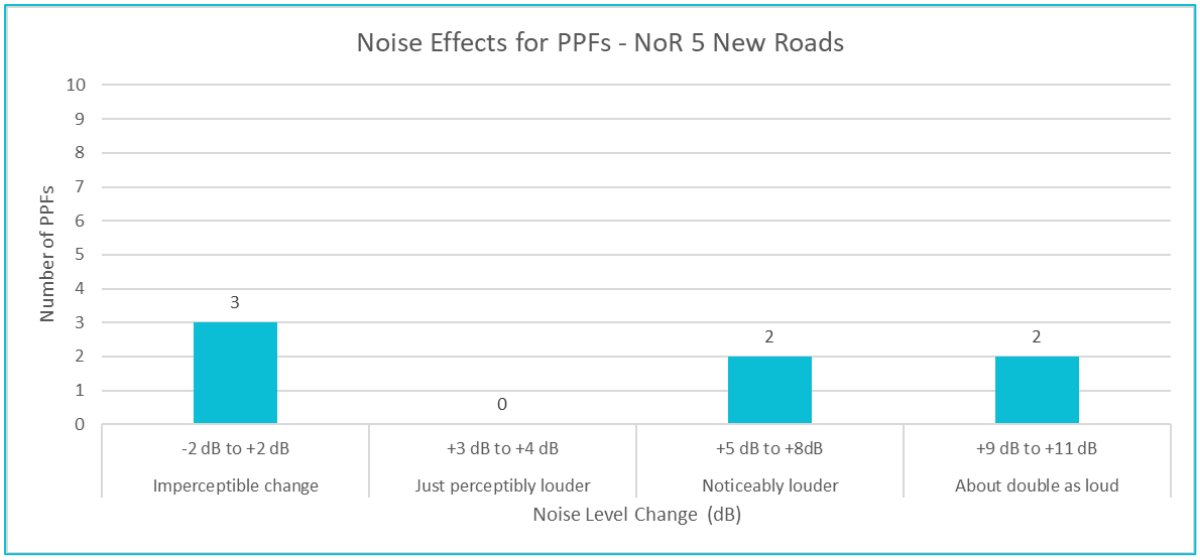


**Figure 6-12: Change in noise level – NoR 5 New roads**

### 6.5.3 Summary

PPFs assessed for NoR 5 have been assessed against the New and Altered roads criteria under NZS 6806. The altered road section does not meet the definition of an Altered road under NZS 6806, therefore mitigation does not need to be considered further under the Standard. All PPFs in the New road section of this NoR meet the Category A noise criterion, therefore mitigation does not need to be considered further under the standard.

With other roads in the vicinity (including other NoRs of the Pukekohe Projects) noise levels are predicted to remain similar or reduce at most PPFs. Noise level increases are predicted at four of the New road PPFs due to the introduction of a new noise source in the area.

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a character change of the area.

Some PPFs may not exist anymore at the time of road construction particularly given NoR 5 is within the FUZ signalling future urban development. Therefore, the predicted effects may not be experienced by current residents.

## 6.6 NoR 6 – Pukekohe South-West Upgrade

The Pukekohe South West Upgrade is for walking and cycling upgrades. This can generally occur within the existing road reserve at a number of roads. Some areas outside of the existing road reserve are proposed to be designated around some existing intersections to provide for the active mode facilities and some driveways where regrading is required. However, the upgrade does not require any changes to the horizontal or vertical alignments of any roads. This NoR is not predicted to bring about any changes to traffic noise generated on the sections of roads that are proposed to be designated, therefore, traffic noise has not been assessed for this NoR. Active mode transport, i.e. walking and cycling, does not generate noise levels high enough to affect the ambient noise environment, particularly where the facilities are adjacent to busy roads.

## 6.7 NoR 7 – Pukekohe North-West Arterial

The Pukekohe North West Arterial NoR 7 is a connection between SH22 and Helvetia Road. The assessment areas for NoR 7 and NoR 4 overlap where they intersect at SH22.

We note that all of the roads in this NoR have been assumed to be surfaced with asphaltic concrete (which is a good low noise road surface) in the Do-minimum scenario. This means that the main noise mitigation measure is already implemented with the Do-minimum scenario, limiting the requirement for further noise mitigation through noise barriers or building modification mitigation.

### 6.7.1 NZS 6806 Assessment

NoR 7 falls within both urban and rural areas (as defined by Stats NZ), therefore for some sections PPFs within 100m of the road edge were assessed, and for other sections PPFs within 200m of the road edge were assessed. Figure 6-13 shows the urban (green) and rural (orange) areas as well as the PPFs assessed against Altered (blue) and New (yellow) roads criteria, along with the assessment area used.

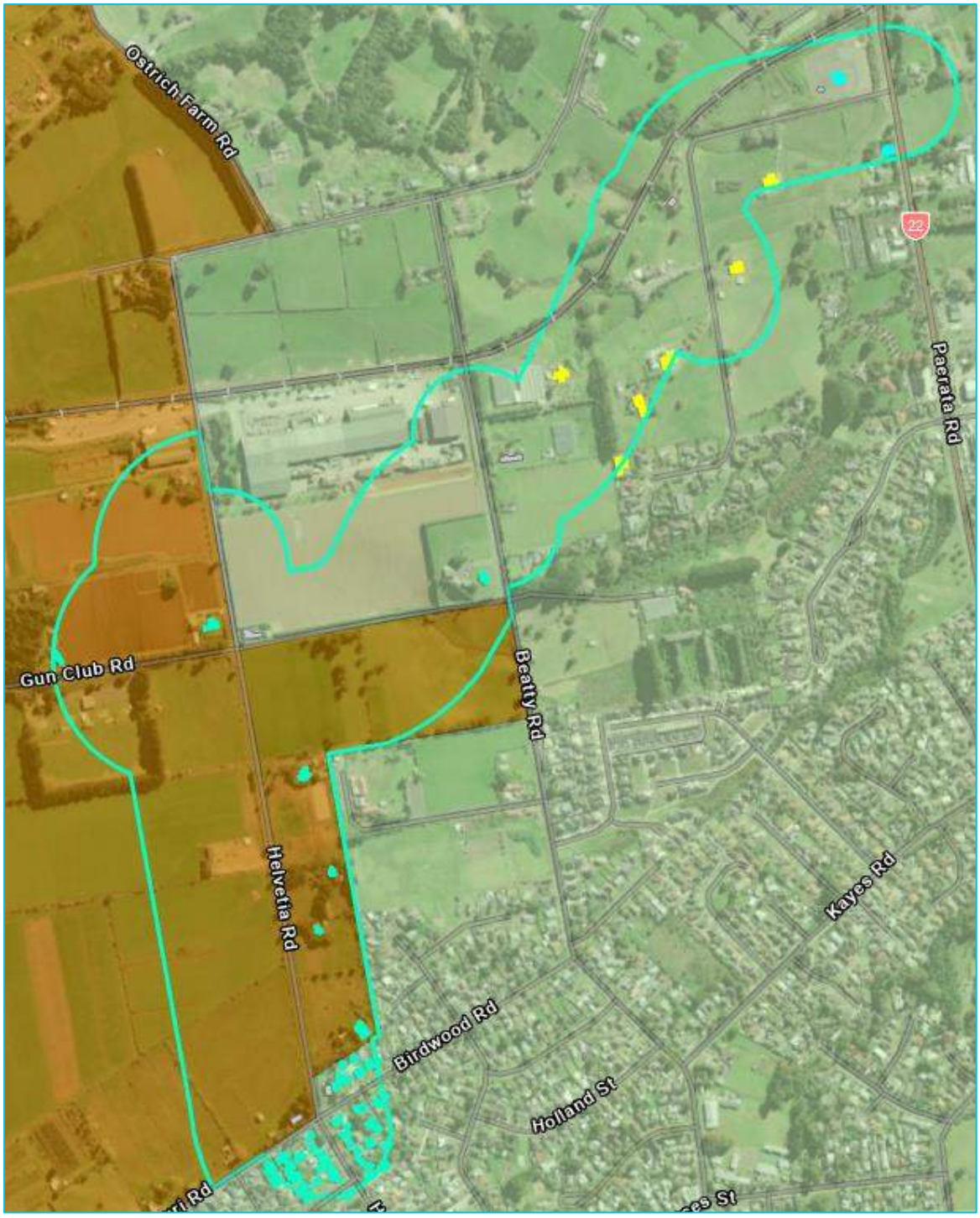


**Figure 6-13 Urban and rural areas – NoR 7**

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

There are a total of 51 PPFs that have been assessed for this NoR, of which six have been assessed against the New road criteria and 45 against the Altered road criteria.

#### 6.7.1.1 Altered Road

PPFs within 100 m of existing roads have been assessed against the Altered roads criteria (refer Section 3.1.2). As discussed, the assessment in accordance with NZS 6806 is undertaken based only on the Project roads, excluding local roads in the area.

Currently, almost all PPFs receive noise levels within Category A. One PPF receive noise levels within Category B, This is due to the relatively low traffic flows in the surrounding road network.

The traffic volumes in the Do-nothing scenario are predicted to increase compared to the existing scenario, resulting in an average 3 decibel noise level increase for most PPFs.

With the construction of the Project, and considering only NoR 7 Project roads without surrounding roads, all PPFs fall within Category A without mitigation. This is due to a number of factors including redistribution of traffic through the surrounding road network, reduction of speed limits around surrounding roads, and implementation of low-noise road surfaces (asphaltic concrete). Therefore, the road does not meet the definition of an Altered road under NZS 6806, meaning that the Standard does not apply, and mitigation options do not need to be considered under the Standard.

Note that some PPFs may not exist anymore at the time of construction of the Project.

A summary of the results of the noise predictions is presented in Table 6-9.

**Table 6-9 Summary of NZS 6806 assessment – NoR 7, Altered roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 45 | 1 | 0 |
| Do-nothing | 45 | 0 | 1 |
| Do-minimum | 46 | 0 | 0 |

#### 6.7.1.2 New Road

Where NoR 7 diverges form existing roads and traverses green field areas, the New road criteria have been used to assess noise levels. Here, the Existing (from existing local roads) and Do-minimum scenarios (NoR 7 roads only) are compared.

Noise levels range from 49 to 55 dB $L_{Aeq(24h)}$ in the Do-minimum scenario without mitigation. No mitigation for the New roads section of NoR 7 is required.

A summary of the results of the noise predictions is presented in Table 6-10.

**Table 6-10 Summary of NZS 6806 assessment – NoR 7, New roads**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 6 | 0 | 0 |
| Do-minimum | 6 | 0 | 0 |

## 6.7.2 Change in noise level

### 6.7.2.1 Altered Road

Noise effects can be described based on the change in noise level with and without the Project by comparing the Do-nothing and the Do-minimum scenarios.

The Projects are predicted to have similar or reduced traffic flows along Beatty Road, Gun Club Road and Butcher Road. However, the introduction of a new noise source (the new north-west arterial) into a currently low noise environment is predicted to result in a change in noise level for some PPFs. These factors together will lead to noise level reductions or imperceptible noise level changes at some PPFs, and noise level increases at other PPFs.

We note that the Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which will result in a character change of the area.

Figure 6-14 shows the distribution of the noise level changes when comparing the Do-nothing and Do-minimum scenarios.

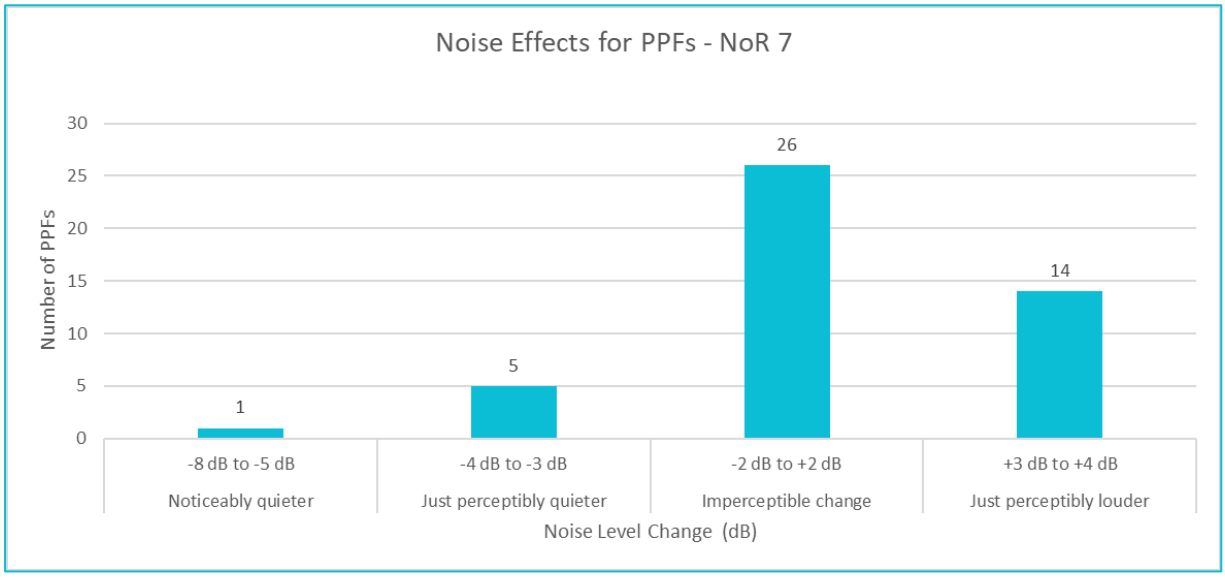


**Figure 6-14: Change in noise level – NoR 7 Altered roads**

### 6.7.2.2 New Road

PPFs in this NoR are not currently exposed to high levels of traffic noise. This means that introduction of a new road in the area leads to noise level increases. When comparing the Existing and Do-minimum scenarios, the introduction of a new noise source is predicted to produce a doubling or greater in perceived traffic noise at three PPFs in this NoR, and a noticeable increase in noise levels at another three PPFs.

We note that the Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which will result in a character change of the area.

Figure 6-15 shows the distribution of the noise level changes when comparing the Existing and Do-minimum scenarios.

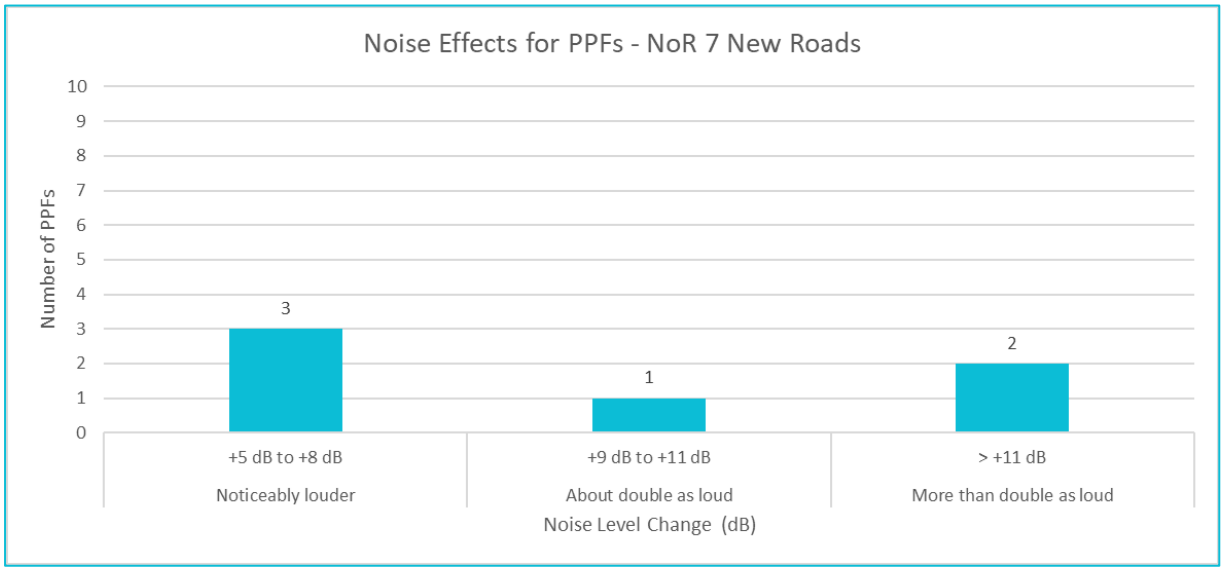


**Figure 6-15: Change in noise level – NoR 7 New roads**

### 6.7.3 Summary

PPFs assessed for NoR 7 have been assessed against the New and Altered roads criteria under NZS 6806. The altered roads section does not meet the definition of an Altered road under NZS 6806, therefore mitigation does not need to be considered further under the Standard. All PPFs in the New section of road meet the Category A noise criterion, therefore mitigation does not need to be considered further for the New road section under the Standard.

With other roads in the vicinity (including other NoRs of the Pukekohe Project), noise levels are predicted to remain similar or increase slightly for some PPFs for Altered roads, and to increase for all PPFs for New roads.

The Project (and neighbouring NoRs) will change the noise environment for the wider area. This would occur in conjunction with the development of the FUZ, which in itself will result in a character change of the area.

Some PPFs may not exist anymore at the time of road construction particularly given NoR 7 is within the FUZ signalling future urban development. Therefore, the predicted effects may not be experienced by current residents.

## 6.8 NoR 8 – Mill Road and Pukekohe East Road Upgrade

NoR 8 (AC and WDC) provides for the widening of approximately 2km of Mill Road from SH1 (at the Bombay Interchange) at its eastern extent to Harrisville Road. Beyond the first 2km widening, only walking and cycling facilities are proposed on the southern side of the existing road (Pukekohe East Road). These active mode facilities do not generate traffic noise and have therefore not been assessed in this report.

All PPFs in the vicinity of NoR 8 have been assessed against the Altered road criteria, given that the existing road is being upgraded. The road straddles the boundary between the Waikato District to the south and Auckland to the north. No significant changes are anticipated in the land use surrounding the road upgrade section of NoR 8 as the zoning is Rural.

The current road surface on Mill Road is chip seal. We have assumed that this road surface would be maintained in the future if the Project does not go ahead, i.e. the existing and Do-nothing situations assume chip seal. However, with the Project in place, we have assumed the use of PA10 30mm (a porous asphalt surface). This will result in a noticeable noise level reduction for the Do-minimum scenario.

### 6.8.1 NZS 6806 Assessment

Mill Road is a current relatively busy arterial road. Intermittent houses are at varying distances from the road, with 22 PPFs identified for assessment. Existing noise levels are generally in the 50 to 60 dB $L_{Aeq(24h)}$ band, with only three PPFs predicted to receive noise levels in Categories B and C. With the projected traffic volume increase to the design year, for the Do-nothing scenario, the number of PPFs receiving noise levels in Categories B and C increases to 5 and 2 PPFs respectively.

The use of low noise road surface results in a reduction in noise level, with only 4 PPFs receiving noise levels above Category A. We tested possible mitigation options, e.g. the use of barriers, at four PPFs (87, 90 and 203 Mill Road). With barriers, two PPFs are predicted to receive noise levels in Category B.

Before construction commences, the BPO mitigation beyond the use of low noise road surface at PPFs identified as requiring mitigation will be carried out. This BPO mitigation will need to meet the noise criteria categories as set out in Appendix **Error! Reference source not found.**.

The PPFs assessed are summarised in Table 6-11, and figures showing the location of the PPFs are included in Appendix 0.

**Table 6-11: Summary of NZS 6806 assessment – NoR 8**

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Existing | 19 | 2 | 1 |
| Do-nothing | 15 | 5 | 2 |
| Do-minimum | 18 | 3 | 1 |

| Scenario | Number of PPFs | | |
|---|---|---|---|
| | NZS 6806 Categories | | |
| | Category A | Category B | Category C |
| Mitigation Option – 2m barriers | 20 | 2 | 0 |

### 6.8.2 Change in noise level

Noise effects can be described based on the change in noise level with and without the Project. For PPFs assessed against the Altered road criteria, the Do-nothing and Do-minimum scenarios are compared. Where mitigation in the form of barriers has been tested, the mitigation option is also included in the future assessment. Note that any mitigation beyond the use of low noise road surface will be determined at the time of detailed design when the BPO is developed.

We predict an average noise level increase from the existing to Do-nothing scenario of less than 2 dB. With the Project (and the low noise road surface) in place, noise levels are predicted to generally reduce across the alignment. Where the widening brings the road closer to PPFs (particularly at the new roundabout beside 182 Mill Road), noise levels may increase up to 5 dB.

If barriers were chosen in the future to represent the BPO mitigation, all but two PPFs would receive the same or lower noise levels.

Figure 6-4 shows the PPFs assessed in each of the change in noise level bands discussed in Table 3-2. This shows clearly that noise levels will reduce with the Project in place. This comparison includes traffic on existing local roads as they will affect the noise environment and are therefore important when assessing potential noise level changes in the area.

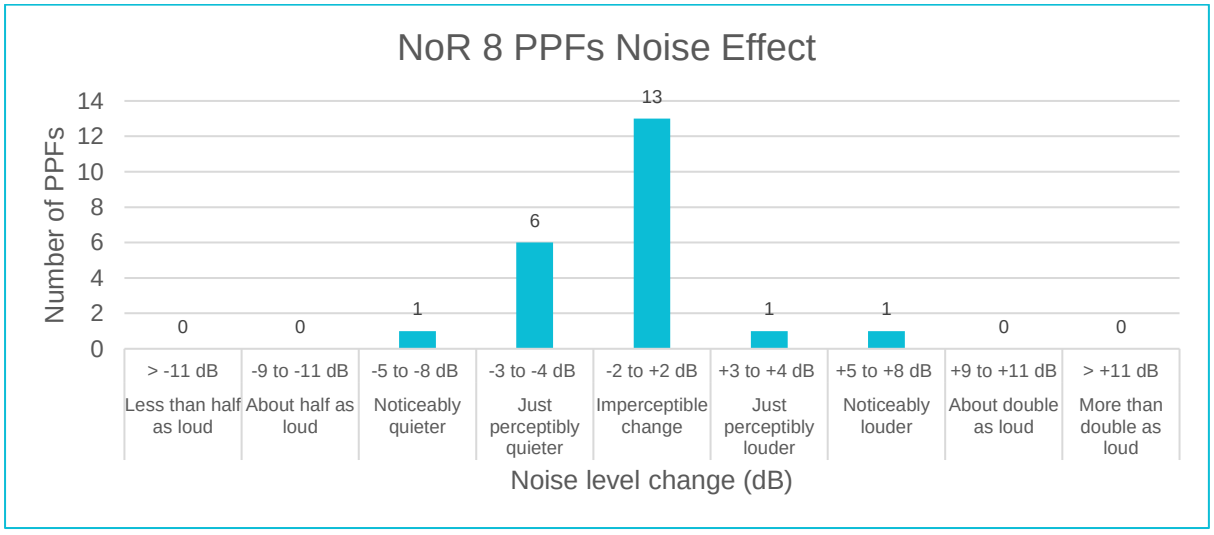


**Figure 6-16: Change in noise level – Altered Road**

### 6.8.3 Summary

The proposed upgrade to Mill Road will have a limited effect on the environment. The existing road is a relatively busy road in a rural environment that controls the existing noise environment. The road

runs along the boundary between Auckland and the Waikato District, with the widening proposed towards the south, generally into Waikato District.

The Project is an Altered road. The proposed upgrade in road surface for the widened road results in an improvement in noise environment for existing PPFs, with most PPFs receiving noise levels in Category A. One PPF[8] is predicted to receive noise levels in Category C with the Project in place without mitigation. With mitigation, all PPFs are predicted to receive noise levels in Categories A and (for two PPFs) B. The BPO mitigation beyond the use of low noise road surface will be determined at the time of detailed design.

The Project is predicted to cause no change to the environment for more than half of the PPFs, and for seven PPFs, result in a perceptible to noticeable noise level reduction.

## 6.9 First year after opening

Low noise road surface will normally be laid within the first 12 months of opening of a road. This allows the road (particularly new roads) to settle so that the low noise road surface does not crack or warp. This means that for the first few months after opening, a noisier road surface is laid, such as chip seal.

The difference in noise level between AC or OGPA and chip seal ranges from 4 to 6 dB. However, traffic volumes at the opening year will also be lower than in the design year of 2048, and have been assumed to reduce design year noise levels by about 2 dB. Therefore, the noise levels in the opening year would be between 2 and 4 dB higher than those predicted in Appendix A.

This would result in a small number of PPFs receiving noise levels in the next higher category (e.g. Category B instead of Category A, or Category C instead of Category B, but at the lowest end up to 68 dB $L_{Aeq(24h)}$). This would only occur if the PPFs still exist when the Projects are being opened, which in some instances may not be the case given the proposed intensification of surrounding land.

The effect will be temporary and will likely only affect new roads rather than existing to be widened roads. Any management of the additional noise effects will be determined at the time of detailed design.

8 311 Pukekohe East Road

# 7 Conclusion

We have assessed operational traffic noise for all NoRs within the Pukekohe Transport Network. There are 8 NoRs, all involving new road designations: two by Waka Kotahi and six by Auckland Transport. All NoRs have been assessed against NZS 6806 and in relation to the change in noise level. Only PPFs in NoRs 2 and 8 require noise mitigation beyond the use of low noise road surface, as all PPFs affected by the other NoRs are predicted to receive noise levels in Category A. Potential mitigation may take the form of roadside barriers or boundary fences. Those PPFs that are identified as requiring mitigation will be reassessed at the detailed design stage to determine which mitigation represents the BPO.

NoR 6 and half of NoR 8 involve active mode upgrades of existing roads only, which does not cause elevated noise levels. Therefore, no PPFs were assessed adjacent to the active mode upgrades.

Of the remaining NoRs, NoR 1 and 8 have been assessed against the Altered road criteria of NZS 6806 as the works only involve upgrades to existing roads.

NoRs 2, 4, 5 and 7 consist of both New and Altered roads. NoR 3 is assessed as a New road only.

Some PPFs, particularly those assessed against the New road criteria, are predicted to receive noise level increases, though for the majority, the resultant noise levels will remain in Category A.

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

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SUPPORTING GROWTH

# Appendix A

## Predicted noise levels for all PPFs

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

# NoR 1 – Drury West Arterial

**PPFs assessed against the Altered Road criteria**

| PPF Address | Existing scenario dB $L_{Aeq(24h)}$ | Do-nothing scenario dB $L_{Aeq(24h)}$ | Do-minimum scenario dB $L_{Aeq(24h)}$ |
|---|---|---|---|
| 598 Burtt Road, Runciman | 60 | 67 | 51 |
| 775 Runciman Road, Runciman | 58 | 63 | 41 |
| 801 Runciman Road, Runciman | 46 | 50 | 46 |
| 588 Burtt Road, Runciman | 54 | 63 | 52 |
| 813 Runciman Road, Runciman | 58 | 60 | 53 |
| 815 Runciman Road, Runciman | 48 | 52 | 48 |
| 110 Karaka Road, Karaka | 56 | 57 | 58 |
| 160 Karaka Road, Karaka | 59 | 60 | 50 |
| 612 Burtt Road, Runciman | 51 | 60 | 42 |
| 834 Runciman Road, Runciman | 55 | 59 | 46 |
| 826 Runciman Road, Runciman | 54 | 58 | 47 |
| 5 Ngakoroa Road, Runciman | 52 | 55 | 47 |
| 576 Burtt Road, Runciman | 46 | 55 | 44 |

# NoR 2 – Drury to Pukekohe Link

**PPFs assessed against New Road criteria**

| PPF Address | Existing scenario dB $L_{Aeq(24h)}$ | Do-minimum scenario dB $L_{Aeq(24h)}$ | Mitigation option dB $L_{Aeq(24h)}$ |
|---|---|---|---|
| 336 Burtt Road | 46 | 53 | 53 |
| 338 Burtt Road | 49 | 53 | 53 |
| 397 Burtt Road | 62 | 60 | 60 |
| 419 Burtt Road | 45 | 49 | 49 |
| 430 Burtt Road | 40 | 55 | 55 |
| 393A Burtt Road | 39 | 53 | 53 |
| 393B Burtt Road (1) | 45 | 55 | 55 |
| 393B Burtt Road (2) | 43 | 48 | 48 |
| 393C Burtt Road | 41 | 47 | 47 |
| 276 Cape Hill Road | 45 | 53 | 53 |
| 278 Cape Hill Road | 47 | 53 | 53 |
| 287 Cape Hill Road | 49 | 54 | 54 |
| 290 Cape Hill Road | 48 | 54 | 54 |
| 334 Cape Hill Road | 60 | 62 | 62 |
| 1222 Great South Road | 40 | 54 | 54 |
| 1233 Great South Road | 35 | 42 | 42 |
| 1236 Great South Road | 38 | 59 | 59 |
| 1246 Great South Road | 43 | 56 | 56 |
| 1255 Great South Road (1) | 42 | 46 | 46 |
| 1255 Great South Road (2) | 39 | 47 | 47 |
| 5 Ngakoroa Road | 48 | 56 | 56 |
| 21A Ngakoroa Road | 43 | 57 | 57 |
| 744 Runciman Road | 58 | 64 | 64 |
| 761 Runciman Road | 45 | 56 | 56 |
| 765 Runciman Road (1) | 41 | 56 | 56 |
| 765 Runciman Road (2) | 38 | 56 | 56 |
| 765 Runciman Road (3) | 38 | 56 | 56 |
| 767 Runciman Road | 35 | 60 | 60 |
| 775 Runciman Road | 49 | 58 | 58 |
| 815 Runciman Road | 46 | 50 | 50 |
| 826 Runciman Road | 42 | 52 | 52 |
| 763A Runciman Road | 36 | 54 | 54 |
| 763B Runciman Road | 35 | 57 | 57 |
| 763C Runciman Road | 34 | 54 | 54 |

| PPF Address | Existing scenario dB $L_{Aeq(24h)}$ | Do-minimum scenario dB $L_{Aeq(24h)}$ | Mitigation option dB $L_{Aeq(24h)}$ |
|---|---|---|---|
| 12 Sim Road | 50 | 61 | 61 |
| 31 Sim Road | 45 | 56 | 56 |
| 54 Sim Road | 44 | 62 | 62 |
| 60 Sim Road | 44 | 61 | 61 |
| 68 Sim Road | 40 | 51 | 51 |
| 72 Sim Road | 42 | 58 | 56 |
| 83 Sim Road | 37 | 54 | 54 |
| 90 Sim Road | 36 | 54 | 54 |
| 94 Sim Road | 37 | 51 | 51 |
| 108 Sim Road | 36 | 44 | 44 |
| 109 Sim Road | 34 | 48 | 48 |
| 111 Sim Road | 31 | 50 | 50 |
| 328 Sim Road | 33 | 53 | 53 |
| 393 Sim Road | 46 | 62 | 62 |
| 401 Sim Road | 45 | 60 | 60 |
| 447 Sim Road | 38 | 56 | 56 |
| 465 Sim Road | 43 | 61 | 61 |
| 469 Sim Road | 44 | 61 | 61 |
| 479 Sim Road | 37 | 53 | 53 |
| 481 Sim Road | 42 | 60 | 60 |
| 491 Sim Road | 46 | 64 | 64 |
| 109C Sim Road | 33 | 46 | 46 |
| 111A Sim Road | 32 | 47 | 47 |
| 64 Tuhimata Road | 42 | 54 | 54 |
| 143 Tuhimata Road | 40 | 51 | 51 |

**PPFs assessed against Altered Road criteria**

| PPF Address | Existing scenario dB $L_{Aeq(24h)}$ | Do-nothing scenario dB $L_{Aeq(24h)}$ | Do-minimum scenario dB $L_{Aeq(24h)}$ |
|---|---|---|---|
| 494 Karaka Road | 47 | 50 | 49 |
| 501 Karaka Road | 49 | 51 | 51 |
| 539 Karaka Road | 53 | 55 | 60 |
| 540 Karaka Road | 51 | 52 | 56 |
| 12 Sim Road | 62 | 63 | 64 |

# NoR 3 – Paerata Connections

**PPFs assessed against the New Road criteria**

| PPF Address | Existing scenario<br>dB $L_{Aeq(24h)}$ | Do-minimum scenario<br>dB $L_{Aeq(24h)}$ |
|---|---|---|
| 328 Sim Road, Paerata | 48 | 46 |
| 393 Sim Road, Paerata | 53 | 33 |

# NoR 4 – Pukekohe North-East Arterial

**PPFs assessed against the Altered Road criteria**

| PPF Address | Existing scenario | Do-nothing scenario | Do-minimum scenario |
|---|---|---|---|
| | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ |
| 240 Cape Hill Road, Pukekohe | 57 | 66 | 53 |
| 133 Pukekohe East Road, Pukekohe | 62 | 64 | 43 |
| 248 Cape Hill Road, Pukekohe | 55 | 64 | 53 |
| 230 Cape Hill Road, Pukekohe | 58 | 67 | 58 |
| 107 Pukekohe East Road, Pukekohe | 72 | 74 | 64 |
| 192 Cape Hill Road, Pukekohe | 54 | 62 | 50 |
| 235A Cape Hill Road, Pukekohe | 58 | 66 | 54 |
| 248A Cape Hill Road, Pukekohe | 50 | 58 | 51 |
| 100 Pukekohe East Road, Pukekohe | 68 | 70 | 59 |
| | | | |
| 112A Pukekohe East Road, Pukekohe | 64 | 66 | 53 |
| 10 Butcher Road, Pukekohe | 55 | 58 | 57 |
| 98B Pukekohe East Road, Pukekohe | 66 | 68 | 57 |
| 98A Pukekohe East Road, Pukekohe | 58 | 60 | 49 |
| 106 Pukekohe East Road, Pukekohe | 66 | 69 | 57 |
| 10 Stockmans Lane, Pukekohe | 54 | 57 | 41 |
| 129 Pukekohe East Road, Pukekohe | 71 | 73 | 64 |
| 1213 Paerata Road, Pukekohe | 54 | 57 | 54 |
| 1210 Paerata Road, Pukekohe | 65 | 68 | 60 |
| 1214 Paerata Road, Pukekohe | 62 | 65 | 56 |
| 1217 Paerata Road, Pukekohe | 65 | 68 | 58 |
| 1223 Paerata Road, Pukekohe | 54 | 56 | 46 |

**PPFs assessed against the New Road criteria**

| PPF Address | Existing scenario | Do-minimum scenario |
|---|---|---|
| | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ |
| 39 Grace James Road, Pukekohe | 30 | 51 |
| 43 Grace James Road, Pukekohe | 23 | 50 |

# NoR 5 – Pukekohe South-East Arterial

**PPFs assessed against the Altered Road criteria**

| PPF Address | Existing scenario | Do-nothing scenario | Do-minimum scenario |
|---|---|---|---|
| | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ |
| 1 Ambedkar Way, Pukekohe | 72 | 75 | 49 |
| 7 Ambedkar Way, Pukekohe | 71 | 75 | 60 |
| 12 Pukekohe East Road, Pukekohe | 69 | 72 | 62 |
| 18 Pukekohe East Road, Pukekohe | 68 | 71 | 56 |
| 3 Pukekohe East Road, Pukekohe | 67 | 71 | 63 |
| 16 Pukekohe East Road, Pukekohe | 67 | 71 | 57 |
| 6A Belgium Road, Pukekohe | 63 | 71 | 57 |
| 4B Belgium Road, Pukekohe | 63 | 71 | 59 |
| 12 Belgium Road, Pukekohe | 62 | 71 | 54 |
| 50 Pukekohe East Road, Pukekohe | 64 | 68 | 51 |
| 7A Pukekohe East Road, Pukekohe | 63 | 66 | 57 |
| 84 Golding Road, Pukekohe | 59 | 61 | 57 |
| 78 Golding Road, Pukekohe | 62 | 64 | 63 |
| 4 Belgium Road, Pukekohe | 55 | 62 | 61 |
| 9 Ambedkar Way, Pukekohe | 60 | 64 | 53 |
| 5 Ambedkar Way, Pukekohe | 59 | 63 | 41 |
| 103 Golding Road, Pukekohe | 50 | 52 | 49 |
| 8 Belgium Road, Pukekohe | 57 | 62 | 63 |
| 52 Golding Road, Pukekohe | 61 | 63 | 59 |
| 12 Ambedkar Way, Pukekohe | 57 | 60 | 53 |
| 6 Ambedkar Way, Pukekohe | 56 | 60 | 44 |
| 49 Golding Road, Pukekohe | 56 | 58 | 57 |
| 26 Golding Road, Pukekohe | 57 | 59 | 55 |
| 8 Ambedkar Way, Pukekohe | 53 | 57 | 45 |
| 10 Belgium Road, Pukekohe | 51 | 56 | 53 |
| 47 Golding Road, Pukekohe | 53 | 55 | 52 |
| 10 Ambedkar Way, Pukekohe | 52 | 56 | 45 |
| 14 Ambedkar Way, Pukekohe | 51 | 55 | 49 |

**PPFs assessed against the New Road criteria**

| PPF Address | Existing scenario | Do-minimum scenario |
|---|---|---|
| | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ |
| 124 Station Road, Pukekohe | 43 | 42 |
| 120 Station Road, Pukekohe | 41 | 47 |
| 43A Youngs Grove, Pukekohe | 37 | 45 |
| 43 Youngs Grove, Pukekohe | 37 | 47 |
| 27C Royal Doulton Drive, Pukekohe | 40 | 46 |
| 110 Golding Road, Pukekohe | 50 | 45 |
| 108A Golding Road, Pukekohe | 50 | 48 |

# NoR 7 – Pukekohe North-West Arterial

**PPFs assessed against the Altered Road criteria**

| PPF Address | Existing scenario | Do-nothing scenario | Do-minimum scenario |
|---|---|---|---|
| | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ |
| 107 Helvetia Road, Pukekohe | 61 | 63 | 62 |
| 1210 Paerata Road, Pukekohe | 65 | 68 | 50 |
| 95 Helvetia Road, Pukekohe | 61 | 62 | 47 |
| 128 Helvetia Road, Pukekohe | 61 | 63 | 62 |
| 122 Helvetia Road, Pukekohe | 61 | 62 | 55 |
| 118 Helvetia Road, Pukekohe | 60 | 61 | 52 |
| 120 Helvetia Road, Pukekohe | 60 | 61 | 54 |
| 124 Helvetia Road, Pukekohe | 60 | 62 | 56 |
| 99A Helvetia Road, Pukekohe | 60 | 60 | 49 |
| 222 Heights Road, Pukekohe | 61 | 64 | 63 |
| 101 Helvetia Road, Pukekohe | 58 | 59 | 50 |
| 103 Helvetia Road, Pukekohe | 59 | 60 | 52 |
| 105 Helvetia Road, Pukekohe | 59 | 60 | 55 |
| 97 Helvetia Road, Pukekohe | 58 | 59 | 44 |
| 126 Helvetia Road, Pukekohe | 58 | 60 | 57 |
| 4 Birdwood Road, Pukekohe | 56 | 61 | 60 |
| 10 Butcher Road, Pukekohe | 55 | 58 | 56 |
| 116 Helvetia Road, Pukekohe | 54 | 55 | 39 |
| 34 Gun Club Road, Pukekohe | 56 | 59 | 50 |
| 10 Kauri Road, Pukekohe | 55 | 58 | 51 |
| 106 Beatty Road, Pukekohe | 55 | 58 | 52 |
| 270 Helvetia Road, Pukekohe | 56 | 61 | 58 |
| 6A Birdwood Road, Pukekohe | 56 | 61 | 58 |
| 256 Helvetia Road, Pukekohe | 56 | 60 | 57 |
| 248 Helvetia Road, Pukekohe | 57 | 62 | 57 |
| 3B Birdwood Road, Pukekohe | 54 | 58 | 50 |
| 3A Birdwood Road, Pukekohe | 53 | 57 | 48 |
| 7 Birdwood Road, Pukekohe | 53 | 56 | 46 |
| 8 Birdwood Road, Pukekohe | 53 | 56 | 48 |
| 6 Birdwood Road, Pukekohe | 52 | 55 | 49 |
| 12 Birdwood Road, Pukekohe | 52 | 55 | 44 |
| 10 Birdwood Road, Pukekohe | 51 | 54 | 44 |
| 24 Kauri Road, Pukekohe | 52 | 55 | 48 |
| 126A Helvetia Road, Pukekohe | 49 | 52 | 50 |
| 222 Helvetia Road, Pukekohe | 52 | 57 | 54 |

| PPF Address | Existing scenario | Do-nothing scenario | Do-minimum scenario |
|---|---|---|---|
| | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ |
| 8A Birdwood Road, Pukekohe | 52 | 56 | 53 |
| 12 Kauri Road, Pukekohe | 47 | 51 | 49 |
| 120A Helvetia Road, Pukekohe | 46 | 46 | 40 |
| 5A Birdwood Road, Pukekohe | 46 | 50 | 45 |
| 101A Helvetia Road, Pukekohe | 46 | 48 | 43 |
| 6 Wairua Place, Pukekohe | 45 | 46 | 39 |
| 99B Helvetia Road, Pukekohe | 45 | 47 | 42 |
| 5 Birdwood Road, Pukekohe | 44 | 47 | 42 |
| 14 Kauri Road, Pukekohe | 44 | 46 | 41 |
| 16 Kauri Road, Pukekohe | 43 | 45 | 40 |
| 22 Kauri Road, Pukekohe | 43 | 46 | 39 |

**PPFs assessed against the New Road criteria**

| PPF Address | Existing scenario | Do-nothing scenario | Do-minimum scenario |
|---|---|---|---|
| | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ | dB $L_{Aeq(24h)}$ |
| 114 Butcher Road, Pukekohe | 44 | 46 | 49 |
| 157A Beatty Road, Pukekohe | 47 | 47 | 55 |
| 64 Butcher Road, Pukekohe | 45 | 48 | 52 |
| 62 Butcher Road, Pukekohe | 46 | 48 | 52 |
| 57 Butcher Road, Pukekohe | 47 | 49 | 51 |
| 17 Butcher Road, Pukekohe | 47 | 50 | 51 |

# NoR 8 (AC) – Mill Road and Pukekohe East Road Upgrade

**PPFs assessed against Altered Road criteria**

| PPF Address | Existing situation<br>dB $L_{Aeq(24h)}$ | Do-nothing situation<br>dB $L_{Aeq(24h)}$ | Do-minimum situation<br>dB $L_{Aeq(24h)}$ | Mitigation option<br>dB $L_{Aeq(24h)}$ |
|---|---|---|---|---|
| 1 Jericho Road | 54 | 55 | 50 | 50 |
| 3 Mill Road | 57 | 58 | 48 | 48 |
| 5 Mill Road (1) | 63 | 65 | 60 | 60 |
| 5 Mill Road (2) | 63 | 65 | 60 | 60 |
| 11 Mill Road | 55 | 57 | 50 | 50 |
| 15 Mill Road | 57 | 59 | 54 | 54 |
| 64 Mill Road | 64 | 66 | 62 | 62 |
| 80 Mill Road | 60 | 62 | 57 | 57 |
| 87 Mill Road | 67 | 68 | 66 | 63 |
| 90 Mill Road | 68 | 70 | 65 | 64 |
| 93 Mill Road | 58 | 60 | 59 | 59 |
| 104 Mill Road | 53 | 55 | 53 | 53 |
| 105 Mill Road | 58 | 60 | 60 | 60 |
| 144 Mill Road | 60 | 62 | 63 | 63 |
| 168 Mill Road | 53 | 55 | 55 | 55 |
| 182 Mill Road | 58 | 60 | 65 | 65 |
| 203 Mill Road | 63 | 65 | 68 | 66 |
| 139A Mill Road | 54 | 56 | 57 | 57 |
| 165A Mill Road | 55 | 57 | 58 | 58 |
| 52A Mill Road | 59 | 60 | 56 | 56 |
| 311 Pukekohe East Road | 65 | 67 | 49 | 49 |
| 11 Turbott Road | 57 | 58 | 51 | 51 |

# NoR 8 (WDC) – Mill Road and Pukekohe East Road Upgrade

**PPFs assessed against Altered Road criteria**

| PPF Address | Existing situation<br>dB $L_{Aeq(24h)}$ | Do-nothing situation<br>dB $L_{Aeq(24h)}$ | Do-minimum situation<br>dB $L_{Aeq(24h)}$ | Mitigation option<br>dB $L_{Aeq(24h)}$ |
|---|---|---|---|---|
| 1 Jericho Road | 54 | 55 | 50 | 50 |
| 3 Mill Road | 57 | 58 | 48 | 48 |
| 5 Mill Road (1) | 63 | 65 | 60 | 60 |
| 5 Mill Road (2) | 63 | 65 | 60 | 60 |
| 11 Mill Road | 55 | 57 | 50 | 50 |
| 15 Mill Road | 57 | 59 | 54 | 54 |
| 64 Mill Road | 64 | 66 | 62 | 62 |
| 80 Mill Road | 60 | 62 | 57 | 57 |
| 87 Mill Road | 67 | 68 | 66 | 63 |
| 90 Mill Road | 68 | 70 | 65 | 64 |
| 93 Mill Road | 58 | 60 | 59 | 59 |
| 104 Mill Road | 53 | 55 | 53 | 53 |
| 105 Mill Road | 58 | 60 | 60 | 60 |
| 144 Mill Road | 60 | 62 | 63 | 63 |
| 139A Mill Road | 54 | 56 | 56 | 56 |
| 52A Mill Road | 59 | 60 | 56 | 56 |
| 311 Pukekohe East Road | 65 | 67 | 49 | 49 |
| 11 Turbott Road | 57 | 58 | 51 | 51 |

TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix B

## Noise level contours

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

# SGA PUKEHOHE

## Overview Map


## Map Legend

**Altered Road (dB $L_{Aeq(24h)}$)**

| | |
|---|---|
| < 64 | Category A |
| 64 - 67 | Category B |
| > 67 | Category C |

**New Road (dB $L_{Aeq(24h)}$)**

| | |
|---|---|
| < 57 | Category A |
| 57 - 64 | Category B |
| > 64 | Category C |

- Nor 8 Alignments
- Nor 2 Alignments
- NoiseWall

**Contours dB $L_{Aeq(24h)}$**

- 55
- 60
- 65
- 70

# NoR 1 – Drury West Arterial

ISO A3 297mm x 420mm


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www.aecom.com

Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Existing NoR 1
**PROJECT**
Supporting growth. Pukekohe
**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831
**DATE**
31/05/2023
**Sheet number**
1

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

| | | | |
|---|---|---|---|
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| Designed | VZ | Date | 31/05/2023 |
| Drawn | VZ | Date | 31/05/2023 |

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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Not PPFs

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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
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- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Not PPFs

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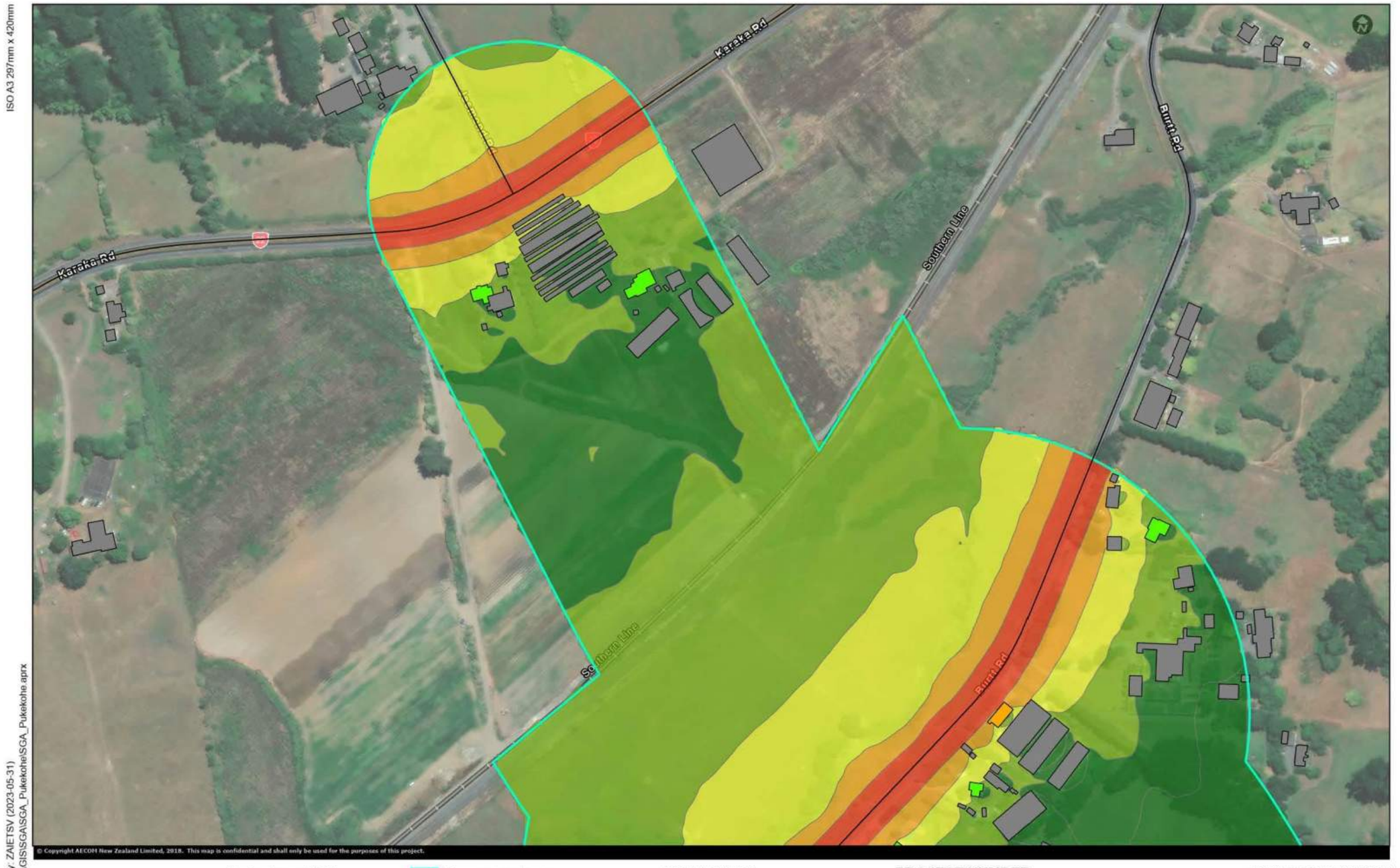


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- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Cat B
- Not PPFs

**SHEET TITLE**
Do-nothing NoR 1

**PROJECT**
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- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Cat B
- Not PPFs

**SHEET TITLE**
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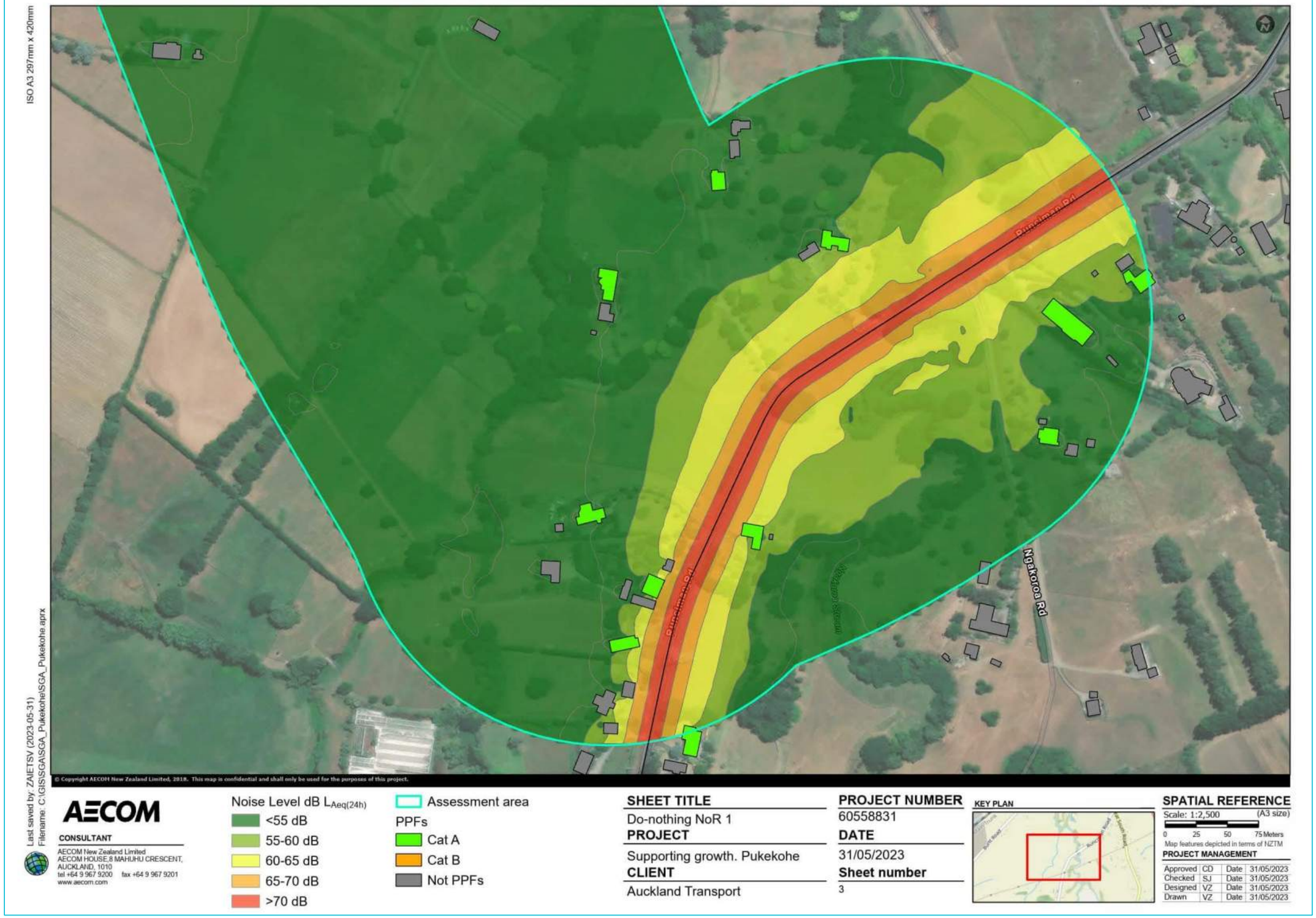
ISO A3 297mm x 420mm
Pukekohe Rd
Ngakoroa Rd
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Noise Level dB LAeq(24h)
<55 dB
55-60 dB
60-65 dB
65-70 dB
>70 dB
Assessment area
PPFs
Cat A
Cat B
Not PPFs
SHEET TITLE
Do-nothing NoR 1
PROJECT
Supporting growth. Pukekohe
CLIENT
Auckland Transport
PROJECT NUMBER
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DATE
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Sheet number
3
KEY PLAN
SPATIAL REFERENCE
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM
PROJECT MANAGEMENT
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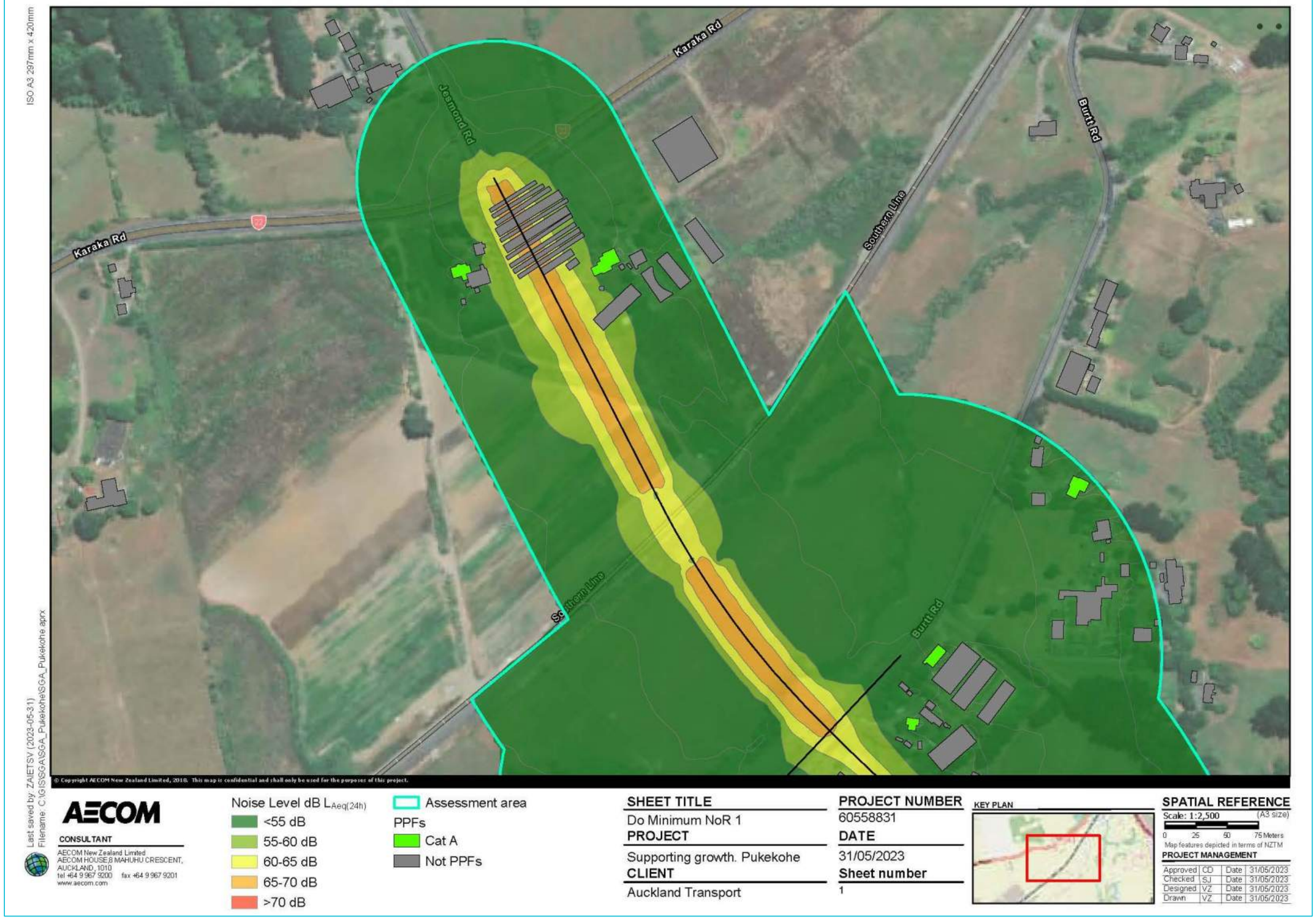
ISO A3 297mm x 420mm
Karaka Rd
Jesmond Rd
Karaka Rd
Southern Line
Burtt Rd
Southern Line
Burtt Rd
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Noise Level dB LAeq(24h)
<55 dB
55-60 dB
60-65 dB
65-70 dB
>70 dB
Assessment area
PPFs
Cat A
Not PPFs
SHEET TITLE
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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Do Minimum NoR 1

**PROJECT**
Supporting growth. Pukekohe

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Auckland Transport

**PROJECT NUMBER**
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KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

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Noise Level dB $L_{Aeq(24h)}$
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- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
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KEY PLAN

**SPATIAL REFERENCE**
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0 25 50 75 Meters
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| | | | |
|---|---|---|---|
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| Checked | SJ | Date | 31/05/2023 |
| Designed | VZ | Date | 31/05/2023 |
| Drawn | VZ | Date | 31/05/2023 |

## NoR 2 – Drury to Pukekohe Link

NOR2


NORTH ISLAND MAIN
393C
419
393A
393B
393B
430
397
Burtt Rd
338
Existing


NORTH ISLAND MAIN
Burtt Rd
Do-Nothing


NORTH ISLAND MAIN
Burtt Rd
Do-Minimum

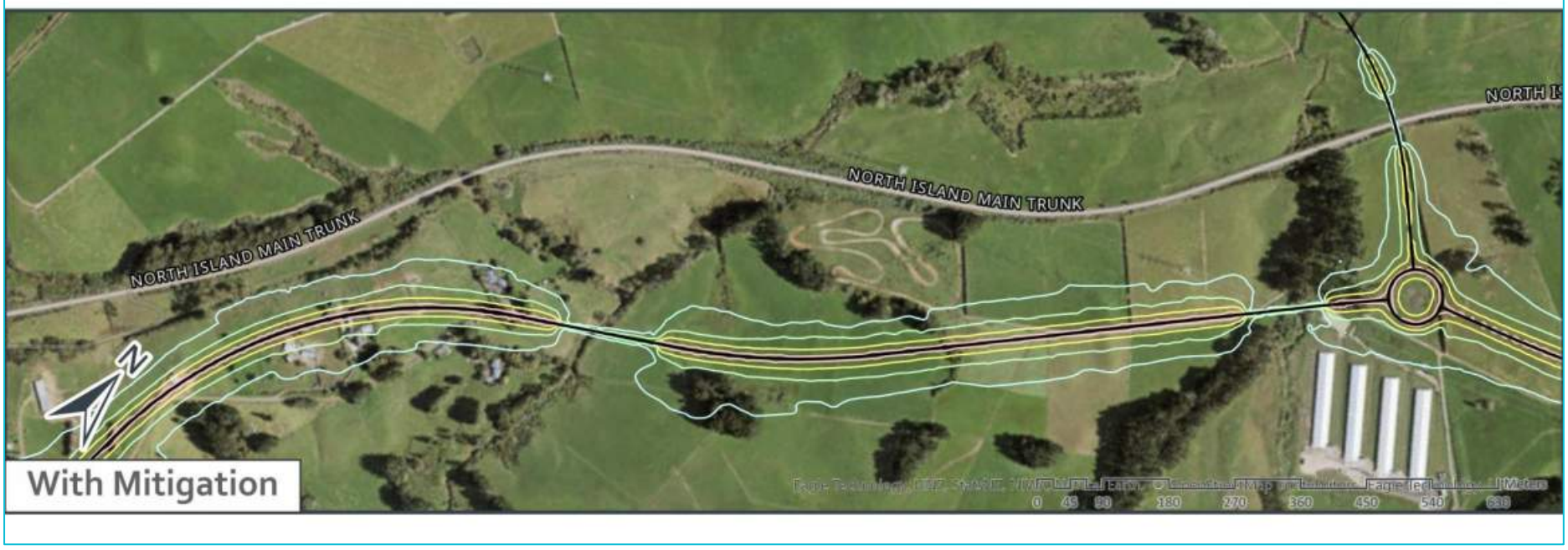

NORTH ISLAND MAIN
Burtt Rd
N
With Mitigation
0 45 90 180 270 360 450 540 630

NOR2


Existing


Do-Nothing


Do-Minimum




With Mitigation


NOR2
494
501
31
12
12
Sim Rd
54
60
72
68
90
83
111
111A
109
109C
94
108
540
539
Existing


Sim Rd
NORTH ISLAND MAIN TRUNK
Do-Nothing


Sim Rd
Do-Minimum


Sim Rd
N
With Mitigation
0
45
90
180
270
360
450
540
630
Meters


NOR2
Existing
Sim Rd
NORTH ISLAND MAIN TRUNK
401
393
328
447
465
Do-Nothing
Do-Minimum
With Mitigation
N
0 45 90 180 270 360 450 540 630 Meters


NOR2
Existing
Do-Nothing
Do-Minimum
With Mitigation
Tuhiim
Sim Rd
Cape Hill Rd
64
401
447
469
465
491
481
479
287
278
276
290
334
143
N
0
45
90
180
270
360
450
540
630
Meters

# NoR 3 – Paerata Connections


ISO A3 297mm x 420mm

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www.aecom.com

Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Existing NoR 3

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
4

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

| | | | |
|---|---|---|---|
| Approved | CD | Date | 31/05/2023 |
| Checked | SJ | Date | 31/05/2023 |
| Designed | VZ | Date | 31/05/2023 |
| Drawn | VZ | Date | 31/05/2023 |

ISO A3 297mm x 420mm




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- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Existing NoR 3

**PROJECT**
Supporting growth. Pukekohe

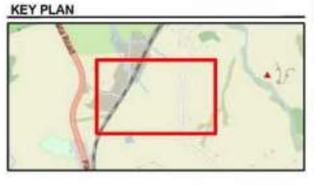
**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
5

KEY PLAN



**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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- Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Do-nothing NoR 3

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
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**DATE**
31/05/2023

**Sheet number**
4

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
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**SHEET TITLE**
Do-nothing NoR 3

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
5

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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ISO A3 297mm x 420mm
Southern Line
Sim Rd
Southern Line
Sim Rd
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Noise Level dB LAeq(24h)
<55 dB
55-60 dB
60-65 dB
65-70 dB
>70 dB
Assessment area
PPFs
Cat A
Not PPFs
SHEET TITLE
Do Minimum NoR 3
PROJECT
Supporting growth. Pukekohe
CLIENT
Auckland Transport
PROJECT NUMBER
60558831
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31/05/2023
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4
KEY PLAN
SPATIAL REFERENCE
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM
PROJECT MANAGEMENT
Approved CD Date 31/05/2023
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Designed VZ Date 31/05/2023
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ISO A3 297mm x 420mm
Southern Line
Sim Rd
Southern Line
Sim Rd
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PPFs
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SHEET TITLE
Do Minimum NoR 3
PROJECT
Supporting growth. Pukekohe
CLIENT
Auckland Transport
PROJECT NUMBER
60558831
DATE
31/05/2023
Sheet number
5
KEY PLAN
SPATIAL REFERENCE
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0 25 50 75 Meters
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PROJECT MANAGEMENT
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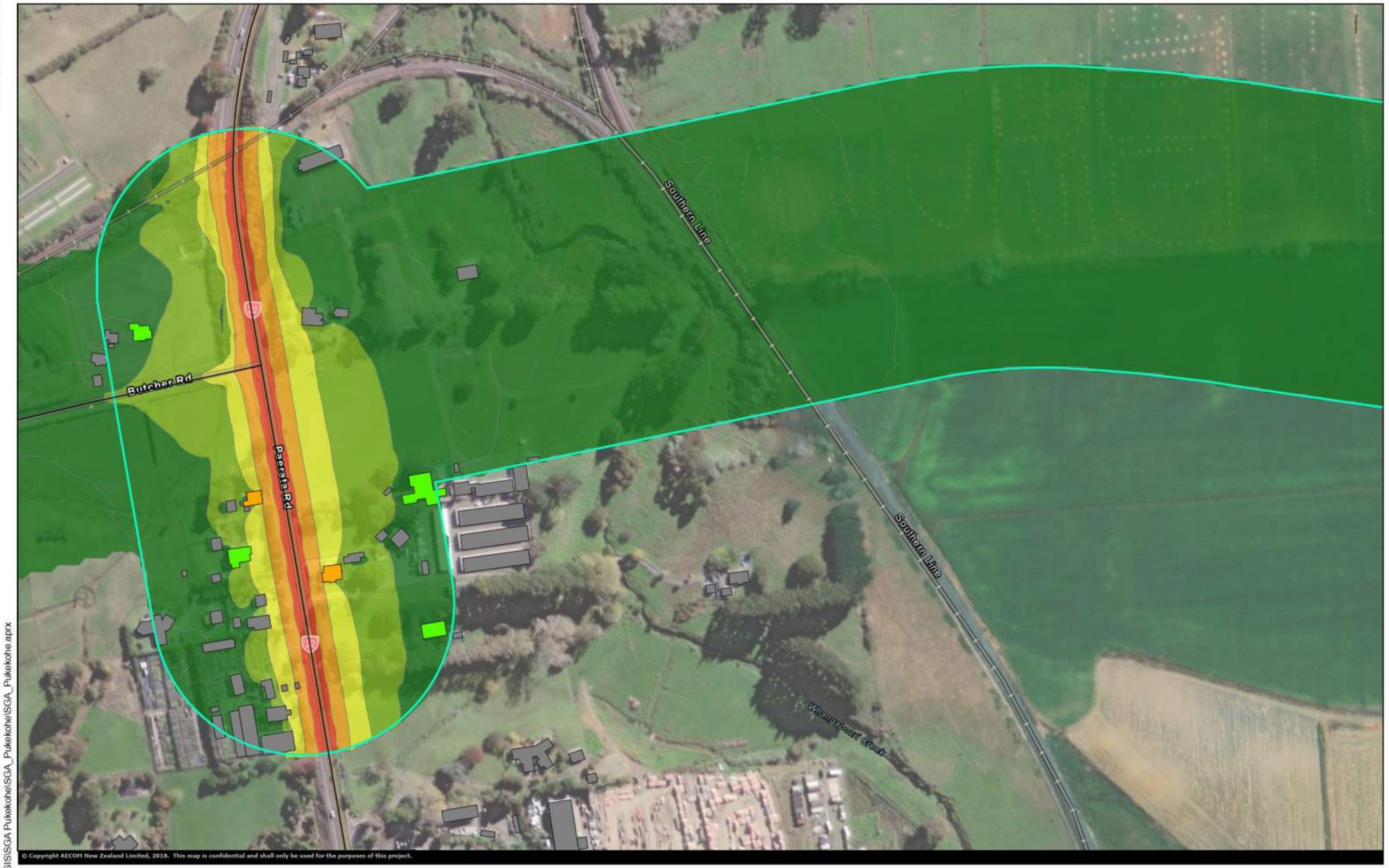
Drawn VZ Date 31/05/2023

# NoR 4 – Pukekohe North-East Arterial

ISO A3 297mm x 420mm



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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Cat B
- Cat C
- Not PPFs

**SHEET TITLE**
Existing NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
18/08/2023

**Sheet number**
6

**KEY PLAN**

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

| | | | |
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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
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- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Cat B
- Cat C
- Not PPFs

**SHEET TITLE**
Existing NoR 4

**PROJECT**
Supporting growth. Pukekohe

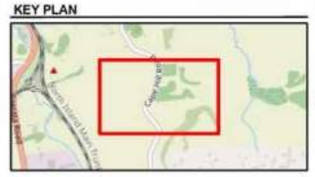
**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
7

KEY PLAN



**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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|---|---|---|---|
| Approved | CD | Date | 31/05/2023 |
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- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Cat B
- Cat C
- Not PPFs

**SHEET TITLE**
Existing NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
8

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Cat B
- Cat C
- Not PPFs

**SHEET TITLE**
Existing NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
9

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

| | | | |
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Noise Level dB LAeq(24h)
<55 dB
55-60 dB
60-65 dB
65-70 dB
>70 dB
Assessment area
PPFs
Cat A
Cat B
Cat C
Not PPFs
SHEET TITLE
Existing NoR 4
PROJECT
Supporting growth. Pukekohe
CLIENT
Auckland Transport
PROJECT NUMBER
60558831
DATE
31/05/2023
Sheet number
10
KEY PLAN
SPATIAL REFERENCE
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM
PROJECT MANAGEMENT
Approved CD Date 31/05/2023
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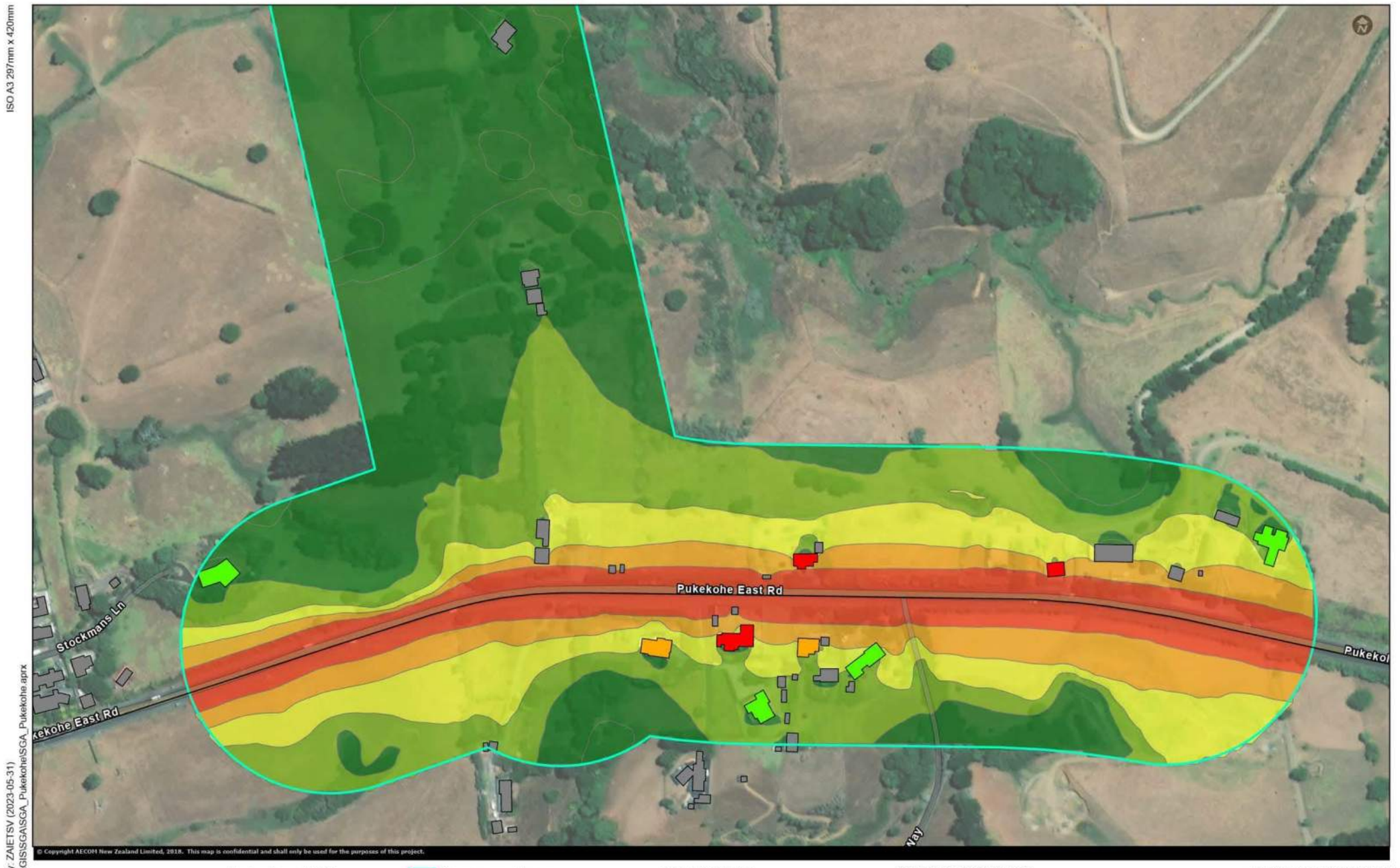


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Assessment area

PPFs
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- Cat B
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**SHEET TITLE**
Existing NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
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**Sheet number**
11

KEY PLAN


**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
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**PROJECT MANAGEMENT**

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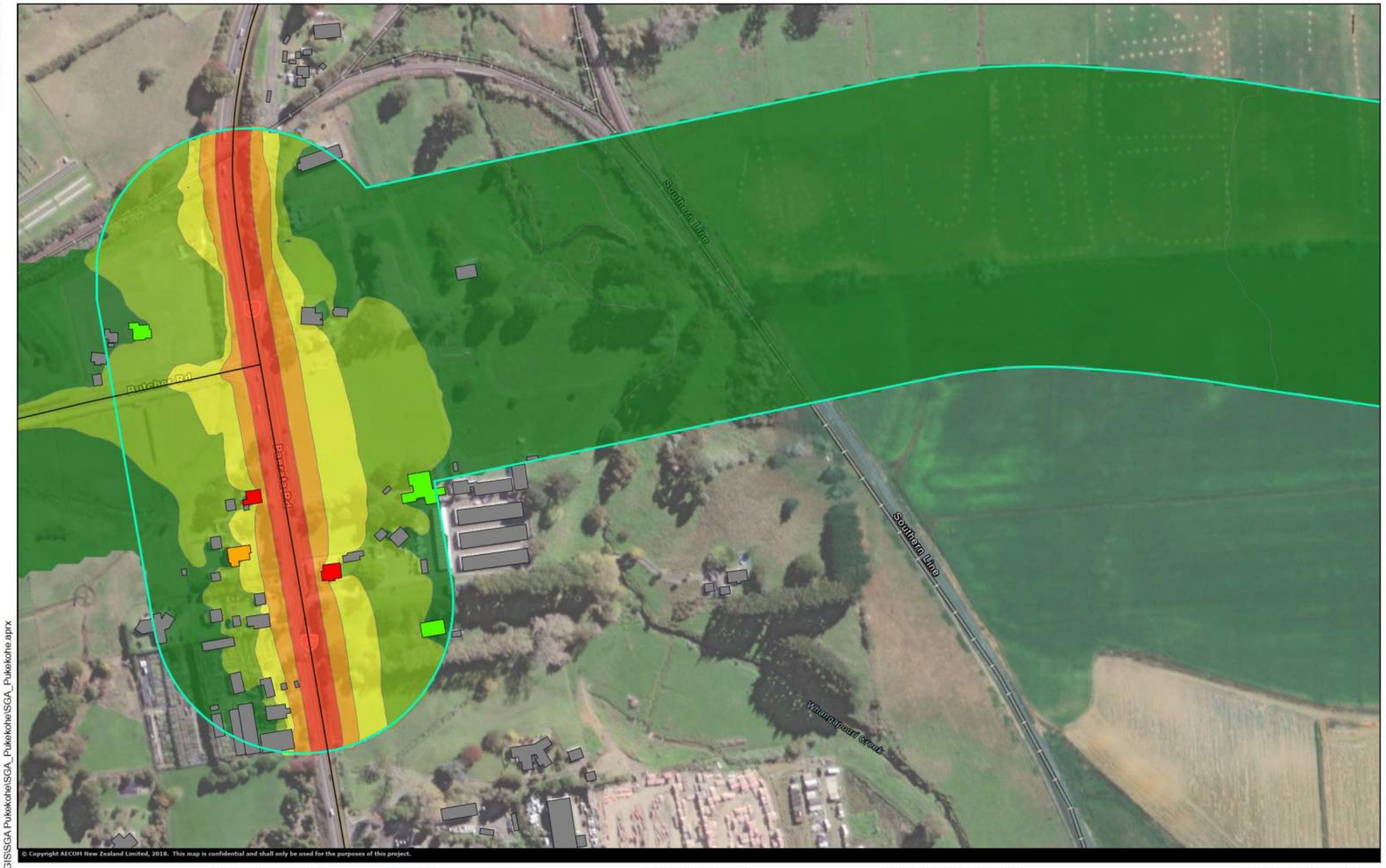




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Assessment area

PPFs

- Cat A
- Cat B
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**SHEET TITLE**
Do-nothing NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
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**DATE**
18/08/2023

**Sheet number**
6

KEY PLAN

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**SHEET TITLE**
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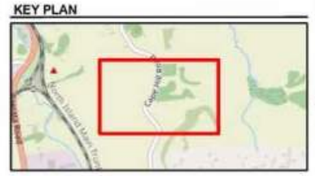

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**SHEET TITLE**
Do-nothing NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

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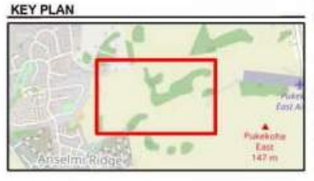


**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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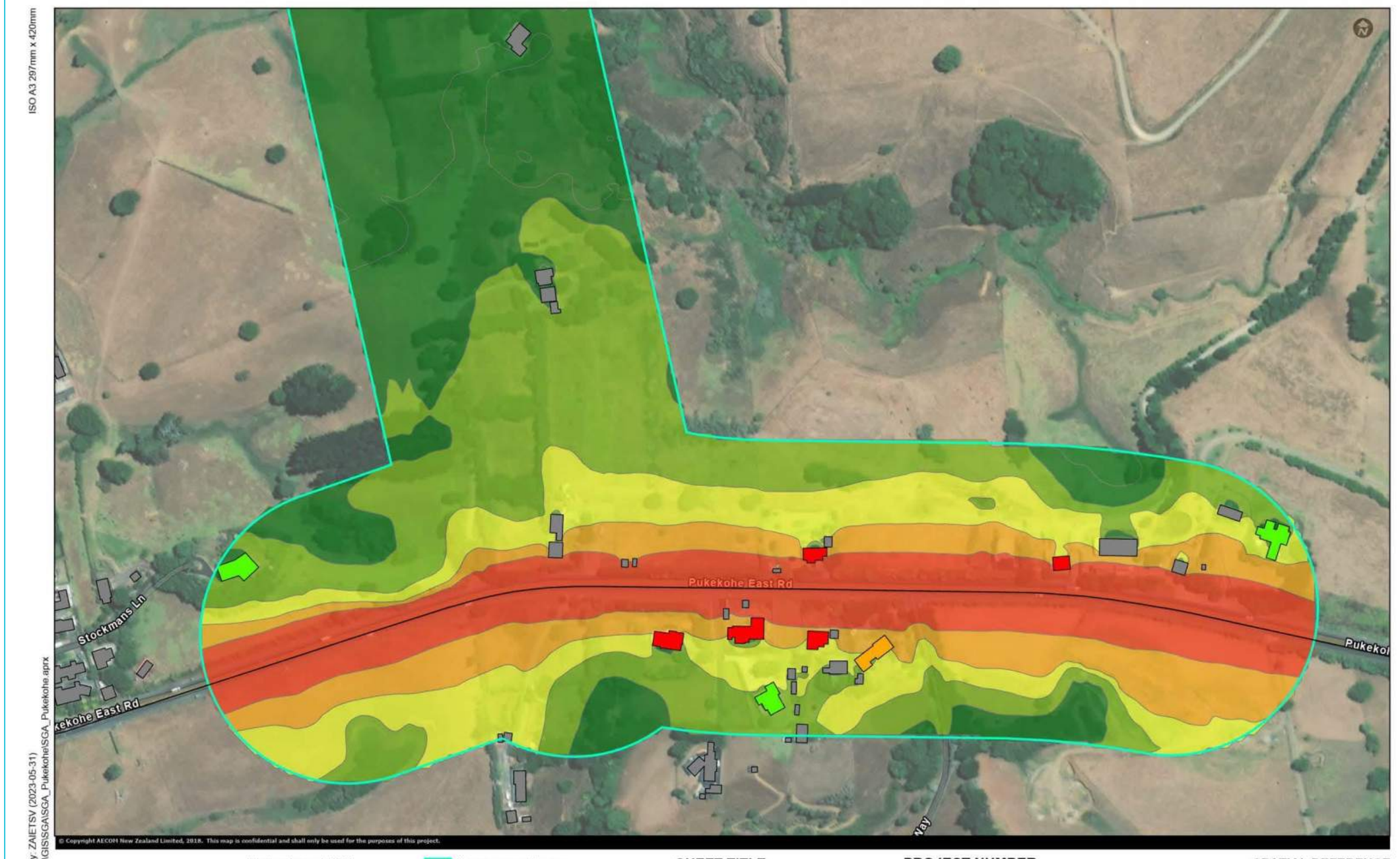
| Approved | CD | Date | 31/05/2023 |
| Checked | SJ | Date | 31/05/2023 |
| Designed | VZ | Date | 31/05/2023 |
| Drawn | VZ | Date | 31/05/2023 |


ISO A3 297mm x 420mm
Pukekohe East Rd
Stockmans Ln
Pukekohe East Rd
Pukekoh
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Filename: C:\GIS\SGA\SGA_Pukekohe\SGA_Pukekohe.aprx
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www.aecom.com
Noise Level dB LAeq(24h)
<55 dB
55-60 dB
60-65 dB
65-70 dB
>70 dB
Assessment area
PPFs
Cat A
Cat B
Cat C
Not PPFs
SHEET TITLE
Do-nothing NoR 4
PROJECT
Supporting growth. Pukekohe
CLIENT
Auckland Transport
PROJECT NUMBER
60558831
DATE
31/05/2023
Sheet number
11
KEY PLAN
SPATIAL REFERENCE
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM
PROJECT MANAGEMENT
Approved CD Date 31/05/2023
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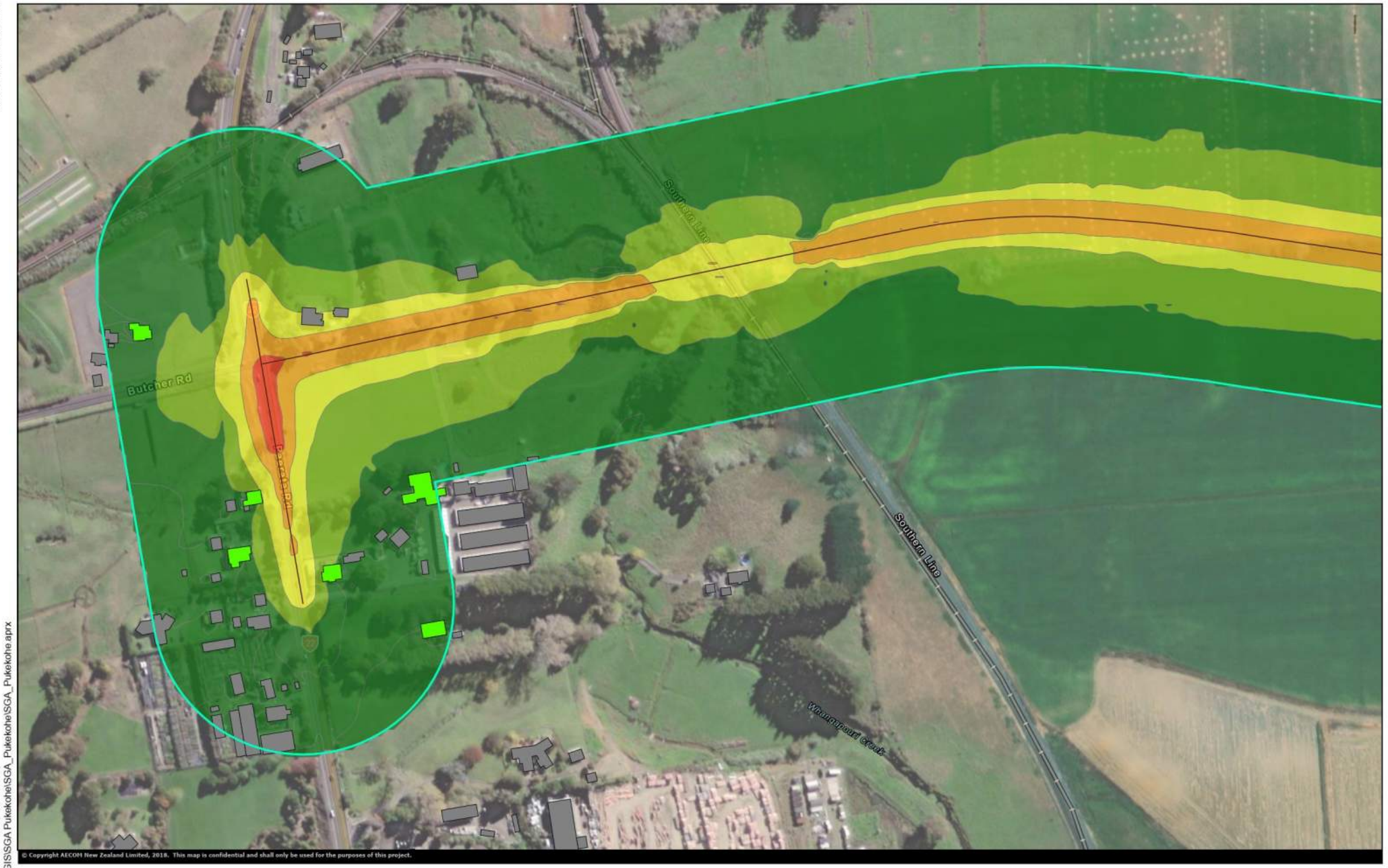
Drawn VZ Date 31/05/2023

ISO A3 297mm x 420mm



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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Do Minimum NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
18/08/2023

**Sheet number**
6

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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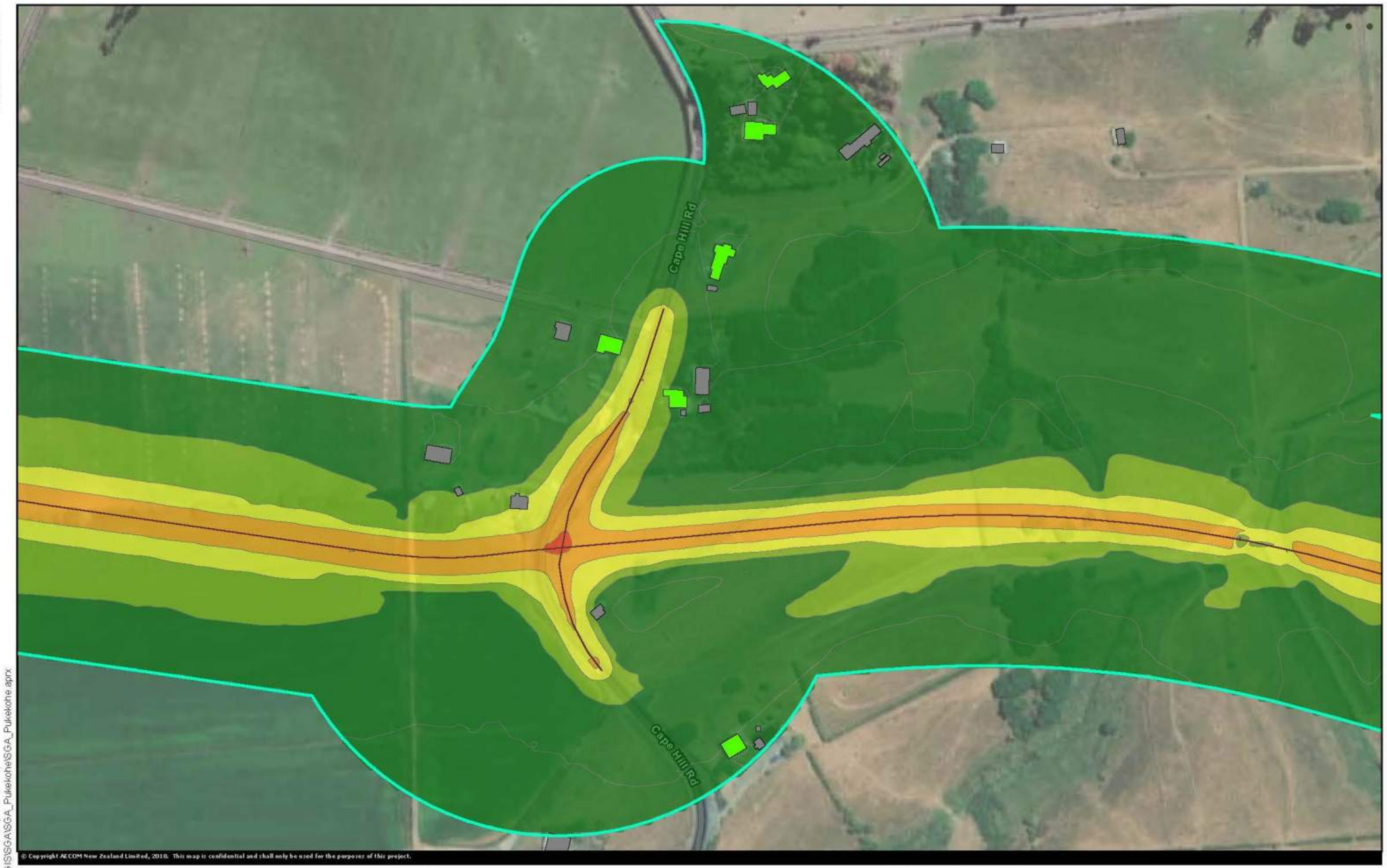
| Designed | VZ | Date | 18/08/2023 |
| Drawn | VZ | Date | 18/08/2023 |

ISO A3 297mm x 420mm



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Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Do Minimum NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
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KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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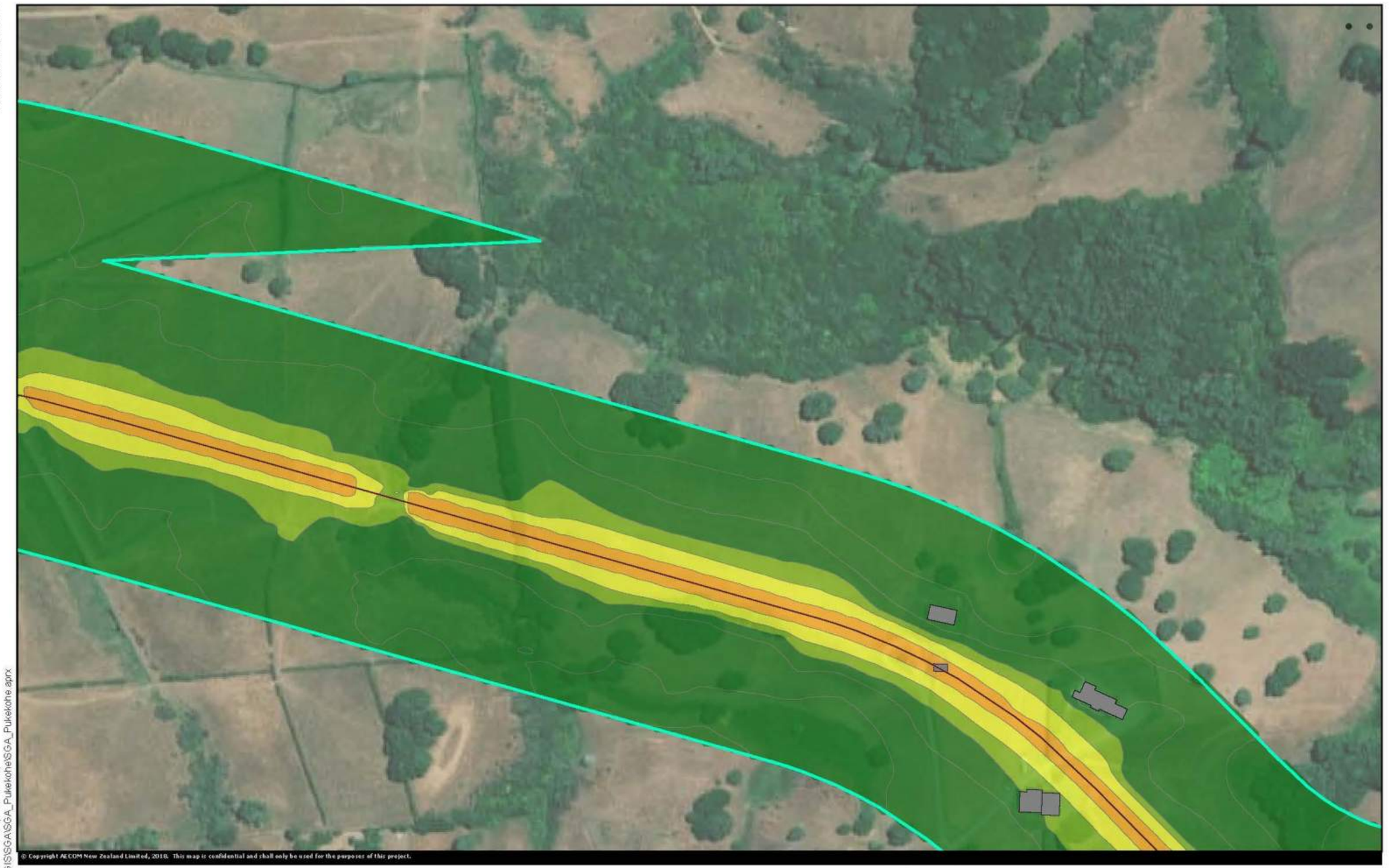
ISO A3 297mm x 420mm





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- >70 dB

- Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
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**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
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KEY PLAN

**SPATIAL REFERENCE**
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Map features depicted in terms of NZTM

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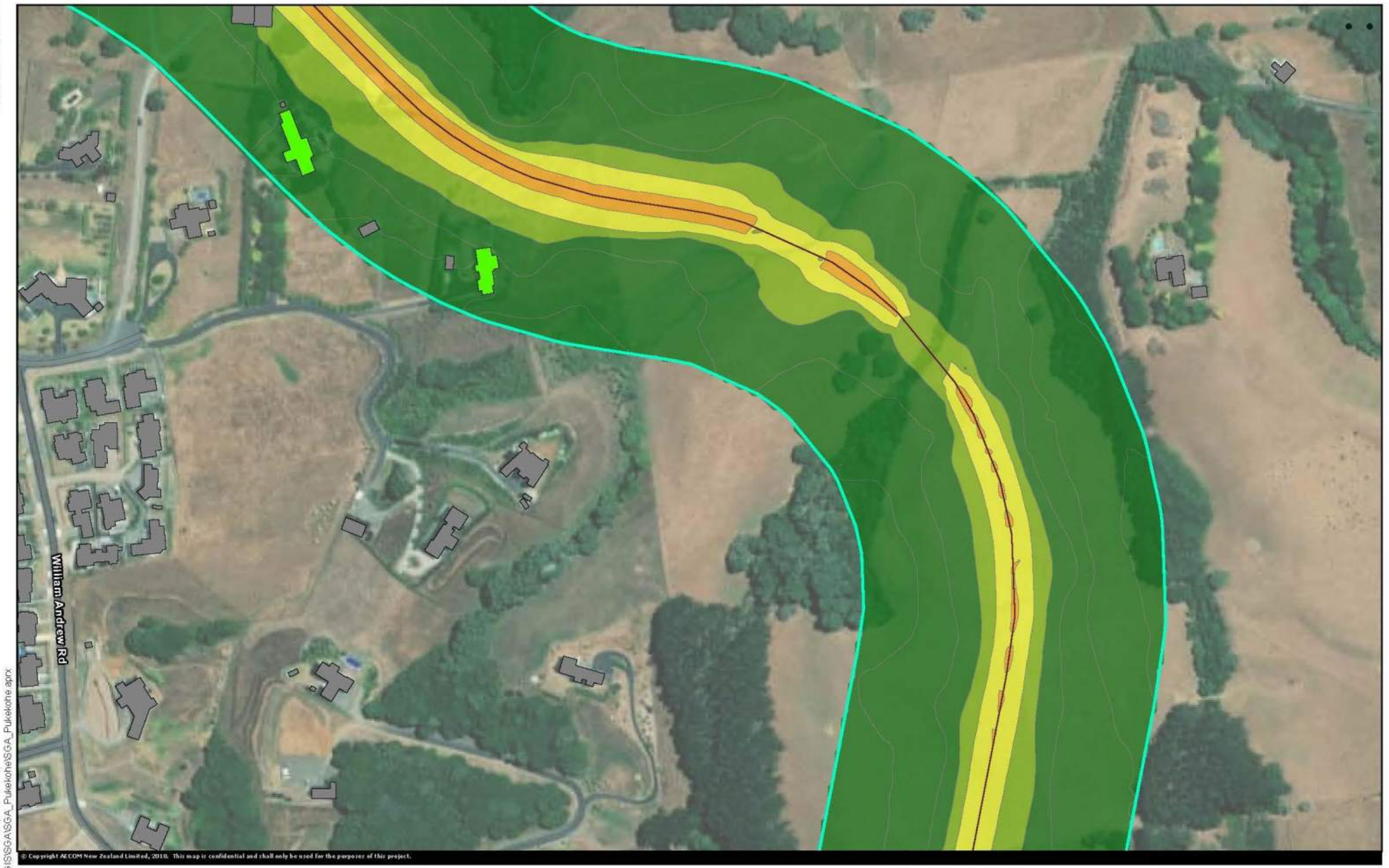
ISO A3 297mm x 420mm



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- 60-65 dB
- 65-70 dB
- >70 dB

- Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Do Minimum NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
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KEY PLAN

**SPATIAL REFERENCE**
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Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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| Drawn | VZ | Date | 31/05/2023 |


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Noise Level dB LAeq(24h)
<55 dB
55-60 dB
60-65 dB
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>70 dB
Assessment area
PPFs
Cat A
Not PPFs
SHEET TITLE
Do Minimum NoR 4
PROJECT
Supporting growth. Pukekohe
CLIENT
Auckland Transport
PROJECT NUMBER
60558831
DATE
31/05/2023
Sheet number
10
KEY PLAN
SPATIAL REFERENCE
Scale: 1:2,500 (A3 size)
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Map features depicted in terms of NZTM
PROJECT MANAGEMENT
Approved CD Date 31/05/2023
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Designed VZ Date 31/05/2023
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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Do Minimum NoR 4

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
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KEY PLAN

**SPATIAL REFERENCE**
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**PROJECT MANAGEMENT**

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| Drawn | VZ | Date | 31/05/2023 |

# NoR 5 – Pukekohe South-East Arterial

ISO A3 297mm x 420mm



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Noise Level dB $L_{Aeq(24h)}$

- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs

- Cat A
- Cat B
- Cat C
- Not PPFs

**SHEET TITLE**
Existing NoR 5

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
4/08/2023

**Sheet number**
12

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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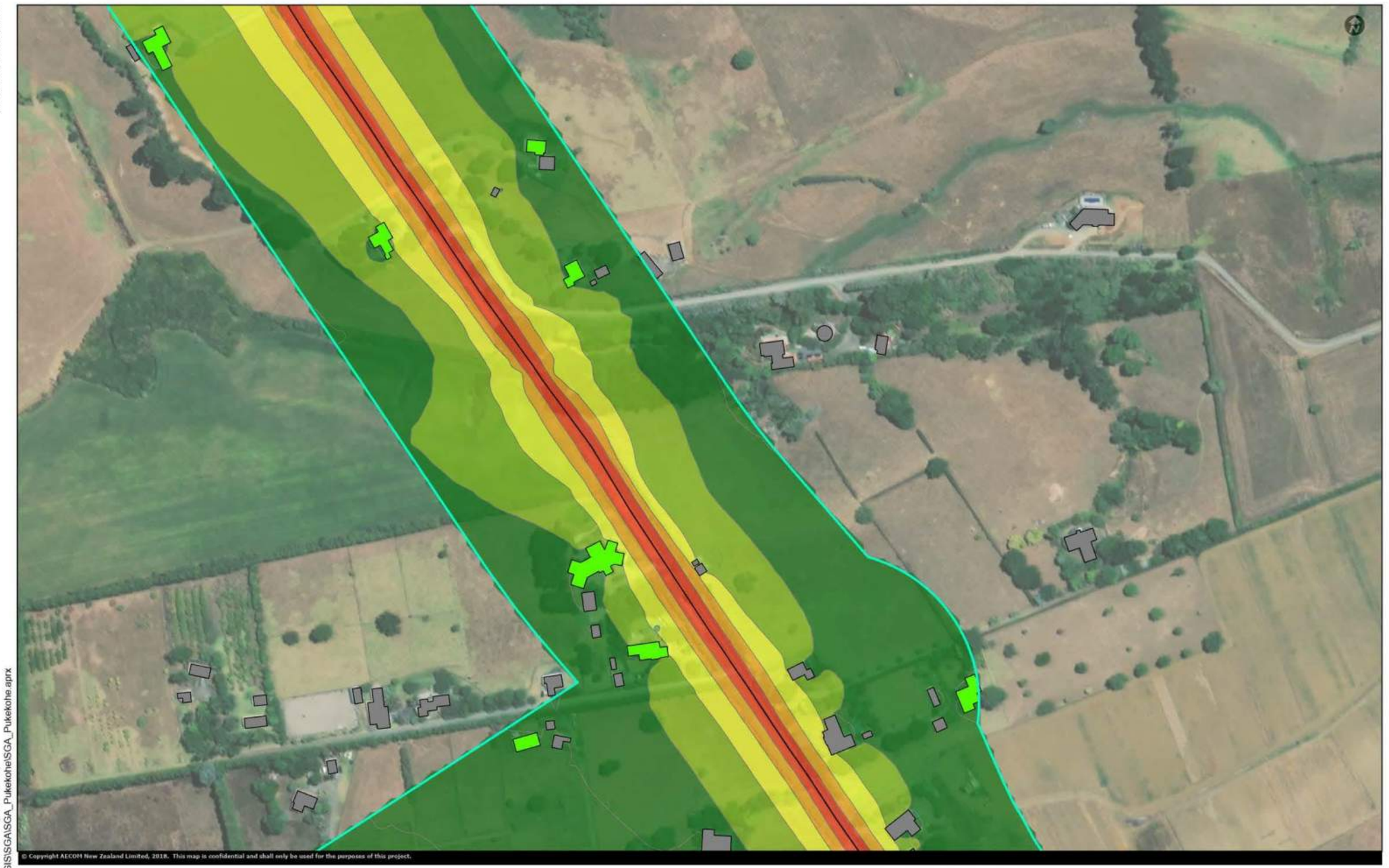
ISO A3 297mm x 420mm





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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Cat B
- Cat C
- Not PPFs

**SHEET TITLE**
Existing NoR 5

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
13

KEY PLAN

**SPATIAL REFERENCE**
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Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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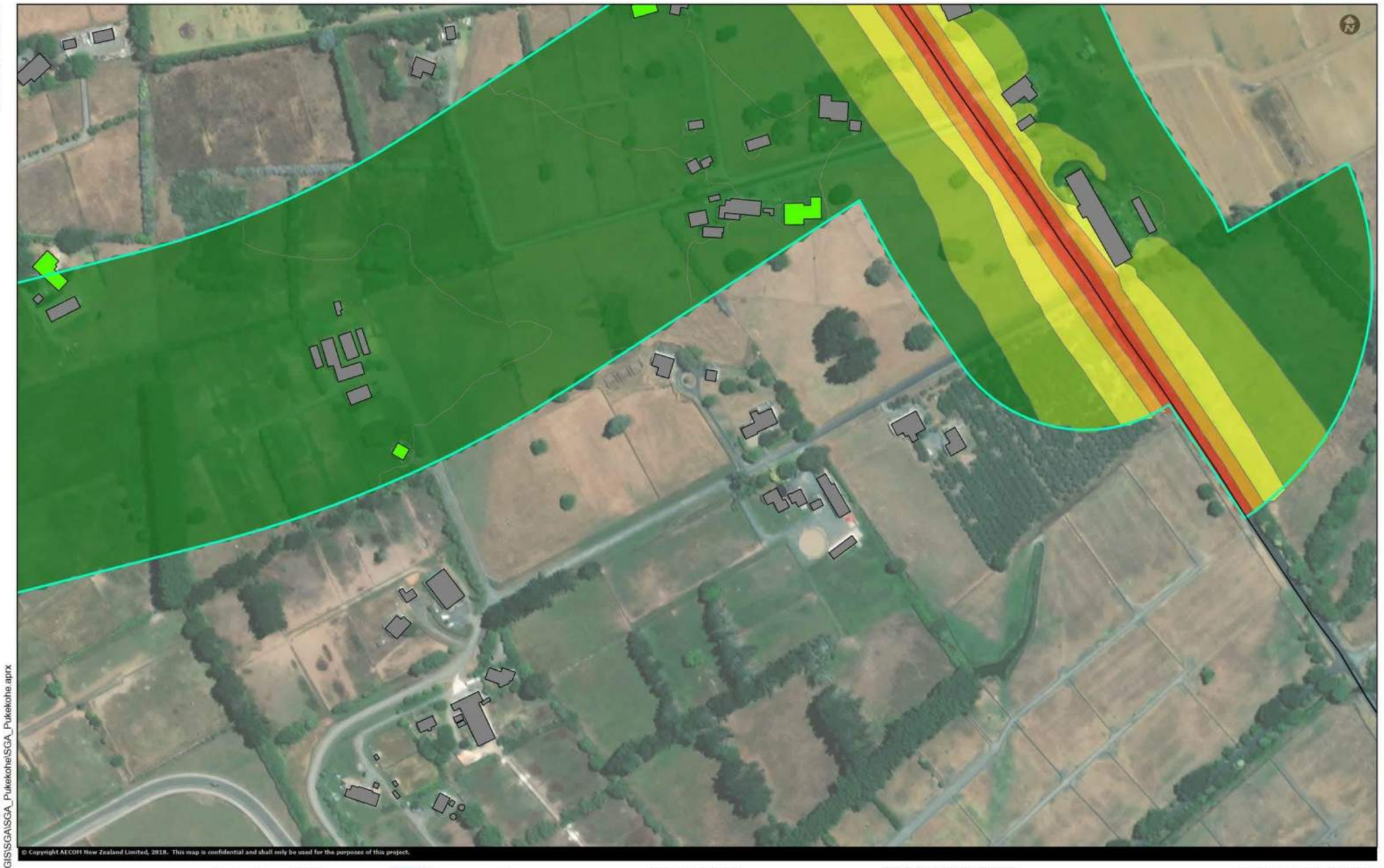
ISO A3 297mm x 420mm





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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
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- Assessment area

PPFs
- Cat A
- Cat B
- Cat C
- Not PPFs

**SHEET TITLE**
Existing NoR 5

**PROJECT**
Supporting growth. Pukekohe

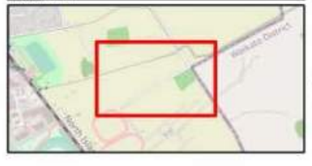
**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
14

KEY PLAN



**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
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Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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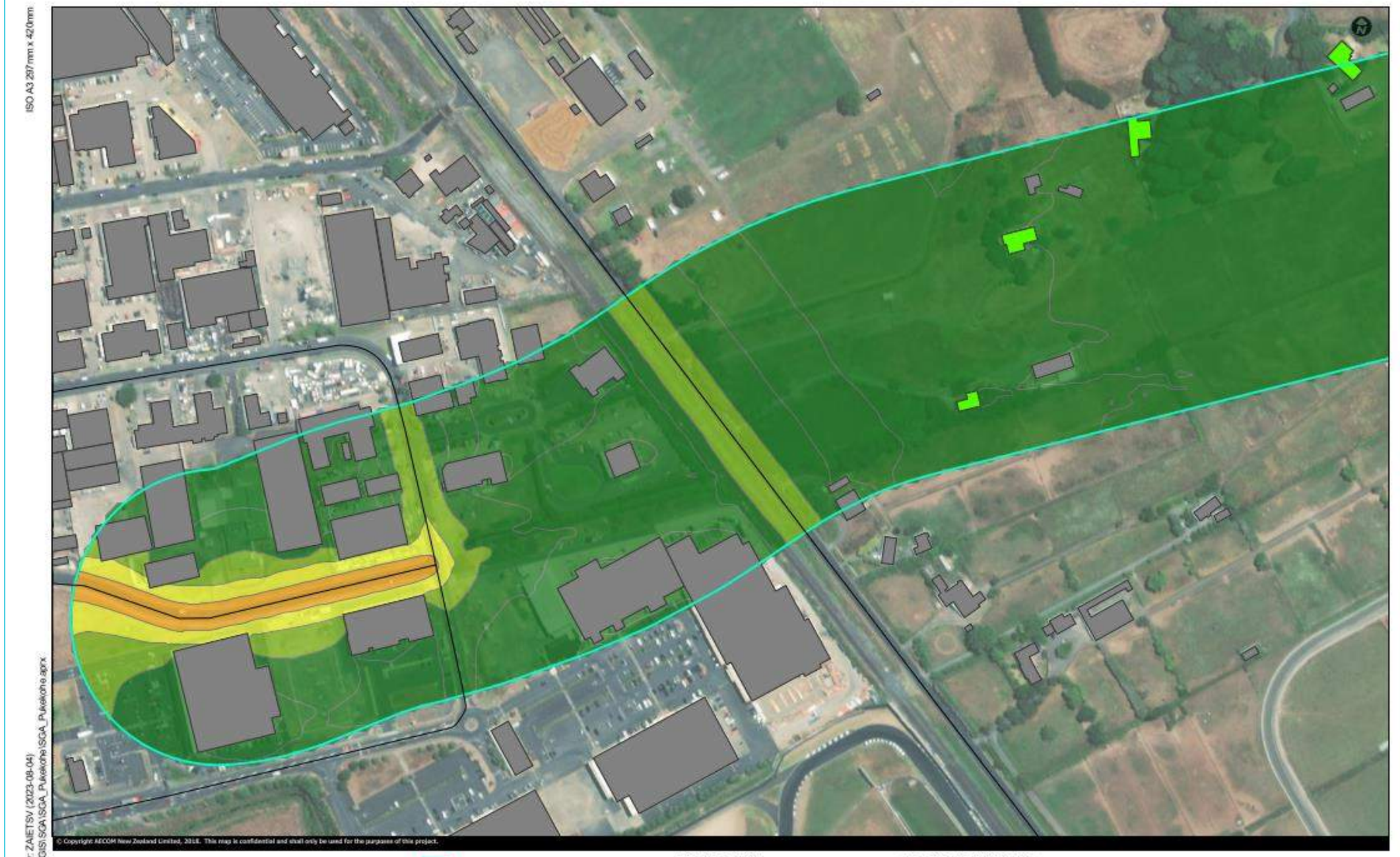
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Noise Level dB $L_{Aeq(24h)}$
<55 dB
55-60 dB
60-65 dB
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Assessment area
PPFs
Cat A
Cat B
Cat C
Not PPFs
SHEET TITLE
Existing NoR 5
PROJECT
Supporting growth. Pukekohe
CLIENT
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PROJECT NUMBER
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KEY PLAN
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Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM
PROJECT MANAGEMENT
Approved CD Date 4/08/2023
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PPFs
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**SHEET TITLE**
Do-nothing NoR 5

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
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KEY PLAN

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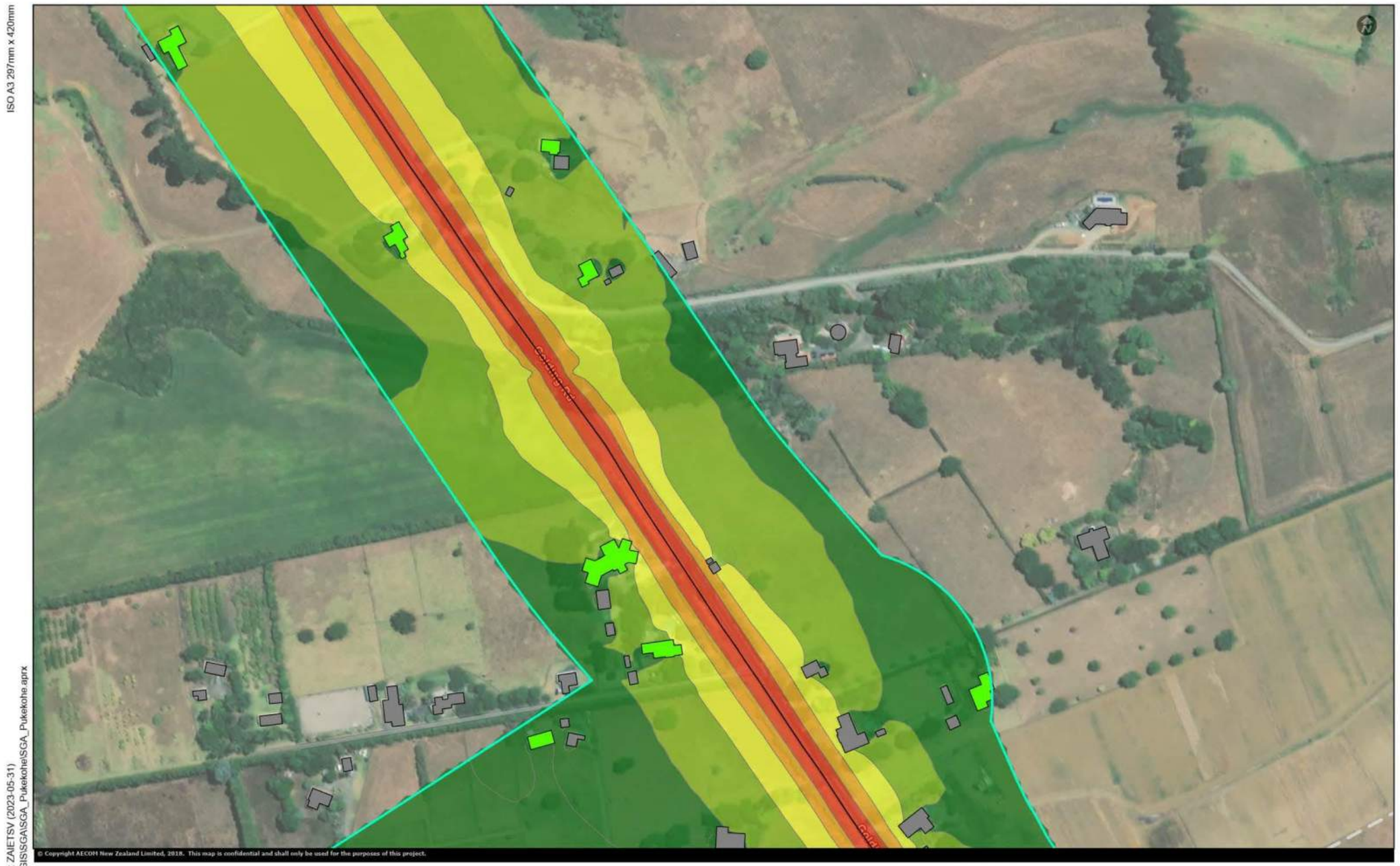
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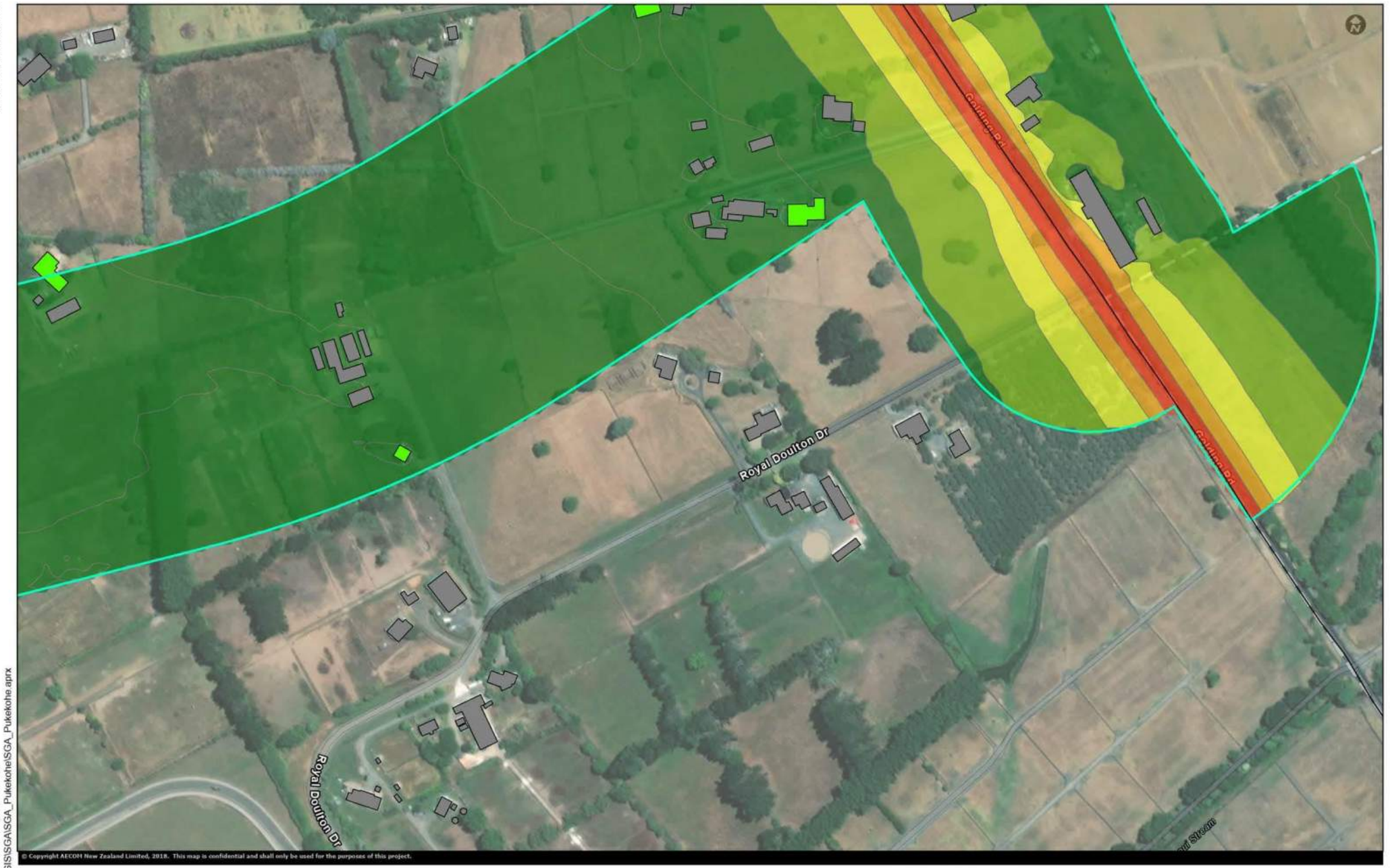
ISO A3 297mm x 420mm

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**SHEET TITLE**
Do-nothing NoR 5

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
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**DATE**
31/05/2023

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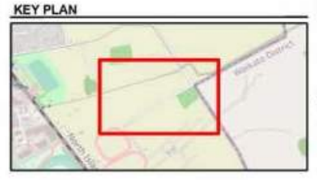
KEY PLAN



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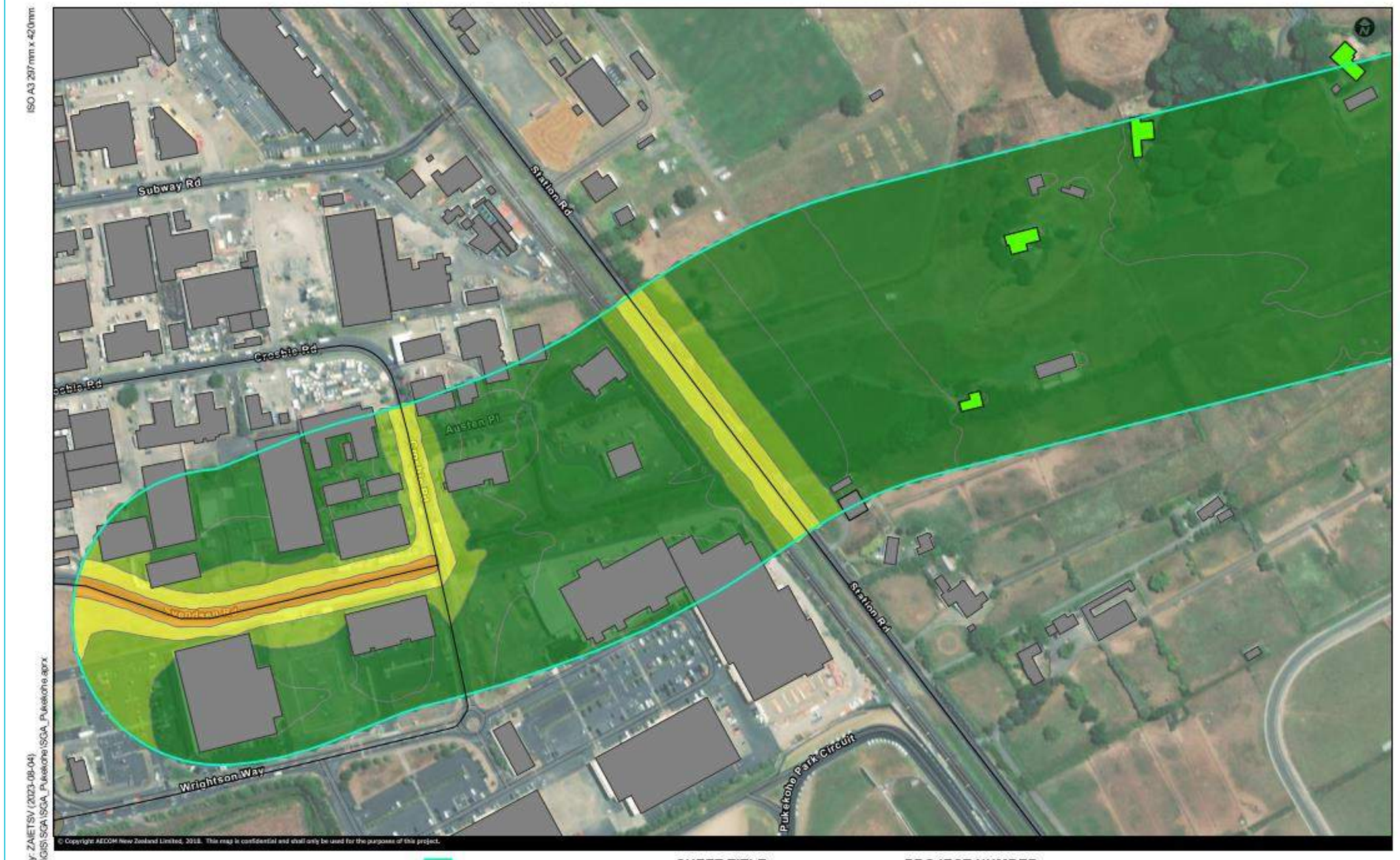


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**PROJECT**
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| Designed | VZ | Date | 4/08/2023 |
| Drawn | VZ | Date | 4/08/2023 |

ISO A3 297mm x 420mm


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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
- 55-60 dB
- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Not PPFs

**SHEET TITLE**
Do Minimum NoR 5

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
4/08/2023

**Sheet number**
12

KEY PLAN

**SPATIAL REFERENCE**
Scale: 1:2,500 (A3 size)
0 25 50 75 Meters
Map features depicted in terms of NZTM

**PROJECT MANAGEMENT**

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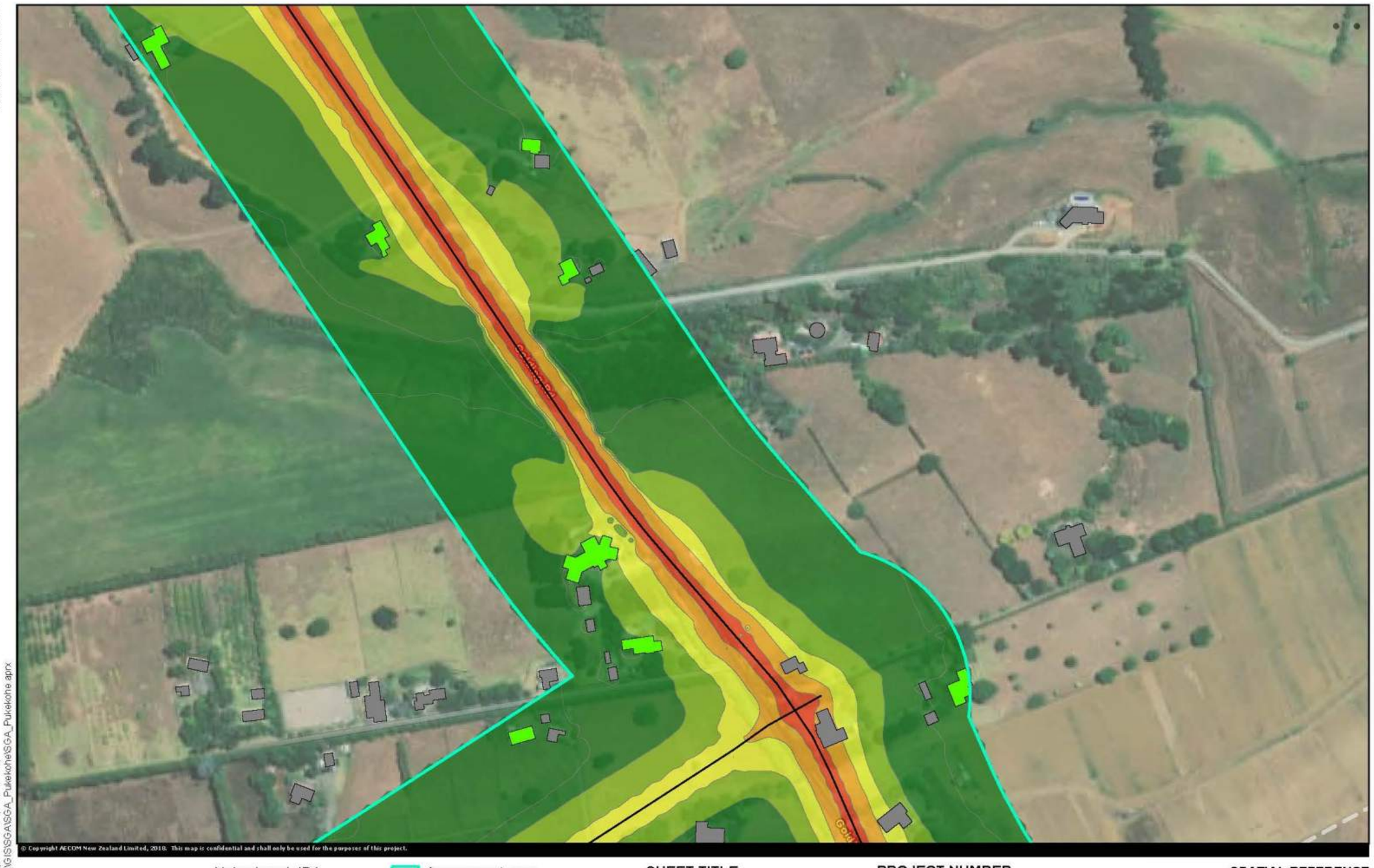
ISO A3 297mm x 420mm

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**SHEET TITLE**
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**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
13

KEY PLAN

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0 25 50 75 Meters
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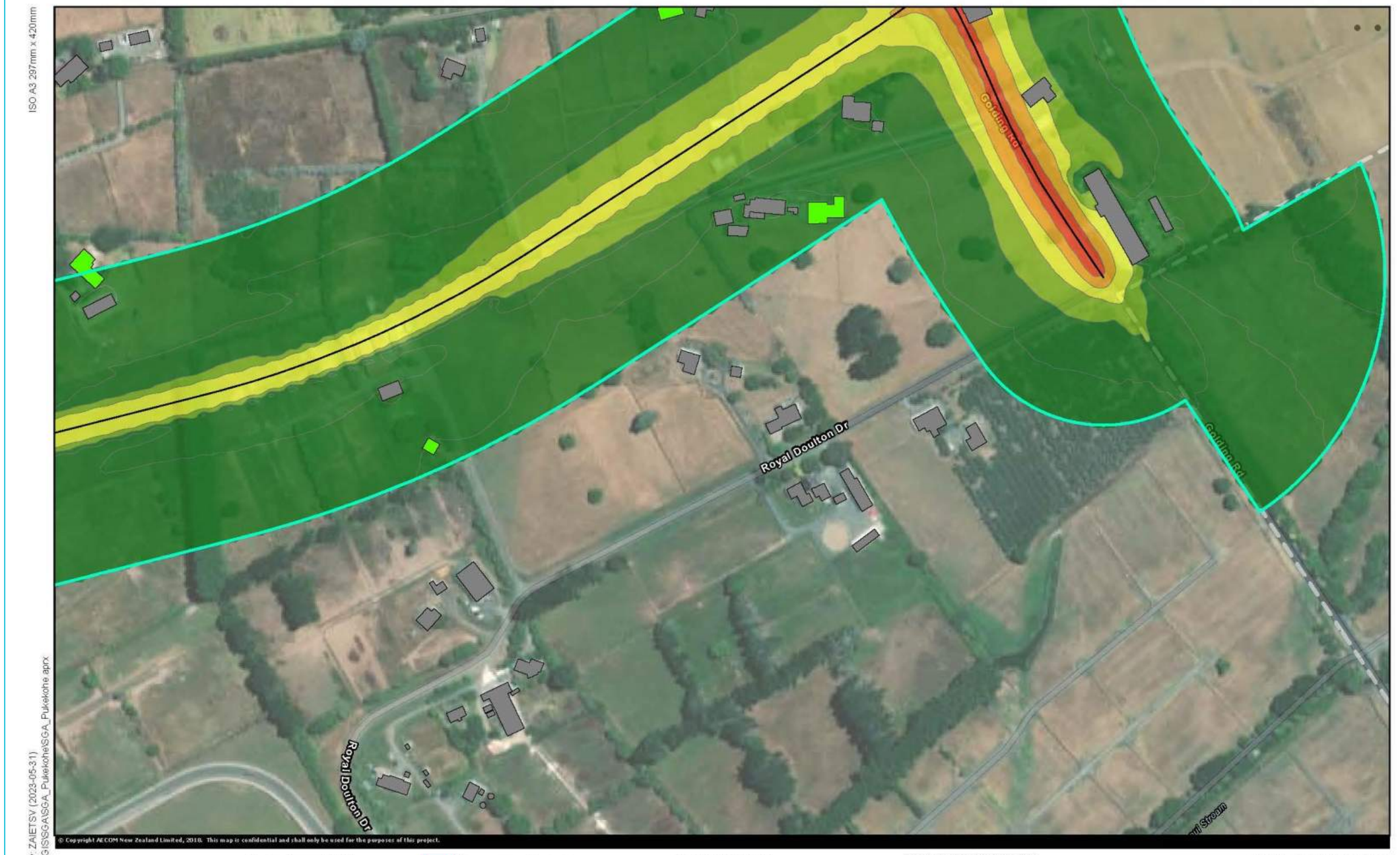


ISO A3 297mm x 420mm

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**PROJECT**
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Auckland Transport

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**DATE**
31/05/2023

**Sheet number**
14

KEY PLAN

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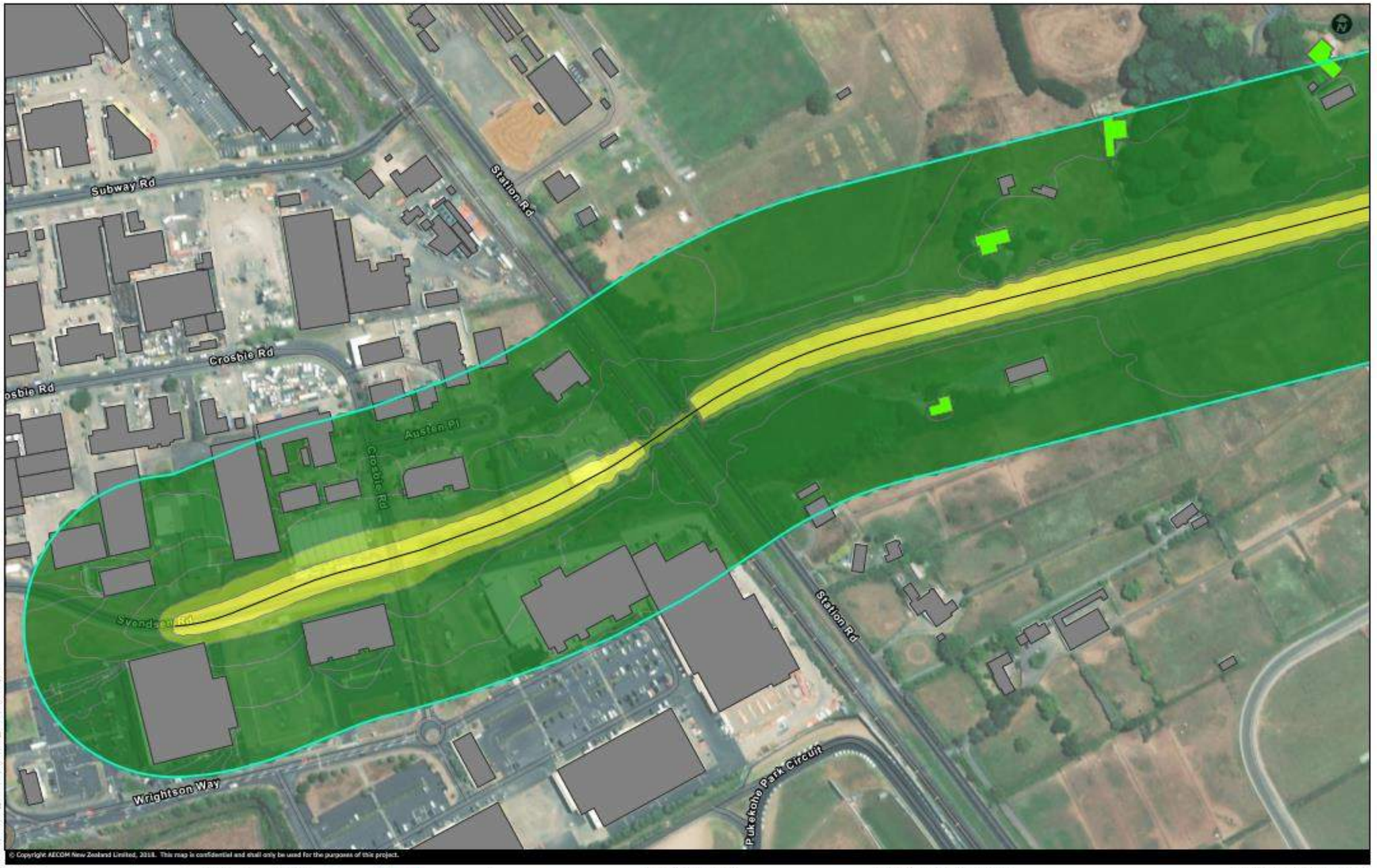
ISO A3 297 mm x 420mm

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**PROJECT**
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15

KEY PLAN

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# NoR 7 – Pukekohe North-West Arterial

ISO A3 297mm x 420mm


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Noise Level dB $L_{Aeq(24h)}$
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- Assessment area

PPFs
- Cat A
- Cat B
- Not PPFs

**SHEET TITLE**
Existing NoR 7

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

**Sheet number**
16

**KEY PLAN**

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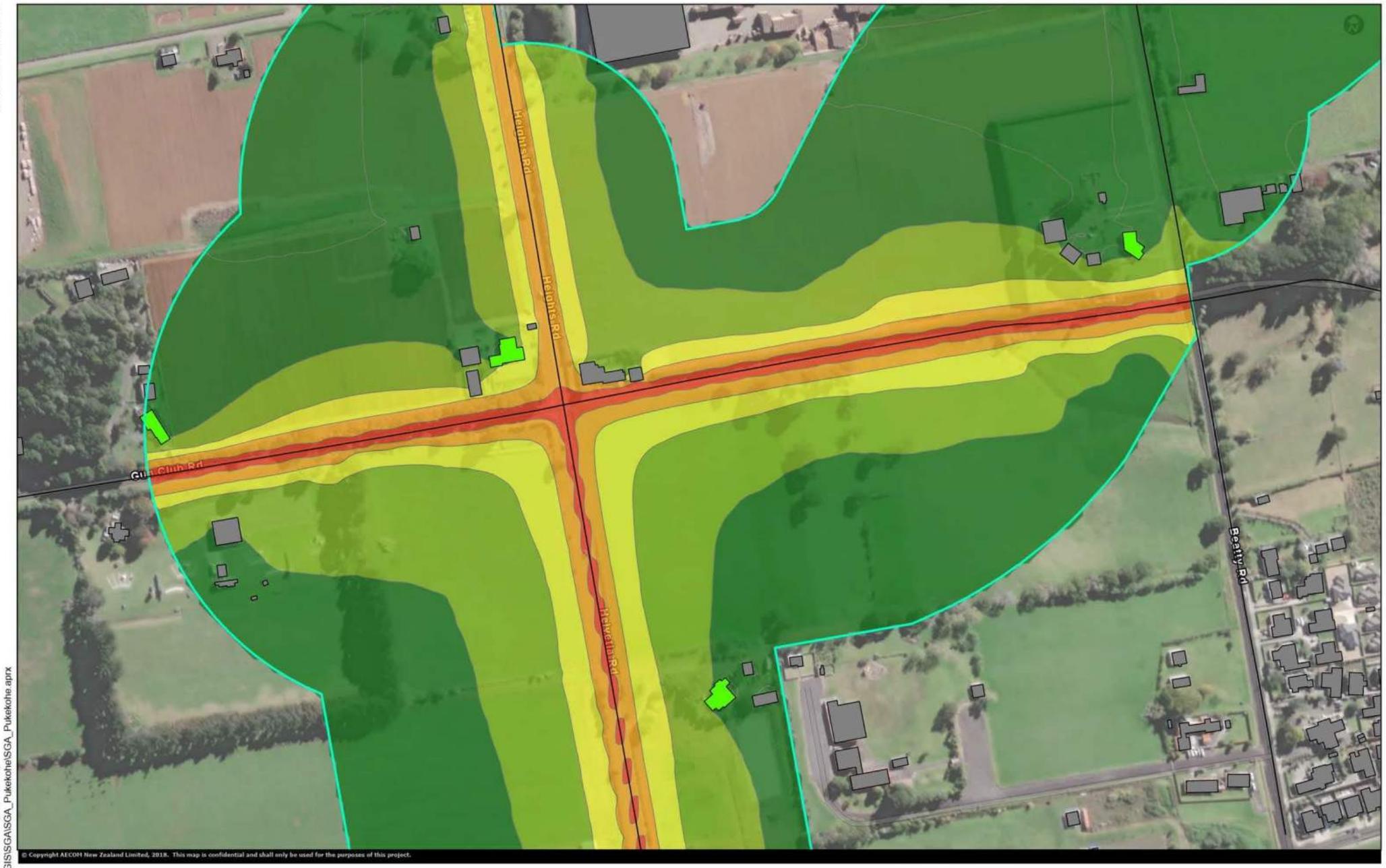
ISO A3 297mm x 420mm



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Assessment area

PPFs
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- Cat B
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**CLIENT**
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**PROJECT NUMBER**
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**DATE**
31/05/2023

**Sheet number**
17

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ISO A3 297mm x 420mm

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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
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- Assessment area

PPFs
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**SHEET TITLE**
Existing NoR 7

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

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31/05/2023

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18

**KEY PLAN**

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Existing NoR 7

**PROJECT**
Supporting growth. Pukekohe

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KEY PLAN

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Noise Level dB $L_{Aeq(24h)}$
- <55 dB
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- 60-65 dB
- 65-70 dB
- >70 dB

Assessment area

PPFs
- Cat A
- Cat C

Not PPFs
- Cat A

**SHEET TITLE**
Do-nothing NoR 7

**PROJECT**
Supporting growth. Pukekohe

**CLIENT**
Auckland Transport

**PROJECT NUMBER**
60558831

**DATE**
31/05/2023

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KEY PLAN

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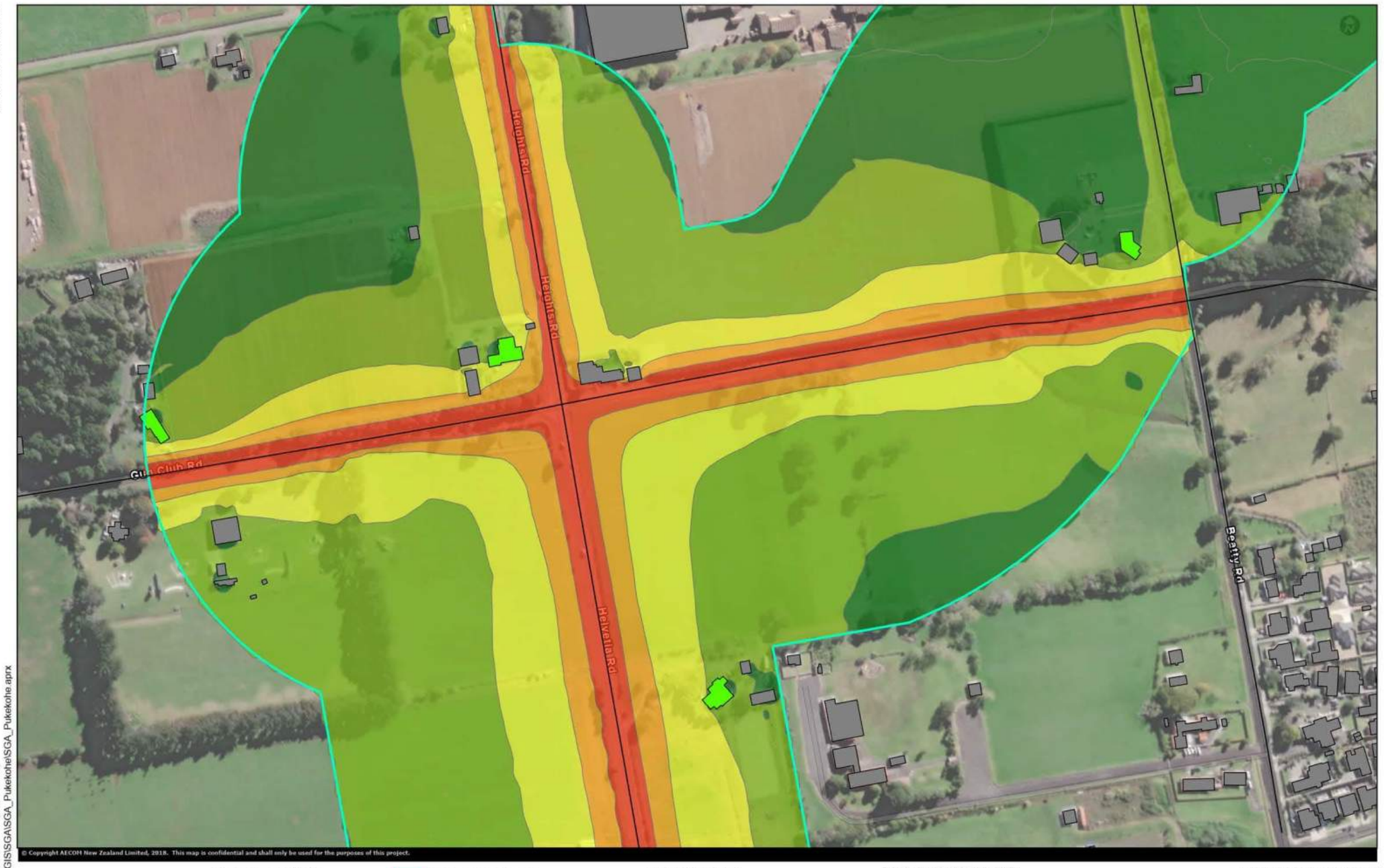




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**SHEET TITLE**
Do-nothing NoR 7

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Supporting growth. Pukekohe

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**DATE**
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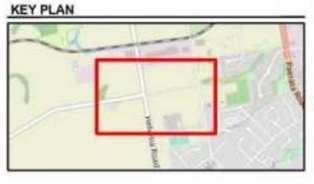
17

KEY PLAN



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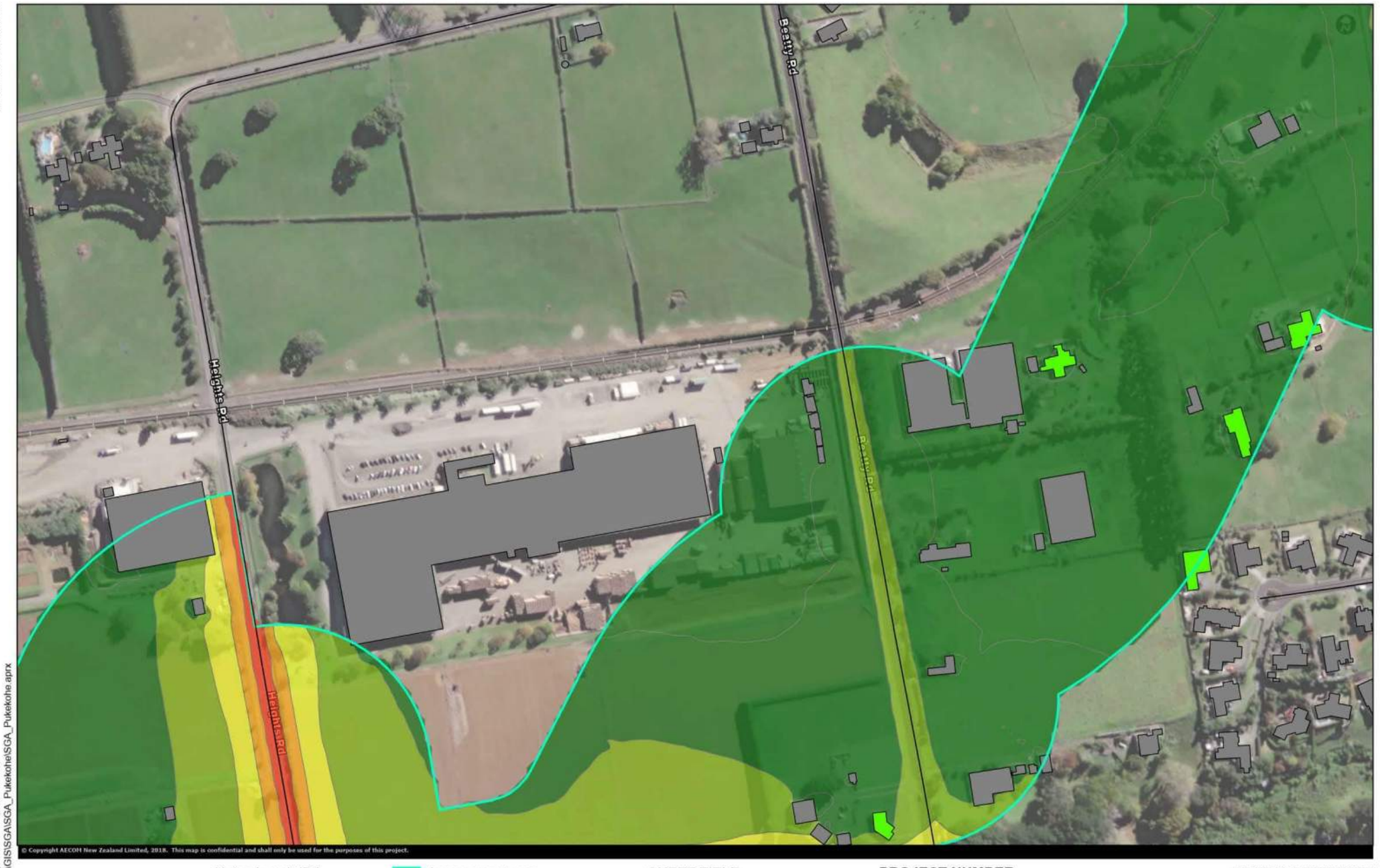


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ISO A3 297mm x 420mm
Heights Rd
Heights Rd
Gun Club Rd
Helvetia Rd
Beatty Rd
© Copyright AECOM New Zealand Limited, 2018. This map is confidential and shall only be used for the purposes of this project.
Last saved by: ZAIETSV (2023-05-31)
Filename: C:\GIS\SGA\SGA_Pukekohe\SGA_Pukekohe aprx
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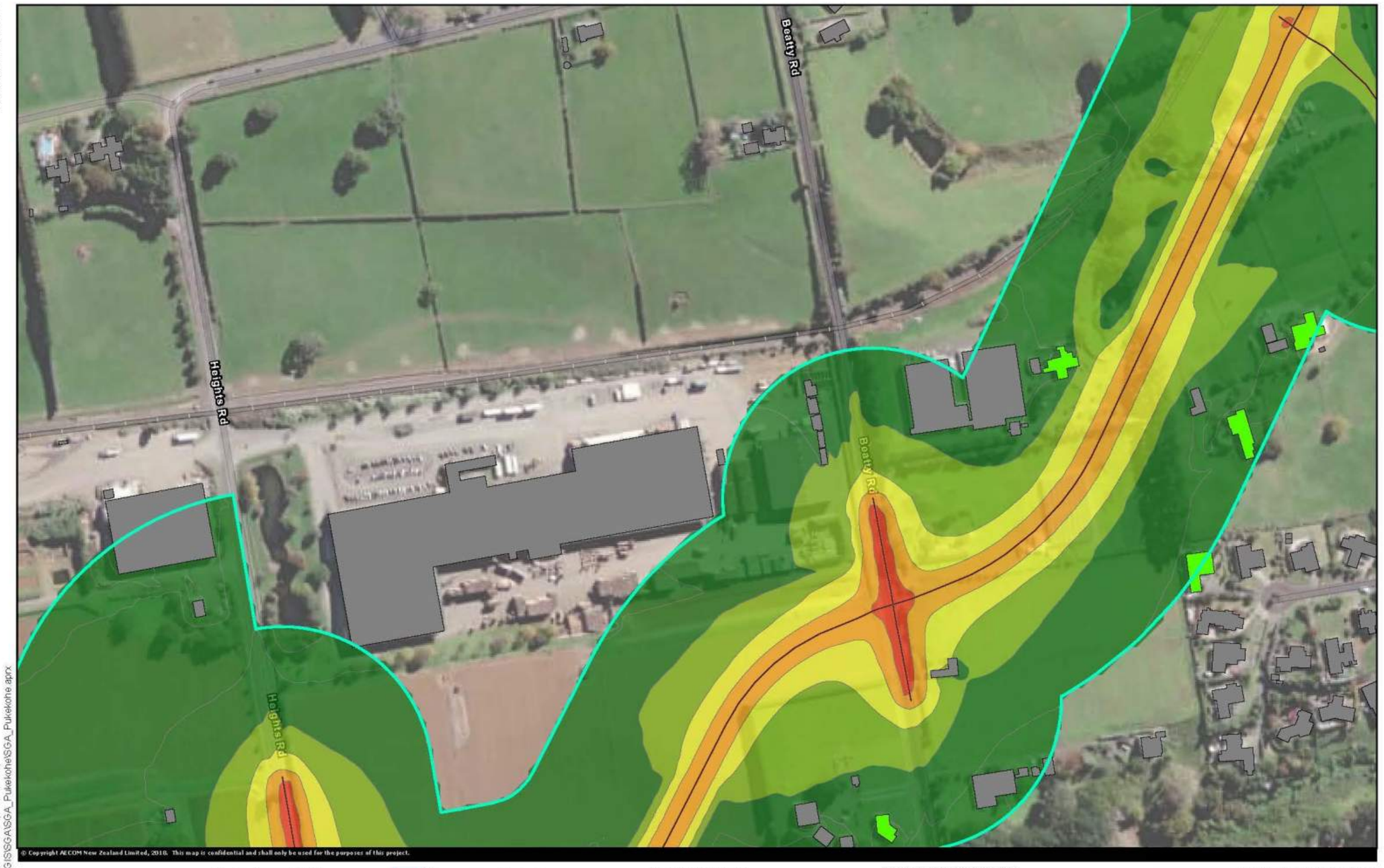


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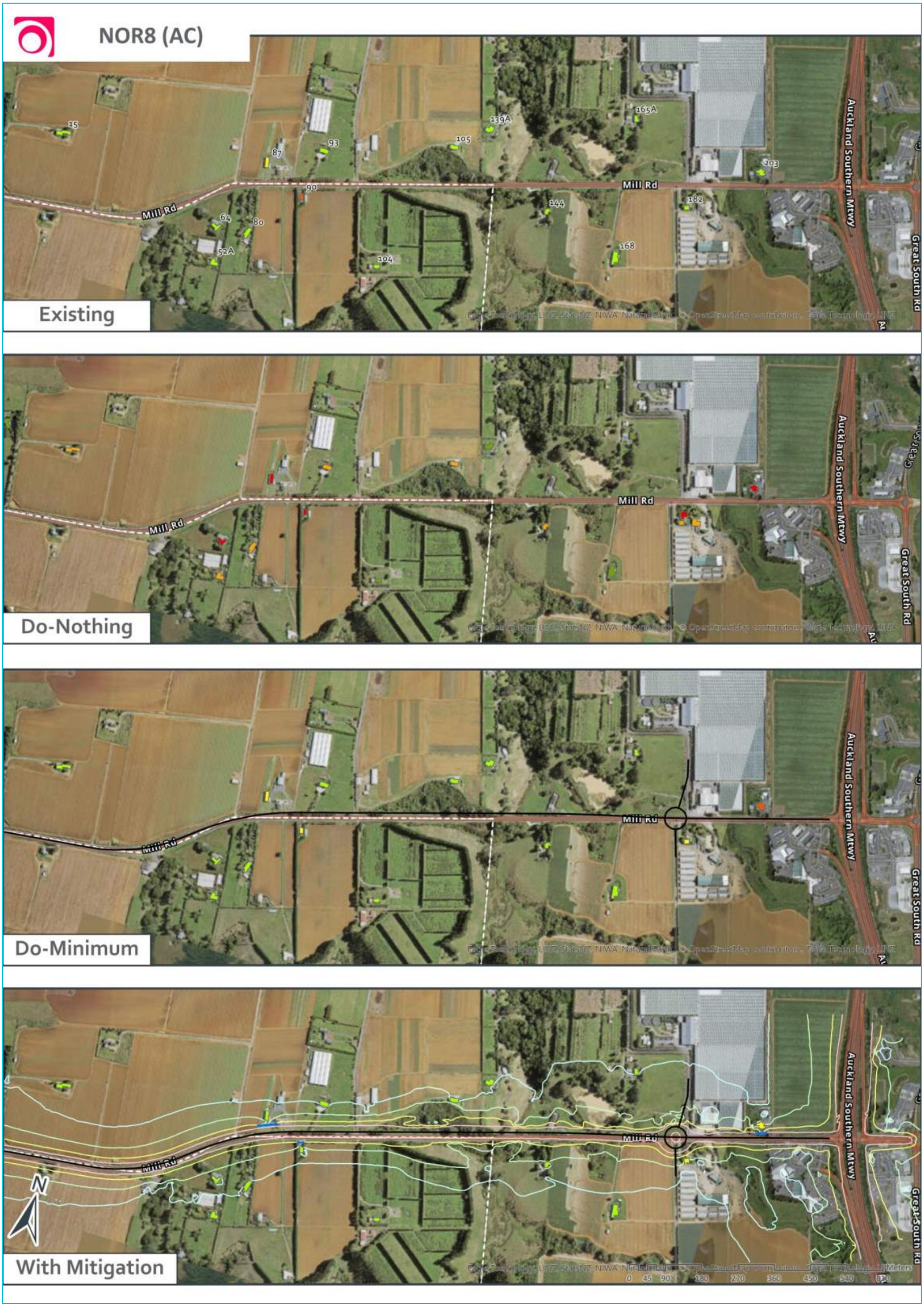
## NoR 8 (AC) – Mill Road and Pukekohe East Road Upgrade



NOR8 (AC)


Existing


Do-Nothing


Do-Minimum


With Mitigation

## NoR 8 (WDC) – Mill Road and Pukekohe East Road Upgrade

TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix C

## Noise survey summary sheets

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

## Logger Measurements

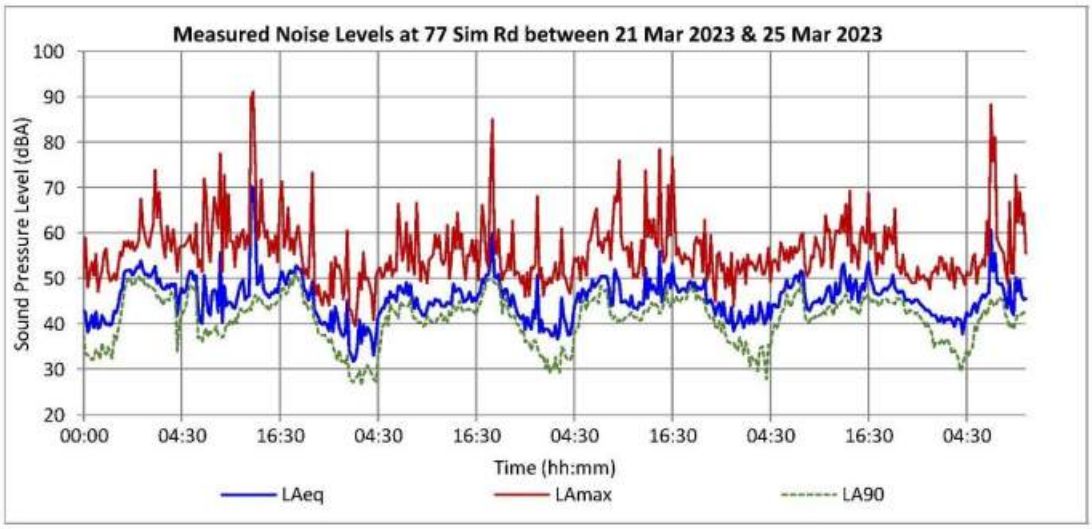
MARSHALL DAY Acoustics

| | |
|---|---|
| Date: | Friday, 28 April 2023 |
| File name: | I:\JOBS\2022\20221119\03 Survey Data & Measurements\Processed data\77 Sim Rd\[77 Sim Road summary.xlsx]Logger_Summary |
| Job number: | 20221119 |
| Job name: | SGA Pukekohe |
| Initials: | OL |
| Measurement Dates: | Tuesday, 21 March 2023 to Saturday, 25 March 2023 |
| Weather during Measurement: | Rain happened for few days, affected data has been removed from the data set before the analysis |
| Notes: | |

**OVERVIEW SUMMARY SHEET**

| | Noise Level, dB | $L_{Aeq}$ | $L_{A10}$ | $L_{A90}$ | $L_{Amax}$ |
|---|---|---|---|---|---|
| Day (0700-1800) | Lowest | 38 | 41 | 32 | 47 |
| | Average | 52 | 53 | 42 | 58 |
| | Highest | 70 | 71 | 50 | 91 |
| Evening (1800-2200) | Lowest | 40 | 42 | 38 | 44 |
| | Average | 50 | 50 | 45 | 56 |
| | Highest | 60 | 55 | 51 | 85 |
| Night (2200-0700) | Lowest | 32 | 34 | 26 | 40 |
| | Average | 45 | 46 | 37 | 53 |
| | Highest | 56 | 55 | 48 | 78 |

$L_{Aeq\ 24\text{-}hr}$ 51 dB



## Logger Measurements

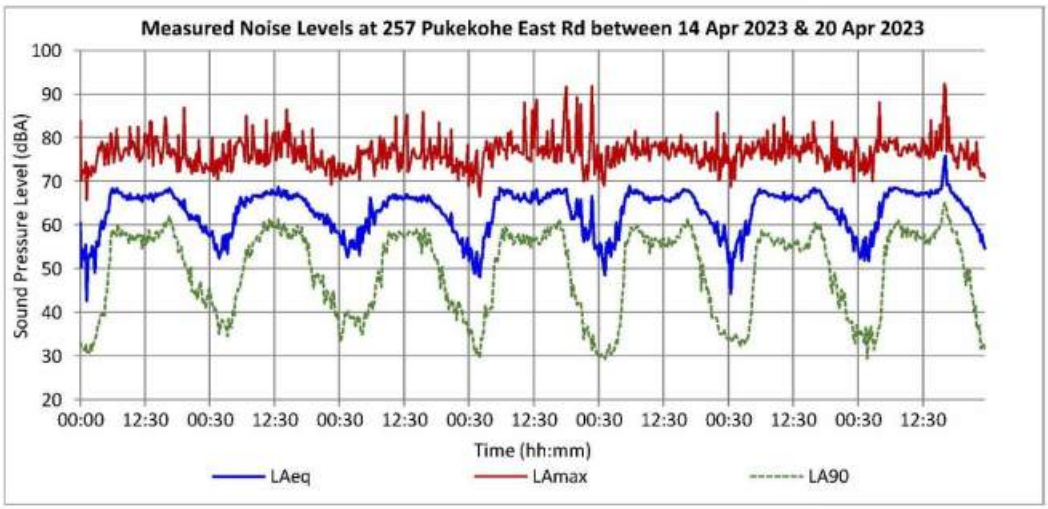
MARSHALL DAY Acoustics

| | |
|---|---|
| Date: | Friday, 28 April 2023 |
| File name: | I:\JOBS\2022\20221119\03 Survey Data & Measurements\Processed data\257 Pukekohe Rd\[257 Pukekohe East Road Summary.xlsx]Logger_Summary |
| Job number: | 20221119 |
| Job name: | SGA Pukekohe |
| Initials: | OL |
| Measurement Dates: | Friday, 14 April 2023 to Thursday, 20 April 2023 |
| Weather during Measurement: | Rain happened for few days, affected data has been removed from the data set before the analysis |
| Notes: | |

**OVERVIEW SUMMARY SHEET**

| Noise Level, dB | | $L_{Aeq}$ | $L_{A10}$ | $L_{A90}$ | $L_{Amax}$ |
|---|---|---|---|---|---|
| Day (0700-1800) | Lowest | 60 | 65 | 43 | 71 |
| | Average | 67 | 70 | 57 | 78 |
| | Highest | 76 | 78 | 65 | 92 |
| Evening (1800-2200) | Lowest | 56 | 60 | 34 | 70 |
| | Average | 64 | 68 | 49 | 76 |
| | Highest | 68 | 71 | 59 | 92 |
| Night (2200-0700) | Lowest | 44 | 37 | 29 | 67 |
| | Average | 61 | 65 | 39 | 75 |
| | Highest | 69 | 72 | 59 | 92 |

$L_{Aeq\ 24\text{-}hr}$ 65 dB



## Logger Measurements

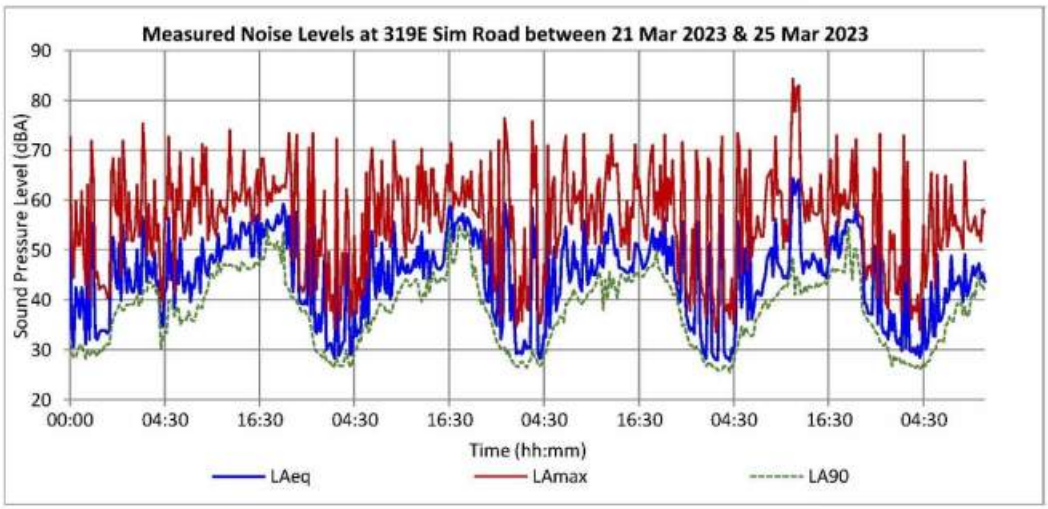
MARSHALL DAY Acoustics

| | |
|---|---|
| Date: | Friday, 28 April 2023 |
| File name: | I:\JOBS\2022\20221119\03 Survey Data & Measurements\Processed data\319E Sim Rd\[319E Sim Road Summary.xlsx]Logger_Summary |
| Job number: | 20221119 |
| Job name: | SGA Pukekohe |
| Initials: | OL |
| Measurement Dates: | Tuesday, 21 March 2023 to Saturday, 25 March 2023 |
| Weather during Measurement: | Rain happened for few days, affected data has been removed from the data set before the analysis |
| Notes: | |

**OVERVIEW SUMMARY SHEET**

| Noise Level, dB | | $L_{Aeq}$ | $L_{A10}$ | $L_{A90}$ | $L_{Amax}$ |
|---|---|---|---|---|---|
| Day (0700-1800) | Lowest | 31 | 32 | 28 | 36 |
| | Average | 52 | 53 | 41 | 59 |
| | Highest | 64 | 65 | 57 | 84 |
| Evening (1800-2200) | Lowest | 37 | 38 | 35 | 43 |
| | Average | 53 | 55 | 43 | 59 |
| | Highest | 59 | 62 | 55 | 75 |
| Night (2200-0700) | Lowest | 28 | 29 | 26 | 34 |
| | Average | 48 | 50 | 32 | 52 |
| | Highest | 59 | 61 | 46 | 76 |

$L_{Aeq\ 24\text{-}hr}$ 51 dB



## Logger Measurements

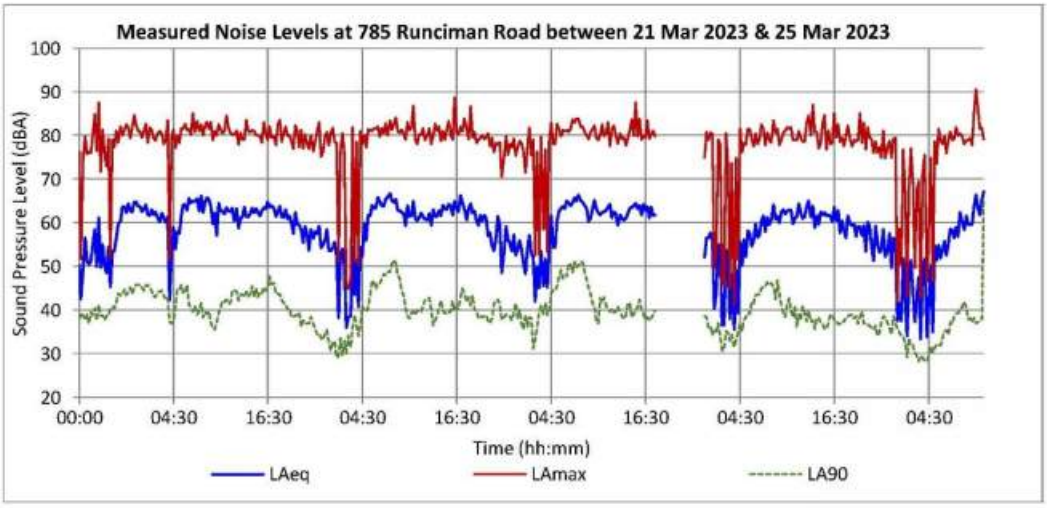
MARSHALL DAY Acoustics

| | |
|---|---|
| Date: | Friday, 28 April 2023 |
| File name: | I:\JOBS\2022\20221119\03 Survey Data & Measurements\Processed data\785 Runciman Rd\[785 Runciman Road Summary.xlsx]Logger_Summary |
| Job number: | 20221119 |
| Job name: | SGA Pukekohe |
| Initials: | OL |
| Measurement Dates: | Tuesday, 21 March 2023 to Saturday, 25 March 2023 |
| Weather during Measurement: | Rain happened for few days, affected data has been removed from the data set before the analysis |
| Notes: | |

**OVERVIEW SUMMARY SHEET**

| | Noise Level, dB | $L_{Aeq}$ | $L_{A10}$ | $L_{A90}$ | $L_{Amax}$ |
|---|---|---|---|---|---|
| Day (0700-1800) | Lowest | 43 | 42 | 36 | 52 |
| | Average | 62 | 62 | 41 | 80 |
| | Highest | 67 | 71 | 51 | 89 |
| Evening (1800-2200) | Lowest | 51 | 43 | 36 | 76 |
| | Average | 60 | 58 | 32 | 64 |
| | Highest | 65 | 66 | 46 | 87 |
| Night (2200-0700) | Lowest | 33 | 35 | 28 | 42 |
| | Average | 59 | 57 | 37 | 74 |
| | Highest | 66 | 67 | 51 | 85 |

$L_{Aeq\ 24\text{-}hr}$ 61 dB

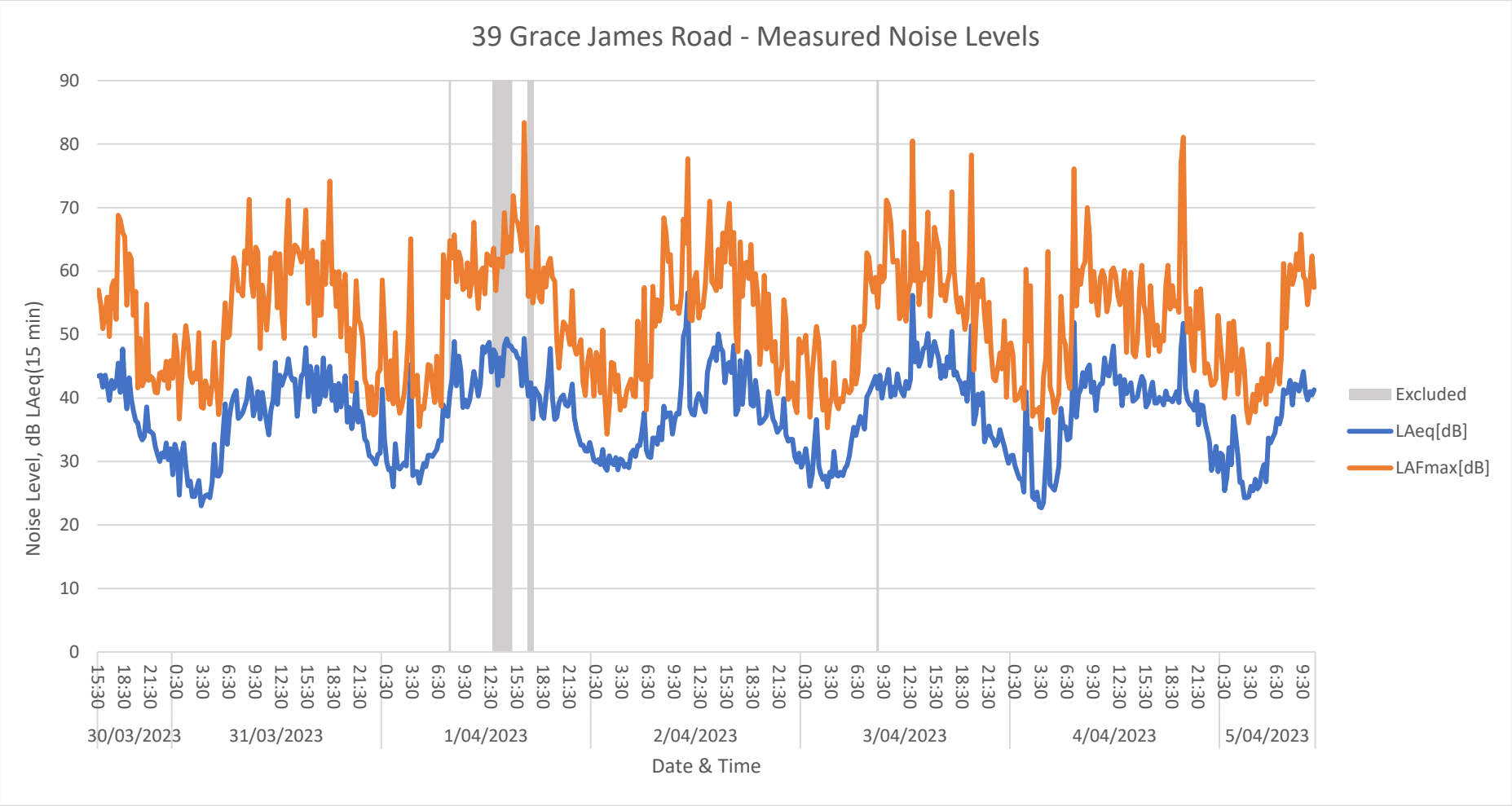


AECOM

| NOISE MONITORING FORM – 39 Grace James Road | | | | | |
|---|---|---|---|---|---|
| **Summary** | | | | | |
| Project name | SGA | | | | |
| Project number | 60558831 | | | | |
| Date / time | 30/03/2023 2:45pm | | | | |
| Engineer(s) | Vitalii Zaiets, Christine Zhou | | | | |
| Address | 39 Grace James Road, Pukekohe | | | | |
| Location (NZTM2000) | X | 1770952 | Y | 5883240 | |
| **Equipment** | | | | | |
| Manufacturer | Acoustic Research Labs | | | | |
| Type | Ngara | | | | |
| Serial number | 8781D0 | | | | |
| Date of last calibration | 30/03/2023 | | | | |
| Calibration drift pre/post | | | | | |
| **Noise Environment** | | | | | |
| Which assessment method is applicable? *I.e., NZS 6802:2008 Simple / Detailed or other.* | Simple | | | | |
| General description of measured noise: specific and residual levels including comments on $k_1$ adjustment and contamination | Mostly wind noise, trees/foliage around the house (more prominent in front yard). Water fountain in backyard, ~20m away from logger. | | | | |
| Any special audible characteristics (tonality, impulsivity etc.) and comment on $k_2$ adjustment | None | | | | |
| **Meteorological Conditions** | | | | | |
| Wind speed and direction at microphone | 4.2 m/s | | | | |
| Wind speed and direction at dominant source(s) | 4.2 m/s | | | | |
| Precipitation | 0 mm | | | | |
| Fog | N/A | | | | |
| Temperature | 18.3 °C | | | | |
| Humidity | 48 % | | | | |
| Percentage cloud cover | | | | | |
| **Site Conditions** | | | | | |
| Microphone height | 1.5m | | | | |
| Distance to dominant noise source(s) | --m (---) | | | | |
| Height of noise source(s) | Ground level | | | | |
| Distance from any reflective surfaces | 10m from façade | | | | |
| Intervening topography | Hill sloping down into garden | | | | |
| Hard, mixed or soft ground | Soft | | | | |
| Barriers between source(s) and microphone | None | | | | |
| **Photos** | | | | | |

AECOM

AECOM

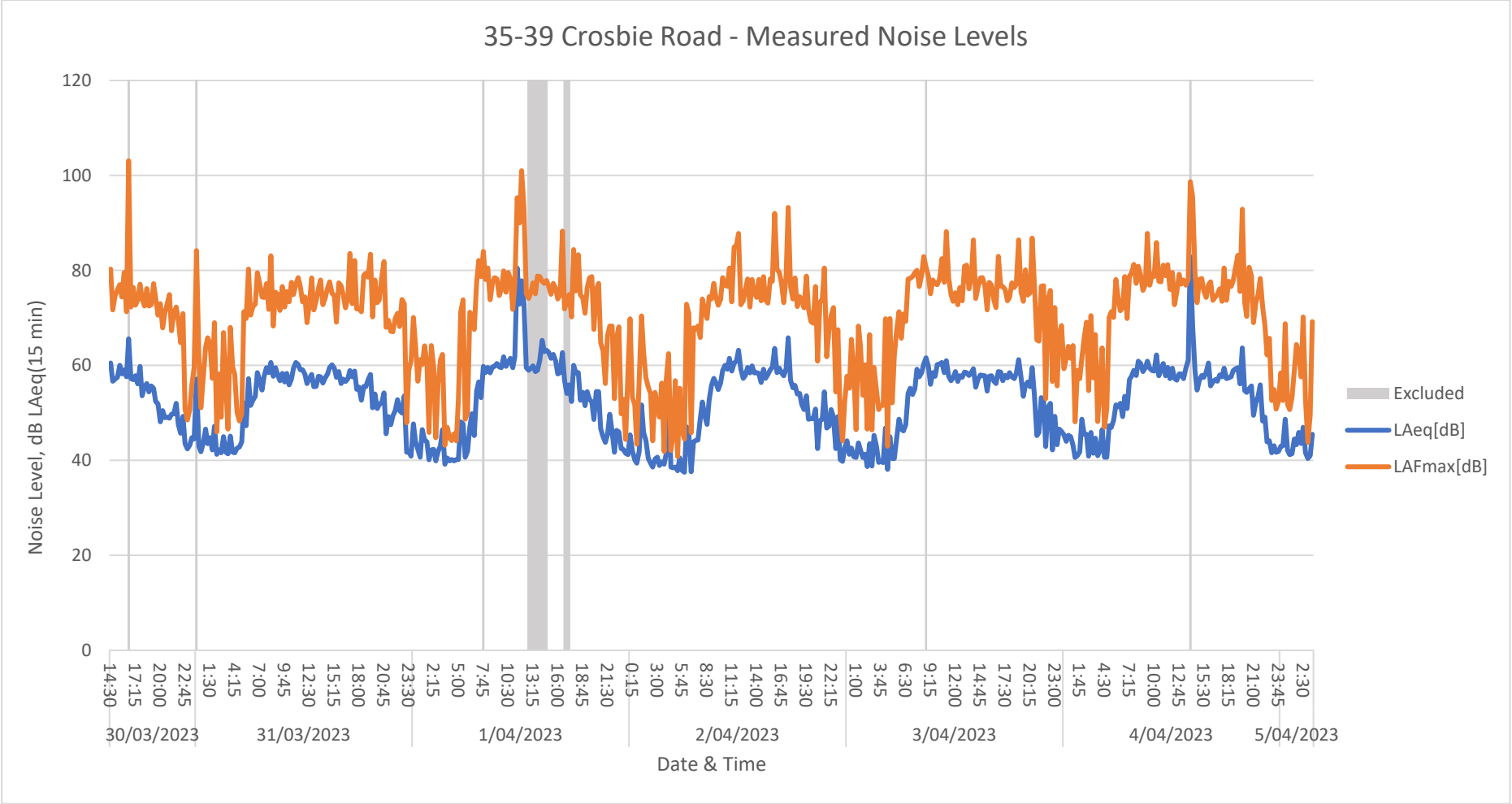

39 Grace James Road - Measured Noise Levels
Noise Level, dB LAeq(15 min)
90
80
70
60
50
40
30
20
10
0
15:30
18:30
21:30
0:30
3:30
6:30
9:30
12:30
15:30
18:30
21:30
30/03/2023
31/03/2023
1/04/2023
2/04/2023
3/04/2023
4/04/2023
5/04/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]

AECOM

| NOISE MONITORING FORM – 35-39 Crosbie Road | | | | | |
|---|---|---|---|---|---|
| **Summary** | | | | | |
| Project name | SGA | | | | |
| Project number | 60558831 | | | | |
| Date / time | 30/03/2023 1:50pm | | | | |
| Engineer(s) | Vitalii Zaiets, Christine Zhou | | | | |
| Address | 35-39 Crosbie Road, Pukekohe | | | | |
| Location (NZTM2000) | X | 1769741 | Y | 5880140 | |
| **Equipment** | | | | | |
| Manufacturer | Acoustic Research Labs | | | | |
| Type | Ngara | | | | |
| Serial number | 8781F3 | | | | |
| Date of last calibration | 30/03/2023 | | | | |
| Calibration drift pre/post | | | | | |
| **Noise Environment** | | | | | |
| Which assessment method is applicable? *I.e., NZS 6802:2008 Simple / Detailed or other.* | Simple | | | | |
| General description of measured noise: specific and residual levels including comments on $k_1$ adjustment and contamination | Road traffic noise, mostly from Manukau Rd and Station Rd. Ongoing construction work surrounding area, not always as prominent as traffic noise. Forklift operations in building opposite where noise logger was located, ~25m away. | | | | |
| Any special audible characteristics (tonality, impulsivity etc.) and comment on $k_2$ adjustment | | | | | |
| **Meteorological Conditions** | | | | | |
| Wind speed and direction at microphone | 4 m/s | | | | |
| Wind speed and direction at dominant source(s) | 4 m/s | | | | |
| Precipitation | 0 mm | | | | |
| Fog | N/A | | | | |
| Temperature | 18.6 °C | | | | |
| Humidity | 46 % | | | | |
| Percentage cloud cover | | | | | |
| **Site Conditions** | | | | | |
| Microphone height | 1.5m | | | | |
| Distance to dominant noise source(s) | --m (---) | | | | |
| Height of noise source(s) | Ground level | | | | |
| Distance from any reflective surfaces | ~1m from shipping crate | | | | |
| Intervening topography | Flat | | | | |
| Hard, mixed or soft ground | Soft | | | | |
| Barriers between source(s) and microphone | Parked cars on street | | | | |
| **Photos** | | | | | |

AECOM

AECOM


35-39 Crosbie Road - Measured Noise Levels
Noise Level, dB LAeq(15 min)
120
100
80
60
40
20
0
14:30
17:15
20:00
22:45
1:30
4:15
7:00
9:45
12:30
15:15
18:00
20:45
23:30
2:15
5:00
7:45
10:30
13:15
16:00
18:45
21:30
0:15
3:00
5:45
8:30
11:15
14:00
16:45
19:30
22:15
1:00
3:45
6:30
9:15
12:00
14:45
17:30
20:15
23:00
1:45
4:30
7:15
10:00
12:45
15:30
18:15
21:00
23:45
2:30
30/03/2023
31/03/2023
1/04/2023
2/04/2023
3/04/2023
4/04/2023
5/04/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]