I hereby give notice that a hearing by commissioners will be held on:

Date:	**Monday 13 to Thursday 16 November 2023** **Monday 20 to Thursday 23 November 2023**
Time:	**9:30am** (unless specified otherwise)
Meeting room:	**Warkworth Town Hall**
Venue:	**2 Alnwick Street, Warkworth**

NOTIFICATION MATERIAL

VOLUME 4

8 NOTICES OF REQUIREMENT FOR THE WARKWORTH PROJECT

TE TUPU NGĀTAHI SUPPORTING GROWTH (AUCKLAND TRANSPORT & WAKA KOTAHI NZ TRANSPORT AGENCY)

COMMISSIONERS

Chairperson	**Richard Blakey**
Commissioners	**Mark Farnsworth**
	Vaughan Smith

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Senior Hearings Advisor

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Note: The reports contained within this agenda are for consideration and should not be construed as a decision of Council. Should Commissioners require further information relating to any reports, please contact the Team Leader Hearings.

VOLUME 1 **TABLE OF CONTENTS** **PAGE NO.**

General Arrangement Plans & Property Boundaries and Schedules

ATTACHMENT 69

LANDSCAPE AND NATURAL CHARACTER AND VISUAL ASSESSMENT

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Package Landscape and Natural Character and Visual Assessment

May 2023

Version 1.0

Document Status

Responsibility	Name	Signature
Author	Chantal Whitby	
Reviewer	John Hudson	
Approver	Heather Wilkins	

Revision Status

Version	Date	Reason for Issue
1.0	12/05/2023	Issue for Lodgement

Table of Contents

Appendices

Appendix A: Graphic Attachments

Appendix B: NPS:UD, MDRS, PC78 and Warkworth Structure Plan

Appendix C: Effects ratings and RMA Terminology

Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
CEMP	Construction Environmental Management Plan
CPTED	Crime Prevention through Environmental Design
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
ha	Hectares
HNC	High Natural Character
km	Kilometres
LNCVA	Landscape and Natural Character and Visual Assessment
MDRS	Medium Density Residential Standards
NPS	National Policy Statement
NPS:FM	National Policy Statement on Freshwater Management
NPS:UD	National Policy Statement on Urban Development
NOR	Notice of Requirement
NOR 1	Northern Public Transport Hub and Western Link - North
NOR 2	Woodcocks Road – West Upgrade
NOR 3	State Highway 1 – South Upgrade
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link - North
NZ	New Zealand
ONC	Outstanding Natural Character
ONF	Outstanding Natural Features
ONFL	Outstanding Natural Features and Landscapes

Acronym/Term	Description
ONL	Outstanding Natural Landscapes
PC78	Plan Change 78
QEII	QEII National Trust Covenant
RUB	Rural Urban Boundary
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SH1	State Highway 1
Te Honohono ki Tai	Matakana Link Road
Te Tangi a te Manu	Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
ULDMP	Urban Landscape and Design Management Plan
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
Warkworth Package	The combined term for all eight NORs covered in this assessment

1 Executive Summary

Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORs including new corridors, existing road upgrades, and a public transport interchange with park and ride.

Table 1. Warkworth Assessment Package – NOR and Project Overview

Notice	Project
NOR 1	Northern Public Transport Hub and Western Link - North
NOR 2	Woodcocks Road – West Upgrade
NOR 3	State Highway 1 – South Upgrade
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link - North

Methodology

This Landscape and Natural Character and Visual Assessment (LNCVA) has been undertaken using best practice guidance for landscape assessment as provided by 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022 (Te Tangi a te Manu). The New Zealand Institute of Landscape Architects seven-point scale of effects has been used in this report when assessing the potential landscape effects arising from the Warkworth Package. The effects scale ranges between" 'Very Low' to 'Low' to 'Low-Moderate' to 'Moderate' to 'Moderate-High' to 'High' to 'Very High' (Table 2).[1]

Table 2 Effects rating table

Very Low	Low	Low-Moderate	Moderate	Moderate-High	High	Very High

Existing and likely receiving environment

The proposed designations are located within and around the town of Warkworth. Warkworth is currently a Satellite Town of Auckland and acts as a rural node. The urban hub is located around the

[1] Rating of effects in relation to Resource Management Act terminology is provided in Appendix C.

town centre and Mahurangi River, however, future planning will enable significant business and urban growth in the area. Future zoning will see this urban character expand into the surrounds of the existing town centre.. As such, those areas of the Warkworth Package which are currently greenfield sites will likely have transformed to an urban environment approximately the same time that the proposed transport corridors are implemented. If urbanisation has not occurred, the roading corridors will not need to be built.

Within this LNCVA it was assumed that this future likely environment was undertaken in accordance with the National Policy Statement Urban Development (NPS:UD) and the Auckland Council Proposed Plan Change 78 – Intensification (PC78), which would be informed by the Warkworth Structure Plan. It is this expected environment which formed the basis for effects to be assessed against. Within this LNCVA, assumptions have been made on the expected likely future environment, these are based on the current National Policy Statements encouraging greater density, the AUP:OP with its existing zoning and FUZ, the Warkworth Structure Plan, and Auckland Council documents on subdivision. The overarching policy direction comes from the National Policy Statements, such as the NPS:UD and the accompanying Medium Density Residential Standard (MDRS).

1.1 Assessment of effects

1.1.1 Overall Warkworth Network

The Warkworth Package will introduce an extensive transport network into Warkworth, which is anticipated to result in modifications to existing residential, rural and light industrial areas, earthworks, vegetation removal, waterbody modification and potential modification to heritage and cultural sites. However, the proposed designations will also provide the opportunity to improve connectivity between existing roads, improve road user safety, enhance active and public transport modes, better connect people and fauna with existing bush and riparian margins, increase the extent and quality of indigenous vegetation, and highlight heritage and cultural narratives in the landscape.

With the implementation and establishment of recommended measures, construction and operational effects are anticipated to be ‘Low-Moderate’ at most. A summary of effects is provided in Table 3. Proposed conditions at the future regional consent stage will provide specific mitigation for future transport projects within each designation.

1.1.2 Effects for Northern, Southern and Individual NORs

Effects on the northern Project Area (NOR 1, NOR 4, NOR 5 and NOR 7), Southern Project Area (NOR2, NOR 3, NOR 6, and NOR 8), and individual NORs have been assessed throughout this report. With the implementation and establishment of recommended measures, construction and operational it is anticipated that effects will vary between ‘Low’ and ‘Moderate-High’.

1.1.3 Summary of Effects and Recommendations

Table 3. Summary of assessment of effects of recommendations – Warkworth Package overall network

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Very Low'** **Natural Character:** **'Very Low'**	Larger construction area, than operational footprint. This may result in some additional vegetation removal.	Appropriately integrate Project with existing landscape features (including natural wetlands) and the wider natural landscape. Consider opportunities for suitable felled tree species for re-use as landscape features.
	Work to be undertaken in or near waterbodies.	Minimise sedimentation of waterbodies using appropriate erosion controls, by limiting the extent of exposed earthworks at any one time and revegetate earthworks, as appropriate. Consider opportunities for topsoil stripping and stockpiling for re-use, ensuring that topsoil is suitable for landscape purposes. Where practicable, undertake bridge construction from dry land, avoid piers in the beds of waterways and wetlands, minimise piers on riverbanks, and minimise fill over waterbodies.
Landscape Character (cont'): **'Very Low'**	Visual effects from the clutter of materials, machinery, and construction yards.	Where appropriate, select visually discrete locations for the placement of construction yards and material storage. Consider screening of construction yards as mitigation for temporary visual effects. Ensure the reinstatement of construction yards is undertaken in a manner appropriate for the anticipated future use of the land. Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape

Residual effect after recommendations	Assessment	Recommendation
Natural Character (cont'): **'Very Low'**		treatment to manage these effects.
	Effects on existing residential areas.	Identify opportunities for the survey, collection, and propagation of heritage amenity plants in private gardens that will be demolished to enable construction to occur (subject to the agreement with the landowner), so that as appropriate these may be re-established as part of the planting programme during finishing works.
Operational effects		
Landscape Character: **'Low-Moderate'** **Natural Character:** **'Low-Moderate'**	Opportunity to integrate the Warkworth Package with the wider landscape.	Consider how the Project (including roadside elements such as lighting, signage and the landscape treatment of structures) can: • Enable integration of the Project's permanent works into the surrounding landscape and urban context; and • Ensure that the Project manages potential adverse landscape and visual effects and contributes to a quality urban environment. Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape treatment to manage these effects. How the Project can enable integration of street trees into the transport corridor design.

Residual effect after recommendations	Assessment	Recommendation
Landscape Character (cont'): **'Low-Moderate'** **Natural Character (cont'):** **'Low-Moderate'**	Potential for effects on landscape features, including indigenous vegetation and waterbodies.	Integrate the Project with existing landscape features (including natural wetlands) and the wider natural landscape.
	Opportunity to integrate stormwater management.	Consider further refinement of stormwater treatment wetland design to appear 'natural' with a variety of habitats, e.g. irregular shape with curved boundaries, varying depths and islands. Consider water sensitive urban design principles. Recommendation to prioritise the use of soft engineering strategies for stormwater management. It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.
	Anticipated likely future environment based on assumptions.	Re-validate the landscape and natural character values identified in the LNCVA prior to the commencement of conceptual design.

1.1.4 Conclusion

Several key issues were raised throughout the LNCVA, including potential effects on, or opportunities regarding:

- Amenity
- Landform
- Vegetation
- Waterbodies (waterways and natural wetlands)
- Rural landscape characteristics
- Heritage values
- Cultural values

Recommendations were made throughout the LNCVA to address potential effects by directing outcomes to be achieved and recognising opportunities. The recommendations made throughout the LNCVA are also reflected in the 'urban design outcomes and opportunities' figures within the Volume 4: Urban Design Evaluation. **Error! Reference source not found.**

2 Introduction

This LNCVA has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance (Te Tupu Ngātahi**)**, for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). It relates to eight Notices of Requirement (NoRs) around the Warkworth area that are packaged together in one assessment (the "Warkworth Package"). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60km from the Auckland city centre, and 30km north of Orewa. It is identified as a Satellite Town in the Auckland Unitary Plan: Operative in Part (AUP:OP). At present and in the future the town acts or will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. Around 1000ha of currently rural land is zoned as Future Urban Zone (FUZ) to support significant business (including industrial) and residential growth. At full development capacity based on the Future Land Supply Strategy (FULSS) it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business zoned land is already operative and the remainder to be 'development ready' by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032.
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037.

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

It is noted that parts of these areas are experiencing earlier than anticipated growth pressure, with parts of Warkworth South subject to a lodged Private Plan Change, as well as sections of Warkworth Northeast.[2]

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 2.

This report addresses the landscape and natural character effects of the Warkworth Package (NOR 1 - NOR 8) identified in Table 4 in Section 2.

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

2.2 Purpose and scope of this Report

This LNCVA forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NORs sought by AT and WK.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Warkworth Package on the existing and likely future environment as it relates to landscape and natural character and visual 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:

a) Identify and describe the landscape context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential landscape effects of each Project corridor within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential landscape effects (including any conditions/management plan required) for each Project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth Package. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of landscape and natural character effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

A relevant factor in the assessment has been acknowledgement that the environment which will exist at the time of construction is anticipated to be different to the current environment that we see today.

[2] https://www.aucklandcouncil.govt.nz/have-your-say/have-your-say-notified-resource-consent/Pages/resource-consent-public-notice.aspx?itemId=194&src=Search

Change is provided for in a range of statutory and non-statutory documents, which have been considered in assessing effects, with intensification and further urban/commercial development anticipated. It is against this future 'base environment' and against the current Project drawings supplied by Te Tupu Ngātahi that all effect and recommendations are assessed and made.

2.3 Report Structure

In order to provide a clear assessment of each NOR this report follows, as appropriate, the structure set out in the AEE. That is, the whole network as well as the individual corridors and facilities have their own section, and each section contains an assessment of the actual and potential effects. Where appropriate, measures to avoid, remedy or mitigate effects are recommended.

The sections are arranged starting from the overall network, then by project starting from Public Transport Hubs, then existing road upgrades, and finally new corridors. Table 5 below describes the extent of each corridor, and where the description of effects can be found in this report.

Table 4. Report Structure

Sections	Section number
Description of the Project	3
Statutory and non-statutory documents relevant to landscape and natural character and visual matters for the Warkworth Package	4
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	5
Identification and description of the existing and likely receiving landscape environment	6
Assessment of general landscape and natural character and visual matters for all Warkworth NORs	7
Assessment of specific landscape and natural character and visual matters for Northern Warkworth NORs	8
Assessment of specific landscape and natural character and visual matters for Southern Warkworth NORs	9
Assessment of specific landscape and natural character and visual matters for Warkworth NOR 1	10
Assessment of specific landscape and natural character and visual matters for Warkworth NOR 2	11
Assessment of specific landscape and natural character and visual matters for Warkworth NOR 3	12
Assessment of specific landscape and natural character and visual matters for Warkworth NOR 4	13
Assessment of specific landscape and natural character and visual matters for Warkworth NOR 5	14

3 Warkworth Package Overview

The Warkworth Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORs including public transport interchanges, existing road upgrades, and new corridors.

An overview of the NORs in the Warkworth Package is set out in Table 5 and shown in Figure .

Table 5. Warkworth NOR Package

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Hub and Western Link – North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road - West	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport
State Highway 1 – South Upgrade	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Matakana Road Upgrade	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Western Link – South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport
Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport
Wider Western Link – North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

Figure 3-1. Warkworth NOR Package overview

4 Statutory and Non-Statutory Documents

Planning framework

Several documents were considered as part of the LNCVA. These included:

- Statutory documents:

– RMA
– NPS:UD
– MDRS
– AUP:OP

- Non-statutory documents:

– Warkworth Structure Plan
– Auckland Code of Practice for Land Development and Subdivision
– Auckland Transport Code of Practice
– Urban Street and Road Design Guide

These documents are discussed further in the 'Assessment Methodology' Section 5.1.5. The consistency of the Warkworth Package with direction provided by the RMA, AUP:OP, and Warkworth Structure Plan on landscape and natural character matters is considered in Section 18 'Statutory Considerations'. Appendix B also highlights key aspects of the NPS:UD, MDRS, PC78 and Warkworth Structure Plan which are relevant to establishing the likely future environment for the Warkworth Package.

5 Assessment Methodology

Preparation for this Report

In preparation for this report, a site visit was undertaken by landscape architects Chantal Whitby, John Hudson, Heather Wilkins and Abby Liang, which occurred on 14th November 2022. A second site visit was undertaken by John Hudson on 21st February 2023, along with members of the Te Tupu Ngātahi and Auckland Council officers.

During the first site visit the extent of the proposed designations was discussed and recorded in field data sheets. The landscape character of the site and its surrounds, along with the visual catchment, were also assessed in relation to the proposed designations.

Private property access was not visited during the site visit as those areas of private property relevant to the LNCVA were not available. As such, ground-truthing the existing character of the designations in these locations was restricted. This limitation applied particularly to NOR 7 and NOR 8, with the visibility of these designations being largely restricted from surrounding, public areas. As a result, some assumptions on the existing landscape character have been informed by desktop research, including analysis through Google Earth.

5.1 Methodology

5.1.1 Best practice guidance

This LNCVA has been undertaken using best practice guidance for landscape assessment as provided by 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022 (Te Tangi a te Manu).

The Te Tangi a te Manu seven-point scale of effects has been used in this report when assessing the potential landscape effects arising from the Warkworth Package. The effects scale ranges between" 'Very Low' to 'Low' to 'Low-Moderate' to 'Moderate' to 'Moderate-High' to 'High' to 'Very High' (Table 6).[3]

Table 6 Effects rating table

Very Low (V-L)	Low (L)	Low-Moderate (L-M)	Moderate (M)	Moderate-High (M-H)	High (H)	Very High (V-H)

As defined by Te Tangi a te Manu, landscape character is each landscape's distinctive combination of physical attributes (e.g. landform and ecological aspects), associative attributes (e.g. heritage and cultural values) and perceptual attributes (e.g. legibility of landcover patterns and aesthetic qualities).

For clarity, visual effects are included in this assessment as a subset of landscape effects.[4] Due to the uncertain nature of the likely future environment (including potential topography changes and the layout of future urban structures) an accurate Zone of Theoretical Visibility cannot be established. The visual effects of the Project from areas where it is highly probable that the proposed transport corridors will be seen are discussed as applicable for individual NORs.

Natural character, as defined by Te Tangi a te Manu, is the distinct combination of an area's natural characteristics and qualities, including degree of naturalness. Natural character is the outcome of physical environment and perception. Within the RMA (Section 6(a)) natural character only relates to the coastal environment and to waterbodies and their margins, rather than the landscape in its entirety.

Te Tangi a te Manu goes further to promote integration of Te Ao Māori – our unique indigenous worldview, as a keystone of Aotearoa landscape assessment practice. It is not, however, the role of the Landscape Architect to determine these values on behalf of mana whenua unless designated to do so. Accordingly, this LNCVA does not specifically address mana whenua values which are being considered through a separate, parallel process. Refer to the AEE for details.

The methodology used is best aligned with an area-based landscape assessment, which is typically a policy-driven assessment as opposed to a proposal-driven assessment. Area-based assessments are typically carried out at a district or regional scale for a variety of resource management policy purposes. They are higher level assessments which assess the potential effects of generic activities, where specific project details are absent. In contrast, a proposal-driven assessment approach applies

[3] Rating of effects in relation to Resource Management Act terminology is provided in Appendix C.

[4] Te Tangi a te Manu: Aotearoa New Zealand Landscape Architects Guidelines refer to visual effects as a subset of landscape effects (page 135). As such, visual values and effects have been considered as part of landscape character.

in a ‘design – build’ situation where the implementation of the ‘project’ is more imminent than what is planned in the case of this NOR process. The more detailed assessment will be undertaken later at a future consenting, implementation, or designation alteration stage as and when required.

According to Te Tangi a te Manu, an area-based landscape assessment would typically:

- Identify (describe) the landscape resource of an area (its character and values), including any Outstanding Natural Features and Landscapes (ONFLs) and other significant landscapes.
- Assess landscape character and values.
- Anticipate potential future effects on landscape values (for this report this includes assessing the current and likely future environment for the ’project’).
- Recommend policy measures to manage landscape values.
- Make specific assessments of ONFLs.[5]

5.1.2 Information sources

The LNCVA utilises information obtained from a desktop study and site assessment. The details of the site assessment have been outlined in Section 3.1 ‘Preparation for this Report’.

The desktop study information has been utilised to help describe the proposed designations, as well as the site and contextual landscape, and to evaluate the key issues and potential landscape effects of the Warkworth Package, including positive and negative effects.

During the site visit, a number of representative viewpoints were identified from publicly accessible locations. Photographs were taken to establish the existing landscape context and the likely visual effect of the Warkworth Package on the landscape in relation to the transitory and fixed viewing audiences. These photographs have been included in this report in the form of a photo essay (Appendix A).

5.1.3 Assessing effects

The LNCVA was undertaken early in the design process. This allows for potential adverse effects to be identified early on and provides the opportunity for recommendations to be incorporated into the design in the future at the regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1).

Analysis of the existing landscape and the change that will likely result from the Warkworth Package has been assessed based on information as discussed in Section 3.1 ‘Preparation for this Report’. An expert opinion has been formed in relation to the ability of the existing and likely future landscape to absorb changes likely to arise from the proposed designations. Noting that while information on the proposed location of the designations is available, the design details of the designations are limited at this stage. Recommended measures to avoid, remedy and mitigate adverse effects have been discussed throughout the report.

While comments around waterways and wetlands have been provided throughout the assessment, as appropriate, it is acknowledged that effects on waterbodies are largely a regional consenting matter and will be addressed in further detail in the future during the regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1).

[5] Te Tangi a te Manu: Aotearoa New Zealand Landscape Architects Guidelines, Tuia Ora Pito New Zealand Institute of Landscape Architects, July 2022 (page 251).

5.1.4 Effects with and without recommendations

Within the LNCVA effects are assessed with and without recommendations to demonstrate the effectiveness of the proposed recommended measures in lessening potential effects. These effects are separated into construction and operational effects. Construction effects include temporary effects of the project solely related to the construction of the proposed transport corridors, such as additional works outside of the operational footprint, construction machinery, stockpiling of materials (including soil), and raw earthworks. Operational effects are ongoing effects which are associated with the ongoing presence of the proposed transport corridors within the permanent designation boundary. For example, this may be areas of cut and fill, visual dominance of structures, and proximity of transport related structures to landscape features and housing.

For the purposes of route protection, earthworks shown in the proposed Project drawings are based on the current existing environment. The actual construction effects and extent of earthworks required will be subject to the outcomes of the future detailed design process, which will reflect any modifications to topography which occur as part of future development.

Generally, it is expected that construction effects will be greater than operational effects, with effects for both situations being greater without recommended measures. Typically, effects will be greatest for construction without recommended measures, followed by construction with recommended measures, then operational without recommended measures. Operational with recommended measures is expected to have the lowest level of effect of the four situations.

5.1.5 Establishing likely future environment

While PC78 is not yet resolved, it is assumed that this plan change (along with future plan changes associated with the FUZ) will apply the principles of the NPS:UD, MDRS, AUP:OP, and Warkworth Structure Plan (Appendix B), as well as be informed by the Auckland Code of Practice for Land Development and Subdivision, Auckland Transport Code of Practice, and Urban Street and Road Design Guide. This is the basis against which I have assessed effects.

It is expected that PC 78 will be implemented, or be in the processing of being implemented, at the time of construction of the proposed transport corridors. As such, PC78 forms the basis for the expected likely future environment for the Warkworth Package, as does the AUP:OP FUZ, which will be actioned by future plan changes.

PC78 will enable intensification of existing urban environments and future urban development, the Warkworth Structure Plan provides direction on how this intensification is undertaken. PC78 has been informed by the Warkworth Structure Plan, which gives considerable recognition of Warkworth's existing natural patterns, processes and elements, and the retainment of these landscape features to ensure Warkworth maintains its unique identity throughout the urbanisation process.

It is this anticipated future environment outlined in the Warkworth Structure Plan and reflected in PC78 that has informed effects assessed in the LNCVA. The purpose of the recommended measures in the LNCVA is to ensure the proposed transport corridors will integrate with the likely future environment enabled by PC78.

6 Existing and likely receiving landscape environment

The projects within each NOR comprising the Warkworth Package will be constructed 10-25 years from now. The implementation timeframe for each project will vary and correspond with future land release within the area. Assessing the effects on the environment solely as it exists today (i.e. at the time of assessment) will not provide an accurate reflection of the environment in which some of the effects will be experienced. Accordingly, the assessment of effects considers both the existing environment, and the likely receiving environment in which the effects will likely occur.

The Warkworth Package will be constructed and will operate alongside existing urban environments or planned future environments (i.e. what can be built under the existing Auckland Unitary Plan: Operative in Part (AUP:OP) and what is identified in the Warkworth Structure Plan):

- **Existing environment:** A number of NOR corridors comprising the Warkworth Package are partially located within/alongside existing urban areas.

– NOR 2 Woodcocks Road – the eastern extent of the corridor has existing residential land uses to the north and south.
– NOR 3 State Highway 1 (Southern Section) – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
– NOR 4 Matakana Road Upgrade – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
– NOR 6 Western Link South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.

- **Future environment**: All the NOR corridors in the Warkworth Package will be partially or wholly constructed and implemented on land identified for future growth (Future Urban Zone) and, as a result, are anticipated to change to urban or business / industrial land uses.

The likelihood and magnitude of land use change regarding the land use planning context has been identified in Table 7 below, provided by Te Tupu Ngātahi. This has been used to inform the assumptions made on the likely future environment.

Table 7. Likelihood and magnitude of land use change

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment[6]	Magnitude of potential change	Likely Receiving Environment[7]
Residential[8]	Residential (Mixed Housing Suburban)	Low	Low	Residential

[6] Based on AUP:OP zoning/policy direction
[7] Based on Warkworth Structure Plan and AUP:OP zoning/policy direction

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment[6]	Magnitude of potential change	Likely Receiving Environment[7]
	Residential (Mixed Housing Urban)	Low	Low	Residential
	Residential (Single House)	Low	Low	Residential
Business	Business (Mixed Use)	Low	Low	Business (Industrial)
	Business (General Business)			Business (General Business)
	Business (Light Industry)	Low	Low	Business (Industrial)
	Business (Local Centre Zone)	Low	Low	Business (Neighbourhood Centre)
Open Space	Open Space – Conservation Zone	Low	Low	Informal Recreation
Greenfield areas	Future Urban Zone	High	High	Urban
Other	Special Purpose – Quarry Zone	Low	Med	Quarry

Refer to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the Warkworth NOR package.

6.1 Landscape context

The proposed designations are located within and around the town of Warkworth. The central area of the town has an urban character. Outside of this urban area is rural-use land, which is largely at the north-east and south-west extents of the town. Currently State Highway 1 (SH1) runs through Warkworth, although once the Ara Tūhono expressway (located to the west of Warkworth) is completed this will become the new SH1.

- Warkworth is currently a Satellite Town of Auckland and acts as a rural node. The urban hub is located around the town centre and Mahurangi River, however, future planning will enable significant business growth in the area (including the expansion of retail, commercial and industrial enterprises). This development will result in a series of small local centres, although the existing town centre will remain the focal point of Warkworth. Land development is already occurring within Warkworth, for instance the residential development to the north of Te Honohono ki Tai (Matakana Link Road) and within the vicinity of Evelyn Street, as well as industrial development along Morrison Drive. Future zoning will see this urban character expand into the surrounds of the existing town centre, which currently include a mix of mostly lifestyle blocks and larger blocks for rural production activities. As such, those areas of the Warkworth Package which are currently greenfield sites will likely have transformed to an urban environment approximately the same time

that the proposed transport corridor is implemented. Within this LNCVA it was assumed that this future likely environment was undertaken in accordance with the Warkworth Structure Plan, with this expected environment forming the basis for effects to assessed against.

6.2 Landform

The Warkworth Package is located within a large basin landform. To the north and south this is contained by hill country. At the outer edges of the basin are the Dome, Conical Peak and Mt Tamahunga to the north, with Moirs Hill being the main hill feature to the south. Inland from Warkworth is the Kaipara Flats, which is a channelised valley.[9]

At a broad scale this basin formation provides the perception of Warkworth being a contained town enveloped by higher landforms, with a human scale. This experience is replicated at a smaller scale within Warkworth where its moderately rolling hill country is interspersed with areas of flat, creating pockets of distinctive spaces, which are physically and visually separated from other areas within the town.

Specific landforms within Warkworth that contribute to the area's character include the hills above the Te Honohono ki Tai (Matakana Link Road) and quarry (within the vicinity of NOR 4 Project and NOR 7 Project), the ridgeline which extends towards Clayden Road, sections of the Mahurangi River escarpment (adjacent to NOR 5 Project), the ridgeline followed by Wilson Road and Thompson Road, the knoll which runs roughly parallel with Woodcocks Road to the south (the location of NOR 6 Project), the elevated landform at Viv Davie Martin Drive (above NOR 2 Project), and the hill between Hudson Road and Falls Road (above NOR 1 Project). These elevated areas provide views outwards and provide focal points for lower lying areas of the town.

6.3 Vegetation

The Warkworth Package area and surrounding landscape have highly modified landcover as a result of urban and agricultural development, with the FUZ currently characterised by farming and rural lifestyle activities, which centres around the urban town centre. Pasture is a dominant landcover in the area, which in places is scattered with mainly exotic trees typical of farmland species, such as eucalyptus, poplars and willows, which are often planted in shelterbelts, providing a linear landscape pattern (such as along the southern half of NOR 3 Project). A significant portion of this rural landscape will likely become urbanised at approximately the same time as the proposed designations are implemented.

Small patches of native vegetation remain within the area and include freshwater habitats of moderate condition.[10] While some of this riparian vegetation is remnant bush, revegetation planting has also occurred, including along a section of the Mahurangi River (right branch) near Valerie Close. In accordance with the Warkworth Structure Plan, the future environment will likely provide a continuous green corridor across Warkworth by connecting currently fragmented terrestrial and freshwater habitats with the Mahurangi River and Mahurangi Harbour, as well as other areas in the immediate surrounds of Warkworth.[11]

[9] Warkworth Structure Plan June 2019
[10] Warkworth Structure Plan June 2019
[11] Ibid

Fragments of remnant bush are scattered across the upland areas around Warkworth. These remnants are typically dominated by tōtara and kahikatea, as well as kauri in some places. A sequence of mature tōtara and kahikatea is present in the basin near the Warkworth Showgrounds, extending northwards below Matakana Road, some of which is protected by a QEII covenant (adjacent to NOR 4 Project). There is also a tōtara dominated forest following the stream corridors immediately east of Matakana Road, with a section of its southern extent vested with QEII (below NOR 7 Project). Either side of the southern extent of Falls Road (north of Woodcocks Road and to the west of the existing town centre) there is a complex mixture of kahikatea, kauri and tōtara. A corridor of tōtara and kahikatea is located along the right branch of the Mahurangi River, from Woodcocks Road towards Perry Road and SH1 to the south (in the vicinity of NOR 2 Project and NOR 8 Project). Substantial native riparian vegetation is also present along the left branch of the Mahurangi River, north of Woodcocks Road (near NOR 2 Project). Coastal bush is present along the main escarpment of the Mahurangi River facing the current town centre, which includes a QEII area (below NOR 5 Project).[12] These interconnected green and blue corridors form a key underlying pattern of the town's existing landscape character and are likely to continue contributing to Warkworth's character in the future.

The AUP:OP contains overlays which are relevant to the Warkworth Package, including Significant Ecological Areas – Terrestrial Overlay (SEA). A significant proportion of the SEA is located along the northern escarpment of the Mahurangi River (below NOR 5 Project), with this area extending westwards between Sandspit Road and Matakana Road (near NOR 4 Project), as well as between Matakana Road and SH1. The SEA extends further to the west out towards Goatley Road, following the waterways it arches in a horseshoe shape south-west, before arching back to the east (parallel in places with NOR 2 Project). In addition, an area of SEA is identified to the south, on the north-east side of the new the Ara Tūhono expressway (to the south of NOR 8 Project). The AUP:OP also identifies Notable Trees within Warkworth (Schedule 10), including two trees on the western side of the southern extent of Matakana Road (adjacent to NOR 4 Project). It is expected that these areas of vegetation will be largely unaffected by the future urbanisation of Warkworth. Vegetation and ecological values are described further in the 'Assessment of Ecological Effects'.

The existing combination of pasture and rural planting in Warkworth, along with remnant native bush creates an attractive setting with distinctive amenity value. This is particularly apparent in the town centre, which is backdropped by the bush-clad escarpment on the north side of the Mahurangi River. While it is expected that the Warkworth Package area will become urbanised and the rural amenity values of the town will significantly change, the Warkworth Structure Plan directs that the existing green corridors of remnant native vegetation be retained and enhanced as part of the future environment. These remnants are a key characteristic of Warkworth's landscape character and are expected to continue to be fundamental to the town's character and identity in the future.[13]

This is supported by the Rodney Greenways: Paths and Trails Plan, Pūhoi to Pakiri (May 2017). The document is intended to be a visionary document which enables the local government and residents to work together to develop their network of cycleways, walkways and parkland. Map 4 and Map 6 of the document illustrate existing, proposed and future greenway connections. Several of these greenway connections relate to the proposed transport corridors, including proposed greenway

[12] Ibid
[13] Warkworth Structure Plan June 2019

connections along Matakana Road and Sandspit Road, and within the vicinity of NOR 6. Future greenway connections are also depicted within the vicinity of NOR 1 and NOR 7.

6.4 Waterways and Wetlands

Water is a connecting element in the landscape and provides a connection between people and the environment, as recognised by Te Mana o Te Wai.[14]

Warkworth is located within the lower Mahurangi River Catchment, which is approximately 5,892ha in area and drains to the Mahurangi Harbour within the Hauraki Gulf. Around the existing settlement of Warkworth there is a network of localised stream valleys and basins amongst a rolling hill type landscape to the north, south and west of the Mahurangi River.[15]

The Mahurangi River is a significant natural feature within the landscape context of the Warkworth Package. It is a central focal point for Warkworth and provides a connecting landscape pattern throughout the town via its extensive tributary system. Many of these waterways are clearly legible and are a dominant landscape attribute.

Streams in the area are all part of the Mahurangi River system (all proposed NoRs, except NOR 4 Project, cross waterways). "*These streams vary from natural streams with good quality indigenous riparian vegetation to farm drains*."[16] The left and right branches of the Mahurangi River join at the intersection of Falls Road and Woodcocks Road.

The Mahurangi Waitematā aquifer lies beneath Warkworth and is designated in the AUP:OP as a High-Use Aquifer Management Area. Typically, high-use aquifers are sensitive to the reduction of impervious surfaces as this can reduce infiltration and aquifer recharge.[17]

There are also several natural wetlands within Warkworth, including to the east of NOR 4, north of NOR 7, and east of NOR 1, as well as east and west of NOR 3 Project, NOR 6 Project and NOR 8 Project. Waterway and wetland ecological values are described further in the 'Assessment of Ecological Effects' and will be addressed in the future regional resource consenting stages of the Warkworth Package.

6.5 Land Use

Much of Warkworth's existing urban footprint is concentrated around its town centre and the Mahurangi River. Residential uses, along with business areas, schools and areas of open space surround the town centre, with small areas of light industrial land in the outskirts of the existing urban footprint, with land outside the built-up settlement area being generally highly productive pasture.[18]

The Warkworth area is in the process of urbanisation. A large proportion of the area inside the RUB is identified as FUZ. While it is not certain what the exact nature of this future urban area will be, the

[14] NPS:FM Clause 1.3: Fundamental concept – Te Mana o te Wai
[15] Warkworth Structure Plan June 2019
[16] Warkworth Structure Plan June 2019, page 130.
[17] Warkworth Structure Plan June 2019
[18] Ibid

Warkworth Structure Plan directs low density zoning along areas with higher elevation (including ridges, hills and knolls), with more intense urban land use on low lying areas within the catchment. Small areas of open space exist within the catchment and are largely sections of esplanade reserve along the Mahurangi River or along tributaries of the river.

The likely future land use zones for the Warkworth Package are as follows:

- NOR 1: Business (Light Industry, Local Centre and Mixed Use), Residential – Mixed Housing Urban, FUZ and Open Space – Sport and Active Recreation.
- NOR 2: FUZ, Open Space – Conservation (adjacent the Mahurangi River), Residential – Single House (a small area south-east of the designation) Residential – Mixed Housing (a small area north-east of the designation).
- NOR 3: primarily FUZ. Residential – Single House (a small area north of the designation), and Business – Local Centre (north-east of the designation). When the Ara Tūhono expressway opens the role of the existing SH1 is expected to operate as an urban arterial road.
- NOR 4: primarily Residential (Single House, Mixed Housing Suburban and Mixed Housing Urban) or FUZ. Open Space – Conservation (a small section south-east and south-west of the designation).
- NOR 5: primarily FUZ (either side of Sandspit Road). Open Space – Conservation (south, adjacent the Mahurangi River, as well as along a tributary at the north-west extent of the designation).
- NOR 6: primarily FUZ. Business – Light Industry and Open Space – Informal Recreation (a small section at the northern extent of the designation).
- NOR 7: primarily FUZ. Open Space – Conservation (a small area south-west, along the tributaries). A limestone quarry currently operates to the north of the road. The AUP:OP identifies a Quarry Buffer Area Overlay around this area.
- NOR 8: FUZ, with Open Space – Conservation (adjacent the Mahurangi River) and Rural Production Zone (immediately to the west).

While much the Warkworth Package area is currently characterised by rural activity, as outlined in the AUP:OP, urbanisation of the town is planned. Implementation of the Warkworth Package will not occur unless urbanisation is undertaken.

6.6 Rural Character

Public feedback as part of the Warkworth Structure Plan showed that the Warkworth community sees itself as a rural town. The community has a strong desire for this rural character to be retained as the town grows and develops.[19]

Aspects which contribute to Warkworth's current rural character include the extensive pastural land on the outskirts of the town (including rural land use in the north-east and south-west areas inside the rural urban boundary (RUB)). These areas are typified by rural roads, farm buildings and yards, fence lines, exotic trees (either in lines or scattered in paddocks), stock, water tanks, and minimal structures. Low areas of traffic, rural smells (such as from animals, grass and soil), dominance of

[19] Warkworth Structure Plan June 2019

natural sounds over humanmade noises, and open vistas also contribute to the rural character of the setting.

In accordance with the Warkworth Structure Plan, it is expected that some rural landscape characteristics will still contribute to the landscape character of the town in the future, including the bush-clad escarpment of the Mahurangi River (as well as views of this area) and by retaining the Morrison's Heritage Orchard as a rural feature of the town. Other rural landscape characteristics expected to be retained include Warkworth's size, green and blue corridors, rural views (such as rural views out from the FUZ into the wider landscape), rural uses in the surrounding area outside of Warkworth, and separation from Auckland's urban area.[20]

6.7 Historical Sites

Several places of heritage interest or significance exist within Warkworth, including several that are unrecorded.[21] Heritage values are discussed further in the 'Assessment of Archaeological Effects'.

One widely recognised historic site is the Morrison's Heritage Orchard (to the west of NOR 3 Project). The orchard was established in the 1870s and by 1914 it was the largest orchard and nursery in New Zealand. The original orchard was closed in 1919. The current Morrison family orchard, which was planted in 1935, continues to sell heirloom fruit.[22]

There are several places of potential or actual historic heritage within Warkworth, including the Coombes and Daldy lime work site and the Wilson's Portland Cement Company dam. The lime and cement industry significantly contributed to the development of Warkworth. There are also WWII US military camp sites and related places in the vicinity of Warkworth (including near NOR 2 Project and NOR 8 Project).[23] Other heritage sites of potential relevance to the Warkworth Package include the remnants of a historical bridge (Cherry's Bridge) within NOR 2 Project, an artefacts site towards the eastern edge of NOR 2 Project, and a historical road bench within NOR 6 Project.[24]

Other places of heritage interest or value identified within the Warkworth catchment include the sites of early (1850s-70s) settler dwellings, including at 360 Sandspit Road and 190 Matakana Road (adjacent NOR 4 Project), which have early plantings of mature English oak trees associated with them. These trees may meet the criteria for inclusion in the AUP:OP Schedule of Notable Trees.[25]

These historical sites add to the character of Warkworth and contribute to the memorability of the place, providing connections between people and place. While not all historical sites are legible (such as the WWII camp sites), the values people associate with these sites remains.

[20] Warkworth Structure Plan June 2019

[21] Warkworth Structure Plan June 2019. Consideration of associative or shared and recognised values are an important part of understanding and assessing a landscape. To gain an understanding of the values that are shared and recognised by the wider community, I have relied on available published information and field work.

[22] Warkworth Structure Plan June 2019

[23] Ibid

[24] Further information is provided in the 'Assessment of Archaeological Effects'.

[25] Bassey and Walker (2018)

6.8 Cultural Significance

Te Tupu Ngātahi engaged with mana whenua on the Warkworth Package prior to and during wider community engagement and have held ongoing monthly hui with mana whenua. Mana whenua partners also attended the multi-criteria analysis workshops. The purpose of these workshops was to gather feedback on specific options under investigation by Te Tupu Ngātahi. Ngāti Manuhiri facilitated a cultural induction for Te Tupu Ngātahi.

Mana whenua have highlighted a number of considerations, including:

- avoiding floodplains
- minimising environmental impacts, particularly those on streams, wetlands, and the Mahurangi River
- avoiding areas of cultural significance to mana whenua
- retaining and enhancing connectivity to communities[26]

People have tangible and intangible cultural connections with landscapes. It is these connections which ground people to a place and give them tūrangawaewae. Cultural considerations are discussed in detail in the 'Cultural Impact Assessment'.

6.9 Protected Areas

The AUP:OP identifies several overlays within the Warkworth area requiring protection, including an Outstanding Natural Feature (ONF), Outstanding Natural Landscape (ONL), High Natural Character (HNC) area and SEA (which are discussed under 5.3 Vegetation and addressed in the 'Assessment of Ecological Effects'). There are also Natural Stream, High-Use Stream, and High-Use Aquifer Management Areas Overlays within the Warkworth catchment. The proposed transport corridors are located outside of ONF, ONL and HNC overlays.

Mahurangi North Parnell Grits is recognised as an ONF. The AUP:OP describes the feature as the best exposed sequence of more than one Parnell Grit bed within the Waitematā Basin. Here, three Parnell Grit beds occur within a Waitematā Sandstone exposure.[27] The nearest proposed designation (NOR 5 Project) is at least 1km from this ONF.

West Mahurangi Harbour is identified as an ONL (ID 43). Asmall section of the ONL is approximately 60m to the south of NOR 3 Project at its closest, with the majority of the ONL being over 100m away, and around 220m south of NOR 5 Project). The ONL is described in the AUP:OP as a very distinctive coastal landscape, combining ridges, river and stream valleys, bays and harbour headlands to create a complex harbour topography that is defined and framed by large pockets of native forest. It includes the Mahurangi River up to Warkworth and its bush-clad escarpment. The ONL is identified as having high levels of naturalness and memorability, as well as having high geological/topographical, ecological, and dynamic values.[28]

[26] Warkworth DBC Engagement Summary report, October 2022, Version 1.0.
[27] AUP:OP, Schedule 6
[28] AUP:OP, Schedule 7

The Mahurangi River southern escarpment is recognised as having HNC (approximately 140m to the south of NOR 5 Project). The AUP:OP describes the area as unmodified by development. It remains extensively vegetated in mature native forest. Although the river's southern banks are extensively modified in places, particularly at the historic cement works, the integrity of the landforms and landcover to the north and the tidal influence of the Hauraki Gulf imbue this area with HNC.[29] There are not areas identified as having outstanding natural character (ONC) within Warkworth.

The relevance of ONF, ONL and HNC overlays are discussed in Section 18 'Statutory Considerations'.

6.10 Existing Character Ratings

The landscape character and natural character of the existing and likely future environment has been assessed based on the description and analysis provided in the previous subsections of Section 6. Existing character ratings were considered at a range of scales, including at the broader scale of Warkworth, the localised scale of the Northern and Southern Project areas, and the site scale of the individual designations.

Landscape character ratings have been particularly influenced by the presence/absence of distinctive landforms and features, areas of vegetation, quality of waterways, existing and expected modifications in the likely future, heritage and cultural values associated with the area, and the proximity of ONFLs.

Natural character ratings have been predominantly influenced by levels of modification to waterway channels, the quality and extent of riparian vegetation, the surrounding landscape context of the existing and likely future environment, and proximity to areas of ONC and HNC. The natural character assessment focused on the waterways themselves, with more importance placed on the immediate context of the waterways.

Figure provides the assessed character ratings of the existing and likely future environment, with more emphasis placed on the urbanised character likely to be present in the future:

Scale	Warkworth	Northern Project Area	Southern Project Area	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
Landscape character	M	M	L-M	L	L-M	L-M	M-H	M-H	L-M	M-H	L-M
Natural character	M	M-H	L-M	L	M	L	M	H	L	M	M

[29] AUP:OP, Schedule 8

Figure 6-1 Northern Project Area refers to NOR 1, NOR 4, NOR 5 and NOR 7. Southern Project Area refers to NOR 2, NOR 3, NOR 6 and NOR 8.

Key: V-L ('Very Low'), L ('Low'), L-M ('Low Moderate'), M ('Moderate'), M-H ('Moderate High'), H ('High') and V-H (Very High).

6.11 Key Considerations

The ridgelines, hills and knolls within Warkworth are a defining landscape feature of the 'rolling hills' landscape character of the area. They provide focal points within the town and give the area its overall sense of enclosure and seclusion. While these landforms are not protected via statutory regulations, it is directed in the documents outlined in Section 5.1.5 of the methodology for future urbanisation to be sensitive to the landform. Although topographical changes may occur as part of this urbanisation, these landforms will likely retain some sensitivity to topographical changes in the future.

There are some significant pockets of remnant native vegetation scattered throughout Warkworth. The integrity and visual coherence of these vegetated areas contribute greatly to the town's aesthetics and amenity and, as such, they are expected to be retained as a key feature as Warkworth becomes urbanised.

Warkworth is incised by an extensive network of waterways, with the Mahurangi River being at the heart of the system. Any changes to these tributaries have flow-on effects for the Mahurangi River. In addition, several natural wetlands are within the Warkworth Package area which contribute to the hydrological system of Warkworth. It is anticipated that the Mahurangi River will retain its importance as urbanisation occurs.

In the future, land use within the RUB is expected to be predominately urban. It is within this context that the Warkworth Package will be experienced. Although the likely future of Warkworth will move from having a largely rural character to one which is urbanised, there are certain rural landscape characteristics which are expected to be retained, including rural uses outside the RUB, as well as views of these areas.

There are several historical sites and cultural overlays within Warkworth which provide connections for people to the area. These connections provide opportunities for their significance to be recognised and celebrated.

The AUP:OP identifies several overlays within Warkworth, including ONFLs, a HNC area and SEA. These areas require protection from inappropriate development, including the protection of physical and visual qualities. It is important to note that these overlays can be affected by changes in the vicinity of the identified areas, but which occurs outside their boundaries.

7 Warkworth Package of NORs – Overall network

This section assesses common or general landscape and natural character matters across the overall Warkworth Package, i.e. the combination of public transport interchanges, existing road upgrades and new corridors. This section also recommends measures to avoid, remedy, or mitigate actual or potential adverse landscape effects for the overall network. Corridor-specific matters are further discussed in the report Sections 10 – 17.

7.1 Overview and description of works

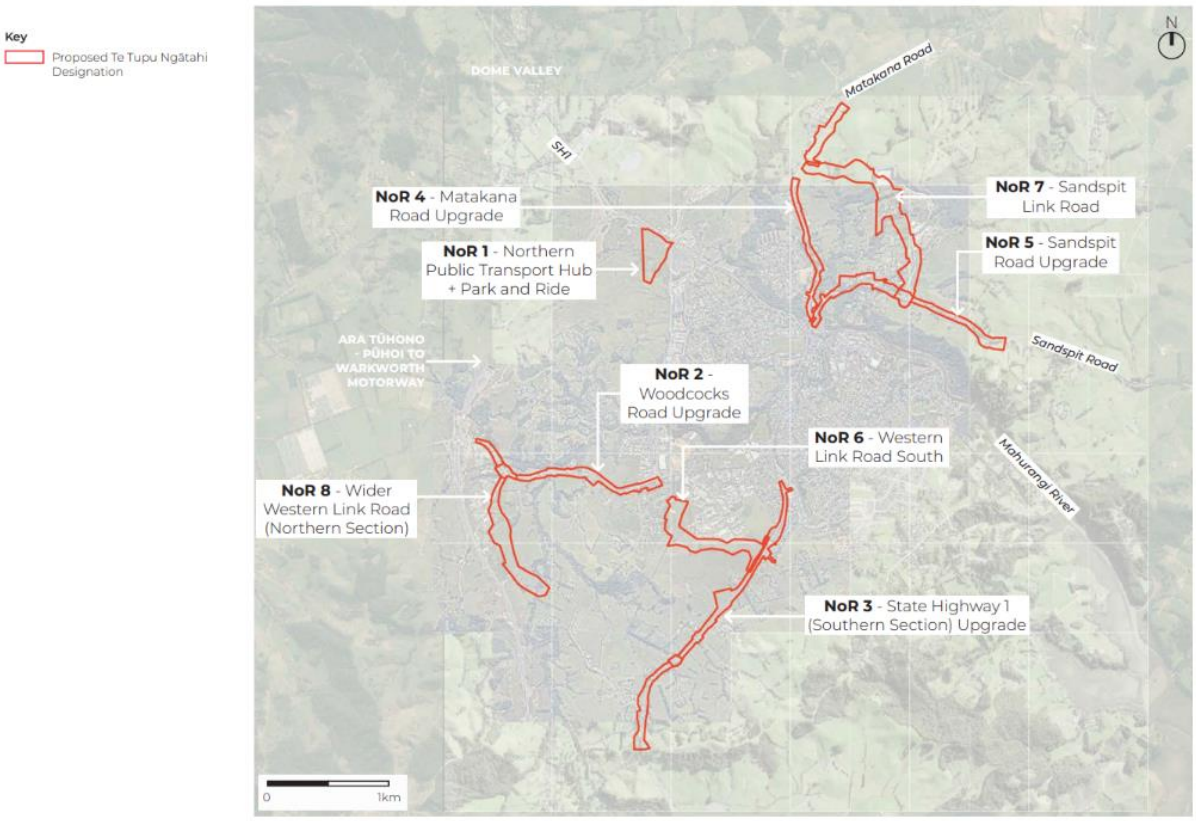


Figure 7-1. Overview of works

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

7.2 Landscape character and natural character assessment

The Warkworth Package will provide part of the infrastructure for the planned urbanisation of Warkworth. It is assumed that the transport corridors will be constructed and operate in the existing and planned urban environment as anticipated by the zones in the AUP:OP.

It is expected that areas of the FUZ in Warkworth will undergo a material change in their character from what is existing. It is likely that the construction of the transport corridors will occur ahead of, or in parallel to, the urbanisation of these areas. Therefore, the starting assumption is that corridors will be constructed predominately in a rural greenfield environment and operate in an urban environment.

As the proposed designations being sought are anticipated to provide longer-term protection of transport corridors there potential for this to be made more certain as design drawings are refined. As part of my assessment I have assumed that roads will be constructed following a similar layout as that shown in the current Project drawings. The LNCVA anticipates the potential effects of the Warkworth Package on existing and likely future landscape values that are important to the area.

Potential effects on existing residential areas

In places, there are tight constraints for the proposed designation boundaries between existing residential properties. In some places, the proposed designations will result in the loss of entire sections and houses and will likely also cause some existing residential sections to be reduced in size, diminishing the buffer between dwellings and the transport corridor where roading upgrades are planned. Where new transport corridors are planned, it anticipated that the existing amenity of the surrounding landscape will have undergone significant change through the planned future urbanisation of Warkworth. Urbanisation in these areas will be planned with the expectation of a transport corridor being implemented at some stage, reducing potential amenity concerns for transport corridors in newly urbanised areas.

Potential effects on landform

Warkworth sits within a 'basin' landscape along the Mahurangi River, which is defined by the surrounding elevated topography. There are several prominent landforms within the town which contribute to Warkworth's distinctive character. It is anticipated that the future urbanisation of Warkworth will be sensitive to the topography of these landforms, although it is recognised that some earthworks will occur as part of this process. Parts of the Warkworth Package are located across elevated sections of the landscape and will likely result in changes to the landform through cut and fill. These landform changes will be experienced cumulatively with any landform modifications undertaken as part of the urbanisation process. Views of the proposed transport corridors will vary throughout the Warkworth area, depending on localised topography (Appendix A).

Potential effects on vegetation

Indigenous vegetation is a distinctive attribute of Warkworth and contributes to both the natural setting and existing rural character of the town. The interaction of rolling topography and mature vegetation creates a layer effect when viewed from different locations, adding to the visual amenity of the landscape. Some exotic trees, including hedge rows and farm shade trees also add to the rural character of the area. However, it is likely that these will not be retained as part of the future urbanisation process as the rural character changes to urban. Mature native vegetation, particularly along waterways, is expected to remain as part of the future urban environment and is recognised as a characteristic in the Structure Plan. It is anticipated that some native vegetation will be removed as part of the Warkworth Package. Several SEAs are located adjacent to, or within, sections of the Warkworth Package. Several QEIIs are also near parts of the Warkworth Package but are outside the scope of works. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

Potential effects on waterbodies

The Mahurangi River catchment is an important element within the landscape and a defining attribute of Warkworth. It is considered taonga by Mana Whenua. The health of the river is directly affected by the health of the tributaries spread throughout the town. As such, it is expected that future urban development will be sensitive to the existing hydrological system and follow water sensitive urban design principles. Due to the extensive network of waterways, as well as the presence of several

natural wetlands, the Warkworth Package will cross numerous waterways and natural wetlands, and directly impact 20 streams ranging from low to high ecological value and 17 natural inland wetlands ranging from low to moderate ecological value.[30] The currently proposed Project drawings show a designation width that allows for fill over such features or specific structures that will reduce the effect of the crossing, such as bridges. Approximately 868m of stream reclamation will be required to accommodate the Project works and approximately 14,863m² of direct wetland loss will occur.[31] This is discussed further in the 'Assessment of Ecological Effects'.

Potential effects on rural landscape characteristics

While the rural character of Warkworth is expected to change with future urban development, as set out by the zones in the AUP:OP, some rural landscape characteristics are likely to be retained, including rural vistas of the landscape outside the RUB, views of the natural environment (including riparian vegetation), and connections with the Morrison's Heritage Orchard. The Warkworth Package will be consistent with the anticipated future urban development within the area and may provide opportunities to enhance views of the wider rural landscape outside the RUB.

Potential effects on heritage values

Throughout Warkworth there are numerous heritage sites. In places the proposed designations will be located adjacent or across heritage sites. These effects are discussed in detail in the 'Assessment of Archaeological Effects'.

Potential effects on cultural values

Te Tupu Ngātahi have engaged with mana whenua on the Warkworth Package prior to, and during, wider community engagement. Cultural values and effects are discussed in detail in the 'Cultural Impact Assessment'.

Potential effects on AUP:OP overlays

An ONF, ONL and area of HNC are identified in the AUP:OP within the broader context of Warkworth. The AUP:OP provides a description of the characteristics which require protection for these identified areas. Potential effects on these recognised areas are discussed in detail in Section 18 'Statutory Considerations'.

7.3 Nature and magnitude of effects

The proposed designations have the potential to affect the landscape character and natural character of Warkworth. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Moderate'**
- Construction effects on natural character: **'Moderate'**
- Operational effects on landscape character: **'Moderate-High'**
- Operational effects on natural character: **'Moderate-High'**

[30] Assessment of Ecological Effects
[31] Ibid

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the proposed transport corridors and permanent effects during the operation of the proposed transport corridors. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

7.4 Assessment of landscape effects during construction

The following section discusses the temporary potential landscape and natural character and visual effects which could arise during the Warkworth Package construction.

Larger construction footprint

The construction works footprint will be somewhat wider than the finished road. Construction machinery will also be present (including heavy vehicles), which may require access tracks. The additional width of works required during construction may cause vegetation outside of the permanent roading structure to be removed and for work to occur within the drip line of existing trees. If riparian vegetation is affected this will likely have implications for natural character.

Work within waterbodies

It is anticipated that work will be undertaken in, or near, waterways and wetlands, potentially including the construction of bridge piers, which could cause waterway and wetland bed disturbance, and potentially significant effects. Potential effects on waterbodies are applicable to landscape character but relate predominately to natural character.

Exposed earthworks

There is the risk of sediment entering waterways where earthworks are exposed and from accidental sediment discharge from within construction areas (including from stockpiles). Exposed earthworks can also result in visual effects. Additional visual effects could arise from the clutter of materials, machinery, and construction yards.

Compaction of soil profile

Stockpiling of construction materials and machinery in construction yards can result in compaction of the soil profile, which potentially alters natural drainage and ground water movement. This compaction potentially adversely effects the long-term success of any reinstated landscape post-construction.

Reduced amenity

During the construction phase of the proposed transport corridors, adjacent residents are likely to experience reduced amenity, including from noise, dust, and lighting, as well as from visual effects caused by the presence of construction machinery, construction yard buildings, material stockpiles, and temporary traffic control measures. There will also be a loss of established plants from within existing residential properties, including heritage amenity plants.

Short-term effects

Adverse effects of this nature are common to infrastructure projects and are mitigated by the short-term duration of the works and subsequent remediation.

7.5 Recommended measures to avoid, remedy or mitigate construction effects

To address the construction effects of the Warkworth Package I recommend the following should be addressed through future outline plan or resource consent.

- How the Project can appropriately integrate with existing landscape features (including natural wetlands) and the wider natural landscape.
- Consider opportunities for suitable felled tree species for re-use as landscape features.
- Minimise sedimentation of waterbodies using appropriate erosion controls, by limiting the extent of exposed earthworks at any one time and revegetate earthworks, as appropriate.
- Consider opportunities for topsoil stripping and stockpiling for re-use, ensuring that topsoil is suitable for landscape purposes.
- Where appropriate, select visually discrete locations for the placement of construction yards and material storage. Consider screening of construction yards as mitigation for temporary visual effects.
- Ensure the reinstatement of construction yards is undertaken in a manner appropriate for the anticipated future use of the land.
- Identify opportunities for the survey, collection, and propagation of heritage amenity plants in private gardens that will be demolished to enable construction to occur (subject to the agreement with the landowner), so that as appropriate these may be re-established as part of the planting programme during finishing works.
- Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape treatment to manage these effects.
- How the Project can enable integration of street trees into the transport corridor design.
- Where practicable, undertake bridge construction from dry land, avoid piers in the beds of waterways and wetlands, minimise piers on riverbanks, and minimise fill over waterbodies.
- It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.

NoR specific recommendations build on the recommendations for the overall network by providing more detail which is specific to individual transport corridors.

With the above recommended measures, it is anticipated that construction effects for the Warkworth Package will be:

- Landscape character: **'Low-Moderate'**
- Natural character: **'Low-Moderate'**

7.6 Assessment of operational effects

The following section discusses the permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed transport corridors.

Landscape character effects and opportunities

In accordance with zoning in the AUP:OP, it is anticipated that greater urban intensification in existing residential zones will occur, compared to what presently exists. It is expected that, with time, existing housing areas will be infilled with additional residential dwellings in line with the MDRS. The proposed

designations will have effects on some existing residential areas. Where existing residential properties and houses are directly adjacent the proposed designation boundaries, it is possible that there will be amenity effects, including loss of privacy, compromised views, reduced buffers between houses and transport corridors, reduced section size, and increased traffic noise and light disturbance (e.g. from car headlights and streetlights).

However, the built outcomes of the proposed transport corridors will be in character with the planned urban intensification, with roads being an essential element of urban areas. As such, amenity effects on future planned residential areas and dwellings will be limited. The Warkworth Package provides the opportunity to enhance connectivity for Warkworth as a whole by integrating with the existing local street network and improving user road safety. It will also improve transport network connectivity to the adjacent landscape outside of Warkworth. The width of the proposed designations has allowed for active modes of transport, with cycle lanes and footpaths on both sides of the road. There is the opportunity for further positive effects to be achieved by integrating active travel routes and recreational paths with Warkworth's 'green network' of bush and vegetated riparian margins.

There is potential for stormwater wetlands to become attractive focal points through considered planting and wetland construction. There is also scope for stormwater wetlands to be integrated with proposed active transport routes.

The UDMLP directs the integration of the proposed transport corridors with future surrounding land uses. As illustrated in the design drawings (Appendix 1), the proposed designation widths can accommodate a good level of amenity planting, for instance street trees, raingardens, and boundary planting (where required, such as to minimise the visual dominance of transport corridors from adjoining sites). Amenity planting has the potential to create attractive environments, which can enhance the built character of their surroundings and positively contribute to the visual quality of the streets and the area's sense of place. These aspects are captured in the proposed Warkworth Package conditions as part of the UDLMP (refer to Condition 9).

Changes to landform

The 'basin' formation of Warkworth's landscape ensures perceptual effects of the proposed designations will be restricted to Warkworth. Within Warkworth there are also a series of distinctive spaces created by knolls, hills, and ridges. These will further limit the perceptual effects of the Warkworth Package, likely resulting in relatively localised effects.

While the proposed designations avoid prominent spurs and ridgelines, some designations do travel across elevated landforms (particularly NOR 6 and NOR 7), and large areas of cut and fill are anticipated for several designations. Some landform modification is expected to occur as part of the urbanisation of Warkworth. To a degree this has the potential to limit the extent of earthworks anticipated to occur as part of the Warkworth Package. However, there is the potential for cut and fill as part of the Warkworth Package to result in visual effects for the Warkworth community due to loss of vegetation, visibility of new transport corridors on elevated landforms, and changes in the topography of the landform. Substantial areas of fill are also likely to be required for designations on flatter areas, changing the existing landform.

Even so, there is the potential for the transport corridors to be absorbed into the adjacent land through contouring of cut and fills and planting. The integration of the proposed transport corridors with future landform and development is anticipated through the proposed Warkworth Package conditions. As noted, it is expected that there will be some earthworks associated with the future urbanisation of

surrounding land, separate to the Warkworth Package. While the proposed transport corridors may become incorporated as part of this process of urbanisation, there is the potential for cumulative effects to occur.

Scope for planted areas

The Warkworth Package will likely result in the removal of some vegetation, which may potentially include mature indigenous species. It is anticipated that the proposed designations will also cross several small sections of SEA. However, the alignment of the proposed designations has been mindful to minimise effects on these areas, as well as avoiding QEII covenant areas.

Where riparian vegetation is affected, it is likely that there will be effects on natural character. This is discussed in more detail in below sections, which address effects on individual designations. There is scope within the designation to include new areas of vegetation and street trees.

Potential for integrated stormwater management

Due to the extensive network of waterways and wetlands within Warkworth, some effects on waterbodies are anticipated, as are effects on natural character. These effects are most likely to occur due to modification of natural overland flow paths, fill over streams and wetlands, bridge piers in waterway and wetland beds, and the removal of riparian vegetation. An increase in impervious surfaces also has the potential to create contaminated road run-off, as well as reduce water infiltration and aquifer recharge. Minimising reductions in infiltration due to development is an important consideration for the continuing viability of aquifer resources.[32]

Where the proposed designations are within greenfield sites, there is the opportunity to integrate stormwater management to maintain pre-development hydrology. This includes providing for on-site infiltration to improve aquifer recharge and stream baseflows, such as through raingardens and vegetated swales. The proposed designation boundaries have allowed space for stormwater treatment wetlands to address issues of run-off treatment and management. However, the location of proposed stormwater wetlands near natural wetlands should be minimised.

Opportunity to maintain some rural landscape characteristics

While the Warkworth Package is expected to be implemented within a future urbanised area, it is expected that some rural landscape characteristics will be retained. There is the potential opportunity for the proposed transport corridors to provide elevated views towards the rural landscape outside the RUB (e.g. NOR 6 Project and NOR 7 Project) and views of vegetated areas within the RUB. Several proposed designations will pass existing remnant bush areas, which will enable transport corridor users to have close-up views of this natural environment.

7.7 Recommended measures to avoid, remedy or mitigate operational effects

To address the operational effects of the Warkworth Package I recommend the following should be addressed through future outline plan or resource consent. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

[32] Warkworth Structure Plan 2019

- How the project can appropriately integrate with existing landscape features (including natural wetlands) and the wider natural landscape.
- How the project (including roadside elements such as lighting, signage and the landscape treatment of structures) can:
- Enable integration of the Project's permanent works into the surrounding landscape and urban context; and
- Ensure that the Project manages potential adverse landscape and visual effects and contributes to a quality urban environment.
- Consider further refinement of stormwater treatment wetland design to appear ‘natural’ with a variety of habitats, e.g. irregular shape with curved boundaries, varying depths and islands.
- Consider water sensitive urban design principles. Recommendation to prioritise the use of soft engineering strategies for stormwater management.
- Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape treatment to manage these effects.
- Re-validate the landscape and natural character values identified in the LNCVA prior to the commencement of conceptual design.
- It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.

NoR specific recommendations build on the recommendations for the overall network by providing more detail which is specific to individual transport corridors.

With the above recommended measures, it is anticipated that operational effects for the Warkworth Package will be:

- Landscape character: **‘Low’**
- Natural character: **‘Low’**

7.8 Summary and Conclusions

The Warkworth Package will introduce an extensive transport network into Warkworth, which is anticipated to result in modifications to existing residential areas, earthworks, vegetation removal, waterbody modification and potential modification to heritage and cultural sites. However, the proposed designations also provide the opportunity to improve connectivity between existing roads, improve road user safety, enhance active and public transport modes, better connect people and fauna with existing bush and riparian margins, increase the extent and quality of indigenous vegetation, and highlight heritage and cultural narratives in the landscape.

It is expected that natural character will be specifically affected by modification of waterways and wetlands, including due to cut and fill, diversions, potential structures within waterbodies, and the removal of riparian vegetation. It is likely that these effects can be reduced through avoidance of waterbodies, the use of bridges, avoiding piers in the beds of waterways and wetlands and minimising piers on the banks of waterbodies, and revegetating riparian margins. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of recommended measures, construction effects are anticipated to be **'Low-Moderate'** and operational effects are anticipated to be **'Low'** A summary of effects is provided in Table 8.

Proposed conditions at the future regional consent stage will provide specific mitigation for future transport projects within each designation.

Table 8. Summary of assessment of effects of recommendations – Warkworth Package overall network

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Low-Moderate'** **Natural Character:** **'Low-Moderate'**	Larger construction area, than operational footprint. This may result in some additional vegetation removal.	Appropriately integrate Project with existing landscape features (including natural wetlands) and the wider natural landscape. Consider opportunities for suitable felled tree species for re-use as landscape features.
	Work to be undertaken in or near waterbodies.	Minimise sedimentation of waterbodies using appropriate erosion controls, by limiting the extent of exposed earthworks at any one time and revegetate earthworks, as appropriate. Consider opportunities for topsoil stripping and stockpiling for re-use, ensuring that topsoil is suitable for landscape purposes. Where practicable, undertake bridge construction from dry land, avoid piers in the beds of waterways and wetlands, minimise piers on riverbanks, and minimise fill over waterbodies.
	Visual effects from the clutter of materials, machinery, and construction yards.	Where appropriate, select visually discrete locations for the placement of construction yards and material storage. Consider screening of construction yards as mitigation for temporary visual effects. Ensure the reinstatement of construction yards is undertaken in

		a manner appropriate for the anticipated future use of the land. Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape treatment to manage these effects.
Residual effect after recommendations	**Assessment**	**Recommendation**
Landscape Character (cont'): **'Low-Moderate'** **Natural Character (cont'):** **'Low-Moderate'**	Effects on existing residential areas.	Identify opportunities for the survey, collection, and propagation of heritage amenity plants in private gardens that will be demolished to enable construction to occur (subject to the agreement with the landowner), so that as appropriate these may be re-established as part of the planting programme during finishing works.
Operational effects		
Landscape Character: **'Low'** **Natural Character:** **'Low'**	Opportunity to integrate the Warkworth Package with the wider landscape.	Consider how the Project (including roadside elements such as lighting, signage and the landscape treatment of structures) can: • Enable integration of the Project's permanent works into the surrounding landscape and urban context; and • Ensure that the Project manages potential adverse landscape and visual effects and contributes to a quality urban environment. Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape treatment to manage these effects. How the Project can enable integration of street trees into the transport corridor design.

Residual effect after recommendations	Assessment	Recommendation
Landscape Character (cont'): **'Low'** **Natural Character (cont'):** **'Low'**	Potential for effects on landscape features, including indigenous vegetation and waterbodies.	Integrate the Project with existing landscape features (including natural wetlands) and the wider natural landscape.
	Opportunity to integrate stormwater management.	Consider further refinement of stormwater treatment wetland design to appear 'natural' with a variety of habitats, e.g. irregular shape with curved boundaries, varying depths and islands. Consider water sensitive urban design principles. Recommendation to prioritise the use of soft engineering strategies for stormwater management. It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.
	Anticipated likely future environment based on assumptions.	Re-validate the landscape and natural character values identified in the LNCVA prior to the commencement of conceptual design.

8 Northern Project Area (NOR 1, NOR 4, NOR 5 and NOR 7)

This section assesses specific landscape and natural character matters at a localised scale relating to the 'Northern Project Area' (NOR 1, NOR 4, NOR 5 and NOR 7) within the Warkworth Package. Corridor-specific matters are further discussed in the report sections 10 – 17.

8.1 Overview and description of works

The Northern Project Area includes a transport hub with a Park and Ride area, a new link transport corridor, and the upgrade of two existing roads which connect Warkworth with the surrounding settlements of Matakana and Sandspit. Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

8.2 Landscape character and natural character assessment

The existing environment of the Northern Project Area is predominately rural with some scattered residential areas and a limestone quarry. The landscape is perceived as a transitional space for those entering and leaving the north end of Warkworth. The Mahurangi River provides the southern border for this area. In line with the AUP:OP zones, it is anticipated that the Northern Project Area will become fully urbanised, with the FUZ accounting for majority of the land area.

Potential effects on existing residential areas

To the west, along Matakana Road, and at the eastern end of the Sandspit Road upgrade, there are existing residential areas which will be affected by the Northern Project Area and could result in reduced residential amenity for these properties, including loss of privacy, compromised views, reduced buffers between houses and transport corridors, reduced section size, and increased traffic noise and light disturbance (e.g. from car headlights and streetlights).

Potential effects on vegetation

Green corridors are a defining attribute of Warkworth's landscape character, and it is expected that they will continue to characterise Warkworth in the future as the town becomes urbanised. There are several SEAs within the Northern Project Area, including the northern bush-clad escarpment of the Mahurangi River. In some places, small sections of the proposed designations cut across these SEAs. There are also other bush areas outside of SEAs which could be potentially affected by the proposed designations, including riparian vegetation. Where riparian vegetation is affected, this will likely have effects on natural character. While several QEII covenant areas are within the Northern Project Area, none are situated within the designations.

Potential effects on waterbodies

As with green corridors, the extensive hydrological network through Warkworth provides a key landscape pattern for the town. It is expected that this broad landscape pattern will remain a key attribute (as emphasised in the Warkworth Structure Plan) as the town is urbanised. Several tributaries which feed into the Mahurangi River flow through the Northern Project Area. There are multiple areas where the proposed designations cross waterways and wetlands, with the potential for this to affect both the landscape and natural character of the Northern Project Area. The currently proposed Project drawings show a designation width that allows for fill over such features or specific structures that will reduce the effect of the crossing, such as bridges.

Opportunity to connect with rural landscape characteristics

Although it is planned for Warkworth to become largely urbanised, it is anticipated that some rural landscape characteristics of the town will remain in the future. Connections with the wider rural context outside the RUB are one way to retain rural landscape characteristics of Warkworth, including

maintaining views towards rural areas outside the RUB. Views eastwards from elevated areas of the proposed transport corridor are expected to provide the best opportunity for these rural views.

Potential effects on heritage values

Heritage values contribute towards how people associate with a landscape. Within the Northern Project Area there are some sites with heritage value, including along Matakana Road. There is the potential for proposed road widening to have some effects on these sites. Heritage values are discussed in the 'Assessment of Archaeological Effects'.

Potential effects on cultural values

The Mahurangi River is important to Mana Whenua and its mana is affected by the health of its connecting tributaries.

Potential effects on AUP:OP overlays

An ONF, ONL and area of HNC are identified in the AUP:OP within the vicinity of the Northern Project Area. The AUP:OP provides a description of the characteristics which require protection for these identified areas. Potential effects on these recognised areas are discussed in detail in Section 18 'Statutory Considerations'.

8.3 Nature and magnitude of effects

The proposed designations have the potential to affect the landscape character and natural character of the Northern Project Area. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Moderate-High'**
- Construction effects on natural character: **'Moderate-High'**
- Operational effects on landscape character: **'Moderate-High'**
- Operation effects on natural character: **'Moderate-High'**

8.4 Summary and Conclusions

The Northern Project Area involves the proposed upgrading and widening of two existing roads, as well as the introduction of a new link road and transport hub. There are no additional effects for the Northern Project Area than what have been identified in Section 7 'Warkworth Package of NORs – Overall Network'. With the implementation and establishment of recommended measures outlined in Section 7, effects are anticipated to be as follows:

- Construction effects on landscape character: **'Low-Moderate'**
- Construction effects on natural character: **'Low-Moderate'**
- Operational effects on landscape character: **'Low'**
- Operational effects on natural character: **'Low'**

9 Southern Project Area (NOR 2, NOR 3, NOR 6 and NOR 8)

This section assesses specific landscape and natural character matters at a localised scale relating to the Southern Project Area (NOR 2, NOR 3, NOR 6 and NOR 8) of the Warkworth Package. Corridor-specific matters are further discussed in the report sections 10 - 17.

9.1 Overview and description of works

The proposed Southern Project Area includes two new link transport corridors, as well as upgrades to two existing roads, one of which serves as the current SH1. Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

9.2 Landscape character and natural character assessment

The Southern Project Area is on the outskirts of Warkworth and is predominately rural with some concentrated residential areas and an industrial area. The Southern Project Area is bordered to the west by the newly constructed Ara Tūhono expressway, while the eastern extent runs parallel with the existing SH1 south of Warkworth township. According to the zones in the AUP:OP, it is expected that most of the area will be FUZ, with heavy industry indicated in the Warkworth Structure Plan within the NOR 8 project area.

Potential effects on amenity

Effects on existing residential areas will be very limited, however, there is potential for adverse visual amenity effects to result from the Southern Project Area being located on elevated land. Views of the Southern Project Area will be possible from existing elevated land which orientates down towards the proposed designations, such as from Viv Davie-Martin Drive towards the NOR 2 Project and NOR 6 Project (Appendix A).

Potential effects on vegetation

There are several SEAs within the Southern Project Area, including north of Woodcocks Road, which contribute to the current character of Warkworth and are expected to remain a defining attribute of the town in the future. In some places small sections of the proposed designations cross these SEAs. There are also other bush areas outside of the SEAs which could potentially be affected by the Southern Project Area, including riparian vegetation. Where riparian vegetation is affected, this will likely impact on natural character.

Potential effects on waterbodies

Several tributaries flow through the Southern Project Area, including the left and right branches of the Mahurangi River. These waterways provide a distinctive pattern in the landscape and are expected to remain a key element as Warkworth is urbanised. There are several areas where the transport corridor will cross waterways and wetlands, with the potential for this to affect both the landscape and natural character of the area. The currently proposed Project drawings show a designation width that allows for fill over such features or specific structures that will reduce the effect of the crossing, such as bridges.

Potential effects on rural landscape characteristics

While it is planned through the AUP:OP for Warkworth to become largely urbanised, some rural landscape characteristics are expected to remain. Retaining views of the wider rural context outside the RUB is one way to assist in retaining the rural landscape characteristics of Warkworth. Views west and south from elevated areas of the proposed transport corridors are anticipated to provide the best opportunities for rural views.

Potential effects on heritage values

Heritage values contribute towards how people associate with a landscape. Within the Southern Project Area there are some sites with heritage value, including along Woodcocks Road. There is potential for proposed road widening and new roads to have some effects on these sites. Heritage values are discussed in the 'Assessment of Archaeological Effects'.

Potential effects on cultural values

The Mahurangi River is important to Mana Whenua and its mana is affected by the health of its connecting tributaries.

9.3 Nature and magnitude of effects

The proposed designations have the potential to affect the landscape character and natural character of the Southern Project Area. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Moderate'**
- Construction effects on natural character: **'Moderate'**
- Operational effects on landscape character: **'Moderate'**
- Operation effects on natural character: **'Moderate'**

9.4 Summary and Conclusions

The Southern Project Area involves the proposed upgrading and widening of two existing roads, as well as the introduction of two new link roads. There are no additional effects for the Southern Project Area than what have been identified in Section 7 'Warkworth Package of NORs – Overall Network'. With the implementation and establishment of recommended measures outlined in Section 7, effects are anticipated to be as follows:

- Construction effects on landscape character: **'Low-Moderate'**
- Construction effects on natural character: **'Low-Moderate'**
- Operational effects on landscape character: **'Low'**
- Operational effects on natural character: **'Low'**

10 NOR 1 – Northern Public Transport Hub and Western Link - North

This section assesses specific landscape and natural character matters relating to the proposed NOR 1 – Northern Public Transport Hub, Park and Ride and Western Link - North (the NOR 1 Project').

10.1 Overview and description of works

The NOR 1 Project involves construction of :

- A Public Transport Hub
- Park and Ride facilities with approximately 228 car park spaces
- A four-lane urban arterial, with cycle lanes and footpaths on both sides
- Two bridges
- A large stormwater wetland
- Areas of cut and fill

This provides a separate facility to the existing park and ride on the north side of SH1.

The proposed designation will enable access to strategic public transport services for residents in Warkworth and the Kōwhai Coast and will enable a viable alternative to public transport use, preventing residents from needing to traverse through Warkworth to access a Park and Ride service.

Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

10.2 Landscape character and natural character assessment

The proposed designation and surrounding area are on the existing urban fringe of Warkworth to the west. Adjacent to the proposed designation is a developing industry area, on which a supermarket is currently being built and a petrol station already exists. The landscape is dissected by the existing SH1, which runs parallel to the designation. To the north Te Honohono ki Tai (Matakana Link Road) provides a new transport corridor through a once rural landscape, which is in the process of being urbanised.

Through zoning and precinct in the AUP:OP, it is anticipated that the future area of the proposed designation and surrounding landscape will be characterised by business activities (including general business, light industry, a local centre and mixed use), residential urban mixed housing, FUZ, and open space for sport and active recreation (to the north across the current SH1). The Warkworth Structure Plan also identifies this area as a business – light industry zone.

Consistent with existing and planned landscape character

The vicinity of the proposed designation is currently characterised by a busy industrial area. It is experienced as a transitional area at the edge of Warkworth and as a thoroughfare along SH1. It is expected that business activity will expand in the future as the area is urbanised. While the low-lying industrial area does not currently have high amenity value and is not anticipated to have high levels of amenity in the future, the area is visible from an existing, elevated residential area to the southeast (Appendix A). Future residential areas to the north are also likely to have views of the proposed designation. Development of this nature will be an expected sight for surrounding residential areas

both now and in the future. As such, while the designation will be visible, adverse visual effects are not expected as the NOR 1 Project will not alter the existing landscape values.

Minimal effects on landform

The area is relatively flat, with elevated land to the north and south containing the area. The designation is located away from prominent landforms. The hill above the designation, between Hudson Road and Falls Road, is a notable landform in Warkworth. It is acknowledged that this landform may undergo some landform modifications as part of the urbanisation process of Warkworth separate to the Warkworth Package.

Limited effects on vegetation

There are several SEAs in the wider area of the designation but none within the designation itself. Vegetation within the designation is predominately exotic pasture grass. Vegetation in the wider area is a mixture of exotic and native species, including taller trees such as eucalyptus, pittosporum, and willow. There is also some residential planting to the southeast. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

Potential effects on waterbodies

A stream runs along the southern and eastern sides of the proposed designation, and links with a natural wetland. The designation crosses a section of this stream and wetland. Effects on these waterbodies are discussed further in the 'Assessment of Ecological Effects'.

No effects on rural landscape characteristics

Although the designation is on an existing urban fringe of Warkworth, it is already undergoing a transition to industrialisation. In line with the AUP:OP zoning, it is expected that this pattern of development will continue into the future. As such, it is not anticipated that the designation will affect rural landscape characteristics. However, it is likely that the area will continue to provide a transitional space between the urban area of Warkworth and the wider, rural area to the west.

10.3 Nature and magnitude of effects

The designation has the potential to affect the landscape character and natural character of the proposed designation and adjacent area. Without recommended measures to avoid, remedy or mitigate effects, It is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Low-Moderate'**
- Construction effects on natural character: **'Moderate'**
- Operational effects on landscape character: **'Low'**
- Operation effects on natural character: **'Low-Moderate'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the transport corridor and permanent effects during the operation of the proposed transport corridor. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

10.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the transport corridor construction.

Work within waterbodies

The currently proposed NOR 1 Project drawing shows the Western Link - North crossing the same waterway and natural wetland twice, with a bridge over both crossings, resulting in two bridges within the NOR. Construction work in waterbodies has the potential to affect both natural character and landscape character.

Exposed earthworks risk to waterbodies

The currently proposed NOR 1 Project drawing depicts a small area of fill at the southern extent of the proposed Transport Hub. Adjacent to this is a waterway and natural wetland. There is the risk of sediment entering the waterway and wetland while earthworks are exposed.

10.5 Recommended measures to avoid, remedy or mitigate construction effects

There are no additional recommended measures for the proposed transport corridor beyond those provided in the overall recommended measures outlined in Section 7.5.

With the relevant recommended measures outlined in Section 7.5, it is anticipated that construction effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low'**

10.6 Natural character: 'Low' Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed designation.

In character with present and future setting

The proposed designation will be co-located with an existing industrial area, adjacent to the existing SH1. While the area currently has some rural attributes, it is anticipated that industrial activities will extend in the future, along with further urbanisation. The proposed Transport Hub will be in character with this future urban setting. However, there is likely to be an extensive area of impervious surface which could be detrimental to the visual amenity of the area. There is scope within the NOR 1 Project to extensively plant the open space around the proposed stormwater wetland. This would assist in softening hardscapes and improving visual amenity by integrating the stormwater wetland with the wider surrounds.

Minor changes to landform

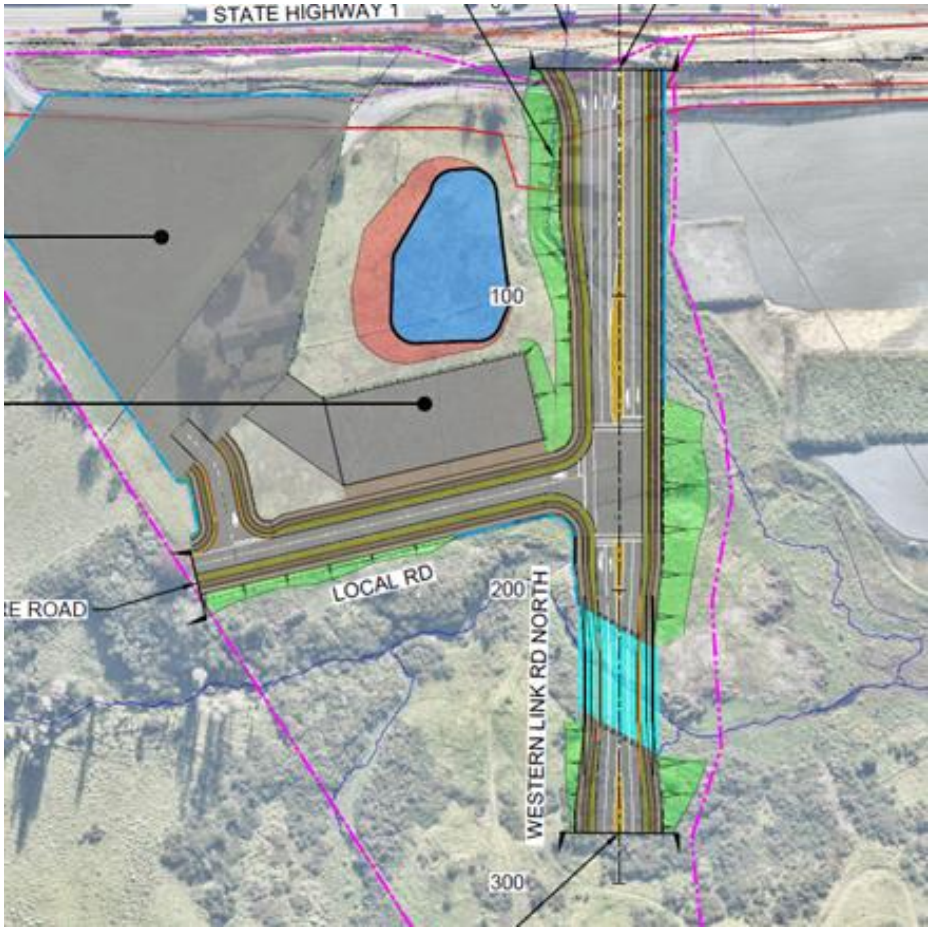
While there will be some small areas of the proposed fill, there will only be minor changes to the landform due to the relatively flat topography within the proposed designation.

Opportunity to increase wetland vegetation

The proposed designation will likely result in the removal of some riparian vegetation, which may have effects on natural character. However, there is an opportunity to extend existing areas of riparian vegetation in the southern section of the designation.

Potential loss of, and alterations to, wetlands and waterways

The currently proposed NOR 1 Project drawings illustrate an existing stream diverted west, away from an area of fill, and directed through an outlet under the Western Link - North. The drawing also shows some fill over the wetland adjacent to the southern crossing (Figure). As such, there is the potential for NOR1 Project to result in adverse effects on the waterway and wetland, consequently affecting natural character (which relates to waterbodies). If adverse effects on natural character occur, these effects are anticipated to be required to be addressed in situ (where the effects occur).



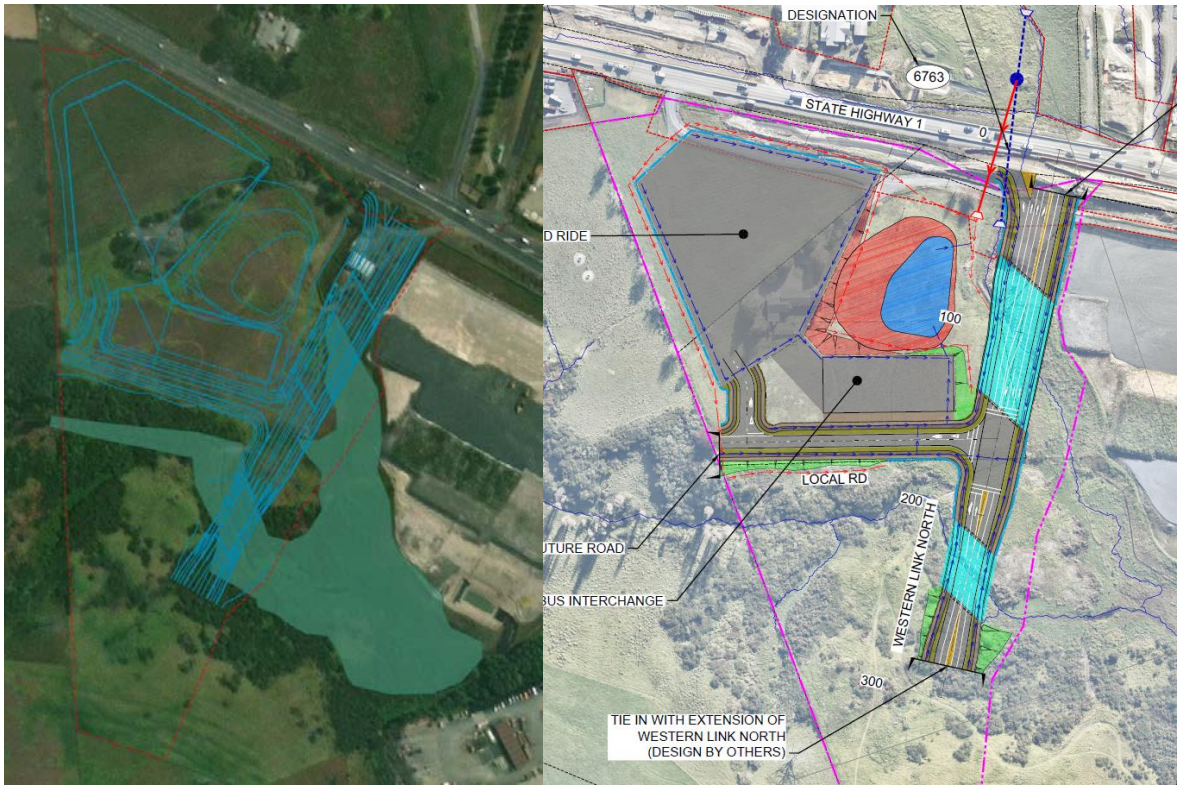


Figure 10-1 Natural wetland area identified in green in left image. Area of fill indicated in bright green in right image.

10.7 Recommended measures to avoid, remedy or mitigate operational effects

There are no additional recommended measures for the proposed transport corridor beyond those provided in the overall recommended measures outlined in Section 7.7. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

With the relevant recommended measures outlined in Section 7.7, it is anticipated that operational effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Very Low'**
- Natural character: **'Low'**

10.8 Summary and Conclusions

The proposed designation will introduce an extensive car park area and roading into the western area of Warkworth, which could potentially result in modifications to a waterway and wetland. However, the proposed designation also provides the opportunity to increase indigenous planting in the area, including natural wetland planting.

There is the potential for natural character to be affected by modifications to a waterway and natural wetland. It is likely that these potential effects could be reduced through avoiding piers in the riverbed, minimising piers on the riverbank, minimising fill over waterbodies, and revegetating the existing wetland. These issues will be addressed during the future regional consenting stages of the

Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Low'** and operational effects are anticipated to be **'Low'** at most. Proposed conditions at the future regional consent stage will provide specific mitigation for future transport projects within each designation.

Table 9. Summary of Assessment of Effects and Recommendations – NOR 1 Northern Public Transport Hub, Park and Ride and Western Link - North (Public Transport Hub Section)

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Low'** **Natural Character:** **'Low'**	Work within waterbodies. Exposed earthworks are a risk to waterbodies.	Refer to overall network recommendations.
Operational effects		
Landscape Character: **'Very Low'** **Natural Character:** **'Low'**	Potential effects on waterbodies.	Refer to overall network recommendations.

11 NOR 2 – Woodcocks Road – West Upgrade

This section assesses specific landscape and natural character matters relating to NOR 2 – Woodcocks Road Upgrade (Western Section) (the ' NOR 2 Project').

11.1 Overview and description of works

The NOR 2 Project includes an existing arterial extending from the interchange with the Ara Tūhono expressway in the west, to the Mansell Drive intersection in the east. The proposed upgrade includes:

- Widening the existing corridor to a two-lane urban arterial, with cycling and walking facilities on both sides.
- Areas of cut and fill

Two stormwater wetlands Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

11.2 Landscape character and natural character assessment

Woodcocks Road has an existing rural character. Within the proposed designation and adjacent area, there is an extensive amount of pastural farmland, which is fragmented in places by native bush and the sinuous left and right branches of the Mahurangi River. East of Mason Heights there is an existing residential area on either side of Woodcocks Road.

The designation area is largely FUZ under the AUP:OP, with Open Space Conservation land predominately to the north of the Mahurangi River. There is also an Open Space Informal Recreation area at the intersection with Falls Road. The existing residential area at the eastern extent of the proposed designation is zoned as Residential Single House and Residential Mixed Housing on the southern side of Woodcocks Road, and Residential Mixed Housing on the northern side of the road. The Warkworth Structure Plan identifies residential – mixing housing urban and business – heavy industry zones (at the western end).

Potential effects on existing residential areas

Key attributes within the existing landscape include pasture, fence lines and rural buildings. A contained residential area exists at the eastern extent of the proposed designation. It is anticipated that the entire surrounding area will be urbanised in the future. The designation is expected to be in-keeping with this planned future environment. However, the character of the future transport corridor will likely affect the amenity of the existing residential area by introducing a new road type into the area, removing existing houses, reducing section sizes, and reducing buffers between the road and residential properties.

Minimal effects on landform

The proposed designation is within the flat basin west of Warkworth town centre. Rolling hills gently extend upwards to the north and south of Woodcocks Road. Although, the proposed designation is located away from prominent landforms, views of the proposed transport corridor will likely be attainable from adjacent raised areas, such as along Viv Davie-Martin Drive looking south. Visual effects are expected to be very low (Appendix A).

Potential effects on indigenous vegetation

Within the NOR 2 Project area existing indigenous vegetation and meandering natural waterways provide a defining pattern in the landscape. It is anticipated that this landscape pattern will remain a key attribute as the area becomes urbanised. There is a large stretch of SEA on the northern side of Woodcocks Road. In places the proposed designation crosses small sections of SEA. Both branches of the Mahurangi River have substantial riparian vegetation, which is visible from Woodcocks Road. Ecological effects are discussed in detail in the ‘Assessment of Ecological Effects’.

Reduced potential effects on waterways

There are two existing bridges along Woodcocks Road which cross the Mahurangi River, with the left branch located on the north side of the road and the right branch to the south. On the northern side of Woodcocks Road, the Mahurangi River runs parallel to the road for almost the entire length of the designation. The currently proposed Project drawings also illustrate bridges in these locations,

reducing the potential for adverse effects on waterways, with 20m of stream length anticipated to be lost as a result of Project works and 57m² of natural wetland.[33] Effects on the Mahurangi River are discussed further in the 'Assessment of Ecological Effects'.

Opportunity to retain rural landscape characteristics

Currently, Woodcocks Road is set within a rural context within the proposed designation boundary. It is anticipated that the area will become urbanised in the future as part of the FUZ in the AUP:OP. However, there is potential for rural landscape characteristics to be retained with future urbanisation, including through existing indigenous vegetation (Appendix A).

Potential effects on heritage values

Three heritage sites have been identified in the 'Assessment of Archaeological Effects' as relevant to NOR 2 Project. These include Cherry's Bridge, a WWII camp and an artefact find spot. Effects on these heritage sites are discussed in detail in the 'Assessment of Archaeological Effects'. There is the opportunity to interpret these heritage areas within the transport corridor through markers and interpretations of the history of the sites.

11.3 Nature and magnitude of effects

The proposed designation has the potential to affect the landscape character and natural character of the adjacent area. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Low-Moderate'**
- Construction effects on natural character: **'Moderate-High'**
- Operational effects on landscape character: **'Low'**
- Operation effects on natural character: **'Moderate'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the proposed transport corridor and permanent effects during the operation of the proposed transport corridor. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

11.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the construction of the proposed transport corridor within this designation.

Designation boundary within SEA

The proposed designation crosses into a SEA on the northern side of Woodcocks Road at the western extent of the designation where it follows the existing road corridor boundary, and the SEA extends inside the road boundary, as well as at the midpoint of the designation, where the bridge crosses the Mahurangi River. There is the potential for construction to result in the removal of additional riparian vegetation outside the operational structures of the proposed transport corridor.

[33] Assessment of Ecological Effects, Table 16-2 and Table 16-3.

Any impacts on riparian vegetation will likely have adverse effects on natural character and landscape character.

Potential work within the Mahurangi River

The proposed designation crosses the Mahurangi River, which is a significant waterway within Warkworth. While there are already bridges in place, the bridges will require widening and lengthening, and one may require a slight realignment. As such, construction work could be required in the waterway, which could have potential effects on natural character and landscape character.

Exposed earthworks in wetland and existing residential area

The currently proposed Project drawings depict an area of fill over a natural wetland on the northern side of Woodcocks Road, towards the eastern extent of the proposed designation. There is the risk of sediment entering the wetland while earthworks are exposed. A large area of cut is also depicted on the southern side of Woodcocks Road, at the eastern end of the proposed designation. This is in an existing residential area and has the potential to be unsightly for neighbouring residents while earthworks are exposed. The extent and location of earthworks will be confirmed at the detailed design phase with potential effects addressed through future regional consent processes.

Reduced amenity for existing residential area

Amenity issues are expected to be concentrated at the eastern extent of the proposed designation, where there is an existing residential area. Most of the effects on amenity will likely be caused by the large area of cut to the south of Woodcocks Road that is currently depicted in the proposed Project drawings.

11.5 Recommended measures to avoid, remedy or mitigate construction effects

In addition to the overall recommended measures outlined in Section 7.5 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific construction effects of the proposed transport corridor.

- Where practicable, stage earthworks for the large area of cut within the existing residential area. Provide temporary screening for residential properties on the southern side of Woodcocks Road until planting on the earthworks is established.

With the above recommended measures, It is anticipated that construction effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low'**
- Natural character: **'Low-Moderate'**

11.6 Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed designation.

Potential effects on existing residential area

The proposed designation includes an existing road which requires upgrading and will also complement the future urbanisation planned for the area. As such, a transport corridor is an expected element in this area and is consistent with the existing and anticipated future landscape. However, widening of the existing road will likely affect a existing residential area at the eastern extent of the proposed designation. Approximately five houses will be removed and three properties on the southern side of Woodcocks Road will have reduced section sizes. Additionally, there will be a reduced buffer between the transport corridor and a row of houses on Oliver Street. The proposed designation is also expected to abut residential land use in the future as the FUZ becomes urbanised. However, the proposed designation will be consistent with this anticipated suburban character, and it is expected that future urban planning will take the designation into consideration.

Opportunity to create an attractive transport corridor

While the large area of cut illustrated in the currently proposed Project drawings on the southern side of Woodcocks Road has the potential to be visually dominant, there is the opportunity to create an attractive planted area, which has the potential to become a community asset. There is also the opportunity to incorporate the stormwater treatment wetland with active transport routes. Furthermore, the location of the proposed designation along the vegetated banks of the Mahurangi River has scope to provide an attractive experience for those travelling both in vehicles and via active modes of transport.

Minimal changes to landform

It is likely that the proposed designation will require some areas of cut and fill, however, these are not relatively extensive due to the location of the proposed designation along a somewhat flat area of land and as it involves the upgrading of an existing road, rather than the creation of a new road. The width of the proposed designation is expected to enable areas of cut and fill to be appropriately integrated with the surrounding, natural landform.

Opportunity for mitigating potential effects on natural character

Based on the currently proposed Project drawings, there is the potential for riparian vegetation to be adversely affected by the proposed designation, which would consequently affect natural character. These potential effects could be addressed by indigenous revegetation planting within the designation.

Opportunity to recognise rural landscape characteristics through views

While the proposed designation is currently predominately rural in character, it is anticipated that the proposed transport corridor and surrounding area will become urbanised in the future. Even so, it is likely that some rural landscape characteristics will be retained. Opportunities to recognise these rural landscape characteristics include design measures which enable transport corridor users views towards the surrounding vegetation, particularly on the northern side of Woodcocks Road.

Opportunity to recognise heritage sites

There are several historical sites within the vicinity of the proposed designation. The NOR 2 Project provides an opportunity to raise awareness of the history in the area, such as cultural markers and interpretation panels that highlight the historical WWII US military campsites.

11.7 Recommended measures to avoid, remedy or mitigate operational effects

In addition to the overall recommended measures outlined in Section 7.7 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific operational effects of the proposed transport corridor. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

- Minimise visual effects on adjacent residential dwellings with appropriate buffering and screening.
- Integration of the transport corridor where the corridor intersects waterways and areas of vegetation.
- Opportunity to provide cultural markers and interpretation panels for historical and culturally significant areas.

With the above recommended measures, it is anticipated that operational effects within, and adjacent to, the proposed designation will be

- Landscape character: **'Very Low'**
- Natural character: **'Low-Moderate'**

11.8 Summary and Conclusions

The proposed designation will result in the upgrading and widening of an existing road in the southwest of Warkworth, which is anticipated to result in modifications to existing residential areas, some earthworks, and potential vegetation removal. However, the proposed designation also provides the opportunity to create an attractive travel corridor, as well as recognise heritage sites.

It is expected that natural character could be potentially affected by the widening of two bridges and the potential removal of riparian vegetation. It is likely that these effects could be reduced through avoiding piers in the riverbed, minimising piers on the riverbank, and riparian revegetation. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Low-Moderate'** at most and operational effects are anticipated to be **'Low-Moderate'** at most. Proposed conditions at the future regional resource consent stage will provide specific mitigation for future transport projects within each designation.

Table 10. Summary of Assessment of Effects and Recommendations – NOR 2 Woodcocks Road Upgrade (Western Section)

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Low'**	Designation boundary within SEA. Work within the Mahurangi River and wetland area.	Refer to overall network recommendations.
Natural Character: **'Low-Moderate'**	Exposed earthworks in wetland and residential area.	Where practicable, stage earthworks for the large area of cut within the existing residential area. Provide temporary screening for residential properties on the southern side of Woodcocks Road until planting on the earthworks is established.
Operational effects		
Landscape Character: **'Very Low'**	Minimising effects on existing residential areas.	Minimise visual effects on adjacent residential dwellings with appropriate buffering and screening.
Natural Character: **'Low-Moderate'**	Addressing effects on waterbodies and natural character.	Integration of the transport corridor where the corridor intersects waterways and areas of vegetation.
	Opportunity for recognising heritage sites	Opportunity to provide cultural markers and interpretation panels for historical and culturally significant areas.

12 NOR 3 –State Highway 1 – South Upgrade

This section assesses specific landscape and natural character matters relating to NOR 3 – Existing State Highway 1 Upgrade (Southern Section) (the 'NOR 3 Project').

12.1 Overview and description of works

SH1 is an existing arterial extending from the Northern Gateway Toll Road in the south to its intersection with Auckland Road in the northeast, with the extents of the proposed NOR 3 Project upgrade from the FUZ boundary in the south to its intersection with Fairwater Road in the north. The proposed NOR 3 Project upgrade involves:

- Upgrading of the existing two-lane highway to a two-lane urban arterial, with cycle lanes and footpaths on both sides
- A large stormwater wetland
- Areas of cut and fill

Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

12.2 Landscape character and natural character assessment

SH1 currently transitions from a rural road in the south to the urban fringes of Warkworth in the north, becoming the southern 'gateway' of Warkworth at the northern extent of the proposed designation.

The existing rural landscape either side of SH1 is zoned FUZ in the AUP:OP and is expected to become urbanised in the future. Other AUP:OP zoning includes Residential Single House at the northern extent of the proposed designation, as well as a Business Local Centre. When the Ara Tūhono expressway opens in 2023 the classification of the existing SH1 is expected to operate as a local urban arterial road. The Warkworth Structure Plan identifies several zones along the length of the designation, including residential (terrace housing and apartment buildings, mixed housing urban, and mixing housing suburban), protection areas (not for development), Morrison's Heritage Orchard, and a business – neighbourhood centre.

Limited effects on amenity

At the northern extent of the proposed designation, the existing residential area which flanks the current SH1 has reduced amenity due to the high use road, which is often congested with traffic in the current situation. The existing large-format retail area at the northern extent of the proposed designation also reduces amenity in this area. Retail stores include a petrol station, fast food restaurants and a building materials store. These stores currently signal the southern 'gateway' to central Warkworth.

Along the urban fringes and the rural landscape to the south, there are higher levels of amenity and it is typically rural in character. Aspects which contribute to the amenity of the setting include residential planting, roadside planting (which largely consists of exotic species), and tree species typical of farms (such as eucalyptus, poplar and willow trees). These farmland trees are often planted in regimented stands as shelterbelts, providing a linear landscape pattern. However, it is expected that this amenity will change in the future as the area becomes urbanised and much of this vegetation will be removed.

Minimal effects on landform

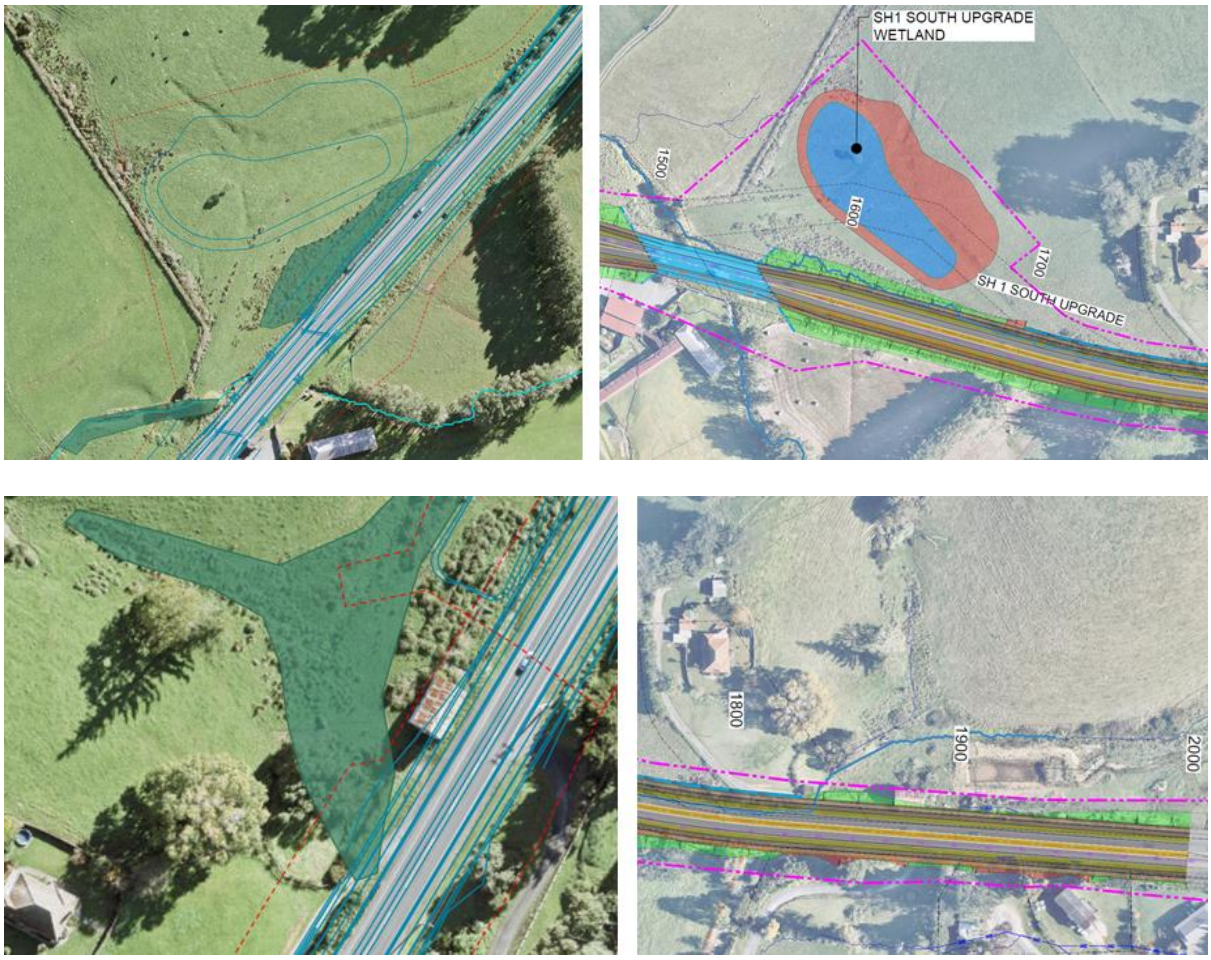
While the proposed designation runs through a relatively flat area of land, some areas of cut and fill are likely to be required, particularly at the southern extent. As the NOR 3 Project involves a road upgrade, rather than a new road, earthworks are less extensive than what would be expected for a transport corridor through a greenfield site.

Limited effects on vegetation

Avice Miller Reserve is located outside the designation, to the southeast, and is identified in the AUP:OP as a SEA and an ONL. The designation is unlikely to affect these identified areas. Other vegetation in the area includes orchard planting, shelterbelts and fence line planting, scattered farm trees, roadside vegetation, and residential planting. Much of this planting is expected to be removed as part of the future urbanisation of Warkworth outside the scope of the Warkworth Package. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

Potential effects on waterbodies

Towards the midpoint of the proposed designation, the transport corridor crosses the right branch of the Mahurangi River twice via two bridges to the north and south of Toovey Road. While these are existing bridges, they will require widening as part of the NOR 3 Project. Areas of fill are also shown in the currently proposed Project drawings over two wetland areas (Figure). It is anticipated that Project works will result in the loss of 206m of stream and 1,564m² of natural wetland.[34] Effects on these waterbodies are discussed further in the 'Assessment of Ecological Effects'.



[34] Assessment of Ecological Effects, Table 16-2 and 16-3.

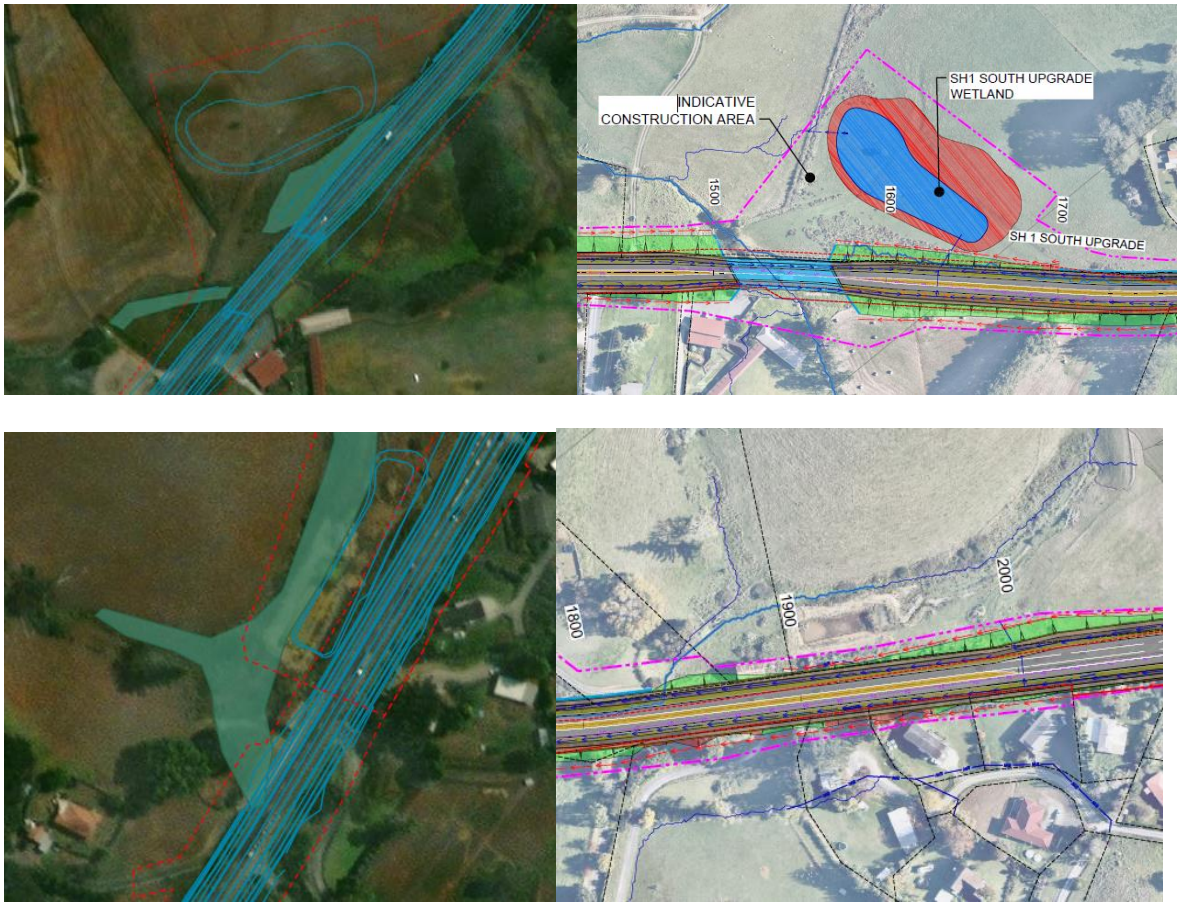


Figure 12-1 Left images show natural wetlands in green. Right images show areas of fill in bright green.

Potential rural landscape characteristics to be retained

Aside from the northern extent of the proposed designation, the existing environment has an overriding rural character due to expansive areas of pasture adjacent to, and visible from, the road. Heading towards the northern extent of the proposed designation, SH1 transitions from a rural to urban character. It is anticipated that this rural character will change to an urbanised landscape in the future, however, rural landscape characteristics, such as Morrison's Heritage Orchard, are likely to remain as discussed in the next section. As it is expected that Project implementation will occur in an urban setting and as it is a road upgrade, rather than a new road, it is anticipated that visual effects will be very low, with the potential for some positive visual effects from streetscaping.

Potential effects on heritage orchard

Towards the southwest of the proposed designation, tucked behind an established planting border, is Morrison's Heritage Orchard. The orchard has heritage value and is identified in the Warkworth Structure Plan as an important rural landscape characteristic. As such, is expected that the orchard will be retained as Warkworth becomes urbanised in the future. The proposed designation will overlap with a small section of the orchard.

Potential effects on AUP:OP overlays

An ONL is identified in the AUP:OP to the south and southeast of the proposed designation. The AUP:OP provides a description of the characteristics which require protection for this identified area.

Potential effects on these recognised areas are discussed in detail in Section 18 'Statutory Considerations'.

12.3 Nature and magnitude of effects

The proposed designation has the potential to affect the landscape character and natural character of the adjacent area. Without recommended measures to avoid, remedy or mitigate effects, It is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Low-Moderate'**
- Construction effects on natural character: **'Low-Moderate'**
- Operational effects on landscape character: **'Low-Moderate'**
- Operation effects on natural character: **'Low'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the proposed transport corridor and permanent effects during the operation of the proposed transport corridor. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

12.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the proposed transport corridor construction.

Disruption to heritage orchard

A retaining wall is depicted in the currently proposed Project drawings adjacent to Morrison's Heritage Orchard. There is the potential for works in this area to disrupt commercial activities within the orchard and may also result in the removal of some orchard trees. This has the potential to affect rural landscape characteristics which contribute to the landscape character, as well as heritage values.

Work within the Mahurangi River

The proposed designation crosses the Mahurangi River, which is a defining feature of Warkworth. There are currently bridges at these crossings, however, the bridges will require widening as part of the proposed design. Therefore, construction could potentially be required in the waterway, which could result in adverse effects on both natural and landscape character.

Exposed earthworks

Some areas of cut and fill are illustrated in the currently proposed Project drawings, including two small sections off fill over two recognised wetlands on the western side of the proposed designation. While earthworks are exposed, there is the risk of sediment entering the wetlands. In addition, some areas of cut and fill may be unsightly for nearby residential properties.

Limited amenity effects

Amenity effects are limited as the proposed designation is for a road upgrade, rather than a new road. However, cut and fill, as well as the removal of planting, have the potential to reduce the area's amenity.

12.5 Recommended measures to avoid, remedy or mitigate construction effects

In addition to the overall recommended measures outlined in Section 7.5 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific construction effects of the proposed transport corridor.

- Where practicable, avoid construction works in Morrison's Heritage Orchard.
- Where practicable, stage earthworks south of the tie-in with the Wider Western Link.
- Provide temporary screening for residential properties south of the tie-in with the Wider Western Link until earthworks are remediated.

With the above recommended measures, it is anticipated that construction effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low'**
- Natural character: **'Low'**

12.6 Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed transport corridor.

Opportunity to improve southern 'gateway'

The proposed designation boundary is near several existing residential dwellings, limiting the ability for mitigation measures, such as planting and/or fencing, to lessen potential effects on residential amenity (Figure). Where the proposed designation is close to residential dwellings, mitigation is expected to be particularly important. There is potential for localised effects on existing residential properties at the northern extent of the proposed designation. However, the NOR 3 Project provides an opportunity to enhance the southern 'gateway' into Warkworth through careful street design, including amenity planting.

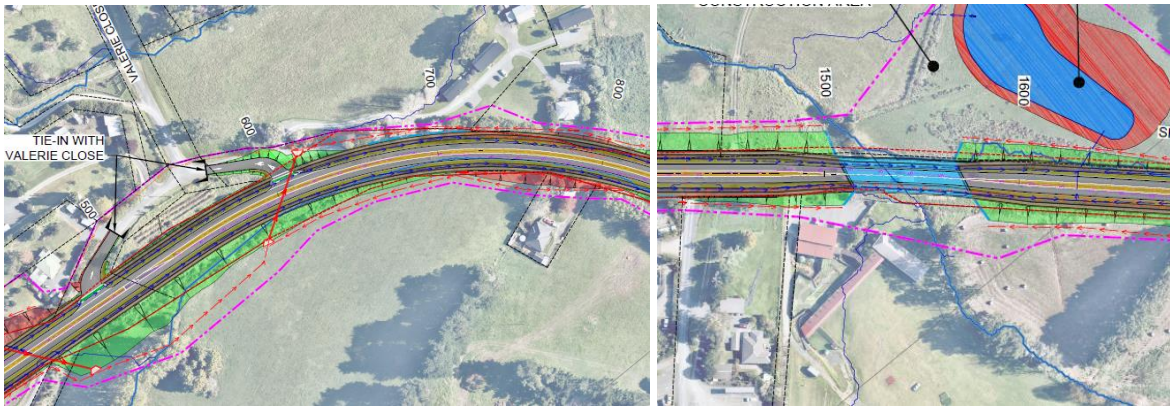


Figure 12-2 Example of locations where the designation boundary is near residential dwellings.

Minimal changes to landform

While it is expected that there will be relatively minimal changes to the landform, towards the southern extent of the proposed designation several large areas of cut and fill are depicted in the currently proposed Project drawings, some of which will be near existing residential properties. It is likely that mitigation planting will be particularly important on the large area of fill adjacent to #1659 SH1 (Figure). Consideration will also need to be given as to how the area of cut at the southern extent of the designation integrates with the adjoining SH1 corridor to minimise effects on landform. This is particularly important given its proximity to an ONL. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment. As it is uncertain at this stage how the topography of the land may change with future development, cut and fill in the proposed Project drawings are based on existing topography.

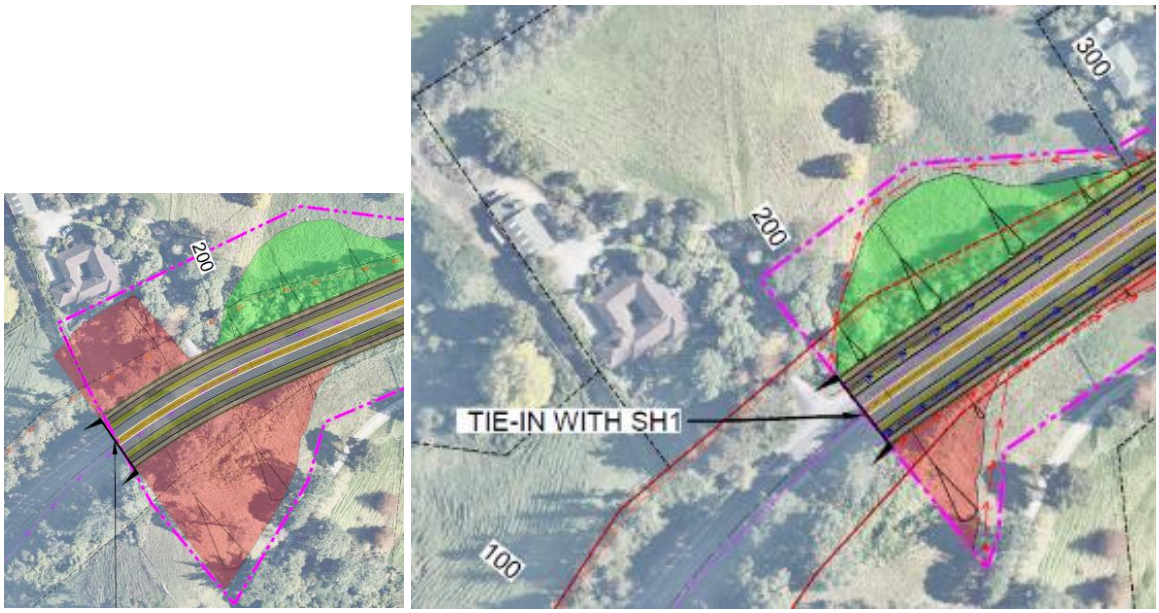


Figure 12-3 Large area of fill near #1659 SH1.

Opportunity for biodiversity and amenity planting

The NOR 3 Project provides an opportunity for planting of indigenous roadside species to enhance biodiversity and improve amenity by minimising the visual dominance of the transport corridor from adjoining sites.

Scope for mitigating potential natural character effects

Small areas of fill are shown in the currently proposed Project drawings over two natural wetland areas. The proposed stormwater treatment wetland is also depicted very close to a natural wetland. Any adverse effects on natural wetlands within the proposed designation will also likely adversely affect natural character. Potential effects on natural character, which relate to waterbodies (including riparian vegetation), would be required to be addressed in situ (where the effects occur). There is an opportunity to increase the extent of riparian indigenous planting within the proposed designation by revegetating wetlands (Figure).

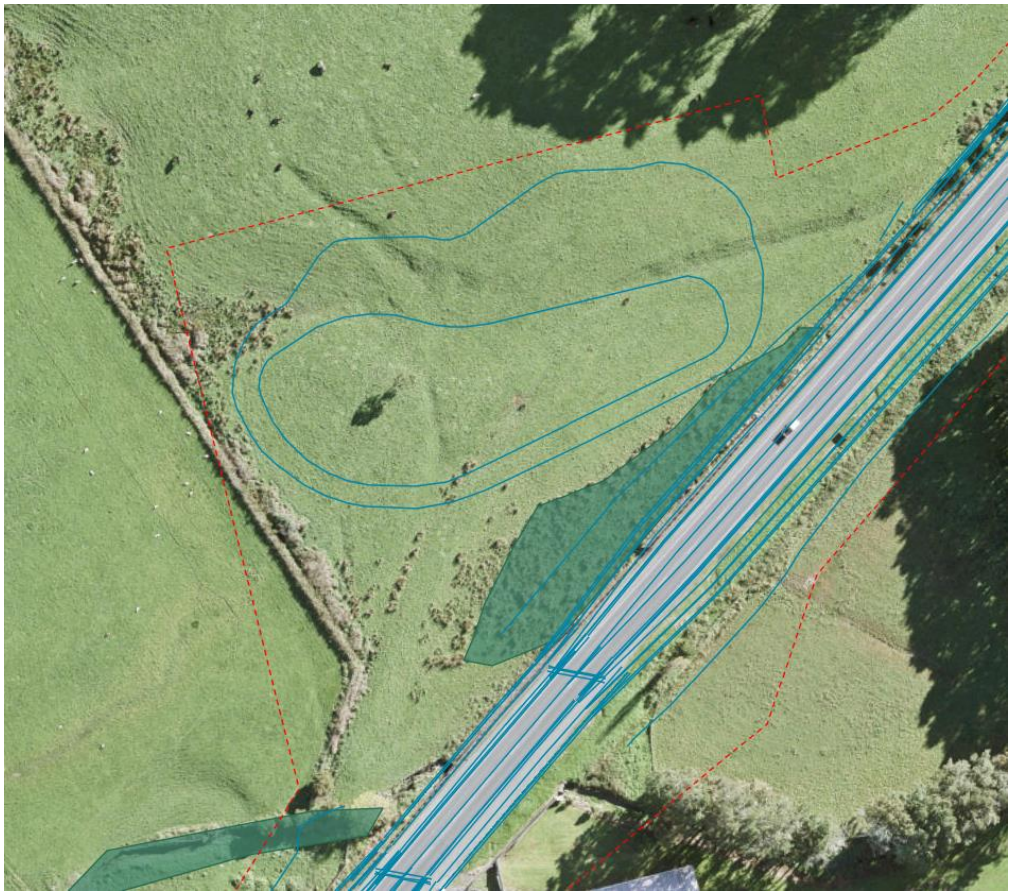


Figure 12-4 Opportunity to revegetate natural wetland to address potential natural character effects.

Opportunity to emphasise existing rural landscape characteristics

Although it is expected that the area's rural character will be altered with future urbanisation separate to the Warkworth Package, it is anticipated that some rural landscape characteristics in the wider landscape will be retained. The NOR 3 Project provides some opportunities for emphasising remaining rural landscape characteristics, such as through roadside planting and design connections with Morrison's Heritage Orchard.

Opportunity to integrate heritage orchard through design

The Warkworth Structure Plan strongly advocates for the protection of Morrison's Heritage Orchard as a means for retaining some rural landscape characteristics in the future urban form of Warkworth. The proposed designation encroaches into Morrison's Heritage Orchard (#1773 SH1), with a retaining wall depicted in the current Project drawings adjacent to the property (Figure). This has the potential to

affect heritage trees within the orchard. However, there is an opportunity to improve access to and from Morrison's Heritage Orchard, including using street trees to signal the entranceway to the orchard.

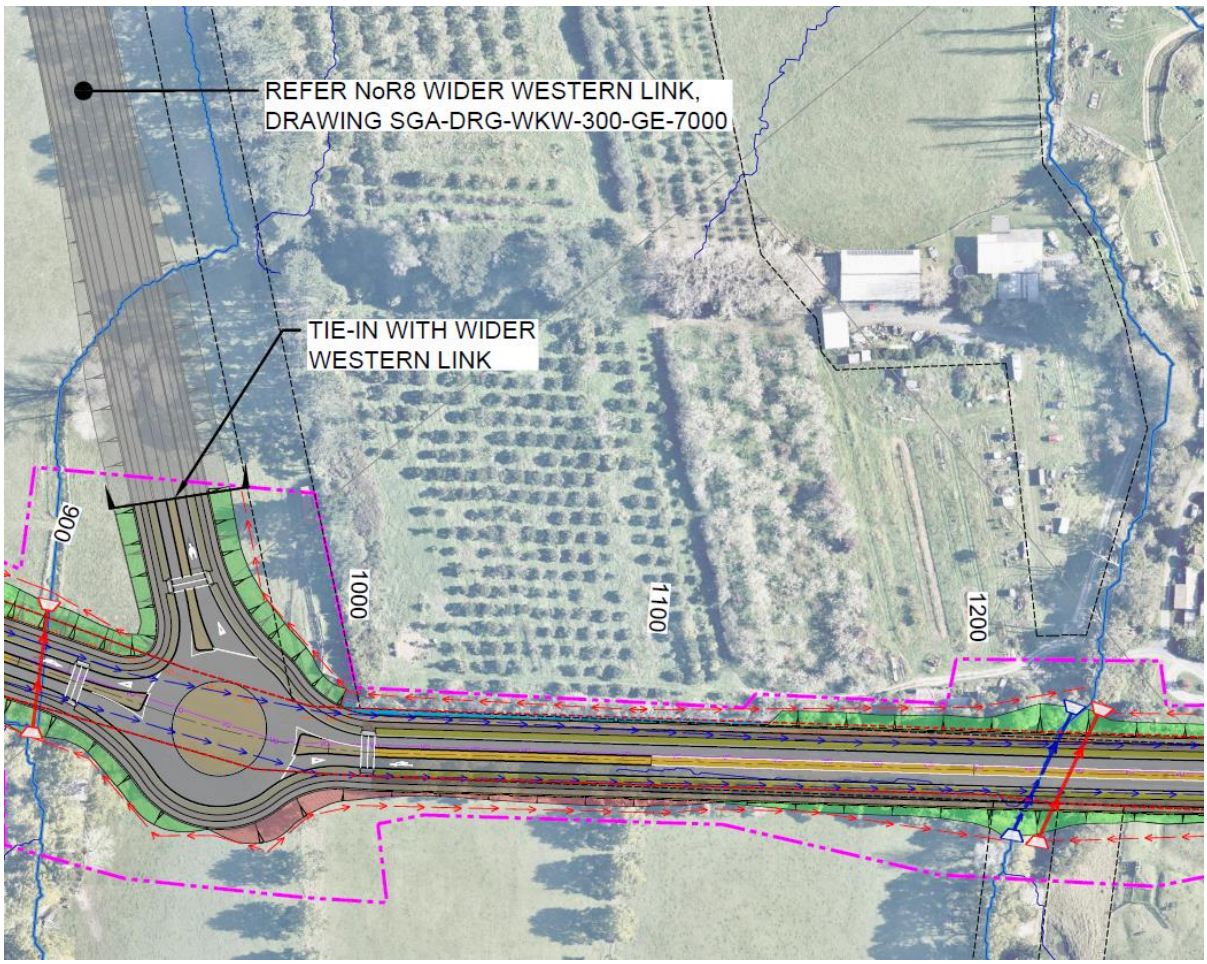


Figure 12-5 Morrison's Heritage Orchard in relation to the NOR 3 Project boundary. Retaining wall indicated by the blue 'RW' line'.

12.7 Recommended measures to avoid, remedy or mitigate operational effects

In addition to the overall recommended measures outlined in Section 7.7 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific operational effects of the proposed transport corridor. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

- Provide detailed plans at the future regional resource consent stage for the enhancement of Warkworth's southern 'gateway'.
- Large area of cut at the southern end of the designation is well integrated with the adjoining SH1 corridor in a way that is sensitive to the landform and reduces the extent of cut.
- Provide suitable separation between natural and artificial wetlands.
- Where practicable, avoid impacts on Morrison's Heritage Orchard. Avoid adverse effects to orchard trees where intrusion into the property boundaries is unavoidable.

- Provide detailed plans at the future regional resource consent stage illustrating how the location of Morrison's Heritage Orchard will be positively enhanced through the transport corridor design.
- It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.

With the above recommended measures, it is anticipated that operational effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low'**
- Natural character: **'Very Low'**

12.8 Summary and Conclusions

The proposed designation will result in the upgrading and widening of an existing road in the southern area of Warkworth, which is anticipated to result in modifications to existing residential areas and some earthworks. However, the NOR 3 Project also provides the opportunity to strengthen the southern 'gateway' of Warkworth and enhance indigenous planting within the proposed designation.

It is expected that natural character will be specifically affected by the widening of two bridges and potential fill over two natural wetlands. It is likely that these effects can be reduced through avoiding piers in the riverbed, minimising piers on the riverbank, and revegetating existing wetlands. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Low'** and operational effects are anticipated to be **'Low'** at most. Proposed conditions at the future regional resource consent stage will provide specific mitigation for future transport projects within each designation.

Table 11. Summary of Assessment of Effects and Recommendations – NOR 3 Existing State Highway 1 Upgrade (Southern Section)

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Low'** **Natural Character:** **'Low'**	Disruption to heritage orchard.	Where practicable, avoid construction works in Morrison's Heritage Orchard.
	Work within the Mahurangi River and wetland area.	Refer to overall network recommendations.
	Exposed earthworks.	Where practicable, stage earthworks south of the tie-in with the Wider Western Link. Provide temporary screening for residential properties south of the tie-in with the Wider Western Link until earthworks are remediated.
Operational effects		
Landscape Character: **'Low'** **Natural Character:** **'Very Low'**	Effects on existing residential areas. Opportunity to improve southern 'gateway'.	Provide detailed plans at the future regional resource consent stage for the enhancement of Warkworth's southern 'gateway'.
	Potential issues with landform integration.	Large area of cut at the southern end of the designation is well integrated with the adjoining SH1 corridor in a way that is sensitive to the landform and reduces the extent of cut.

Residual effect after recommendations	Assessment	Recommendation
Natural Character (cont'): **'Low** **Natural Character (cont'):** **'Very Low**	Scope for mitigating effects on natural character.	Provide suitable separation between natural and artificial wetlands. It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.
	Potential effects on heritage orchard.	Avoid Morrison's Heritage Orchard. Avoid adverse effects to orchard trees where intrusion into the property boundaries is unavoidable. Provide detailed plans at the future regional resource consent stage illustrating how the location of Morrison's Heritage Orchard will be positively enhanced through the transport corridor design.

13 NOR 4 – Matakana Road Upgrade

This section assesses specific landscape and natural character matters relating to NOR 4 – Matakana Road Upgrade (the 'NOR 4 Project').

13.1 Overview and description of works

Matakana Road is an existing arterial connecting the growth area of Warkworth and the towns of Matakana and Omaha. The proposed designation extends from the tie-in with the Hill Street intersection upgrade (a non-Te Tupu Ngātahi project) in the south, to the FUZ boundary in the north, where it is intersected by the Te Honohono ki Tai (a non-Te Tupu Ngātahi project) at its midpoint.

The Matakana Road upgrade will consist of:

- Widening of the existing road corridor to a 18m-24m two-lane cross section, including cycle lanes and footpaths
- The portion of the corridor between Hill Street and Melwood Drive is proposed to have a bidirectional facility for cyclists, rather than separate cycle lanes on both sides of the corridor
- Two large stormwater wetlands
- Areas of cut and fill
- Removal of some residential dwellings

Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

13.2 Landscape character and natural character assessment

Matakana Road is currently an urban road to the south, transitioning to a rural road in the north. There is an existing residential area to the west of the road. Scattered residential housing also extends northwards up both sides of the road.

Under the zoning in the AUP:OP, it anticipated that the proposed transport corridor and surrounding area will become fully urbanised in the future. The area is primarily zoned as residential (including single house, mixed housing suburban and mixed housing urban) or FUZ. There is also a small section of existing open space conservation land east and west of the proposed designation. The Warkworth Structure Plan also identifies residential zoning (mixed housing suburban and mixed housing urban) adjacent the designation.

Effects on existing residential areas

The southern extent of Matakana Road is characterised by the busy Hill Road intersection, which is frequently congested. Existing residential areas located along the edge of Matakana Road are typically screened by roadside vegetation and topography. Proposed widening of the road will result in the loss of houses, reduced section sizes, removal of vegetation and changes to topography.

Landform constraints

Along with existing residential areas, steep topography adds to the high constraints for development along Matakana Road between Hill Street and North of Melwood Drive. Within the southern extent of the proposed designation, sections of land drop to the west and rise away from the road to the east. Towards the northern end of the proposed designation the landscape becomes more open and views

of the rolling hill country to the east are attainable. However, it is anticipated that these views may become somewhat obscured by future urbanisation separate to the Warkworth Package.

Due to the topography, it is anticipated that visual effects will be varied for residents. Where residential properties are located close to areas of cut and fill, it is expected that potential visual effects will be greater. However, as the proposed transport corridor is for a road upgrade, rather than a new road, visual effects are reduced. Overall, visual effects are anticipated to be low but will vary for specific viewpoints, with some residential areas expected to experience greater effects.

Established vegetation characterises the designation and surrounding area

At the southern extent of the proposed designation, there is mature native vegetation in the adjacent Kōwhai Park. This connects with the bush along the Mahurangi River escarpment, providing a natural contrast to the busy roads in the area. On the eastern side of Matakana Road, a section of this vegetation is protected with a QEII covenant. Heading north the existing road is sandwiched between established residential plantings, which are a mix of native and exotic species. The AUP:OP identifies two Notable Trees on the western side of the proposed designation, near Melwood Drive (Figure 13-3 Area of fill depicted near the designation). The roadside in the northern section of the proposed designation is predominately covered with pastural grass. However, under the AUP:OP zoning, this is expected to become urbanised in the future. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

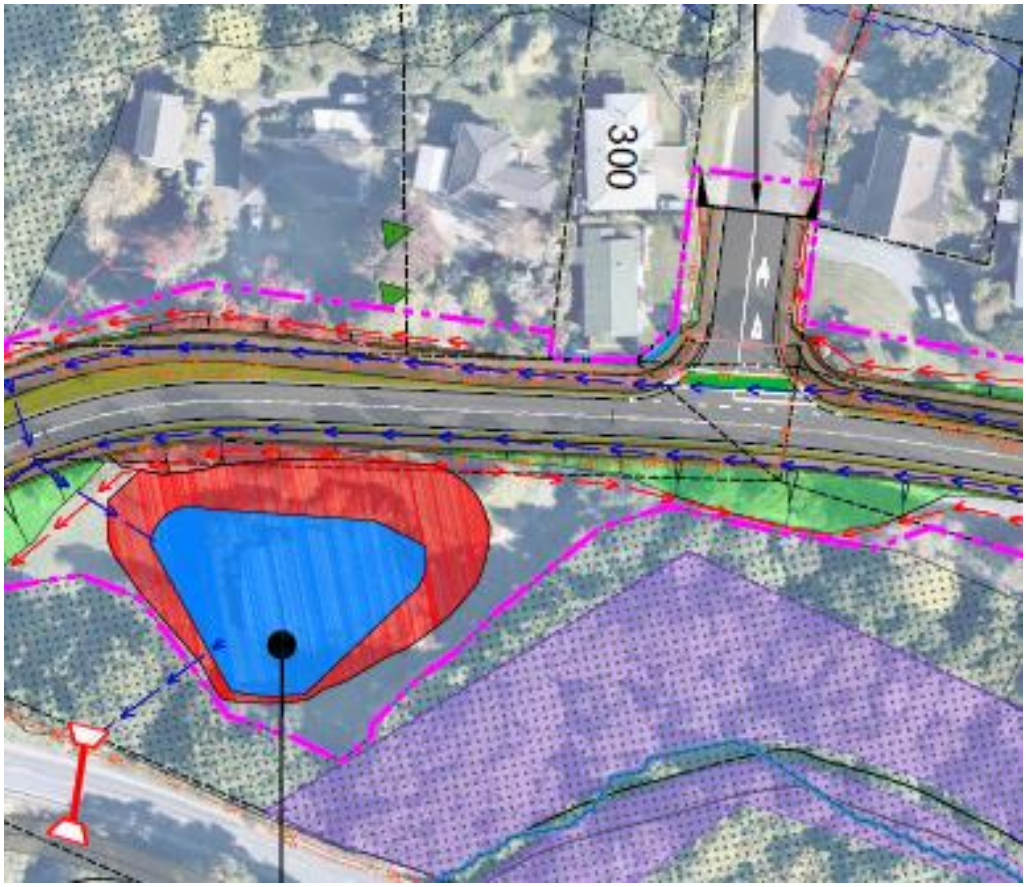


Figure 13-1 Notable Trees are indicated by the two green triangles on the opposite side of the road from the proposed stormwater wetland (indicated in blue and red).

Potential effects on waterbodies

Several recognised natural wetlands are in the northern section of the proposed designation, on the eastern side of Matakana Road. It is anticipated that Project works will result in the loss of 76m of stream and 857m² of natural wetland.[35] Potential effects on these natural wetlands are discussed further in the 'Assessment of Ecological Effects'.

Opportunity for visual connections with wider rural character

- The southern extent is enclosed by topography, houses, and vegetation. Further north where there are less houses, roadside vegetation and ground changes either side of the road, open vistas across rolling hills are attainable, with pasture characterising the eastern side of the road at the northern extent of the proposed designation. Under the AUP:OP zoning it is expected that this landscape will become urbanised in the future, however, the adjacent land to the north will remain in rural production. There is scope for strengthening connections between the designation and these adjacent rural areas, such as through views to the wider landscape beyond (Appendix A). This has the potential to provide some positive visual effects.

Potential effects on heritage and associational values

A property with heritage value is located at 190 Matakana Road, which has an early (1850s-70s) settler dwelling and early plantings of five mature oak trees. These trees may meet the criteria for inclusion in the AUP:OP Schedule of Notable Trees.[36] It is likely that the proposed designation will affect this property and is discussed further in 'Assessment of Archaeological Effects'.

13.3 Nature and magnitude of effects

The proposed designation has the potential to affect the landscape character and natural character of the adjacent area. Without recommended measures to avoid, remedy or mitigate effects, It is anticipated that effects will be as follows:

- Construction effects on landscape character: **'High'**
- Construction effects on natural character: **'Low'**
- Operational effects on landscape character: **'High'**
- Operation effects on natural character: **'Low'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the transport corridor and permanent effects during the operation of the transport corridor. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

[35] Assessment of Ecological Effects, Table 16-2 and 16-3.
[36] Bassey and Walker (2018)

13.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the proposed transport corridor construction.

Exposed earthworks and reduced amenity for residential areas

Areas of fill are illustrated in the currently proposed Project drawings over identified natural wetlands towards the northern extent of the proposed designation, on the eastern side of Matakana Road. There is the potential risk of sediment entering the wetlands while earthworks are exposed. Several large areas of cut and fill are also depicted in the currently proposed Project drawings adjacent to existing residential properties. These have the potential to be unsightly for neighbouring residents while earthworks are exposed.

13.5 Recommended measures to avoid, remedy or mitigate construction effects

In addition to the overall recommended measures outlined in Section 7.5 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific construction effects of the proposed transport corridor.

- Provide temporary screening for residential properties adjacent areas of cut and fill until earthworks are remediated.

With the above recommended measures, it is anticipated that construction effects within, and adjacent to, the proposed designation will be:

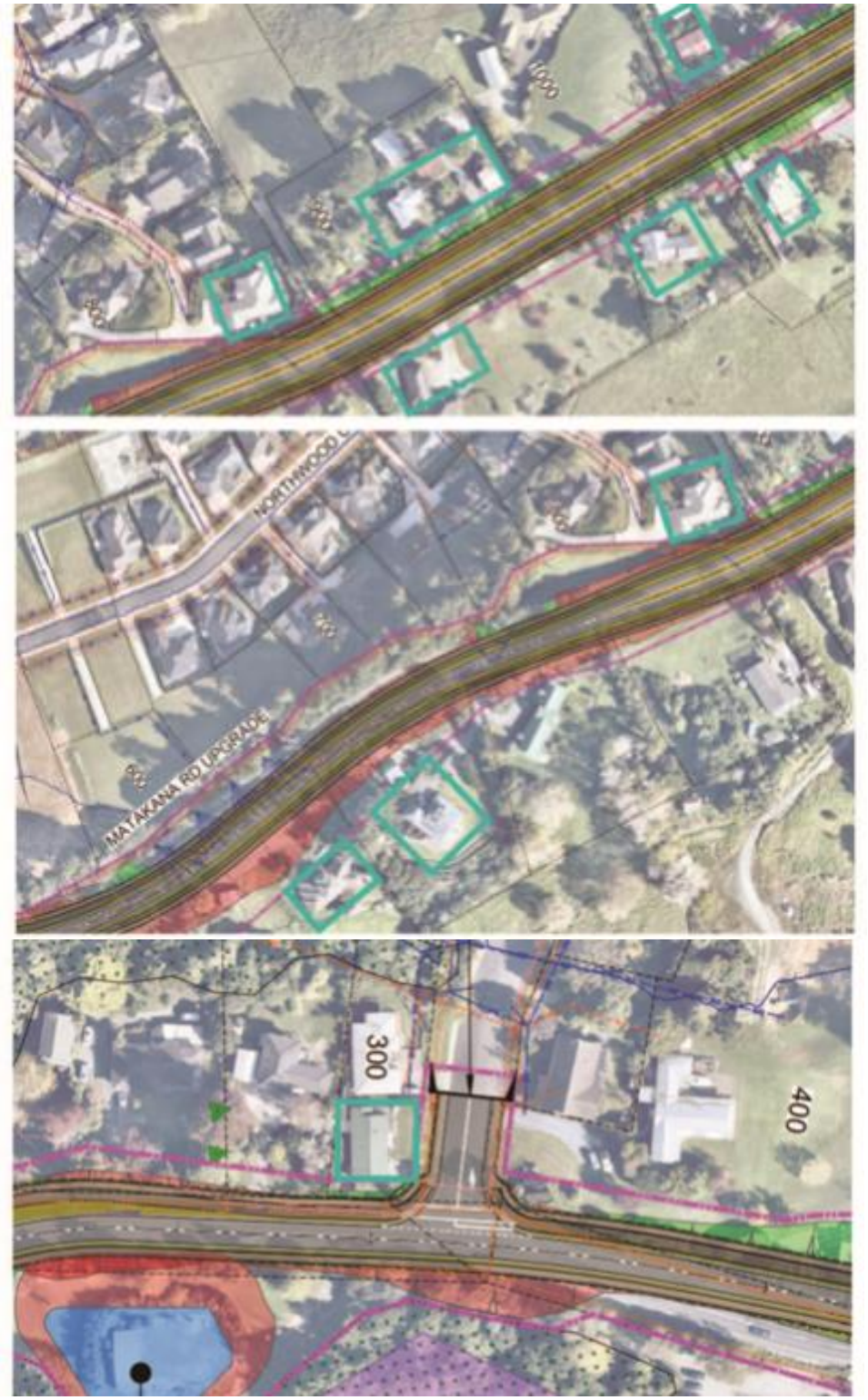
- Landscape character: **'Moderate-High'**
- Natural character: **'Low'**

13.6 Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed transport corridor.

Opportunity to create attractive transport corridor

The main landscape issue for the proposed designation will be potential effects on existing residential areas, due to the proximity of existing residential properties to Matakana Road. The NOR 4 Project will result in the removal of several houses and a reduction in size for numerous residential sections. The proposed designation boundary will be near several remaining residential dwellings, potentially limiting the ability of mitigation planting and/or fencing (Figure 13-4). Where the proposed designation is close to residential dwellings, mitigation will be particularly important. However, there are opportunities to create an attractive transport corridor through careful design, including amenity planting.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MATAKANA RD UPGRADE
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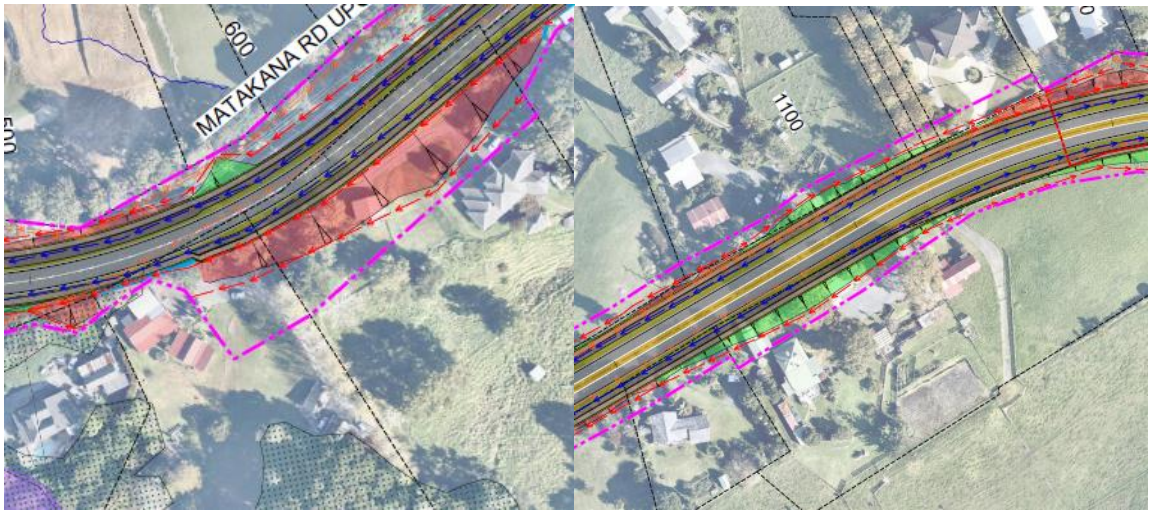

Figure 13-2 Examples of the close proximity of the designation boundary with some existing residential dwellings.

Potential adverse effects from cut and fill

As the proposed designation involves the upgrading of an existing road, rather than creation of a new road, effects on landform are limited to an extent. However, areas of cut and fill are still likely to be required, some of which will be potentially close to existing residential areas. In general, the width of the proposed designation is expected to enable areas of cut and fill to be appropriately integrated with the surrounding, natural landform. Specific mitigation may be required near 49 Matakana Road, where the proposed designation boundary follows closely to an area of fill depicted in the currently proposed Project drawings (Figure).

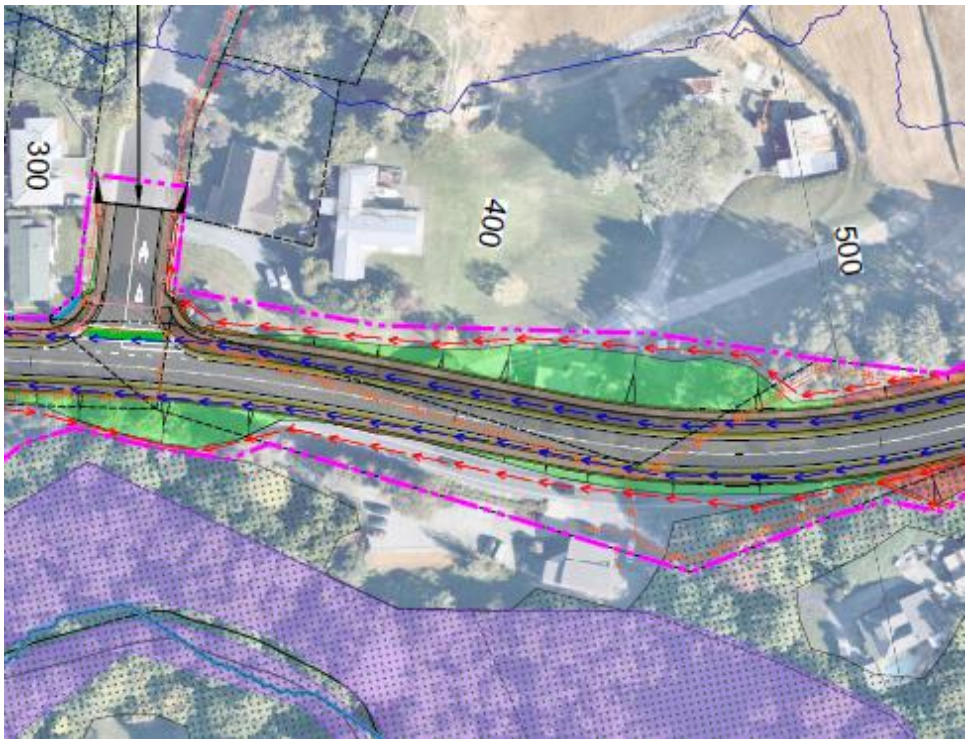

Figure 13-3 Area of fill depicted near the designation boundary at 49 Matakana Road.

Scope to increase planted areas

The proposed designation crosses several sections of existing SEA towards the southern extent of the NOR 4 Project, which could potentially result in adverse effects on vegetation. Sections of the proposed designation (such as adjacent to 96 Matakana Road and the section north of the Te Honohono ki Tai (Matakana Link Road) tie-in, on the eastern side of Matakana Road) provide opportunities for indigenous revegetation (Figure 13-4).

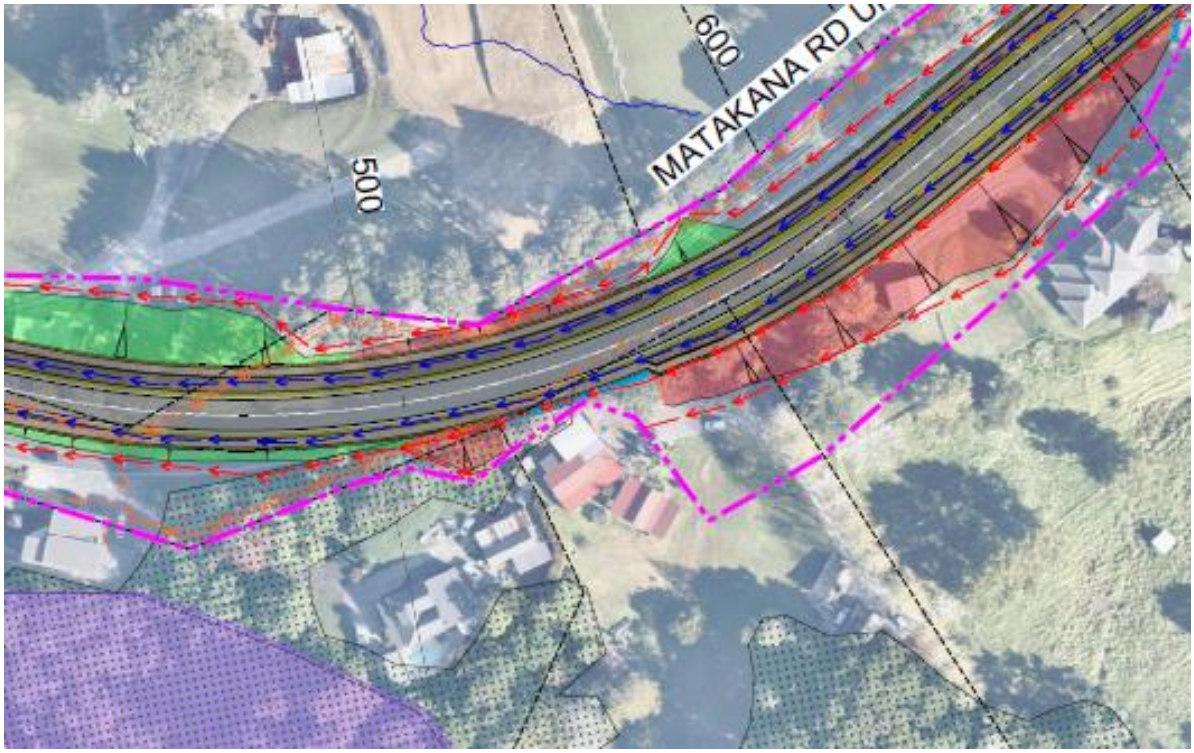

Figure 13-4 Opportunity for the revegetation of cut areas outside 96 Matakana Road.

Opportunities for mitigating potential natural character effects

Towards the northern extent of the proposed designation, areas of fill are shown in the currently proposed Project drawings across two natural wetlands (Figure 13-5Figure 13-5). This has the potential to have adverse effects on natural character. Effects on natural character relate to waterbodies and are required to be addressed in situ (where the effects occur). Opportunities for mitigating potential effects on natural character include wetland revegetation.

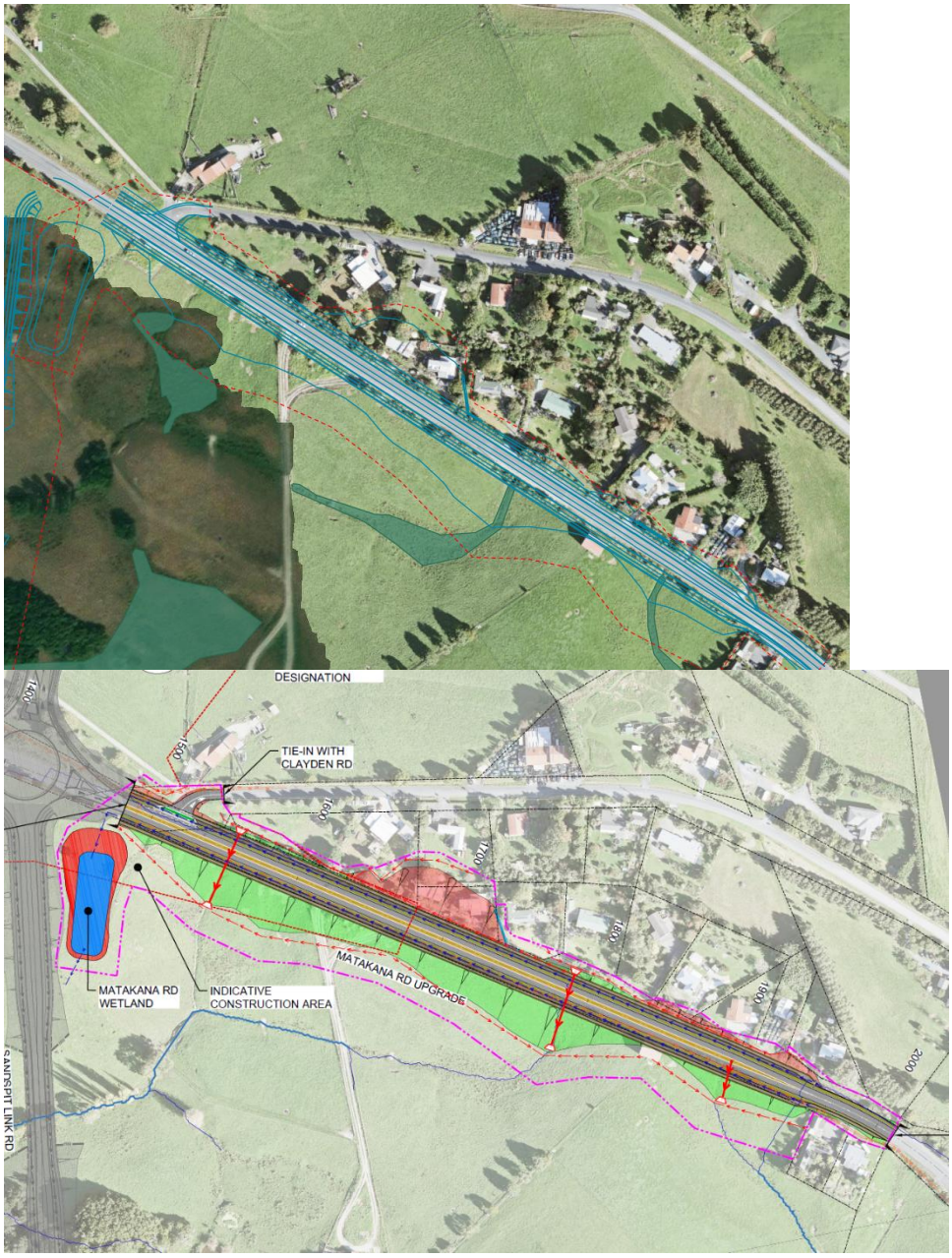

Figure 13-5 Proposed designation areas of fill over natural wetlands.

Opportunity to create visual connections with surrounding rural landscape

While the surrounding area is expected to become urbanised in the future separate to the Warkworth Package, there is an opportunity to provide visual connections with the surrounding rural landscape through rural vistas for Matakana Road users. Towards the northern extent of the proposed designation there is scope to retain views to the east, particularly from sections of raised road.

Possible effects on Notable Trees and potential heritage trees

The AUP:OP identifies two Notable Trees near 5 Matakana Road (Figure). The proposed designation boundary is adjacent to these trees. While the trunks of the trees are located outside of the designation, there is the potential that these trees will require further protection to avoid negative impacts on tree health.

The proposed designation also extends into the historic property at 190 Matakana Road, which could potentially affect the dwelling and five English oak trees that have potential heritage value. Heritage values are discussed in detail in the 'Assessment of Archaeological Effects'.

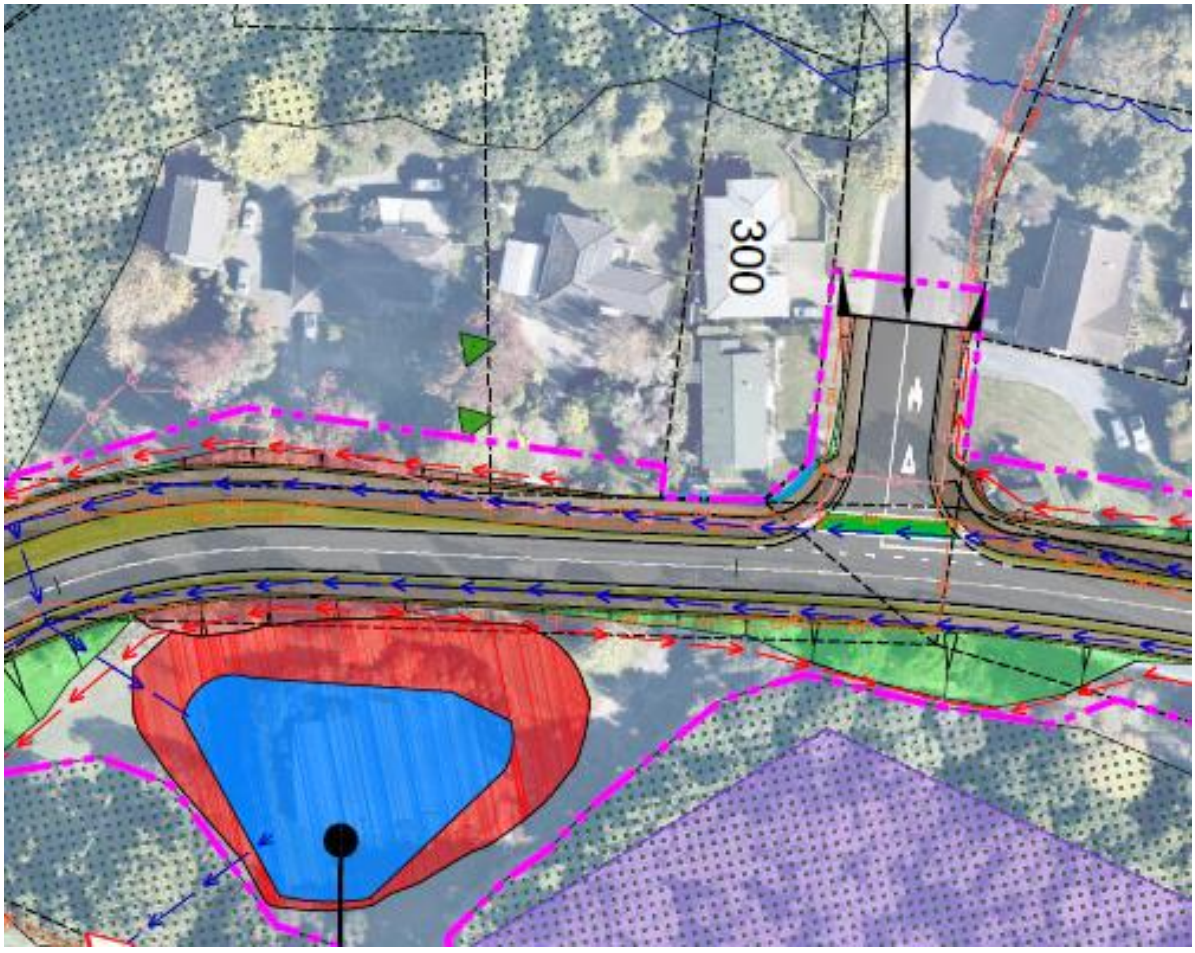

Figure 13-6 Notable Trees indicated by the two green triangles near 5 Matakana Road.

13.7 Recommended measures to avoid, remedy or mitigate operational effects

In addition to the overall recommended measures outlined in Section 7.7 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific operational effects of the proposed transport corridor. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

- To the north of the Te Honohono ki Tai tie-in, consider opportunities to frame key rural views for northbound transport corridor users.

With the above recommended measures, it is anticipated that operational effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Moderate'**
- Natural character: **'Low'**

13.8 Summary and Conclusions

The proposed designation will include the upgrading and widening of an existing road in the northern area of Warkworth, which is anticipated to result in modifications to existing residential areas, earthworks, and potential adverse effects on vegetation, natural wetlands and heritage values. However, the proposed designation also provides the opportunity to create an attractive transport corridor, extend areas of indigenous vegetation and provide visual connections with the adjacent rural landscape.

It is expected that natural character will be specifically affected by fill over natural wetlands. It is likely that these effects can be reduced through wetland revegetation. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Moderate-High'** at most and operational effects are anticipated to be **'Moderate'** at most. Proposed conditions at the future regional resource consent stage will provide specific mitigation for future transport projects within each designation.

Table 12. Summary of Assessment of Effects and Recommendations – NOR 4 Matakana Road Upgrade

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Moderate-High'** **Natural Character:** **'Low'**	Exposed earthworks and reduced amenity for residential areas.	Provide temporary screening for residential properties adjacent areas of cut and fill until earthworks are remediated.
Operational effects		
Landscape Character: **'Moderate'** **Natural Character:** **'Low'**	Effects on existing residential areas. Opportunity to create attractive transport corridor.	Refer to overall network recommendations.
	Some crossovers between the designation boundary and SEAs. Potential effects on wetlands.	

Residual effect after recommendations	Assessment	Recommendation
Landscape Character (cont'): **'Moderate'** **Natural Character (cont'):** **'Low'**	Opportunity to provide visual connections with surrounding rural landscape.	To the north of the Te Honohono ki Tai (Matakana Link Road) tie-in, consider opportunities to frame key rural views for northbound transport corridor users.

14 NOR 5 – Sandspit Road Upgrade

This section assesses specific landscape and natural character matters relating to NOR 5 – Sandspit Road Upgrade (the 'NOR 5 Project').

14.1 Overview and description of works

Sandspit Road is an existing arterial providing an east-west connection between the Warkworth growth area and the towns of Sandspit and Snells Beach. The proposed designation extends to tie in with the Hill Street intersection upgrade (non-Te Tupu Ngātahi project) in the west and to the eastern FUZ boundary.

It is proposed that the existing rural corridor be upgraded and include:

- An indicative 18m-24m urban arterial cross section with cycle lanes and footpaths on both sides of the corridor (along the eastern portion only). Along the western portion of Sandspit Road, the cross-section ranges between 18m and 20m, to accommodate active mode users an offline shared walking and cycling facility has been proposed from the Hill Street intersection to the second bridge along the corridor.

Areas of cut and fill A large stormwater wetland A boardwalk Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

14.2 Landscape character and natural character assessment

Sandspit Road is currently a rural road which provides a transit route west into Warkworth town centre. Tributaries to the north of Sandspit Road feed down to the Mahurangi River on the south side of the road.

In the AUP:OP, the area along Sandspit Road is primarily FUZ. There is also open space conservation to the south of Sandspit Road, adjacent the Mahurangi River, as well as along a tributary at the northwest extent of the proposed designation. The Warkworth Structure Plan identifies several areas of zoning alongside the designation, including residential – large lot, residential – single house, areas for further landscape protection controls, and protection areas (not for development).

Limited effects on existing residential area

Due to the low number of existing residential houses along Sandspit Road, effects on residential amenity will be limited. The NOR 5 Project provides an opportunity to contribute positively to the amenity of the area through planting, as well as via a boardwalk through existing vegetation. As such, it is expected that there is the potential for positive visual effects to occur.

Located away from characteristic landforms

The topography either side of Sandspit Road is steep, with rolling hill country characterising the landform north of the road. To the south of road, the land typically rises before sharply descending to the Mahurangi River. The escarpment on the northern side of the Mahurangi River is a significant feature in Warkworth, however, the proposed designation boundaries are located away from this area. According to the AUP:OP, FUZ is planned both to the north and south of Sandspit Road.

Potential effects on vegetation

There are several SEAs adjacent to the proposed designation, with the transport corridor crossing some sections of SEA. There is the potential for the NOR 5 Project to affect vegetation in these areas. A QEII covenanted area is also located adjacent to the western extent of the proposed designation and over part of the Mahurangi River escarpment, to the south of Sandspit Road. The proposed designation avoids this QEII covenanted area. The proposed designation will also avoid effects on the coastal bush along the river escarpment. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

Potential effects on waterbodies

The Mahurangi River, which is a significant feature in Warkworth, runs almost parallel to Sandspit Road, on the southern side of the road. While the proposed designation will cross some tributaries, it will not cross the Mahurangi River. It is anticipated that Project works will result in the loss of 105m of stream and 325m² of natural wetland.[37] Effects on these waterbodies are discussed further in the 'Assessment of Ecological Effects'.

Opportunities to create visual connections with surrounding rural landscape

Sandspit Road is characterised by roadside planting which is a mix of native and exotic trees and shrubs, as well as open vistas over paddocks, which in places afford views of the vegetated ridgeline to the north. As part of AUP:OP zoning, it is anticipated that the areas adjacent to Sandspit Road will become urbanised in the future separate to the Warkworth Package and much of this vegetation is expected to be removed as part of that process. However, further north, much of the rolling hill country will retain its rural character as zoning in this area will remain rural. There are opportunities for visual connections to be maintained with this rural character by retaining strategic views from the transport corridor alignment towards the wider rural landscape to the north.

14.3 Nature and magnitude of effects

[37] Assessment of Ecological Effects, Table 16-2 and 16-3.

The proposed designation has the potential to affect the landscape character and natural character of the adjacent area. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'High'**
- Construction effects on natural character: **'High'**
- Operational effects on landscape character: **'Moderate-High'**
- Operation effects on natural character: **'Moderate-High'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the proposed transport corridor and permanent effects during the operation of the proposed transport corridor. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

14.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the proposed transport corridor construction.

Designation boundary within SEA

The proposed transport corridor crosses into a SEA at the western extent of the proposed designation, on both the north and south side of Sandspit Road (Figure), predominantly where it follows the existing road corridor boundary, and the SEA extends inside the boundary. Construction could result in the removal or damage of additional riparian vegetation outside the footprint of permanent operational structures in the transport corridor. Any impacts on riparian vegetation will also likely have adverse effects on natural character and landscape character.

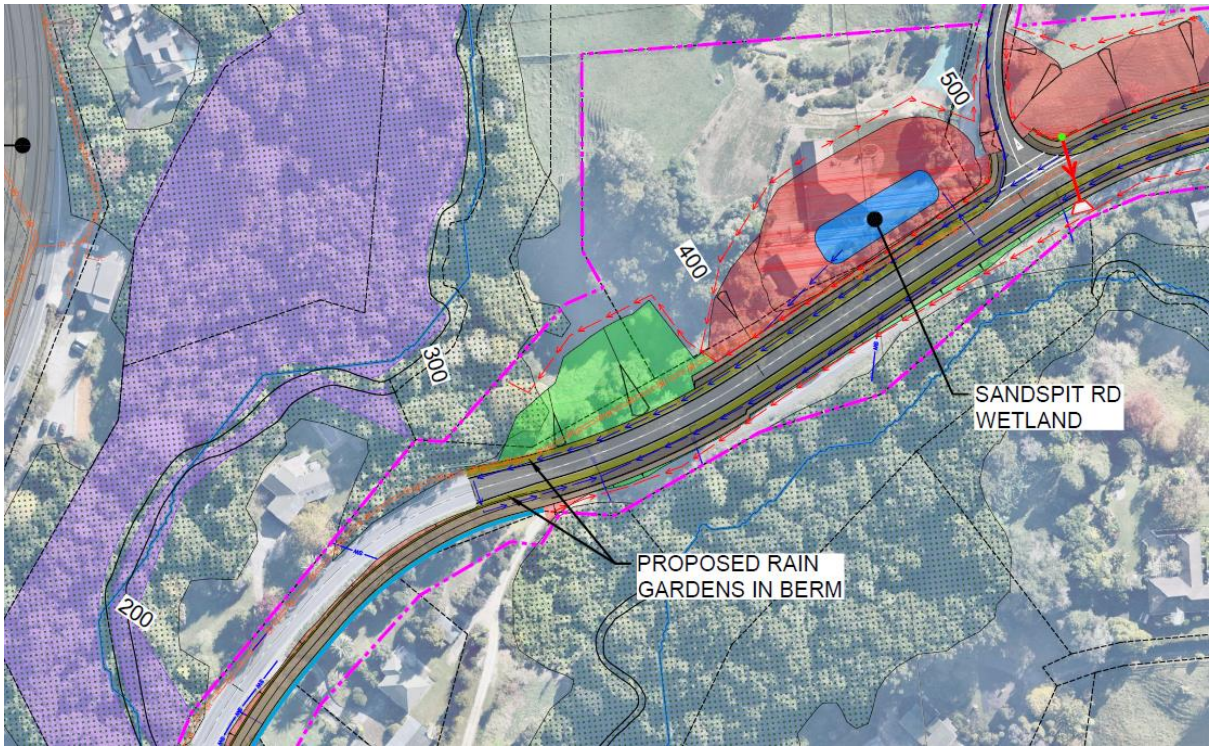

Figure 14-1 NOR 5 Project crosses into a SEA.

Work within waterways

The proposed designation crosses a tributary of the Mahurangi River. While there is already a bridge in place, the bridge will require widening. Therefore, construction work could potentially be required in the waterway, which could affect both natural character and landscape character.

Exposed earthworks near waterway

Towards the western extent of the proposed designation, on the northern side of Sandspit Road, an area of fill is illustrated in the currently proposed Project drawings over a section of SEA (Figure 14-2). There is the risk of sediment entering the adjoining waterway while earthworks are exposed.

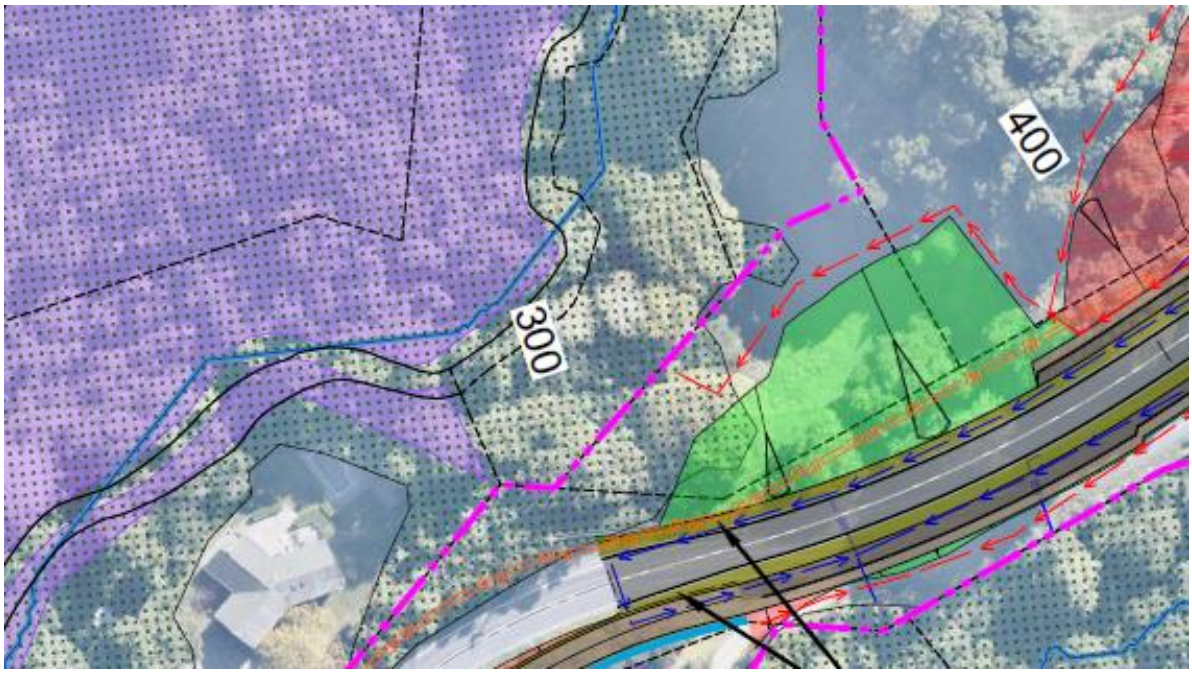

Figure 14-2 Area of fill depicted over SEA.

Large areas of cut near Withers Lane

A potential large area of cut is proposed to the east of Withers Lane, as well as an area of cut to the west of Withers Lane, associated with the proposed stormwater wetland. Exposed earthworks during construction have the potential to be unsightly and cause sedimentation.

14.5 Recommended measures to avoid, remedy or mitigate construction effects

There are no additional recommended measures for the proposed transport corridor beyond those provided in the overall recommended measures outlined in Section 7.5.

With the recommended measures outlined in Section 7.5, it is anticipated that construction effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Moderate-High'**
- Natural character: **'Moderate-High'**

14.6 Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed transport corridor.

Opportunity to create attractive transport corridor

As the proposed designation involves the upgrade of an existing road, rather than the construction of a new road, a transport corridor is an expected element in the setting. Furthermore, the NOR 5 Project will be consistent with the urban character that is anticipated in the future, separate to the Warkworth Package. The proposed transport corridor provides an opportunity to enhance the urban amenity of the setting through careful design, including amenity planting. There is also the opportunity to create visual interest through careful design of the proposed stormwater wetland, by applying a natural design approach to the wetland. It is noted that the stormwater wetland depicted in the current Project drawings is indicative only and its design will be confirmed through detailed design, which will include its integration with the surrounding landscape (as per the recommendations in Table 8).

The proposed designation has scope to enhance riparian planting along the proposed boardwalk to create an attractive amenity walkway. There is the opportunity to incorporate cultural elements into the boardwalk, for instance in relation to the Mahurangi River.

Changes to landform

Landform changes are limited as the proposed designation is for enabling a road upgrade, rather than the creation of a new road. While it is accepted that some landform modification is likely to be undertaken during the urbanisation of the area, due to the topography, some large areas of cut and fill will still be potentially required, which are anticipated to result in adverse effects. The width of the proposed designation is expected to enable areas of cut and fill to be appropriately integrated with the surrounding, natural landform. Appropriate planting of earthworked areas will also assist in reducing potential adverse effects.

Opportunity to enhance biodiversity

The proposed transport corridor crosses sections of SEA towards the western extent of the proposed designation, which `have the potential to result in vegetation loss. Where riparian vegetation is affected, natural character will also be affected. To mitigate potential effects on natural character replacement planting would likely be required. There is an opportunity to increase the extent of indigenous planting within the proposed designation, including riparian vegetation.

The proposed designation has space for extensive indigenous planting to be undertaken on the southern side of Sandspit Road, near the bridge (Figure 14-3). This has the potential to reduce habitat fragmentation for the bush on the northern escarpment of the Mahurangi River. There is also the opportunity for extensive indigenous planting to the north of the proposed stormwater wetland (Figure 15-2). This planting has the potential to enhance the contiguous indigenous habitat within the adjacent QEII covenant area.

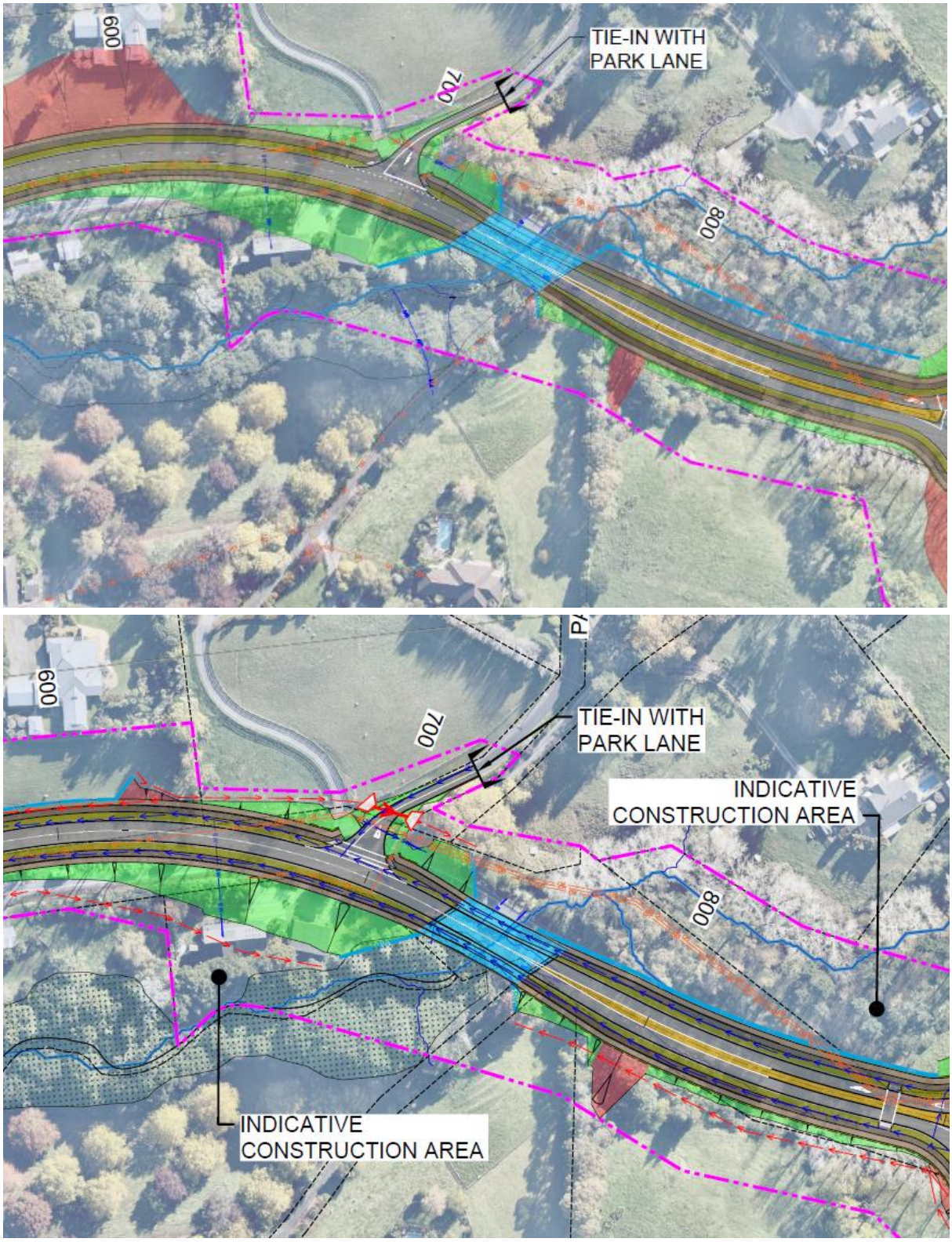
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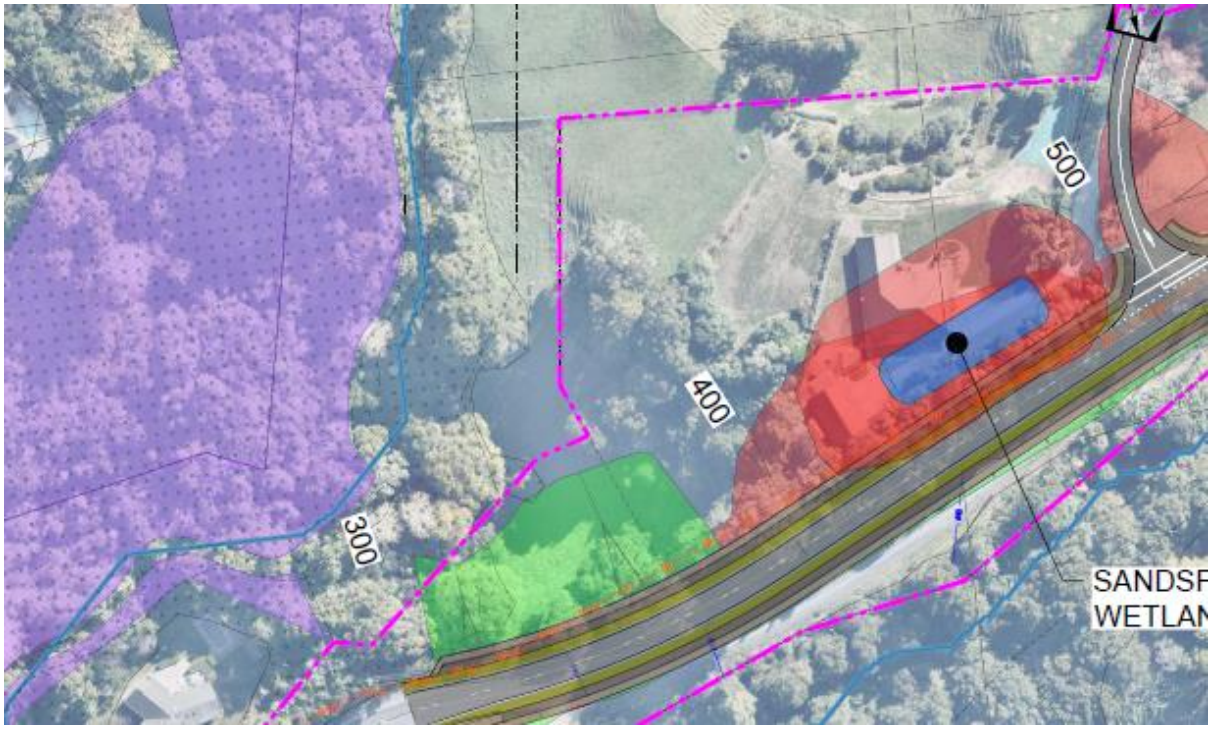
Figure 14-3 The southern side of Sandspit Road has space for extensive planting.



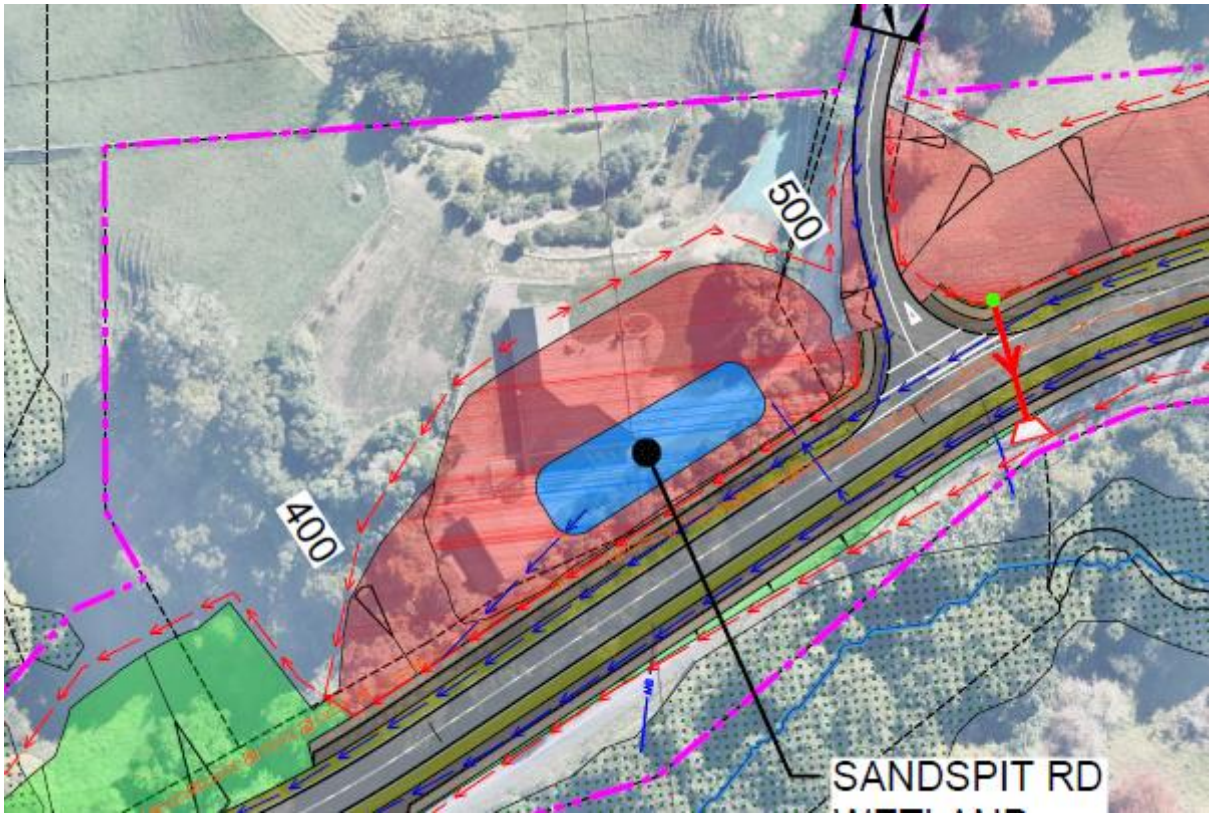


Figure 14-4 Space for extensive planting north of the stormwater treatment wetland.

Opportunity to create visual connections with surrounding rural landscape

Although it is planned through the AUP:OP for the proposed transport corridor to become urbanised, the rural character of the northern hill country will remain. There is an opportunity to create visual connections with this surrounding rural landscape by framing key rural vistas to the north, along Sandspit Road.

14.7 Recommended measures to avoid, remedy or mitigate operational effects

In addition to the overall recommended measures outlined in Section 7.7 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific operational effects of the proposed transport corridor. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

- Where feasible, and appropriate, enable opportunities for cultural expression in the design of the Mahurangi River boardwalk.
- Investigate opportunities to frame key rural views to the north of Sandspit Road, for transport corridor users.

With the above recommended measures, it is anticipated that operational effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Moderate'**
- Natural character: **'Moderate'**

14.8 Summary and Conclusions

The proposed designation will involve the upgrading and widening of an existing road in the northeast area of Warkworth, which is anticipated to result in modifications to a limited number of existing residential areas, earthworks, and potential vegetation removal. However, the proposed designation also provides the opportunity to create an attractive transport corridor, extend areas of indigenous vegetation, and retain rural connections through views.

It is expected that natural character will be specifically affected by the widening of an existing bridge and the potential removal of riparian vegetation. It is likely that these effects can be reduced through avoiding piers in the riverbed, minimising piers on the riverbank, and revegetating riparian margins. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Moderate-High'** and operational effects are anticipated to be **'Moderate'**. Proposed conditions at the future regional resource consent stage will provide specific mitigation for future transport projects within each designation.

Table 13. Summary of Assessment of Effects and Recommendations – NOR 5 Sandspit Road Upgrade

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Moderate-High'** **Natural Character:** **'Moderate-High'**	Designation boundary within SEA and work within waterways. Exposed earthworks near waterway.	Refer to overall network recommendations.
Operational effects		
Landscape Character: **'Moderate'** **Natural Character:** **'Moderate'**	Opportunity to create an attractive transport corridor with cultural connections.	Where feasible, and appropriate, enable opportunities for cultural expression in the design of the Mahurangi River boardwalk.
	Potential effects on SEAs. Scope to increase planted areas.	Refer to overall network recommendations.
	Opportunity to increase visual connections with surrounding rural landscape.	Investigate opportunities to frame key rural views to the north of Sandspit Road, for transport corridor users.

15 NOR 6 – Western Link - South

This section assesses specific landscape and natural character matters relating to NOR 6 – Western

15.1 Overview and description of works

The NOR 6 Project runs through existing greenfield land and is located at the end of Evelyn Street in the north, to SH1 in the south. The proposed designation involves the construction of:

- A new two-lane urban arterial, with walking and cycling facilities on both sides
- Two stormwater wetlands
- Large areas of cut and fill
- A bridge

Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

15.2 Landscape character and natural character assessment

The proposed designation and surrounding area are currently predominately a rural landscape. However, existing residential development is located to the northwest of proposed designation, as well as light industry to the northeast. The eastern extent of the proposed designation is bordered by SH1 and a residential area.

According to the zoning in the AUP:OP, it is anticipated that the industrial area will extend through part of the proposed designation. The remaining area is primarily FUZ. There is also a small area of informal recreation space existing at the northern edge of the proposed designation. The Warkworth Structure Plan identifies existing light industry and residential – mixing housing suburban zone within this area.

Views towards, and out from, the designation

The rural amenity of the area is already undergoing change due to residential and industrial development separate to the Warkworth Package. The proposed designation is expected to be consistent with the urban character predicted for the future of the area. Views of the proposed transport corridor are obtainable in several places to the west and north outside of the proposed designation, including from the elevated land along Viv Davie-Martin Drive and Mason Heights (Appendix A). Due to its visibility and proposed areas of cut and fill, it is anticipated that some adverse visual effects are likely to occur. Extensive views of the surrounding landscape will potentially be possible from within the proposed transport corridor, including distant views of the extensive ridges and bush-clad skyline of the Dome Forest to the north.

Potential effects on landform

The proposed designation will cross a distinctive knoll (Figure). The northern side of the knoll currently slopes steeply down towards the adjacent industrial buildings, with existing buildings cut into the hillside. There is limited space between the top of the knoll and the existing buildings. A retaining wall between the proposed transport corridor and 68 Morrison Drive is depicted in the current Project drawings. Large areas of cut are also anticipated towards the middle of the designation and at the western extent of the proposed transport corridor. While it is accepted that some landform modification is likely to occur within the NOR 6 Project area as Warkworth becomes urbanised

separate to the Warkworth Package, it is anticipated that the general form of the knoll will not be significantly altered, with future urban development expected to be sensitive to the landform in accordance with quality urban design principles. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment. As it is uncertain at this stage how the topography of the land may change with future development, cut and fill in the proposed Project drawings are based on existing topography.

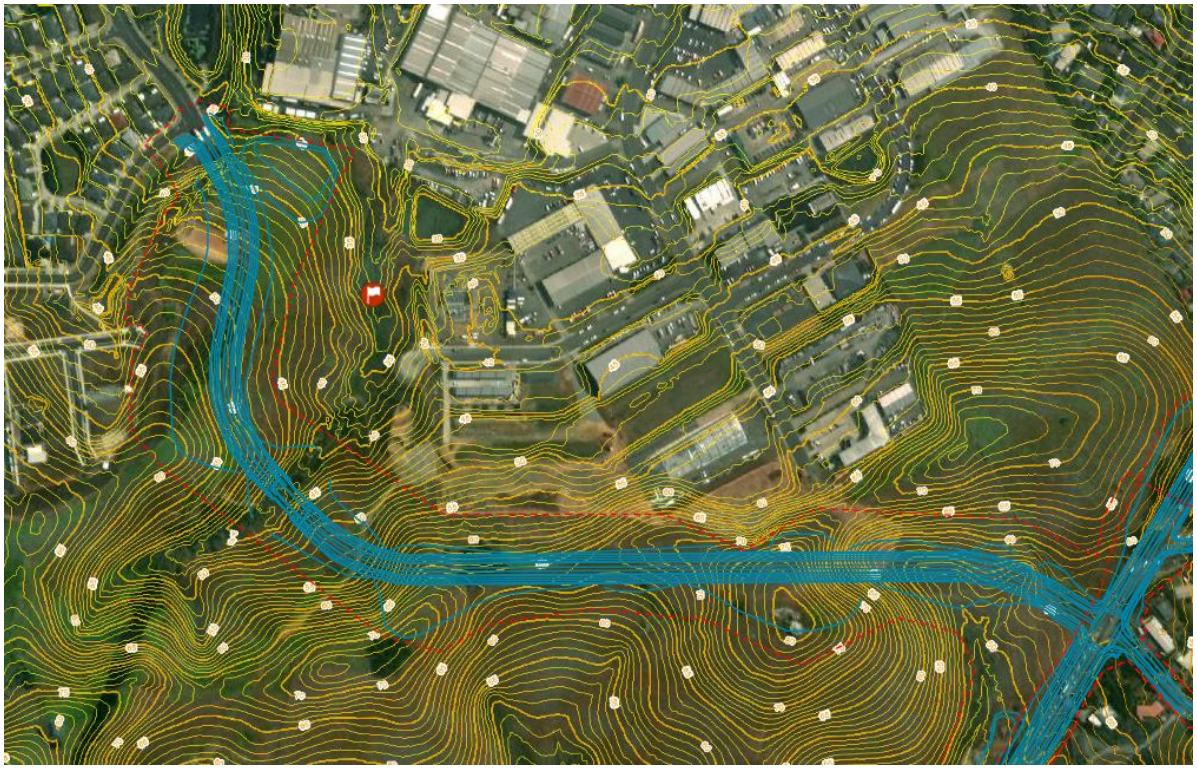


Figure 15-1 Designation shown with 1m contour intervals.

Potential effects on trees with associative value

To the south of the proposed designation centre there is a mature Pohutukawa grove. The trees were planted by a past generation of the family who currently own the land and, as such, hold associative value for the current landowners. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

Potential effects on waterbodies

The proposed designation will cross two wetlands and a waterway within the area. It is anticipated that Project works will result in the loss of 225m² of natural wetland.[38] Effects on these waterbodies are discussed further in the 'Assessment of Ecological Effects'.

Opportunity for visual connections with wider rural landscape

The top of the eastern knoll is marked with a concrete water tank, emphasising the current rural character of the landscape. While the rural character of the area is expected to change, there are

[38] Assessment of Ecological Effects, Table 16-2 and 16-3.

likely to be opportunities to provide visual connections with the wider rural landscape outside the RUB from within the proposed designation.

Potential effects on heritage road bench

A historic road bench is recorded within the designation. Several sections of the road bench are still visible and being used as farm tracks. Heritage values are discussed further in the 'Assessment of Archaeological Effects'.

15.3 Nature and magnitude of effects

The proposed designation has the potential to affect the landscape character and natural character of the adjacent area. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Moderate-High'**
- Construction effects on natural character: **'Moderate'**
- Operational effects on landscape character: **'High'**
- Operation effects on natural character: **'Moderate-High'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the proposed transport corridor and permanent effects during the operation of the proposed transport corridor. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

15.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the proposed transport corridor construction.

Work within waterbodies

The proposed transport corridor crosses a natural wetland and waterway in the western section of the proposed designation, as well as another natural wetland at the eastern extent of the designation. There is the potential for construction to occur within these waterbodies. Any impacts on these wetlands and waterway will also likely have adverse effects on natural character and landscape character.

Exposed earthworks and reduced amenity

Due to the topography of the proposed designation, there is the potential for a substantial amount of cut and fill to be required. There is the risk of sediment entering the natural wetlands and waterway while earthworks are exposed. There is also potential for exposed cuts to be unsightly from several surrounding areas. Options for mitigation measures are limited for addressing effects on more distance views due to the elevated perspective from distant locations (Appendix A). However, there is potential for mitigation of amenity effects on neighbouring residential areas.

15.5 Recommended measures to avoid, remedy or mitigate construction effects

In addition to the overall recommended measures outlined in Section 7.5 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific construction effects of the proposed transport corridor.

- Where practicable, stage earthworks. Provide temporary screening, as feasible, for residential properties on the block between Mason Heights, Jamie Lane and Dunningham Street, until earthworks are remediated.

With the above recommended measures, it is anticipated that construction effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Moderate'**
- Natural character: **'Low-Moderate'**

15.6 Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed transport corridor.

Opportunity to enhance corridor user amenity

While the proposed designation will introduce a transport corridor into a currently rural landscape, the amenity of the area is already compromised by industrial activity and is future zoned for urbanisation separate to the Warkworth Package. The proposed transport corridor will be consistent with this future urban character. At this stage it is unknown whether access will be taken off the proposed transport corridor to service this future development and this may be a potential matter which needs to be addressed as part of the future processes of the Project. Planting provides the opportunity to enhance transport corridor user amenity by strategically framing distant views of the extensive ridgelines and the bush-clad Dome Forest skyline to the north.

Substantial changes to landform

It is expected that there will be substantial changes to the current landform, with large areas of cut and fill across a distinctive knoll, and limited space between earthworks and existing industrial buildings. Although it is expected that future urbanisation of the surrounding area will involve some earthworks (undertaken separately from the proposed transport corridor), it is anticipated that urban development will follow quality urban design principles and the general form of the landscape will not be altered, with future urban development generally following existing contours. The proposed designation could potentially result in benched cuts and retaining walls (Figure 15-2). Careful treatment of these areas will be required to reduce visual effects, such as through the use of natural and non-reflective materials, planting, and artistic expression for vertical surface treatments. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment. As it is uncertain at this stage how the topography of the land may change with future development, cut and fill in the proposed Project drawings are based on existing topography.

Figure 15-2 Minimal space between large cut area and designation boundary could potentially result in benched cuts.

Opportunity for wetland enhancement

The proposed transport corridor crosses natural wetlands and a waterway to the west of the proposed designation and again at its eastern extent (Figure). Any adverse impacts on these waterbodies will also likely adversely affect natural character. Wetland restoration provides an opportunity to mitigate natural character effects.

Figure 15-3 Natural wetlands are depicted as green areas and waterways by bright blue lines.

Opportunity to increase visual connections with surrounding rural landscape

The elevated position of the proposed designation provides opportunities for new views of the surrounding rural landscape outside the RUB to be experienced.

15.7 Recommended measures to avoid, remedy or mitigate operational effects

In addition to the overall recommended measures outlined in Section 7.7 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific operational effects of the proposed transport corridor. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

- Consider opportunities to frame key rural views in the surrounding landscape outside the RUB for transport corridor users.

With the above recommended measures, it is anticipated that operational effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low-Moderate'**
- Natural character: **'Low'**

15.8 Summary and Conclusions

The proposed designation will introduce a new transport corridor into the southern area of Warkworth, which is anticipated to result in substantial modifications to the landform. However, the proposed designation also provides the opportunity to restore wetlands and provide new views of the rural landscape outside the RUB.

It is expected that natural character will be specifically affected by work in natural wetlands and a waterway. It is likely that these effects could be reduced through avoiding piers in the beds of wetlands and waterways, minimising piers on banks of waterbodies, and revegetating natural wetlands. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Moderate'** at most and operational effects are anticipated to be '**Low-Moderate'** at most. Proposed conditions at the future regional resource consent stage will provide specific mitigation for future transport projects within each designation.

Table 14. Summary of Assessment of Effects and Recommendations – NOR 6 Western Link - South

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Moderate'**	Work within waterbodies.	Refer to overall network recommendations.
Natural Character: **'Low-Moderate'**	Exposed earthworks and reduced amenity.	Where practicable, stage earthworks. Provide temporary screening, as feasible, for residential properties on the block between Masons Heights, Jamie Lane and Dunningham Street, until earthworks are remediated.
Operational effects		
Landscape Character: **'Low-Moderate'** **Natural Character:** **'Low'**	Substantial changes to landform. Potential effects on waterbodies. Opportunity to create visual connections with rural character in the wider landscape.	Refer to overall network recommendations. Consider opportunities to frame key rural views in the surrounding landscape outside the RUB for transport corridor users.

16 NOR 7 – Sandspit Link

This section assesses specific landscape and natural character matters relating to NOR 7 – Sandspit Link (the ‘ NOR 7 Project’).

16.1 Overview and description of works

The NOR 7 Project is a proposed new transport corridor with the purpose of providing strategic east-west movements to Matakana and Kōwhai Coasts, as well as providing local access to the northern growth area. The proposed designation extends from Matakana Road in the northwest and connects to Sandspit Road in the southeast. The alignment provides an alternative to the SH1 and Hill Street intersection, whilst improving dual accessibility between the northern growth area and Warkworth.

The proposed designation involves the construction of:

- A two-lane urban arterial, with cycle lanes and footpaths on both sides, as well as a new intersection at the connection with Sandspit Road and Matakana Road
- Large areas of cut and fill
- Two large stormwater wetlands
- Three bridges
- The removal of residential dwellings

Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

16.2 Landscape character and natural character assessment

The proposed transport corridor is set within a currently rural landscape. There are residential properties scattered towards the southern extent of the proposed designation and quarrying activity is present to the northeast. As part of the AUP:OP zoning, it is expected that the future area of the proposed designation and surrounding landscape will be largely urbanised in the future (FUZ), with a small area of open space conservation land along the lower extent of some tributaries. The AUP:OP identifies the existing limestone quarry as being within a Quarry Buffer Area Overlay. The Warkworth Structure Plan identifies several zones adjacent the designation, including residential (large lot, mixing housing suburban, mixing housing urban, and single house) and protection areas (not for development).

Limited effects on amenity

The proposed designation area is currently characterised by pasture, scattered exotic trees within paddocks, densely vegetated tributaries, a limestone quarry, scattered residential properties, a fertiliser plant, and a refuse station. Residential and roading development is occurring beyond the western extent of the proposed designation. It is expected that the area will become urbanised in the future and the proposed transport corridor will be consistent with this character.

Potential effects on landform

The proposed transport corridor travels across a notable hill to the north of Warkworth town centre. However, it is located below the prominent ridgeline. Due to the steep topography of the area, it is probable that the NOR 7 Project will result in changes to the landform. It is accepted that some landform changes may have already occurred as part of the future urbanisation of the area separate

from the Warkworth Package, however, it is anticipated that urban development will be sensitive to the landform. Any landform changes as part of the NOR 7 Project will need to be considered cumulatively with landform changes undergone during urbanisation. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment. As it is uncertain at this stage how the topography of the land may change with future development, cut and fill in the proposed Project drawings are based on existing topography. Changes to the landform have the potential to result in adverse visual effects. However, due to the location of the proposed transport corridor away from the ridgeline and the likely future urbanised environment, views towards the designation from the wider landscape are expected to be limited (Appendix 1).

Potential effects on vegetation

There are several streams within the proposed designation and adjacent area that have dense riparian vegetation. To the south, above Sandspit Road, a section of this vegetation is vested with QEII, however, this is beyond the designation boundary. As these vegetation corridors are a key attribute of Warkworth's landscape character, it is expected that it will be retained during the urbanisation process. There are no existing views of the quarry from distant areas around Warkworth due to screening vegetation within the quarry property (Appendix 1). However, it is possible that these trees may be removed as part of the urbanisation of the area. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

Potential effects on waterbodies

There are several waterbodies within the area, including wetlands and tributaries that flow south towards the Mahurangi River. It is anticipated that Project works will result in the loss of 180m of stream and 3,314m² of natural wetland.[39] Effects on these waterbodies are discussed further in the 'Assessment of Ecological Effects'.

Consistent with future urban character

The proposed designation is within a currently rural landscape, with this character contributed to by extensive areas of pasture, fence lines, farm infrastructure (such as water tanks), and linear patterns of farm trees and shelterbelts. It is anticipated that this will change to an urban context as residential development occurs in the future. The designation will be consistent with this new character.

16.3 Nature and magnitude of effects

The proposed designation has the potential to affect the landscape character and natural character of the adjacent area. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'High'**
- Construction effects on natural character: **'High'**
- Operational effects on landscape character: **'High'**
- Operation effects on natural character: **'High'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the proposed transport corridor and permanent effects during the operation of the

[39] Assessment of Ecological Effects, Table 16-2 and 16-3.

proposed transport corridor. Measures are recommended to avoid, remedy or mitigate these effects. The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

16.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the proposed transport corridor construction.

Potential work within and around waterbodies

As the proposed designation crosses four tributaries and a natural wetland, construction in waterbodies is likely. The currently proposed Project drawings depict three bridges and some areas of cut and fill in the wetland area. There is the risk of sediment entering the waterways and wetland while earthworks are exposed. Construction work has the potential to affect both natural character and landscape character.

Exposed earthworks and reduced amenity

Due to the topography within the proposed designation area, there is the potential for a substantial amount of cut and fill to be required, with the potential for exposed cuts to be unsightly from some surrounding areas, including from future residential areas adjacent to the proposed transport corridor. However, as the proposed transport corridor is below the ridgeline, the likelihood of its visibility from the wider landscape is lessened (Appendix A). The visibility of the proposed works will be influenced by the future urban layout in the area. Mitigation measures are limited for addressing effects on possible distance views due to the angle of view from distant locations (Appendix A). However, there is the potential for mitigation of amenity effects on neighbouring residential areas if required.

16.5 Recommended measures to avoid, remedy or mitigate construction effects

There are no additional recommended measures for the proposed transport corridor beyond those provided in the overall recommended measures outlined in Section 7.5.

With the relevant recommended measures outlined in Section 7.5, it is anticipated that construction effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low-Moderate'**
- Natural character: **'Low-Moderate'**

16.6 Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed transport corridor.

Opportunity to provide new views

The proposed designation will introduce a new transport corridor into the area and will result in the removal of three existing residential houses, as well as a reduction in some residential sections. It is expected that the transport corridor will operate within a future urbanised context and that the amenity

of the area will change over time outside of the Warkworth Package. However, the area will likely still be appreciation for its elevated landform, distinctive skyline, and rural character on the higher slopes. There is an opportunity to provide new vistas from the transport corridor over the surrounding landscape, including views south towards the existing Warkworth town centre and the Mahurangi River.

Changes to landform

Although it is expected that future urbanisation of the area will involve some earthworks (undertaken separately from the Warkworth Package), it is anticipated that the general form of the landscape will not be altered. There is scope for cut and fill areas to be extensively planted with indigenous species (while retaining views as appropriate). There is the opportunity for planting to be used to enhance existing vegetation within the area. The width of the proposed designation is also expected to enable areas of cut and fill to be appropriately integrated with the surrounding, natural landform.

Opportunity to increase planted areas

There is the potential for some loss of riparian vegetation between the western and central bridges, which will have possible effects on natural character. If effects were to occur on natural character, replacement riparian planting would likely be required. There is an opportunity to increase the extent of indigenous planting within the proposed designation, although scope for riparian planting is limited due to limited riparian planting areas within the designation (Figure). Effects on natural character, which relate to waterbodies (including riparian vegetation), are required to be addressed in situ (where the effects occur).

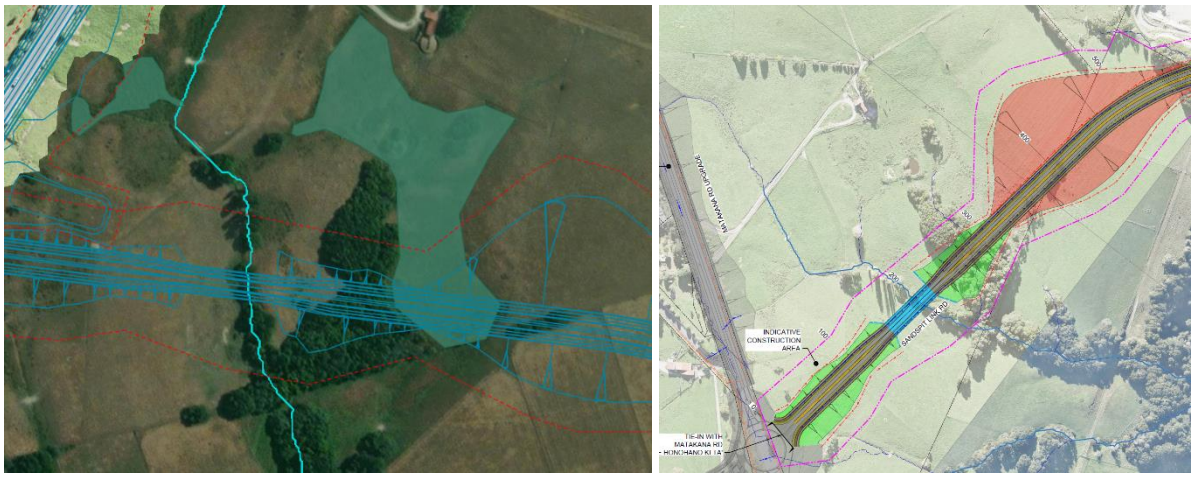


Figure 16-1 Natural wetland depicted in green in left image. Waterway shown as blue line in right image.

Opportunity to create visual connections with wider rural landscape

There is an opportunity to create visual connections with the wider rural landscape outside the RUB by retaining views towards surrounding vegetation and nearby rural areas.

16.7 Recommended measures to avoid, remedy or mitigate operational effects

In addition to the overall recommended measures outlined in Section 7.7 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific operational effects of the proposed transport corridor. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

- Through planting design frame key views, as appropriate, of vegetated areas and the wider rural landscape outside the RUB for transport corridor users.

With the above recommended measures, it is anticipated that operational effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low-Moderate'**
- Natural character: **'Low-Moderate'**

16.8 Summary and Conclusions

The proposed designation will introduce a new transport corridor into the northern area of Warkworth, which has the potential to result in substantial modifications to the landform, as well as the removal of some vegetation. However, the proposed designation also provides the opportunity to extend areas of indigenous vegetation and provide new views of the surrounding landscape.

It is expected that natural character will be specifically affected by the implementation of three bridges, earthworks over waterways and a natural wetland, and the potential removal of riparian vegetation. It is likely that these effects can be reduced through avoiding piers in the beds of waterbodies, minimising piers on the banks of waterways and the wetlands and revegetating riparian margins and the existing natural wetland. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Low-Moderate'** and operational effects are anticipated to be **'Low-Moderate'**. Proposed conditions at the future regional resource consent stage will provide specific mitigation for future transport projects within each designation.

Table 15. Summary of Assessment of Effects and Recommendations – NOR 7 Sandspit Link

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Low-Moderate'** **Natural Character:** **'Low-Moderate'**	Work within and around waterbodies. Exposed earthworks and reduced amenity.	Refer to overall network recommendations.
Operational effects		
Landscape Character: **'Low-Moderate'** **Natural Character:** **'Low-Moderate'**	Changes to landform. Opportunity to increase planted areas. Opportunity to create visual connections with the wider rural landscape.	Refer to overall network recommendations. Through planting design frame key views, as appropriate, of vegetated areas and the wider rural landscape outside the RUB for transport corridor users.

17 NOR 8 – Wider Western Link - North

This section assesses specific landscape natural character matters relating to NOR 8 – Wider Western Link (Northern Section) (the ‘ NOR 8 Project’).

17.1 Overview and description of works

The NOR 8 Project is a proposed new arterial road extending from Woodcocks Road in the north, towards SH1 in the south. The extent of the proposed designation is from Woodcocks Road in the north (including the intersection), to the midway point of the Warkworth south FUZ and is inclusive of the Mahurangi River.

The proposed transport corridor involves the construction of:

- A two-lane urban arterial, with walking and cycling facilities on both sides
- Two stormwater wetlands
- A bridge
- Large areas of fill

The proposed designation connects the Southern Interchange to Woodcocks Road and SH1, and provides access into the southern FUZ, where access would otherwise be difficult due to topography and streams.

For avoidance of doubt, at this stage the Wider Western Link - South is not being taken forward to NOR.

Refer to the AEE in Volume 2 for a more detailed description of works to be authorised.

17.2 Landscape character and natural character assessment

Currently, the proposed designation has an overriding rural character. To the east the Mahurangi River (left branch) provides a natural divider through the landscape. To the west the Ara Tūhono expressway forms a structural divider.

It is anticipated under the AUP:OP, that the proposed designation and surrounding area will become largely urbanised, as the FUZ extends through most of the area. The Warkworth Structure Plan indicates industrial activity to the north and residential areas to the south. There is also an existing open space conservation area adjacent the Mahurangi River. Immediately to the west of the proposed designation land use is expected to remain as rural. The Warkworth Structure Plan identifies business – heavy industry zone and protection areas (not for development) alongside the designation.

Limited effects on amenity

The proposed designation and the surrounding area are currently characterised by rural attributes, including pasture, shelterbelts, fence lines and minimal structures. However, it is expected that aside from the rural western extent outside the RUB, the area will become urbanised in the future. The Ara Tūhono expressway (to the west) is currently under construction and runs through the rural landscape. While there are only a few residential areas within the proposed transport corridor and adjacent land, the proposed designation is still likely to result in reduced section sizes for residential properties at either end.

Potential effects on landform

The proposed transport corridor crosses a low-lying area. Views of the proposed designation will be possible from some elevated surrounding areas, including from houses along Viv Davie-Martin Drive and Wyllie Road (Appendix A). Currently the area is seen in the context of rolling pasture. Some large areas of fill are depicted in the currently proposed Project drawings towards the south to enable the proposed designation to tie-in with the future Ara Tūhono expressway interchange. There is the potential for these areas of fill to result in adverse visual effects for nearby residents and from wider viewpoints.

Potential effects on vegetation

The riparian margin of the Mahurangi River is vegetated with tōtara and kahikatea. There are also exotic shelterbelts within paddocks. Within the proposed designation, pasture is the dominant vegetation type. It is anticipated that while riparian and mature indigenous vegetation remain, other vegetation will be removed during the urbanisation process. Ecological effects are discussed in detail in the 'Assessment of Ecological Effects'.

Potential effects on waterbodies

The Mahurangi River (left branch) and several smaller waterways cross through the proposed designation and surrounding area. At the southern extent, currently proposed Project drawings show the proposed transport corridor crossing the Mahurangi River via a bridge. It is anticipated that Project works will result in the loss of 211m of stream and 8,521m² of natural wetland.[40] Effects on these waterbodies are discussed further in the 'Assessment of Ecological Effects'.

Opportunity to emphasise rural landscape characteristics

Currently the landscape within the proposed designation is rolling pasture and fence lines, with fragments of native vegetation, and existing roading to service rural-residential development. While most of the area is likely to become urbanised, the land to the west of the proposed designation outside the RUB is expected to remain as rural productive land. The retention of vegetation and views of the adjacent rural landscape are two ways to emphasise rural landscape characteristics.

17.3 Nature and magnitude of effects

The proposed designation has the potential to affect the landscape character and natural character of the adjacent area. Without recommended measures to avoid, remedy or mitigate effects, it is anticipated that effects will be as follows:

- Construction effects on landscape character: **'Moderate-High'**
- Construction effects on natural character: **'Moderate-High'**
- Operational effects on landscape character: **High'**
- Operation effects on natural character: **'High'**

The following sections breakdown the nature and magnitude of effects into temporary effects during construction of the proposed transport corridor and permanent effects during the operation of the proposed transport corridor. Measures are recommended to avoid, remedy or mitigate these effects.

[40] Assessment of Ecological Effects, Table 16-2 and 16-3.

The residual magnitude of effects is then assessed once the recommended measures have been implemented or established.

17.4 Assessment of landscape effects during construction

The following section discusses the specific temporary potential landscape and natural character and visual effects which could arise during the proposed transport corridor construction.

Work within waterbodies

The proposed transport corridor crosses two tributaries and two wetlands, as well as the Mahurangi River, which is a significant waterway within Warkworth. A bridge is depicted in the currently proposed Project drawings over the Mahurangi River to the south and large areas of fill are illustrated over other waterways and wetlands. There is the risk of sediment entering the waterways and wetlands while earthworks are exposed. Construction work has the potential to affect both natural character and landscape character.

Reduced amenity

Large areas of fill are shown in the currently proposed Project drawings and could potentially be unsightly from adjacent areas, including from Viv Davie-Martin Drive, Wyllie Road and the Ara Tūhono expressway. Mitigation measures are limited for addressing effects on distant views due to the elevated perspective from distant locations (Appendix A).

17.5 Recommended measures to avoid, remedy or mitigate construction effects

In addition to the overall recommended measures outlined in Section 7.5 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific construction effects of the proposed transport corridor.

- As appropriate, provide temporary screening for #346 Woodcocks Road (at on the northern extent of the designation) until earthworks are remediated.

With the above recommended measures, it is anticipated that construction effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Moderate'**
- Natural character: **'Moderate'**

17.6 Assessment of operational effects

The following section discusses the specific permanent potential landscape and natural character and visual effects which could arise during the operation of the proposed transport corridor.

Consistent with existing urban character

It is expected that the proposed transport corridor will be in character with the anticipated urban development in the designation and surrounding area. The Ara Tūhono expressway is a major

transport network already associated with the setting. The NOR 8 Project will be consistent with this transport corridor development.

Changes to landform from potentially large areas of fill

The currently proposed Project drawings depict large areas of fill in a relatively flat area. The width of the proposed designation is expected to enable areas of fill to be appropriately integrated with the surrounding, natural landform.

Opportunity to increase planted areas

Potentially there will be some loss of riparian vegetation towards the southern extent of the proposed designation (particularly to the north of the proposed roundabout), which will have potential effects on natural character. Other effects on natural character could occur due to potentially large areas of fill over waterways and natural wetlands (as depicted in the currently proposed Project drawings) (Figure).

If effects were to occur on natural character, replacement riparian planting would likely be required. There is the opportunity to increase the extent of indigenous planting within the proposed designation, although scope for riparian planting is limited due to restricted riparian planting areas within the proposed designation. Effects on natural character, which relate to waterbodies (including riparian vegetation), are required to be addressed in situ (where the effects occur). Consideration will need to be given to maintaining the hydrological connection of waterways and natural wetlands on both sides of the proposed transport corridor.

There is also the opportunity to undertake indigenous planting throughout the designation to reduce fragmentation of the riparian habitat along the Mahurangi River. Planting creates an opportunity for visual interest for transport corridor users and those with views towards the proposed transport corridor.


400
500
TIE-IN WITH SOUTH
RWAY INTERCHANGE

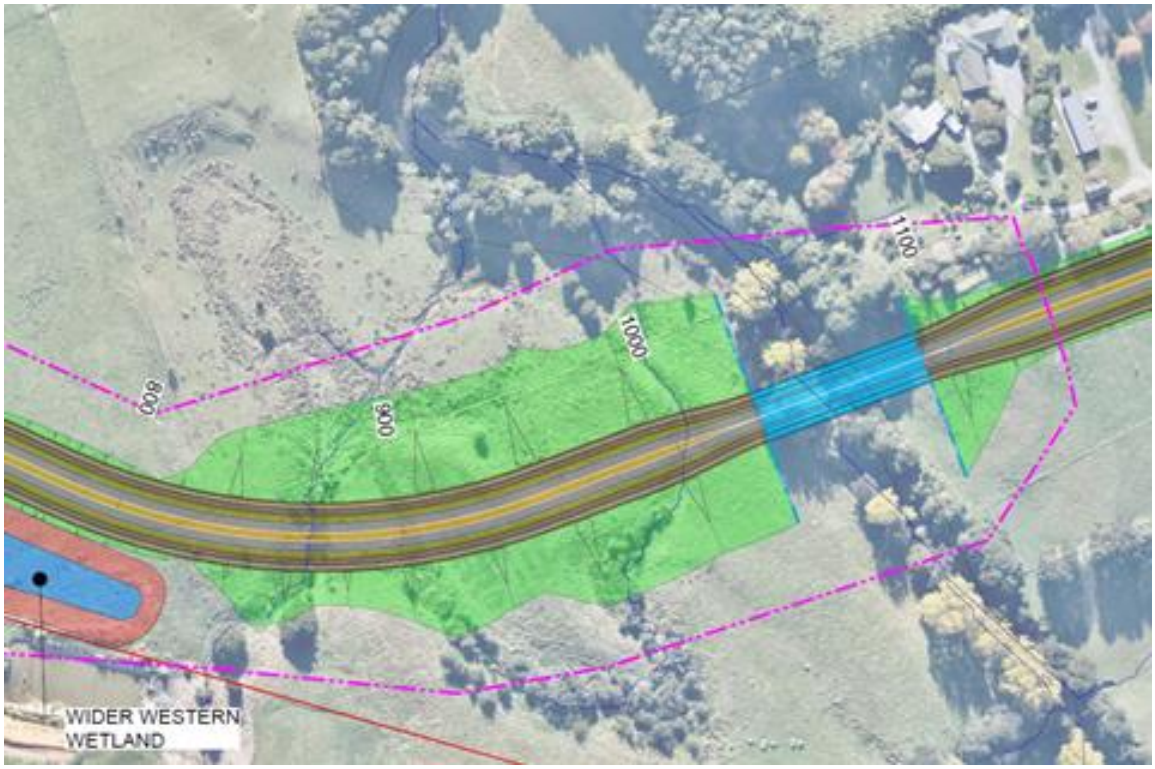

1100
1000
900
300
WIDER WESTERN
WETLAND

Figure 17-1 Natural wetlands are indicated by areas of green in the top image. Areas of fill are shown in bright green in the bottom image.

Opportunity to attain new views of the landscape

The elevation of the proposed transport corridor provides the opportunity to attain new views towards the Mahurangi River and the adjacent rural landscape to the west outside the RUB.

17.7 Recommended measures to avoid, remedy or mitigate operational effects

In addition to the overall recommended measures outlined in Section 7.7 (as relevant), I recommend the following measures should be addressed through future outline plan or resource consent processes (as appropriate) to address the specific operational effects of the proposed transport corridor. In this regard, it is noted that the primary means of mitigating effects is through design responses to be illustrated in an ULDMP.

- Through planting design frame key views, as appropriate, of vegetated areas and the wider rural landscape outside the RUB for transport corridor users.

With the above recommended measures, anticipated that operational effects within, and adjacent to, the proposed designation will be:

- Landscape character: **'Low-Moderate'**
- Natural character: **'Low-Moderate'**

17.8 Summary and Conclusions

The proposed designation will introduce a new transport corridor into the southwest area of Warkworth, which has the potential to result in large areas of fill, disruption to waterways and natural wetlands (as depicted in the currently proposed Project drawings), and vegetation removal. However, the proposed designation also provides the opportunity to extend areas of indigenous vegetation and provide new views over the natural environment, as well as views over the rural landscape within the wider area beyond the RUB.

It is expected that natural character will be specifically affected by the construction of a new bridge and areas of fill over waterways and natural wetlands. It is likely that these effects can be reduced through avoiding piers in the riverbed, minimising piers on the riverbank, and revegetating existing wetlands. These issues will be addressed during the future regional consenting stages of the Warkworth Package and the proposed outline plan process (Condition 1), with the primary means of mitigating effects being through design responses to be illustrated in an ULDMP (Condition 9).

With the implementation and establishment of the recommended measures, construction effects are anticipated to be **'Moderate'** and operational effects are anticipated to be **'Low-Moderate'**. Proposed conditions at the future regional resource consent stage will provide specific mitigation for future transport projects within each designation.

Table 16. Summary of Assessment of Effects and Recommendations – NOR 8 Wider Western Link (Northern Section)

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Moderate'**	Work within waterbodies.	Refer to overall network recommendations.
Natural Character: **'Moderate'**	Potential effects on existing residential areas.	As appropriate, provide temporary screening for #346 Woodcocks Road (at on the northern extent of the designation) until earthworks are remediated.
Operational effects		
Landscape Character: **'Low-Moderate'**	Opportunity to integrate transport corridor into the surrounding landscape, including increasing planted areas.	Refer to overall network recommendations.
Natural Character: **'Low-Moderate'**	Opportunity to provide visual connections with the wider rural landscape.	Through planting design frame key views, as appropriate, of vegetated areas and the wider rural landscape outside the RUB for transport corridor users.

18 Statutory Considerations

The RMA and AUP:OP have been considered as part of this report to assess the consistency of the Warkworth Package with the requirements, outcomes, or limits in the relevant statutory plan provisions.

The NPS:UD has been addressed in 'Volume 2: Assessment of Environment Effects'. The National Policy Statement on Freshwater Management (NPS:FM) contains several provisions relevant to the Warkworth Package, including:

- *Policy 6: There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.*
- *Policy 7: The loss of river extent and values is avoided to the extent practicable.*

The NPS:FM has been considered in detail as part of the 'Assessment of Ecological Effects'.

Resource Management Act 1991

The preservation of the natural character of wetlands and rivers and their margins and the protection of them from inappropriate subdivision, use and development is directed as a matter of national importance under Section 6(a) of the RMA. Taking into consideration recommended measures, there will be 'Low-Moderate' construction and 'Low' operational effects on natural character at the broader scale of Warkworth, while natural character effects on the localised scale of the Northern Project Area and Southern Project Area will be also be 'Low-Moderate' for construction and 'Low' for operational. Natural character effects at the site scale of the proposed designations will vary between 'Low' and 'Moderate-High' for construction and between 'Very Low' and 'Low-Moderate' for operational.

While the natural character of the Warkworth Package area is likely to experience some adverse effects, appropriate measures have been recommended to ensure the natural character of waterways and natural wetlands will be preserved and protected.

The protection of ONFLs from inappropriate subdivision, use and development is also directed as a matter of national importance under Section 6(b) of the RMA. The AUP:OP identifies an ONF to the south-east of the proposed Sandspit Road designation (NOR 5 Project). The AUP:OP also identifies an ONL to the south of Sandspit Road (NOR 5 Project), as well as the south and southeast of the proposed SH1 designation (NOR 3 Project). The Warkworth Package will avoid adverse effects on ONFLs, as discussed in the sections below.

The maintenance and enhancement of amenity values are outlined in Section 7(c) of the RMA and the maintenance and enhancement of the quality of the environment in Section 7(f) of the RMA. it is anticipated that the existing amenity and quality of the environment will be maintained for the following reasons:

- Following recommended measures, effects on landscape character will be 'Moderate-High' at most for construction effects and 'Moderate' at most for operational effects.
- The Warkworth Package provides the opportunity to create an attractive transport corridor through careful design, including amenity planting.
- The Warkworth Package has scope to provide separate active transport routes to enhance transport corridor user experience, with the potential for these routes to be incorporated within, or adjacent to, vegetated areas and waterways.

- The Warkworth Package provides opportunities for new views of the wider surrounding rural and natural landscape.
- The Warkworth Package will be consistent with the expected future urban character of the area.
- There is scope to provide some areas of screening and buffers for residential areas, including during construction.
- The Warkworth Package is located away from prominent ridgelines.
- Where existing vegetation is affected, measures have been recommended to appropriately replace removed vegetation.
- Ongoing consultation with mana whenua.

I consider the Warkworth Package to be consistent with sections of the RMA which are relevant to landscape and natural character.

Auckland Unitary Plan: Operative in Part

The AUP:OP contains objectives and policies relating to specific precincts and zones within Warkworth. These have been considered as part of this assessment.

Although Warkworth currently has strong aspects of rural character on the periphery, it is expected that the area will be incrementally urbanised in the future through the development of urban zoned land. The Warkworth Package provides opportunities to retain rural landscape characteristics which are anticipated to remain post urbanisation by enhancing indigenous planting and providing views of the wider rural landscape beyond the RUB.

Several measures have been recommended to address potential adverse effects on ecological values of streams, natural wetlands, and indigenous vegetation. This includes proposed measures to revegetate wetlands and road edges with indigenous species, and stage earthworks. It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.

Pedestrian and cycleway connectivity has also been considered, with all proposed designations providing the opportunity to include active transport routes. This is reflected in the ULDMP. In places, there is scope for these routes to travel through, or be adjacent to, vegetated areas and waterways.

In addition, proposed designation widths provide scope for amenity planting to increase the attractiveness of proposed transport corridors, which has the potential to positively contribute to the amenity values of future urban neighborhoods. Proposed ULDMP conditions also include direction on adherence to CPTED principles, including passive surveillance.

There are opportunities to address the potential visual dominance of transport corridor structures through planting, feathering of earthworks into the surrounding natural contours, use of appropriate materials, and the avoidance of proposed designations across prominent ridgelines.

Together the above measures assist the potential of the Warkworth Package in positively contributing towards the planned urban form of Warkworth, providing opportunities for a quality and safe transport network which adds to Warkworth's sense of place.

ONF

The AUP:OP identifies the Mahurangi North Parnell Grits as an ONF. The nearest proposed designation (NOR 5 Project) is at least 1km from this ONF and is separated from the feature by the

Mahurangi River and its steep northern escarpment. It is assessed that the Warkworth Package will avoid adverse effects on ONFs.

ONL

The AUP:OP identifies the West Mahurangi Harbour as an ONL (to the south of the NOR 3 Project and south and southeast of the NOR 5 Project). The Warkworth Package does not overlap with this ONL. To the north the NOR 5 Project is approximately 220m from the ONL and is separated from the ONL by intervening topography. The southern extent of the NOR 3 Project is 60m north of the ONL, however, SH1 already extends through the ONL to the south of the proposed designation. While there is no physical connectivity between the proposed designations and the ONL, there is the opportunity for indigenous planting to be undertaken within the Warkworth Package, which could positively contribute to the remnant native forest within the ONL by reducing habitat fragmentation. The Warkworth Package will not affect any landforms or vegetation within the ONL and as both the NOR 3 Project and NOR 5 Project are roading upgrades, rather than proposed new roads, the proposed designations will be consistent with the current landscape character of the area, as well as being consistent with the planned urbanisation of Warkworth. It is assessed that the Warkworth Package will avoid adverse effects on ONLs.

HNC

The AUP:OP identifies the Mahurangi River southern escarpment as having HNC (approximately 140m to the south of the NOR 5 Project). The HNC area is separated from the NOR 5 Project by intervening topography. The Warkworth Package will not affect vegetation associated with the HNC area and there is the opportunity for planting to be undertaken within the designation boundary which could enhance the HNC's forested area by providing an adjacent habitat corridor. The NOR 5 Project also involves the upgrading of an existing road, rather than the implementation of a new road, and is therefore an expected element within the setting. It is assessed that the Warkworth Package will avoid significant adverse effects on areas of HNC.

I consider the Warkworth Package to be consistent with the AUP:OP district policies and objectives that are relevant to landscape and natural character.

Warkworth Structure Plan (2019)

While the Warkworth Structure Plan is a non-statutory document, it is relevant to the Warkworth Package and has been considered as part of this assessment. Key considerations include:

- Protection of views towards the bush-clad northern escarpment of the Mahurangi River and of rural views from within the FUZ towards the outside of the RUB that contribute to rural landscape characteristics associated with Warkworth's character.
- Protection and enhancement of existing bush and natural areas.
- Enabling possible public access for a network of walking and cycling trails through ecological corridors.
- Prioritising active transport through a walking and cycling network.
- Opportunities to improve ecological values in the area.
- Protecting and enhancing the urban forest.
- Treating tributaries as being vital to the health of the Mahurangi River.
- Retaining and buffering natural watercourses.

- Celebrating and protecting Warkworth's heritage, both Māori and European, and its relationship with mana whenua.
- High-quality and integrated urban development that reinforces Warkworth's identity.
- Use of urban trees (such as street trees) and vegetation to enhance the amenity of the built environment.

19 Conclusions

This LNCVA has assessed the potential effects of eight NORs as part of the Warkworth Package. Potential effects took into consideration the existing environment and the likely future environment of Warkworth.

Several key issues were raised throughout the LNCVA, including potential effects on, or opportunities regarding:

- Amenity
- Landform
- Vegetation
- Waterbodies (waterways and natural wetlands)
- Rural landscape characteristics
- Heritage values
- Cultural values

Recommendations were made throughout the LNCVA to address potential effects by directing outcomes to be achieved and recognising opportunities. Landscape and natural character recommendations for the overall Warkworth Package are provided in the table below (Table 17). The recommendations made throughout the LNCVA are also reflected in the 'urban design outcomes and opportunities' figures within the 'Urban Design Evaluation'.

The below tables illustrate the assessed construction and operational effects on landscape character and natural character with and without the recommended measures outlined in the LNCVA.

As noted in Section 5 'Methodology', access to areas of the Warkworth Package site were limited due to private property access constraints. It is recommended that at the future regional resource consenting phase evaluations made throughout this report are ground-truthed, as appropriate, to re-validate the landscape and natural character values identified in the LNCVA before conceptual design commences. This will assist in establishing more refined mitigation measures to address effects more effectively.

Table 17 Summary of assessment of effects of recommendations – Warkworth Package overall network

Residual effect after recommendations	Assessment	Recommendation
Effects during construction		
Landscape Character: **'Very Low'** **Natural Character:** **'Very Low'**	Larger construction area, than operational footprint. This may result in some additional vegetation removal.	Appropriately integrate Project with existing landscape features (including natural wetlands) and the wider natural landscape. Consider opportunities for suitable felled tree species for re-use as landscape features.
	Work to be undertaken in or near waterbodies.	Minimise sedimentation of waterbodies using appropriate erosion controls, by limiting the extent of exposed earthworks at any one time and revegetate earthworks, as appropriate. Consider opportunities for topsoil stripping and stockpiling for re-use, ensuring that topsoil is suitable for landscape purposes. Where practicable, undertake bridge construction from dry land, avoid piers in the beds of waterways and wetlands, minimise piers on riverbanks, and minimise fill over waterbodies.

Residual effect after recommendations	Assessment	Recommendation
Landscape Character (cont'): **'Very Low'** **Natural Character (cont'):** **'Very Low'**	Visual effects from the clutter of materials, machinery, and construction yards.	Where appropriate, select visually discrete locations for the placement of construction yards and material storage. Consider screening of construction yards as mitigation for temporary visual effects. Ensure the reinstatement of construction yards is undertaken in a manner appropriate for the anticipated future use of the land. Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape treatment to manage these effects.
	Effects on existing residential areas.	Identify opportunities for the survey, collection, and propagation of heritage amenity plants in private gardens that will be demolished to enable construction to occur (subject to the agreement with the landowner), so that as appropriate these may be re-established as part of the planting programme during finishing works.
Operational effects		

Residual effect after recommendations	Assessment	Recommendation
Landscape Character: **'Low-Moderate'** **Natural Character:** **'Low-Moderate'**	Opportunity to integrate the Warkworth Package with the wider landscape.	Consider how the Project (including roadside elements such as lighting, signage and the landscape treatment of structures) can: • Enable integration of the Project's permanent works into the surrounding landscape and urban context; and • Ensure that the Project manages potential adverse landscape and visual effects and contributes to a quality urban environment. Take into account the potential visual impacts of structures and look to adopt appropriate architectural and landscape treatment to manage these effects. How the Project can enable integration of street trees into the transport corridor design.
Landscape Character (cont'): **'Low-Moderate'** **Natural Character (cont'):** **'Low-Moderate'**	Potential for effects on landscape features, including indigenous vegetation and waterbodies.	Integrate the Project with existing landscape features (including natural wetlands) and the wider natural landscape.

Residual effect after recommendations	Assessment	Recommendation
	Opportunity to integrate stormwater management.	Consider further refinement of stormwater treatment wetland design to appear 'natural' with a variety of habitats, e.g. irregular shape with curved boundaries, varying depths and islands. Consider water sensitive urban design principles. Recommendation to prioritise the use of soft engineering strategies for stormwater management. It is noted that detailed responses to waterway and natural wetland treatment will be detailed in the future regional resource consenting stages of the Warkworth Package.
	Anticipated likely future environment based on assumptions.	Re-validate the landscape and natural character values identified in the LNCVA prior to the commencement of conceptual design.

Summary tables illustrating construction and operational construction landscape character and natural character effects without recommended measures and following recommended measures are provided below.

Scale	Warkworth	Northern Project Area	Southern Project Area	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
Landscape character construction effects	**M**	**M-H**	**M**	**L-M**	**L-M**	**L-M**	**H**	**H**	**M-H**	**H**	**M-H**

Scale	Warkworth	Northern Project Area	Southern Project Area	NOR 1	NOR 2	NOR 3	NOR 4	NOR 5	NOR 6	NOR 7	NOR 8
Natural character construction effects	M	M-H	M	M	M-H	L-M	L	H	M	H	M-H

NOR	Construction (Temporary) Effects without Recommended Measures		Construction (Temporary) Effects following Recommended Measures	
	Landscape Character	Natural Character	Landscape Character	Natural Character
Warkworth	M	M	L-M	L-M
Northern Project Area	M-H	M-H	L-M	L-M
Southern Project Area	M	M	L-M	L-M
1	L-M	M	L	L
2	L-M	M-H	L	L-M
3	L-M	L-M	L	L
4	H	L	M-H	L
5	H	H	M-H	M-H
6	M-H	M	M	L-M
7	H	H	L-M	L-M
8	M-H	M-H	M	M

Figure 19-1 Summary table illustrating the construction landscape character and natural character effects without recommended measures and following recommended measures

Key: V-L ('Very Low'), L ('Low'), L-M ('Low Moderate'), M ('Moderate'), M-H ('Moderate High'), H ('High') and V-H (Very High).

19-2NOR	Operational (Permanent) Effects without Recommended Measures		Operational (Permanent) Effects following Recommended Measures	
	Landscape Character	Natural Character	Landscape Character	Natural Character
Warkworth	M-H	M-H	L	L
Northern Project Area	M-H	M-H	L	L
Southern Project Area	M	M	L	L
1	L	L-M	V-L	L
2	L	M	V-L	L-M
3	L-M	L	L	V-L
4	H	L	M	L
5	M-H	M-H	M	M
6	H	M-H	L-M	L
7	H	H	L-M	L-M
8	H	H	L-M	L-M

Figure 19-2Summary table illustrating the operational landscape character and natural character effects without recommended measures and following recommended measures

Key: V-L ('Very Low'), L ('Low'), L-M ('Low Moderate'), M ('Moderate'), M-H ('Moderate High'), H ('High') and V-H (Very High).

20 References

Auckland Council, Warkworth Structure Plan, June 2019, https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/place-based-plans/structure-plans/A%20copy%20of%20the%20Warkworth%20Structure%20Plan/warkworth-structure-plan.pdf

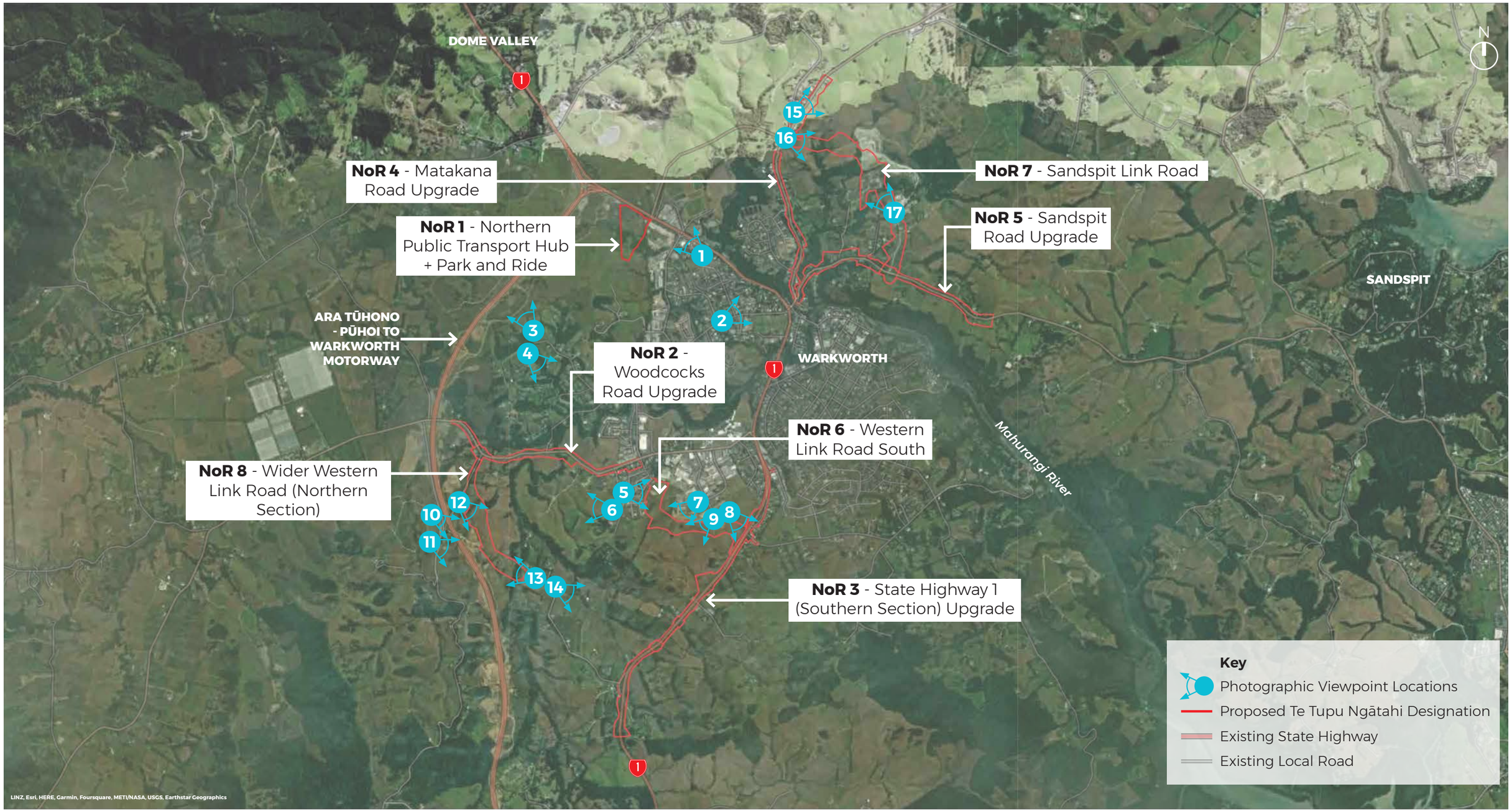
R. Bassey and M. Walker (2018). Historic Heritage Assessment Report: Draft Warkworth Structure Plan. Prepared by Plans and Places Department for Auckland Council.

1 Appendix A: Graphic Attachment

Warkworth
Landscape and Natural Character and Visual Assessment

Appendix A:
Photo Essay

4 May 2023
Final for Lodgement
Rev 3



Viewpoint Reference Plan - Project Extents

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 **Status:** Final for Lodgement **Revision:** 3

Sheet Number: LA001 **Author:** Melinda Drysdale **Reviewed By:** Chantal Whitby

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 1: View from Wikitoria Lane looking northwest towards NoR 1 - Northern Public Transport Hub + Park and Ride

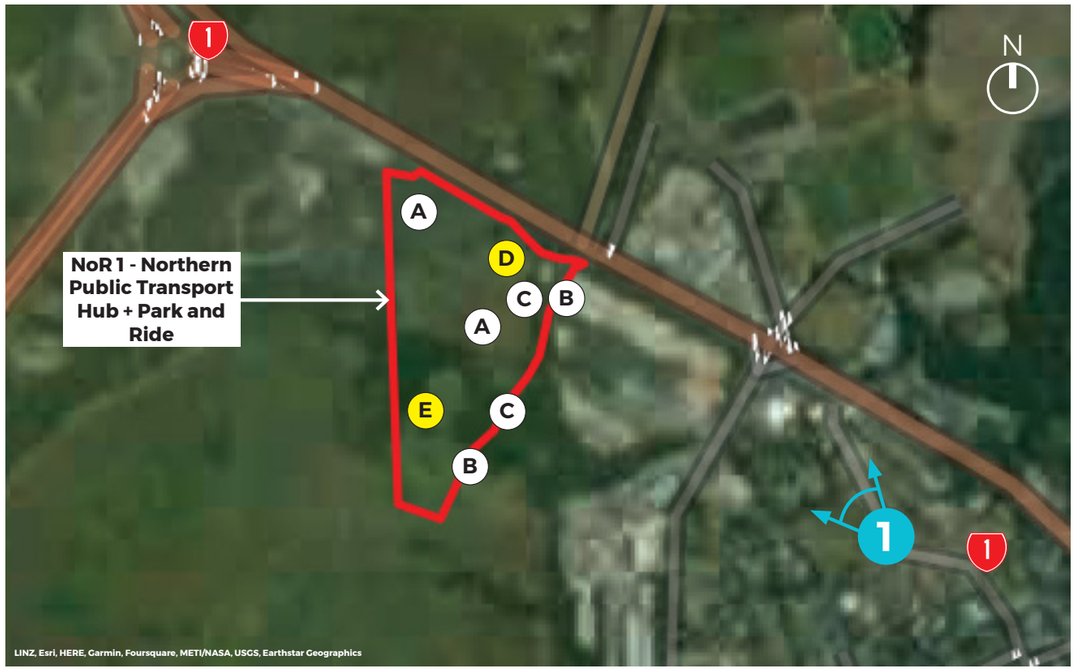
NORTHERN PUBLIC TRANSPORT HUB + PARK AND RIDE AND WESTERN LINK ROAD - NORTH SECTION

ISSUES

A	Potential large area of impervious surface
B	Potential removal of riparian vegetation
C	Potential loss of, and alterations to, natural wetlands and waterways

OPPORTUNITIES

D	Potential for large area of amenity planting
E	Opportunity to extend riparian planting



Location of NoRs and viewpoint

Viewpoint 1

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA002

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.392956, 174.652311 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 12:23pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 2: View from Hill Street looking east towards State Highway 1 and Sandspit Road Intersection

SANDSPIT LINK ROAD

ISSUES

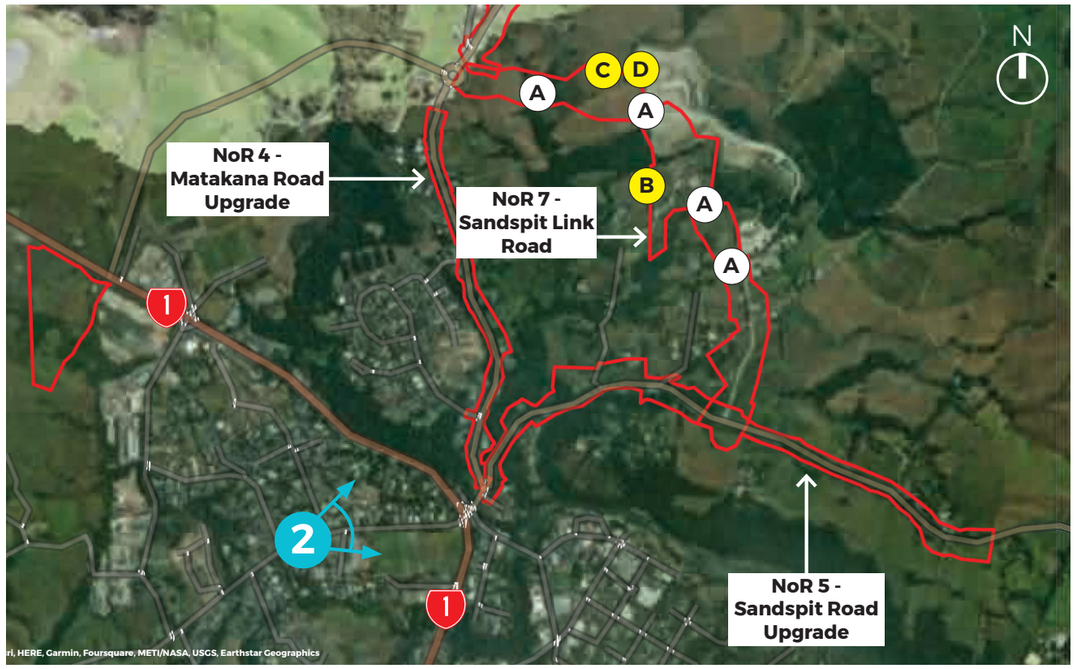
(A) Potential loss of riparian vegetation

OPPORTUNITIES

(B) Potential opportunity to provide elevated views towards the surrounding landscape

(C) Potential to enhance indigenous vegetation, including riparian planting

(D) Opportunity to integrate areas of cut and fill. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment



Location of NoRs and viewpoint

Viewpoint 2

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA003

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.397518, 174.656239 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 12:34pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 3: View from Viv Davie-Martin Drive looking northwest towards Ara Tūhono - Pūhoi to Warkworth Motorway

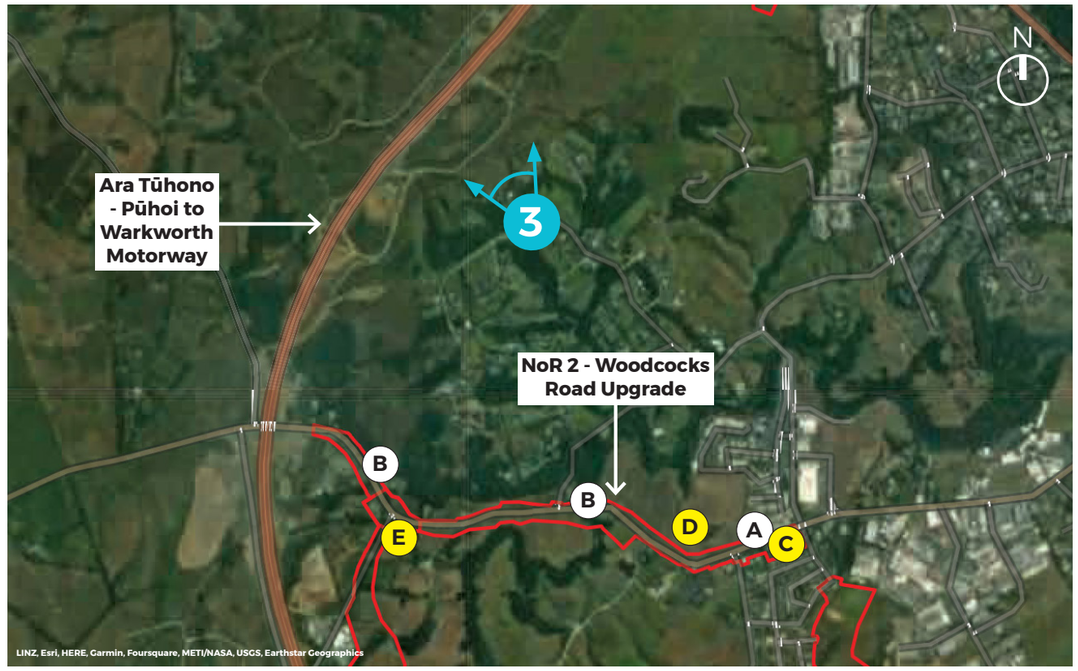
WOODCOCKS ROAD DESIGNATION

ISSUES

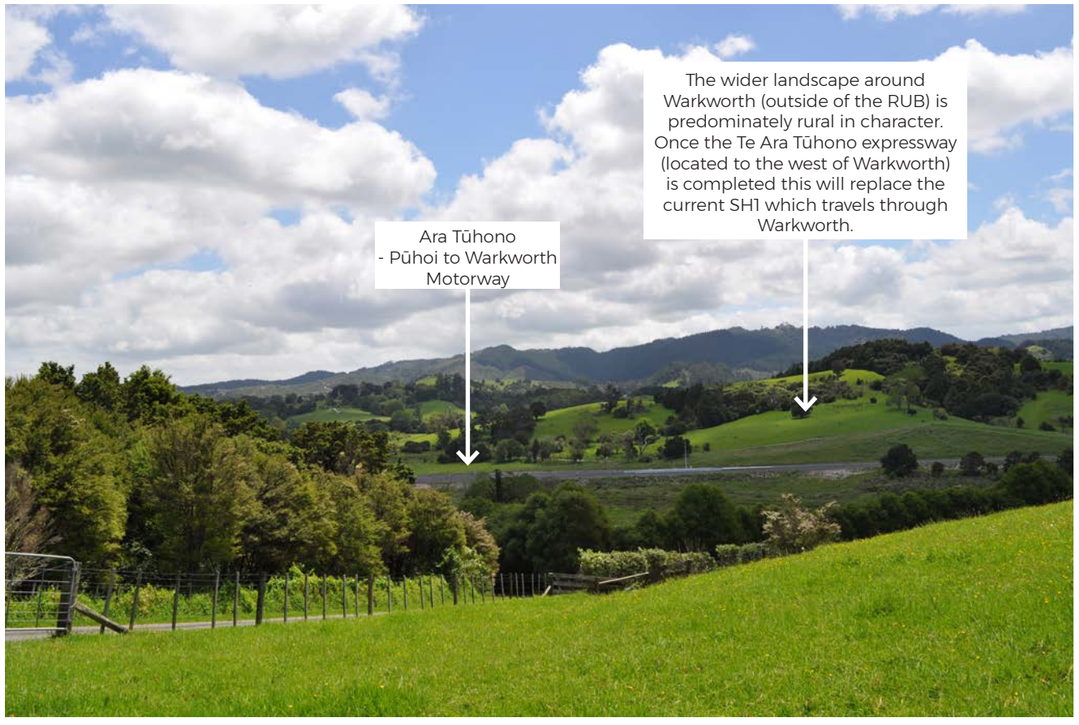
A	Potential effects on existing residential areas
B	Potential effects on SEAs, including removal of riparian vegetation

OPPORTUNITIES

C	Opportunity to create attractive planted area which is incorporated with active transport routes, adjacent to existing residential areas.
D	Opportunity to revegetate natural wetland area
E	Opportunity to highlight historical sites with cultural markers and interpretation panels



Location of NoRs and viewpoint



Viewpoint 3

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA004

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.399611, 174.638522 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 12:51pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 4: View from Viv Davie-Martin Drive looking southeast towards NoR 2 - Woodcocks Road Upgrade

WOODCOCKS ROAD DESIGNATION

ISSUES

(A) Potential effects on existing residential areas

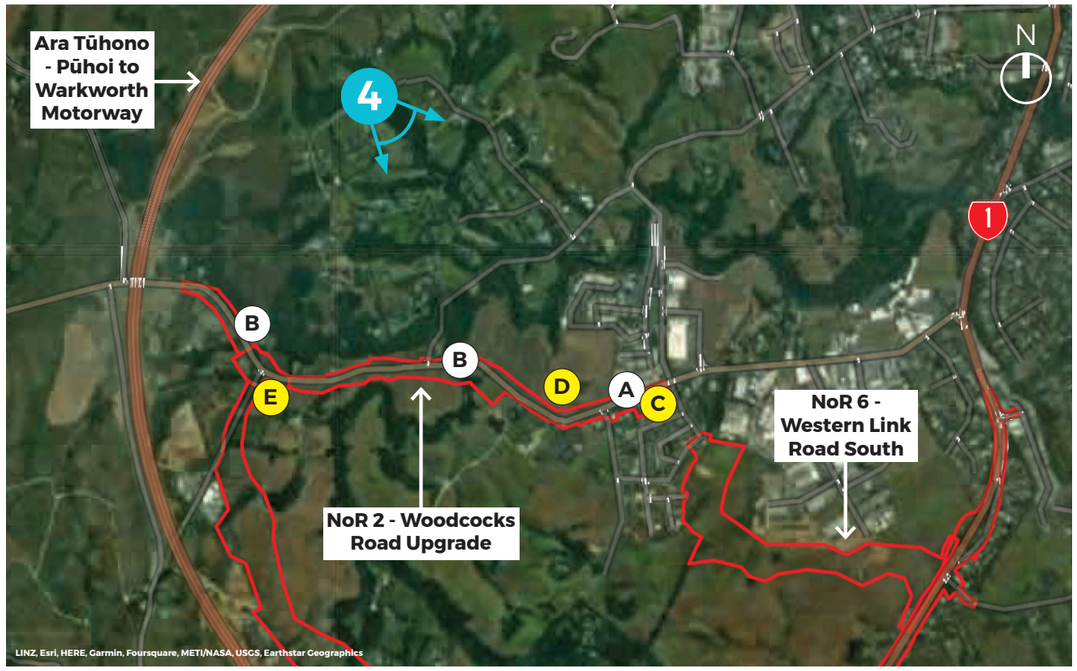
(B) Potential effects on SEAs, including removal of riparian vegetation

OPPORTUNITIES

(C) Opportunity to create attractive planted area which is incorporated with active transport routes, adjacent to existing residential areas.

(D) Opportunity to revegetate natural wetland area

(E) Opportunity to highlight historical sites with cultural markers and interpretation panels



Location of NoRs and viewpoint

Viewpoint 4

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA005

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.400515, 174.636396 (Photo taken using a Canon EOS 5D Camera with 50mm lens at 1:15pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 5: View from Mason Heights looking east towards NoR 6 - Western Link Road South

WESTERN LINK ROAD SOUTH DESIGNATION

ISSUES

A	Potential substantial earthworks and changes to the landform across large extent of designation corridor
B	Potentially limited visual mitigation possible during construction

OPPORTUNITIES

C	Opportunity to revegetate natural wetlands and extend indigenous vegetation
D	Opportunity to provide for new vistas towards bush and ridgelines to the north
E	Opportunity to integrate areas of cut and fill. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment

Location of NoRs and viewpoint

Viewpoint 5

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA006

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.410795, 174.646179 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 1:26pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 6: View from Mason Heights looking west towards NoR 8 - Wider Western Link Road Northern Section

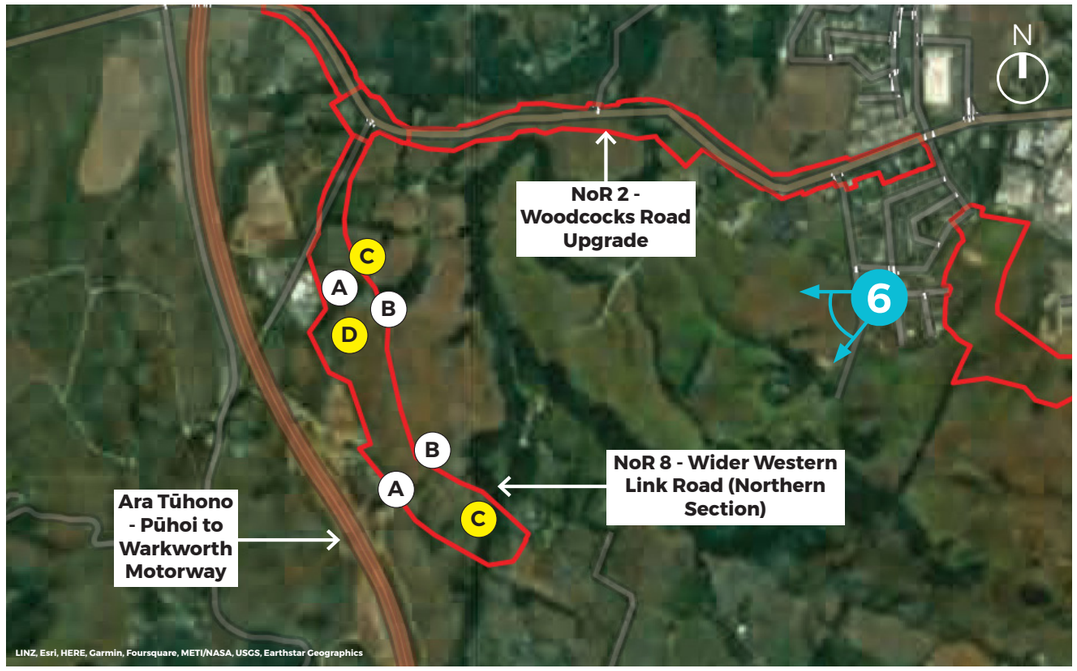
WIDER WESTERN LINK ROAD (NORTHERN SECTION) DESIGNATION

ISSUES

A	Potential large areas of fill, including over natural wetlands and waterways
B	Potential loss of riparian vegetation

OPPORTUNITIES

C	Opportunity to enhance existing vegetation, including natural wetland revegetation
D	Opportunity to attain views towards the Mahurangi River and wider rural landscape outside the RUB



Location of NoRs and viewpoint

Viewpoint 6

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA007

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.410980, 174.646100 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 1:19pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 7: View from Morrison Drive looking southwest towards NoR 6 - Western Link Road South

WESTERN LINK ROAD SOUTH DESIGNATION

ISSUES

A	Potential substantial earthworks and changes to the landform across large extent of designation corridor
B	Potentially limited visual mitigation possible during construction

OPPORTUNITIES

C	Opportunity to revegetate natural wetlands and extend indigenous vegetation
D	Opportunity to provide for new vistas towards bush and ridgelines to the north
E	Opportunity to integrate areas of cut and fill. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment

Location of NoRs and viewpoint

Viewpoint 7

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA008

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.410940, 174.6538289 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 1:38pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 8: View from Morrison Drive looking southeast towards NoR 6 - Western Link Road South

WESTERN LINK ROAD SOUTH DESIGNATION

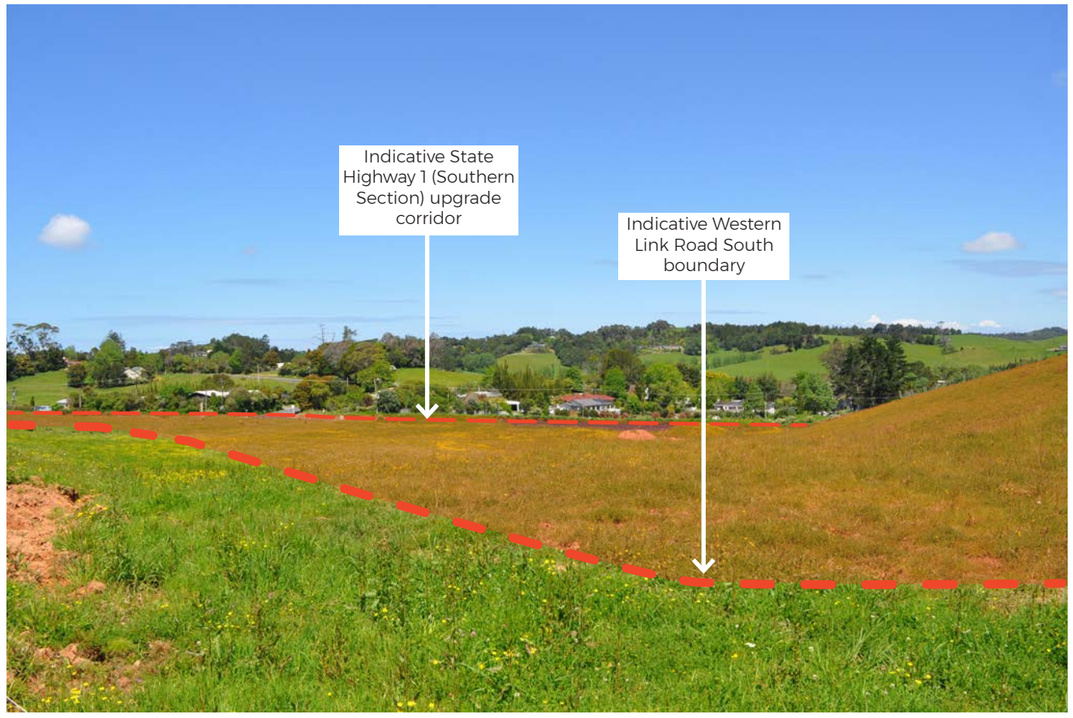
ISSUES

A	Potential substantial earthworks and changes to the landform across large extent of designation corridor
B	Potentially limited visual mitigation possible during construction

OPPORTUNITIES

C	Opportunity to revegetate natural wetlands and extend indigenous vegetation
D	Opportunity to provide for new vistas towards bush and ridgelines to the north

Location of NoRs and viewpoint



Viewpoint 8

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA009

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.411938, 174.654707 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 1:42pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 9: View from Morrison Drive looking west towards NoR 6 - Western Link Road South

WESTERN LINK ROAD SOUTH DESIGNATION

ISSUES

(A) Potential substantial earthworks and changes to the landform across large extent of designation corridor

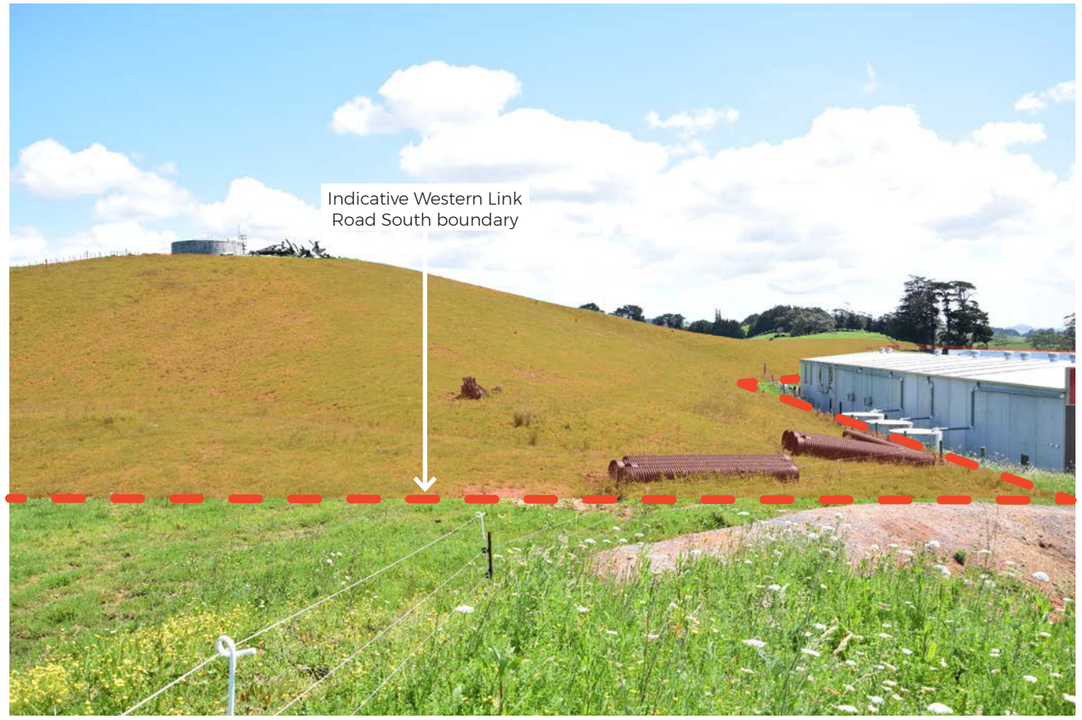
(B) Potentially limited visual mitigation possible during construction

OPPORTUNITIES

(C) Opportunity to revegetate natural wetlands and extend indigenous vegetation

(D) Opportunity to provide for new vistas towards bush and ridgelines to the north

Location of NoRs and viewpoint



Viewpoint 11

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA010

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.411961, 174.654805 (Photo taken using a Nikon D5300 Camera with 18mm lens with 1.5x multiplier at 1:45pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 10: View from Wyllie Road looking southeast towards Ara Tūhono - Pūhoi to Warkworth Motorway and NoR 8 - Wider Western Link Road Northern Section

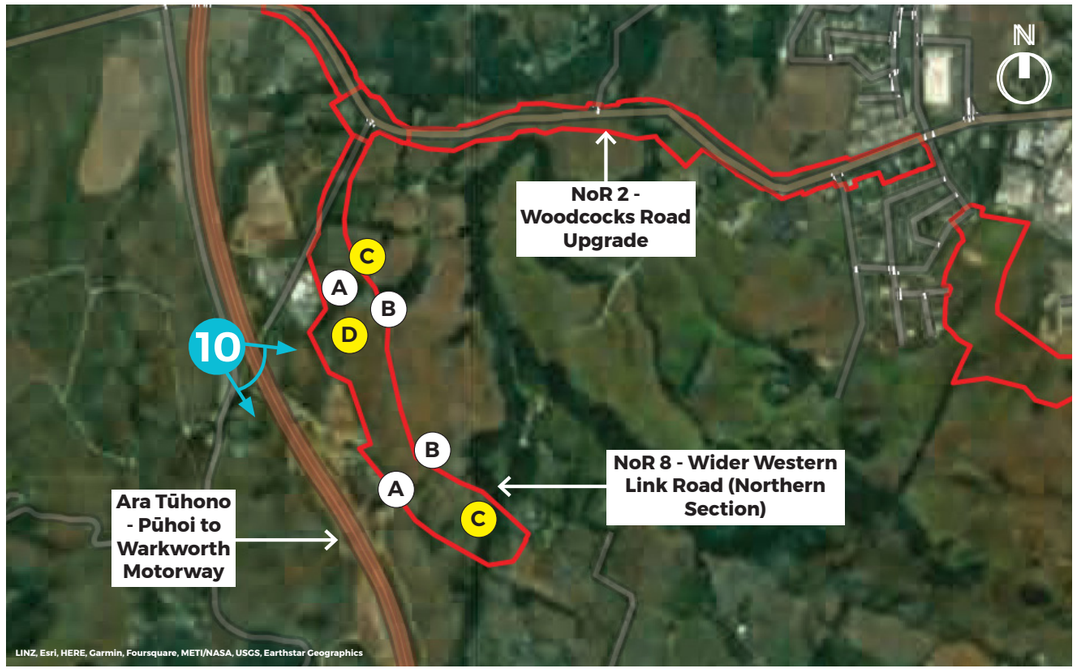
WIDER WESTERN LINK ROAD (NORTHERN SECTION) DESIGNATION

ISSUES

A	Potential large areas of fill, including over natural wetlands and waterways
B	Potential loss of riparian vegetation

OPPORTUNITIES

C	Opportunity to enhance existing vegetation, including natural wetland revegetation
D	Opportunity to attain views towards the Mahurangi River and wider rural landscape outside the RUB



Location of NoRs and viewpoint

Viewpoint 10

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA011

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.412188, 174.630521 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 1:55pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 11: View from Wyllie Road looking southeast towards Ara Tūhono - Pūhoi to Warkworth Motorway and NoR 8 - Wider Western Link Road Northern Section

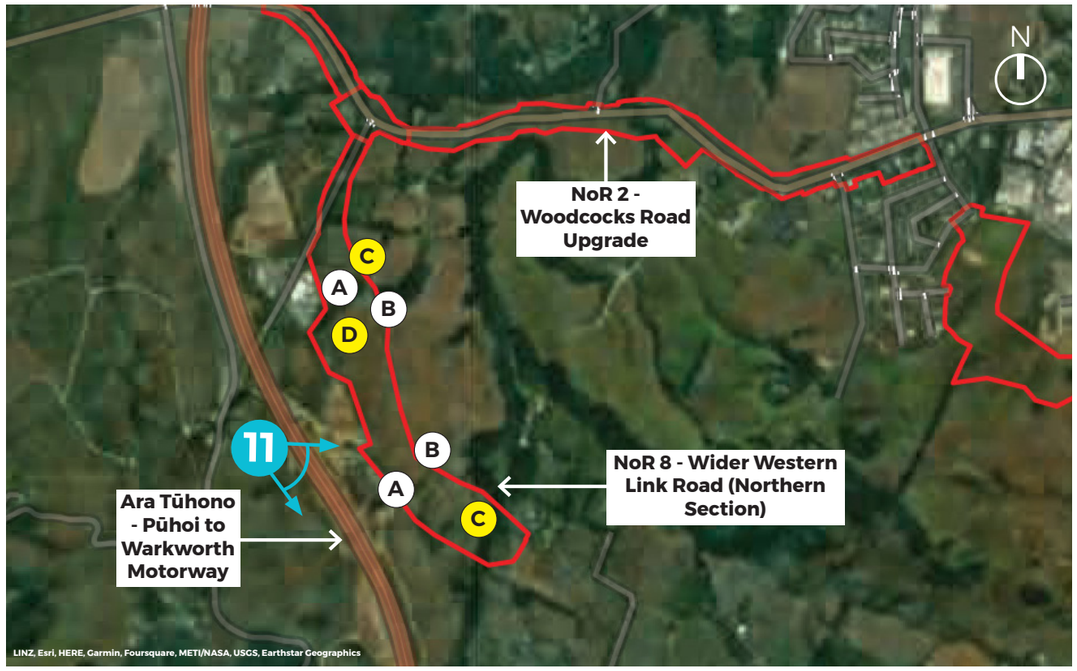
WIDER WESTERN LINK ROAD (NORTHERN SECTION) DESIGNATION

ISSUES

A	Potential large areas of fill, including over natural wetlands and waterways
B	Potential loss of riparian vegetation

OPPORTUNITIES

C	Opportunity to enhance existing vegetation, including natural wetland revegetation
D	Opportunity to attain views towards the Mahurangi River and wider rural landscape outside the RUB



Location of NoRs and viewpoint

Viewpoint 11

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA012

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.414163, 174.630203 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 2:01pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 12: View from Wyllie Road looking southeast towards NoR 8 - Wider Western Link Road Northern Section

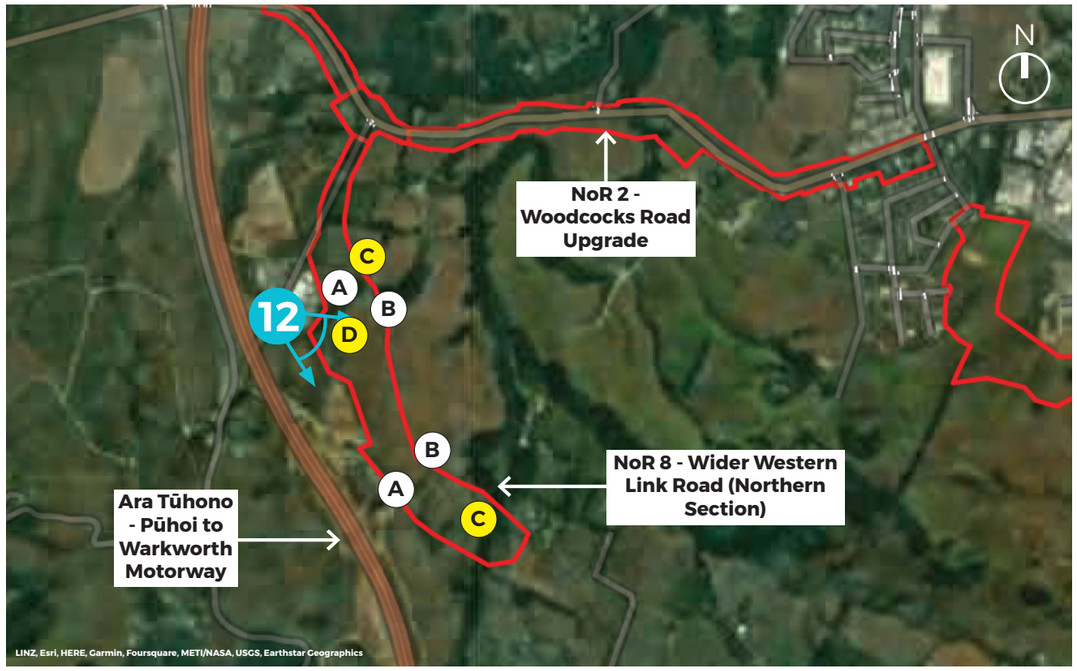
WIDER WESTERN LINK ROAD (NORTHERN SECTION) DESIGNATION

ISSUES

A	Potential large areas of fill, including over natural wetlands and waterways
B	Potential loss of riparian vegetation

OPPORTUNITIES

C	Opportunity to enhance existing vegetation, including natural wetland revegetation
D	Opportunity to attain views towards the Mahurangi River and wider rural landscape outside the RUB



Location of NoRs and viewpoint

Viewpoint 12

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA013

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.411667, 174.632500 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 2:12pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 13: View from Valerie Close looking northwest towards NoR 8 - Wider Western Link Road Northern Section

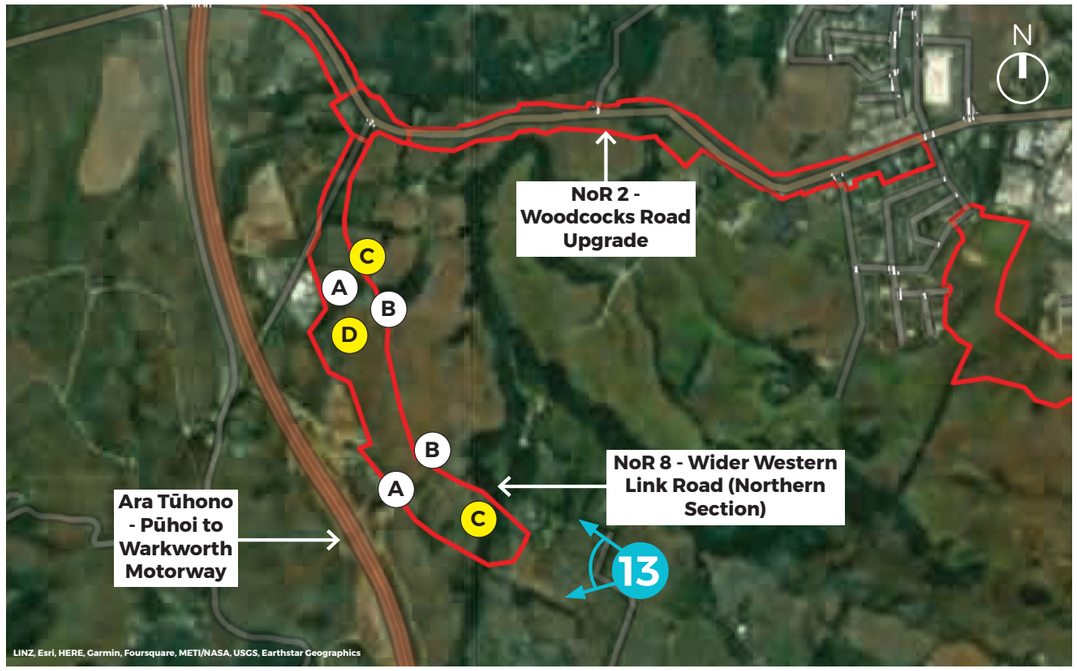
WIDER WESTERN LINK ROAD (NORTHERN SECTION) DESIGNATION

ISSUES

A	Potential large areas of fill, including over natural wetlands and waterways
B	Potential loss of riparian vegetation

OPPORTUNITIES

C	Opportunity to enhance existing vegetation, including natural wetland revegetation
D	Opportunity to attain views towards the Mahurangi River and wider rural landscape outside the RUB



Location of NoRs and viewpoint

Viewpoint 13

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA014

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.416645, 174.639552 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 2:32pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 14: View from Valerie Close looking southeast towards NoR 3 - State Highway 1 Southern Section Upgrade

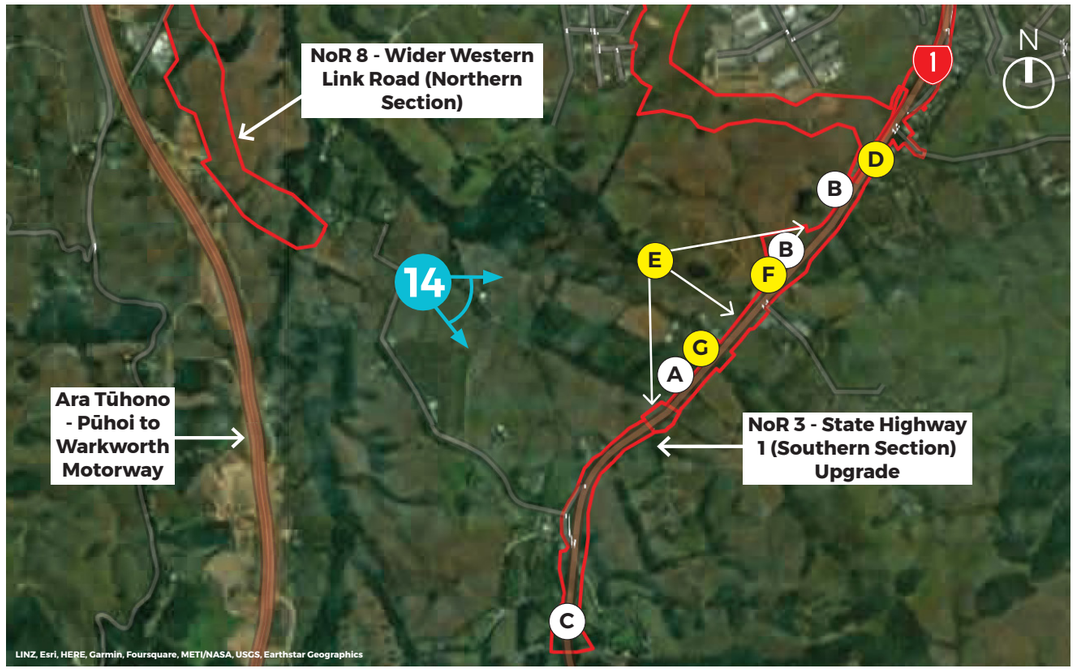
STATE HIGHWAY 1 (SOUTHERN SECTION) DESIGNATION

ISSUES

- (A) Potential effects on Morrison's Heritage Orchard
- (B) Potential fill over natural wetlands
- (C) Potential area of cut 60m north of ONL but outside ONL overlay

OPPORTUNITIES

- (D) Opportunity to enhance the southern 'gateway' through street design, including amenity planting
- (E) Opportunity for indigenous roadside planting to enhance biodiversity and amenity
- (F) Opportunity to revegetate natural wetland area
- (G) Opportunity to improve entrance to Morrison's Heritage Orchard through road design



Location of NoRs and viewpoint

Viewpoint 14

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA015

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.417094, 174.640647 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 2:34pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 15: View from Clayden Road and Matakana Road Intersection looking northeast towards NoR 4 - Matakana Road Upgrade

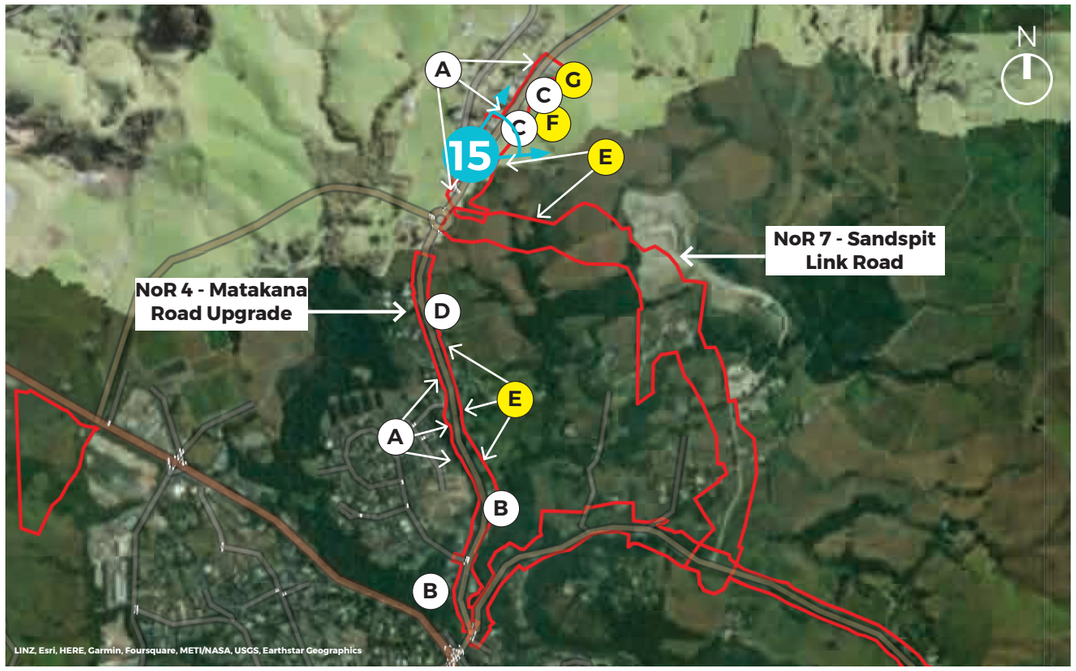
MATAKANA ROAD DESIGNATION

ISSUES

A	A large extent of the designation corridor is highly constrained between steep topography and existing residential properties. The designation cuts across several properties and is located close to several existing dwellings. This limits the ability for potential mitigation measures.
B	Potential adverse effects on vegetation in SEA
C	Potential fill over natural wetlands
D	Potential for historic house site to be partially damaged by works

OPPORTUNITIES

E	Opportunity to extend indigenous roadside planting along extent of designation corridor
F	Opportunity to revegetate natural wetlands
G	Opportunity to retain views to east of the rural landscape outside the RUB



Location of NoRs and viewpoint

Viewpoint 15

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA016

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.384008, 174.660637 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 2:59pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 16: View from Matakana Road looking southeast towards NoR 7 - Sandspit Link Road

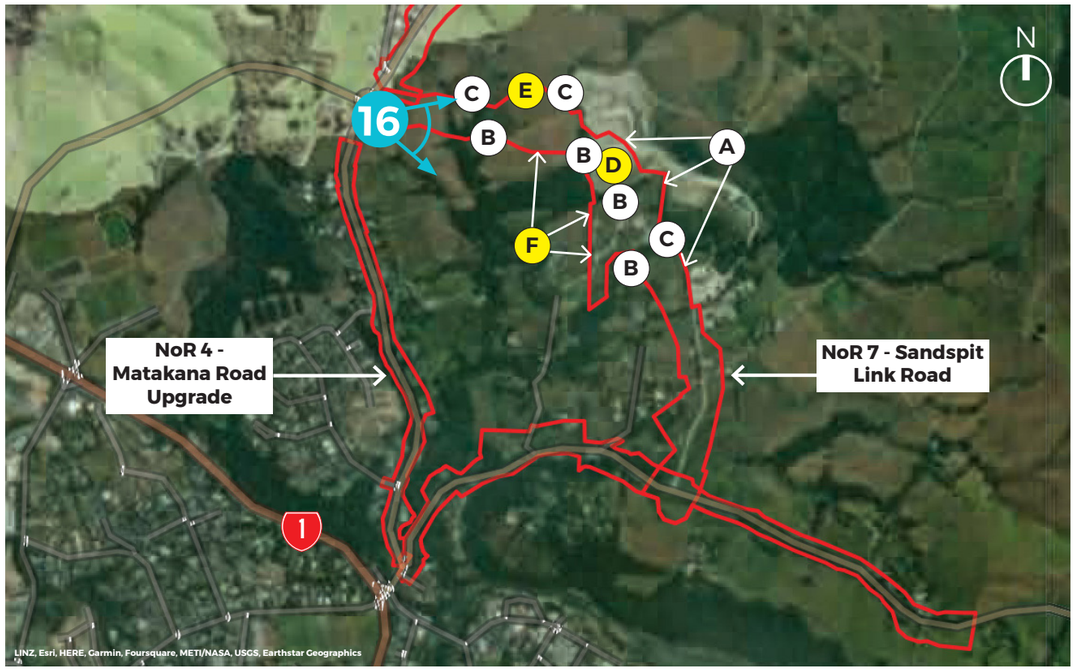
SANDSPIT LINK ROAD DESIGNATION

ISSUES

A	Substantial changes to landform due to large areas of cut and fill across large extent of designation corridor
B	Loss of riparian vegetation
C	Effects on waterways and wetlands

OPPORTUNITIES

D	Provide for new public views south towards Warkworth town centre and the wider rural landscape
E	Potential to enhance existing vegetation, including wetland revegetation
F	Opportunity to integrate areas of cut and fill. Condition 9 of the ULDMP directs the integration of the proposed transport corridor with the surrounding future environment



Location of NoRs and viewpoint

Viewpoint 16

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA017

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.384797, 174.660446 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 3:02pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

VP 17: View from Warkwork Resource Recovery Park Paper Road looking northwest towards NoR 7 - Sandspit Link Road

SANDSPIT LINK ROAD

ISSUES

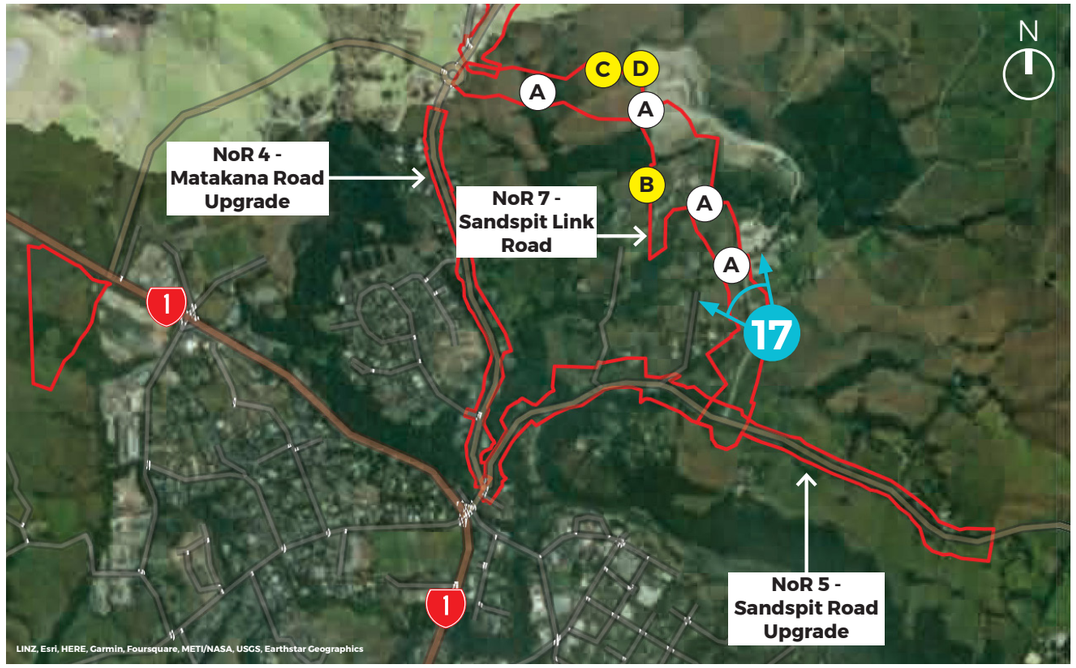
(A) Potential loss of riparian vegetation

OPPORTUNITIES

(B) Opportunity to provide new vistas over the surrounding landscape

(C) Potential to enhance indigenous vegetation, including riparian planting

(D) Potential change to the landform from cut and fill



Location of NoRs and viewpoint

Viewpoint 17

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Status:** Final for Lodgement **Revision:** 3 **Sheet Number:** LA018

Author: Abby Liang **Reviewed By:** Melinda Drysdale

Photo Location: -36.390207, 174.670008 (Photo taken using a Nikon D90 Camera with 34mm lens with 1.5x multiplier at 3:40pm on 14/11/2022)

PREPARED BY WSP NZ FOR TE TUPU NGĀTAHI SUPPORTING GROWTH ALLIANCE

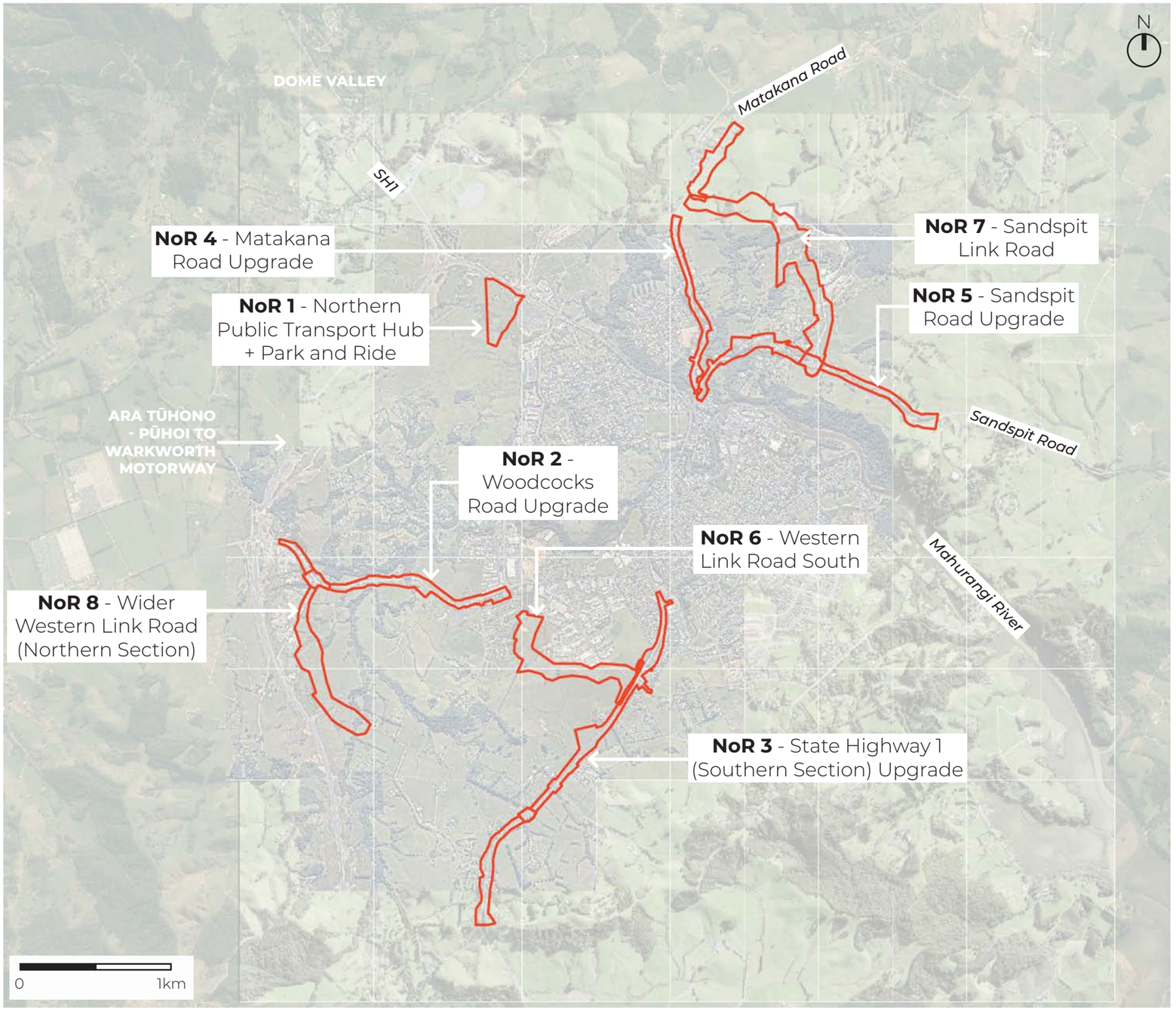
Warkworth
Landscape and Natural Character and Visual Assessment

Maps

4 May 2023
Final for Lodgement
Rev 3

Key

Proposed Te Tupu Ngātahi Designation

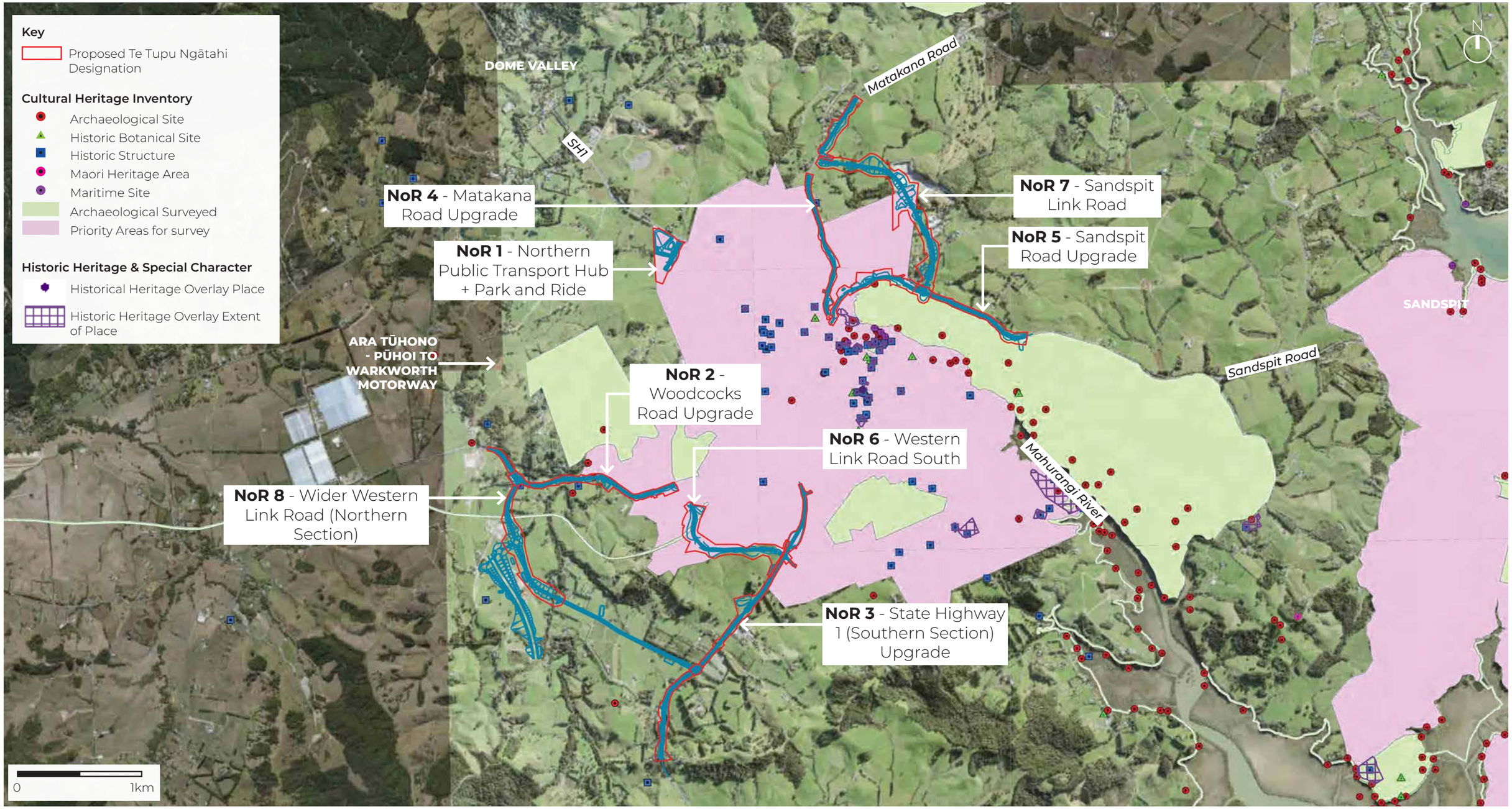


Map 01: NoR Extents

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA001

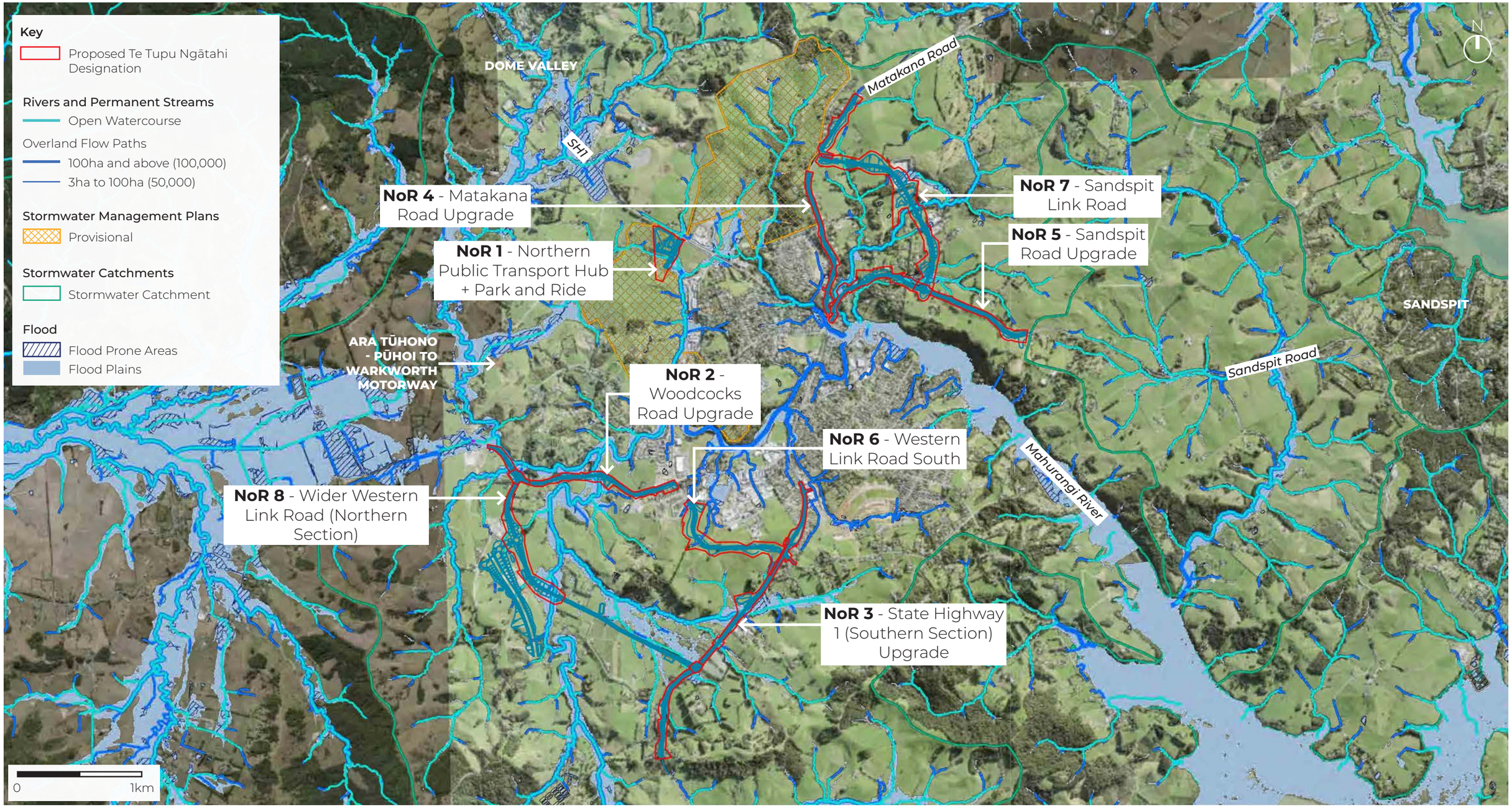


Map 02: Cultural and Historic Heritage

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA002

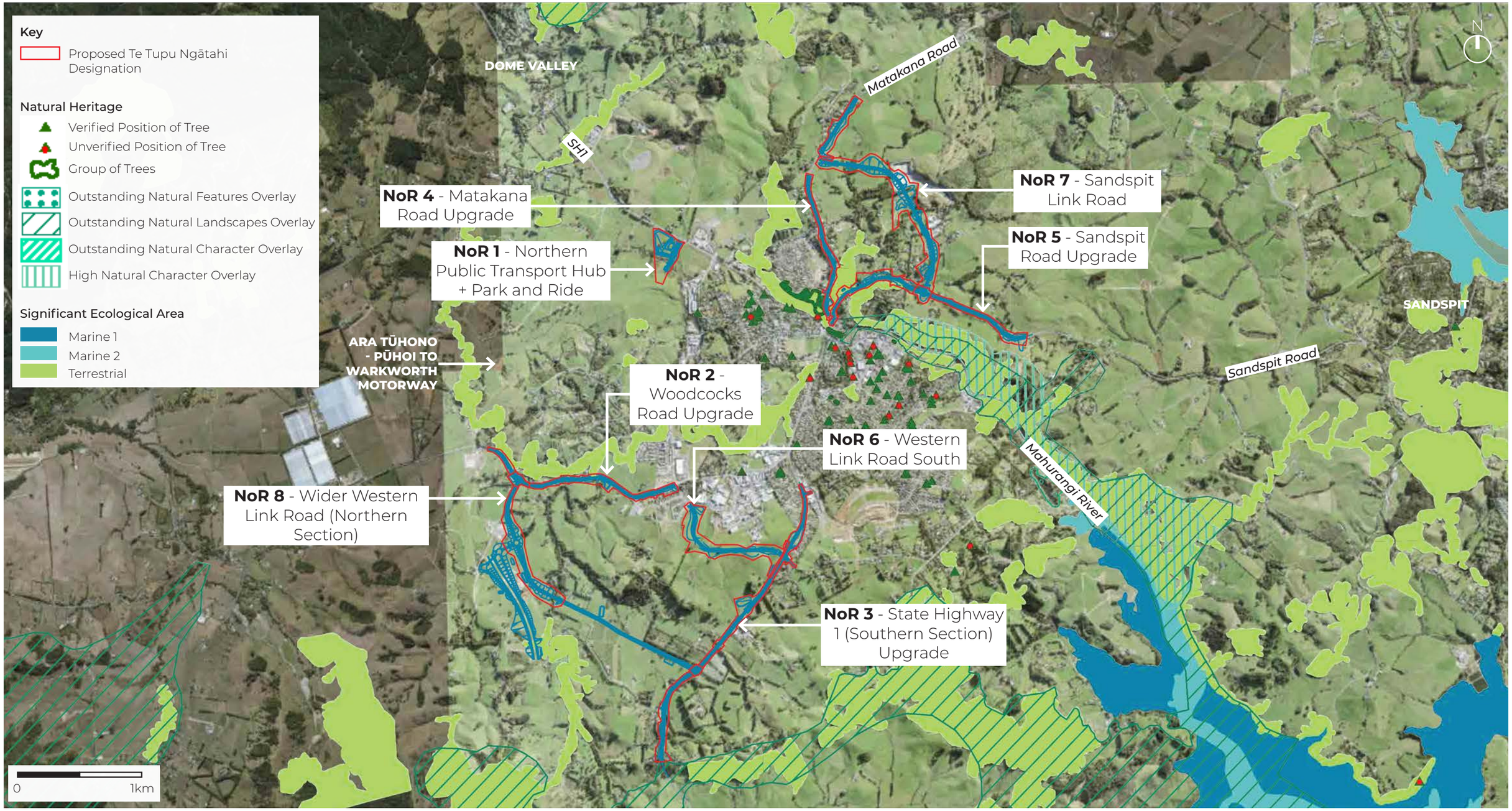


Map 03: Water Catchment and Hydrology

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA003

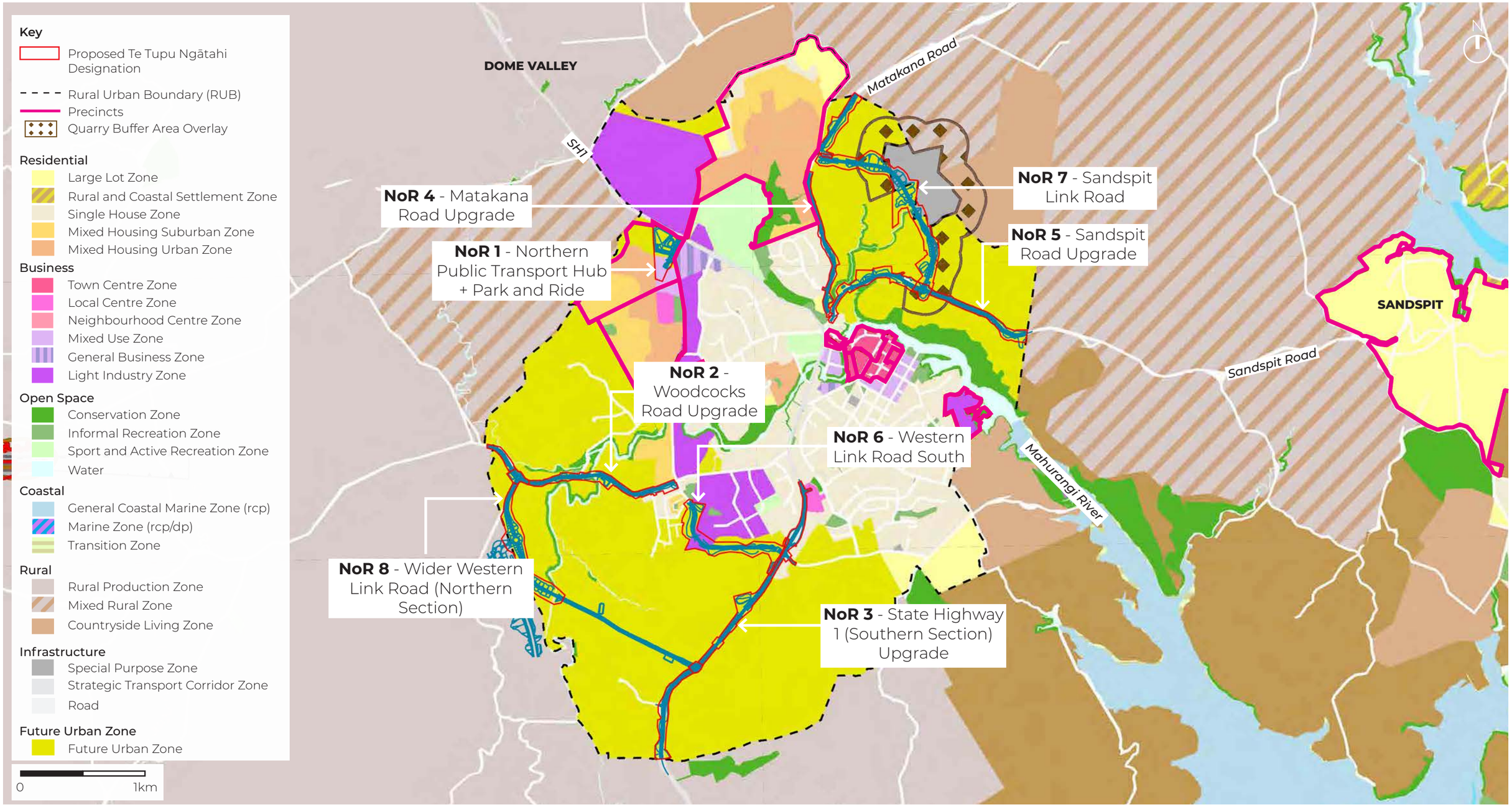


Map 04: Natural Heritage, Significant Ecological Area and Outstanding Overlays

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA004

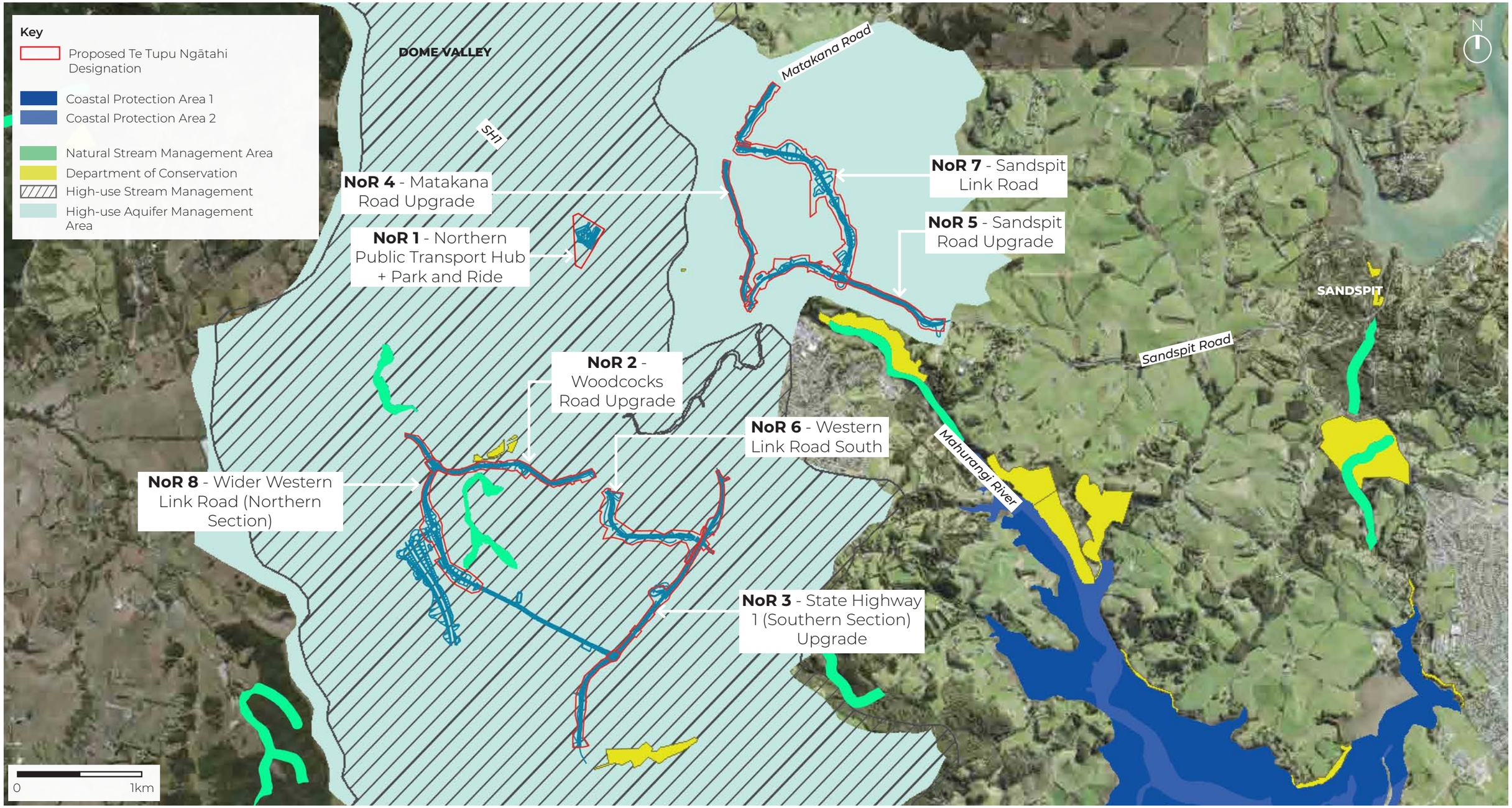


Map 05: Unitary Plan Zones and Infrastructure

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA005

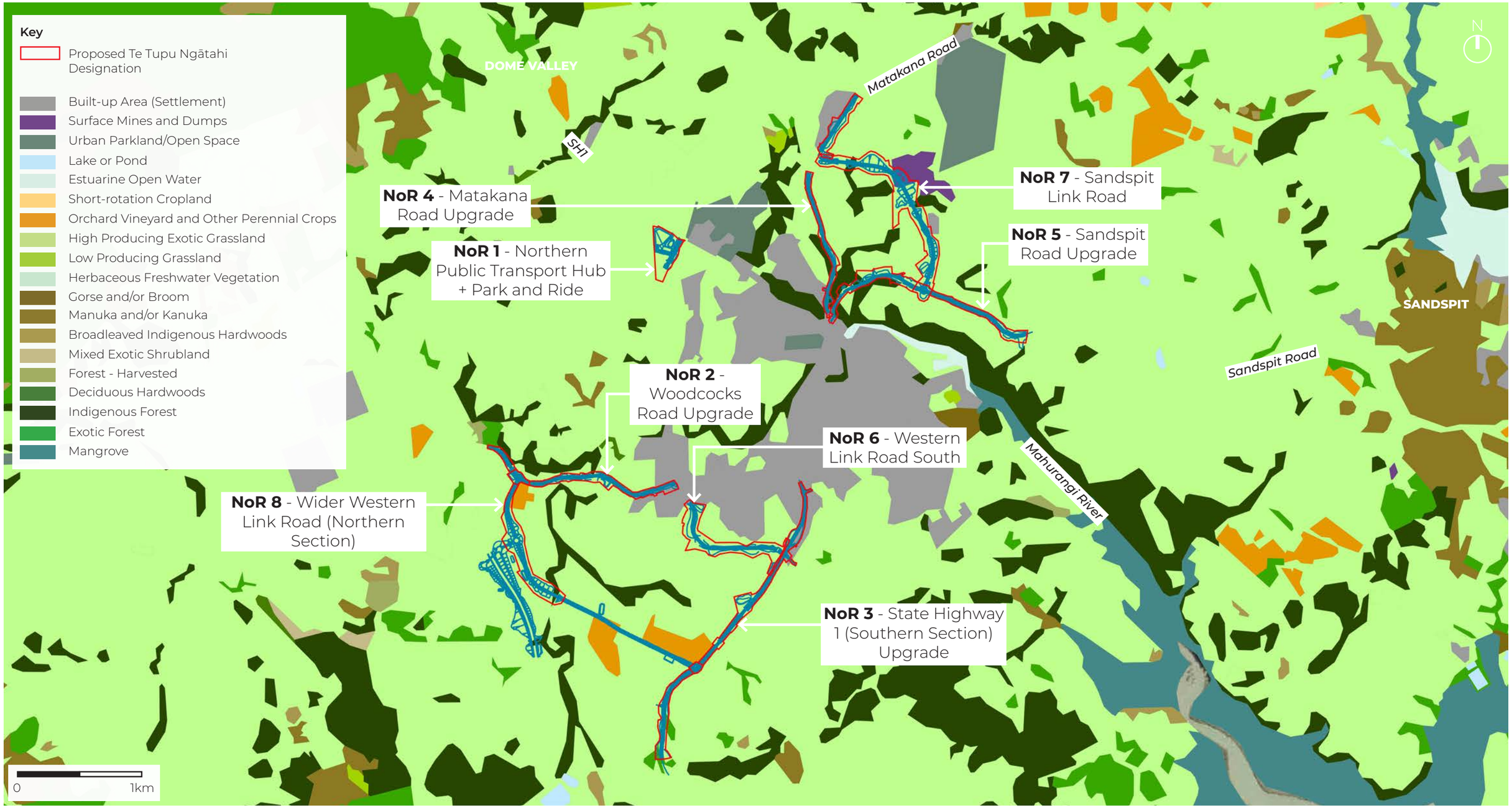


Map 06: Coastal Protection Areas and Natural Stream Management Areas

Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA006



Map 07: Land Cover Map

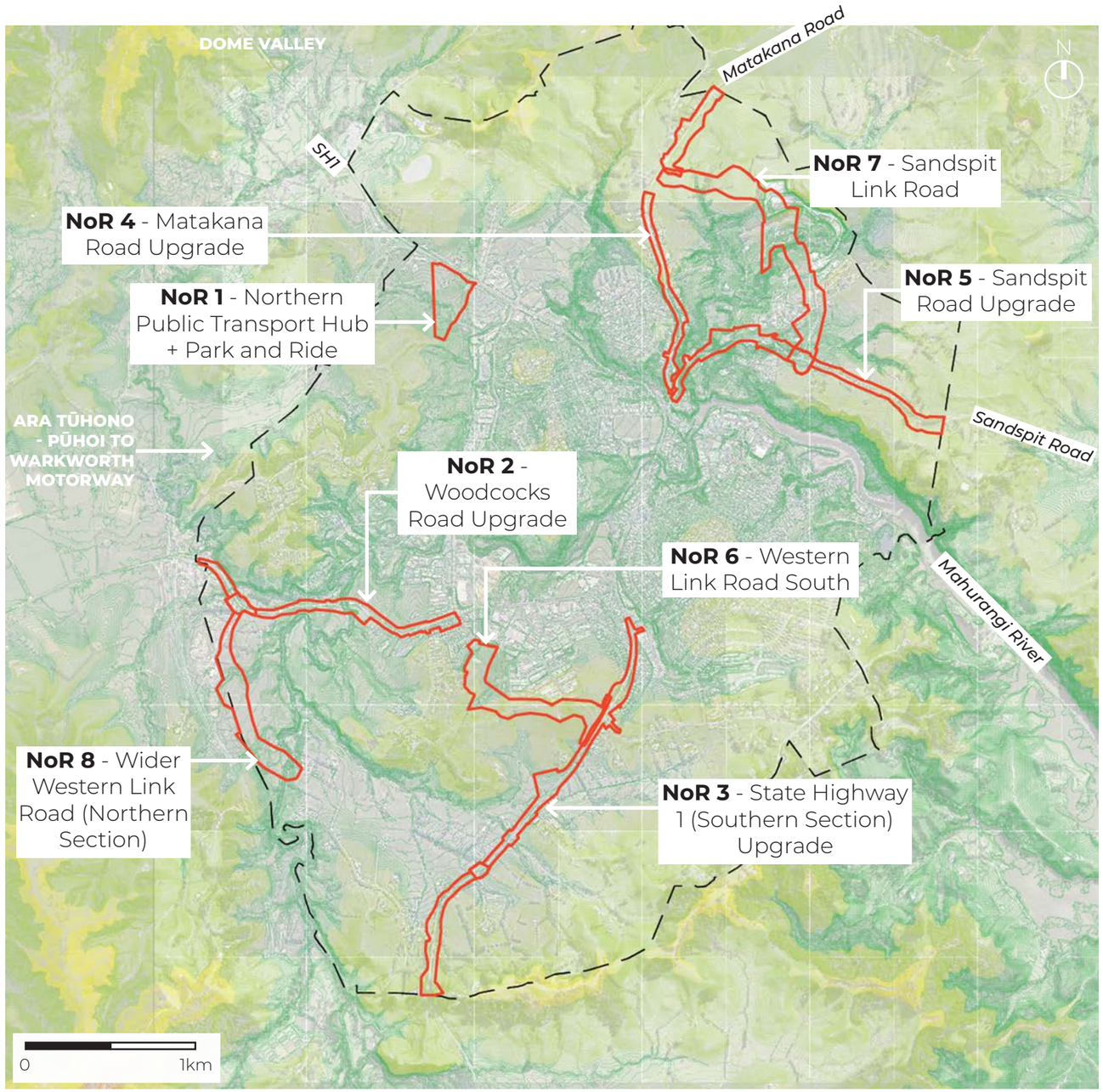
Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA007

Key

- Proposed Te Tupu Ngātahi Designation
- Roads
- 0 - 50m Contours
- 50.5 - 100m Contours
- 100.5 - 150m Contours
- 150.5 - 200m Contours
- Rural Urban Boundary



Map 08: Topographical Map

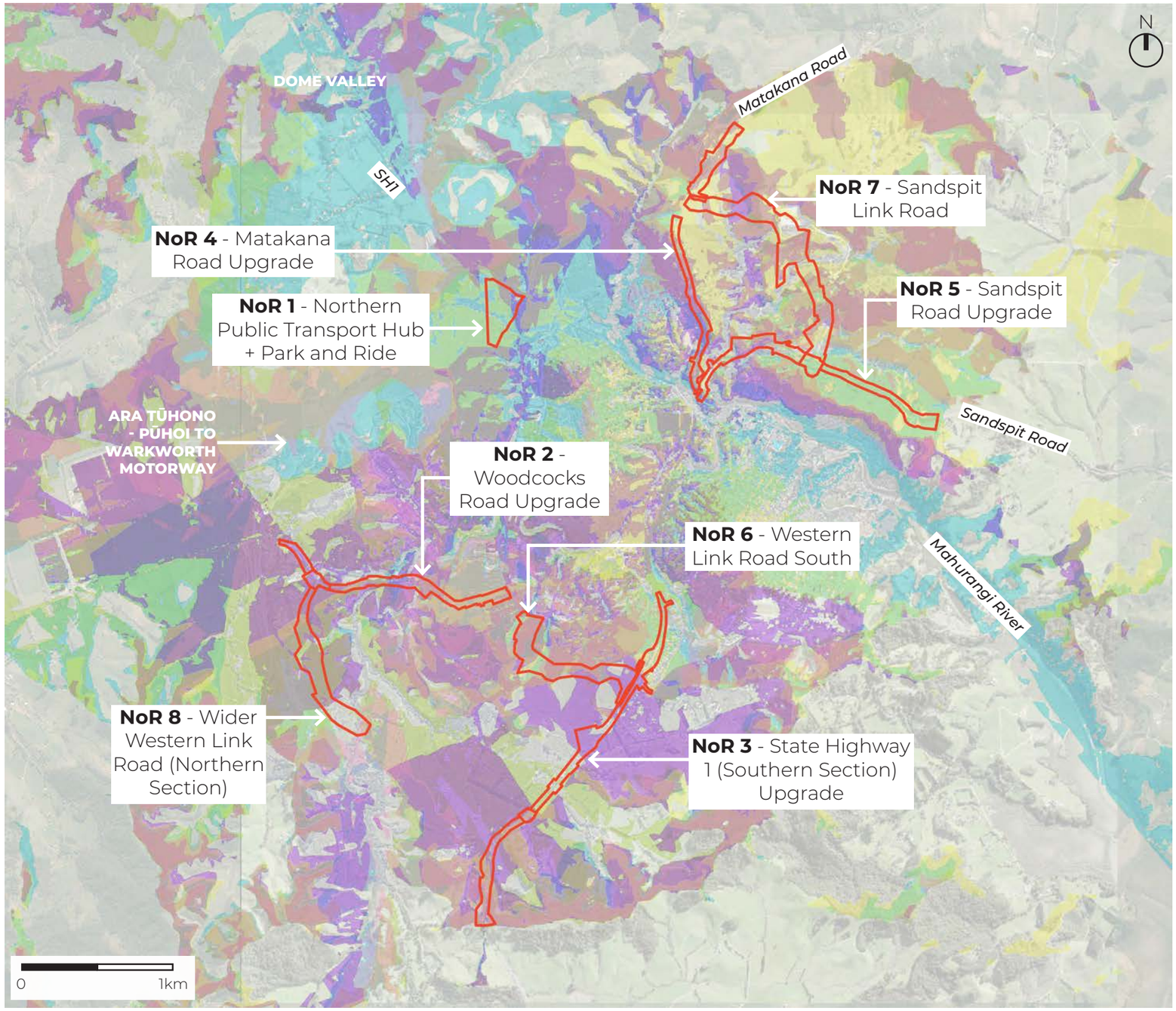
Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA008

Key

- Proposed Te Tupu Ngātahi Designation
- NOR 1&5 Viewshed
- NOR 1&6 Viewshed
- NOR 5 Viewshed
- NOR 7 Viewshed
- NOR 8 Viewshed



Map 09: Viewshed Map Overall

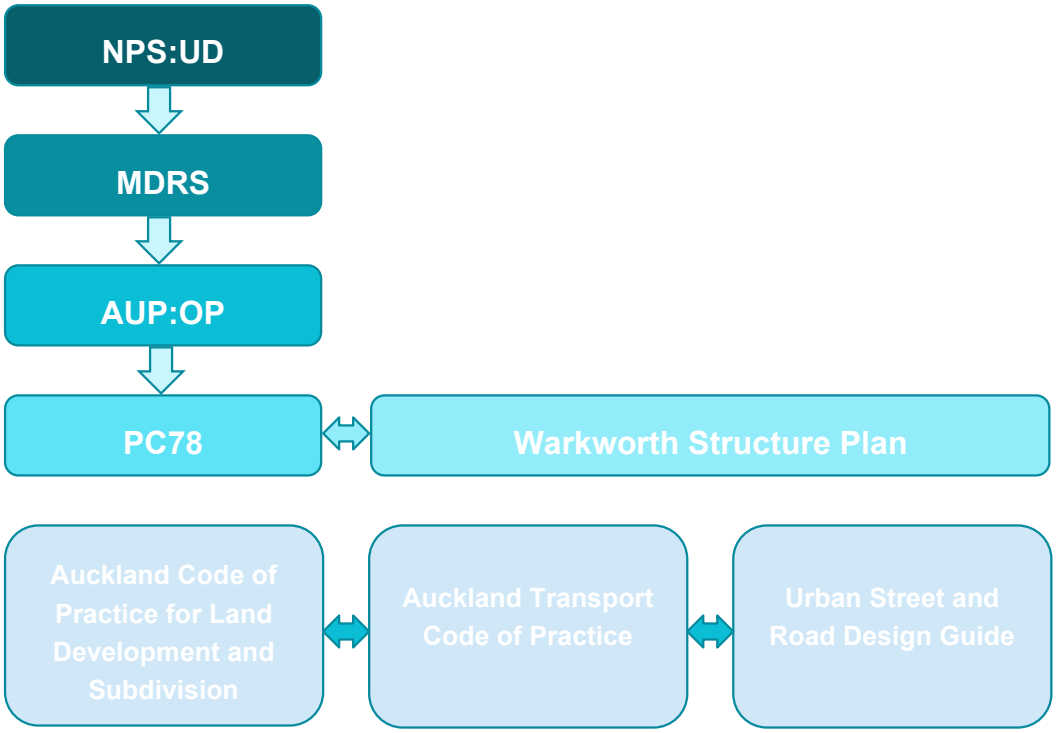
Project Name: Te Tupu Ngātahi Supporting Growth Alliance | Warkworth Network | Landscape and Natural Character and Visual Assessment

Date: 4 May 2023 **Scale:** 1:30,000 @A3 **Status:** Final for Lodgement **Revision:** 3 **Prepared By:** Maddie Palmer **Reviewed By:** Chantal Whitby

Figure: LA009

2 Appendix B: NPS:UD, MDRS, PC78 and Warkworth Structure Plan

Highlighted below are key aspects of the NPS:UD, MDRS, PC78 and Warkworth Structure Plan which are relevant to establishing the likely future environment for the Warkworth Package. The below figure illustrates the interrelationship of these documents, along with the AUP:OP, Auckland Code of Practice for Land Development and Subdivision, Auckland Transport Code of Practice, and Urban Street and Road Design Guide, discussed in Section 5.1.5 of the methodology.



NPS:UD and MDRS

A territorial authority may make the MDRS (and the relevant building height or density requirements under policy 3 of the NPS:UD) less enabling of development in a relevant residential zone only to the extent necessary to accommodate one or more qualifying matters. A qualifying matter makes higher density inappropriate in an area. Qualifying matters include RMA section 6 matters of national importance, including the preservation and protection of natural character from inappropriate subdivision, use and development.

PC78

Objectives and policies in PC78 relevant to establishing the likely future environment:

E38. Subdivision – Urban

E38.2. Objectives

(8) Subdivision maintains or enhances the natural features and landscapes that contribute to the character and amenity values of the areas.

(9) Subdivision to protect indigenous vegetation or wetlands is provided for in the residential zones.

(10) Subdivision:

(c) maintains the function of flood plains and overland flow paths to safely convey flood waters, while taking into account the likely long term effects of climate change.

E38.3. Policies

(3) Require subdivision design to respond to the natural landscapes by: (f) avoiding building platforms and, where practicable, infrastructure, on identified or dominant ridgelines on sites zoned Residential – Large Lot Zone or Residential – Rural and Coastal Settlement Zone;

(g) locating and designing roads, access and infrastructure in a manner which minimises earthworks; and

(h) locating roads and development to follow land contours.

(14) Encourage the design of subdivision to incorporate and enhance land forms, natural features, and indigenous trees and vegetation.

(22) Require subdivision to be designed to manage stormwater:

(d) to protect natural streams and maintain the conveyance function of overland flow paths;

(e) to maintain, or progressively improve, water quality;

(24) Require esplanade reserves or strips when subdividing land adjoining the coast and other qualifying water-bodies.

H3. Residential – Single House Zone

H5.2. Objectives

(5) Development does not adversely affect the environmental values of adjoining water bodies including riparian, lakeside and coastal protection areas and does not increase the impact from natural hazard risks.

(6) Development contributes to a high-quality built environment that is resilient to the effects of climate change.

(6A) Require development to achieve a built form that contributes to high-quality built environment outcomes by:

(f) minimising adverse effects on the natural environment, including restricting maximum impervious area on a site to reduce the amount of stormwater runoff generated by a development and ensure that adverse effects on water quality, quantity and amenity values are avoided or mitigated;

(11) Require buildings to be setback from water bodies to maintain and protect environmental, open space, amenity values of riparian margins of lakes, streams and coastal areas and water quality and to provide protection from natural hazards.

(15) Require buildings on sites subject to significant ecological areas to be of a scale that protects and maintains the significant ecological values of those areas.

Warkworth Structure Plan

The Warkworth Structure Plan is outlined as:

> *Warkworth is a Satellite Town that retains its rural, natural, and cultural character. It is centred around the Mahurangi River and has easy walking and cycling access around the town. There are a variety of high-quality residential neighbourhoods. Warkworth is largely self-sufficient with plenty of employment, education, shopping and recreation opportunities. Transport and other infrastructure are sequenced to support Warkworth's planned growth.*

The Warkworth Structure Plan planning principles are grouped under seven headings:

- The Mahurangi River is Warkworth's taonga
- Character and identity
- A place to live and work
- Sustainability and natural heritage
- A well-connected town
- Quality urban environment
- Infrastructure

Within these planning principles protection of the Mahurangi River from the effects of urbanisation is highlighted as a matter of paramount importance in the development of the FUZ, with the development of the FUZ used to improve the health and quality of the Mahurangi River wherever possible. As well as to treat all the tributaries in the FUZ as being vital to the health of the Mahurangi River.

The planning principles also direct the celebration and protection of Warkworth's heritage and its relationship with mana whenua, and the protection of views from the current town centre to the bush clad northern escarpment of the Mahurangi River and the rural views out from the FUZ that contribute to Warkworth's rural character. There is also direction to apply lower density residential zones to areas valued for their landscape, character, or heritage significance.

Sustainability and natural heritage are incorporated into the planning principles, including designing the FUZ to be able to adapt to the effects of climate change, and protecting and enhancing existing bush and natural areas and to create ecological corridors which link FUZ to other ecological areas.

The planning principles include principles regarding quality built urban environment which reinforces the Warkworth's identity, including a green network of walking and cycling trails along streams.

One of the key high-level features of the Warkworth Structure Plan includes:

> *Important areas for ecology, stormwater, heritage, or cultural values are set aside from any built urban development. This will help to improve water quality for the Mahurangi River, recover ecological linkages, create visual amenity, and enable possible public access for a network of walking/cycling trails.*

3.3.1.1 of the Warkworth Structure Plan notes that:

> *The Warkworth Structure Plan is built on the foundation of setting aside areas that are important for ecology, stormwater, heritage, and cultural values from any built urban development. These areas have been excluded from the development yield (they are assumed to have no dwellings or businesses on them… Auckland's natural environment is our primary infrastructure… The notion of protecting Warkworth's environment (particularly the Mahurangi River) as the town grows was a clear theme from public consultation on the structure plan in April 2018… Feedback from mana whenua has highlighted that the Green Network areas also have cultural value.*
>
> *The 'protection areas' include the following elements:*
>
> - *Flood plains*
> - *Streams with a 10m buffer*
> - *Wetlands*
> - *Significant Ecological Areas*
> - *Covenanted bush*
> - *Historic heritage extent of place area*

The Warkworth Structure Plan also discusses the treatment of existing landform, particularly under section 3.3.10.4 Landscape and 3.3.10.5 Urban Design. The Warkworth Structure Plan proposes the retention of significant landforms through the application of Large Lot zoning. It recommends the concentration of development in general being within the lower lying areas of the catchment, with larger lot types of development on elevated ridges, hills and knolls, such as around Sandspit Link. The Warkworth Structure Plan also recommends that new development is sympathetic to the character of the existing settlement and landscape context.

The Warkworth Structure Plan provides an indication of potential future zonings (illustrated in the graphic below) with actual zonings and land use to be confirmed through future statutory processes such as a plan change.

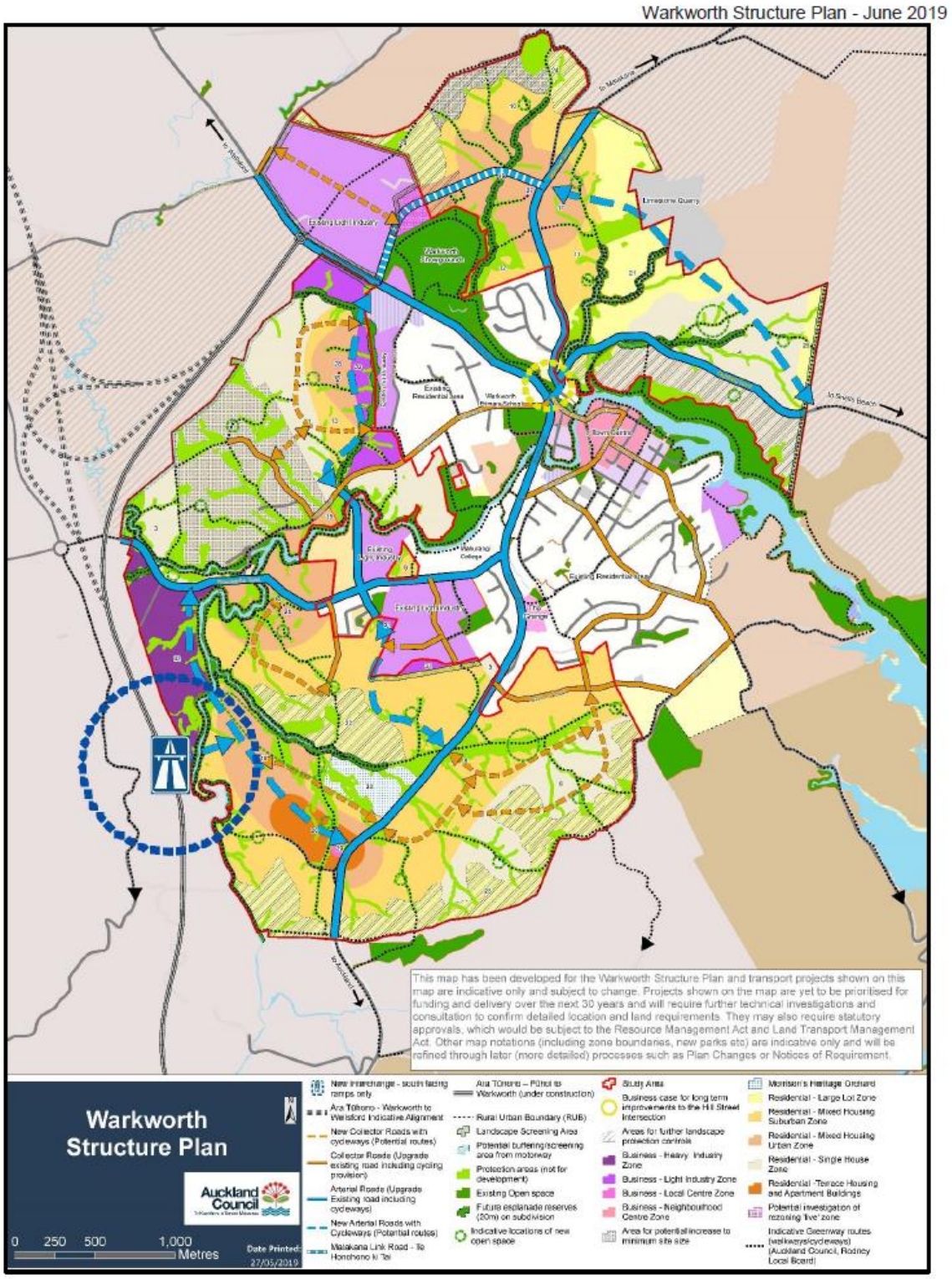


Figure 1: Warkworth Structure Plan – Land use plan

3 Appendix C: Effects ratings and RMA Terminology

Te Tangi a te Manu provide some guidance on how the seven-point rating scale relates to RMA terminology (illustrated in the table below):

"the terms can be described as follows:
- 'More than minor' can be characterised as 'moderate' or above.
- 'Minor' adverse effects means some real effect but of less than moderate magnitude and significance. It means the lesser part of the 'minor-moderate-major' scale. 'Minor' can be characterised as 'low' and 'mod-low' on the 7-point scale.
- 'Less than minor' means insignificant. It can be characterised as 'very low' and overlapping with 'low' on the 7-point scale.

However, avoid an overly mechanical approach: "One is dealing with degrees of smallness. Where the line might be drawn between the three categories might not be easily determined." There are different interpretations within the profession as to where the boundaries of such categories precisely fall. The key is to be transparent and explain the reasons to justify a professional judgement. The 7-point scale is a rating of magnitude, whereas an assessment of whether effects are minor (or less than or more than) is a reasoned consideration of the magnitude and importance (significance) of such effects in context. Assess the individual effects first using the 7-point scale in the normal manner. Following that, consider whether the adverse effects are minor (or less than or more than) in the context of the relevant test."[41]

	Effects rating scale	**RMA terminology**
	Very low	Less than minor effects
	Low	Minor effects
	Low-moderate	Minor effects
	Moderate	More than minor effects
	Moderate-high	More than minor effects
	High	Significant effects
	Very high	Significant effects

[41] Te Tangi a te Manu: Aotearoa New Zealand Landscape Architects Guidelines (page 150 - 151).

ATTACHMENT 70

ASSESSMENT OF FLOODING EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Flooding Effects

May 2023

Version 1.0

Document Status

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Revision Status

Version	Date	Reason for Issue
1.0	12/05/2023	Issue for lodgement

Table of Contents

Glossary of Abbreviations, Defined Terms and Acronyms

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
ARI	Average Recurrence Interval
AT	Auckland Transport
AUP: OP	Auckland Unitary Plan: Operative in Part
CEMP	Construction Environmental Management Plan
GD01	Auckland Council Guideline Document: Stormwater management devices in the Auckland region, GD2017/001 (an update of TP10)
GD05	Auckland Council Guideline Document: Erosion and Sediment Control Guide, GD2016/005
LGA	Local Government (Auckland Council) Act 2009
MfE	Ministry for the Environment
MPD	Maximum Probable Development
NES	National Environmental Standard
NPS	National Policy Statement
NPS: FM	National Policy Statement on Freshwater Management
NPS: UD	National Policy Statement on Urban Development
NoR	Notice of Requirement
P2W	Puhoi to Warkworth State Highway currently under construction
RCP	Representative Concentration Pathways relating to future climate change scenarios
SEA	Significant Ecological Area
SH1	State Highway 1
SMAF	Stormwater Management Area: Flow
SRP	Sediment Retention Pond
Te Honohono ki Tai	Te Honohono ki Tai / Matakana Link Road project
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

Defined Terms and Acronyms

Acronym / Term	Description
AT	Auckland Transport an Auckland Council controlled organisation.
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Dry Pond	A permanent pond that is normally dry but during rainfall events temporarily stores stormwater runoff to control discharges. Dry wetlands provide limited water quality treatment.
Freeboard	An allowance above the modelled flood level, be it road level or other features (e.g. existing floor level). For buildings freeboard shall be measured from the top water level to the finished floor level. The relevant design manual shall be referred to for the appropriate freeboard and method of calculation.
Lay down areas	An area that has been cleared for the temporary storage of materials and equipment and may include site compounds, stockpiles, sediment retention wetlands.
MPD	Maximum Probable Development according to the AUP: OP zonings and the Auckland Council Healthy Waters technical memorandum dated
Pre-development	Prior to construction of the Project
Post-development	After construction of the Project
Warkworth Assessment Package	Made up of eight Notice of Requirement
Stormwater Wetland	Constructed wetlands that temporarily store runoff and support conditions suitable for the growth of wetland plants. Stormwater wetlands provide enhanced water quality treatment of stormwater runoff through vegetation uptake, retention and settling.
Terrain	An elevation model which includes the ground levels based on 2016 LiDAR and the concept design ground levels.
Wetland	A permanent pond that has a standing pool of water and provides water quality treatment, and storage of stormwater runoff to reduce the peak water volume from a rainfall event and provide downstream erosion protection.

1 Executive Summary

1.1 Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight notice of requirements (NOR) including new corridors, existing road upgrades, and a public transport interchange with park and ride.

Flooding is a natural hazard and has therefore been considered as part of the Warkworth NOR to assess if the SGA proposals will impact that flooding using the Auckland Council Healthy Waters (ACHW) model that AECOM recently updated to understand the existing flood risks. Note that the model has not been sent to AC HW for review and acceptance so the results are preliminary and have been compared to those published on the AC Geomaps site and the proposed NOR has not been modelled to assess the impacts.

The land required for mitigating future stormwater impacts have also been considered; bridges and culverts, attenuation and treatment of runoff NOR impervious surfaces and impacts on stream diversions or flow paths.

Flood modelling will be required at the detailed design phase to confirm the final corridor design will comply with the NOR conditions. It is also acknowledged that there will be a subsequent outline plan process and process for seeking regional resource consents which will address potential stormwater quantity and quality effects and will require additional detailed modelling and design in future.

In the context of this assessment, flood hazard risk may include changes to:

- the flood freeboard to existing habitable buildings, overland flow paths
- the ability to access property by residents and emergency vehicles
- the level of flooding to roads and flooding arising from the blockage of stormwater drainage
- effects to existing habitable buildings / infrastructure and potential future effects on upstream and downstream properties.

1.2 Methodology

The assessment of flooding effects for the Warkworth NoR involved the following steps:

- Desktop assessment to identify potential flooding locations
- Modelling of the pre-development terrain with future Maximum Probable Development (MPD) and 100year Average Recurrence Interval (ARI) plus climate change rainfall using the latest AC HW model. MPD allows for the maximum allowable impervious coverage as per the AUP: OP zonings and the AC Healthy Waters memo of 4 Sept 2019.Two future climate scenarios were modelled, allowing for 2.1°C and 3.8°C of temperature increase
- Producing flood level maps for the pre-development scenario to show the flood levels and extents (greater than 50 mm deep) that need to be considered
- Inspection and review of flood maps at key locations such as proposed bridges, culverts, wetlands and major earthworks.

While stormwater effects (apart from flooding) were not assessed, provision is made for the future mitigation of potential stormwater effects (stormwater quantity, stormwater quality and instream structures) by identifying the space required for stormwater management devices (for example wetlands) and incorporating land for that purpose into the proposed boundaries.

1.3 Assessment of effects

1.3.1 Overall Warkworth Network

The flooding assessment for the Warkworth catchment has been completed using the pre-Te Tupu Ngātahi development (base case) and AC Geomaps model results.

The main flood effects that may impact the proposed Te Tupu Ngātahi transport corridors and adjacent property are associated with streams, ponding / depression areas and overland flow paths rather than urban pipe network issues. Flooding is associated with excess flow that the primary network cannot cope with and where ponding can occur, or overland flow exceeds Auckland Council hazard criteria (flow and depth).

Positive effects

The main positive effects that could be designed for are:

- proposed roadways to be above the flood plains, particularly existing overtopping roads
- added water quality treatment and attenuation of the total roadway impervious area as opposed to just the additional roadway area, previously existing impervious road areas may not have been treated
- attenuation of the total impervious area associated with the new or widened roadways which reduces the overall runoff rates back to pre-SGA development.

Construction effects

The proposed construction works which could potentially result in flooding effects include raised road formations, temporary works for proposed bridges and culverts restricting flows, interruption of flow paths by new wetlands and temporary laydown or construction areas.

The management and mitigation measures for construction effects are:

- Setting the earthwork construction period during typically drier periods
- Locating lay down and construction areas outside of flooding and overland flow paths
- Temporary diversions for bridge, culvert and wetland construction
- Manage overland flow paths to reduce the risk of increased flooding
- Construction Environmental Management Plans developed and implemented, including continuous improvement as necessary.

Operational effects

The potential operational effects are:

- Increasing impervious areas leading to extra peak runoff and exacerbating flooding
- Altering or obstructing existing overland flow paths
- Changing flows through bridge or culvert crossings

- Increased impervious area to treat for treatment, attenuation or both dependent on the location of the device in the catchment.

Mitigation measures which may be implemented include:

- Detailed flood modelling of the detailed final corridor design during the later design stage to meet designation condition requirements and optimise bridges, culverts and wetlands will be needed to assess cumulative effects of upstream NOR on downstream NOR (e.g NOR 8 on 2, NOR 3 on 2 and NOR 7 on 5)
- Designing culvert sizes so that the upstream and downstream water level differences do not increase by more than 0.05m on land zoned for urban development or no increase for existing floors at risk of flooding. Culverts will be designed for the 100yr future ARI event and checked to ensure that there is no increase in water level upstream or downstream of culverts. Checks will also be made of capacity reduction in accordance with the Auckland Council Code of Practise (Jan 2023) to understand overland flow paths and water level impacts of this capacity reduction. This will be completed in later detailed design stages
- Providing overland flow paths to avoid creating flood prone areas
- Installing drains at the toe of embankment sloping towards the culverts can also provide additional storage to decrease the velocity and peak flow through the culvert crossings
- Installing drains at the top of cuttings to reduce water entering the cutting
- Providing space for wetlands for treatment and attenuation as needed.

A Flood Hazard condition is also recommended which will require the future detailed design of the transport corridors to be designed to achieve specific flood risk outcomes – refer NOR condition sets.

1.3.2 Warkworth Network Summary of Effects and Recommendations

The main potential flooding issues within the proposed Warkworth SGA Network are:

- Very large catchment flows and potential flood effects for NOR associated with the Mahurangi River upstream of Woodcocks Rd (NOR 2 and 8)
- Existing roads predicted to overtop and proposed to be raised to flood protect the roads (e.g. NOR 2, 3 and 5)
- New formations /bridges / culverts over or near existing streams
- Earthworks for roadway, construction of wetlands, deep cuttings and large fills
- Flood plain storage loss
- Treatment for water quality only in areas near downstream ends of catchments

The summary of the main issues and recommendations are shown in Table 1 below.

Table 1. Warkworth Network summary of Effects and Recommendations

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Mahurangi River bridges require works in river (such as temporary works) which can restrict flows. Also the very large upstream catchments can create very large flows. New bridges and piers must be built over existing river and will therefore be exposed to the flood risk	Large flows passing through the bridge construction site could cause scour and temporary works to be washed away or could be obstructed by temporary works and cause upstream flooding. Major diversions are not feasible. Works require controls to reduce the risk	NOR2 and NOR8: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for and warning systems for larger events as part of the plan.
SH1 culvert upgrade at PT Hub will increase downstream water levels and flows therefore increasing construction flood risk in PT Hub	Greater flood flows from the larger pipe along with works which could reduce flood storage (wetland, embankment and bridge construction) could cause the site to become inundated and spill over on to adjoining land during construction.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Existing flood plain storage volume loss with new embankments in flood plains could increase flood levels at culverts/bridges	Flood plain levels upstream and downstream of new formations may not achieve flood mitigation targets unless conveyance beneath the formation (bridges or culverts) is	NOR1, 2, 7 and 8: Detailed modelling to assess best option to meet Flood Hazard condition requirements for upstream and downstream water levels.

Effect	Assessment	Recommendation
	designed appropriately - additional cross conveyance capacity may be needed.	
Raising existing roads above the predicted 100yr future flood levels could increase upstream flood levels.	Greater protection of road to flooding will require increased flow capacity beneath the road with the aim of flood neutrality upstream and downstream of the raised road formation	NOR 2, 3 and 5 Optimisation of bridge or culverts through later detailed modelling (of the detailed design) and design to achieve flood consent conditions.
Mahurangi River bridges with large predicted flood flows could have significant effects on flood levels if not carefully designed to achieve flood level requirements	Bridge opening could impact upstream and downstream water levels so it needs to be optimised to minimise changes to flood levels.	NOR2 and NOR8: Detailed modelling (of the detailed design) of the bridge and associated formation design during later design stages to optimise bridge opening to meet consent conditions.
Deep cuttings without benches will increase flood flows into cuttings thus increasing conveyance needs, concentrating flows at discharge points	Increased flood conveyance and concentrating flows could exacerbate existing flooding needs at discharge points.	NOR6 and NOR7: Benches for deep cuts to reduce face runoff into cutting. Cutting design needs to optimise top of face drains, benches and base conveyance to reduce concentrated flows and flood risk
SH1 pipe upgrade from 1.2 to 2.4m will increase downstream flows and water levels in PT Hub area.	The increased flow rate and water levels downstream of the 2.4m culvert and the available flood storage needs to be understood as it will impact wetland, embankment and bridge design.	NOR1. Design of wetland, embankments and bridge needs to be optimised to reduce flood levels in line with consent conditions. Detailed design and modelling needed at later stages.
Wetlands for treatment only will reduce footprint needs	Downstream wetlands could be water quality only (GD01) as opposed to treatment and attenuation	NOR4 and NOR5: Detailed modelling (of detailed design) to show attenuation not needed during later design stages.
Bridge over existing stream could create upstream flood water level increase	Bridge opening size needs to be optimised in line with consent conditions	Detailed modelling (of the detailed design) of the bridge and associated formation design during later design stages also ties in with Sandspit Rd bridge to meet consent conditions

1.3.3 Conclusions

Later detailed design and any associated modelling of this design will give further consideration to potential NOR flooding effects to identify how the post SGA flooding effects of the final design will be managed to achieve the consent conditions.

The positive flooding effects are primarily associated with raising existing roads out of the flood plain (NOR 2, 3 and 5) that are currently predicted to flood in the future 100yr events .

The construction management and mitigation controls apply to all NOR.

The flooding effects and controls within the Warkworth assessment area are associated with:

- P2W increase of the existing SH1 culvert from 1.2 to 2.4m which will increase downstream flows and water levels. This needs to be modelled to fully understand the risk.
- the large potential flood flows upstream of NOR 2 (Woodcocks Rd) and 8 (Wider Western Link Rd). Monitoring of rainfall upstream of these sites should be completed to prepare and control effects of any large rainfall flood flows;
- the raising of Sandspit Rd where the current bridge is predicted to overtop will require construction controls and flood modelling / design to optimise the bridge level / opening to meet consent conditions, and;
- raising of SH1 Southern section above the predicted 100yr flood plain will also require optimisation of the construction method and number / size of bridge openings through later detailed design and modelling to meet consent conditions.

The assessed flood effects can be managed by adjusting the proposed road geometry and changing the culvert and bridge opening areas so that the proposed NOR conditions will be met. In particular, the conditions require that there will be no increase in flooding of existing identified flooded habitable floors and no more than 50mm change to flood levels within properties.

The detailed design of stormwater management will also be subject to regional consenting requirements.

2 Introduction

This stormwater flooding assessment has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60km from the Auckland city centre, and 30km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP: OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. 1,000Ha of currently rural land has been rezoned (Future Urban Zone) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business land is already live zoned and remainder to be development ready by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 – 20 years.

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 2.

This report addresses the stormwater flooding effects of the Warkworth Package (NOR 1 – NOR8) identified in Table 4 and Figure 3 in Section 3.

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

2.2 Purpose and scope of this Report

This Flooding and Stormwater assessment forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NoRs sought by AT and WK.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Warkworth Package on the existing and likely future environment as it relates to

Flooding effects and recommended measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the Flooding context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential Flooding effects of each Project corridor within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential Flooding effects (including any conditions/management plan required) for each Project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project. The AEE also contains a detailed description of works to be authorised within each NoR, and the typical construction methodologies that will be used to implement this work. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

During the later outline plan and regional consenting phase additional detailed modelling and design will be completed to refine the proposed design to quantity and optimise the Flooding and Stormwater effects to meet to meet designation Flood Hazard condition requirements. The detailed design of stormwater management will also be subject to regional consenting requirements.

2.3 Report Structure

In order to provide a clear assessment of each NoR, this report follows as appropriate, the structure set out in the AEE and shown in Table 2 below. Table 2 below the extent of each corridor, and which section covers the description of effects can be found.

This report contains an assessment of the actual and potential effects of the Warkworth project on an overall catchment basis as well as the individual corridors having their own sections explaining if there are specific issues for each. Where appropriate, measures to avoid, remedy or mitigate effects are recommended for catchment wide and specific flooding and stormwater issues.

Section 6 identifies general predicted flooding and stormwater effects on an overall catchment basis whilst section 7 to 14 covers specific issues for each NOR.

Table 2. Report Structure

Sections	Section number
Description of the Project	3
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	4

Sections	Section number
Identification and description of the existing and likely receiving Flooding and Stormwater environment;	5
Assessment of general Flooding and Stormwater matters for all Warkworth NoRs	6
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 1	7
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 2	8
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 3	9
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 4	10
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 5	11
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 6	12
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 7	13
Assessment of specific Flooding and Stormwater matters for Warkworth NOR 8	14
Overall conclusion of the level of potential adverse Flooding and Stormwater effects of the Warkworth Project	15

3 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NoRs including public transport interchanges, existing road upgrades, and new corridors.

An overview of the Warkworth network is set out in Table 3 and shown in Figure 1.

Table 3. Warkworth NOR Package

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Hub and Western Link – North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road - West	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport
State Highway 1 – South Upgrade	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Matakana Road Upgrade	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Western Link – South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport
Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Wider Western Link – North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

Figure 1. Warkworth NOR package Overview

4 Assessment Methodology

The assessment of flooding effects has involved the following steps using the Auckland Council and Te Tupu Ngātahi GIS.

- Desktop assessment to identify potential flooding locations, namely:

– Existing buildings appear to be near/within the existing flood plains.
– Where works are near stream crossings and major overland flow paths.

- Flood modelling of the pre-development (without Te Tupu Ngātahi) terrain, including:

– Flood modelling of the proposed future land use using Maximum Probable Development (MPD) development with the 100year ARI plus climate change rainfall using both 2.1 and 3.8° temperature increases. MPD allows for the maximum allowable impervious coverage as per the AUP: OP zonings and the AC Healthy Waters memo of 4 Sept 2019.
– Model results were used to identify potential changes in the flood water levels for the two climate change scenarios to understand the risk of future increased climate change impacts.

- Inspection of the flood maps to identify flooding effects, including:

– At key cross drainage locations such as culverts and where there are noticeable deep flood levels, consideration was given to flood hazard issues.
– Properties and buildings with habitable floors showing potential to flooding hazard through flood extent within the existing building footprints.

Stormwater effects apart from flooding were not assessed, with this to be undertaken through the regional consenting phase at detailed design**,** provision was made for the future management of potential stormwater effects (stormwater quantity and quality) by identifying the space required for stormwater management devices (i.e. treatment and attenuation wetlands) and incorporating land for that purpose into the NORs and designations.

In identifying the land required for these devices, preliminary sizing and siting has been undertaken and extra space allowed for constructing the works. Potential sites are shown for each of the specific NORs.

Some key assumptions that were used to identify the amount of land sought for stormwater management works within the designation include the following:

- Wetlands are sized to attenuate 100year peak flows from the corridor (as this gives the largest footprint) using a rule of thumb of 10% of the specific impervious catchment area provides the wetland footprint
- Quality and retention/detention requirements are able to fit within the footprint
- Allowance is made for wetland attenuation storage and hydraulic gradients from corridor inlet to discharge point (typically a minimum of 2.0 to 2.5m vertically)
- Wetland geometry and footprints were modelled to determine the required cut and fill and a 15m buffer added for construction purposes and maintenance access
- A minimum 6m buffer is provided around the corridor earthworks extents to provide space for construction purposes and allow for works such as drainage channels and culvert inlets/outlets and flexibility in the vertical alignment

- Diversion channels are identified where they are needed to prevent upstream flooding.

These allowances are considered appropriate for sizing the devices at this early stage of the design process and also provide some flexibility for future refinement. The design of devices is not discussed further in this report as this is considered a matter that will be developed further for the future regional consenting phase and implementation processes.

4.1 Methodology

The assessment looked at the construction and operational impacts associated with each of the NOR using the Rev B drawings to understand the potential locations for flooding and stormwater effects to occur.

Overland flow paths are shown as blue lines in Figure 2 below with line thickness and solidness indicating the relative order of the flow rate (dotted = < 0.5m^3/s, thinner solid blue 0.5 to <2 m^3/s and thicker solid blue > 2 m^3/s).

Flood prone areas (black hatched areas in Figure 2) are where there is a potential depression upstream of an inlet which will create flooding / ponding if that inlet blocks (e.g. culvert inlet).

Flood plains are based on ponding areas, and overland flow rates (> 2 m^3/s). If there are areas of flooding upstream associated with a depression (that exceeds certain criteria) then downstream overland flow from that flooding depression area only needs to exceed 0.5 m^3/s to be considered flood plain.

Note the flood plain extent shown in Figure 3 is based on AC Geomaps which shows the modelling was completed in August 2017 by Auckland Council. It is understood that Auckland Council are in the process of updating this modelling and when complete will update Geomaps accordingly.

The required freeboard for bridges and culverts used to assess the suitability of the indicative design is set out in Table 4: Freeboard allowance for the level of serviceability to traffic (NZ Bridge Manual).

Table 4: Freeboard allowance for the level of serviceability to traffic (NZ Bridge Manual)

Waterway Structure	Situation	Freeboard	
		Measurement Points	Level (m)
Bridge	Normal circumstances	From the predicted peak flood water level to the underside of the superstructure	0.6
	Where the possibility that large trees may be carried down the waterway exists		1.2
Culvert	All situations	From the predicted flood water level to the road surface	0.5

Figure 2: Overland flow paths, flood prone areas and flood plains (source AC Geomaps January 2023)

4.1.1 Construction

Construction effects apply to the entire project, however, are more likely at locations within or adjacent to overland flow paths, permanent streams, flood prone or flooding areas.

4.1.2 Operational

There are a range of operational effects particularly from proposed road crossings (formations, bridges and culverts) over permanent steams / rivers and overland flow paths.

Future detailed design will be subject to a separate flooding assessment at the outline plan and regional consenting stage and location / size plus type of treatment (attenuation, water quality or both).

For the project the assessment of operational flooding and stormwater effects considered:

- Proposed culvert and bridge crossings

- Areas where the new road embankment encroaches onto predicted flood plain and flood prone land
- Raised road levels where previously the road overtopped
- Land requirements for treatment wetlands and devices.
- The potential of flooding on existing properties due to the new project corridor and associated works.

4.2 Preparation for this Report

In preparation of this report several resources were used to support the assessment. These included technical specialist inputs, previous reports including Auckland Council Geomaps, catchment flood models and team workshops. The Auckland Council Mahurangi flood hazard model was used as the basis for this assessment and minor improvements made to the model to reduce model instabilities and issues.

While Project wide site visits were undertaken, no site specific site visits were undertaken for this assessment as the work has been based on publicly available information discussed above and flood modelling done by Te Tupu Ngātahi.

The AUP: OP was used to identify the existing and likely future environment.

Information from the Project Team and Te Tupu Ngātahi Warkworth base case model was used to assess the flood water levels and extents of the existing (pre-development) terrain based on the Auckland Council 2016 LiDAR.

5 Existing and likely receiving flooding environment

The projects encompassing the Warkworth NOR package will be constructed 15-20 years from now. The implementation timeframe for each project will vary and correspond with future land release within the area. Assessing the effects on the environment solely as it exists today (i.e., at the time of assessment) will not provide an accurate reflection of the environment in which some of the effects will be experienced. Accordingly, the assessment of effects considers both the existing environment, and the likely receiving environment in which the effects will likely occur.

The Warkworth NOR package falls within the Warkworth stormwater catchment with an overall area of approx. 5,893Ha, with the township of Warkworth at its outlet. The extent of the catchment is shown in Figure 3 with its outlet environment being the Mahurangi Harbour.

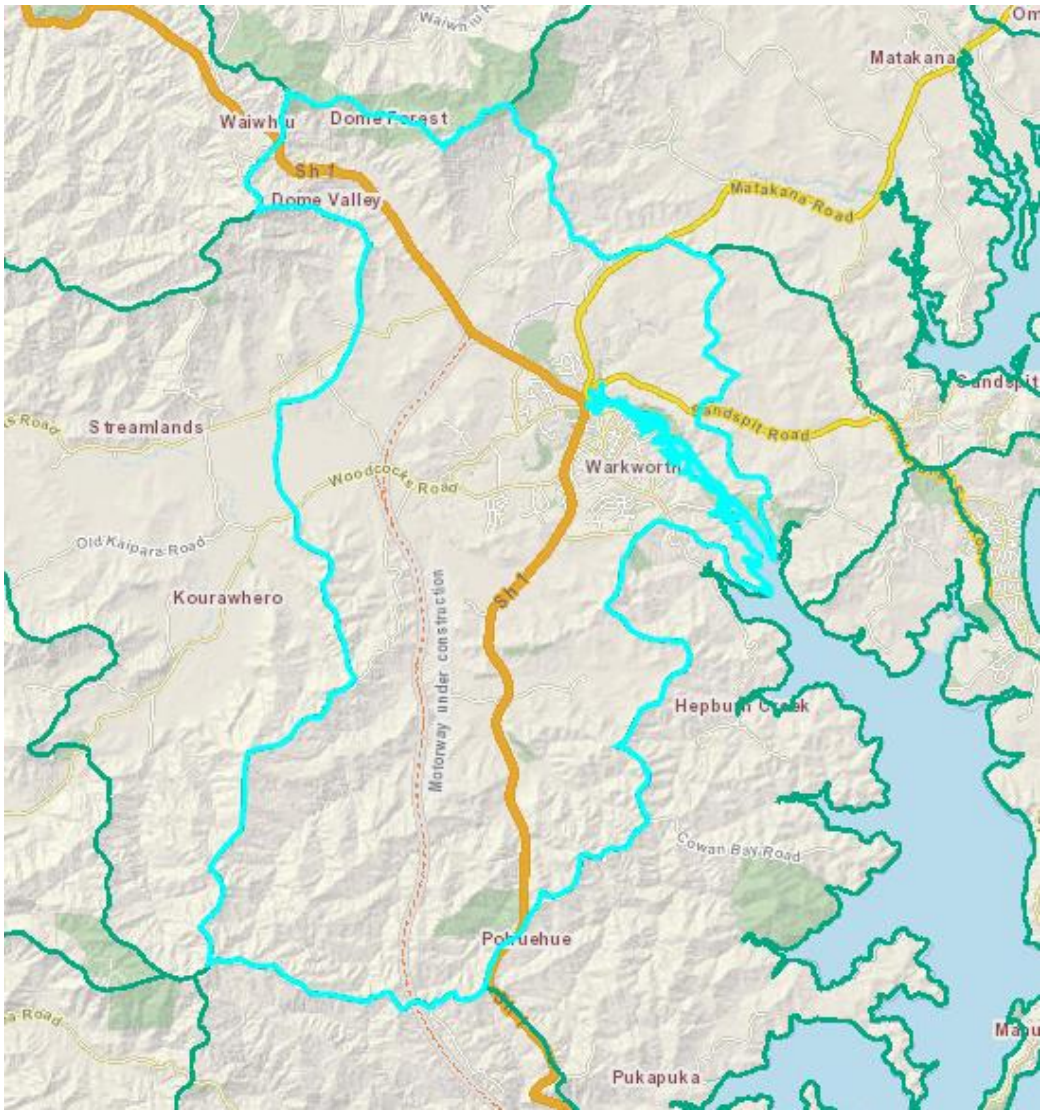

Figure 3: Warkworth stormwater catchment boundary

The main river running through the catchment is the Mahurangi River with over 2,454Ha of rural land upstream of the Wider Western Link. The main floodplains and permanent streams for the catchment are shown in Figure 4.

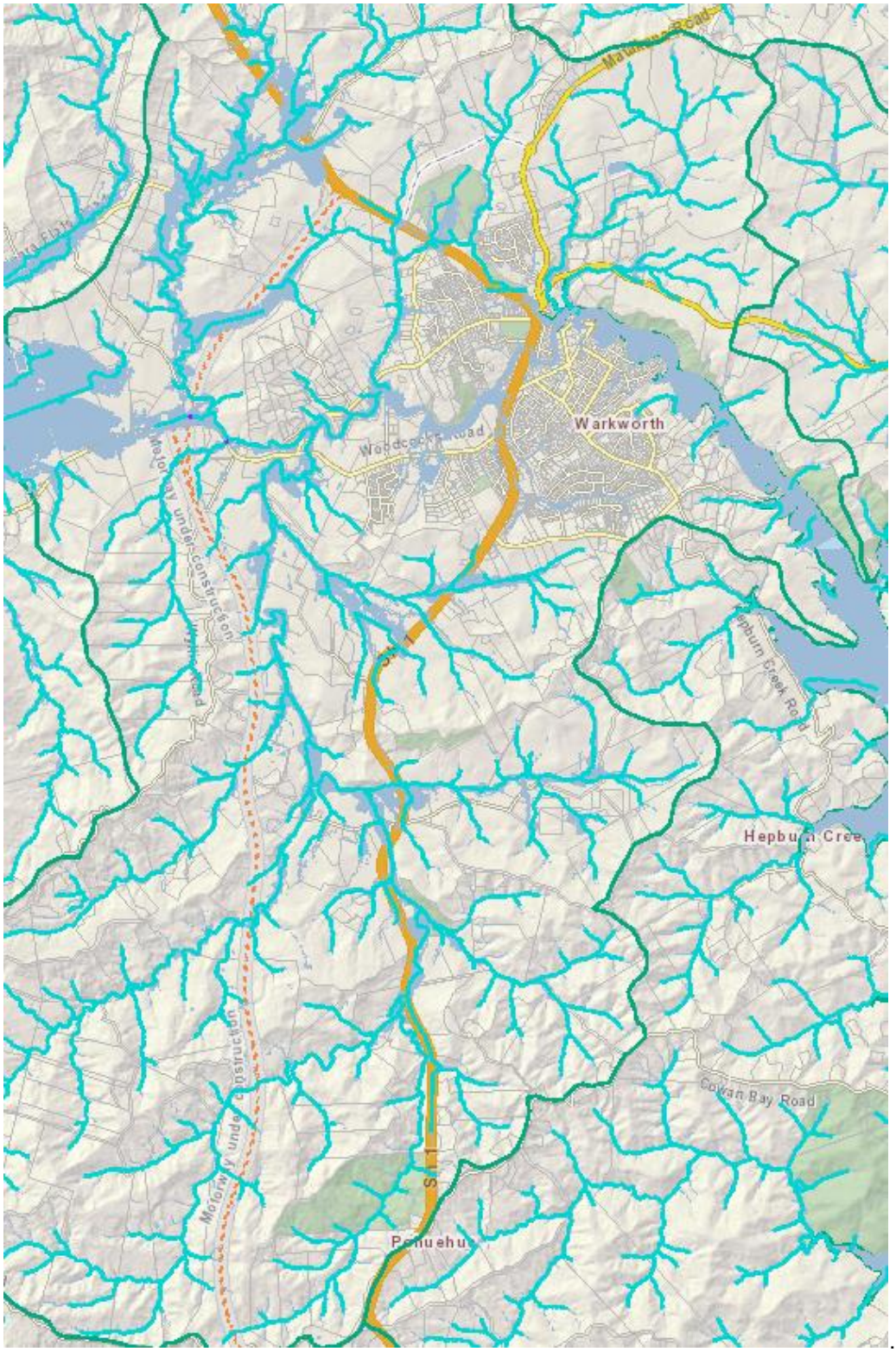

Figure 4: Permanent streams and flood plains (AC Geomaps 2023)

The Warkworth NOR package will be constructed and will operate alongside existing urban environments or planned future environments (i.e. what can be built under the existing Auckland Unitary Plan: Operative in Part (AUP: OP) and what is identified in the Warkworth Structure Plan):

1. **Existing environment:** A number of corridors comprising the Warkworth NOR package are partially located within / alongside existing urban areas.

a) Matakana Road Upgrade – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
b) Western Link South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.
c) State Highway 1 (Southern Section) – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
d) Woodcocks Road – the eastern extent of the corridor has existing residential land uses to the north and south.

2. **Future environment**: All the corridors in the Warkworth NOR package will partially or wholly be constructed and implemented on land identified for future growth (Future Urban Zone) and as a result are anticipated to change to urban or industrial land uses.

The likelihood and magnitude of land use change regarding the land use planning context has been identified in Table 5. Likelihood and magnitude of land use change below. This has been used to inform the assumptions made on the likely future environment.

Table 5. Likelihood and magnitude of land use change

Existing environment	Current AUP: OP Zoning	Likelihood of Change for the environment[1]	Magnitude of potential change	Likely Receiving Environment[2]
Residential[3]	Residential (Mixed Housing Suburban)	Low	Low	Residential
	Residential (Mixed Housing Urban)	Low	Low	Residential
	Residential (Single House)	Low	Low	Residential
Business	Business (Mixed Use)	Low	Low	Business (Industrial)
	Business (General Business)			Business (General Business)
	Business (Light Industry)	Low	Low	Business (Industrial)
	Business (Local Centre Zone)	Low	Low	Business (Neighbourhood Centre)
Open Space	Open Space – Conservation Zone	Low	Low	Informal Recreation
Greenfield areas	Future Urban Zone	High	High	Urban

[1] Based on AUP:OP zoning/policy direction
[2] Based on Warkworth Structure Plan and AUP:OP zoning/policy direction

Existing environment	Current AUP: OP Zoning	Likelihood of Change for the environment[1]	Magnitude of potential change	Likely Receiving Environment[2]
Other	Special Purpose – Quarry Zone	Low	Med	Quarry

Refer to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the Warkworth NOR package.

6 Warkworth NoRs – Overall network

This section assesses common or general flooding and stormwater matters across the overall Warkworth Project (i.e. the combination of public transport interchanges, existing road upgrades and new corridors).

This section also recommends measures to avoid, remedy, or mitigate actual or potential adverse effects for the overall network.

Corridor-specific matters are further discussed in the following report sections 7 to 14.

The Warkworth network projects all have the same common features:

- New or widened / improved roads with formations and bridges / culverts over existing streams;
- Treatment / attenuation wetlands normally located near an existing stream crossing with the aim to optimise number, location and sizing of wetlands. Sizing of the wetlands governed by attenuation needs rather than treatment alone
- Where existing roads are widened treatment of the entire road impervious area will be designed to improve downstream water quality
- Streams and floodplains impacted by construction and operation of the NORs.

6.1 Overview and description of works

The Warkworth NOR package falls within the Warkworth stormwater catchment with an overall area of approx. 5,893Ha, with the township of Warkworth at its outlet. The extent of the catchment is shown in Figure 5.

Figure 5: Warkworth stormwater catchment boundary

The main river running through the catchment is the Mahurangi River.

The works covered in this technical assessment were as follows:

- Assessment of the future predicted flood plains based on Auckland Council Geomaps and the Te Tupu Ngātahi modelling for the network and terrain that exists now
- Flooding impacts associated with new road alignments
- Location and sizing of wetlands for stormwater quality treatment, retention and attenuation

6.2 Assessment Features

Existing flooding at proposed NOR bridge or culvert crossings needs to be carefully considered in later modelling and design stages to reduce the potential for increased flooding due to proposed formations reducing available flood storage volume and maintaining as much as possible flood neutrality, particularly areas of future development (upstream and downstream of the NOR).

Predicted flooding impacts of the Warkworth network become greater the closer you get to Warkworth, particularly along the Mahurangi River branch.

6.3 Positive flooding and stormwater effects

The main positive effects that could be designed in the Warkworth NOR are:

- proposed new roadways to be above the predicted future flood plains,
- proposed widened and improved roadways to be above the predicted future flood plains, particularly existing overtopping roads (e.g. Sandspit Rd and SH1 Southern section)
- ability to convey flows without worsening flooding impacts upstream or downstream of the works
- added water quality treatment and attenuation of the total roadway impervious area as opposed to just the additional roadway area for upgraded roads.

6.4 Assessment of construction effects

The proposed construction works which could result in flooding effects include:

- Construction of new culvert crossings or upgrading of existing culvert crossings or bridges
- Installation of diversion drains / realignment of existing overland flow paths or natural streams, as a last resort
- Construction of new attenuation wetlands or upgrading of existing attenuation wetlands
- Temporary use of lay down and construction areas.
- Bulk earthworks to complete the contouring for new landscape features, (e.g. attenuation wetlands and new or upgraded culverts) require a dry works area and can alter overland flow paths or generate erosion and sediment effects
- The siting of attenuation wetlands within an existing overland flow path can obstruct runoff and result in flows being diverted towards existing properties due to the need for embankments
- The location and number of wetlands.

6.5 Recommended measures to avoid, remedy or mitigate construction effects

The management and mitigation measures for construction effects are outlined below.

General

- Carrying out earthworks during the summer / dry months to reduce the risk of flooding
- Regular monitoring of predicted rainfall, particularly extreme events with high volume or intensity can then prepare for impact
- Locating lay down areas outside of predicted overland flow paths and flood plains, where possible
- Managing the overland flow paths to make sure flows are not diverted toward existing buildings or properties
- Construction Environmental Management Plans (CEMP) be developed prior to construction in conjunction with an experienced Stormwater Engineer and shall consider the effects of temporary works, earthworks, storage of materials, temporary diversion and drainage on flow paths, flow levels and velocities. Including (but not limited to):

- Siting construction yards and stockpiles outside the predicted flood plains
- Diverting overland flow paths away from area of work
- Minimizing the physical obstruction to flood flows at the road sag points
- Staging and programming to provide new drainage prior to raising road design levels and carry out work when there is less risk of extreme flood events
- Actions to take in response to heavy rain warnings which may include reducing the conveyance of materials and plant that are considered necessary to be stored or sited within the predicted flood plain or significant overland flow path.

Construction of new and existing culvert crossings and stormwater wetlands and wetlands:

- Existing culvert extensions should be done prior to commencement of bulk earthworks to allow for the passage of clean water across the site. Pipe extensions can affect pipe capacity by increasing pipe length which could raise the upstream water level
- Installing temporary diversions to allow flows to be maintained while new culverts and wetlands are constructed
- For larger embankments requiring a longer duration of works or for overland flow paths with more regular and higher flow rates diversions should be installed prior to works commencing
- Where no diversion is required a 6m working clearance between any earthworks and designation boundary should be adopted to accommodate access and materials
- For larger diameter pipes (> 600mm in size) a working clearance of ±20m from the upstream extent and ±15m from the downstream extents should be provided.

A Flood Hazard condition is also recommended which will require the future detailed design of the transport corridors to be designed to achieve specific flood risk outcomes – refer NOR condition sets.

6.6 Assessment of operational effects

There are a range of operational effects particularly from proposed road crossings (formations, bridges and culverts).

Future detailed design will be subject to a separate detailed flood assessment at the outline plan and regional consenting phase which will refine the design of formations, culverts, bridge crossings and location / size of treatment (attenuation, water quality or both).

For the project the assessment of operational flooding and stormwater effects considered:

- New culvert (≥ 600 mm diameter) and bridge crossings
- Areas where the new road embankment encroaches onto predicted flood plain and flood prone land
- Potential bridge and culvert sizing to convey flows and not increase flood levels upstream and downstream of the bridge or culvert in the future 100yr 2.1° temperature increase scenario
- Land requirements for wetlands
- The potential of flooding on existing properties due to the new project corridor.

The effects of these are:

- Increasing impervious areas resulting in increased runoff and potentially increased flood levels
- Altering existing overland flow paths resulting in flows being redirected on a different alignment
- Obstructing an existing overland flow path resulting in ponding at existing low points or newly created depressions along the corridor
- Improving flows under the road reducing upstream flood levels and increasing flood levels at properties further downstream
- Increased impervious area to treat for attenuation, treatment or both and pond locations.

Further details of these are covered in Sections 7 to 14 for each NOR.

The assessed flood effects can be managed by adjusting the proposed road geometry and changing the amount of culvert and bridge opening area, so that the proposed NOR conditions will be met. In particular, the conditions require that there will be no increase in flooding of existing identified flooded habitable floors and no more than 50mm change to flood levels within properties.

6.7 Recommended measures to avoid, remedy or mitigate operational effects

Mitigation measures which may be implemented include:

- Detailed flood modelling of the detailed design during the later detailed design stage to meet designation condition requirements and optimise bridges, culverts and wetlands will be needed to assess cumulative effects of upstream NOR on downstream NOR (e.g. NOR 8 on 2, NOR 3 on 2 and NOR 7 on 5)

- Creating new overland flow path diversions to discharge to nearby overland flow paths or streams to mitigate ponding and decrease flood levels at affected properties. This is where existing predicted overland flow paths run parallel to the proposed roads and do not cross under the road
- Designing culvert and bridge sizes so that the upstream and downstream water level differences do not increase by more than 0.05m on land zoned for urban development or no increase for existing floors at risk of flooding. Aim to maintain flood neutrality if downstream flooding issues exist. Culverts will be designed for the 100yr future ARI event and checked to ensure that there is no increase in water level upstream or downstream of culverts. Checks will also be made of capacity reduction in accordance with the Auckland Council Code of Practise (Jan 2023) to understand overland flow paths and water level impacts of this capacity reduction. This will be completed in later detailed design stages
- Aim for culvert sizing to maintain freeboard of 0.5m at the upstream inlet and bridges 0.6m and 1.2m freeboard dependent on risk of debris
- Upgrading culverts by adding smaller culverts to create a balance between the flood level differences upstream and downstream, particularly for existing road sites that overtop and are to be raised
- Installing drains at the toe of the embankment sloping towards the culverts can also allow for additional storage to decrease the velocity and peak flow through the culvert crossings
- Installing treatment wetlands in optimum locations to reduce conveyance to and treatment areas to the wetlands. Fewer optimised wetlands can reduce future maintenance costs along with pipe networks to convey flows to the wetlands.

Further details of these are covered in Sections 7 to 14 for each NOR.

A Flood Hazard condition is also recommended which will require the future detailed design of the transport corridors to be designed to achieve specific flood risk outcomes – refer NOR condition sets.

6.8 Summary and Conclusions

The main positive effects that could be designed in the future works for the Warkworth NOR are:

- proposed new roadways to be above the predicted future flood plains,
- proposed widened and improved roadways to be above the predicted future flood plains, particularly existing overtopping roads (e.g. Sandspit Rd and SH1 Southern section)
- ability to convey flows without worsening flooding impacts upstream or downstream of the works
- added water quality treatment and attenuation of the total roadway impervious area as opposed to just the additional roadway area for upgraded roads.

The following summary and conclusions can be drawn for the over Warkworth Network flooding and stormwater effects as shown in Table 6.

Table 6. Summary of Assessment of Effects of Recommendations - Overall network

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
If Mahurangi River bridges require works in river (such as temporary works) which can restrict flows. Also the very large upstream catchments can create very large flows. New bridges and piers must be built over existing river and will therefore be exposed to the flood risk	Large flows passing through the bridge construction site could cause scour and temporary works to be washed away or could be obstructed by temporary works and cause upstream flooding. Major diversions are not feasible. Works require controls to reduce the risk	NOR2 and NOR8: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for and warning systems for larger events as part of the plan.
SH1 culvert upgrade at NOR1 will increase downstream water levels and flows therefore increasing construction flood risk in NOR1	Greater flood flows from the larger pipe along with works which could reduce flood storage (wetland, embankment and bridge construction) could cause the site to become inundated and spill over on to adjoining land during construction.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Existing flood plain storage volume loss with new embankments in flood plains could increase flood levels at culverts/bridges	Flood plain levels upstream and downstream of new formations may not achieve flood mitigation targets unless conveyance beneath the formation (bridges or culverts) is designed appropriately - additional	NOR1, 2, 7 and 8: Detailed modelling (of detailed design) to assess best option to meet to meet designation. Flood Hazard condition requirements for

Effect	Assessment	Recommendation
	cross conveyance capacity may be needed.	upstream and downstream water levels. .
Raising existing roads above the predicted 100yr future flood levels could increase upstream flood levels.	Greater protection of road to flooding will require increased flow capacity beneath the road with the aim of flood neutrality upstream and downstream of the raised road formation	NOR 2, 3 and 5 Optimisation of bridge or culverts through later detailed modelling (of detailed design) and design to achieve flood consent conditions.
Mahurangi River bridges with large predicted flood flows could have significant effects on flood levels if not carefully designed to achieve flood level requirements	Bridge opening could impact upstream and downstream water levels so it needs to be optimised to minimise changes to flood levels.	NOR2 and NOR8: Detailed modelling of the bridge and associated formation design during later design stages to optimise bridge opening to meet consent conditions.
Deep cuttings without benches will increase flood flows into cuttings thus increasing conveyance needs, concentrating flows at discharge points	Increased flood conveyance and concentrating flows could exacerbate existing flooding needs at discharge points.	NOR6 and NOR7: Benches for deep cuts to reduce face runoff into cutting. Cutting design needs to optimise top of face drains, benches and base conveyance to reduce concentrated flows and flood risk
SH1 pipe upgrade from 1.2 to 2.4m will increase downstream flows and water levels in PT Hub area.	The increased flow rate and water levels downstream of the 2.4m culvert and the available flood storage needs to be understood as it will impact wetland, embankment and bridge design.	NOR1. Design of wetland, embankments and bridge needs to be optimised to reduce flood levels to within consent conditions. Detailed design and modelling needed at later stages.
Wetlands for treatment only will reduce footprint needs	Downstream wetlands could be water quality only (GD01) as opposed to treatment and attenuation	NOR4 and NOR5: Detailed modelling (of detailed design) to show attenuation not needed during later design stages.

Flood modelling will be required at the detailed design phase to confirm the final corridor design will comply with the NOR conditions.

7 NOR 1 – Northern Public Transport Hub and Western Link – North

This section assesses specific flooding and stormwater matters relating to NOR 1 – Northern Public Transport Hub and Western Link - North

7.1 Overview and description of works

The Northern PT Hub and Park & Ride is located adjacent to the intersection of State Highway 1 and the proposed new Western Link - North. This project involves:

- Construction of a PT Hub
- Park and Ride facilities with 228 car park spaces attached to the PT Hub
- Construction of the new Western Link - North, a four-lane urban arterial with cycle lanes and footpaths on both sides

The PT Hub crosses two existing streams with the stream impacted the most crossing under SH1 by the SH1 / PT Hub intersection.

The indicative design allows for the existing SH1 culvert to be diverted to west of the proposed SH1 / PT Hub connection formation though a new open channel then flow through a new bridge under the formation as shown in Figure 6. As noted previously, future detailed design will be subject to a separate detailed flood assessment at the outline plan and regional consenting stage which will refine the design of formations, culverts, bridge crossings and location / size of treatment (attenuation, water quality or both).

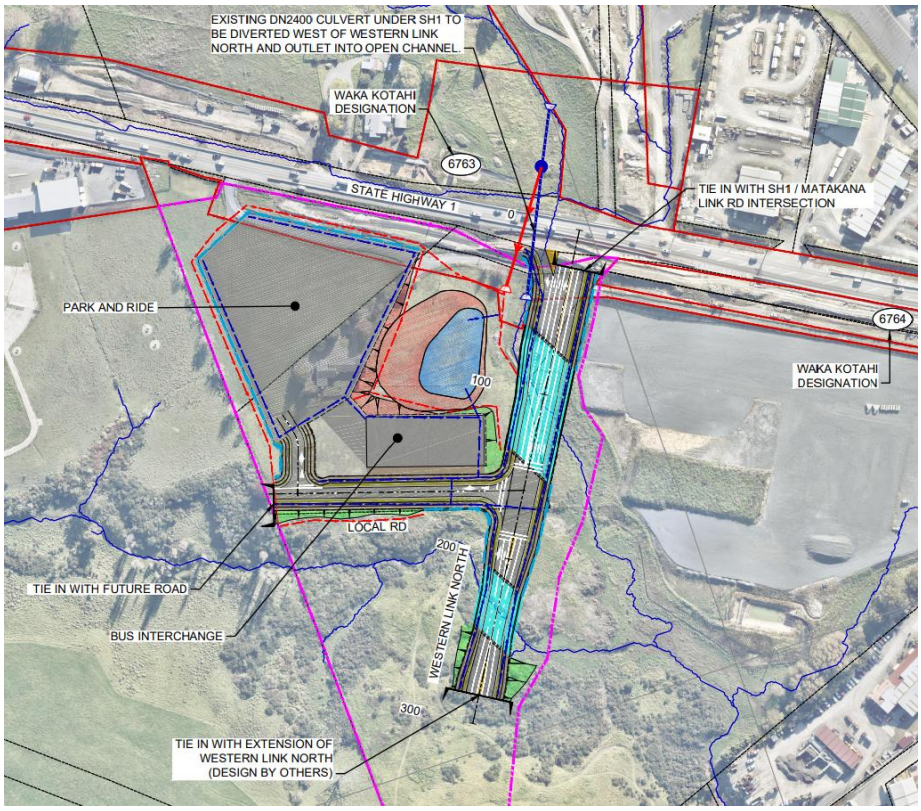

Figure 6: Indicative PT Hub layout

A new treatment wetland is proposed to allow for treatment of the impervious area associated with the PT Hub, Park and Ride, Bus interchange for water quality and attenuation.

7.2 Assessment Features

The flooding and stormwater features for this NOR relates to the earthworks, minor stream diversion, flood storage volume loss, construction of bridges over the two streams and formation / wetland construction within the flood plain.

Waka Kotahi (P2W) is understood to be replacing the existing culvert under SH 1 (1.2m diameter) with a larger 2.4m diameter culvert on the same existing culvert alignment. This will reduce the risk of SH1 overtopping and flooding of the SH1 and Te Honohono ki Tai (Matakana Link Road) intersection including upstream of this culvert inlet but may increase flood flows and water levels downstream of SH1. The flow capacity of the SH1 culvert can increase by a factor of four due to the diameter increase alone thus increasing flow directly into the downstream outlet area.

7.3 Positive Flooding and stormwater effects

The proposed PT Hub connection to SH1 is affected by the existing flooding of SH1 (shown in Figure 7 below) due to the existing SH1 culvert.

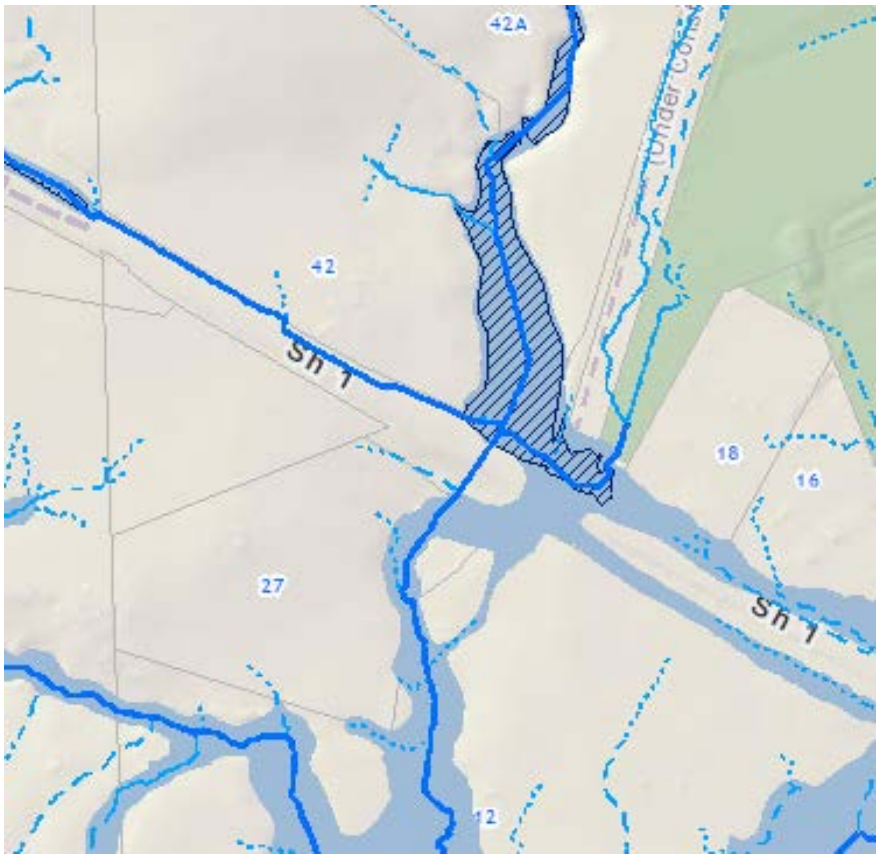

Figure 7: PT Hub overland flow, flood prone area, permanent stream and flooding extent (Source: AC Geomaps Jan 2023)

There is an opportunity for Te Tupu Ngātahi to work with P2W (through Waka Kotahi) to locate the culvert outlet for the benefit of both projects.

A proposed wetland will provide water quality treatment for the PT Hub impervious area.

7.4 Assessment of construction effects

The Rev B design construction impacts are predicted to be:

- Construction of new culvert and bridges over existing streams which could create flooding impacts dependent on the construction method, particularly if large storms are predicted
- Installation of diversion drains / realignment of existing natural streams which could create minor flooding issues
- Construction of new wetland within a predicted flood plain which displaces flood volume and increases flood levels
- Temporary use of lay down and construction areas in flood plains or overland flow paths which can create flooding that are not predicted prior to the work.
- Bulk earthworks to complete the formations require a dry works area and can alter overland flow paths or generate erosion and sediment effects and flooding impacts

7.5 Recommended measures to avoid, remedy or mitigate construction effects

The proposed NOR has the same general construction measures as noted in Section 6.5.

- Carrying out earthworks during the summer / dry months to reduce the risk of flooding
- Regular monitoring of predicted rainfall, particularly extreme events with high volume or intensity can then prepare for impact
- Locating lay down areas outside of predicted overland flow paths and flood plains which could be achieved by using the proposed Park and Ride area
- Managing the overland flow paths
- Construction Environmental Management Plans (CEMP) shall consider the effects of temporary works, earthworks, storage of materials, temporary diversion and drainage on flow paths, flow levels and velocities.
- Existing culvert extensions should be done prior to commencement of bulk earthworks to allow for the passage of clean water across the site.
- Installing temporary diversions to allow flows to be maintained while new culverts and wetland are constructed
- For larger diameter pipes (> 600mm in size) a working clearance of ±20m from the upstream extent and ±15m from the downstream extents should be provided.

7.6 Assessment of operational effects

With the existing SH1 culvert being upsized greater flow will pass through the culvert to increase flood risk downstream. This flood risk assessment will be addressed by P2W for the upsized culvert and future detailed modelling and design associated with this NOR should take account of this issue.

The following potential operational effects are associated with the proposed NOR design.

- diversion of the existing stream and flood plain to the west of the formation which could increase flooding in a constrained area

- construction of a wetland within a constrained flood plain. Greater flows and increased flooding potential will occur with the proposed upgrade of the exiting SH1 culvert by P2W and outlet to this western area
- minor length reduction of open permanent stream
- construction of new road formation reduces flood storage volume, which could increase tailwater effects and reduce the SH1 culvert capacity
- bridge openings sized to maintain flood neutrality.

7.7 Recommended measures to avoid, remedy or mitigate operational effects

The following operational measures are proposed:

- Work with P2W and Waka Kotahi to optimise the proposed 2.4m SH1 culvert alignment and outlet location.
- Later detailed modelling of detailed design to assess flood levels / extent / depth due to the P2W SH1 culvert upgrade downstream of SH1 and through the PT Hub site so as to provide for the refinement of the design of bridges, wetland location / footprint and footprint of the proposed formation to meet the proposed designation Flood Hazard condition requirements.
- The detailed design of stormwater management will also be subject to regional consenting requirements.
- Locate the wetland as near the Park and Ride as possible to reduce the flood storage volume loss issue.

7.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects shown in Table 7.

Table 7. Summary of Assessment of Effects and Recommendations - Northern Public Transport Hub, Park and Ride and Western Link - North

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Wetland construction within constrained flood plain due increased flow, new embankment and bridge	Increased risk of construction site flooding	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Temporary use of lay down and construction areas can create flooding risk.	Potential flood damage risk	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
SH1 culvert upgrade at PT Hub will increase downstream water levels and flows therefore increasing construction flood risk in PT Hub	Greater flood flows from the larger pipe along with works which could reduce flood storage (wetland, embankment and bridge construction) could cause the site to become inundated and spill over on to adjoining land during construction.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Flood plain storage volume loss and minor stream loss	New SH1 culvert outlet reduces natural stream length and outlets near wingwall plus earthworks for embankments and wetland	Detailed modelling and design to assess impacts with 2.4m diameter culvert (associated with non-SGA SH1 upgrade works) in place and proposed SGA works in later stages.
Wetland	Loss of flood storage volume with wetland potentially in flood plain	Optimise wetland attenuation as close to Park and Ride as possible

Effect	Assessment	Recommendation
		which can be assessed during the later detailed design / modelling stages.
SH1 pipe upgrade from 1.2 to 2.4m (associated with non-SGA SH1 upgrade works) will increase downstream flows and water levels in PT Hub area.	The increased flow rate and water levels downstream of the 2.4m culvert and the available flood storage needs to be understood as it will impact wetland, embankment and bridge design.	Design of wetland, embankments and bridge needs to be optimised to reduce flood levels to within consent conditions. Detailed design and modelling needed at later stages.

Flood modelling will be required at the detailed design phase to confirm the final corridor design will comply with the NOR conditions. This modelling will also identify any potential issues of increasing the SH1 culvert from 1.2 to 2.4m diameter, particularly at the outlet end of the culvert.

So far as practicable, collaboration with P2W should occur to ensure that the proposed 2.4m diameter culvert upgrade under SH1 provides the best outcomes for NOR1in terms of the proposed culvert outlet.

The detailed design of stormwater management will also be subject to regional consenting requirements.

8 NOR 2 – Woodcocks Road Upgrade (Western Section)

This section assesses specific Flooding and Stormwater matters relating to NOR 2 – Woodcocks Road Upgrade (Western Section).

8.1 Overview and description of works

Flooding and stormwater Rev A design allows for and is shown in Figure 8:

- The existing single lane Mahurangi Bridge to be widened, raised and lengthened on a slightly different alignment
- The existing two-lane bridge (to the west of Mahurangi River) is to be widened, raised and lengthened
- Western end of Woodcocks Rd connects to the part of the road being realigned as part of the P2W Highway
- Two wetlands, plus the Wider Western Link wetland.

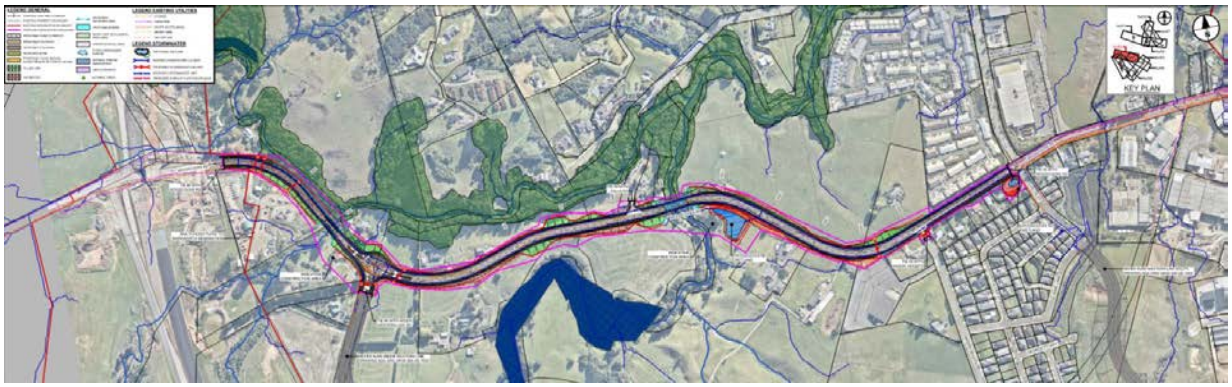

Figure 8: Woodcocks Rd layout

8.2 Assessment Features

This assessment focusses on flood, stream / river and water quality / attenuation effects.

Refer to the AEE Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

8.3 Positive Flooding and Stormwater effects

The following positive effects are noted.

- Raising of Woodcocks Rd at the two bridges crossing will reduce the potential for road overtopping and flooding
- Treating all of the proposed road surface will improve water quality.

8.4 Assessment of construction effects

There are no additional construction effects that apply to NOR 2 that are not set out in section 6.4.

8.5 Recommended measures to avoid, remedy or mitigate construction effects

Rainfall radar and long weather forecasts need to be monitored to ensure that no large volume or high intensity / short duration rainfall events occur during construction to prepare for and mitigate flood damage and reduce downstream flood impact risks, particularly the Mahurangi Road proposed bridge.

There are no additional construction effects that apply to NOR 2 that are not set out in Section 6.5.

8.6 Assessment of operational effects

The following specific operational effects need to be considered for the proposed Woodcocks Rd upgrade.

- Flood flows from the Mahurangi River are large and increasing the flow capacity beneath the Mahurangi River bridge by lengthening and raising it needs to be controlled to reduce downstream flood impacts
- The need for attenuation within wetlands.

8.7 Recommended measures to avoid, remedy or mitigate operational effects

Recommended measures are to maintain the same waterway capacity beneath the two upgraded bridges and check the flood impacts upstream and downstream of the two proposed bridges through detailed modelling in the later detailed design stage. The aim is to stay within flood design criteria, particularly with the downstream catchments identified for future development, which could occur before this NOR is constructed.

Confirm with later design modelling that wetland attenuation is not required for Mahurangi River bridge.

The P2W design for the western end of the Woodcocks Rd upgrade needs to be considered so that construction effects are not impacted by the design and measures (if needed) to minimise the effect implemented.

8.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects as shown in Table 8.

Table 8. Summary of Assessment of Effects and Recommendations – Woodcocks Road Upgrade (Western Section)

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Mahurangi River bridges require works in river (such as temporary works) which can restrict flows. Also the very large upstream catchments can create very large flows. New bridges and piers must be built over existing river and will therefore be exposed to the flood risk	Large flows passing through the bridge construction site could cause scour and temporary works to be washed away or could be obstructed by temporary works and cause upstream flooding. Major diversions are not feasible. Works require controls to reduce the risk	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for and warning systems for larger events as part of the plan.
Operational		
Mahurangi River bridges with large predicted flood flows could have significant effects on flood levels if not carefully designed to achieve flood level requirements	Bridge opening could impact upstream and downstream water levels so it needs to be optimised to minimise changes to flood levels.	Detailed modelling (of detailed design) of the bridge and associated formation design during later design stages to optimise bridge opening to meet consent conditions.
Wetlands for treatment only will reduce footprint needs	Downstream wetlands could be water quality only (GD01) as opposed to treatment and attenuation	Detailed modelling (of detailed design) to show attenuation not needed during later design stages.

Flood modelling will be required at the detailed design phase to confirm the final corridor design will comply with the NOR conditions. The main potential flooding effects and controls within the Woodcocks NOR are associated with:

- the large potential flood flows upstream of NOR 2 (Woodcocks Rd). Monitoring of rainfall upstream of these sites should be completed to prepare and control effects of any large rainfall flood flows;
- raised and lengthened Woodcocks Rd bridges could increase flow rates and downstream impacts. Aim to maintain the existing waterway capacity under bridges.

The detailed design of stormwater management will also be subject to regional consenting requirements.

9 NOR 3 – State Highway 1 Upgrade - South

This section assesses specific Flooding and Stormwater matters relating to NOR 3. The SH1 corridor which NOR 3 (SH1 - South) is located extends from the Northern Gateway Toll Road, Silverdale in the south to its intersection with Auckland Road in the northeast. The proposed upgrades covered by NoR3 extend from the RUB boundary in the south to the intersection with Fairwater Road in the north. The SH1 (southern section) upgrade involves the urbanisation of the corridor to a 24m two-lane urban arterial with cycle lanes and footpaths on both sides of the entire corridor length.

9.1 Overview and description of works

SH1 is an existing arterial extending from the Northern Gateway Toll Road in the south to its intersection with Auckland Road in the northeast, with the extents of the proposed upgrade from the Future Urban Zone boundary in the south to its intersection with Fairwater Road in the north.

The SH1 - South upgrade involves the urbanisation of the corridor to two-lane urban arterial with cycle lanes and footpaths on both sides of the entire corridor length.

The two existing culvert crossings shown as sites 1 and 2 on Figure 9 below are proposed to be upgraded to bridges with raised road formations and longer / wider bridge spans. The treatment wetland near site 1 on the downstream side will be out of the flood plain after the road is raised.

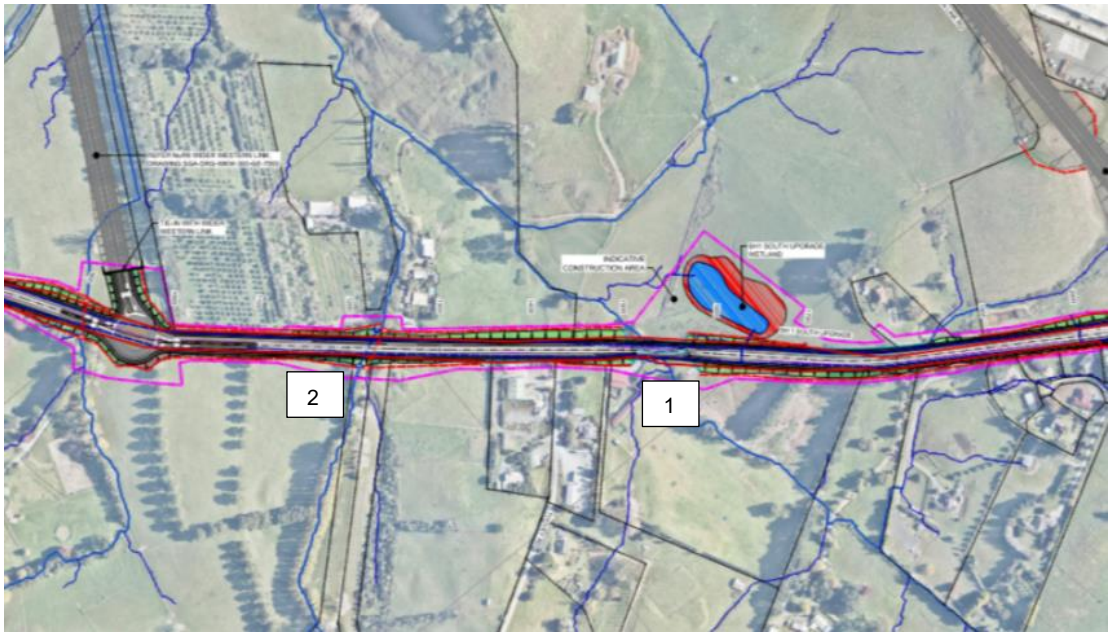

Figure 9: SH1 upgrade (southern section) area assessed

9.2 Assessment Features

Both proposed bridge sites are predicted to overtop in the existing 100yr 2.1° and 3.8° temperature increase scenarios due to the existing culverts being under capacity.

It is unclear what the Wider Western Link Rd connection to SH1 impact will have on treatment needs for SH1.

Refer to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

9.3 Positive Flooding and Stormwater effects

Raising of SH1 at the two bridges crossing will reduce the potential for road overtopping and flooding.

The wetland location has been selected to be downstream of SH1 and reduce the flood risk to the wetland.

The wetland associated with Western Link will provide treatment and attenuation opportunities for the SH1 upgrade as well.

Treating and attenuating all of the road surface will improve water quality and provide attenuation for 10 and 100yr flood flows associated with the added impervious road area.

9.4 Assessment of construction effects

Construction of bridges over streams to replace the existing culverts and wetland construction has the same construction effects as noted in Section 6.4.

9.5 Recommended measures to avoid, remedy or mitigate construction effects

A bridge is proposed at the existing culvert crossings to significantly increase the flow conveyance capacity and therefore maintain the flood levels upstream of the corridor. The proposed bridge site should be reviewed at the detailed design phase with the possibility of adding extra culvert capacity to improve performance which will also reduce construction impacts associated with new bridges.

Renewing the bridges, raising of the road formation and wetland construction has the same general construction measures as noted in Section 6.5.

9.6 Assessment of operational effects

The two existing culverts are predicted to have the following performance issues for the design rainfall events shown below in Table 9.

Table 9: SH1 southern section culvert performance

Culvert # (as shown on Figure 9)	**100yr 2.1° results**				**100yr 3.8° results**			
	Peak culvert flow (m^3/s)	US Water level (RL m)	DS Water level (RL m)	Peak flow over road (m^3/s)	Peak culvert flow (m3/s)	US Water level (RL m)	DS Water level (RL m)	Peak flow over road (m3/s)
1	8.4	41.4	40.9	19.6	8.4	41.5	41	27.8
2	8.9	43.1	41.7	10	9.1	43.1	41.9	15.4

Table 11 indicates the following:

- Culvert 1 (with the largest upstream catchment) and potential development of 66% imperviousness has little predicted upstream to downstream water level difference due mainly to the predicted wide area of road overtopping balancing out the head difference. The existing culvert can only cope with:
  - approximately 30% of the total approach flow in the 100yr 2.1° temperature increase,
  - dropping to 23% in the 100yr 3.8° temperature increase
- Culvert 2 (with the smaller upstream catchment) and potential development of 60% imperviousness has a much higher predicted upstream to downstream water level difference due to less predicted road overtopping with potentially greater existing freeboard. The existing culvert can only cope with:
  - approximately 47% of the total approach flow in the 100yr 2.1° temperature increase,
  - dropping to 37% in the 100yr 3.8° temperature increase

9.7 Recommended measures to avoid, remedy or mitigate operational effects

As the upstream catchments currently could pose a tree debris risk the freeboard should be set at 1.2m to the underside of the bridge which will create greater embankment length needing to be raised and sizing of the waterway to maintain the predicted upstream water levels. With the upstream catchment being fully developed (AC Geomaps shows approx. 88% imperviousness) the risk of tree debris would reduce but this will be a development timing issue.

With the existing SH1 predicted to overtop, raising the road formation will act like a stop bank and added capacity will be needed beneath the proposed road to reduce upstream flood impacts to within 500mm of the existing scenario. This may change with future development upstream and floor levels being based on the existing predicted flood levels with freeboard which will then impact works needed to reduce upstream flood water level impacts.

If multiple culverts could be utilised alongside the existing culvert the road formation raising would be reduced due to freeboard from the predicted water level only being 500mm.

Added culvert sizes would be developed based on the predicted upstream and downstream water levels to optimise the pipe sizes with the aim of maintaining flood neutrality and achieving freeboard. The existing culvert inverts would be maintained with added culvert inverts being slightly higher to maintain low flows through the existing culvert at each site and the added culvert/s provided added higher flow capacity.

Adding culverts would be confirmed at the later detailed design stage using a detailed flood model to assess upstream / downstream impacts and freeboard.

The treatment pond locations and sizes to be optimised with potential for two sites being adjacent to the two existing steams on the downstream (west) side of SH1. Two wetlands although creating greater construction disruption will reduce the need to convey the road flows from site 2 to site 1 pond.

9.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects as shown in Table 10.

Table 10. Summary of Assessment of Effects and Recommendations - Existing State Highway 1 Upgrade (Southern Section)

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Wetland construction within constrained flood plain can increase flooding by obstructing overland flow and displacing flood volume	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Raising existing roads above the predicted 100yr future flood levels could increase upstream flood levels.	Greater protection of road to flooding will require increased flow capacity beneath the road with the aim of flood neutrality upstream and downstream of the raised road formation	Optimisation of bridge or culverts through later detailed modelling (of detailed design) and design to achieve flood consent conditions.

It is anticipated that flood modelling the final design will be required at the detailed design phase to assess the final corridor design, to confirm the flood effects, with the aim that the confirmed detailed design, so far as it relates to flooding effects, will give effect to the NOR conditions.

The main potential flooding effects and controls within the SH1 Southern upgrade are associated with the raised formation to stop road overtopping which is between 85 and 240m in length. This may require added culverts to balance upstream water levels and provide conveyance under SH1.

The assessed flood effects can be managed by adjusting the proposed road geometry and changing the amount of culvert and bridge opening area, so that the proposed NOR conditions will be met. In particular, the conditions require that there will be no increase in flooding of existing identified flooded habitable floors and no more than 50mm change to flood levels within properties.

The detailed design of stormwater management will also be subject to regional consenting requirements.

10 NOR 4 – Matakana Road Upgrade

This section assesses specific Flooding and Stormwater matters relating to NOR 4 – Matakana Road Upgrade.

10.1 Overview and description of works

Upgrading Matakana Road to accommodate a two-lane cross-section with cycle lanes and footpaths on both sides of the corridor. Two treatment and attenuation wetlands are proposed near the intersections with Sandspit Link and Sandspit Rd. The layout is shown in Figure 10.

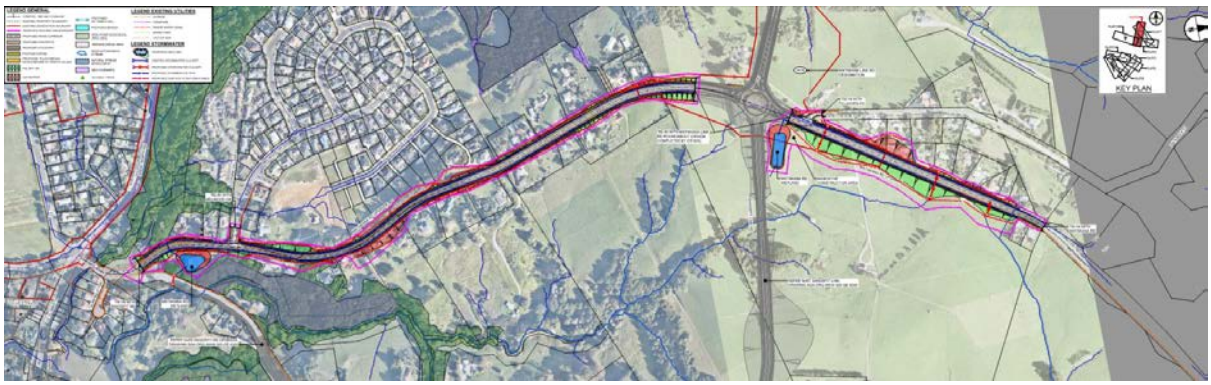

Figure 10: Matakana Road upgrade layout

10.2 Assessment Features

Matakana Road does not impact on any flood plains or overland flow paths therefore flooding is not an issue, apart from near the lower pond location by Sandspit Road.

The two proposed wetlands can provide water quality and attenuation.

Refer to AEE Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

10.3 Positive Flooding and Stormwater effects

Improved water quality treatment / retention in the proposed wetlands.

10.4 Assessment of construction effects

The main construction effects are the two treatment wetlands with the lower one (wetland 1) having the greatest impact as it is closer to the predicted flood plain plus the formation construction.

There are no additional construction effects that apply to NOR 4 that are not set out in section 6.4.

10.5 Recommended measures to avoid, remedy or mitigate construction effects

There are no additional construction effects that apply to NOR 4 that are not set out in section 6.**5**

10.6 Assessment of operational effects

There are no predicted flooding impacts associated with this NOR although wetland 1 is proposed adjacent to a flood plain.

10.7 Recommended measures to avoid, remedy or mitigate operational effects

Wetland 1 (near Sandspit Rd) location and size to be checked during detailed design phase to confirm that it is outside of the predicted flood plain through detailed flood modelling, particularly larger events.

10.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects as shown in Table 11.

Table 11. Summary of Assessment of Effects and Recommendations - Matakana Road Upgrade

Effect	Assessment	Recommendation
Construction		
New wetland near existing flooding can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Existing flood plain storage volume loss with new wetlands in flood plains could increase flood levels at culverts/bridges	Flood plain levels upstream and downstream of new formations may not achieve flood mitigation targets unless conveyance beneath the formation (bridges or culverts) is designed appropriately - additional cross conveyance capacity may be needed.	Detailed modelling (of detailed design) to assess best option to meet Flood Hazard condition requirements for upstream and downstream water levels.

The wetland layout and location with regard to the flood plain will be confirmed at the detailed design phase , although it is anticipated that it will be out of any flood plain and therefore minimise any potential constructional and operational impacts.

The detailed design of stormwater management will also be subject to regional consenting requirements.

11 NOR 5 – Sandspit Road Upgrade

This section assesses specific flooding and stormwater matters relating to NOR 5 – Sandspit Road Upgrade

11.1 Overview and description of works

Sandspit Road is an existing arterial providing east-west connection between the Warkworth growth area and the towns of Sandspit and Snells Beach.

This project extends from the tie in with the Hill Street intersection upgrade Project (a non Te Tupu Ngātahi project) in the west and to the eastern Future Urban Zone boundary. It is proposed to upgrade Sandspit Road to a two-lane urban arterial with cycle lanes and footpaths on both sides as shown in Figure 11.

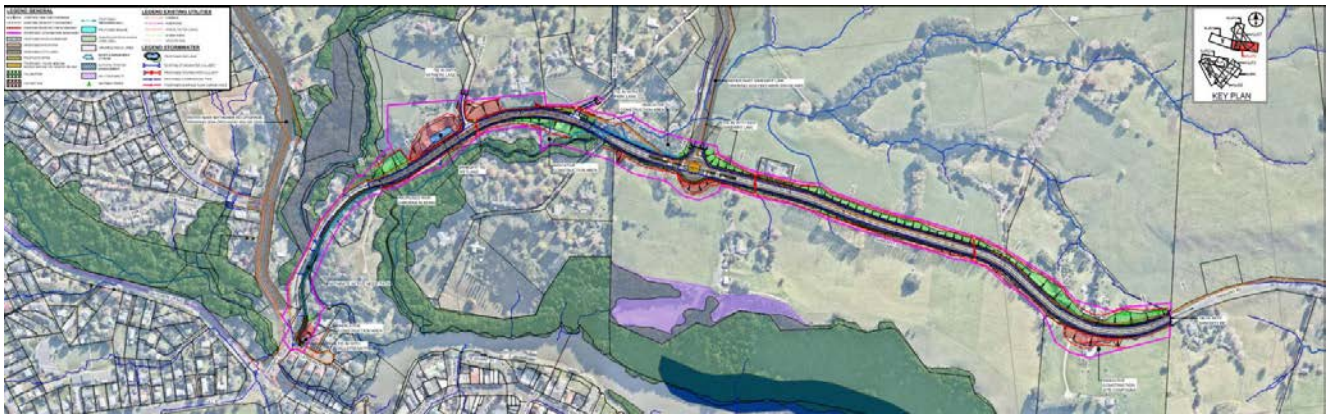

Figure 11: Sandspit Road upgrade

11.2 Assessment Features

The proposed road formation, upgraded bridge and wetlands are the features that could impact flooding and stormwater.

Refer to the AEE Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

11.3 Positive Flooding and Stormwater effects

Raising the bridge over the existing stream (downstream of Sandspit Link intersection) and associated road formation which is predicted to flood in the existing scenario.

Improved water quality outcomes through two new wetlands providing treatment and attenuation along with Sandspit Link Rd wetland 2 providing treatment and attenuation.

11.4 Assessment of construction effects

There are no additional construction effects that apply to NOR 5 that are not set out in section 6.4.

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11.5 Recommended measures to avoid, remedy or mitigate construction effects

Renewing the bridge, raising of the road formation and wetlands construction has the same general construction measures as noted in Section 6.5.

Specific retaining may be required to minimise the impact on the permanent stream with the road formation raising with the upgraded bridge.

11.6 Assessment of operational effects

The existing Sandspit Rd bridge is predicted to be overtopped in the 100yr future event.

Water quality and attenuation is achieved through proposed wetlands.

Specific retaining may be required to minimise the impact on the permanent stream should the road formation need raising with the upgraded bridge.

11.7 Recommended measures to avoid, remedy or mitigate operational effects

Sizing of the bridge opening and associated road formation needs to be confirmed with detailed modelling during later detailed design stages which will have no impact on designation boundaries.

Opportunity for the proposed wetland near Matakana Road intersection could be converted to treatment only as attenuation may not be required. This could be achieved through bio-retention devices.

11.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects as shown in Table 12.

Table 12. Summary of Assessment of Effects and Recommendations - Sandspit Road Upgrade

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Wetland near Matakana Road could create flood risk during construction	Type of wetland near flood plain could increase flood risk	Opportunity to change to bio-retention device to minimise diversion of flood flows during construction.
Operational		
Bridge over existing stream could create upstream flooding	Bridge opening may be increased to reduce formation levels based on increased downstream flows	Detailed modelling (of detailed design) of the bridge and associated formation design during later design stages also ties in with Sandspit Link Rd bridge with aim to meet flood consent conditions
Wetlands for treatment only will reduce footprint needs	Downstream wetlands could be water quality only (GD01) as opposed to treatment and attenuation	Detailed modelling (of detailed design) to show attenuation not needed during later design stages.

It is anticipated that flood modelling of the final design will be required at the detailed design phase to assess the final corridor design, to confirm the flood effects, with the aim that the confirmed detailed design, so far as it relates to flooding effects, will give effect to the NOR conditions. The flooding effects and controls within the Sandspit Rd upgrade NOR are associated with the raised formation and bridge lengthening to stop road overtopping. Construction method and contingency plans need to allow for large rain events to reduce flood risk whilst monitoring rainfall events.

The detailed design of stormwater management will also be subject to regional consenting requirements.

12 NOR 6 – Western Link South

This section assesses specific flooding and stormwater matters relating to NOR 6 – Western Link South.

12.1 Overview and description of works

The Western Link South is located at the end of Evelyn Street in the north to SH1 in the south and runs through existing greenfield land. The Western Link South Project involves the construction of a new two-lane urban arterial with walking and cycling facilities on both sides and upgrading the intersection with McKinney Road as shown in Figure 12.

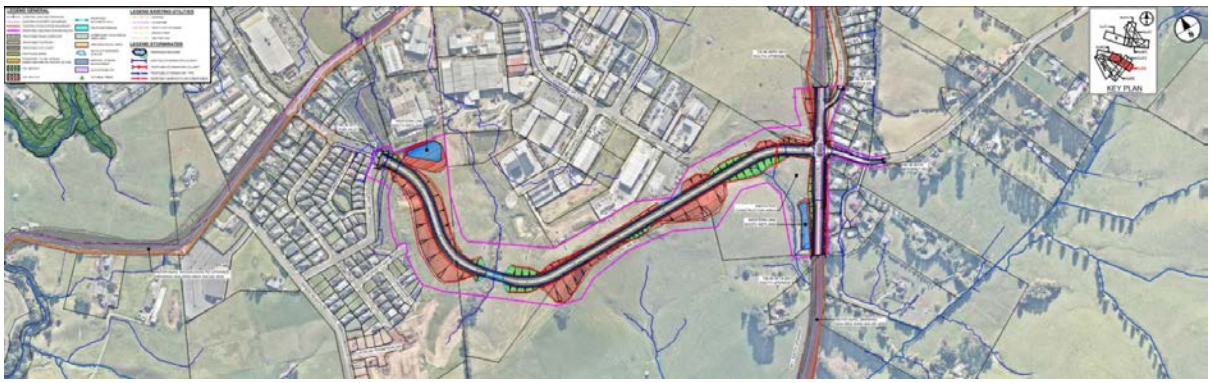

Figure 12: Western Link layout

12.2 Assessment Features

The Western Link South alignment crosses a small stream near the centre of the alignment and has two proposed wetlands at either end of the alignment (one near Evelyn Rd and the other adjacent to SH1).

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

12.3 Positive Flooding and Stormwater effects

There are minor potential flooding and stormwater issues associated with this alignment.

The proposed wetlands can provide water quality improvement and flood attenuation associated with the new road alignment carriageway.

The second NOR6 wetland by SH1 can also be used for the SH1 South upgrade, particularly the McKinney Road, SH1 and Western Link South intersection to provide improved water quality and attenuation effects.

12.4 Assessment of construction effects

There are no additional construction effects that apply to NOR 6 that are not set out in section 6.4.

12.5 Recommended measures to avoid, remedy or mitigate construction effects

See Section 6.5 for measures to avoid, remedy and mitigate predicted construction effects.

12.6 Assessment of operational effects

There are no predicted flooding impacts associated with this NOR.

At detailed design stage consideration can be given to siting the proposed wetland near SH1 closer to the proposed Western Link South alignment to facilitate its combined use.

Conveyance of flows through the deep cuttings will be required.

12.7 Recommended measures to avoid, remedy or mitigate operational effects

Improvements on the proposed NOR design are suggested below.

- The siting of the proposed wetland near SH1 could be located closer to the proposed Western Link South alignment and intersection
- The proposed bridge could be changed to a culvert with upstream catchment of approx. 8.5Ha and 100yr RCP8.5 flow rate of 6.1m^3/s. A culvert will provide easier conveyance of road flows over the culvert to the wetland to the north. A culvert will also provide greater freeboard (0.5m culvert compared to 1.2m bridge) between the predicted flood and road level.

These will have no impact on the NOR designation required and can be refined in the later detailed design / modelling phase.

12.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects as shown in Table 13.

Table 13. Summary of Assessment of Effects and Recommendations - Western Link South

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Bridge over existing stream	Proposed as bridge but could be culvert as upstream catchment is small and low flood impacts.	Confirm culvert will maintain water levels and flow capacity in later detailed modelling / design stages.
SH1 wetland location and catchment	Utilise wetland for SH1 and Western Link Rd	Relocate wetland closer to intersection for treatment and attenuation.

It is anticipated that flood modelling of the final design will be required at the detailed design phase to assess the final corridor design, to confirm the flood effects, with the aim that the confirmed detailed design, so far as it relates to flooding effects, will give effect to the NOR conditions.

There are no significant flooding effects and controls within this NOR.

The detailed design of stormwater management will also be subject to regional consenting requirements.

13 NOR 7 – Sandspit Link

This section assesses specific flooding and stormwater matters relating to NOR 7 – Sandspit Link.

13.1 Overview and description of works

Sandspit Link is a proposed new road with the purpose of providing strategic east-west movements to Matakana and Kowhai Coasts and providing local access to the northern growth area.

The corridor extends from Matakana Road in the north-west and connects to Sandspit Road in the southeast.

The alignment provides a resilient alternative to SH1 and Hill Street Intersection whilst improving dual accessibility between the northern growth area and Warkworth.

The Sandspit Link Project involves the construction of a two-lane urban arterial with cycle lanes and footpaths on both sides and a new intersection at the connection with Sandspit Road as shown in Figure 13.

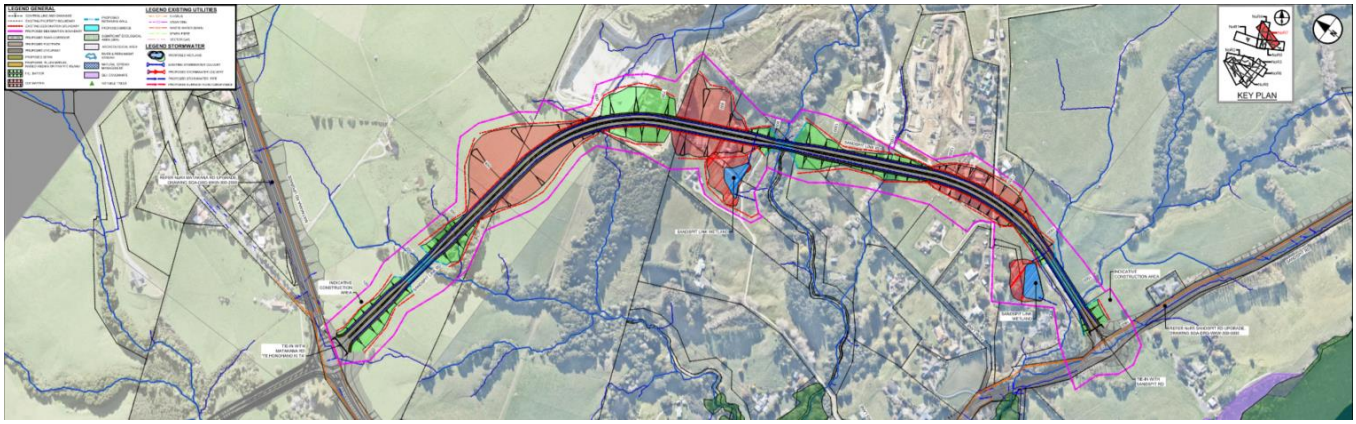

Figure 13: Sandspit Link Rd

13.2 Assessment Features

The design allows for a new formation to be built between Sandspit Rd and Matakana Rd. This alignment crosses six (6) existing streams varying in upstream catchment size from 2.8 Ha up to 190.2Ha. There are predicted flood plains along the three major streams, with minor flooding along the three other streams.

The road slopes from Sandspit Rd intersection at approx. 42m RL to approx. 65m RL at the Matakana Road intersection. There are deep cuttings at the Matakana Road end of the alignment where flow will need to be conveyed through them and drains at the top of the cuttings to divert water away from the cutting faces.

There are two proposed wetlands with one near the centre of the alignment and the second by Sandspit Road.

Refer to AEE Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

13.3 Positive Flooding and Stormwater effects

The road alignment allows for the road surface to be well above any predicted flood plains and treatment wetlands to treat and attenuate flows.

13.4 Assessment of construction effects

The main construction effects are diversion of flows due to the earthworks for the two treatment wetlands, bridges, culverts and formation construction with very deep cut and fill sections.

See Section 6.4 for issues associated with bridge, culvert, wetland and road formation construction.

13.5 Recommended measures to avoid, remedy or mitigate construction effects

See Section 6.5 for other measures to avoid, remedy and mitigate predicted construction effects.

13.6 Assessment of operational effects

The greatest area of predicted flooding is near the proposed bridge by Sandspit Road (shown above) due to potential reduced waterway.

The treatment of proposed road surface will be achieved in the two proposed wetland with water quality and attenuation outcomes.

13.7 Recommended measures to avoid, remedy or mitigate operational effects

The Sandspit Link Rd bridge opening (near Sandspit Rd) needs to be assessed in terms of further refinement to be optimised for flooding, along with the Sandspit Rd bridge renewal / raising at the same time through detailed modelling during the later design stages.

13.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects as shown in Table 14.

Table 14. Summary of Assessment of Effects and Recommendations - Sandspit Link

Effect	Assessment	Recommendation
Construction		
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Bridge over existing stream could create upstream flood water level increase	Bridge opening size needs to be optimised to meet consent conditions	Detailed modelling (of the detailed design) of the bridge and associated formation design during later design stages also ties in with Sandspit Rd bridge to meet consent condtions
Deep cuttings without benches will increase flood flows into cuttings thus increasing conveyance needs, concentrating flows at discharge points	Increased flood conveyance and concentrating flows could exacerbate existing flooding needs at discharge points.	Benches for deep cuts to reduce face runoff into cutting. Cutting design needs to optimise top of face drains, benches and base conveyance to reduce concentrated flows and flood risk

It is anticipated that flood modelling of the final design will be required at the detailed design phase to assess the final corridor design, to confirm the flood effects, with the aim that the confirmed detailed design, so far as it relates to flooding effects, will give effect to the NOR conditions, ,There are no notable flooding effects and controls within this NOR.

The detailed design of stormwater management will also be subject to regional consenting requirements.

14 NOR 8 – Wider Western Link - North

This section assesses specific flooding and stormwater matters relating to NOR 8 – Wider Western Link – North

14.1 Overview and description of works

The Wider Western Link is a proposed new arterial extending from Woodcocks Road in the north to SH1 in the south.

The extent of the proposed new Wider Western Link – North is from Woodcocks Road in the north to the midway point of the Warkworth South Future Urban Zone and is inclusive of the Mahurangi River. The Wider Western Link – North project involves the construction of a two-lane urban arterial with walking and cycling facilities on both sides with layout shown in Figure 14.

The Wider Western Link (southern section) is not being taken forward to NoR.

Figure 14: Overall Wider Western Link Rd with northern section designation shown

14.2 Assessment Features

The main flooding impact is the proposed bridge crossing the Mahurangi River with some estimated 2,454Ha upstream and a predicted 100yr RCP8.5 flow rate of approximately 307m^3/s. Although most of the area remains rural with low imperviousness the peak flow rate is large due to the very large catchment size.

Wetland locations are downstream of the connection to P2W Highway and by Woodcocks Rd.

Refer to the AEE Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

14.3 Positive Flooding and Stormwater effects

No impacts are predicted to flood plains if bridge and culverts are appropriately sized and meet the proposed NOR conditions.

New impervious area from road carriageway will be diverted to the proposed wetlands for treatment and attenuation as required.

14.4 Assessment of construction effects

Main issues are construction of the proposed bridge over Mahurangi River and smaller culverts on smaller tributaries, plus two wetlands and road formation.

See Section 6.4 for issues associated with bridge, culvert, wetland and road formation construction.

14.5 Recommended measures to avoid, remedy or mitigate construction effects

See Section 6.5 for measures to avoid, remedy and mitigate predicted construction effects.

14.6 Assessment of operational effects

Mahurangi River bridge design may increase the upstream or downstream flooding effects.

Two wetlands will treat and attenuate the road impervious area.

Culverts designed to convey smaller catchment flows beneath the formation on the same alignment as the existing streams without creating increased upstream / downstream flooding issues.

14.7 Recommended measures to avoid, remedy or mitigate operational effects

Mahurangi River bridge length as shown in Figure 14 covers the predicted flood plain therefore, with no change to the existing terrain under the proposed bridge it will have no flood impacts upstream or downstream of the proposed bridge site.

The wetland discharging to Mahurangi River should be designed for water quality treatment / retention only as defined by GD01 whilst the wetland by Woodcocks Rd would be water quality treatment / retention and attenuation.

14.8 Summary and Conclusions

The standard construction and operational impacts discussed under Section 6 apply to this catchment with the following catchment specific effects as shown in Table 15. Specifically rainfall monitoring for the Mahurangi River bridge site.

Table 15. Summary of Assessment of Effects and Recommendations - Wider Western Link - North

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows, and construction site flood risk.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Mahurangi River bridges with large predicted flood flows could have significant effects on flood levels if not carefully designed to achieve flood level requirements	Bridge opening could impact upstream and downstream water levels so it needs to be optimised to minimise changes to flood levels.	NOR2 and NOR8: Detailed modelling (of the detailed design) of the bridge and associated formation design during later design stages to optimise bridge opening to meet consent conditions.

It is anticipated that flood modelling of the final design will be required at the detailed design phase to assess the final corridor design, to confirm the flood effects, with the aim that the confirmed detailed design, so far as it relates to flooding effects, will give effect to the NOR conditions.

The main potential flooding effects and controls within the Wider Western Link NOR are associated with the large potential upstream flood flows. Monitoring of rainfall upstream of the site should be completed to prepare and control effects of any large rainfall flood flows and flood risk.

The proposed indicative Mahurangi Bridge design spans the predicted 100yr future flood extent therefore the bridge should have no impact on upstream or downstream flood flows and water levels but this needs to be confirmed with detailed modelling associated with the final detailed bridge design.

The detailed design of stormwater management will also be subject to regional consenting requirements.

15 Conclusions

15.1 Summary

The following Summary of the Flooding and Stormwater effects in shown in Table 16.

Table 16: Summary of flooding and stormwater effects

Effect	Assessment	Recommendation
Construction		
New formations over or near existing stream can block flow paths and create upstream flooding if not managed	Increased risk of construction site and upstream flooding	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Building bridges and culverts over existing streams can create flooding by restricting flow paths if not managed	Working in stream and flood plains increases the risk of upstream flooding, uncontrolled flows and construction site flood risk.	All: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Mahurangi River bridges require works in river (such as temporary works) which can restrict flows. Also the very large upstream catchments can create very large flows. New bridges and piers must be built over existing river and will therefore be exposed to the flood risk	Large flows passing through the bridge construction site could cause scour and temporary works to be washed away or could be obstructed by temporary works and cause upstream flooding. Major diversions are not feasible. Works require controls to reduce the risk	NOR2 and NOR8: Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for and warning systems for larger events as part of the plan.
SH1 culvert upgrade at PT Hub will increase downstream water levels and flows therefore increasing construction flood risk in PT Hub	Greater flood flows from the larger pipe along with works which could reduce flood storage (wetland, embankment and bridge construction) could cause the site to become inundated and spill over on to adjoining land during construction.	Construction methodology needs to be developed and followed to reduce the risk of construction related flooding. Also ties in with construction contingency planning for larger events with rainfall monitoring as part of the plan.
Operational		
Existing flood plain storage volume loss with new embankments in flood plains could increase flood levels at culverts/bridges	Flood plain levels upstream and downstream of new formations may not achieve flood mitigation targets unless conveyance beneath the formation (bridges or culverts) is designed appropriately - additional cross conveyance capacity may be needed.	NOR1, 2, 7 and 8: Detailed modelling (of detailed design) to assess best option to meet to meet designation. Flood Hazard condition requirements for upstream and downstream water levels. .

Effect	Assessment	Recommendation
Raising existing roads above the predicted 100yr future flood levels could increase upstream flood levels.	Greater protection of road to flooding will require increased flow capacity beneath the road with the aim of flood neutrality upstream and downstream of the raised road formation	NOR 2, 3 and 5 Optimisation of bridge or culverts through later detailed modelling (of detailed design) and design to achieve flood consent conditions.
Mahurangi River bridges with large predicted flood flows could have significant effects on flood levels if not carefully designed to achieve flood level requirements	Bridge opening could impact upstream and downstream water levels so it needs to be optimised to minimise changes to flood levels.	NOR2 and NOR8: Detailed modelling (of detailed design) of the bridge and associated formation design during later design stages to optimise bridge opening to meet consent conditions.
Deep cuttings without benches will increase flood flows into cuttings thus increasing conveyance needs, concentrating flows at discharge points	Increased flood conveyance and concentrating flows could exacerbate existing flooding needs at discharge points.	NOR6 and NOR7: Benches for deep cuts to reduce face runoff into cutting. Cutting design needs to optimise top of face drains, benches and base conveyance to reduce concentrated flows and flood risk
SH1 pipe upgrade from 1.2 to 2.4m will increase downstream flows and water levels in PT Hub area.	The increased flow rate and water levels downstream of the 2.4m culvert and the available flood storage needs to be understood as it will impact wetland, embankment and bridge design.	NOR1. Design of wetland, embankments and bridge needs to be optimised to reduce flood levels to within consent conditions. Detailed design and modelling needed at later stages.
Wetlands for treatment only will reduce footprint needs	Downstream wetlands could be water quality only (GD01) as opposed to treatment and attenuation	NOR4 and NOR5: Detailed modelling (of detailed design) to show attenuation not needed during later design stages.

15.2 Conclusions

Later detailed design and any associated modelling of this design will give further consideration to potential NOR flooding effects to identify how the post SGA flooding effects of the final design will be managed in line with the consent conditions.

The positive flooding effects are primarily associated with raising existing roads out of the flood plain (NOR 2, 3 and 5) that are currently predicted to flood in the future 100yr events.

The construction management and mitigation controls apply to all NOR.

The significant flooding effects and controls within the Warkworth assessment area are associated with:

- P2W increase of the existing SH1 culvert from 1.2 to 2.4m which will increase downstream flows and water levels. This needs to be modelled to fully understand the risk.
- the large potential flood flows upstream of NOR 2 (Woodcocks Rd) and 8 (Wider Western Link Rd). Monitoring of rainfall upstream of these sites should be completed to prepare and control effects of any large rainfall flood flows;
- the raising of Sandspit Rd where the current bridge is predicted to overtop will require construction controls and flood modelling / design to optimise the bridge level / opening to meet consent conditions, and;
- raising of SH1 Southern section above the predicted 100yr flood plain will also require optimisation of the construction method and number / size of bridge openings through later detailed design and modelling to meet consent conditions.

The assessed flood effects can be managed by adjusting the proposed road geometry and changing the amount of culvert and bridge opening area, so that the proposed NOR conditions will be met. In particular, the conditions require that there will be no increase in flooding of existing identified flooded habitable floors and no more than 50mm change to flood levels within properties.

The detailed design of stormwater management will also be subject to regional consenting requirements.

References

- Auckland Council GD01
- Auckland Council Geomaps
- Auckland Council Code of Practice
- Te Tupu Ngātahi Warkworth base case modelling
- Te Tupu Ngātahi Rev B drawings
- Te Tupu Ngātahi Warkworth Specialist Briefing Pack – 10 August 2022

ATTACHMENT 71

ASSESSMENT OF TRAFFIC NOISE AND VIBRATION EFFECTS PART 1 OF 4

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Traffic Noise and Vibration Effects

May 2023

Version 1.0

Document Status

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Revision Status

Version	Date	Reason for Issue
1.0	12/05/2023	Issue for lodgement

Table of Contents

Appendices

Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AADT	Annual Average Daily Traffic
AC	Auckland Council
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
BPO	Best Practicable Option
FUZ	Future Urban Zone
N/A	Not Applicable
NOR	Notice of Requirement
NOR 1	Northern Public Transport Hub and Western Link – North
NOR 2	Woodcocks Road (Western Section)
NOR 3	State Highway 1 – South
NOR 4	Matakana Road
NOR 5	Sandspit Road
NOR 6	Western Link - South
NOR 7	Sandspit Link
NOR 8	Wider Western Link – North
NZ	New Zealand
RMA	Resource Management Act 1991
SH1	State Highway 1
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

1 Executive Summary

1.1.1.1 Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORs including new corridors, existing road upgrades, and a public transport interchange with park and ride (NOR 1). The table below provides an overview of each NOR.

Notice	Project
NOR 1	**Northern Public Transport Hub and Western Link - North**
NOR 2	**Woodcocks Road (Western Section)**
NOR 3	**State Highway 1 – South**
NOR 4	**Matakana Road**
NOR 5	**Sandspit Road**
NOR 6	**Western Link - South**
NOR 7	**Sandspit Link**
NOR 8	**Wider Western Link – North**

1.1.1.2 Assessment undertaken

This report provides an assessment of road traffic noise effects for the Warkworth Assessment Package.

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

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

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

The Existing scenario represents the current road network with current traffic volumes, i.e. the existing environment as it is experienced now. The Do Nothing scenario represents the current road network with future traffic volumes, assuming a full build out of the area. The Do Minimum scenario represents the proposed future road network, incorporating NoRs 1 to 8 and other transport projects in the area.

This scenario also assumes a full build out of the area, and the transport infrastructure to support the development. This is a realistic scenario at a point in time when all NoRs are operational.

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

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

Since the projects are not anticipated to be built until they are required to service the anticipated growth in Warkworth, the Best Practice Option (BPO) will be confirmed for all current PPFs, at the time of construction. The review, confirmation, and refinement of the BPO will aim to achieve the same noise criteria categories as determined with the recommended mitigation as presented in Appendix 1.

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

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

For NoR 1, noise from the interchange facility has been assessed against the noise criteria corresponding to expected future zoning at the boundaries of the site.

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

1.1.1.3 Assessment assumptions

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

The traffic noise effects from the Projects assume that all NoRs are operational together, e.g. when the design year of NOR 2 is reached, NORs 3 to 8 are also operational. No allowance was made for individual NORs being implemented, or some NORs not being implemented at all. This is due to two

reasons; the transport models did not allow for these options, and the individual or combined assessment of NORs would lead to a large number of combinations that could not all be assessed. Therefore, the decision was made to assess the furthest point in time when all surrounding areas were developed to capacity and the associated road network.

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

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

1.1.1.4 NOR 1 - Northern Public Transport Hub and Western Link - North

An assessment of operational noise from the Northern public transport hub and PT hub section of the Western Link - North during peak hours was carried out based on indicative information for the peak hours as provided by the Project team.

The predictions indicate that the most stringent AUP:OP night-time noise criteria will be met at adjacent existing and likely future receivers during operation of the facility.

1.1.1.5 NOR 2 – Woodcocks Road (Western Section)

The project proposes the upgrade of Woodcocks Road to a two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor.

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered.

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

1.1.1.6 NOR 3 – State Highway 1 – South

The existing SH1 corridor in which NOR 3 (SH1 – South) is located extends from the Northern Gateway Toll Road, Silverdale in the south to its intersection with Auckland Road in the northeast. The proposed upgrades covered by NOR 3 extend from the Rural Urban Boundary (RUB) in the south to the intersection with Fairwater Road in the north. The SH1 (south) upgrade involves the urbanisation of the corridor to a two-lane urban arterial with cycle lanes and footpaths on both sides of the entire corridor length.

Road traffic noise levels have been assessed in accordance with NZS 6806. Under the Do Minimum scenario, five PPFs are in Category B, with the remaining PPFs in Category A. With the recommended mitigation of a low noise road surface, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario (representative of the design year without the Project) and the Mitigation scenario (representative of the design year with the Project and the implementation of an AC-14 road surface) indicates that noise level changes will be positive for the majority of PPFs.

1.1.1.7 NOR 4 – Matakana Road

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Matakana Road Upgrade. Under the Do Minimum scenario, one PPF is in Category C, four PPFs are in Category B with the rest in Category A. With the recommended mitigation option of AC-14 low noise road surface implemented, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Mitigation scenario (representative of the design year with the Project and the implementation of an AC-14 road surface) indicates that noise level changes will be negligible for the majority of PPFs.

1.1.1.8 NOR 5 – Sandspit Road

The project proposes the upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. All PPFs in this scenario would fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs.

1.1.1.9 NOR 6 – Western Link - South

The project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor.

NOR 6 contains both Altered and New roads. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated further for these sections.

For New roads under the Do Minimum scenario the majority of PPFs are in Category A with four in Category B. A noise barrier was considered for the four Category B PPFs, however, its performance would be compromised by the gap required to maintain access from the road. A low noise road surface, AC-14, is already included as the Do Minimum road surface. Noise levels are predicted to increase at all PPFs under the Do Minimum scenario.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs if the Project were constructed, with all PPFs falling into Category A.

1.1.1.10 NOR 7 – Sandspit Link

The project proposes a new two lane urban arterial cross-section with cycle lanes and footpaths on both sides of the corridor.

NOR 7 contains both Altered and New roads. For Altered roads under the Do Minimum scenario, noise level changes are predicted to be negligible for both PPFs under consideration, with both falling into Category A. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for New roads in the Existing and the Do Minimum scenarios indicates that changes in noise levels are likely to be negligible at all three PPFs. For the Altered Roads, the comparison of the Do Nothing and Do Minimum scenarios shows a slight to moderate positive effect for both PPFs. All PPFs fall into Category A under the Do Minimum scenario.

1.1.1.11 NOR 8 – Wider Western Link – North

The project proposes a new two lane urban arterial cross-section with walking and cycling facilities on both sides of the corridor.

NOR 8 contains both New and Altered roads. For the Altered roads under the Do Minimum scenario, noise level changes are predicted to be moderately positive at one PPF, and slightly adverse at the other PPF. However, both PPFs would fall into Category A. The Altered roads in this NoR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for the New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be substantially adverse at the one PPF under consideration. However, it should be noted that this PPF would still fall into Category A.

2 Introduction

This traffic noise assessment has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NORs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60km from the Auckland city centre, and 30km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP:OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area will be less than 5km north-south and east-west and will make a significant contribution to the future growth of Auckland's population. A 1000ha of currently rural land has been rezoned (Future Urban Zone) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 8,200 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area will be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Business land is already live zoned and remainder to be development ready by 2022.
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 6.

This report addresses the traffic noise effects of the Warkworth Package (NOR 1 – NOR 8) identified in Table 6-1 and Figure 6-1 in Section 6.

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

2.2 Purpose and scope of this Report

This traffic noise assessment forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NoRs sought by AT.

This report considers the actual and potential effects associated with the operation of the Warkworth Package on the existing and likely future environment as it relates to traffic 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:

a) Identify and describe the existing and likely future noise environment;
b) Identify and describe the actual and potential traffic noise effects of each Project corridor within the Warkworth Assessment Package;
c) 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 Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects for each Project corridor within the Warkworth Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project.

2.3 Report Structure

In order to provide a clear assessment of each NoR, this report follows as appropriate, the structure set out in the AEE. This report contains an assessment of the actual and potential traffic noise effects of the Warkworth project on an overall network basis. Where appropriate, measures to avoid, remedy or mitigate effects are recommended. The sections of this report are arranged accordingly. Table 2-1 below provides an overview of the report structure and where the description of effects can be found in this report.

Table 2-1. Report Structure

Sections	Section number
Description of the Project	6
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	4
Identification and description of the existing and likely receiving noise environment;	5
Assessment of specific traffic noise matters for Warkworth NOR 1	6.1
Assessment of specific traffic noise matters for Warkworth NOR 2	7
Assessment of specific traffic noise matters for Warkworth NOR 3	8
Assessment of specific traffic noise matters for Warkworth NOR 4	9
Assessment of specific traffic noise matters for Warkworth NOR 5	10
Assessment of specific traffic noise matters for Warkworth NOR 6	11
Assessment of specific traffic noise matters for Warkworth NOR 7	12

Sections	Section number
Assessment of specific traffic noise matters for Warkworth NOR 8	13
Overall conclusion of the level of potential adverse traffic noise effects of the Warkworth Project	14

3 Assessment Criteria

3.1 Road Traffic Noise

Rule E25.6.33 of the Auckland Unitary Plan (AUP:OP) requires that New Roads and Altered Roads which are within the scope of NZS 6806:2010[1] comply with the requirements of that standard. The assessment of NORs 2 to 8 has used NZS 6806. NOR 1 is assessed against the provisions of the AUP:OP (refer section 3.2).

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

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

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

- The Do Minimum noise environment would be greater than or equal to 64 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do Nothing noise environment; or
- The Do Minimum noise environment is greater than or equal to 68 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 1 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the do-nothing noise environment.

3.1.1 Protected premises and facilities

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

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

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

[1] New Zealand Standard 6806:2010 Acoustics - Road-traffic noise – New and altered roads

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

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

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

3.1.2 Noise Prediction Scenarios

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

- The "Existing noise environment", which is the ambient noise levels at the date of assessment.
- A "Do Nothing" scenario, which represents the traffic noise levels at the PPFs at the design year assuming no alterations are made to the existing road.
- A "Do Minimum" scenario, which represents the traffic noise levels at the PPFs at the design year with the Project implemented, but without any specific noise mitigation. Road surfaces, safety barriers and other structures which are required for non-acoustic purposes may provide incidental noise mitigation and are included in this scenario.
- "Mitigation" scenarios, which represent the traffic noise levels at the PPFs at the design year with various specific noise mitigation options implemented with the aim of achieving the noise criteria categories.

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

The Do Minimum scenario represents the proposed future road network, incorporating NoRs 1 to 8 and other transport projects in the area (refer to the discussion on Assessment Assumptions in Appendix A below). This scenario assumes a full build out of the area, and the transport infrastructure to support the development. This is a realistic scenario at a point in time when all NoRs are operational. Considering the wider distribution of future traffic over an increased road network enabled by the NoRs, traffic volumes appear to reduce on individual roads when compared with the (theoretical) Do Nothing scenario.

3.1.3 NZS 6806 Noise Criteria

For each of the Projects the noise criteria as summarised below are applicable.

[2] New Zealand: An Urban/Rural profile, Statistics New Zealand

Table 3-1: NZS 6806 noise criteria

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

Section 6.2 of NZS 6806 is applicable to Projects in the Warkworth Assessment Package where it states:

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

Such circumstances may include, but are not limited to:

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

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

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

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

The Warkworth Assessment Package has both "Altered Roads" and "New Roads" as defined by NZS 6806.

Altered Roads include existing SH1 - South, Matakana Road, Sandspit Road, and Woodcocks Road. For these roads, the noise predictions for the NZS 6806 assessment did not include the surrounding road network for the Do Minimum scenario, as Section 6.2.2 of the Standard states that mitigation is only required for traffic noise generated on the altered road. The surrounding road network was included in the noise predictions for all scenarios for the assessments of road traffic noise effects in relation to the change in noise level.

The three new roads that are proposed to be built are Sandspit Link, Western Link - South, and Wider Western Link - North. These roads have been assessed as a "New Road" under NZS 6806.

Where the New Road Projects listed above 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.

3.1.4 Design Year

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

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

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

3.1.5 Noise Mitigation

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

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

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

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

3.1.6 Road Traffic Vibration

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

3.2 Interchange Facility Noise

Road traffic noise originating from carparks and transit facilities is not covered by NZS 6806. The noise criteria for the underlying and adjacent zones, as set out in the AUP:OP, are therefore recommended to assess noise from the Interchange Facility.

Interchange facility noise has been predicted using the ISO 9613-2:1996 *"Acoustics – Attenuation of sound outdoors – Part 2: general method of calculation"* prediction algorithm, implemented in SoundPLAN v8.2 computational modelling software.

Noise from the interchange facility has been assessed according to likely future zoning when the facility becomes operational. The Warkworth Structure Plan indicates that future zoning of the area surrounding NOR 1 will be *Business – Light Industry Zone*, with a *Residential – Mixed Housing Suburban Zone* to the south west.

Table 4-1 sets out the applicable noise criteria from the AUP:OP for noise from the interchange facility received at each of the surrounding zones.

Table 3-2 Zone noise limits

Receiving Zone	AUP:OP Rule Reference	Time	Noise level
Residential – Mixed Housing Suburban Zone	E.25.6.19 – Business Zones Interface	Monday to Saturday 7am-10pm	55 dB L_{Aeq}
		Sunday 9am-6pm	45 dB L_{Aeq} 75 dB L_{AFMax}
		All other times	
Business – Light Industry Zone	E25.6.5.1 Business – Light Industry Zone	All times	65 dB L_{Aeq}

3.3 Overview of Traffic Noise Effects

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

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

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

[3] Stevens, S. S. (1957). On the psychophysical law. Psychological Review, 64(3), 153–181. https://doi.org/10.1037/h0046162

Table 3-3 Noise level change compared with general subjective perception

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

4 Assessment Methodology

Road traffic data provided for the Warkworth Assessment Package relies on the development and urbanisation of the local areas. Some projects will have a direct impact on the traffic flow.

The purpose of this assessment is to determine the future potential impacts to support the future growth within the Warkworth area. Therefore, it has been assumed all transport infrastructure developments will be constructed by the design year 2048 as indicated in Section 2.1. It should be noted an urban speed reduction is expected across all project roads (NOR 2 to NOR 8) at the time of growth. Therefore, in accordance with the standard, speed change has been applied at the Do Nothing, Do Minimum and Mitigation scenarios, where applicable. As noted previously, the Do Nothing scenario is a theoretical scenario for these Projects as the existing road network would not be able to accommodate the traffic volume expected from the full future development of the area.

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

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

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

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

4.1 Road Traffic Noise Model

A computer noise modelling software SoundPLAN (V8.2) has been used to predict road traffic noise impacts. The road traffic noise modelling employs the "*Calculation of Road Traffic Noise*" (CoRTN) algorithm, as recommended in NZS 6806. The CoRTN methodology has been adjusted for New Zealand Road Surfaces in accordance with LTNZ Report No. 326[4] and the Waka Kotahi *Guide to state highway road surface noise*[5]. The model settings are described in Table 4-1 below.

Table 4-1: Road traffic noise modelling parameters

Parameter	Setting/source
Software	Sound Plan 8.2
Algorithm	CoRTN
Reflection	CoRTN
Ground absorption	0.8
Receiver height	1.5 m above height of each floor
Noise contour grid	1.5 m height, 5 m resolution
Receivers and grid position	Free-field

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

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

4.1.1 Traffic data

All traffic data including AADT, percentage of heavy vehicles and posted speed limit has been sourced from the Project team and based on the SATURN model. The Existing scenario has been based on 2018 data as provided. Traffic volumes have to change significantly to affect noise levels to a meaningful degree. Therefore, using traffic data from 2018, which is the most up to date data, is appropriate to represent the existing circumstances. The change in traffic volume from 2018 to 2023 would amount to a less than 1 decibel change in noise level. Traffic modelling methodology and results are described in the report *Warkworth DBC Appendix D – Modelling Specifications* and the *Warkworth Transport Assessment.*

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

[4] https://www.nzta.govt.nz/assets/resources/research/reports/326/docs/326.pdf
[5] https://www.nzta.govt.nz/assets/resources/road-surface-noise/docs/nzta-surfaces-noise-guide-v1.0.pdf

4.1.2 Topography

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

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

4.1.3 Buildings

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

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

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

4.1.4 Road alignments

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

4.1.5 Road surfaces

Surfaces of existing roads in the Do Nothing scenario have been modelled as the current surfaces recorded by Mobile Road,[6] a collaborative app supported by Waka Kotahi, including State Highway New Zealand databases and Council Road databases, including road surface types. For the Do Minimum scenarios the road surface has been modelled based on Auckland Transport's (AT) road surfacing principles. Table 4-2 below summarises the road surfaces proposed for the Do Minimum scenario for each NoR..

6 www.mobileroad.org

Table 4-2 Do Minimum Road Surfaces

NoR	Do Minimum Road Surface
NOR 1	AC-14 Asphalt
NOR 2	Chipseal
NOR 3	Chipseal
NOR 4	Chipseal
NOR 5	AC-14 Asphalt
NOR 6	AC-14 Asphalt
NOR 7	AC-14 Asphalt
NOR 8	AC-14 Asphalt

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

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

4.1.6 Existing noise barriers

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

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

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

4.2 Uncertainties and Limitations

The predicted road traffic noise levels presented in the following sections are based on a road traffic noise model developed in accordance with NZS 6806 and relevant guidance. The accuracy of the model is largely dependent upon the limitations of the available input data as detailed above.

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

Uncertainties in the modelled noise levels can occur for a number of reasons. Uncertainties are typically related to the effects of topographical screening, appropriateness of the traffic data in terms of volumes of light and heavy vehicles, speeds (observed vs posted) and road surface type.

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

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

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

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

Table 4-3 compares the measured data with the predicted noise levels. The predicted traffic noise levels are within the tolerance of NZS 6806 and therefore the existing model is appropriately accurate for the calculation of traffic noise levels for all scenarios.

Table 4-3: Comparison of measured and predicted noise levels

Address	Measured noise level, $L_{Aeq,24hr}$, dB(A)	Predicted noise level, $L_{Aeq,24hr}$, dB(A)	Difference, dB(A)	Notes
153 Woodcocks Road	59	62	3	Difference in noise level considered to be acceptable.
10 Georgetti Way	47	43	4	Higher than likely normal noise readings recorded in the early morning after Cyclone Gabrielle. Recorded noise later in the day reduced to expected levels. Difference considered acceptable.
171 Matakana Road	54	56	2	Within tolerance.

4.3 Potential Traffic Noise Mitigation Options

For those PPFs where the NZS 6806 Category A criterion is predicted to be exceeded, the effect of the mitigation options on road-traffic noise levels at each PPF were modelled. Where NZS 6806 does not apply due to noise levels not reaching the required threshold to qualify as an Altered road, no mitigation options have been considered.

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

4.3.1 Noise barriers

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

We note that as per Section 3.1.5, NZS 6806 recommends that the combined structural mitigation achieve:

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

4.3.2 Building modification

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

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

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

4.3.3 Maintenance of structural mitigation measures

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

This means that any barrier should not develop gaps or other openings or material failure. Any damage and vandalism to the barrier will need to be replaced, and asphalt surfaces should be

maintained to be smooth and even, in order to achieve the same noise reducing qualities as following initial installation. Maintenance of structural mitigation measures to the performance standards of NZS 6806 should be undertaken for the Projects in order to achieve the noise level reductions on which the noise level predictions are based.

4.4 Interchange Facility

The source noise levels, and vehicle movements used in this assessment for the interchange facility are detailed in Table 4-4. These levels and movements are based on previous interchange facilities and AECOM's library of measurements of these activities and correlate to the vehicle type and speed to be used at the Project site. It should be noted that information on predicted movement numbers is indicative at this stage and should be confirmed during detailed design.

Bus and passenger car movements around the car park and drop off areas have been modelled as moving point sources. Fixed point sources have been used to represent idling buses and those accelerating away from the stations.

The bus fleet is expected to be fully electrified by the year 2035, before construction of the interchange facility. Therefore, the bus fleet has been assumed to be fully comprised of electric vehicles for this assessment.

Total bus idle time and acceleration time at each bus stop every hour has been calculated based on the indicative number of bus stops anticipated, and assuming an idle time of 5 minutes and peak acceleration time of 3 seconds for each bus. Sound power level data for the assessment were adopted from Laib et al.[8]

The following inputs have been used within SoundPLAN:

Table 4-4 Sound power levels, vehicle movements and on-times used in assessment

Noise Source	Sound Power Level, LwA	Peak Time Operation, 2048
Electric bus movements (driving at 30 km/h)	92 dB	14 bus movements per hour
Stationary electric buses	82 dB	33 mins idle time per hour per bus stop
Electric buses accelerating away from station	98 dB	20 seconds accelerating away per hour per bus stop
Passenger car movements (driving at 30 km/h)	86 dB	228 car movements per hour

[8] Laib et al (2019), Modelling noise reductions using electric buses in urban traffic. A case study from Stuttgart, Germany. https://www.sciencedirect.com/science/article/pii/S2352146518306227

5 Existing and Likely Receiving Noise Environment

The projects encompassing the Warkworth NOR package will be constructed 15-20 years from now. The implementation timeframe for each project will vary and correspond with future land release within the area. Implementation of the Projects is only required to support future urbanisation and will not happen until this occurs.

5.1 Existing and Likely Receiving Planning Environment

The Warkworth NOR package will be constructed and will operate alongside existing urban environments or planned future environments (i.e. what can be built under the AUP:OP and what is identified in the Warkworth Structure Plan):

1. **Existing environment:** A number of corridors comprising the Warkworth NOR package are partially located within/alongside existing urban areas.

a) Matakana Road – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
b) Western Link - South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.
c) SH1 - South – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
d) Woodcocks Road – the eastern extent of the corridor has existing residential land uses to the north and south.

2. **Future environment**: All the corridors in the Warkworth NOR package will partially or wholly be constructed and implemented on land identified for future growth (Future Urban Zone) and as a result are anticipated to change to urban residential or business land uses.

The likelihood and magnitude of land use change regarding the land use planning context has been identified in Table 5-1 below. This has been used to inform the assumptions made on the likely future environment

Table 5-1. Likelihood and magnitude of land use change

Existing environment	Current AUP:OP Zoning	Likelihood of Change for the environment[1]	Magnitude of potential change	Likely Receiving Environment[2]
Residential	Residential (Mixed Housing Suburban)	Low	Low	Residential
	Residential (Mixed Housing Urban)	Low	Low	Residential
	Residential (Single House)	Low	Low	Residential
Business	Business (Mixed Use)	Low	Low	Business (Industrial)
	Business (General Business)			Business (General Business)
	Business (Light Industry)	Low	Low	Business (Industrial)
	Business (Local Centre Zone)	Low	Low	Business (Neighbourhood Centre)
Open Space	Open Space – Conservation Zone	Low	Low	Informal Recreation
Greenfield areas	Future Urban Zone	High	High	Urban
Other	Special Purpose – Quarry Zone	Low	Med	Quarry

Table notes: 1. Based on AUP:OP zoning/policy direction, 2.Based on Warkworth Structure Plan and AUP:OP zoning/policy direction

Refer to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the Warkworth NOR package.

5.2 Existing Ambient Noise Environment

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

5.2.1 Noise Monitoring Procedure

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

The noise monitoring was undertaken in general accordance with the relevant requirements of NZS 6801[9], 6802[10] and 6806. This meant the results could adequately inform both the operational and construction noise assessments.

Measurements were undertaken at the following three locations:

- 153 Woodcocks Avenue
- 10 Georgetti Way
- 171 Matakana Road

These locations were selected to represent an existing environment that is unlikely to change significantly up until the design year, and where road traffic is currently the controlling noise source. The measurement positions were chosen to avoid extraneous factors which could have influenced the sound levels, where practicable. Measurement and calibration details required by NZS 6801 are held on file.

The unattended noise monitoring results can be found in Appendix B. Forms summarising the noise monitoring at each location are provided in Appendix C. Monitoring was undertaken for one week.

5.2.2 Meteorological Conditions

During the surveys, meteorological data was obtained from Auckland, Warkworth Ews (17838) weather station operated by NIWA. This is the closest station where data was available at an hourly resolution or less.

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

5.2.3 Data Analysis

Road traffic was the dominant noise source at all measurement locations. There is a natural variation in the noise environment throughout the day, and often variations for the weekends. Each day's data was analysed, and abnormal events were excluded. A summary of the measured noise levels at each location for each day is presented in Table 5-2.

The $L_{Aeq(24h)}$ was calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded. This meant that data for the 12th and 13th of February were excluded due to rain.

Note that data was not recorded at 153 Woodcocks Avenue and 171 Matakana Road on the 16th of February since the batteries ran out of power for those sound level meters on that day.

[9] New Zealand Standard 6801:2008 Acoustics – Measurement of environmental sound
[10] New Zealand Standard 6802:2008 Acoustics – Environmental noise

Table 5-2: Summary of measured noise levels

Date	Noise Level, dB $L_{Aeq\ (24h)}$		
	153 Woodcocks Avenue	10 Georgetti Way	171 Matakana Road
09/02/2023	59	40	49
10/02/2023	59	43	51
11/02/2023	58	50	55
14/02/2023	59	50	57
15/02/2023	58	45	53
16/02/2023	-	43	-

The average $L_{Aeq(24h)}$ for the unattended measurement at each location was:

- 153 Woodcocks Road: 59 dB $L_{Aeq(24h)}$
- 10 Georgetti Way: 47 dB $L_{Aeq(24h)}$
- 171 Matakana Road: 54 dB $L_{Aeq(24h)}$

6 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NoRs including public transport interchanges, existing road upgrades, and new corridors.

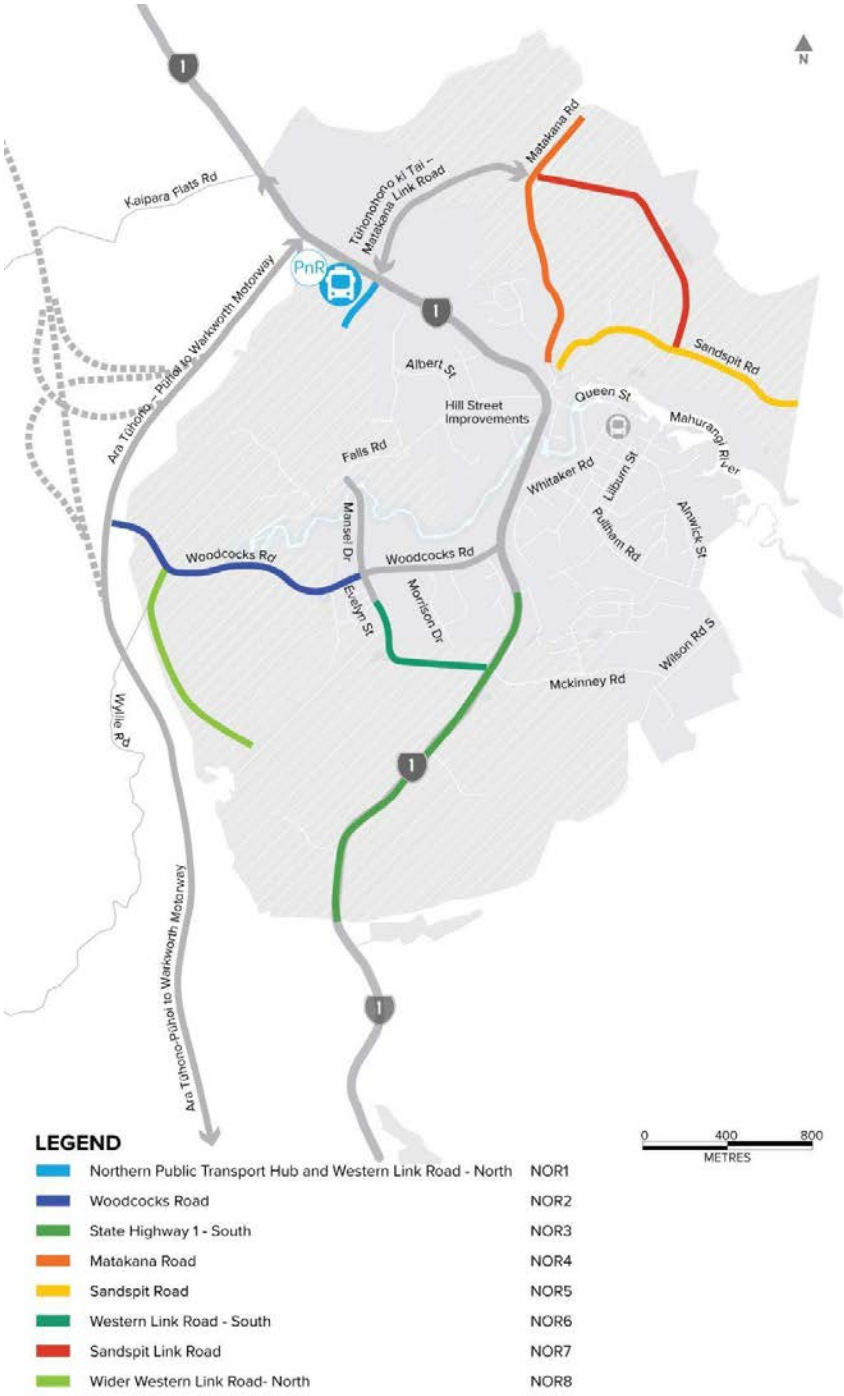
An overview of the Warkworth NOR package is set out in Table 6-1 and shown in Figure 6-1.

Table 6-1. Warkworth Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Northern Public Transport and Western Link - North	1	New northern public transport hub and associated facilities including a park and ride at the corner of State Highway 1 (SH1) and the new Western Link – North. New urban arterial cross-section with active mode facilities between the intersection of SH1 and Te Honohono ki Tai (Matakana Link Road) to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct.	Auckland Transport
Woodcocks Road (Western Section)	2	Upgrade of the existing Woodcocks Road corridor between Mansel Drive and Ara Tūhono (Puhoi to Warkworth) to an urban arterial cross-section with active mode facilities.	Auckland Transport
State Highway 1 Upgrade - South	3	Upgrade of the existing SH1 corridor between Fairwater Road and the southern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Matakana Road	4	Upgrade of the existing Matakana Road corridor between the Hill Street intersection and the northern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Sandspit Road	5	Upgrade of the existing Sandspit Road corridor between the Hill Street intersection and the eastern Rural Urban Boundary to an urban arterial cross-section with active mode facilities.	Auckland Transport
Western Link - South	6	New urban arterial cross-section with active mode facilities between the intersection of SH1 and McKinney Road and Evelyn Street.	Auckland Transport

Sandspit Link	7	New urban arterial cross-section with active mode facilities between the intersection of Matakana Road and Te Honohono ki Tai (Matakana Link Road) and Sandspit Road.	Auckland Transport
Wider Western Link - North	8	New urban arterial cross-section with active mode facilities between Woodcocks Road and the Mahurangi River.	Auckland Transport

Figure 6-1. Warkworth NOR package Overview



6.1 NOR 1 - Northern Public Transport Hub and Western Link - North

This section assesses specific operational noise matters relating to NOR 1 – Northern Public Transport Hub and Western Link – North.

6.2 Overview and Description of Works

The Northern PT Hub and Park & Ride is located adjacent to the intersection of the existing SH1 and the proposed new Western Link - North). This project involves:

- A PT Hub
- Park and Ride facilities with approximately 228 car park spaces attached to the PT Hub
- The new Western Link - North an urban arterial with cycle lanes and footpaths on both sides

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

Note that the Western Link - North has not been assessed against NZS 6806, as there are no existing PPFs or future PPFs with building consent as of the time of writing of this assessment within 100m of the road edge.

6.2.1 Noise Environment

The proposed site for the Northern Public Transport Hub is currently located in a rural environment with few dwellings nearby. The noise environment is dominated by road traffic noise from vehicles using the existing SH1.

PPC25 and the Warkworth Structure Plan indicate that the land near the Northern Public Transport Hub will likely be re-zoned to Light Industry or Business Zone. This zoning would likely result in an increase in ambient noise levels.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

6.3 Predicted Operational Noise Levels

Predicted worst-case noise levels for peak hours are shown in Table 6-2, and have been assessed in the context of the future land use zoning for the area, as shown in Figure 6-2. It is assumed the interchange will start operation at around 5am and will have the potential to operate until after 10pm. Therefore, predicted noise levels have been assessed against the most stringent criteria during the night-time. The prediction locations relative to the Facility and adjacent land use receivers are shown in Figure 6-2. Noise contour maps are provided in Appendix E.

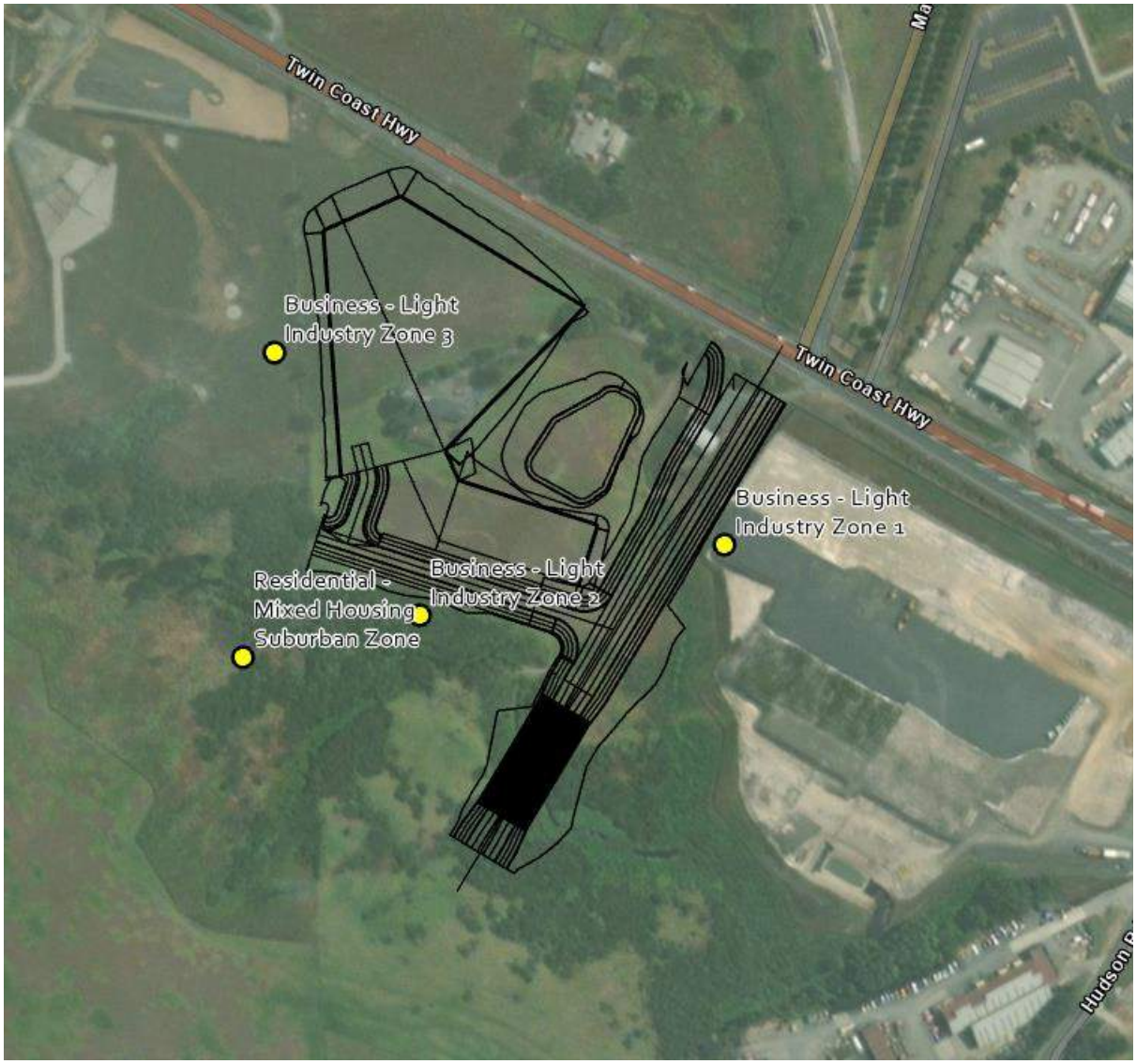


Figure 6-2 Assessed receiver locations relative to the Facility - NOR 1

Table 6-2 Predicted peak hour noise levels at future land use zones - NOR 1

Likely Future Land Use Zone	Noise Criterion		Design Year 2048
	Daytime noise criterion, dB L_{Aeq}	Night-time noise criterion, dB L_{Aeq}	Predicted worst-case peak hour noise level, dB L_{Aeq}
Residential – Mixed Housing Suburban Zone	55	45	34
Business - Light Industry Zone 1	65	65	31
Business - Light Industry Zone 2	65	65	41
Business - Light Industry Zone 3	65	65	34

6.3.1 Summary of Predicted Noise Levels

Predictions show operational noise levels during peak hours, without mitigation, will meet the daytime and night-time criteria at adjacent sites based on the likely future land use zoning in both assessed scenarios. This applies to any remaining existing receivers as well as potential future receivers. Further mitigation measures have therefore not been recommended at this stage, however this assessment should be revisited during detailed design, when more information on the design and proposed movements is known.

6.3.2 Noise Effects

The noise levels modelled represent a worst-case situation which is predicted to last 2 hours at most. Predicted noise levels were assessed against the most stringent criteria for night-time, but it is yet to be confirmed when the peak use of the site will occur.

These operational traffic volumes rely on the urbanisation of the area. As such, the results are only indicative of a possible future scenario which does not consider the noise effects from the wider development of the area. It is not possible to determine with certainty at this stage what the impact will ultimately be when the Project and surrounding infrastructure is built. Development of the surrounding areas will likely increase activity and associated noise levels. The future urban environment may also include a range of other noise sources.

6.4 Conclusions

An assessment of operational noise from the interchange facility during peak hours was carried out based on indicative information for the peak hours as provided by the Project team.

The predictions indicate that the most stringent night-time noise criteria will be met at adjacent existing and likely future receivers after completion of the full build design in 2048. The predictions were undertaken for the daytime peak hour.

7 NOR 2 – Woodcocks Road (Western Section)

This section assesses specific traffic noise matters relating to NOR 2 – Woodcocks Road (Western Section).

7.1 Overview and description of works

Woodcocks Road (western section) is an existing arterial extending from the interchange with Ara Tūhono in the west to the Mansell Drive intersection in the east. It is proposed to upgrade the existing corridor to a two-lane urban arterial with cycling and walking facilities on both sides of the corridor.

The proposed upgrade will provide a key east-west connection for all modes between existing SH1 and the western growth area in Warkworth. Additionally, the corridor connects to key future north-south links including the Wider Western Link Round and Western Link - South. The upgrade will also improve active mode user safety along the corridor.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

7.1.1 Noise Environment

Woodcocks Road (western section) runs through a rural and residential environment. The land adjacent to Woodcocks Road is predominantly zoned Future Urban on both sides of the existing corridor with a small area of Residential Zoned land to the east of Mason Heights.

The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

The Warkworth Structure Plan indicates that the area surrounding Woodcocks Road is likely to be zoned as Residential. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

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

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

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

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

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

- 2 Wyllie Road
- 111 Woodcocks Road
- 105 Woodcocks Road

- 105-103 Woodcocks Road
- 99 Woodcocks Road
- 97 Woodcocks Road
- 95 Woodcocks Road

7.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 7-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum scenario as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Do Minimum scenario for the assessment of road traffic noise effects in Section 7.2.2.

Table 7-1 NZS 6806 Assessment and Summary

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	53	46	53
Cat B	67 dB $L_{Aeq(24h)}$	0	4	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	3	0
Total		**53**	**53**	**53**

Existing scenario predictions show that noise levels within the Project area is between 37 dB $L_{Aeq(24h)}$ and 62 dB $L_{Aeq(24h)}$. All PPFs are in Category A.

Under the Do Nothing scenario, there is an increase in noise levels due to the predicted traffic volume increase with a predicted range of 42 dB $L_{Aeq(24h)}$ and 71 dB $L_{Aeq(24h)}$. Four PPFs, one located at 87 Woodcocks Road and three at 86-94 Woodcocks Road, are in Category B. Three PPFs located at 5, 6, and 7 Evelyn Street are in Category C, with the remainder in Category A.

For the Do Minimum scenario, predictions show a traffic noise level range between 33 dB $L_{Aeq(24h)}$ and 64 dB $L_{Aeq(24h)}$. All PPFs in this scenario fall into Category A

7.2.2 Assessment of Road Traffic Noise Effects

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

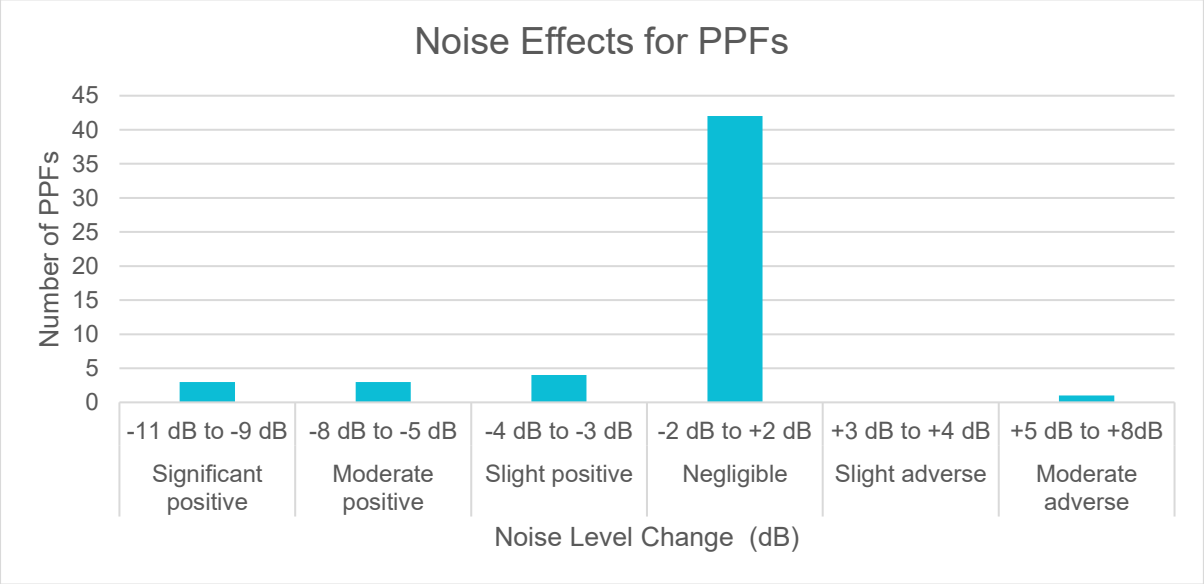


Figure 7-1: Change in Noise Level - Do Nothing Vs Do Minimum – NOR 2

Noise levels are predicted to change by a negligible margin (±2 dB between the Do Nothing and Do Minimum scenario) at 42 PPFs after implementation of the Project.

Predictions indicate that one PPF will experience an increase in noise level of 5-8 dB, resulting in moderate adverse noise effects.

Increases in noise levels at this PPF is due to the proposed surrounding road network, which includes Woodcocks Road in addition to Western Link - South. All PPFs are predicted to remain in Category A in the Do Minimum scenario.

Predictions indicate that four PPFs will experience a decrease in noise levels of 3-4 dB, resulting in slight positive effects. Three PPFs will experience a decrease in noise levels of 5-8 dB, resulting in moderate positive effects. Three PPFs will experience a decrease in noise levels of 9-11 dB, resulting in significant positive effects.

Positive noise level changes are brought about by a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network and road design changes including retaining walls providing some shielding to PPFs.

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

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

7.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Woodcocks Road Upgrade (Western Section).

An initial screening assessment has been carried out and the Woodcocks Road Upgrade (Western Section) does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options have not been considered.

A comparison of the predicted road traffic noise levels between the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs.

8 NOR 3 – State Highway 1 Upgrade - South

This section assesses specific traffic noise matters relating to NOR 3 – State Highway 1 - South.

8.1 Overview and description of works

The section of SH1 within NOR 3 extends from the Northern Gateway Toll Road in the south to its intersection with Auckland Road in the northeast, with the extents of the proposed upgrade from the FUZ boundary in the south to its intersection with Fairwater Road in the north. The SH1 – South upgrade involves the urbanisation of the corridor to a two-lane urban arterial with cycle lanes and footpaths on both sides of the entire corridor length.

The proposed upgrade will provide a key north-south connection through Warkworth and with the provision of dedicated walking and cycling facilities will become the primary north-south active mode corridor in Warkworth.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

8.1.1 Noise Environment

The land on both sides of the southern section of the alignment is zoned FUZ. The northern section of the alignment is predominantly zoned as Residential – Single House zone and to the east of the corridor as Business – Local Centre Zone.

The existing SH1 is an existing road with commercial buildings and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on the existing SH1.

It is anticipated that the noise environment in the future will change as a result of the opening of Ara Tūhono (Puhoi to Warkworth). When Ara Tūhono opens, the road will no longer be SH1 and it is anticipated that the majority of traffic passing through Warkworth will use the new corridor.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

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

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

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

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

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

- 1693 State Highway 1

8.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Existing State Highway 1 Upgrade (Southern Section) meets the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. A summary of the results is presented in Table 8-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum and Mitigation scenarios as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Mitigation scenario for the assessment of road traffic noise effects in Section 7.2.2.

Table 8-1 NZS 6806 Assessment and Summary

Category		Number of PPFs			
	Criteria	Existing	Do Nothing	Do Minimum	Mitigation
Cat A	64 dB $L_{Aeq(24h)}$	85	97	92	97
Cat B	67 dB $L_{Aeq(24h)}$	12	0	5	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0	0
Total		**97**	**97**	**97**	**97**

Existing scenario predictions show that noise levels within the Project area is between 47 dB $L_{Aeq(24h)}$ and 67 dB $L_{Aeq(24h)}$. 12 PPFs are in Category B, with the remaining PPFs in Category A.

Under the Do Nothing scenario, there is a decrease in noise levels with a predicted range of 46 dB $L_{Aeq(24h)}$ and 64 dB $L_{Aeq(24h)}$. All PPFs are in Category A.

For the Do Minimum scenario, predictions show a traffic noise level range between 37 dB $L_{Aeq(24h)}$ and 66 dB $L_{Aeq(24h)}$. Five PPFs are in Category B, with the remaining PPFs in Category A.

Mitigation has been considered to reduce noise levels at PPFs. This mitigation option involves applying AC-14 to the road surface, resulting in all PPFs falling into Category A. This is the recommended mitigation option for NOR 3.

8.2.2 Assessment of Road Traffic Noise Effects

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

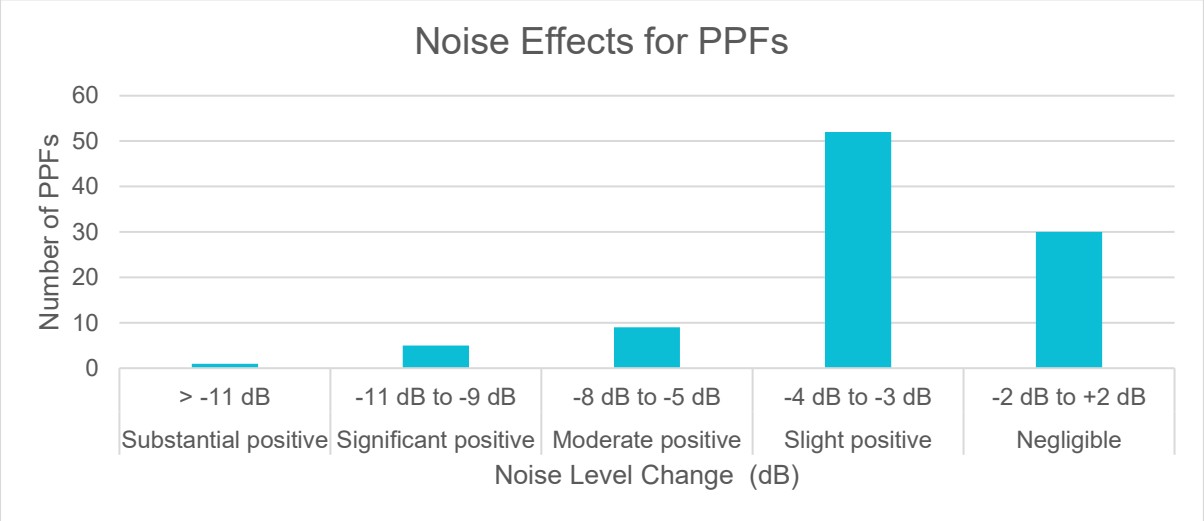


Figure 8-1: Change in Noise Level - Do Nothing Vs Mitigation– NOR 3

Noise levels are predicted to change by a negligible margin (±2 dB between the Do Nothing and Mitigation scenario) at 30 PPFs after implementation of the Project.

Predictions indicate that 52 PPFs will experience a decrease in noise levels of 3-4 dB, resulting in slight positive effects, 9 PPFs will experience a decrease in noise levels of 5-8 dB, resulting in moderate positive effects, five PPFs will experience a decrease in noise levels of 9-11 dB, resulting in significant positive effects, and one PPF will experience a decrease in noise levels of greater than 11 dB, resulting in substantial positive effects.

Positive noise level changes are brought about by changes to the road design (including speed limit reductions, concrete safety barriers and retaining walls) along some sections of the alignment and a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network. Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

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

8.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Existing State Highway 1 Upgrade (Southern Section).

Under the Do Minimum scenario, five PPFs are in Category B, with the remaining PPFs in Category A. With the recommended mitigation of a low noise road surface, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Mitigation scenario indicates that noise level changes will be positive for the majority of PPFs.

9 NOR 4 – Matakana Road Upgrade

This section assesses specific traffic noise matters relating to NOR 4 – Matakana Road Upgrade.

9.1 Overview and description of works

Matakana Road is an existing arterial connecting the growth area of Warkworth and the towns of Matakana and Omaha. This project extends from the tie in with the Hill Street intersection upgrade project in the south to the Future Urban Zone boundary in the north, and it is intersected by the Te Honohono ki Tai (Matakana Link Road) project at its mid-point.

It is proposed to upgrade Matakana Road to a two-lane urban arterial with cycle lanes and footpaths on both sides.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

9.1.1 Noise Environment

The existing Matakana Road corridor runs through predominantly residential land uses. The eastern extent of Matakana Road is zoned as Future Urban Zone. The western and north-western sections of the corridor are comprised of residential land uses (Residential – Single House Zone, Mixed Housing Suburban Zone, and Mixed Housing Urban Zone).

The Warkworth Structure Plan indicates that the FUZ area surrounding Matakana Road is likely to be zoned as Residential in the future. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

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

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

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

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

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

- 304 Matakana Road

9.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Matakana Road Upgrade meets the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. A summary of the results of the assessment are presented in Table 9-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum and Mitigation scenarios as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Mitigation scenario for the assessment of road traffic noise effects in Section 7.2.2.

Table 9-1 NZS 6806 Assessment and Summary

Category		Number of PPFs			
	Criteria	Existing	Do Nothing	Do Minimum	Mitigation
Cat A	64 dB $L_{Aeq(24h)}$	54	61	63	68
Cat B	67 dB $L_{Aeq(24h)}$	9	4	4	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	5	3	1	0
Total		**68**	**68**	**68**	**68**

Existing scenario predictions show that noise levels within the Project area are between 50 dB $L_{Aeq(24h)}$ and 72 dB $L_{Aeq(24h)}$. Nine PPFs are predicted to fall within Category B, and five PPFs are predicted to fall into Category C. The Category C PPFs are as follows:

- 299 Matakana Road
- 170 Matakana Road
- 74 Matakana Road
- 1 Millstream Place
- 96 Matakana Road

Under the Do Nothing scenario, noise levels are predicted to be in the range of 47 dB $L_{Aeq(24h)}$ to 69 dB $L_{Aeq(24h)}$. Three PPFs are predicted to fall in Category C, four PPFs are in Category B, with the remainder in Category A. The PPFs in Category C are 74 Matakana Road, 96 Matakana Road, and 1 Millstream Place.

For the Do Minimum scenario, predictions show a traffic noise level range between 42 dB $L_{Aeq(24h)}$ and 68 dB $L_{Aeq(24h)}$. One PPF at 96 Matakana Road remains in Category C. Four PPFs remain in Category B, these PPFs are:

- 299 Matakana Road
- 303 Matakana Road
- 170 Matakana Road
- 130 Matakana Road

One mitigation option has been considered to reduce noise levels at PPFs. The option comprises the use of AC-14 low noise road surface. This option results in all PPFs falling into Category A. This is the recommended mitigation option for NOR 4.

9.2.2 Assessment of Road Traffic Noise Effects

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

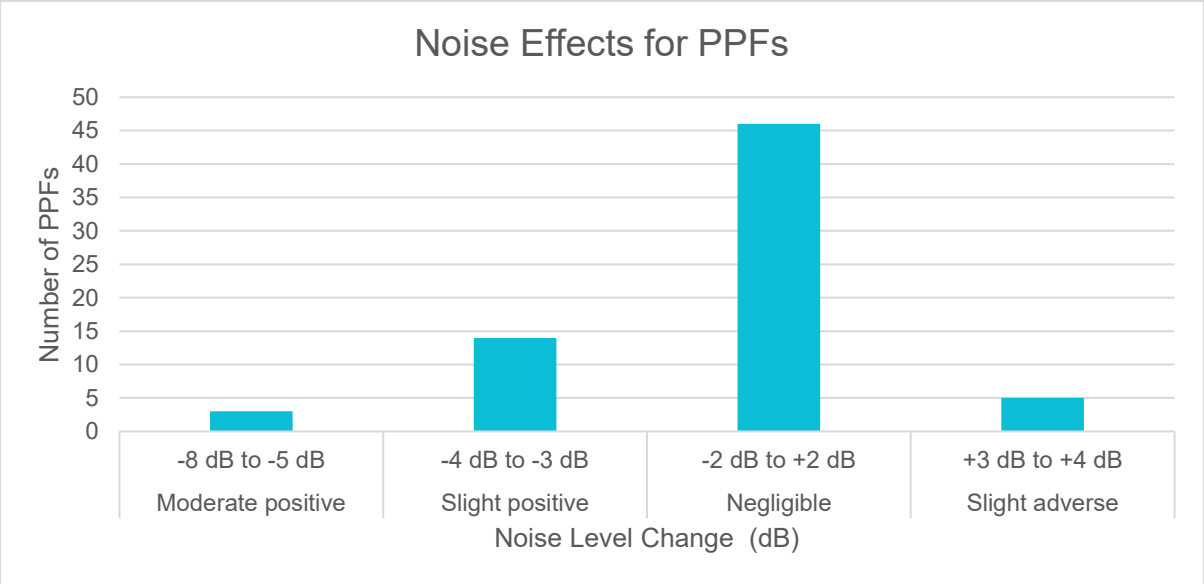


Figure 9-1: Change in Noise Level - Do Nothing Vs Mitigation – NOR 4

Noise levels are predicted to change by a negligible margin (±2 dB between the Do Nothing and Mitigation scenario) at 46 PPFs after implementation of the Project.

Predictions indicate that five PPFs will experience an increase in noise level of 3-4 dB, resulting in slight adverse effects.

Increases in noise levels at these PPFs are due to the demolition of some houses which would otherwise provide acoustic shielding to PPFs behind, in addition to bringing the road alignment closer to some PPFs.

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

Positive noise level changes are brought about by localised terrain changes (addition of active transport corridor providing screening between Matakana Road and some PPFs), a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network, in addition to the inclusion of a low noise AC-14 road surface.

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

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

9.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Matakana Road Upgrade. Under the Do Minimum scenario, one PPF at 96 Matakana Road is in Category C, and four PPFs are in Category B, with the rest in Category A. With the recommended mitigation option of AC-14 low noise road surface implemented, all PPFs fall into Category A.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Mitigation scenario indicates that noise level changes will be negligible for the majority of PPFs.

10 NOR 5 – Sandspit Road Upgrade

This section assesses specific traffic noise matters relating to NOR 5 – Sandspit Road Upgrade.

10.1 Overview and description of works

Sandspit Road is an existing arterial providing east-west connection between the Warkworth growth area and the towns of Sandspit and Snells Beach. This project extends from the tie in with the Hill Street intersection upgrade Project in the west and to the eastern Future Urban Zone boundary.

It is proposed to upgrade Sandspit Road to a two-lane urban arterial with cycle lanes and footpaths on both sides. The proposed upgrade will improve accessibility for active mode users to social and economic opportunities around the Warkworth growth area and contribute to improved safety outcomes along the corridor.

Refer back to the AEE in Volume 2 for a more det0ailed description of works to be authorised.

10.1.1 Noise Environment

Sandspit Road currently runs through urban and rural environments. In the rural area there are a few dwellings near the road. The noise environment is dominated by road traffic noise from vehicles using Sandspit Road and the surrounding road network.

The land on both sides of the corridor is zoned as Future Urban Zone. There is a high likelihood of urban development in the FUZ to the north of the corridor. This is signalled in the Warkworth Structure Plan as land use change to Residential – Single House Zone. An increase in ambient noise levels is expected as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

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

All PPFs for this NOR have been assessed against the Altered Roads criteria as per Section 3.1.3.

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

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

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

- 360 Sandspit Road
- 325 Sandspit Road

- 126 Sandspit Road
- 101-105 Sandspit Road
- 89 Sandspit Road
- 35 Sandspit Road
- 2 Millstream Place

10.2.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Sandspit Road Upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 10-1.

As noted in Section 3.1.3, the NZS 6806 assessment requires that mitigation is only provided for the contribution of noise within the Altered Road extents, therefore the noise level predictions for PPFs at the ends of the NOR are reduced for the Do Minimum scenario as the surrounding road network contribution is not included. The surrounding road network is included in the noise predictions for the Do Minimum scenario for the assessment of road traffic noise effects in Section 7.2.2

Table 10-1 NZS 6806 Assessment and Summary

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	14	15	18
Cat B	67 dB $L_{Aeq(24h)}$	2	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	2	3	0
Total		**18**	**18**	**18**

Existing scenario predictions show that noise levels within the Project area are between 50 dB $L_{Aeq(24h)}$ and 70 dB $L_{Aeq(24h)}$. Two PPFs are predicted to fall in Category B, and two PPFs are predicted to fall within Category C. The Category C PPFs are shown below:

- 108 Sandspit Road
- 1 Millstream Place

Under the Do Nothing scenario, the range of predicted noise levels falls between 50 dB $L_{Aeq(24h)}$ and 69 dB $L_{Aeq(24h)}$. Compared to the Existing scenario, 108 Sandspit Road and 1 Millstream Place remain in Category C, and 384 Sandspit Road moves to Category C, with all other PPFs being in Category A.

For the Do Minimum scenario, there is an overall reduction in noise levels at the upper end, with a predicted range of between 47 dB $L_{Aeq(24h)}$ and 64 dB $L_{Aeq(24h)}$. All PPFs in this scenario fall into Category A.

10.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 10-1 shows the

predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

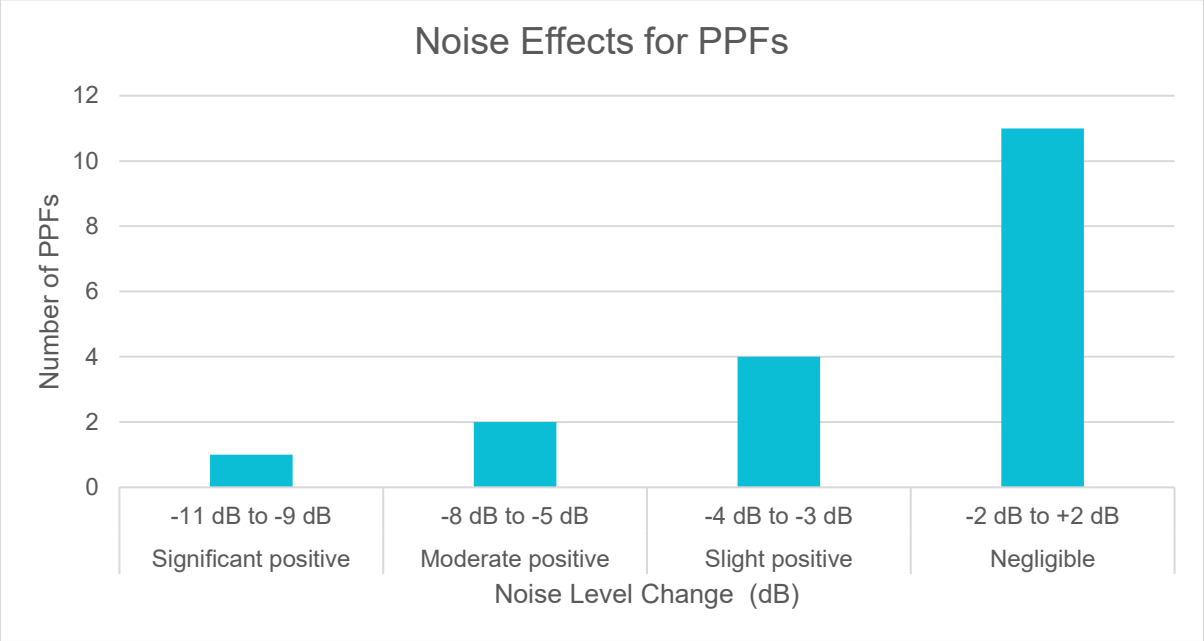


Figure 10-1: Change in Noise Level - Do Nothing Vs Do Minimum – NOR 5

Noise levels are predicted to change by a negligible margin (±2 dB between the Do Nothing and Mitigation scenario) at 11 PPFs after implementation of the Project.

Predictions indicate that four PPFs will experience a decrease in noise level of 3-4 dB, resulting in slight positive effects, two PPFs will experience a decrease in noise level of 5-8 dB, resulting in moderate positive effects. One PPF will experience a decrease in noise level of 9-11 dB, resulting in significant positive effects

Positive noise level changes are brought about by localised terrain changes (addition of active transport corridor providing screening between Sandspit Road and some PPFs), the addition of a low noise AC-14 pavement, and a reduction in road traffic flow due to redistributed road traffic throughout the surrounding proposed road network.

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

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

10.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806. An initial screening assessment has been carried out and the Sandspit Road Upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 2.1. The Standard therefore does not apply, and mitigation options do not need to be considered.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible for the majority of PPFs.

11 NOR 6 – Western Link - South

This section assesses specific traffic noise matters relating to NOR 6 – Western Link - South.

11.1 Overview and description of works

The Western Link - South is located at the end of Evelyn Street in the north to SH1 in the south and runs through existing greenfield land. The Western Link - South Project involves the construction of a new two-lane urban arterial with walking and cycling facilities on both sides and upgrading the intersection with McKinney Road.

The new corridor will provide key north-south connection in the Warkworth network. The purpose of the Western Link is to enable development in west Warkworth and provide access to FUZ land and industrial areas while taking pressure off the existing SH1 and Hill Street intersection.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

11.1.1 Noise Environment

Western Link - South is an existing road with commercial and residential dwellings along the road corridor. The noise environment is dominated by road traffic noise from vehicles on the existing SH1, and industrial noise from the neighbouring Business – Light Industry Zone.

The majority of land adjacent to the Western Link - South is currently zoned as Future Urban Zone. There is a small area zoned as Business – Light Industry Zone.

The Warkworth Structure Plan indicates that the area to the South and West of the Wider Western Link is likely to be zoned as Residential. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

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

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 3.1.3.

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

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

11.2.1 Altered Roads

11.2.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Western Link - South does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the NZS 6806 assessment is shown in Table 11-1.

Table 11-1 NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	9	8	11
Cat B	64 dB $L_{Aeq(24h)}$	2	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	3	0
Total		**11**	**11**	**11**

Existing scenario predictions show the noise level within the Project area is between 40 dB $L_{Aeq(24h)}$ and 65 dB $L_{Aeq(24h)}$. Two PPFs at 1848 State Highway 1 and 8F McKinney Road are in Category B. No PPFs are in Category C.

In the Do Nothing scenario, noise levels within the Project area are between 54 dB $L_{Aeq(24h)}$ and 71 dB $L_{Aeq(24h)}$. This scenario results in all PPFs falling into Category A, with the exception of 5, 6, and 7 Evelyn Street, which fall into Category C.

For the Do Minimum scenario, noise levels within the Project area are between 41 dB $L_{Aeq(24h)}$ and 62 dB $L_{Aeq(24h)}$. This scenario results in all PPFs falling into Category A.

11.2.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 11-2 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

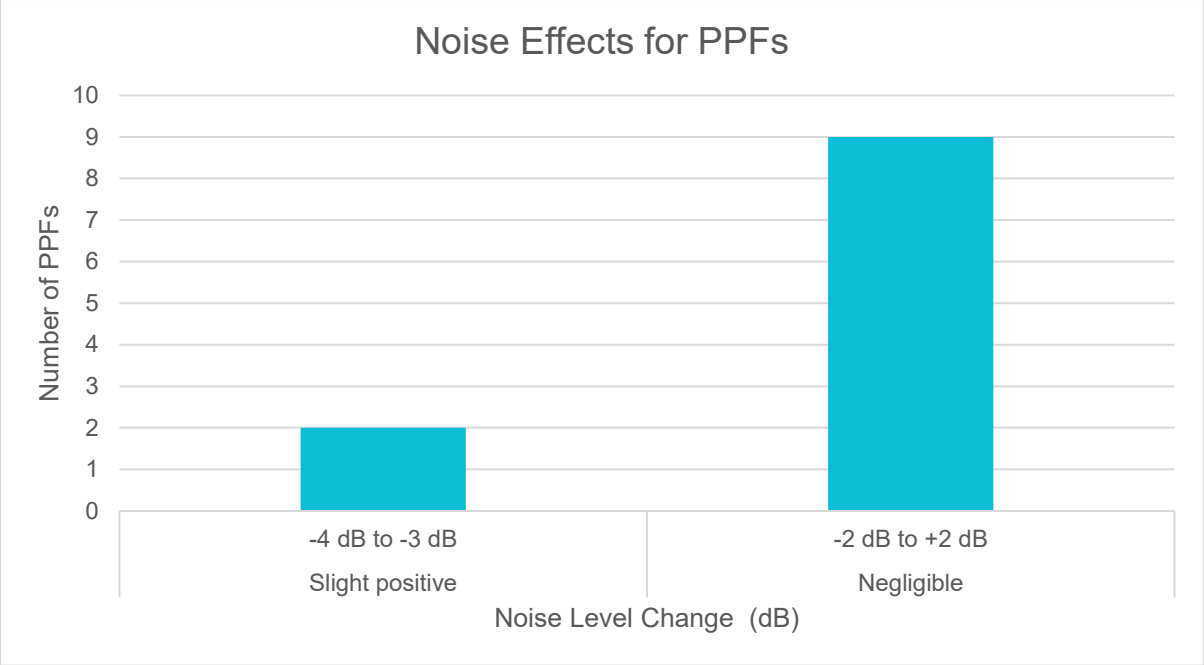


Figure 11-1: Change in Noise Level – Do Nothing Vs Do Minimum – NOR 6 Altered Roads

Predictions indicate that noise level changes will typically be negligible at the majority of PPFs when comparing the Do Nothing and Do Minimum scenarios.

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

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

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

11.2.2 New Roads

11.2.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the New road, so the Existing and Do Minimum scenarios are compared.

A summary of the results of the NZS 6806 assessment is shown in Table 11-2.

Table 11-2 NZS 6806 Assessment and Summary – New Roads

Category		Number of PPFs	
	Criteria	Existing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	27	23
Cat B	64 dB $L_{Aeq(24h)}$	0	4
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0
Total		**27**	**27**

Existing scenario predictions show the noise level within the Project area is between 37 dB $L_{Aeq(24h)}$ and 42 dB $L_{Aeq(24h)}$. All PPFs are predicted to fall into Category A.

For the Do Minimum scenario there is an overall increase in noise levels with a predicted range of 43 dB $L_{Aeq(24h)}$ to 62 dB $L_{Aeq(24h)}$. In this scenario, four PPFs are predicted to fall into Category B. These are located at:

- 2 Jamie Lane
- 1 Christopher Lane
- 2 Christopher Lane
- 1 Oliver Street

Since AC-14 is already considered as the Do Minimum road surface for NOR 6, a noise barrier was considered for the four Category B PPFs. However, a gap would be required in the barrier to maintain access from the road, which would compromise the barrier's performance and is therefore not recommended as BPO.

11.2.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 11-2 shows the predicted change in noise level at PPFs when comparing the Existing and Do Minimum scenarios with the local road network included.

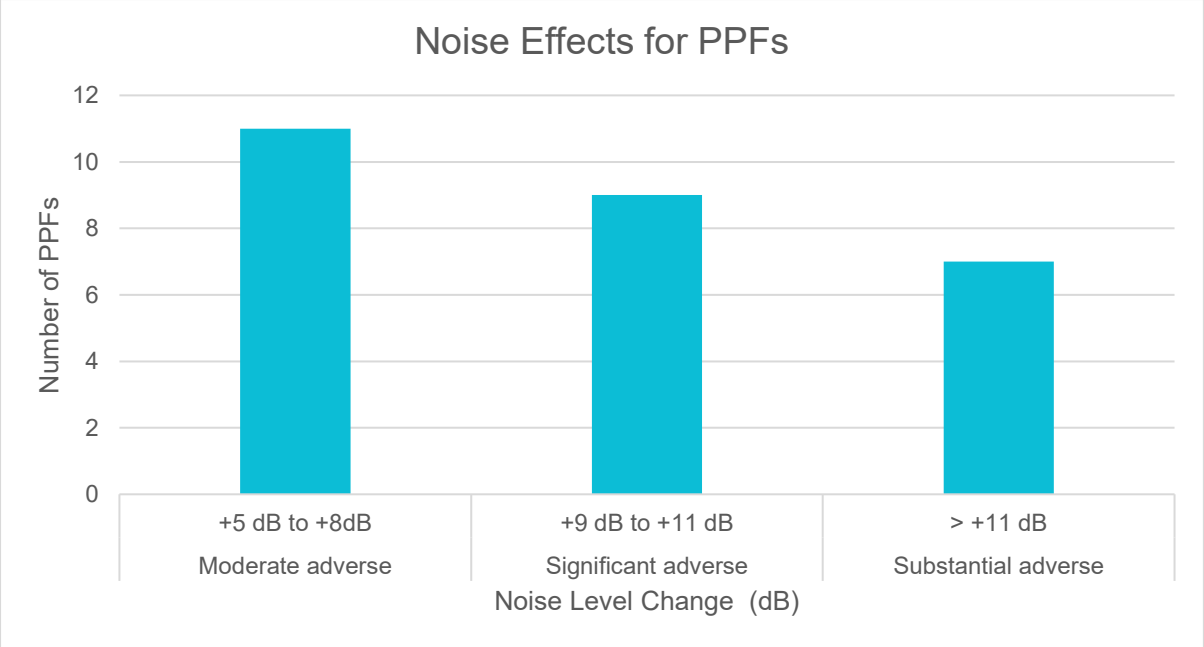


Figure 11-2: Change in Noise Level - Existing Vs Do Minimum – NOR 6 New Roads

Predictions indicate that noise levels will increase at all PPFs assessed against the New Road criteria when comparing the Existing and Do Minimum scenarios.

Predictions indicate that 11 PPFs will experience an increase in noise level of 5-8 dB, resulting in moderate adverse effects. Nine PPFs will experience an increase in noise level of 9-11 dB, resulting in significant adverse noise effects. Seven PPFs will experience an increase in noise level of more than 11 dB, resulting in substantial adverse effects.

Increases in noise levels at these PPFs is due to the construction of a new road corridor throughout this project extent, where no road previously existed. Some PPFs are located within close proximity to this proposed road alignment, resulting in a significant shift in road traffic noise levels at these locations.

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

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

11.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Western Link - South. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated further for these sections.

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

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that noise levels are likely to increase at most PPFs, with up to 16 PPFs experiencing significant or substantial adverse effects. Since AC-14 is already considered as the Do Minimum road surface for NOR 6, a noise barrier was considered for this location. However, its performance would be compromised due to the gap required to maintain access from the road.

12 NOR 7 – Sandspit Link

This section assesses specific traffic noise matters relating to NOR 7 – Sandspit Link.

12.1 Overview and description of works

Sandspit Link is a proposed new road with the purpose of providing strategic east-west movements to Matakana and Kowhai Coasts and providing local access to the northern growth area. The corridor extends from Matakana Road in the north-west and connects to Sandspit Road in the southeast. The alignment provides a resilient alternative to SH1 and Hill Street Intersection whilst improving dual accessibility between the northern growth area and Warkworth.

The Sandspit Link Project involves the construction of a two-lane urban arterial with cycle lanes and footpaths on both sides and a new intersection at the connection with Sandspit Road.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

12.1.1 Noise Environment

The proposed Sandspit Link runs through a currently rural environment. In the rural area there are few dwellings near existing roads. The noise environment is dominated by road traffic noise from vehicles using the Matakana Road and the surrounding road network as well as noise associated with the nearby quarry.

Sandspit Link is zoned as FUZ on both sides of the alignment. To the northeast of the alignment is an existing Special Purpose – Quarry Zone.

The Warkworth Structure Plan indicates that the land surrounding the proposed Sandspit Link is likely to be zoned Residential. This zoning would likely result in an increase in ambient noise levels as the area urbanises.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

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

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 3.1.3.

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

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

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

- 181 Sandspit Road

12.2.1 Altered Roads

12.2.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Sandspit Link does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the NZS 6806 assessment is shown in Table 12-1.

Table 12-1 NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	2	2	2
Cat B	64 dB $L_{Aeq(24h)}$	0	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		**2**	**2**	**2**

Existing scenario predictions show the noise level within the Project area is between 59 dB $L_{Aeq(24h)}$ and 61 dB $L_{Aeq(24h)}$. The two PPFs assessed under the Altered road criteria both fall into Category A.

For the Do Nothing Scenario, predictions show that noise levels within the Project are between 58 dB $L_{Aeq(24h)}$ and 60 dB $L_{Aeq(24h)}$. Similarly, all PPFs fall into Category A.

For the Do Minimum scenario traffic noise levels are predicted in the range of 54 dB $L_{Aeq(24h)}$ at both PPFs. All PPFs in this scenario fall into Category A.

12.2.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 12-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

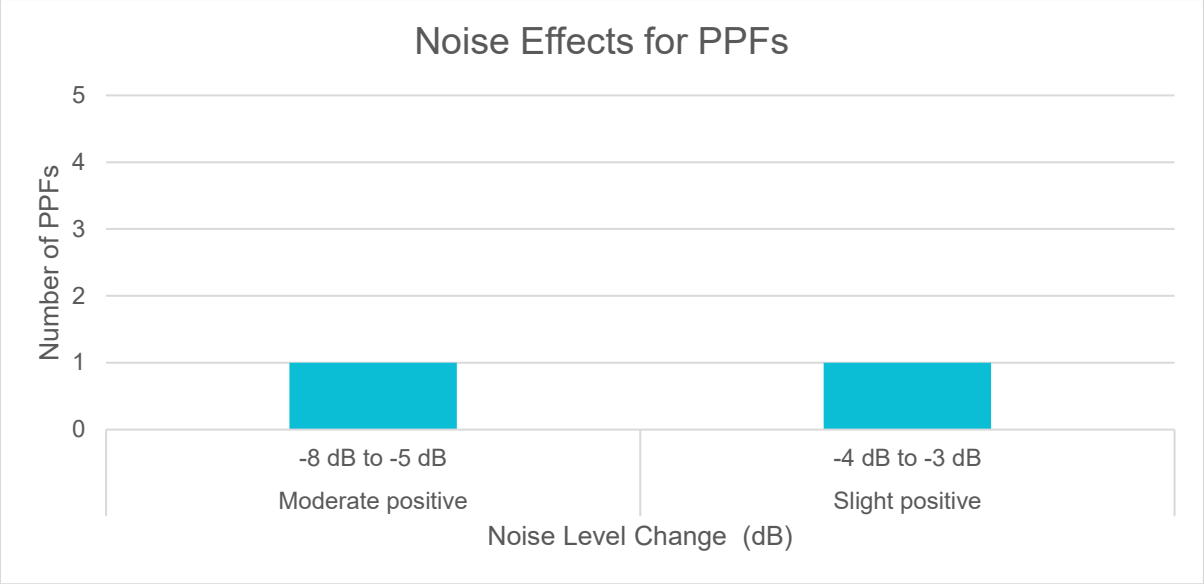


Figure 12-1: Change in Noise Level – Do Nothing Vs Do Minimum – NOR 7 Altered Roads

Predictions indicate that noise levels at one PPF are predicted to decrease by 3-4 dB, resulting in slight positive effects. One PPF will experience a decrease of 5-8 dB, resulting in moderate positive effects.

Decreases in noise levels at these PPFs are predominantly due to an overall reduction in road traffic flow on Altered roads as a result of the redistribution of traffic throughout the Project area.

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

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

12.2.2 New Roads

12.2.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the New road, so the Existing and Do Minimum scenarios are compared.

A summary of the results of the NZS 6806 assessment is shown in Table 12-2.

Table 12-2 NZS 6806 Assessment and Summary – New Roads

Category		Number of PPFs	
	Criteria	Existing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	3	3
Cat B	64 dB $L_{Aeq(24h)}$	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0
Total		**3**	**3**

Existing scenario predictions show the noise level within the Project area is between 46 dB $L_{Aeq(24h)}$ and 48 dB $L_{Aeq(24h)}$, with all PPFs falling into Category A.

For the Do Minimum scenario traffic noise levels are predicted in the range of 46 dB $L_{Aeq(24h)}$ to 48 dB $L_{Aeq(24h)}$. All PPFs in this scenario fall into Category A.

12.2.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 12-2 shows the predicted change in noise level at the three PPFs when comparing the Existing and Do Minimum scenarios with the local road network included.

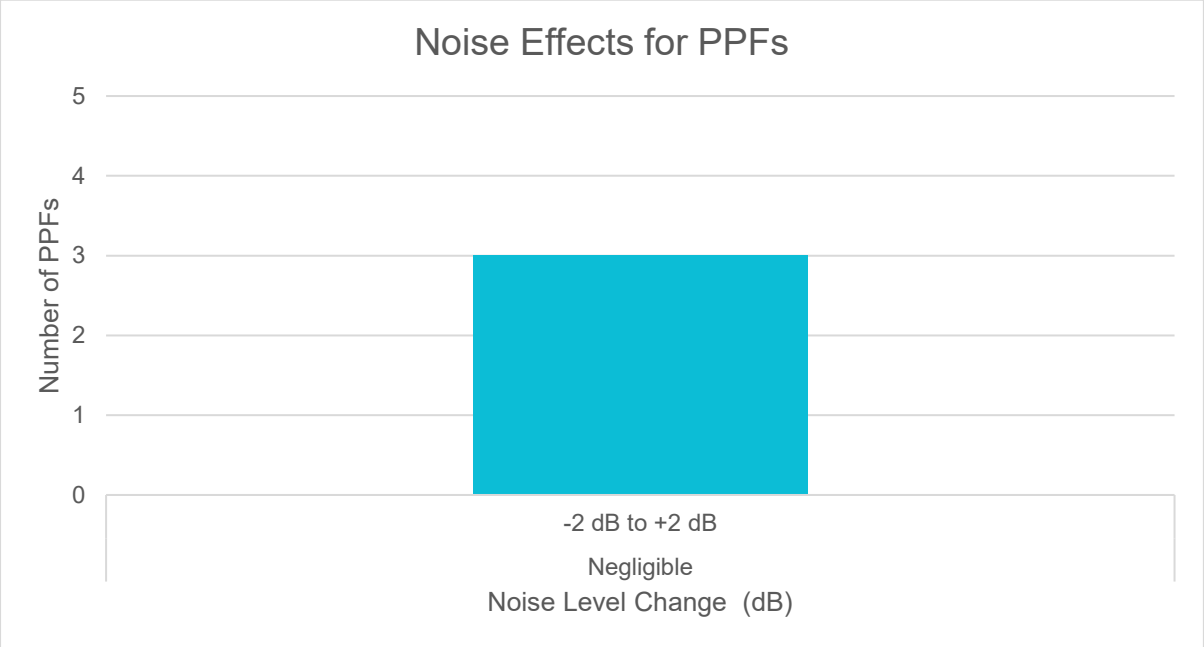


Figure 12-2: Change in Noise Level - Existing Vs Do Minimum – NOR 7 New Roads

Predictions indicate that noise levels are predicted to change by a negligible margin (±2 dB between the Existing and Do Minimum scenario) at all three PPFs after implementation of the Project.

Despite the construction of a new road corridor near these PPFs, the overall reduction of road traffic on the surrounding road network results in a net change that is negligible.

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

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

12.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Sandspit Link Upgrade. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicates that noise levels changes will be slightly to moderately positive for all PPFs, due to a reduction of road traffic on Altered roads as traffic is redistributed throughout the Project Area.

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be negligible at all three PPFs. All PPFs would fall into Category A in the Do Minimum scenario.

13 NOR 8 – Wider Western Link – North

This section assesses specific traffic noise matters relating to NOR 8 – Wider Western Link – North.

13.1 Overview and description of works

The Wider Western Link is a proposed new arterial extending from Woodcocks Road in the north to SH1 in the south. The extent of the proposed new Wider Western Link - North is from Woodcocks Road in the north to the midway point of the Warkworth South FUZ and is inclusive of the Mahurangi River.

The Wider Western Link – North project involves the construction of two-lane urban arterial with walking and cycling facilities on both sides. The corridor connects the Southern Interchange to Woodcocks Road and SH1 and, provides access into the southern FUZ where access will otherwise be difficult due to topography and streams.

Refer back to the AEE in Volume 2 for a more detailed description of works to be authorised.

13.1.1 Noise Environment

The Wider Western Link runs through a predominantly rural area with some residential dwellings located close to the road corridor. The noise environment is dominated by road traffic noise from vehicles on Woodcocks Road.

It is anticipated that the noise environment in the future will change as a result of the opening of Ara Tuhono (Puhoi to Warkworth). When Ara Tuhono opens, the road will no longer be SH1, and it is anticipated that the majority of traffic passing through Warkworth will use the new corridor.

Wider Western Link (Northern Section) is located on land which is zoned as FUZ. There is a high likelihood of urban development in the FUZ. This is signalled by the Warkworth Structure Plan which identifies a future change to Business – Heavy Industrial Zone in the northern section of the alignment and residential land uses in the southern section of the alignment. This zoning would likely result in an increase in ambient noise levels as the area urbanises compared to the current rural nature.

Refer back to the AEE in Volume 2 for a detailed description of the existing and likely receiving environment for the overall Warkworth package.

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

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 3.1.3.

Predicted road-traffic noise levels at all existing PPFs for the Existing and Do Minimum scenarios are shown in Appendix D. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

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

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

- 2 Wyllie Road

13.2.1 Altered Roads

13.2.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the Sandspit Link does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the NZS 6806 assessment is shown in Table 13-1.

Table 13-1 NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	2	2	2
Cat B	64 dB $L_{Aeq(24h)}$	0	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		**2**	**2**	**2**

Existing scenario predictions show the noise level within the Project area is between 53 dB $L_{Aeq(24h)}$ and 62 dB $L_{Aeq(24h)}$. Both PPFs are predicted to fall into Category A.

In the Do Nothing scenario, noise levels within the Project area are between 52 dB $L_{Aeq(24h)}$ and 60 dB $L_{Aeq(24h)}$. Both PPFs are similarly predicted to fall into Category A.

For the Do Minimum scenario traffic noise levels are predicted in the range of 54 dB $L_{Aeq(24h)}$ to 56 dB $L_{Aeq(24h)}$. This scenario results in all PPFs falling into Category A.

13.2.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 13-1

shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios with the local road network included.

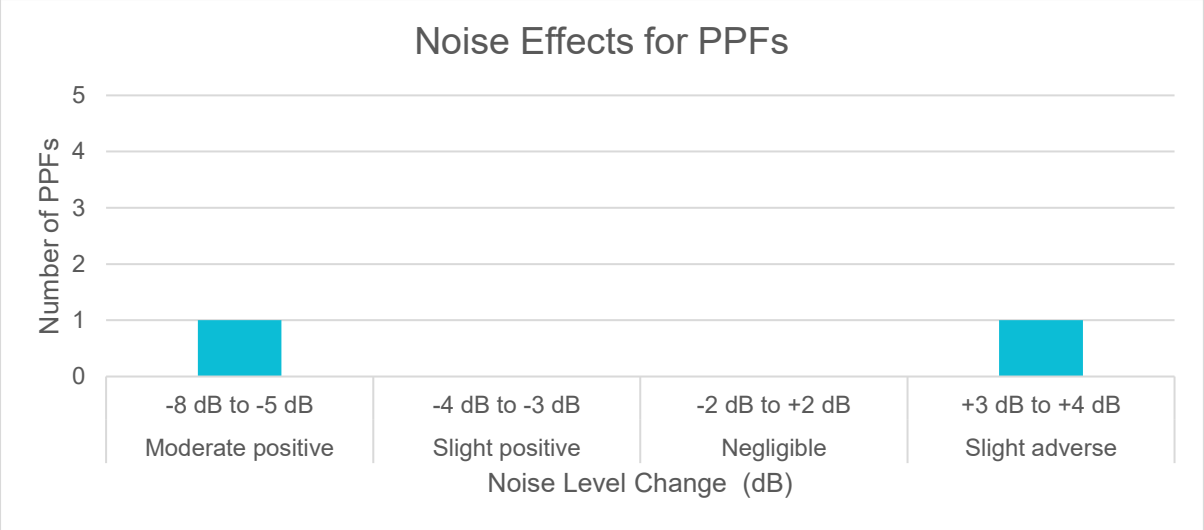


Figure 13-1: Change in Noise Level – Do Nothing Vs Do Minimum – NOR 8 Altered Roads

Predictions indicate that one PPF at 346 Woodcocks Road will experience a decrease in noise level of 6 dB, resulting in moderate positive effects.

One PPF located at 12 Wyllie Road is predicted to have traffic noise levels increase by 4 dB, resulting in slight adverse effects. However, it should be noted that all PPFs are in Category A.

While the PPF at 12 Wyllie Road is within 100m of Woodcocks Road (hence its assessment against the Altered Roads criteria), an increase in noise level is predicted at this PPF due to the construction of the new road corridor to the east of the PPF where no road previously existed.

Reduced traffic flows along Woodcocks Road results in the PPF at 346 Woodcocks Road experiencing a reduction in road traffic noise levels.

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

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

13.2.2 New Roads

13.2.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the New road, so the Existing and Do Minimum scenarios are compared.

A summary of the results of the NZS 6806 assessment is shown in Table 13-2.

Table 13-2 NZS 6806 Assessment and Summary – New Roads

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

Existing scenario predictions show the noise level at the single PPF under consideration at 123 Valerie Close in this assessment is 35 dB $L_{Aeq(24h}$, therefore falling into Category A.

For the Do Minimum scenario traffic noise levels are predicted to be 48 dB $L_{Aeq(24h)}$. This scenario results in the PPF falling into Category A.

13.2.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario with the local road network included can be compared to determine the predicted noise level increase or decrease at 123 Valerie Close as a result of the Project.

Predictions indicate that this PPF will experience an increase in noise level of 13 dB, resulting in substantial adverse effects.

The increase in noise level at this PPF is due to the construction of a new road corridor throughout this project extent, where no road previously existed. The PPF is located within close proximity to this proposed road alignment, resulting in a shift in road traffic noise levels at this location. Although a 13 dB increase is predicted at this PPF, the resulting noise level of 48 dB $L_{Aeq(24h)}$ is still typical of a rural environment.

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

13.3 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Wider Western Link (Northern Section). The Altered roads in this NOR did not meet the definition of an Altered road according to NZS 6806, so mitigation measured were not investigated for these sections.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicated noise level changes will be moderately positive at one PPF and slightly adverse at the other. Both PPFs in this case would fall into Category A for both scenarios.

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be substantially adverse at

the single PPF under consideration in the assessment. Despite this noise level increase, this PPF would still fall into Category A in both the Existing and Do Minimum scenarios. Although a 13 dB increase is predicted at this PPF, the resulting noise level of 48 dB $L_{Aeq(24h)}$ is still typical of a rural environment.

14 Conclusions

An assessment of traffic noise has been carried out for the Warkworth Assessment Package for New and Altered Roads based on NZS 6806 and the predicted change in noise level. To determine the change in noise level a comparison has been made between the predicted road traffic noise levels in the Existing (for New Roads) or Do Nothing (for Altered Roads) scenarios (representative of the design year without the Project, assuming traffic from full area development on the existing road network) and Do Minimum or Mitigated scenarios (with the Project and all other Warkworth Package projects implemented along with BPO mitigation where applicable).

All existing PPFs within 100m of each alignment have been considered within the assessment. Buildings that are within the NOR designation areas have been removed from the Do Minimum and Mitigated scenarios as they will not remain following the Project implementation.

An assessment of operational noise from the interchange facility (NOR 1) during peak hours was carried out based on indicative information for the peak hours as provided by the Project team. The predictions indicate that the most stringent night-time noise criteria will be met at adjacent existing and likely future receivers at the Design Year.

NOR 2 does not meet the definition of an Altered Road. The Standard therefore does not apply, and mitigation options do not need to be considered. A comparison of the Do Nothing and Mitigation scenarios indicates that noise level changes will be negligible at a majority of PPFs as a result of speed reduction and redistribution of traffic across the network. All PPFs would fall into Category A.

For NOR 3, noise level changes are predicted to be positive at the majority of PPFs with the implementation of AC-14 low noise road surface mitigation for the existing SH1. With mitigation in place, all PPFs fall into Category A.

For NOR 4, noise level changes are predicted to be negligible at the vast majority of PPFs after implementation of the recommended mitigation option of low-noise road surface. With mitigation in place all PPFs are in Category A.

NOR 5 does not meet the definition of an Altered Road. The Standard therefore does not apply, and mitigation options do not need to be considered. A comparison of the Do Nothing and Mitigation scenarios indicates that noise level changes will be negligible at a majority of PPFs as a result of speed reduction and redistribution of traffic across the network. All PPFs would fall into Category A.

NOR 6 contains both Altered and New roads. Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated further. A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario and the Do Minimum scenario indicates that noise level changes will be negligible or positive, with all PPFs falling into Category A.

For New roads under the Do Minimum scenario the majority of PPFs are in Category A with four PPFs in Category B. A low noise road surface, AC-14, is already included as the Do Minimum road surface. A noise barrier was considered for the four PPFs in Category B, however, its performance would be compromised by the gap required to maintain access from the road. Noise levels are predicted to increase at all PPFs under the Do Minimum scenario.

NOR 7 contains both Altered and New roads. For Altered roads under the Do Minimum scenario, noise level changes are predicted to be negligible for the two PPFs under consideration, with both

falling into Category A. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for New roads in the Existing and the Do Minimum scenarios indicates that changes in noise levels are likely to be moderately or slightly positive at all three PPFs. All PPFs fall into Category A under the Do Minimum scenario.

NOR 8 contains both New and Altered roads. For the Altered roads under the Do Minimum scenario, noise level changes are predicted to be moderately positive at one PPF, and slightly adverse at the other PPF. However, both PPFs would fall into Category A. The Altered roads in this NOR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated.

A comparison of the predicted road traffic noise levels for the New roads in the Existing scenario and the Do Minimum scenario indicates that changes in noise levels are likely to be substantially adverse at the one PPF under consideration. However, the PPF would still fall into Category A and the resulting noise level of 48 dB $L_{Aeq(24h)}$ is still typical of a rural environment.

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

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

Nevertheless, the predictions show that all but four PPFs across all Projects will receive levels within the Category A criteria, which is the most stringent Category and represents the lowest design noise levels. This is provided that any mitigation measures outlined in this document are implemented.

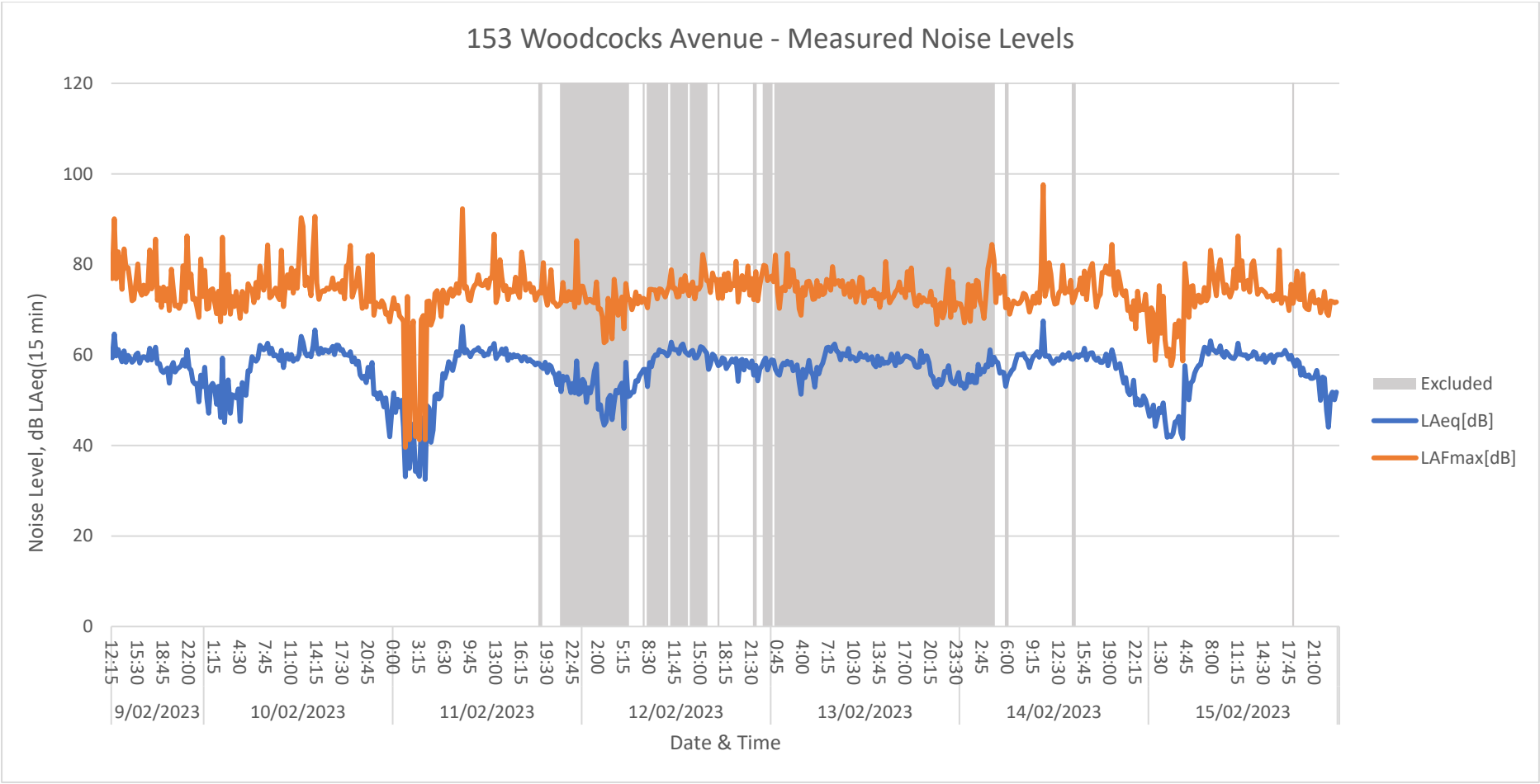
Traffic vibration from new or upgraded roading projects is not generally expected to create any vibration issues. Therefore, traffic vibration has not been assessed for the Projects.

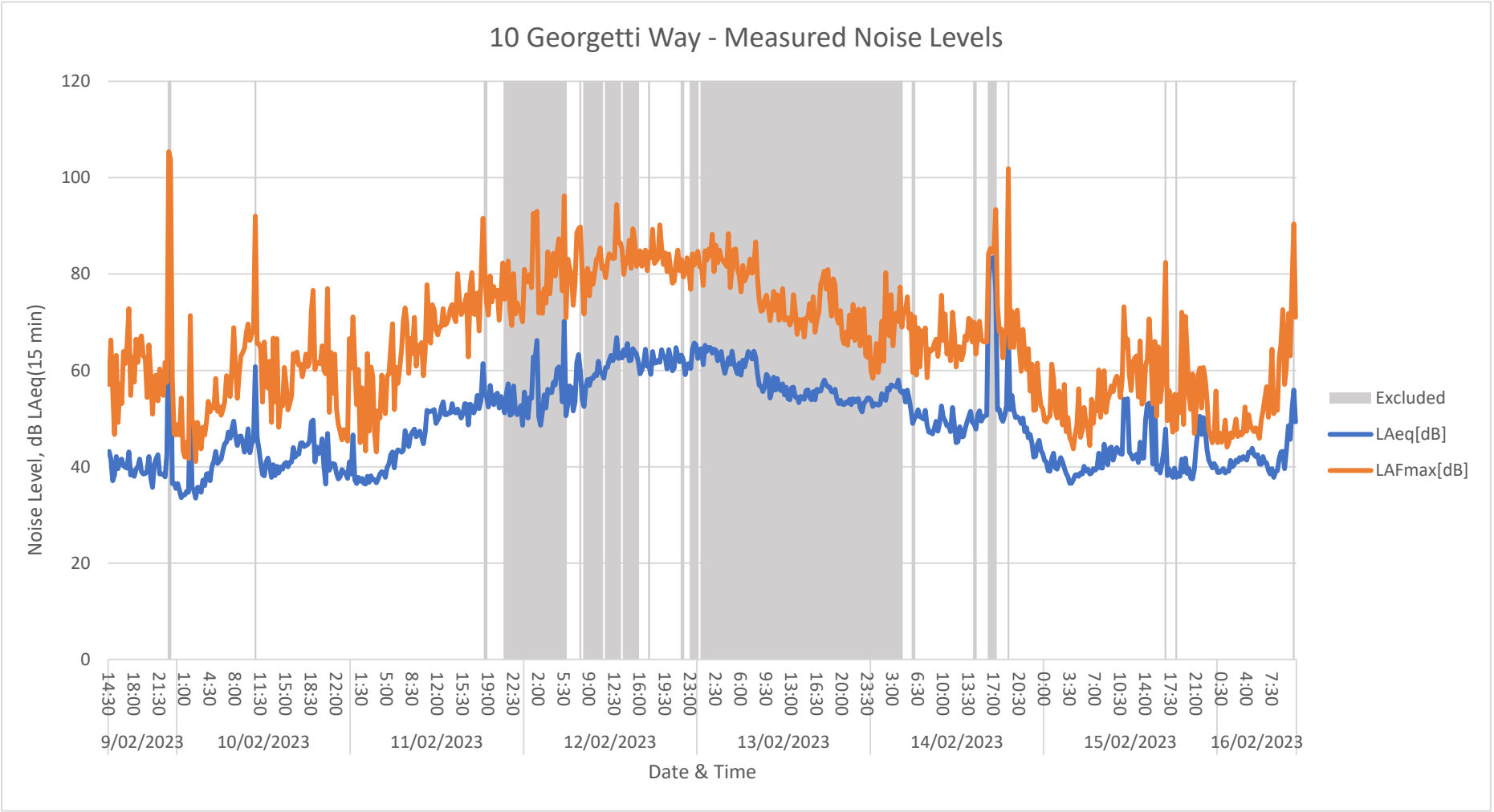
1 Appendix A: Assumptions

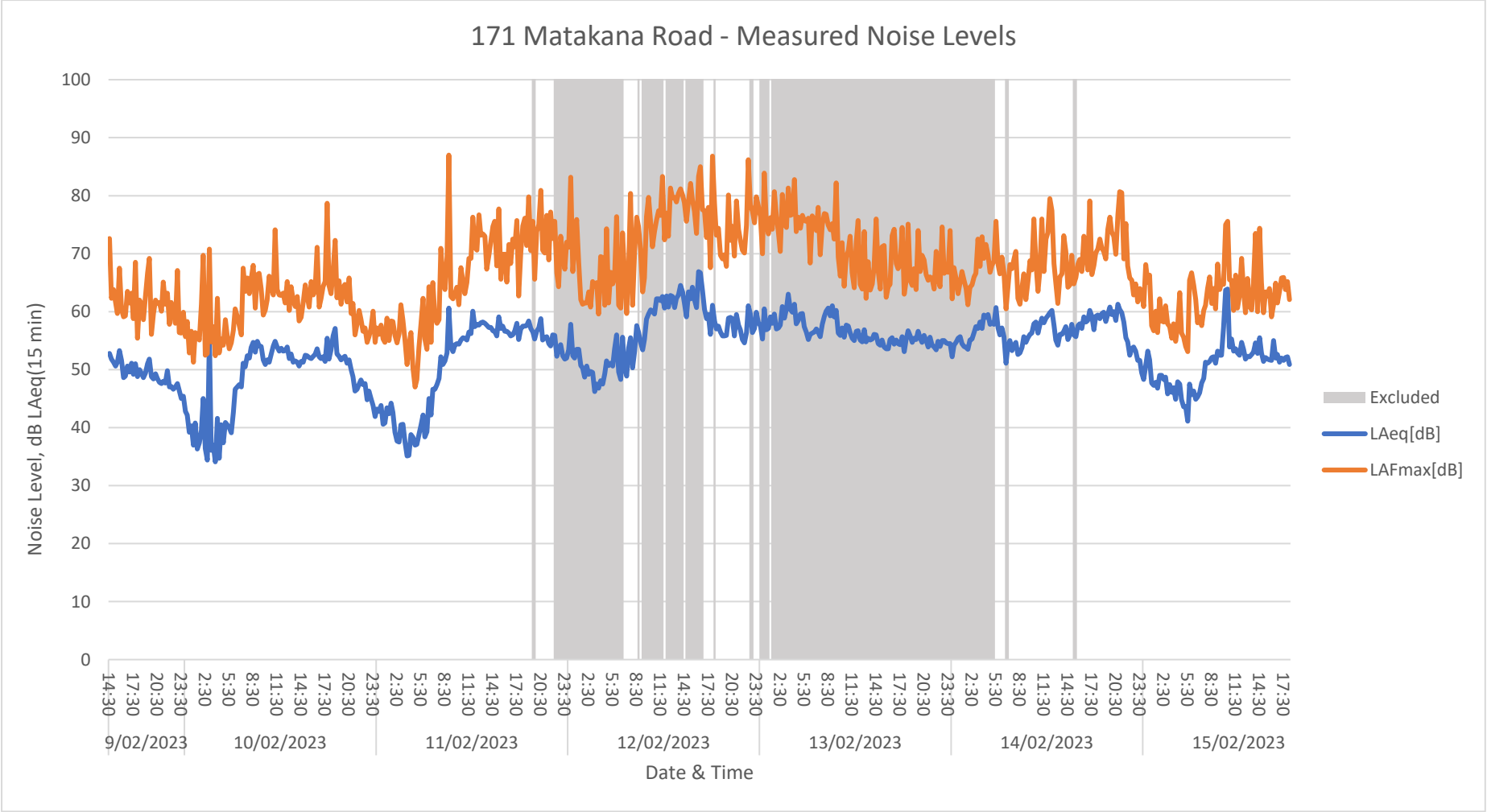
Package	Project(s)	Existing	Do Nothing	Do Minimum
Warkworth	New Northern Public Transport Interchange and Park and Ride (NoR 1)	x	√	√
	New Southern Public Transport Interchange	x	x	x
	New Southern Interchange on Ara Tūhono Puhoi to Warkworth Motorway	x	x	x
	SH1 Upgrade (NoR 3)	x	√	√
	Woodcocks Road Upgrade (NoR 2)	x	√	√
	Matakana Road Upgrade (NoR 4)	x	√	√
	Sandspit Road Upgrade (NoR 5)	x	√	√
	New Western Link Road – North (Mansel Drive to SH1)	x	x	x
	New Western Link Road – Central (Mansel Drive and Evelyn Street)	x	x	x
	New Western Link Road – South (Evelyn Street to SH1) (NoR 6)	x	x	x
	New Wider Western Link Road (Woodcocks Road to SH1) (NoR 8)	x	x	x
	New Sandspit Road Link (Between Matakana Road and Sandspit Road) (NoR 7)	x	x	x

Key	
√	Included
x	Excluded
*	Minimal Network Change

2 Appendix B: Noise Monitoring Results


153 Woodcocks Avenue - Measured Noise Levels
Noise Level, dB LAeq(15 min)
120
100
80
60
40
20
0
12:15
15:30
18:45
22:00
1:15
4:30
7:45
11:00
14:15
17:30
20:45
0:00
3:15
6:30
9:45
13:00
16:15
19:30
22:45
2:00
5:15
8:30
11:45
15:00
18:15
21:30
0:45
4:00
7:15
10:30
13:45
17:00
20:15
23:30
2:45
6:00
9:15
12:30
15:45
19:00
22:15
1:30
4:45
8:00
11:15
14:30
17:45
21:00
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]


10 Georgetti Way - Measured Noise Levels
Noise Level, dB LAeq(15 min)
120
100
80
60
40
20
0
14:30
18:00
21:30
1:00
4:30
8:00
11:30
15:00
18:30
22:00
1:30
5:00
8:30
12:00
15:30
19:00
22:30
2:00
5:30
9:00
12:30
16:00
19:30
23:00
2:30
6:00
9:30
13:00
16:30
20:00
23:30
3:00
6:30
10:00
13:30
17:00
20:30
0:00
3:30
7:00
10:30
14:00
17:30
21:00
0:30
4:00
7:30
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
16/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]


171 Matakana Road - Measured Noise Levels
Noise Level, dB LAeq(15 min)
100
90
80
70
60
50
40
30
20
10
0
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
20:30
23:30
2:30
5:30
8:30
11:30
14:30
17:30
9/02/2023
10/02/2023
11/02/2023
12/02/2023
13/02/2023
14/02/2023
15/02/2023
Date & Time
Excluded
LAeq[dB]
LAFmax[dB]

3 Appendix C: Noise Monitoring Forms

NOISE MONITORING FORM – 10 Georgetti Way				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 14:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747792	Y	5969208
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898330			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
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	Dominant noise source: Road noise from Georgetti Way			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.6			
Wind speed and direction at dominant source(s)	3.6			
Precipitation	0			
Fog	N/A			
Temperature	18.6			
Humidity	43%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	8m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	N/A			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

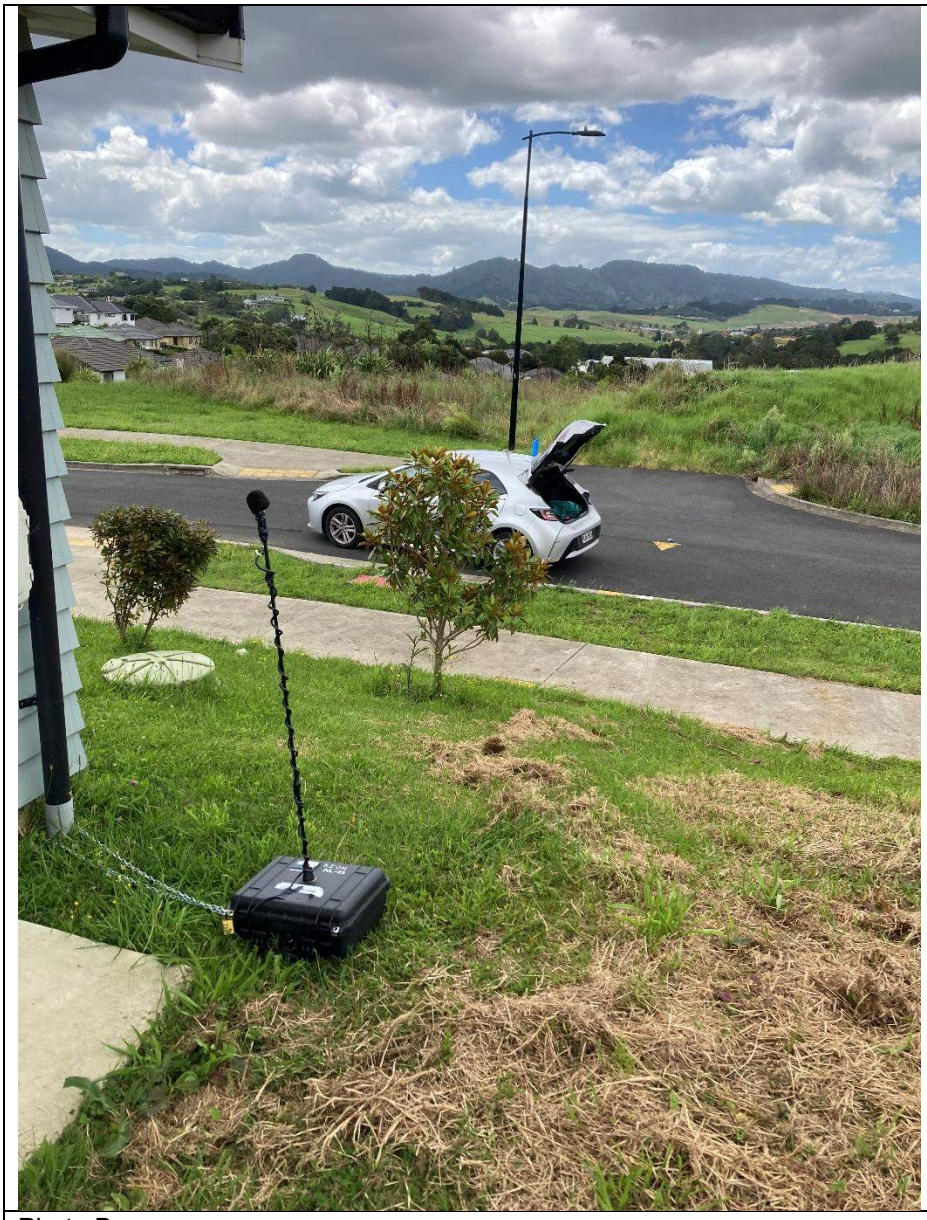


Photo B:

NOISE MONITORING FORM – 171 Matakana Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 13:30pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1748825	Y	5971672
Equipment				
Manufacturer	01dB			
Type	Cube			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
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	Dominant noise source: Road noise from Matakana Rd, foliage, and insect noise from surrounding area			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.1 m/s			
Wind speed and direction at dominant source(s)	3.1 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.5			
Humidity	38			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	30m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Slight hill between noise source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

NOISE MONITORING FORM – 153 Woodcocks Road				
Summary				
Project name	Supporting Growth Alliance			
Project number	60558831			
Date / time	09/02/2023, 12:15pm			
Engineer(s)	Dhulkifl Ahmed			
Location (NZTM2000)	X	1747278	Y	5969508
Equipment				
Manufacturer	Rion			
Type	NL-52			
Serial number	00898331			
Date of last calibration	29/11/2021			
Calibration drift pre/post	N/A			
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	Dominant noise source: Road noise from Woodcocks Ave			
Any special audible characteristics (tonality, impulsivity etc.) and comment on k_2 adjustment	N/A			
Meteorological Conditions				
Wind speed and direction at microphone	3.2 m/s			
Wind speed and direction at dominant source(s)	3.2 m/s			
Precipitation	0			
Fog	N/A			
Temperature	19.2			
Humidity	42%			
Percentage cloud cover	60%			
Site Conditions				
Microphone height	1.5m			
Distance to dominant noise source(s)	10m			
Height of noise source(s)	Ground level			
Distance from any reflective surfaces	1.5m			
Intervening topography	Foliage between source and receiver			
Hard, mixed or soft ground	Mixed			
Barriers between source(s) and microphone	N/A			
General comments and sketches				

Photo A: View toward the source

4 Appendix D: Predicted Road Traffic Noise Levels

NOR 2

Address	Existing	Do Nothing	Do Min
372 Woodcocks Road, Warkworth	56	56	49
371 Woodcocks Road, Warkworth	59	58	54
100 Woodcocks Road, Warkworth	48	52	52
2 Mason Heights, Warkworth	55	59	60
1 Mason Heights, Warkworth	51	56	56
18 Oliver Street, Warkworth	46	51	50
10 Oliver Street, Warkworth	45	52	49
12 Oliver Street, Warkworth	46	51	50
14 Oliver Street, Warkworth	46	51	50
16 Oliver Street, Warkworth	45	51	50
20 Oliver Street, Warkworth	46	51	52
3 Mason Heights, Warkworth	47	51	52
22 Oliver Street, Warkworth	40	47	44
8 Oliver Street, Warkworth	43	53	48
6 Oliver Street, Warkworth	43	56	49
4 Oliver Street, Warkworth	44	61	50
6 Evelyn Street, Warkworth	46	71	49
7 Evelyn Street, Warkworth	43	69	46
5 Evelyn Street, Warkworth	46	69	48
85 Woodcocks Road, Warkworth	52	57	37
83 Woodcocks Road, Warkworth	44	53	33
127 Woodcocks Road, Warkworth	49	52	54
317 Woodcocks Road, Warkworth	51	50	52
153 Woodcocks Road, Warkworth	52	55	56
172A Woodcocks Road, Warkworth	59	63	63
286 Woodcocks Road, Warkworth	58	60	59
326 Falls Road, Warkworth	53	54	56
314 Woodcocks Road, Warkworth	62	60	60
346 Woodcocks Road, Warkworth	62	60	55
12 Wyllie Road, Warkworth	53	52	52
125 Woodcocks Road, Warkworth	48	51	53
87 Woodcocks Road, Warkworth	56	66	53
86-94 Woodcocks Road, Warkworth	60	64	64
86-94 Woodcocks Road, Warkworth	60	65	64
86-94 Woodcocks Road, Warkworth	60	64	64
86-94 Woodcocks Road, Warkworth	60	65	64
86-94 Woodcocks Road, Warkworth	46	50	50
86-94 Woodcocks Road, Warkworth	43	47	48
86-94 Woodcocks Road, Warkworth	38	44	40
86-94 Woodcocks Road, Warkworth	37	42	41
86-94 Woodcocks Road, Warkworth	38	42	42
86-94 Woodcocks Road, Warkworth	39	45	40
86-94 Woodcocks Road, Warkworth	53	59	40
86-94 Woodcocks Road, Warkworth	60	65	64
86-94 Woodcocks Road, Warkworth	54	62	49
86-94 Woodcocks Road, Warkworth	41	46	44
86-94 Woodcocks Road, Warkworth	41	47	43
86-94 Woodcocks Road, Warkworth	37	43	41
105 Woodcocks Road, Warkworth	55	60	61
101-103 Woodcocks Road, Warkworth	58	62	63
111 Woodcocks Road, Warkworth	56	61	62

99 Woodcocks Road, Warkworth	58	62	63
97 Woodcocks Road, Warkworth	54	59	58

NOR 3

Address	Existing	Do Nothing	Do Min	Mitigation
1659 State Highway 1, Warkworth	59	56	59	54
1829 State Highway 1, Warkworth	60	57	59	55
1773 State Highway 1, Warkworth	61	58	60	56
1723B State Highway 1, Warkworth	53	50	51	47
1723 State Highway 1, Warkworth	66	63	66	61
1728 State Highway 1, Warkworth	60	56	60	55
1695 State Highway 1, Warkworth	52	49	50	46
1695 State Highway 1, Warkworth	49	46	50	45
1773 State Highway 1, Warkworth	53	50	52	47
15 Wech Drive, Warkworth	55	53	56	51
17A Wech Drive, Warkworth	47	48	48	45
1/6 Wech Drive, Warkworth	62	61	61	56
45 Campbell Drive, Warkworth	55	53	51	47
5 Wickens Place, Warkworth	58	55	55	51
7 Wickens Place, Warkworth	59	56	57	52
17 Wickens Place, Warkworth	61	58	58	54
10 Wickens Place, Warkworth	54	52	52	48
12 Wickens Place, Warkworth	54	52	53	48
16 Wickens Place, Warkworth	56	54	55	50
21 Wickens Place, Warkworth	64	61	62	57
24 Wickens Place, Warkworth	63	62	63	58
25 Wickens Place, Warkworth	58	56	58	53
18 Wickens Place, Warkworth	57	55	57	52
20 Wickens Place, Warkworth	58	57	58	54
22 Wickens Place, Warkworth	65	63	65	60
5 Wech Drive, Warkworth	56	54	55	50
2/6 Wech Drive, Warkworth	51	49	51	46
7 Wech Drive, Warkworth	56	54	54	49
7A Wech Drive, Warkworth	49	48	49	44
8A Wech Drive, Warkworth	57	56	56	51
8 Wech Drive, Warkworth	49	48	49	44
10 Wech Drive, Warkworth	60	58	60	55
9 Wech Drive, Warkworth	51	49	51	46
12A Wech Drive, Warkworth	49	48	49	44
11 Wech Drive, Warkworth	56	55	57	52
14 Wech Drive, Warkworth	55	53	57	52
16 Wech Drive, Warkworth	50	48	52	47

Address	Existing	Do Nothing	Do Min	Mitigation
2/18 Wech Drive, Warkworth	47	48	47	44
1/18 Wech Drive, Warkworth	54	53	58	53
17 Wech Drive, Warkworth	55	53	58	53
19 Wech Drive, Warkworth	56	54	58	54
21 Wech Drive, Warkworth	57	56	59	54
20 Wech Drive, Warkworth	48	51	50	49
22 Wech Drive, Warkworth	60	59	61	57
7 McKinney Road, Warkworth	58	61	62	61
6 McKinney Road, Warkworth	57	62	62	62
1848 State Highway 1, Warkworth	65	61	65	61
8C McKinney Road, Warkworth	56	53	56	51
8B McKinney Road, Warkworth	56	53	56	52
8D McKinney Road, Warkworth	56	53	56	52
8E McKinney Road, Warkworth	67	63	66	61
13A Campbell Drive, Warkworth	66	64	43	38
27B Campbell Drive, Warkworth	64	61	54	49
27 Campbell Drive, Warkworth	61	58	55	50
29 Campbell Drive, Warkworth	55	53	50	46
33 Campbell Drive, Warkworth	67	64	56	51
31 Campbell Drive, Warkworth	57	54	51	46
35 Campbell Drive, Warkworth	65	62	56	51
41 Campbell Drive, Warkworth	53	50	49	44
43 Campbell Drive, Warkworth	51	48	48	44
3 Wickens Place, Warkworth	59	56	56	51
37 Campbell Drive, Warkworth	66	63	58	53
39 Campbell Drive, Warkworth	55	52	51	46
9 Wickens Place, Warkworth	59	57	53	48
11 Wickens Place, Warkworth	67	64	58	53
22 Campbell Drive, Warkworth	54	51	51	46
20 Campbell Drive, Warkworth	56	54	51	47
18 Campbell Drive, Warkworth	56	54	51	46
16 Campbell Drive, Warkworth	56	54	50	45
14 Campbell Drive, Warkworth	53	51	46	42
1 Clegg Place, Warkworth	54	53	46	42
11B Campbell Drive, Warkworth	60	58	37	32
102 Hauiti Drive, Warkworth	50	49	39	34
100 Hauiti Drive, Warkworth	50	48	40	35
98 Hauiti Drive, Warkworth	55	53	43	38
82 Hauiti Drive, Warkworth	56	54	38	34
15 Campbell Drive, Warkworth	62	60	47	43
17 Campbell Drive, Warkworth	62	60	50	46
19 Campbell Drive, Warkworth	60	58	48	44
21 Campbell Drive, Warkworth	66	64	59	54
23 Campbell Drive, Warkworth	63	60	55	50
25 Campbell Drive, Warkworth	63	60	55	50
8F McKinney Road, Warkworth	65	62	65	61
4/6 Wech Drive, Warkworth	50	48	49	44
3/6 Wech Drive, Warkworth	50	48	49	44
4B Wech Drive, Warkworth	49	47	49	44
4A Wech Drive, Warkworth	50	48	49	44

Address	Existing	Do Nothing	Do Min	Mitigation
4 Wech Drive, Warkworth	55	53	54	49
3B Wech Drive, Warkworth	53	50	51	47
3 Wech Drive, Warkworth	55	53	54	49
1 Wech Drive, Warkworth	56	53	54	50
13 Wickens Place, Warkworth	67	64	59	54
14 Wickens Place, Warkworth	55	53	54	49
23 Wickens Place, Warkworth	62	60	61	56
7 Toovey Road, Warkworth	55	51	54	50
1673 State Highway 1, Warkworth	63	60	63	58
3 McKinney Road, Warkworth	62	61	64	61

NOR 4

Address	Existing	Do Nothing	Do Min	Mitigation
40 Clayden Road, Warkworth	59	57	54	51
190 Matakana Road, Warkworth	62	60	57	55
8 Clayden Road, Warkworth	58	56	54	51
6 Clayden Road, Warkworth	55	53	52	51
293 Matakana Road, Warkworth	63	60	61	58
295 Matakana Road, Warkworth	61	58	59	56
297 Matakana Road, Warkworth	67	64	64	61
299 Matakana Road, Warkworth	69	66	65	61
303 Matakana Road, Warkworth	67	64	65	62
4 Clayden Road, Warkworth	57	55	55	56
2 Clayden Road, Warkworth	65	62	63	60
223 Matakana Road, Warkworth	65	62	61	57
170 Matakana Road, Warkworth	68	65	65	61
165 Matakana Road, Warkworth	66	63	62	58
160 Matakana Road, Warkworth	65	62	61	58
211 Matakana Road, Warkworth	64	61	60	56
171 Matakana Road, Warkworth	57	54	52	48
185 Matakana Road, Warkworth	54	51	51	47
13 Northwood Close, Warkworth	50	47	45	40
19 Northwood Close, Warkworth	61	58	58	54
6 Melwood Drive, Warkworth	57	55	53	49
49 Matakana Road, Warkworth	60	58	62	58
74 Matakana Road, Warkworth	72	69	63	59
76 Matakana Road, Warkworth	63	61	60	57
98 Matakana Road, Warkworth	60	58	61	58
120 Matakana Road, Warkworth	64	61	61	58
130 Matakana Road, Warkworth	65	62	66	62
140 Matakana Road, Warkworth	59	56	57	53
1 Millstream Place, Warkworth	70	69	53	49
3 Millstream Place, Warkworth	58	58	54	49
5 Millstream Place, Warkworth	60	60	51	46
7 Millstream Place, Warkworth	58	58	50	46
14 Millstream Place, Warkworth	54	54	42	37

Address	Existing	Do Nothing	Do Min	Mitigation
12 Millstream Place, Warkworth	55	55	51	46
10 Millstream Place, Warkworth	53	53	53	49
4 Millstream Place, Warkworth	61	61	57	53
6 Millstream Place, Warkworth	60	61	56	52
8 Millstream Place, Warkworth	55	56	52	48
5 Matakana Road, Warkworth	63	63	61	57
1 Melwood Drive, Warkworth	67	67	63	61
3 Melwood Drive, Warkworth	58	57	56	52
4 Melwood Drive, Warkworth	59	58	59	55
3 Matakana Road, Warkworth	62	62	61	57
9 Millstream Place, Warkworth	52	52	48	45
15 Northwood Close, Warkworth	53	51	49	44
17 Northwood Close, Warkworth	53	51	50	45
23 Northwood Close, Warkworth	58	56	53	49
25 Northwood Close, Warkworth	55	53	49	44
27 Northwood Close, Warkworth	50	48	47	42
29 Northwood Close, Warkworth	55	52	48	44
31 Northwood Close, Warkworth	57	54	50	45
35 Northwood Close, Warkworth	54	51	48	44
33 Northwood Close, Warkworth	56	54	50	45
39 Northwood Close, Warkworth	56	54	50	45
233 Matakana Road, Warkworth	59	58	52	48
207 Matakana Road, Warkworth	52	50	48	44
44 Clayden Road, Warkworth	58	57	52	48
37 Northwood Close, Warkworth	55	52	48	44
43 Northwood Close, Warkworth	55	52	48	43
45 Northwood Close, Warkworth	58	55	50	46
47 Northwood Close, Warkworth	58	56	51	47
55 Northwood Close, Warkworth	58	55	51	47
61 Northwood Close, Warkworth	58	55	52	48
41 Northwood Close, Warkworth	58	55	50	46
57 Northwood Close, Warkworth	60	57	52	48
59 Northwood Close, Warkworth	60	57	54	49
96 Matakana Road, Warkworth	72	69	68	64
306 Matakana Road, Warkworth	67	65	61	57

NOR 5

Address	Existing	Do Nothing	Do Min
109 Sandspit Road, Warkworth	55	54	51
108 Sandspit Road, Warkworth	70	69	58
1 Millstream Place, Warkworth	69	59	60
3 Millstream Place, Warkworth	58	55	55
5 Millstream Place, Warkworth	60	42	50
7 Millstream Place, Warkworth	50	46	48
12 Millstream Place, Warkworth	54	49	47
10 Millstream Place, Warkworth	53	48	47

Address	Existing	Do Nothing	Do Min
4 Millstream Place, Warkworth	61	58	58
6 Millstream Place, Warkworth	60	59	57
8 Millstream Place, Warkworth	55	53	51
265 Sandspit Road, Warkworth	51	50	48
384 Sandspit Road, Warkworth	67	54	53
137 Sandspit Road, Warkworth	61	60	53
146 Sandspit Road, Warkworth	54	53	50
209 Sandspit Road, Warkworth	65	64	59
34 Sandspit Road, Warkworth	62	63	57
36 Sandspit Road, Warkworth	63	64	58

NOR 6 New Roads

Address	Existing	Do Min
13 Christopher Lane, Warkworth	37	46
12 Jamie Lane, Warkworth	37	47
10 Jamie Lane, Warkworth	37	48
8 Jamie Lane, Warkworth	37	49
6 Jamie Lane, Warkworth	38	52
4 Jamie Lane, Warkworth	38	53
2 Jamie Lane, Warkworth	39	62
3 Christopher Lane, Warkworth	38	50
9 Christopher Lane, Warkworth	38	45
7 Christopher Lane, Warkworth	38	45
1 Christopher Lane, Warkworth	40	62
8 Christopher Lane, Warkworth	39	45
10 Christopher Lane, Warkworth	38	45
6 Christopher Lane, Warkworth	39	47
4 Christopher Lane, Warkworth	39	48
2 Christopher Lane, Warkworth	42	60
1 Oliver Street, Warkworth	42	59
3 Oliver Street, Warkworth	40	51
5 Oliver Street, Warkworth	40	49
7 Oliver Street, Warkworth	39	46
10 Georgetti Way, Warkworth	39	46
8 Georgetti Way, Warkworth	37	43
3 Dunningham Street, Warkworth	38	44
5 Dunningham Street, Warkworth	38	45
7 Dunningham Street, Warkworth	38	45
9 Dunningham Street, Warkworth	38	47
5 Christopher Lane, Warkworth	38	48

NOR 6 Altered Roads

Address	Existing	Do Nothing	Do Min
6 Evelyn Street, Warkworth	40	71	46
7 Evelyn Street, Warkworth	43	69	41
5 Evelyn Street, Warkworth	40	69	45
19 Wech Drive, Warkworth	56	54	54
21 Wech Drive, Warkworth	57	56	54
22 Wech Drive, Warkworth	60	59	57
7 McKinney Road, Warkworth	58	61	62
6 McKinney Road, Warkworth	57	62	62
1848 State Highway 1, Warkworth	65	61	61
8F McKinney Road, Warkworth	65	62	61
3 McKinney Road, Warkworth	62	61	62

NOR 7 New Roads

Address	Existing	Do Min
169 Sandspit Road, Warkworth	47	46
195 Sandspit Road, Warkworth	48	48
95 Sandspit Road, Warkworth	46	46

NOR 7 Altered Roads

Address	Existing	Do Nothing	Do Min
137 Sandspit Road, Warkworth	61	60	54
245 Matakana Road, Warkworth	59	58	54

NOR 8 New Roads

Address	Existing	Do Min
123 Valerie Close, Warkworth	35	48

NOR 8 Altered Roads

Address	Existing	Do Nothing	Do Min
346 Woodcocks Road, Warkworth	62	60	54
12 Wyllie Road, Warkworth	53	52	56

5 Appendix E: Noise Contour Maps

Date Printed: 4/11/2022 10:53 AM

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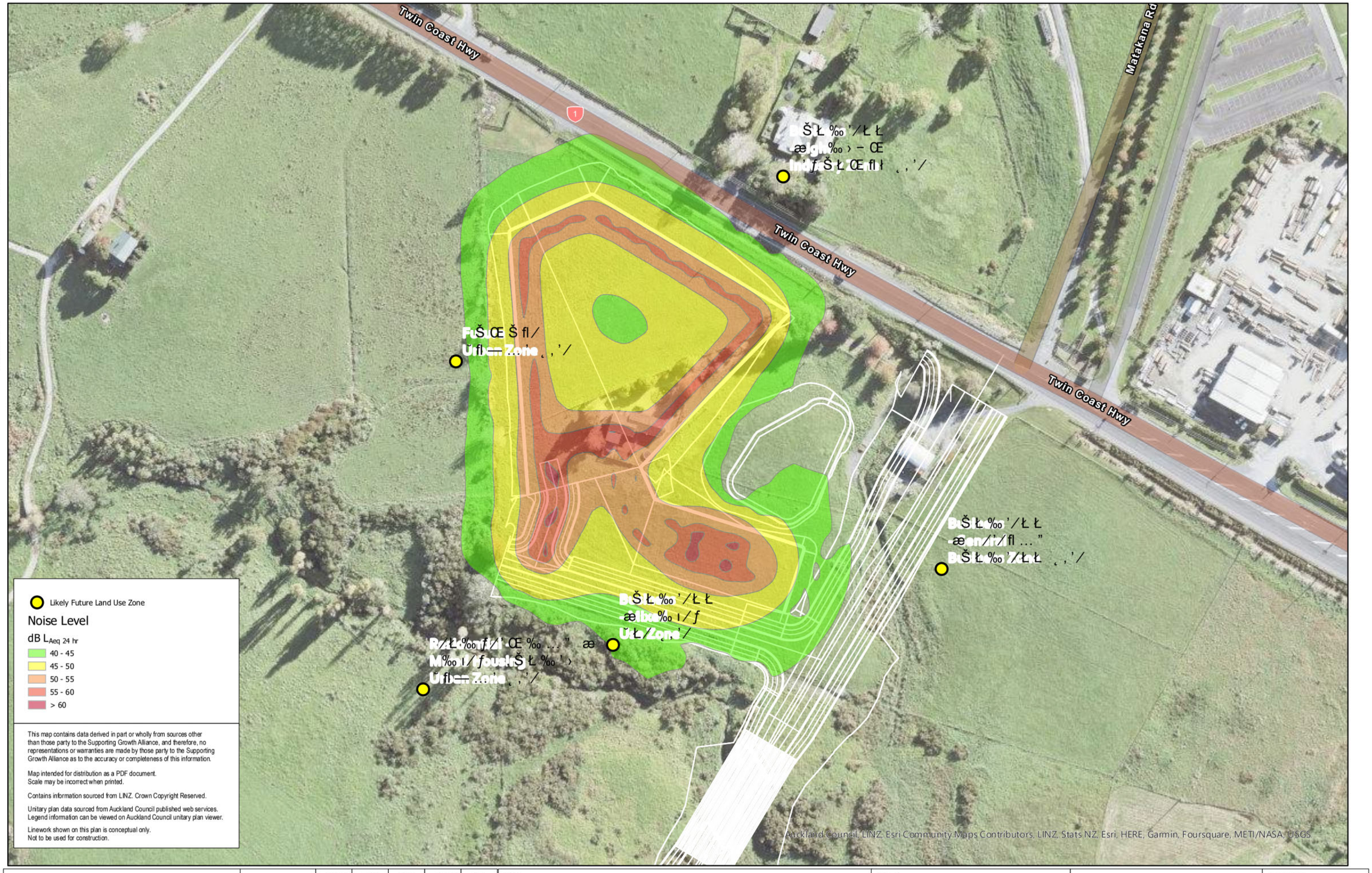

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Revision	Author	Verified	Approved	Date
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Title:

Supporting Growth

NoR 1 - Design 2028

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

Date Printed: 4/11/2022 10:53 AM

Name: NoR 1

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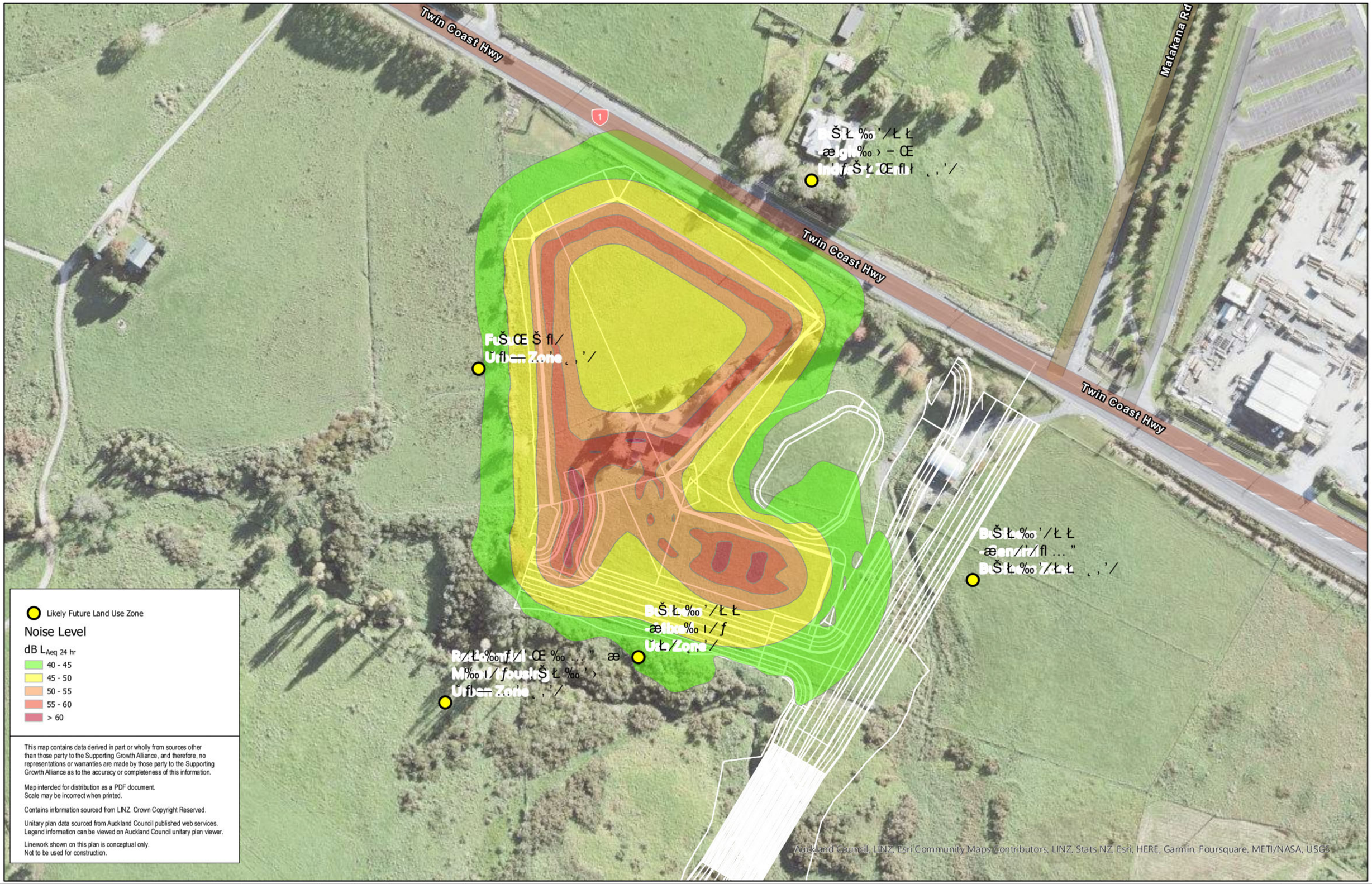

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							NoR 1 - Design 2048
							Working Plans of Te Tupu Ngatahi. *For the purpose of INTERNAL workshops (not for wider distribution)*
		1	Author	DRAFT	DRAFT	dd/mm/yyyy	

Client:	Discipline:
Supporting Growth	GIS
Project:	Drawing No:
Warkworth	SGA-NV-NW-013

TE TUPU NGĀTAHI Supporting Growth

Date Printed: 4/11/2022 10:53 AM

Name: NoR 2

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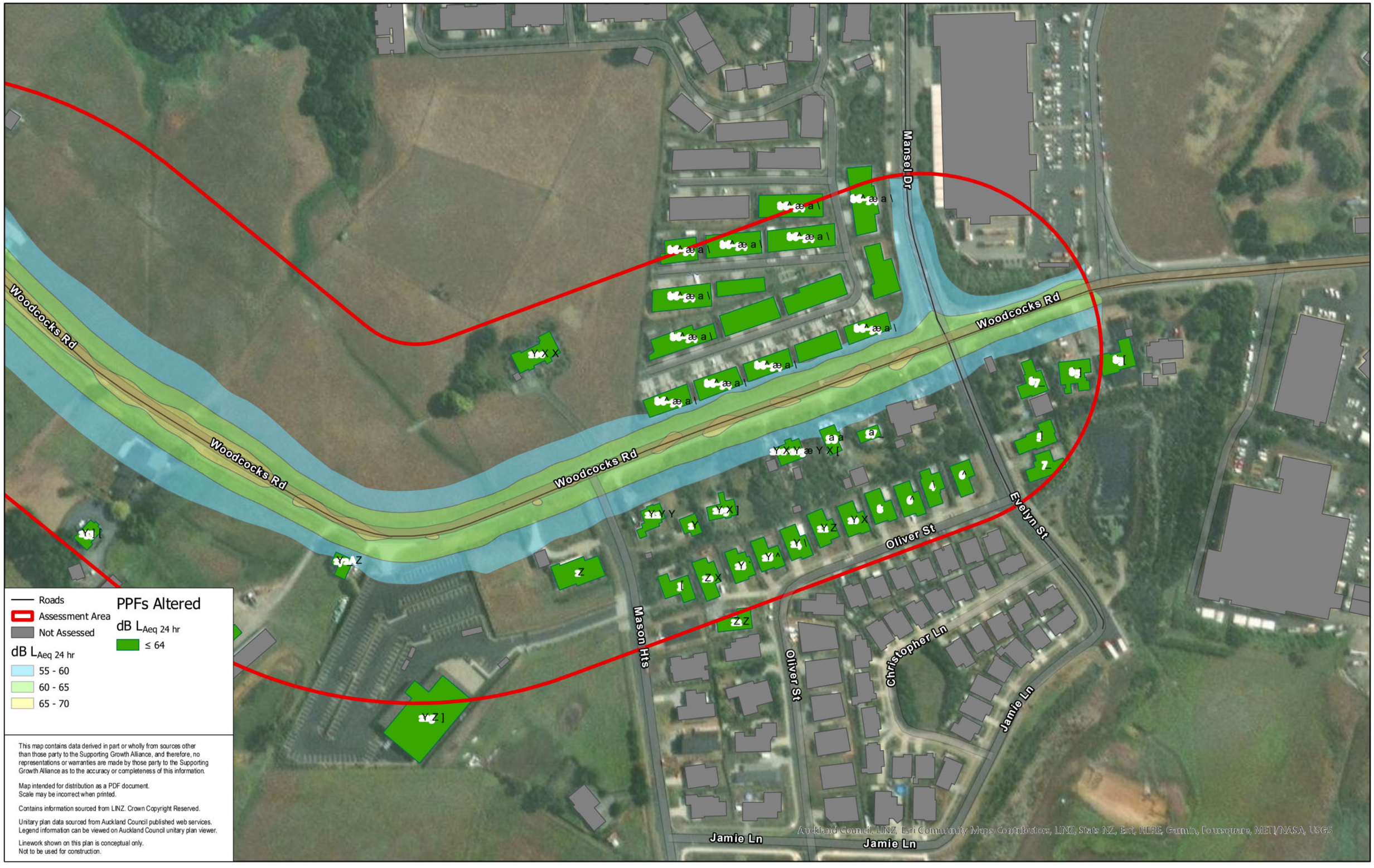

Map Scale @ A3:

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

Title: **Supporting Growth**

NoR 2 - Existing

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

Client: **Supporting Growth**

Project: **Warkworth**

TE TUPU NGĀTAHI Supporting Growth

Discipline: **GIS**

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

Date Printed: 4/11/2022 10:53 AM

Name: NoR 2

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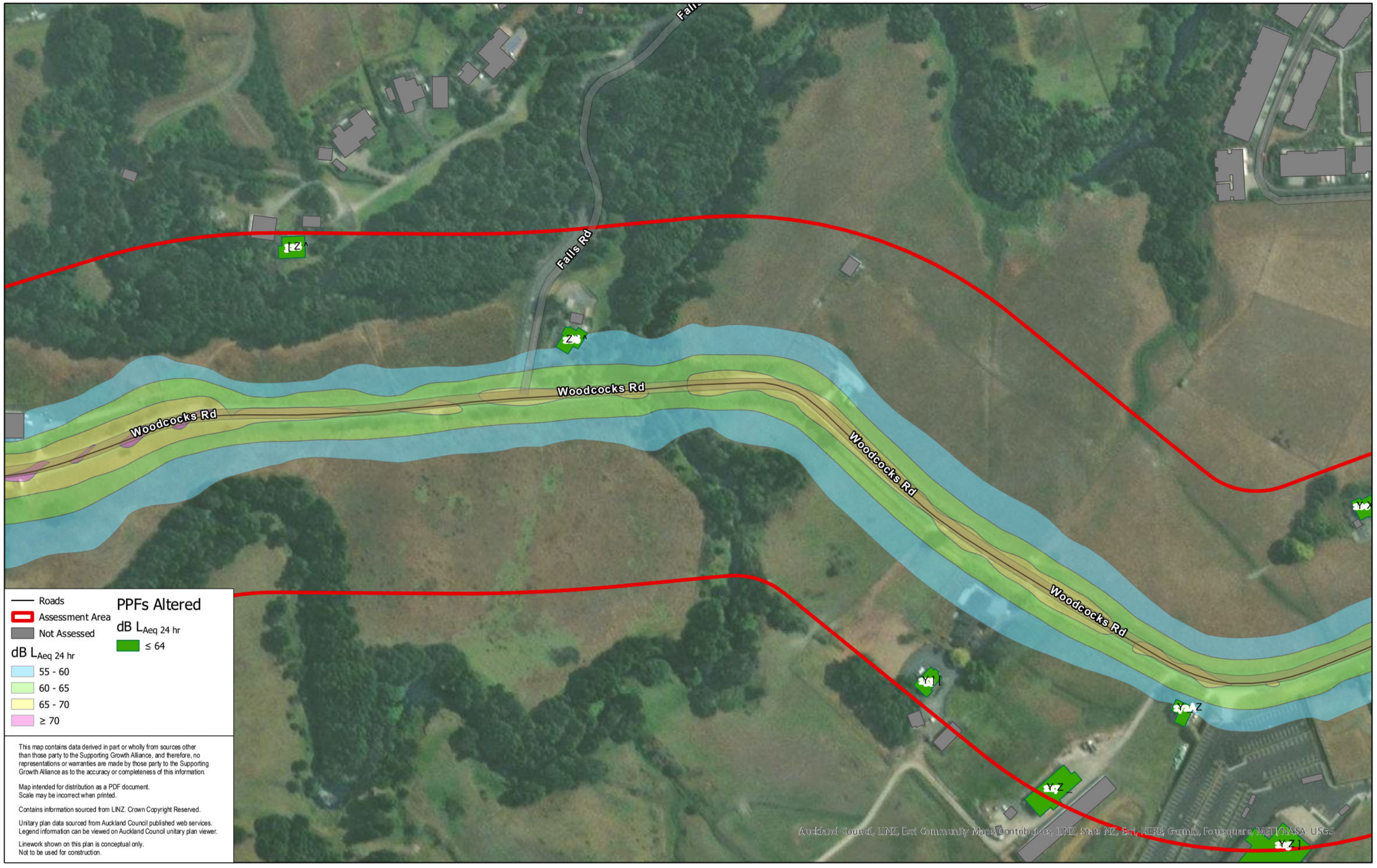

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TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

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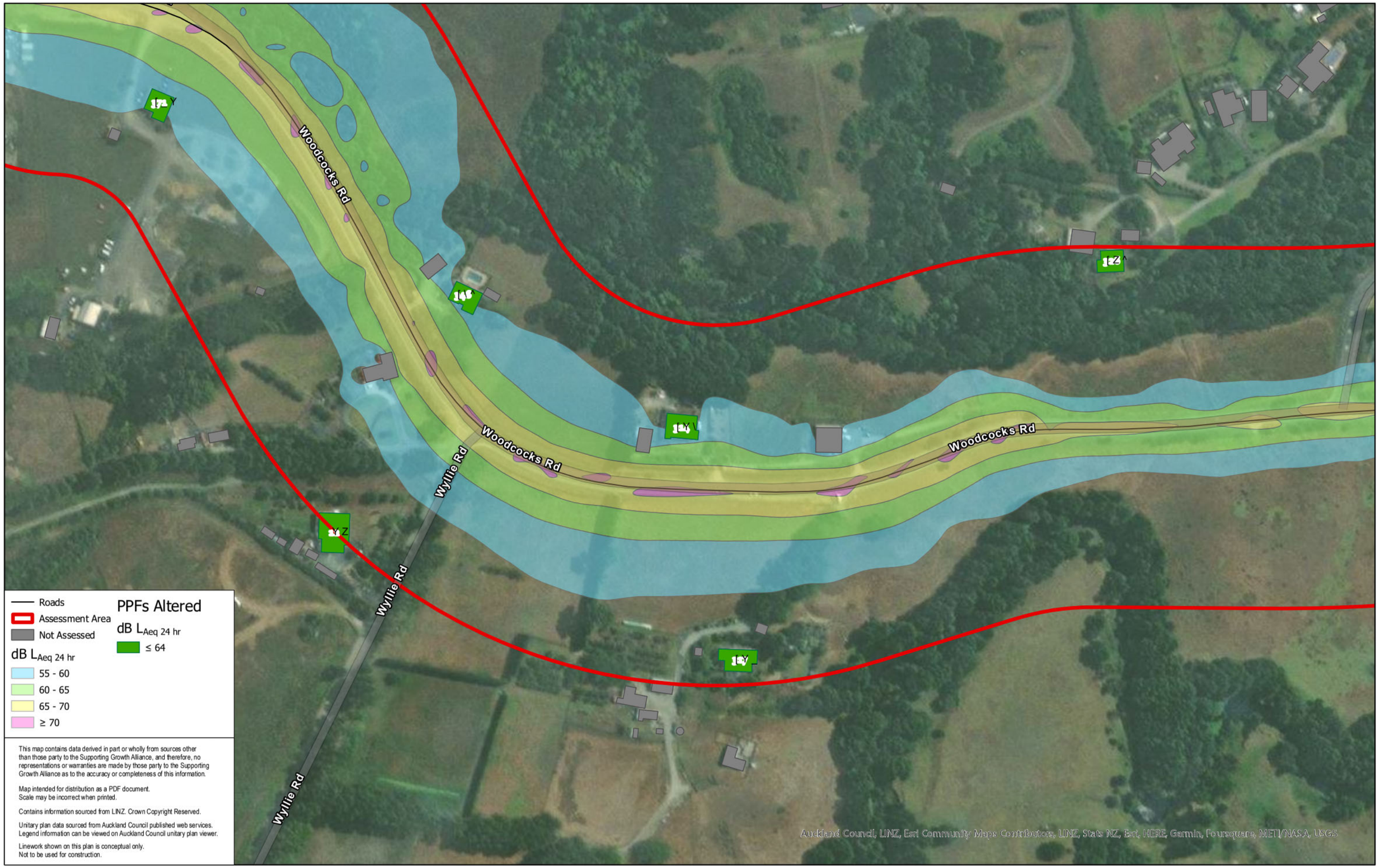

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Discipline: GIS

Drawing No: SGA-NV-NW-013

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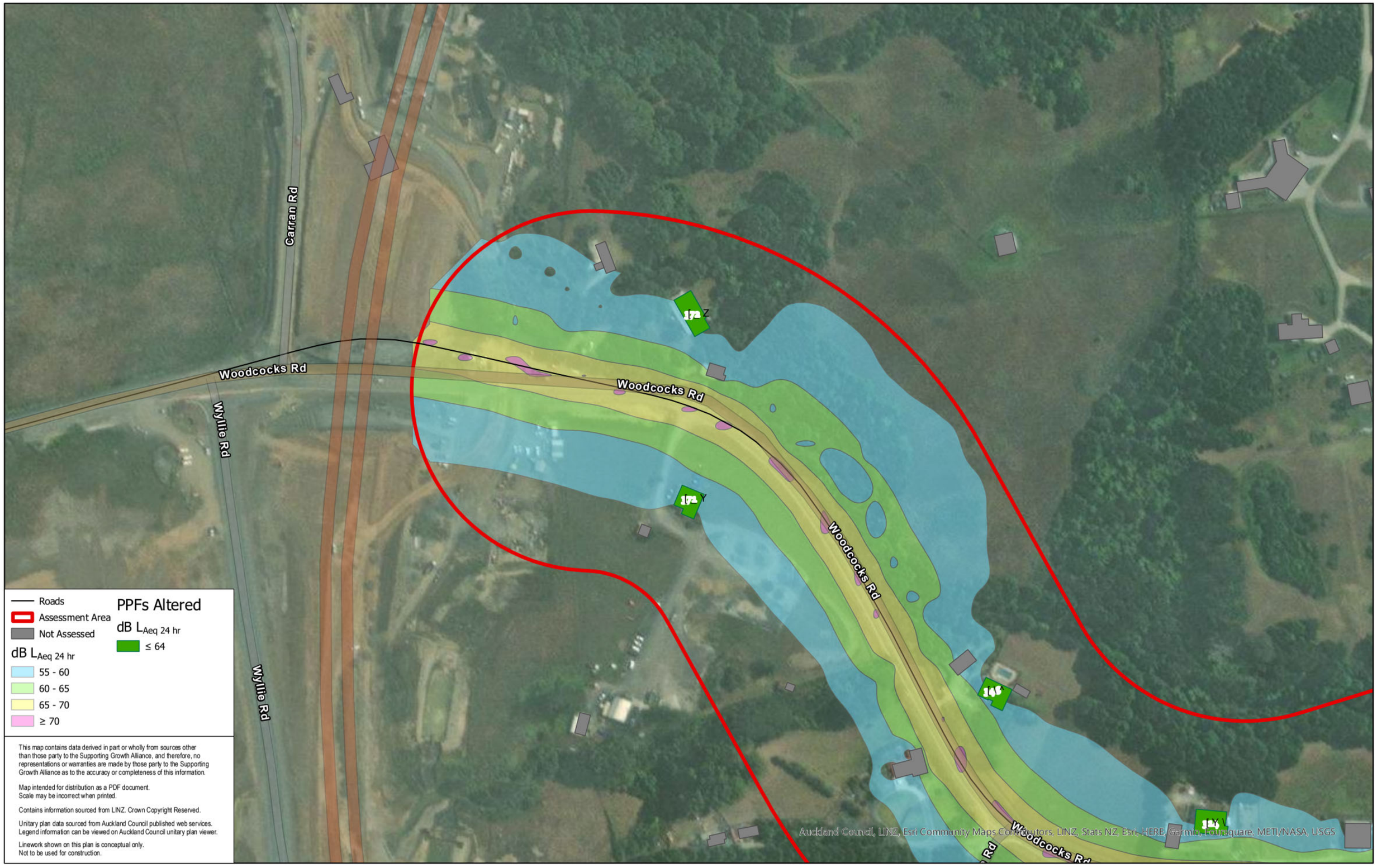
Name: NoR 2



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TE TUPU NGĀTAHI Supporting Growth

Discipline: **GIS**

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

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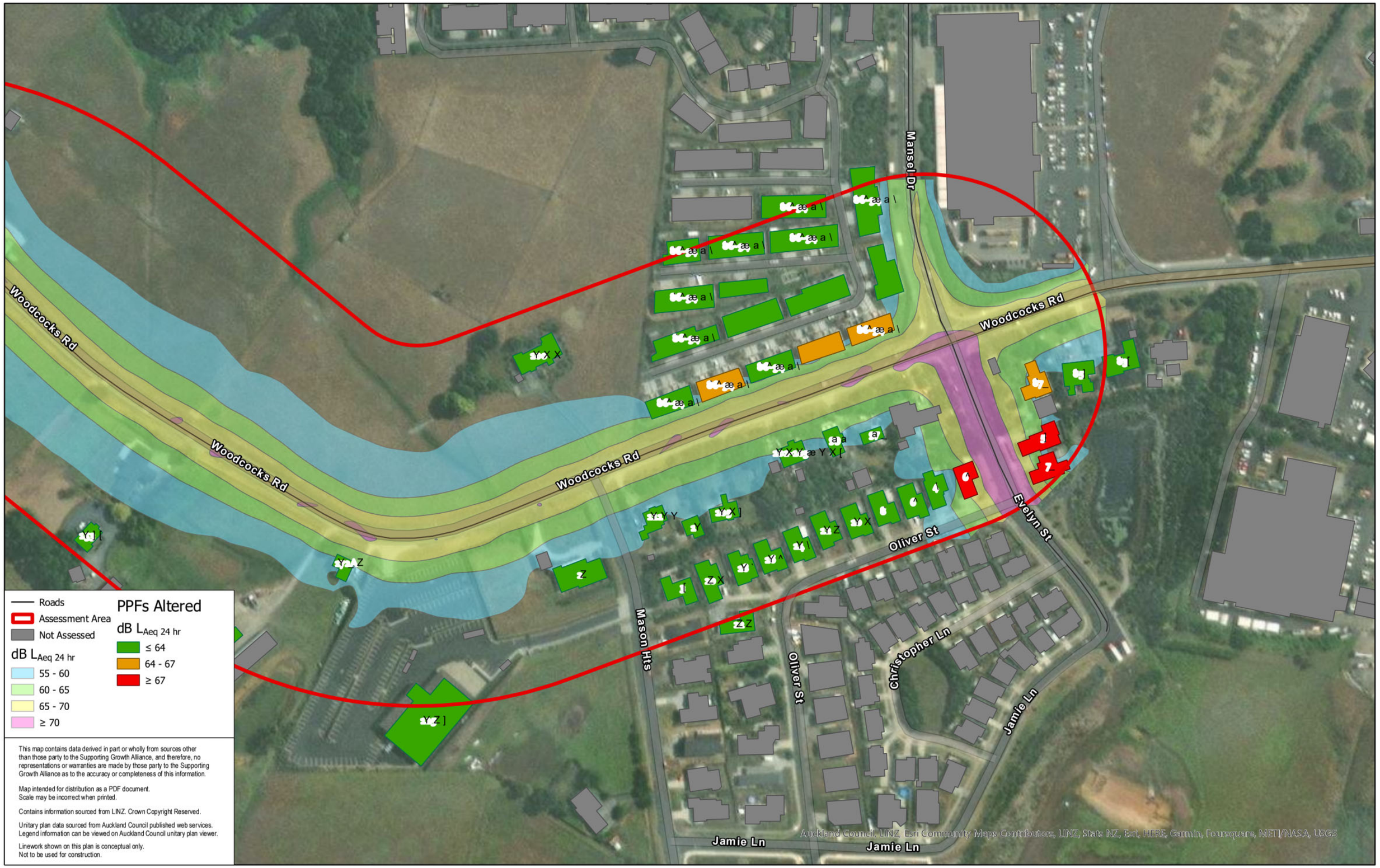

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Revision	Author	Verified	Approved	Date
	JR	CD		
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Title: **Supporting Growth**

NoR 2 - Do Nothing

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

Date Printed: 4/11/2022 10:53 AM

Name: NoR 2

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Falls Rd

Woodcocks Rd

Woodcocks Rd

Woodcocks Rd

Woodcocks Rd

Roads
Assessment Area
Not Assessed

dB $L_{Aeq\ 24\ hr}$
55 - 60
60 - 65
65 - 70
≥ 70

PPFs Altered
dB $L_{Aeq\ 24\ hr}$
≤ 64

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Title: **Supporting Growth**

NoR 2 - Do Nothing

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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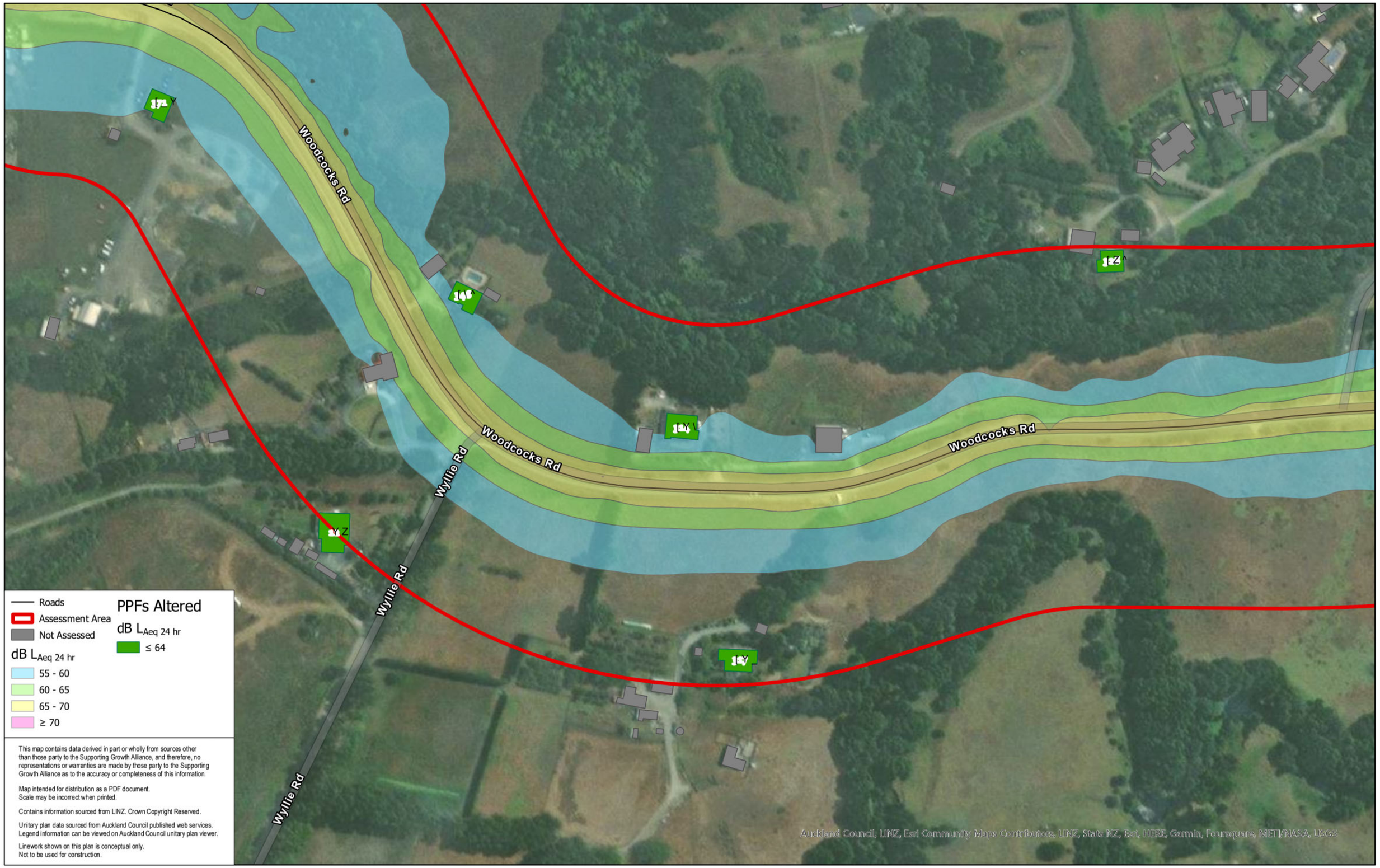

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NoR 2 - Do Nothing

Working Plans of Te Tupu Ngatahi.
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Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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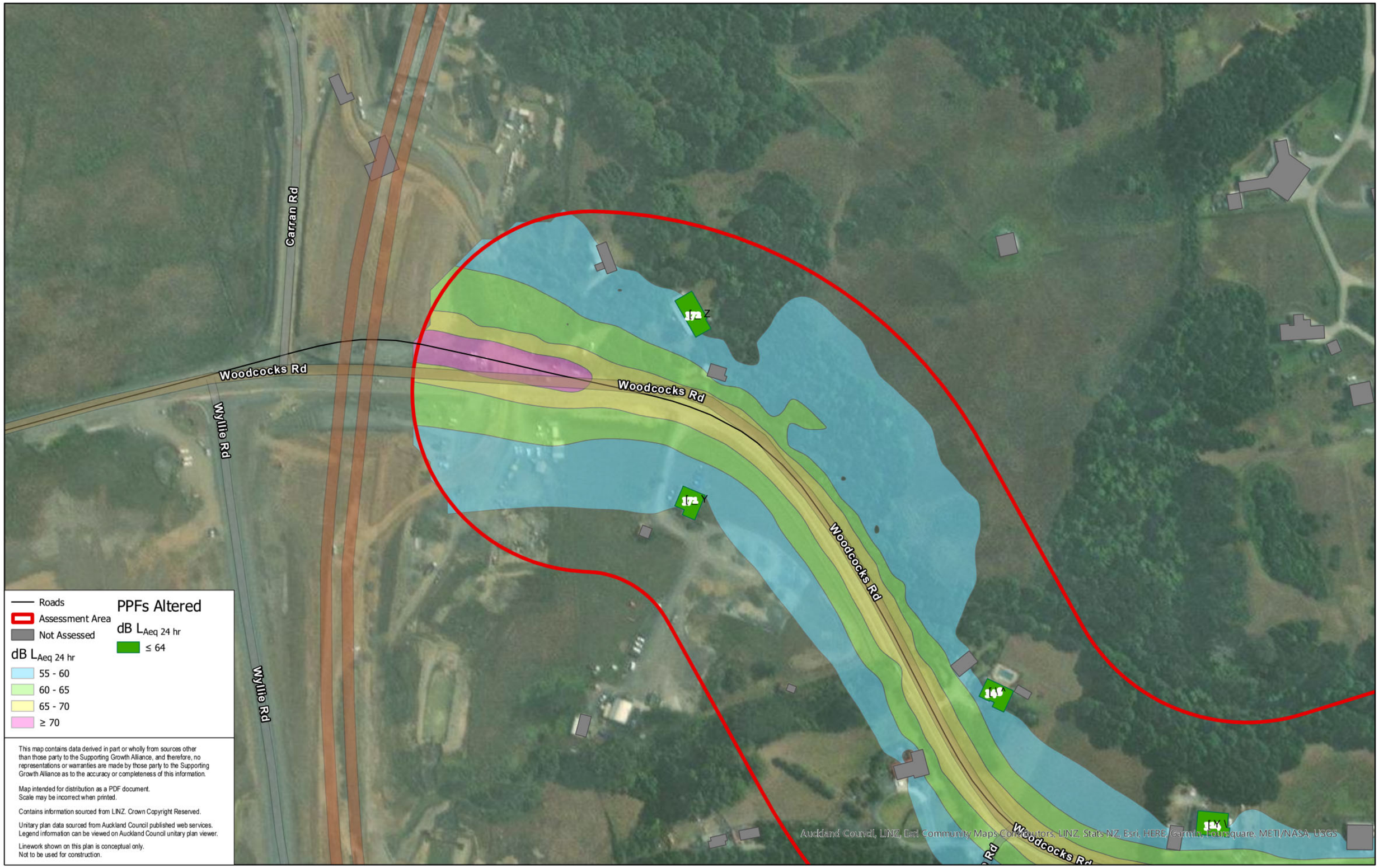

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								Project: **Warkworth**	Drawing No: **SGA-NV-NW-013**
		1	Author	DRAFT	DRAFT	dd/mm/yyyy			

TE TUPU NGĀTAHI Supporting Growth

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Name: NoR 2

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Mansel Dr

Woodcocks Rd

Woodcocks Rd

Woodcocks Rd

Woodcocks Rd

Evelyn St

Oliver St

Mason Hts

Oliver St

Christopher Ln

Jamie Ln

Jamie Ln

Jamie Ln

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Roads

Assessment Area

Not Assessed

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

Map Scale @ A3:

N

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

Title: **Supporting Growth**

NoR 2 - Do Minimum

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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Name: NoR 2

Path: C:\GIS\SGA_Warkworth\SGA_Warkworth.aprx

Falls Rd

Woodcocks Rd

Woodcocks Rd

Woodcocks Rd

Woodcocks Rd

Roads

Assessment Area

Not Assessed

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

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NoR 2 - Do Minimum

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Project: **Warkworth**

TE TUPU NGĀTAHI Supporting Growth

Discipline: **GIS**

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

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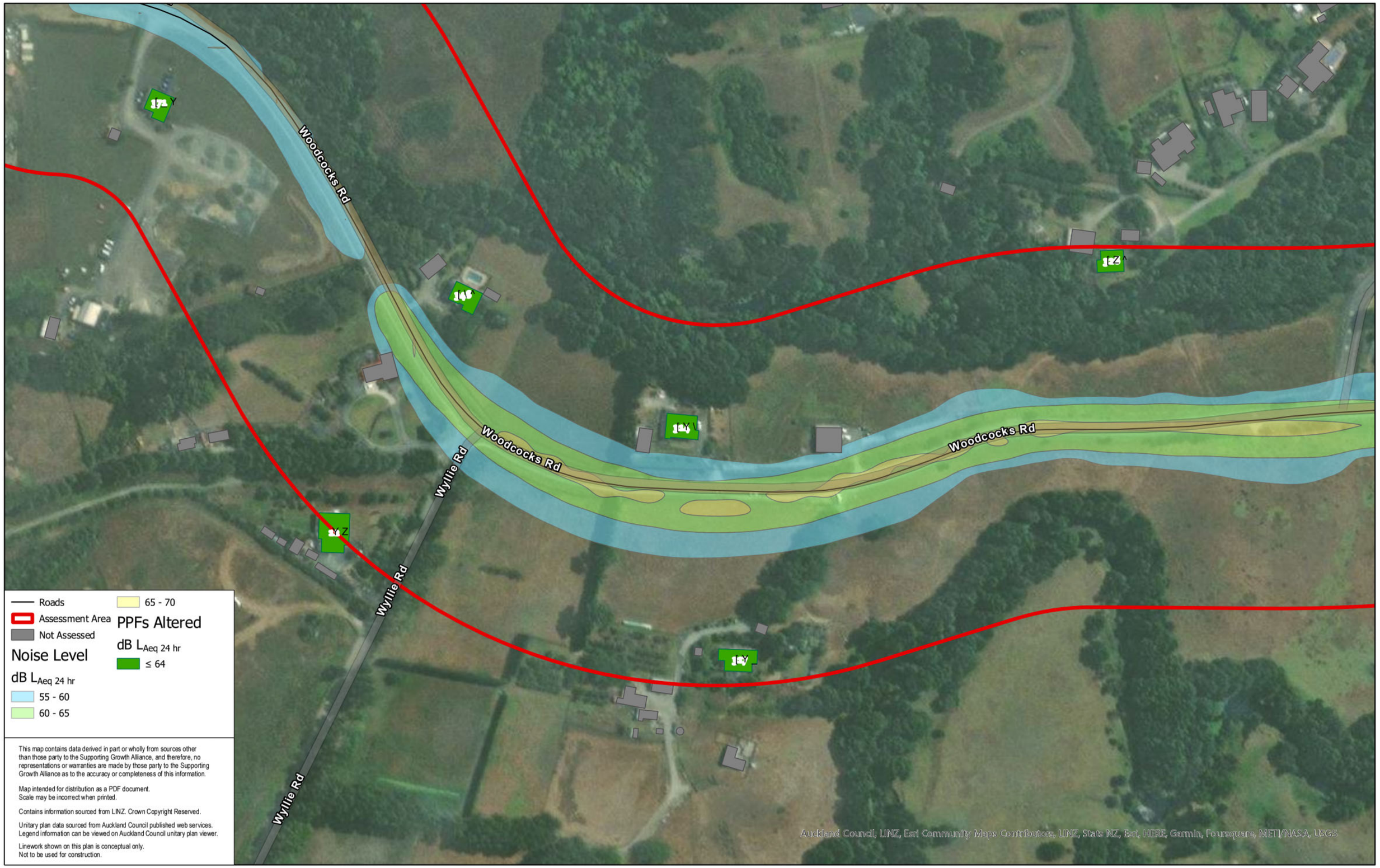

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NoR 2 - Do Minimum

Working Plans of Te Tupu Ngatahi.
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Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

ATTACHMENT 72

ASSESSMENT OF TRAFFIC NOISE AND VIBRATION EFFECTS PART 2 OF 4

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Name: NoR 2

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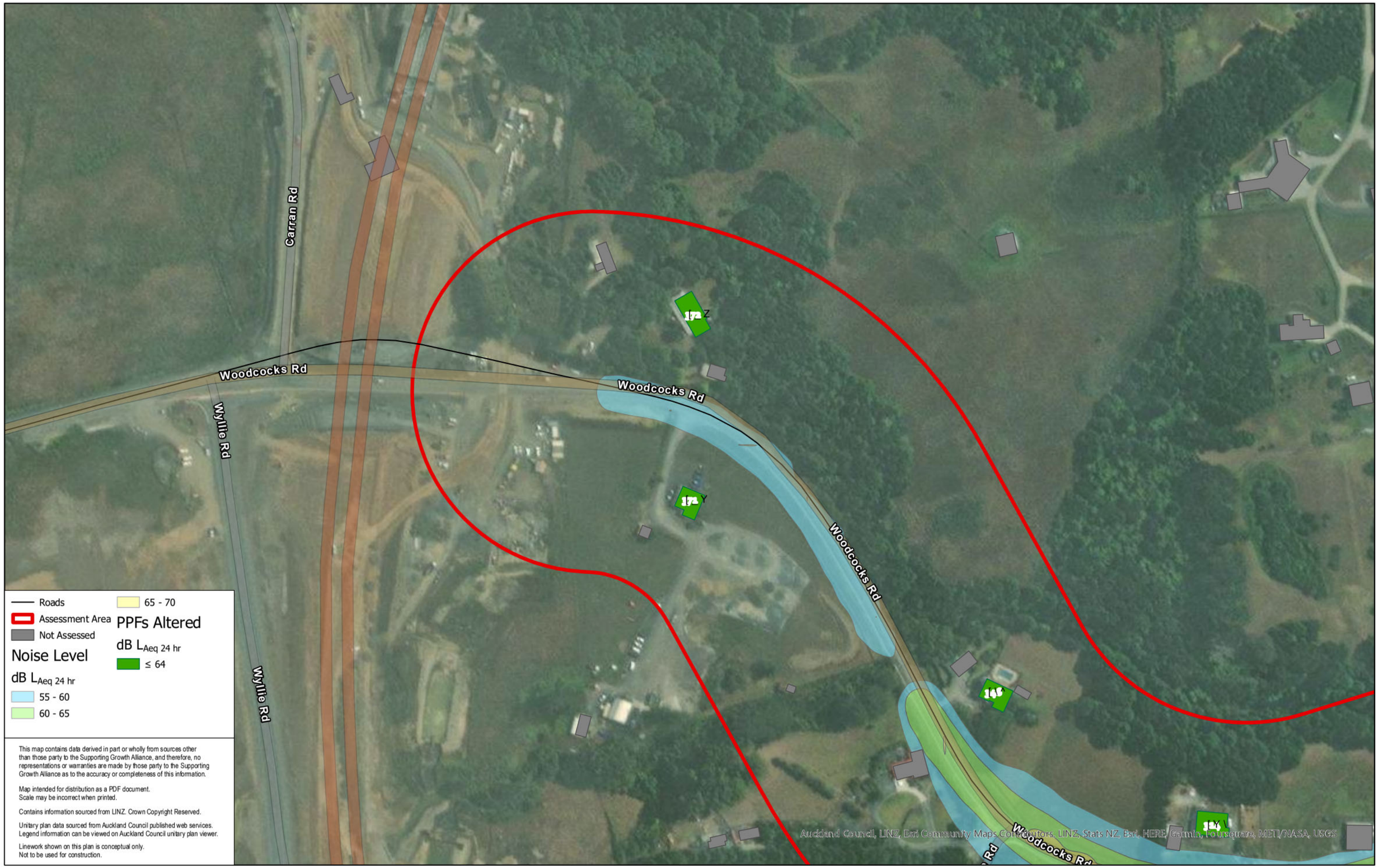

Roads
Assessment Area
Not Assessed

Noise Level
dB $L_{Aeq\ 24\ hr}$
55 - 60
60 - 65
65 - 70

PPFs Altered
dB $L_{Aeq\ 24\ hr}$
≤ 64

Map Scale @ A3:

N

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

Title:

Supporting Growth

NoR 2 - Do Minimum

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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Name: NoR 3

Path: C:\GIS\SGA_Warkworth\SGA_Warkworth.aprx

Twin Coast Hwy

Twin Coast Hwy

Twin Coast Hwy

Not Assessed

Assessment Area

Roads

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

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1	Author	DRAFT	DRAFT	dd/mm/yyyy

Title:

Supporting Growth

NoR 3 - Existing

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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Project: **Warkworth**

TE TUPU NGĀTAHI Supporting Growth

Discipline: **GIS**

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

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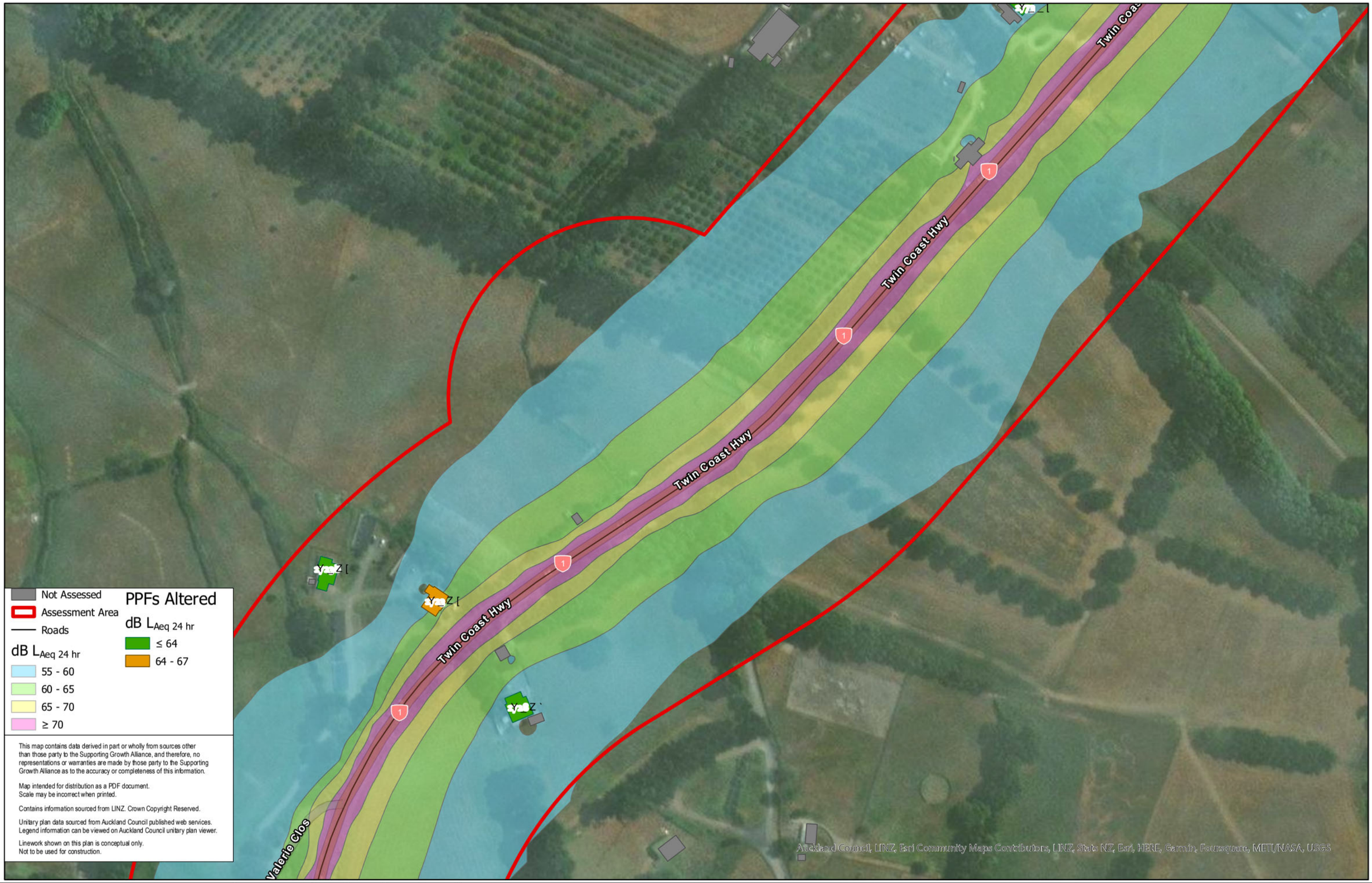

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Revision	Author	Verified	Approved	Date
	JR	CD		
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Title: **Supporting Growth**

NoR 3 - Existing

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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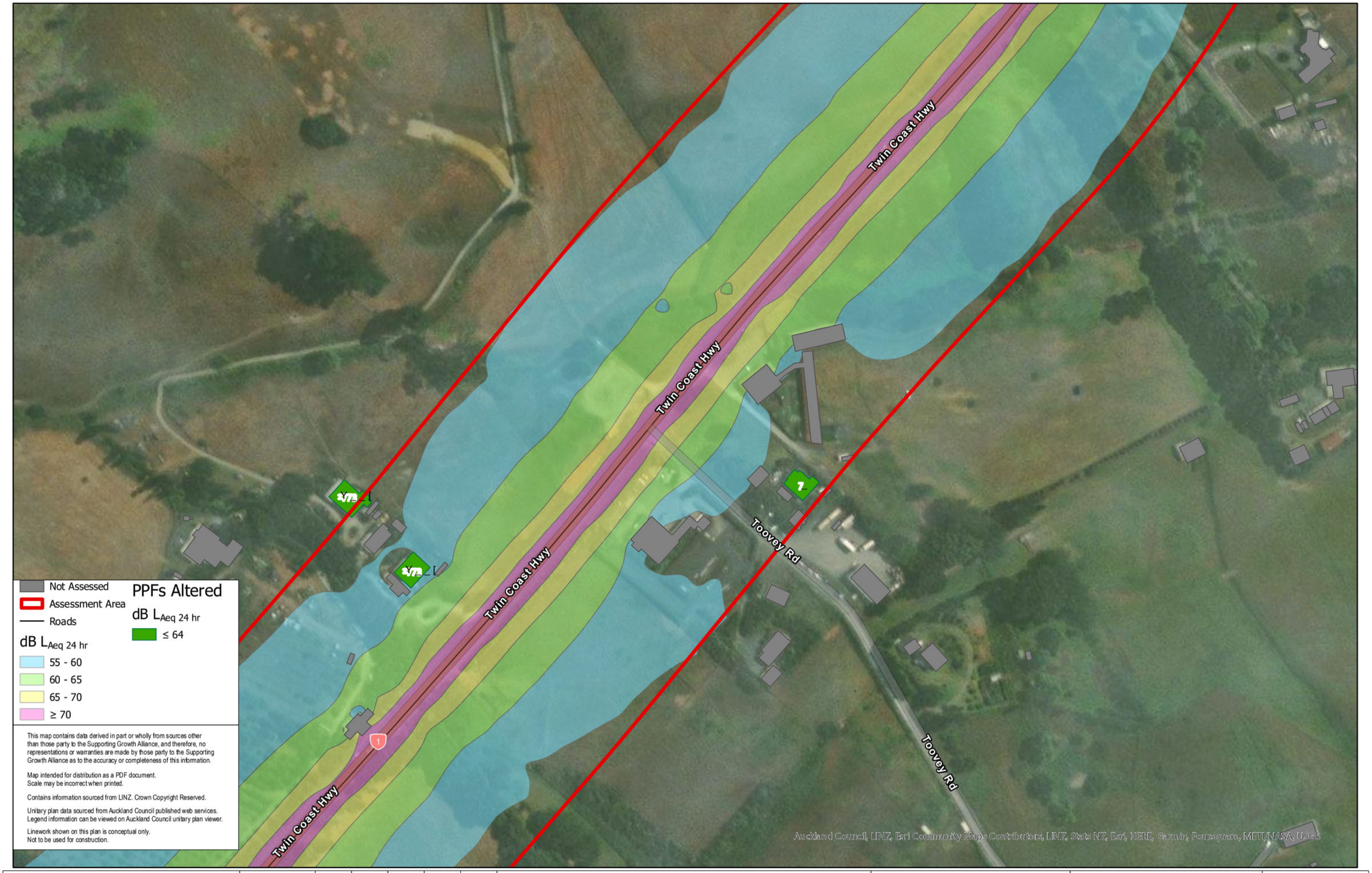

Map Scale @ A3:

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

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Discipline: GIS

Drawing No: SGA-NV-NW-013

Date Printed: 4/11/2022 10:53 AM

Name: NoR 3

Path: C:\GIS\SGA_Warkworth\SGA_Warkworth.aprx

Woodcocks Rd

Campbell Dr

Clegg Pl

Glenmore Dr

Auckland Rd

Hauiti Dr

Blue Gum Dr

Fairwater Rd

Jamish Dr

Not Assessed

Assessment Area

Roads

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

64 - 67

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Revision	Author	Verified	Approved	Date
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TE TUPU NGĀTAHI Supporting Growth

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Title: **Supporting Growth**

NoR 3 - Do Nothing

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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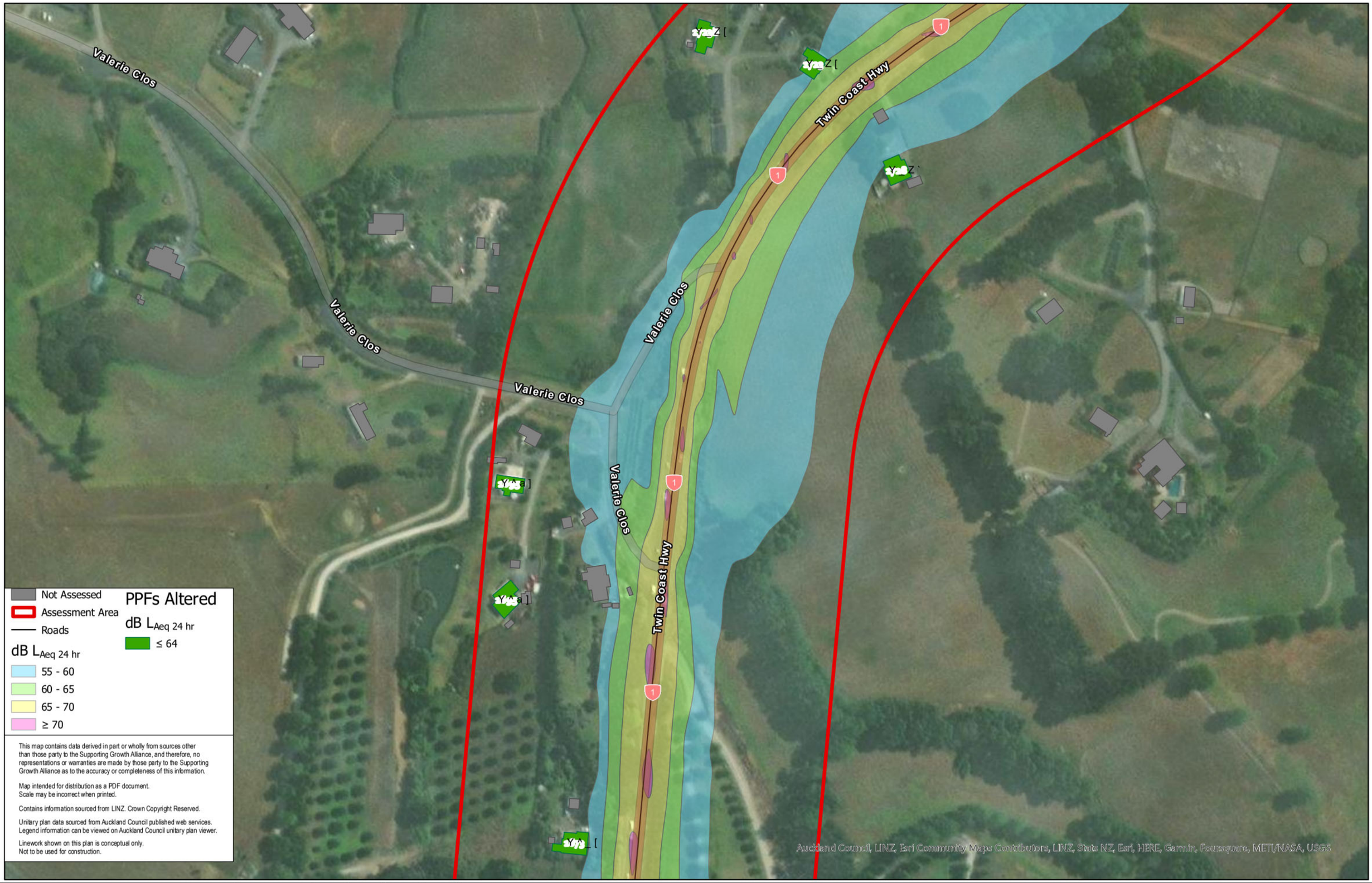

Map Scale @ A3:

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

Title: **Supporting Growth**

NoR 3 - Do Nothing

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

Date Printed: 4/11/2022 10:53 AM

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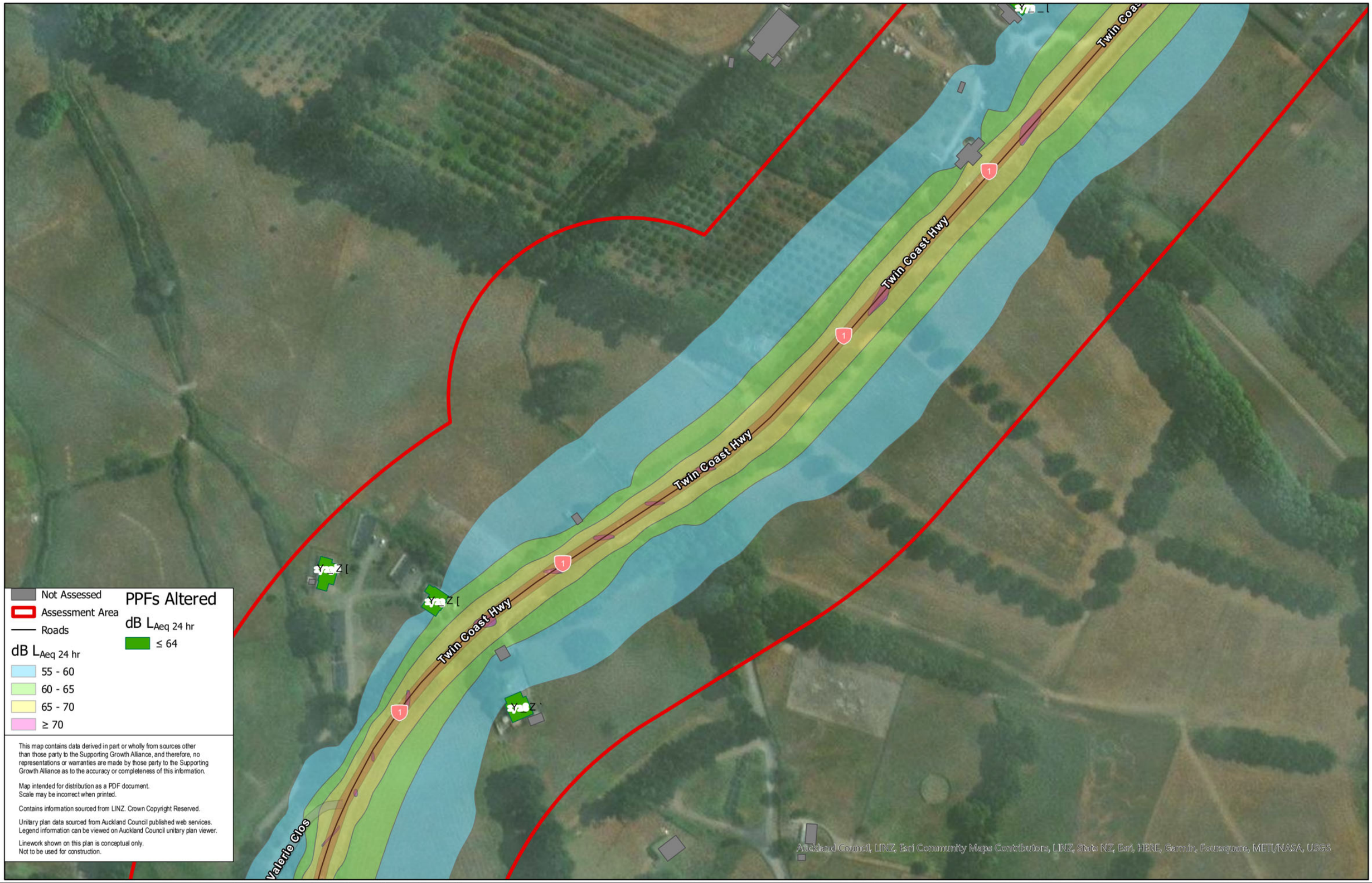

Map Scale @ A3:

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

Title:

Supporting Growth

NoR 3 - Do Nothing

Working Plans of Te Tupu Ngatahi.
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Auckland Rd

Fairwater Rd

Jamish Dr

Jamish Dr

Not Assessed

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55 - 60

60 - 65

65 - 70

≥ 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

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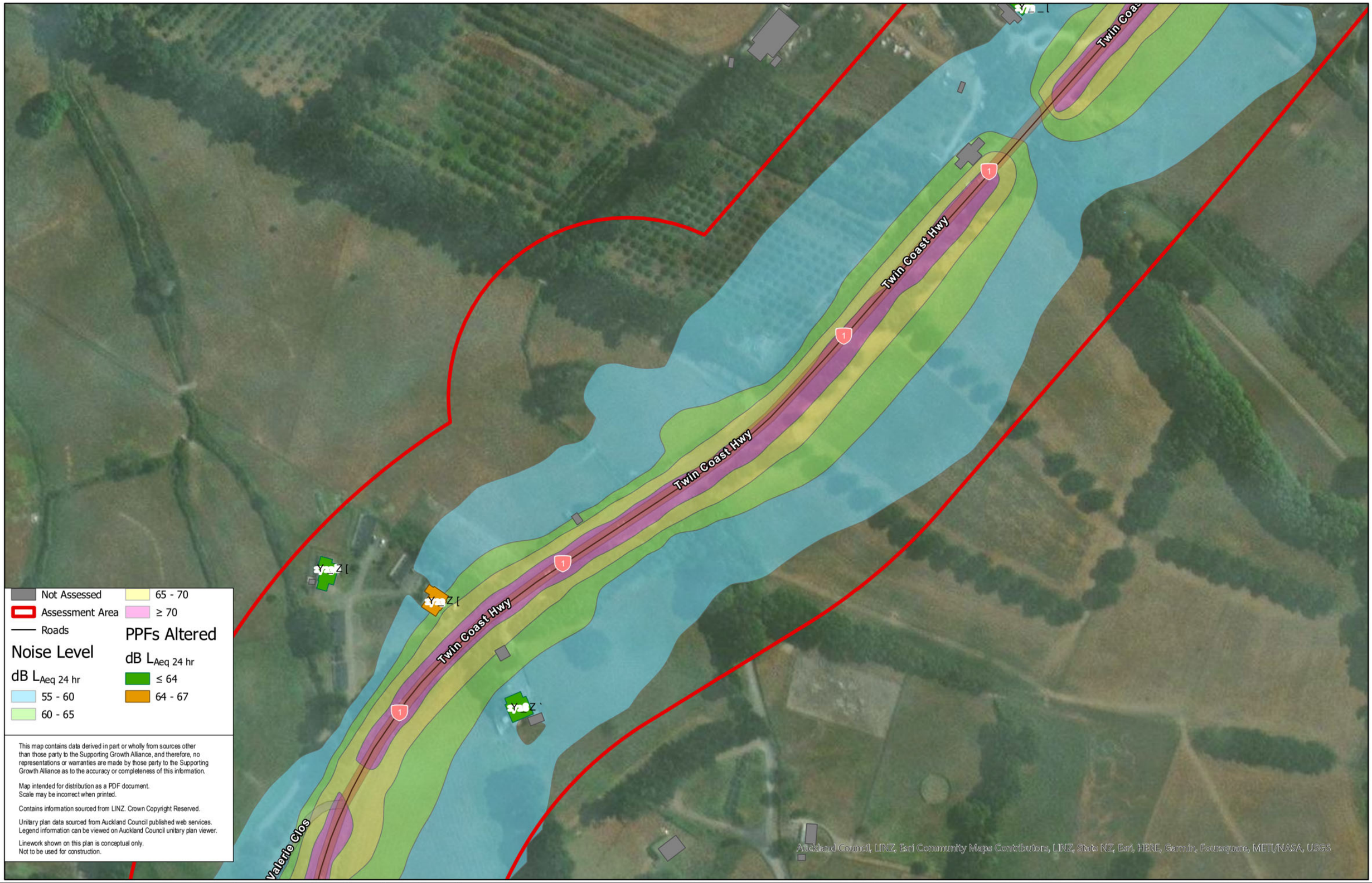

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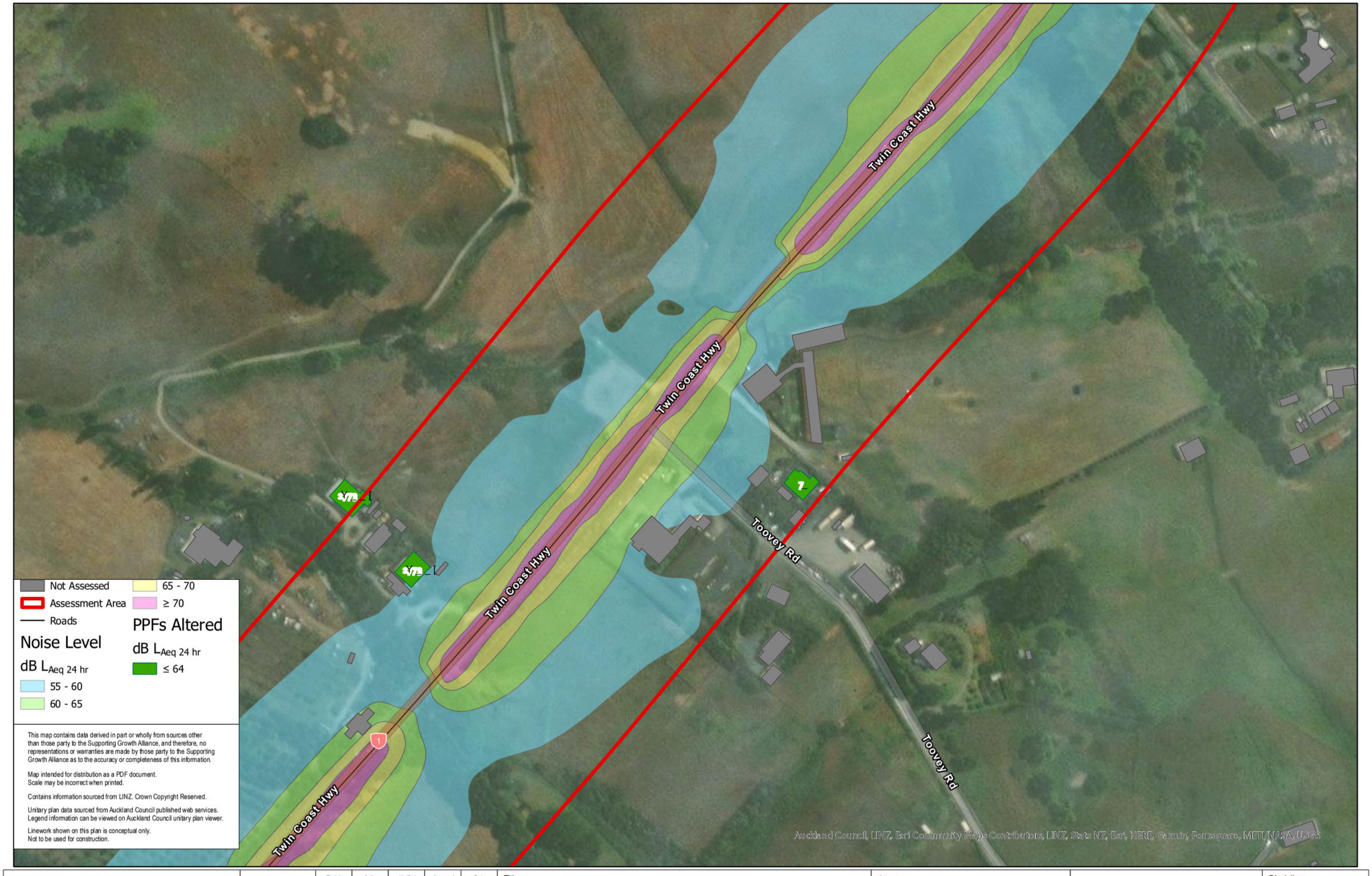

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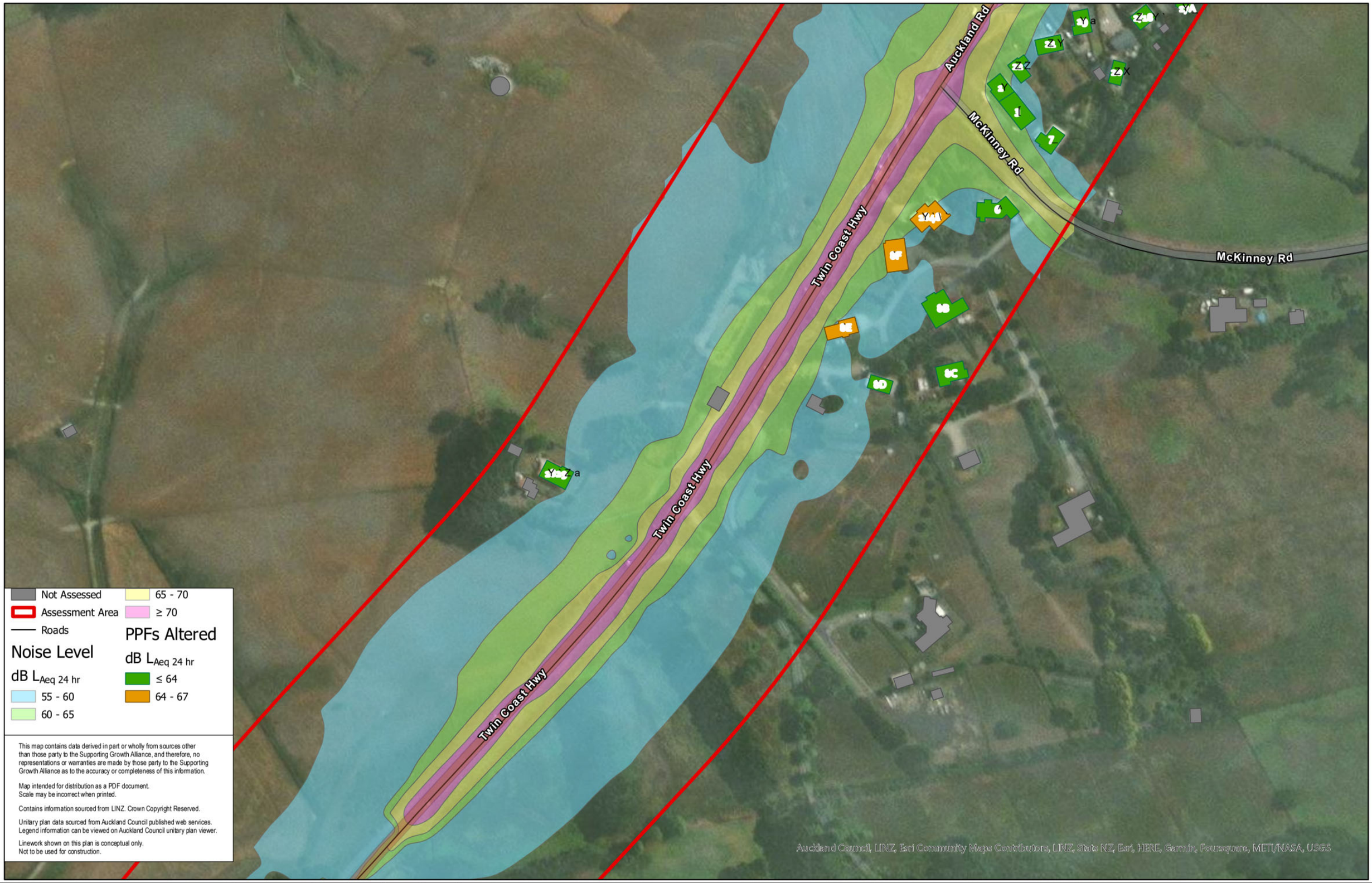

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Auckland Rd

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Jamish Dr

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Roads

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

64 - 67

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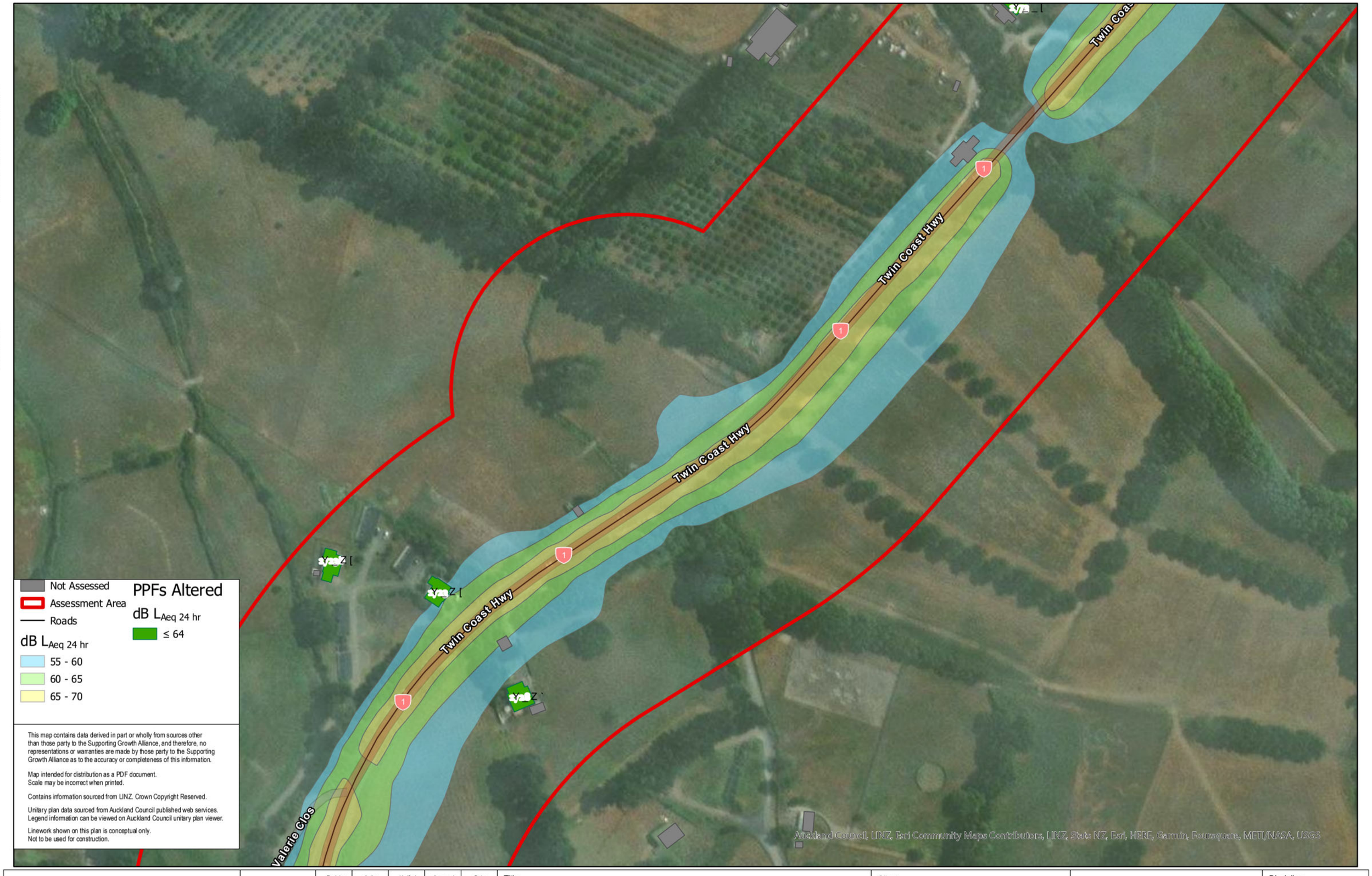

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Twin Coast Hwy

Twin Coast Hwy

Twin Coast Hwy

Twin Coast Hwy

Toovey Rd

Toovey Rd

Not Assessed

Assessment Area

Roads

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

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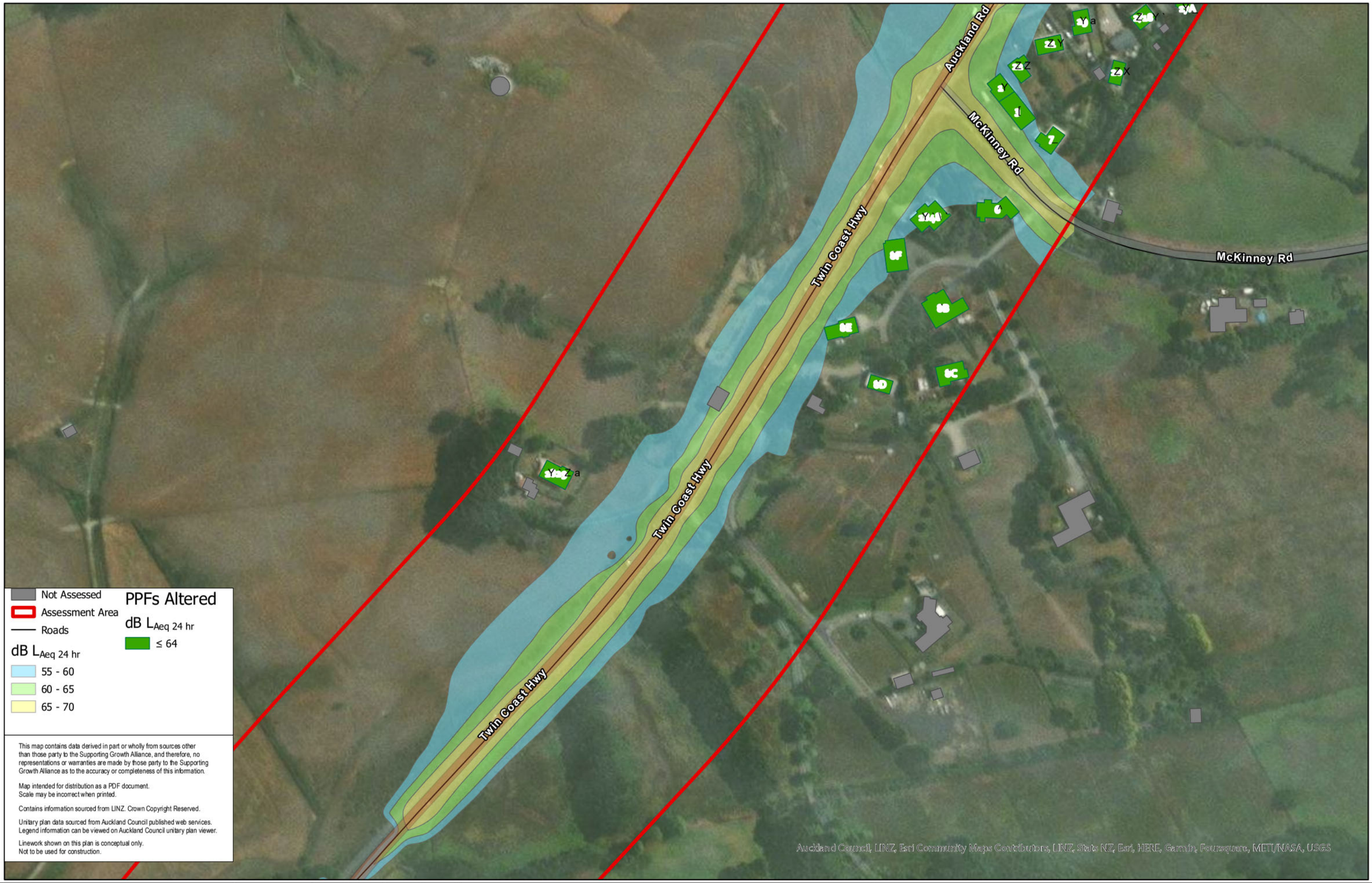

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Glenmore Dr

Morrison Dr

Auckland Rd

Wech Dr

Fairwater Rd

Jamish

Dome Ln

Titapu Rd

McKinney Rd

Twin Coast Hwy

Not Assessed

Assessment Area

Roads

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

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Melwood Dr

Matakana Rd

Sandspit Rd

Great North Rd

Kowhai Park

Millstream Pl

Hill St

Brown Rd

Elizabeth St

Wharf St

Queen St

Warkworth

Not Assessed

Assessment Area

Roads

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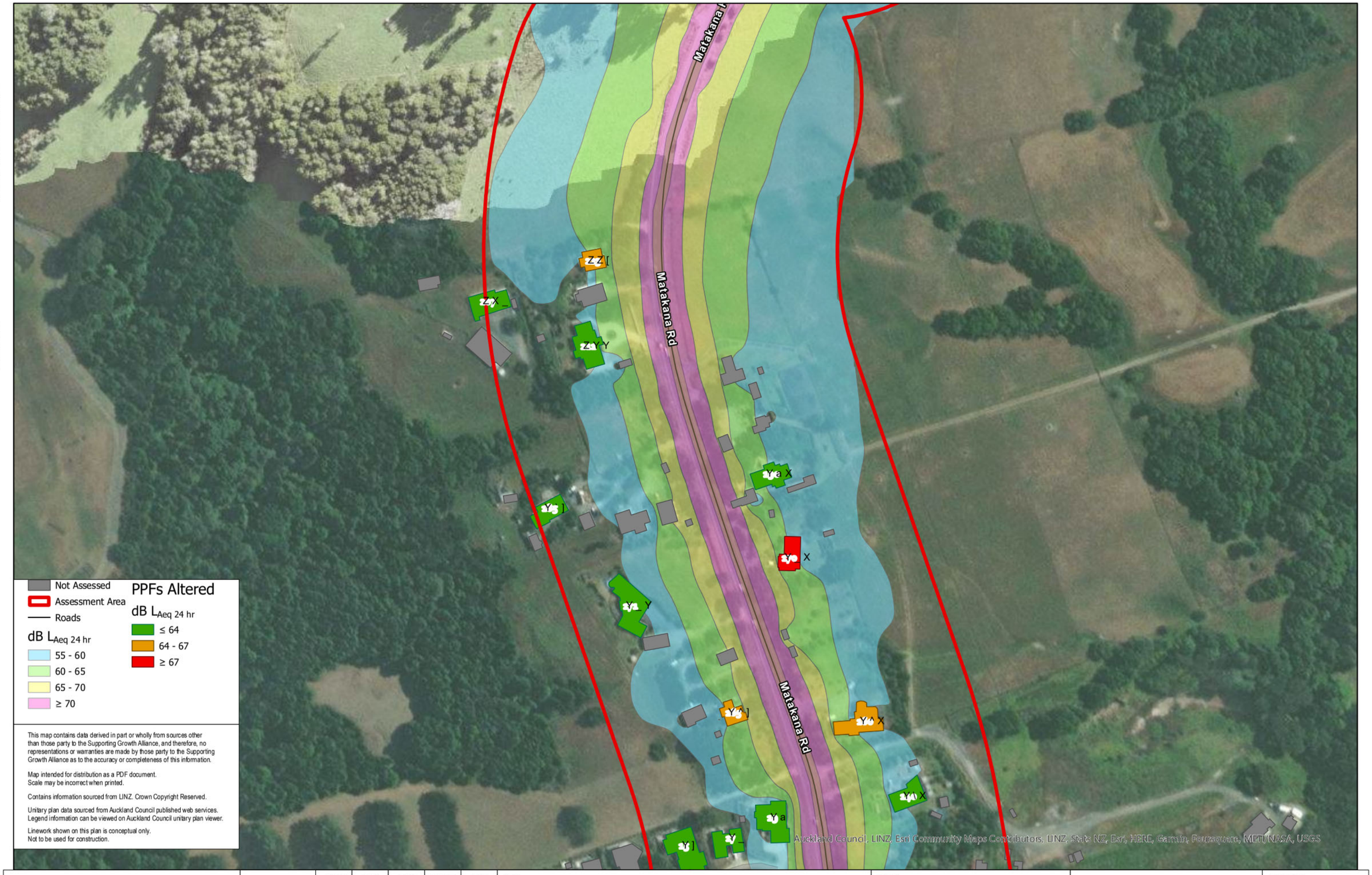

Not Assessed
Assessment Area
Roads

dB $L_{Aeq\ 24\ hr}$
55 - 60
60 - 65
65 - 70
≥ 70

PPFs Altered

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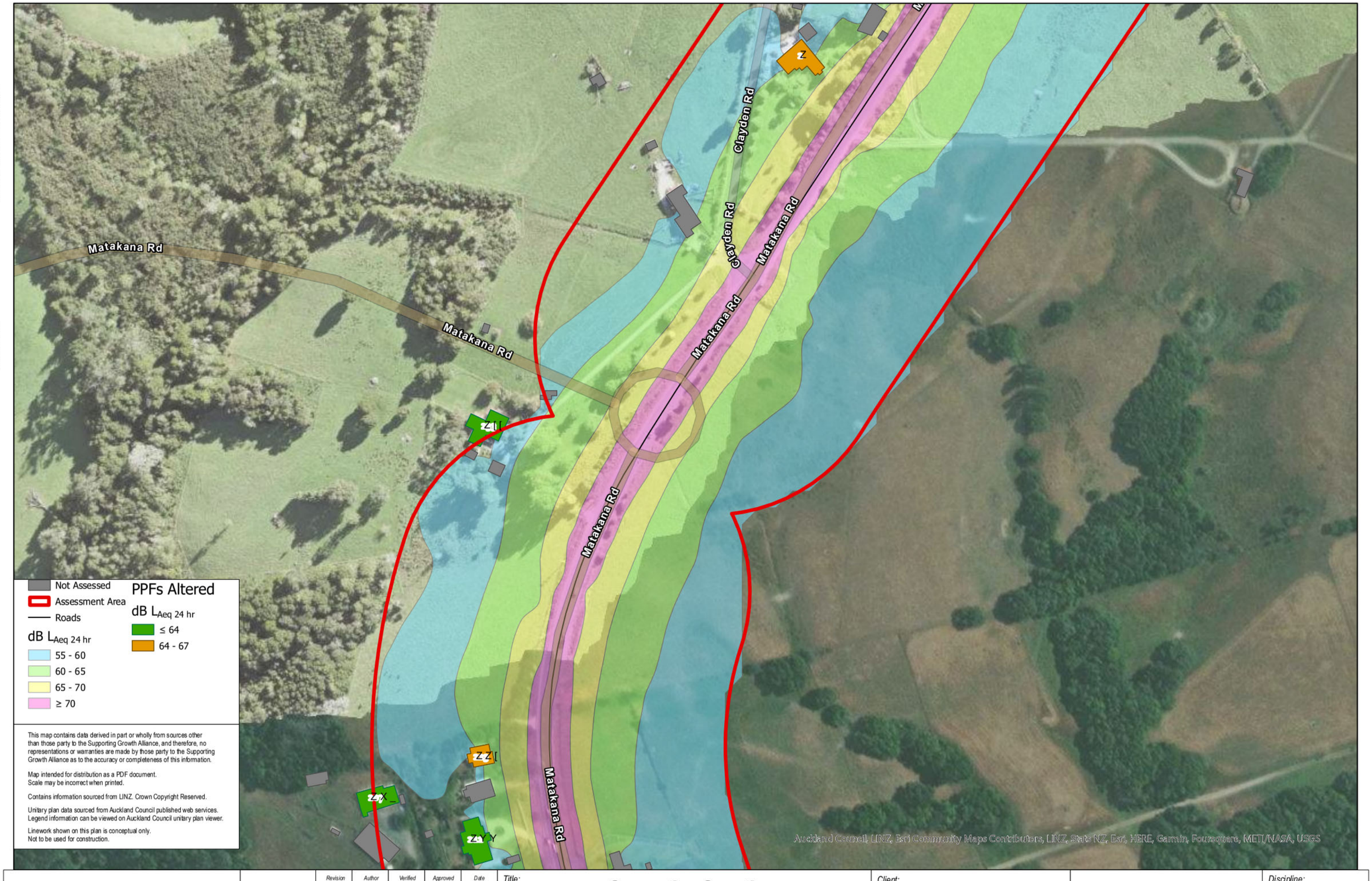

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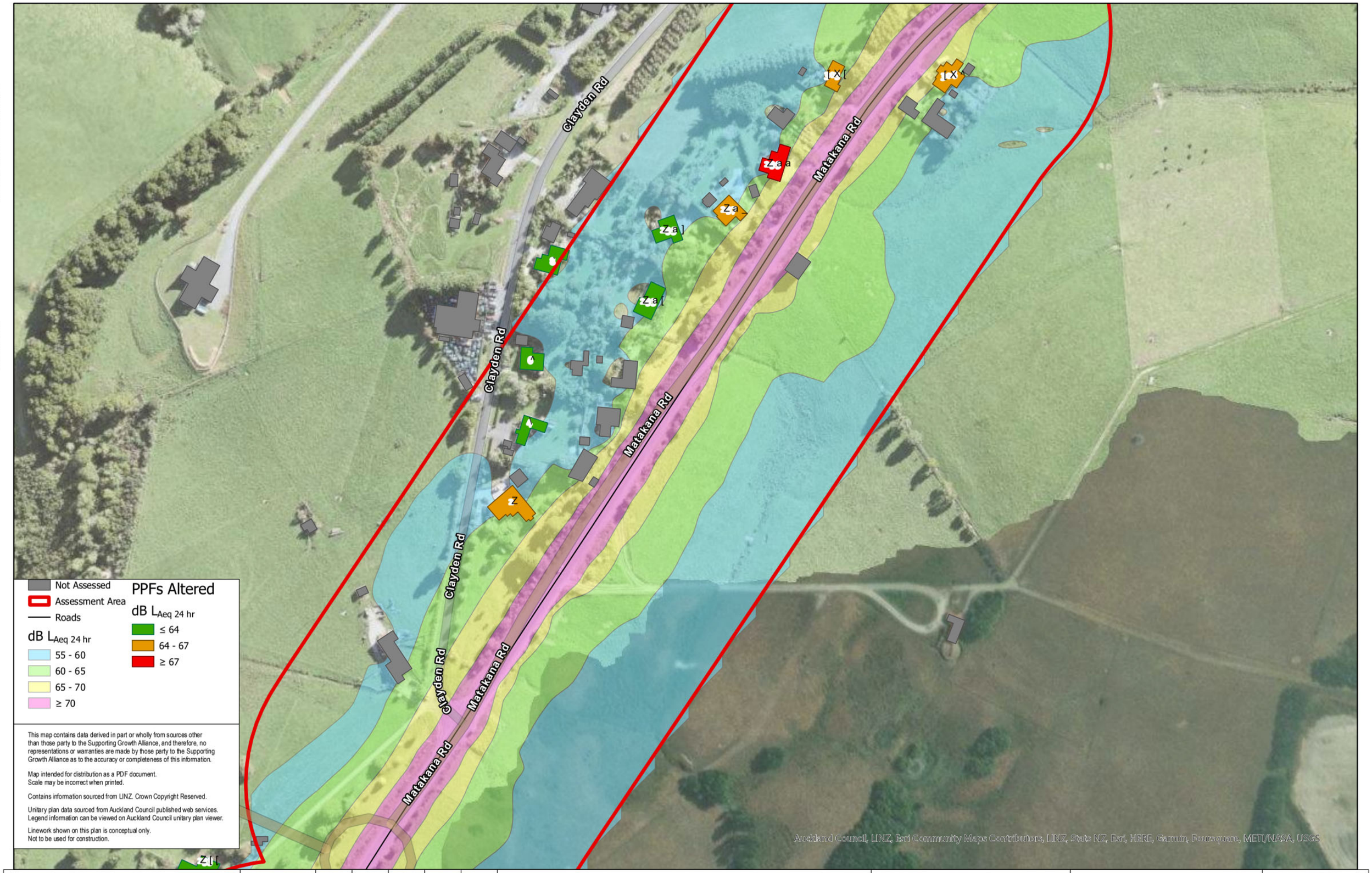

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Clayden Rd

Matakana Rd

Not Assessed

Assessment Area

Roads

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NoR 4 - Do Nothing

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

Client: Supporting Growth

Project: Warkworth

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

Date Printed: 4/11/2022 10:53 AM

Name: NoR 4

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Matakana Rd

Northwood Clos

Ashmore Cres

Not Assessed

Assessment Area

Roads

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

64 - 67

≥ 67

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Matakana Rd

Clayden Rd

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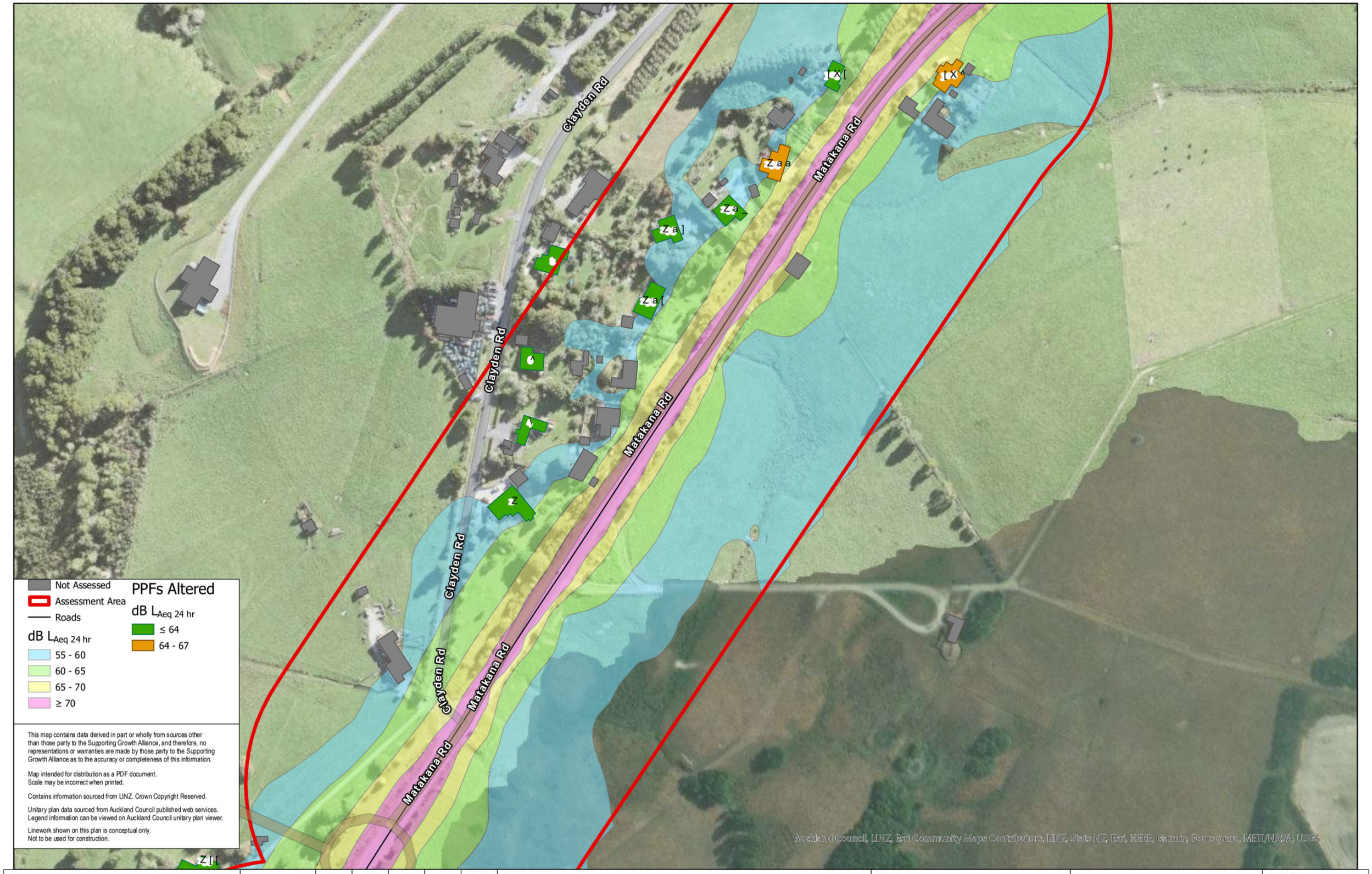

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Clayden Rd

Matakana Rd

Not Assessed

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Melwood Dr
Matakana Rd
Sandspit Rd
Great North Rd
Kowhai Park
Millstream Pl
Hill St
Brown Rd
Elizabeth St
Wharf St
Queen St
Warkworth

Not Assessed
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Ashmore Cres

Ashmore Cres

Westpark Gln

Melwood Dr

Northwood Clos

Matakana Rd

Matakana Rd

Withers Ln

Withers Ln

Sandspit Rd

Sandspit Rd

Not Assessed

Assessment Area

Roads

Noise Level

dB $L_{Aeq\ 24\ hr}$

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Matakana Rd

Clayden Rd

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Matakana Rd

Sandspit Rd

Great North Rd

Kowhai Park

Millstream Pl

Hill St

Brown Rd

Elizabeth St

Wharf St

Queen St

Warkworth

Not Assessed

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55 - 60

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Matakana Rd

Northwood Clos

Ashmore Cres

Matakana Rd

Northwood Clos

Ashmore Cres

Not Assessed

Assessment Area

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ATTACHMENT 73

ASSESSMENT OF TRAFFIC NOISE AND VIBRATION EFFECTS PART 3 OF 4

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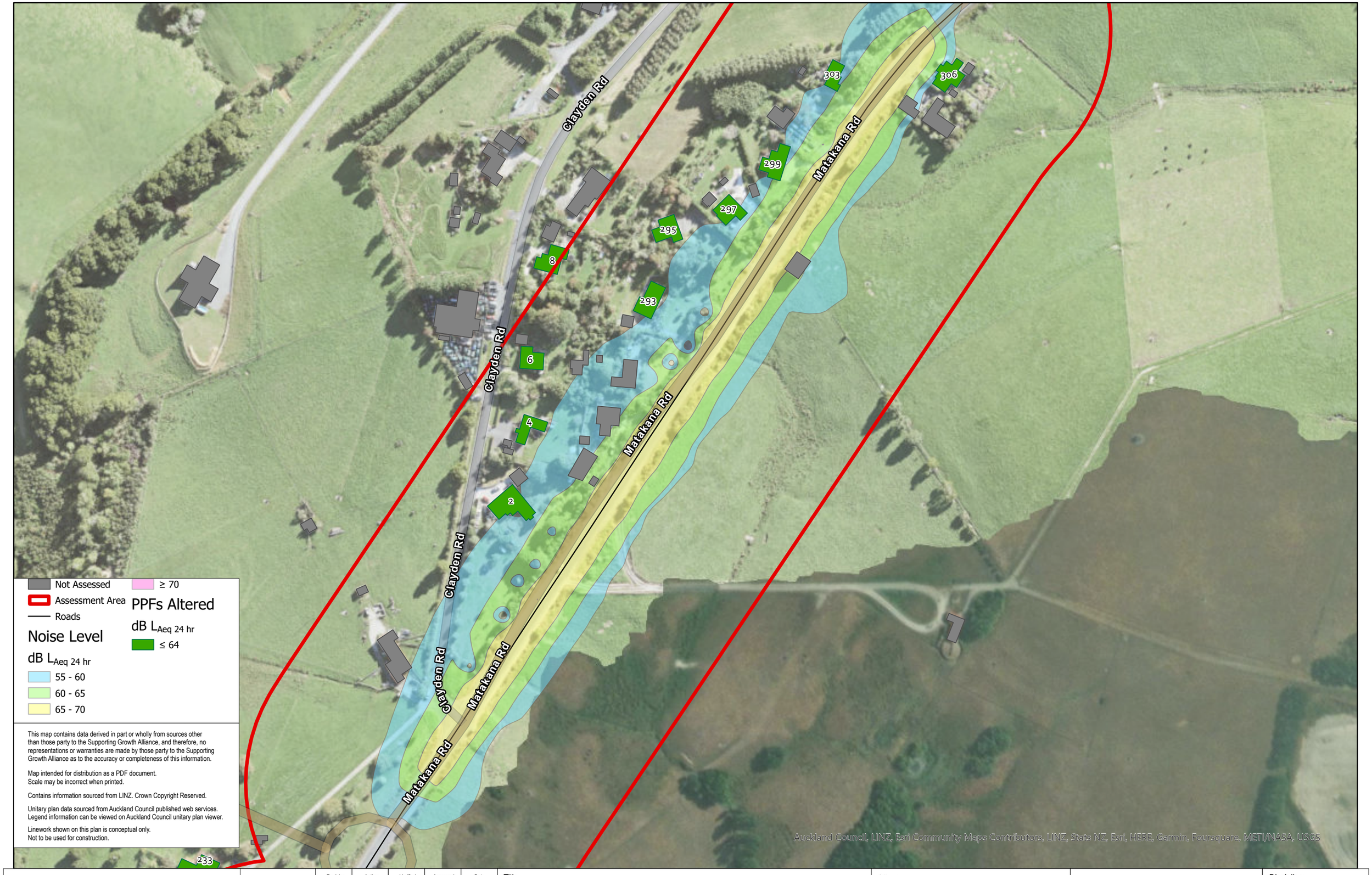

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Path: C:\GIS\SGA_Warkworth\SGA_Warkworth.aprx

Matakana Rd

Matakana Rd

Sandspit Rd

Sandspit Rd

Great North Rd

Kowhai Park

Millstream Pl

1

3

4

5

6

7

8

10

12

34

Not Assessed

Assessment Area

Roads

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

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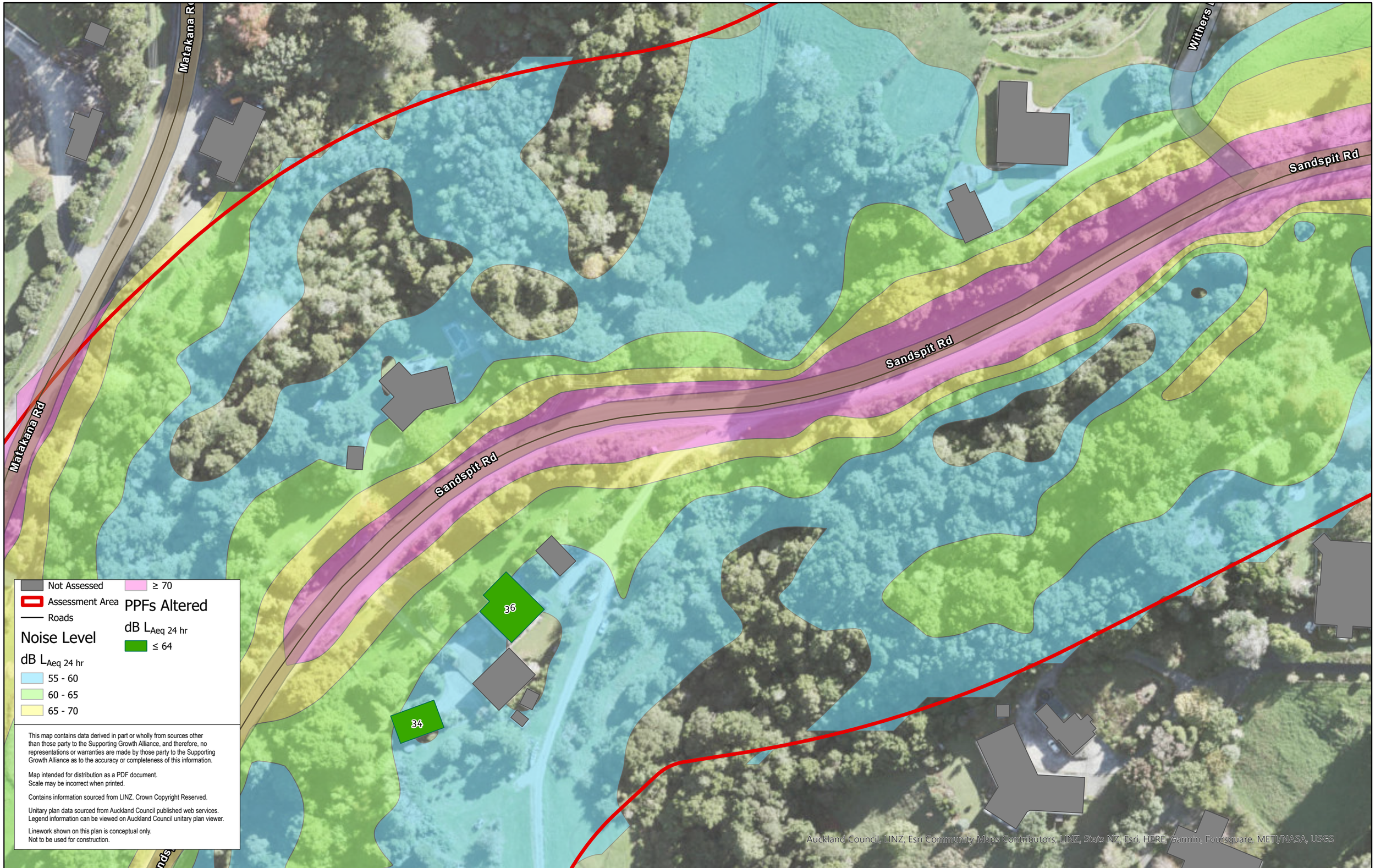

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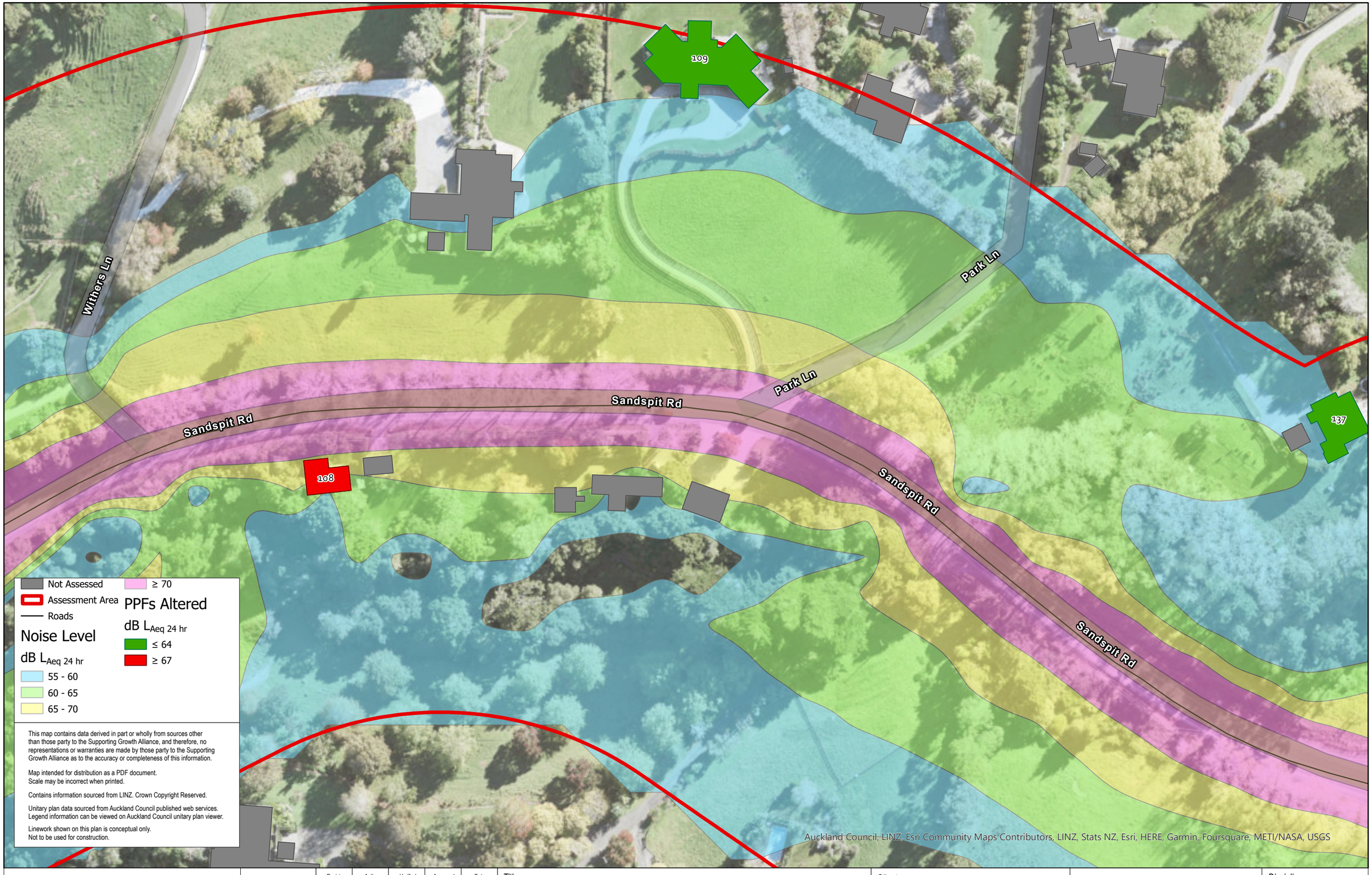

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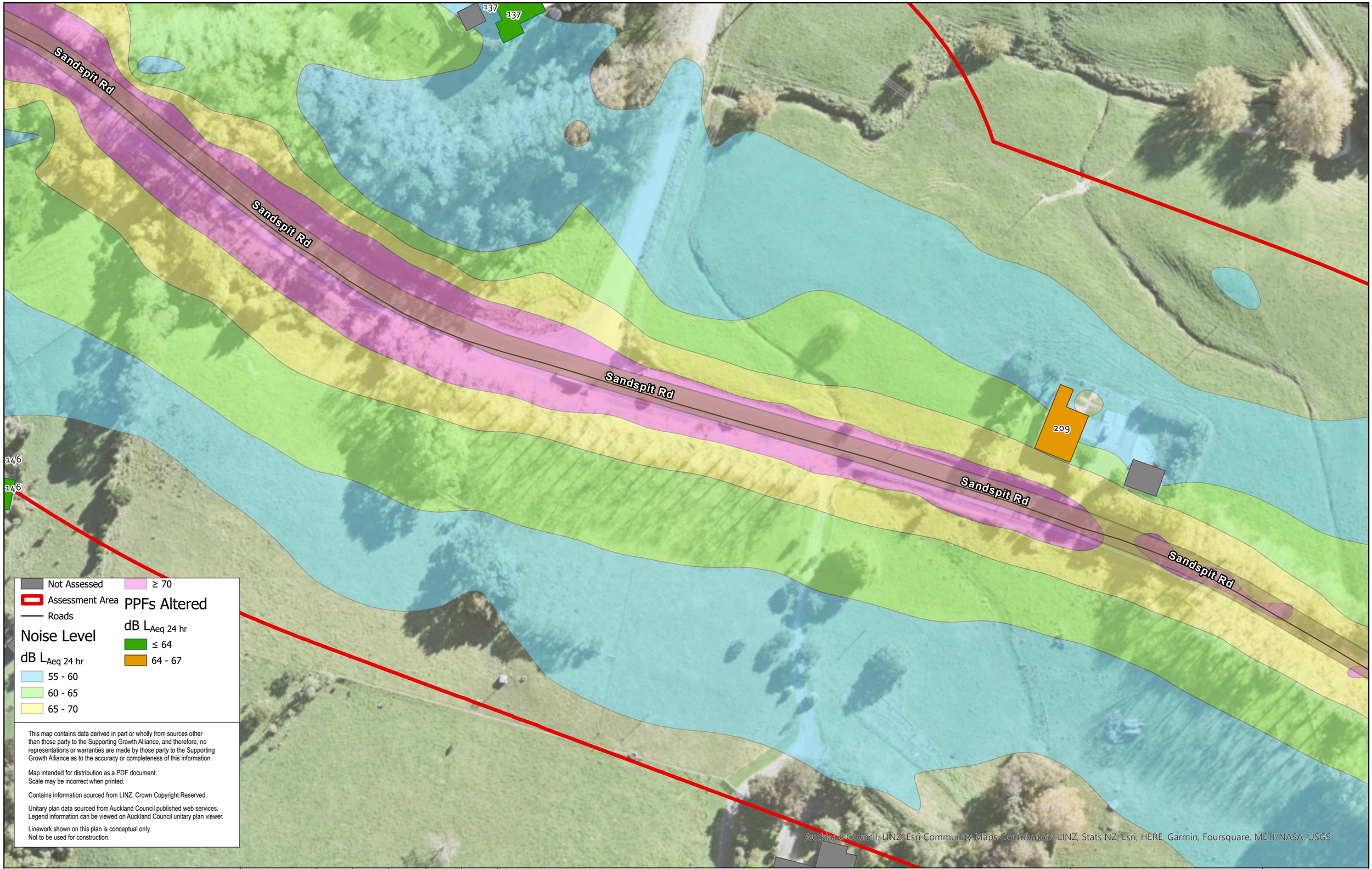

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NoR 5 - Existing

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

Client: **Supporting Growth**

Project: **Warkworth**

TE TUPU NGĀTAHI Supporting Growth

Discipline: **GIS**

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

Date Printed: 4/11/2022 10:53 AM

Name: NoR 5

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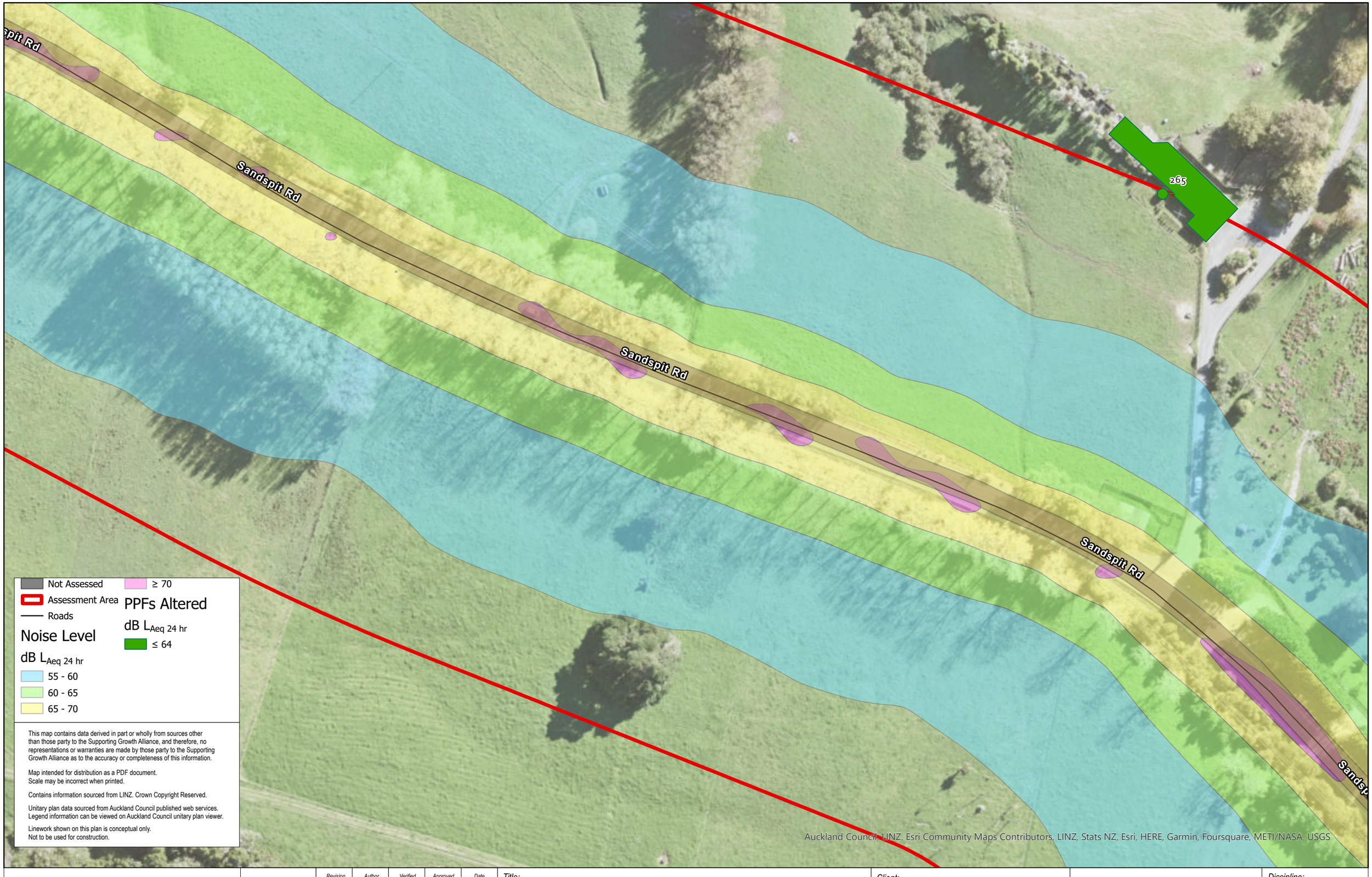

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	JR	CD		
1	Author	DRAFT	DRAFT	dd/mm/yyyy

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Name: NoR 5

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Sandspit Rd

Sandspit Rd

Sandspit Rd

Sandspit Rd

384

Not Assessed

Assessment Area

Roads

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

64 - 67

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Name: NoR 5

Path: C:\GIS\SGA_Warkworth\SGA_Warkworth.aprx

Matakana Rd

Sandspit Rd

Great North Rd

Kowhai Park

Millstream Pl

34

6

8

4

10

12

1

3

5

7

Not Assessed

Assessment Area

Roads

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

≥ 67

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TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

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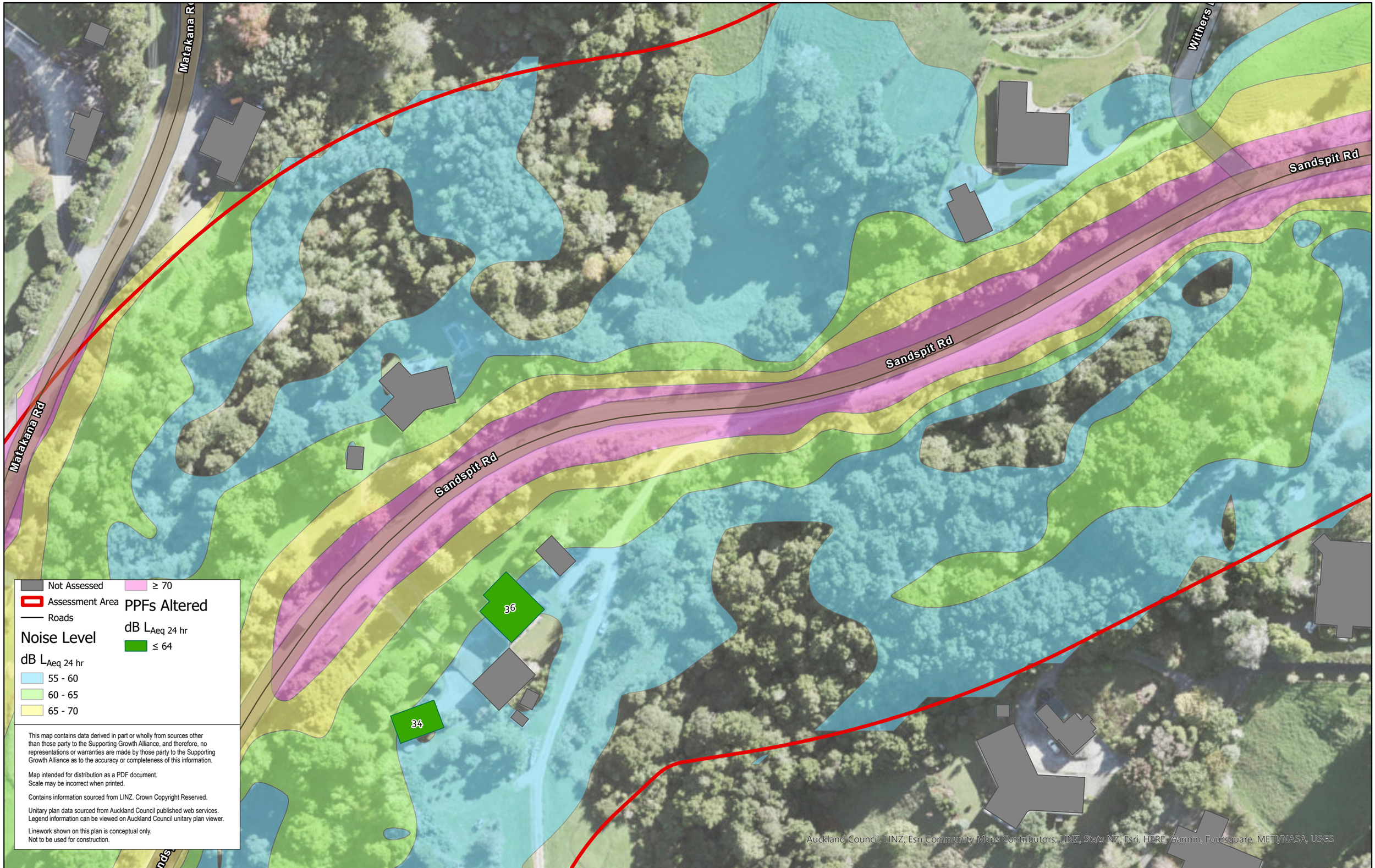

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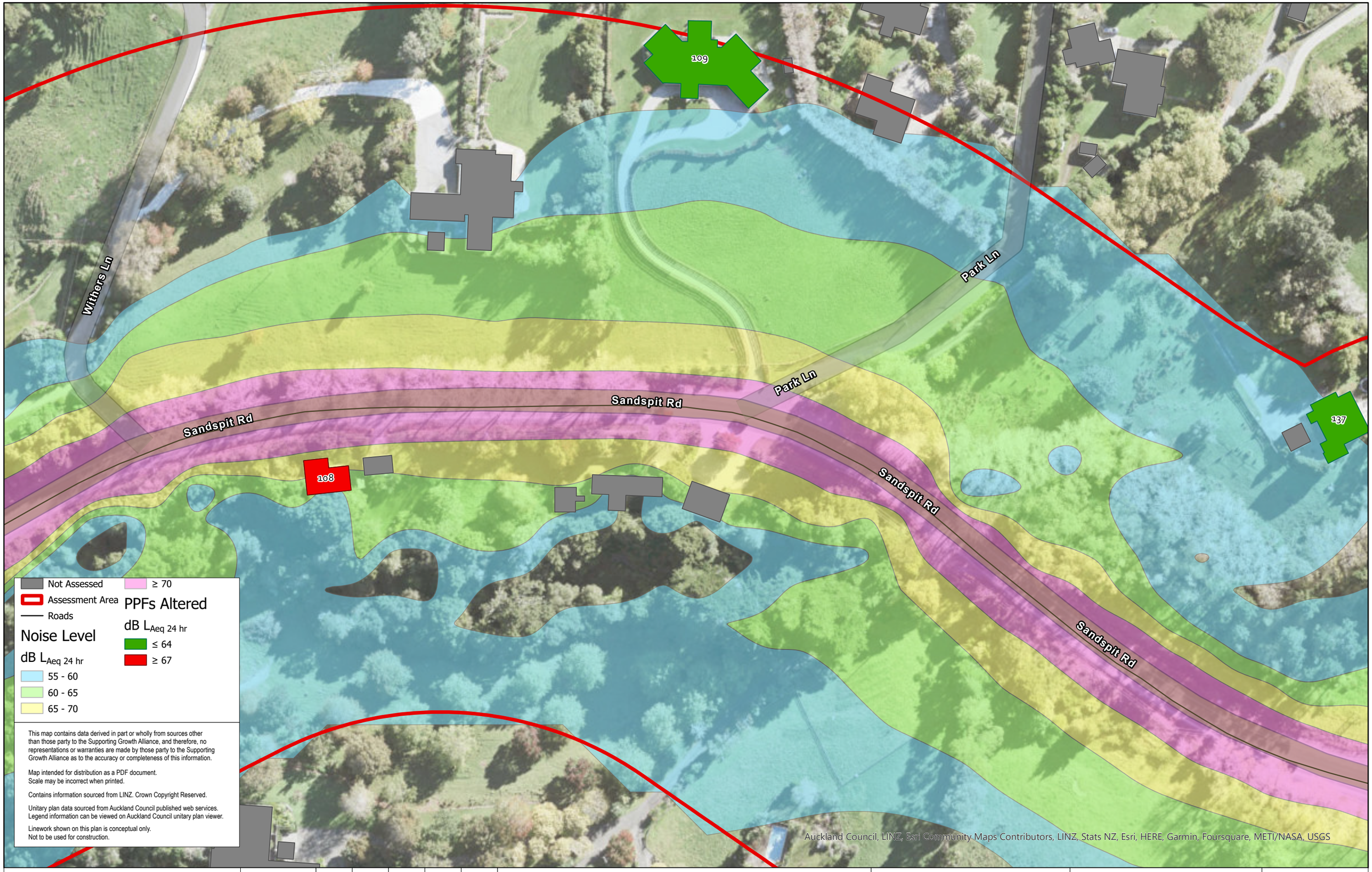

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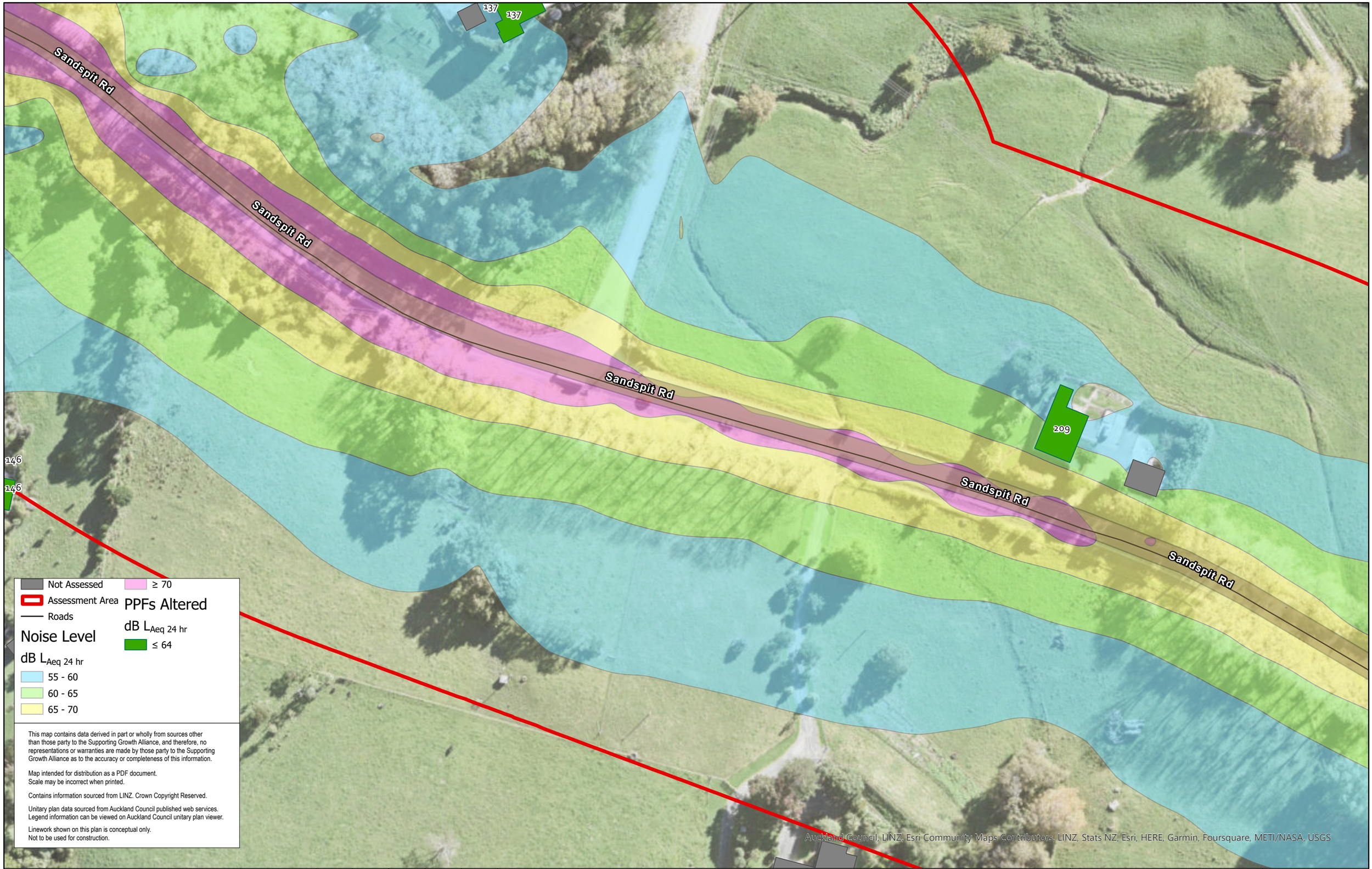

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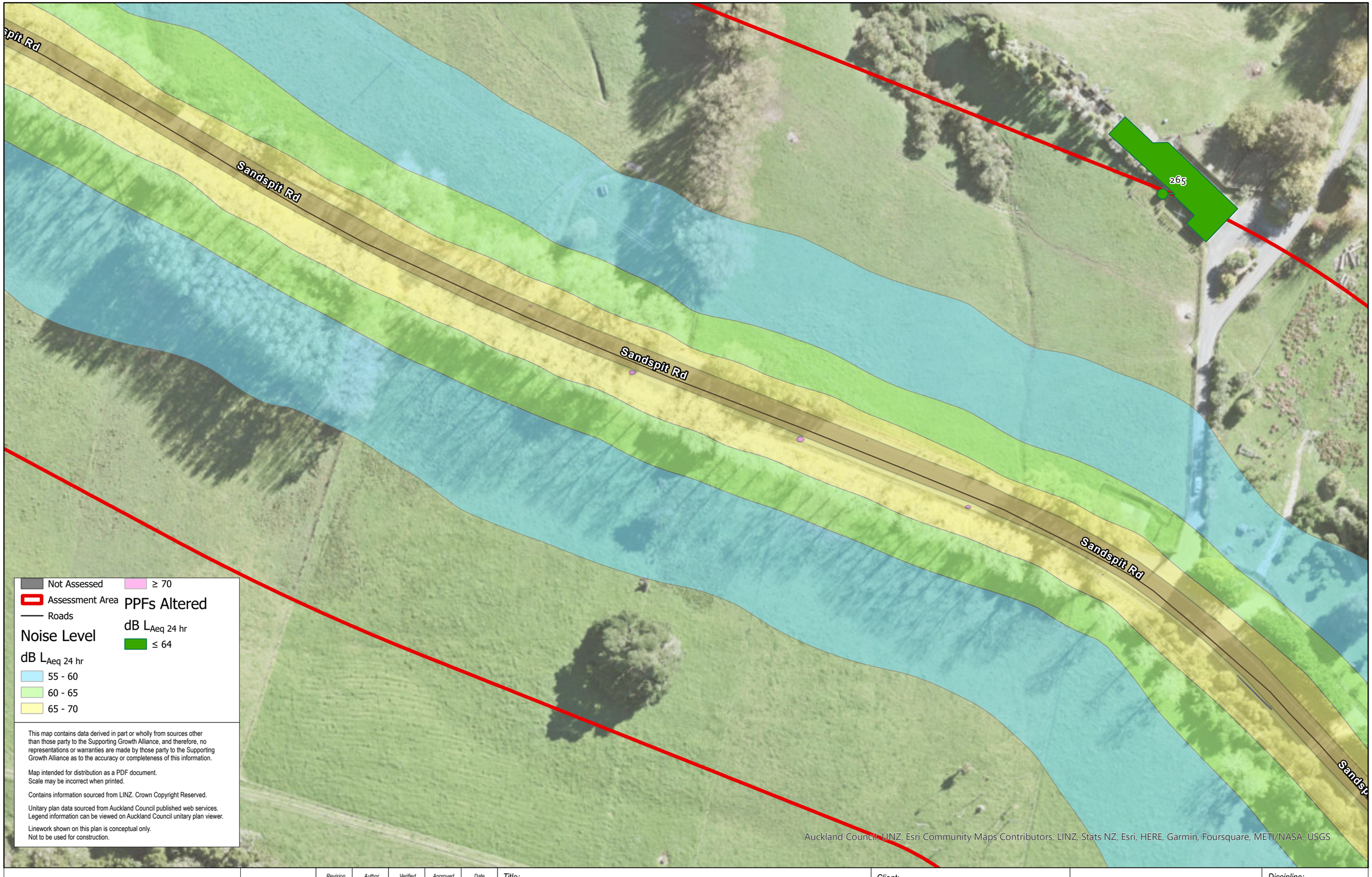

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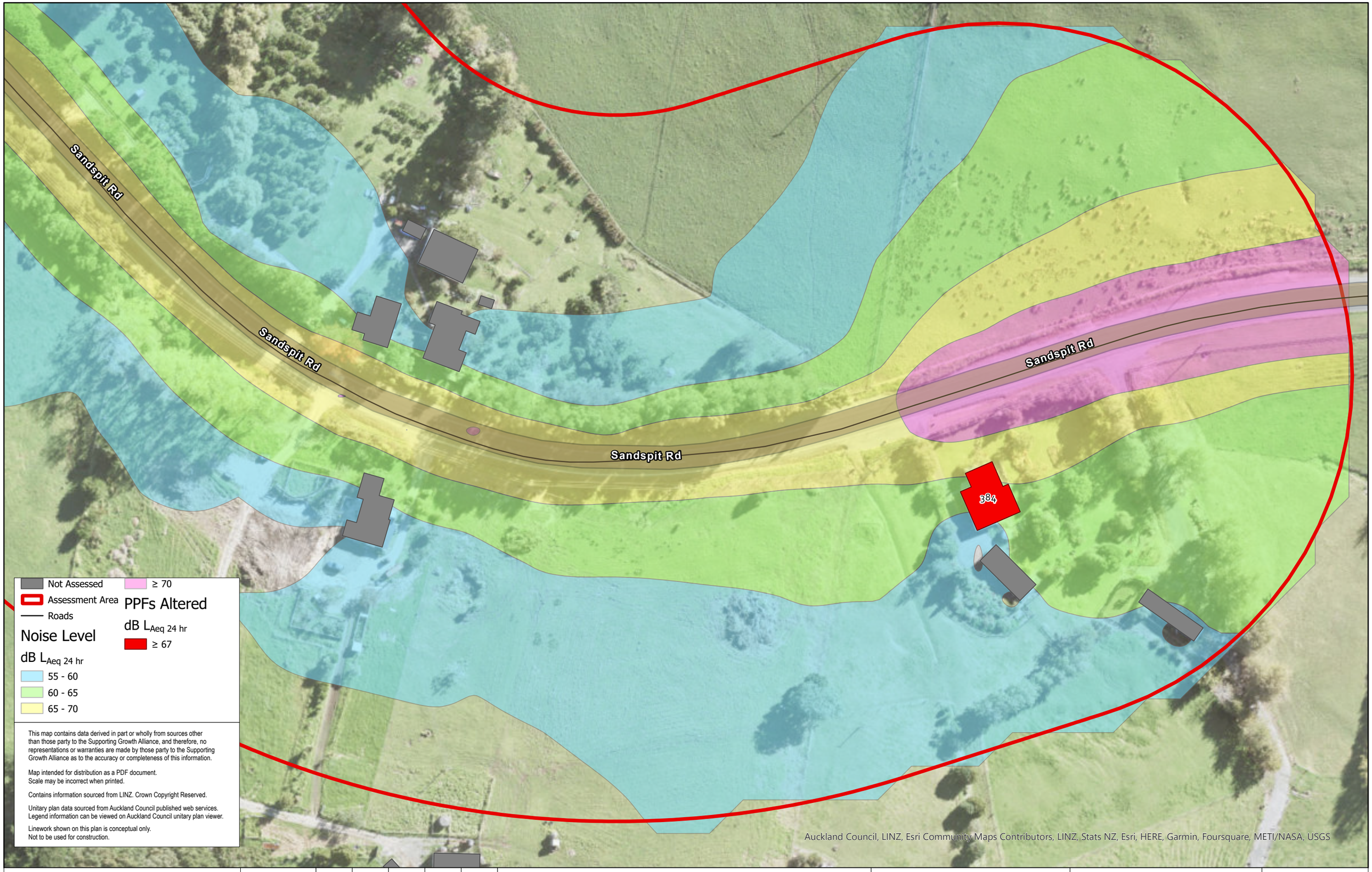

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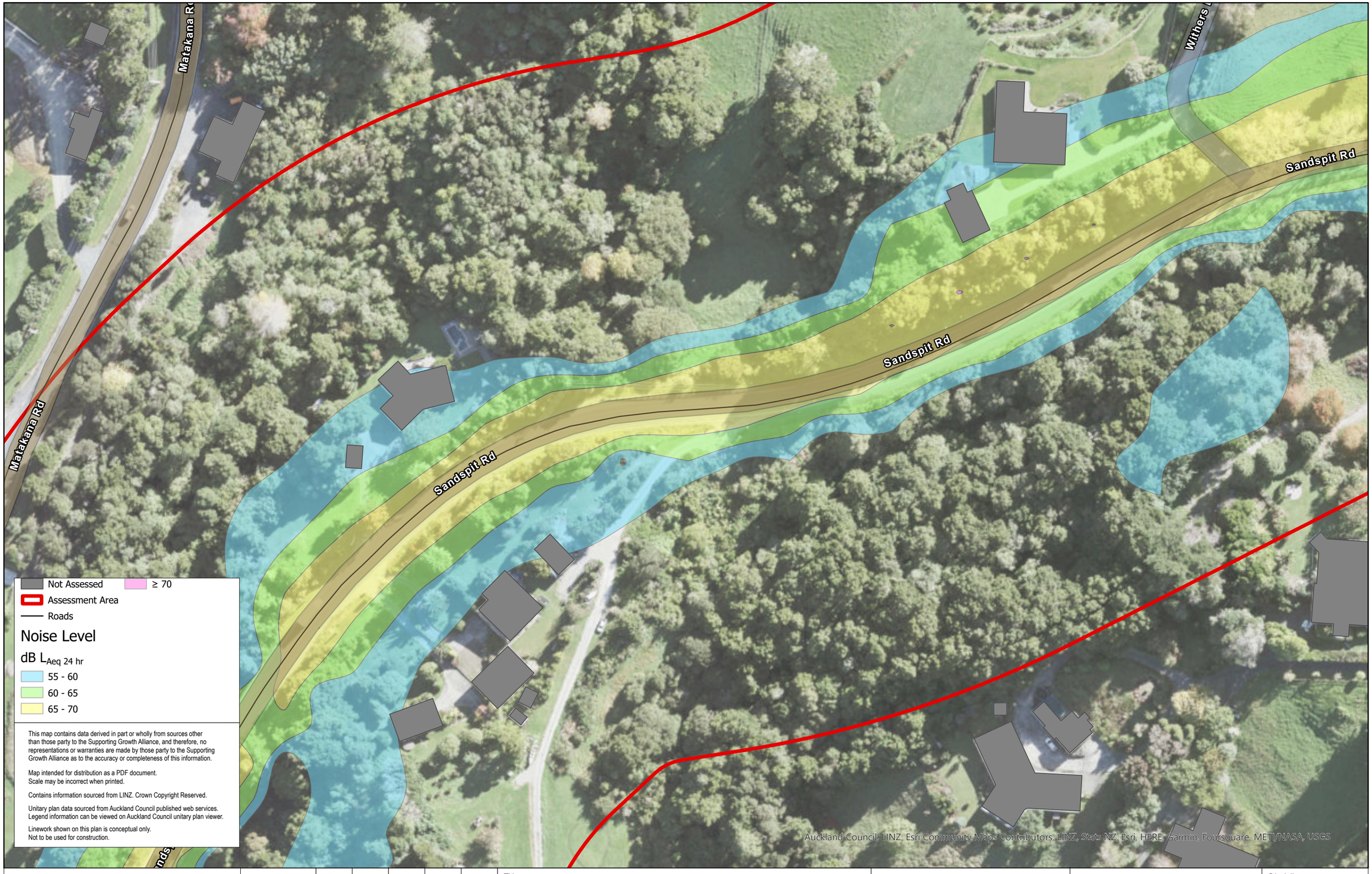

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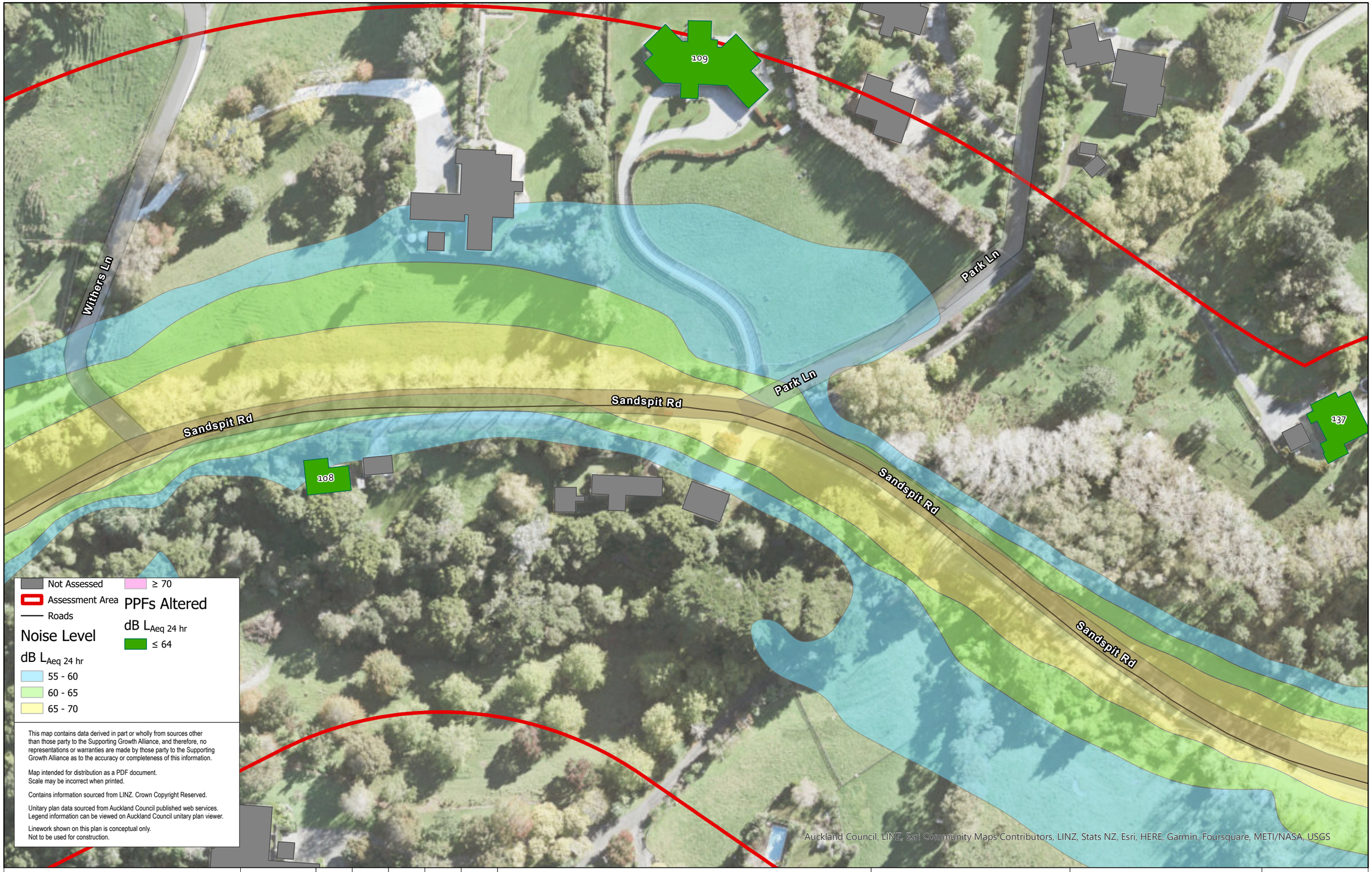

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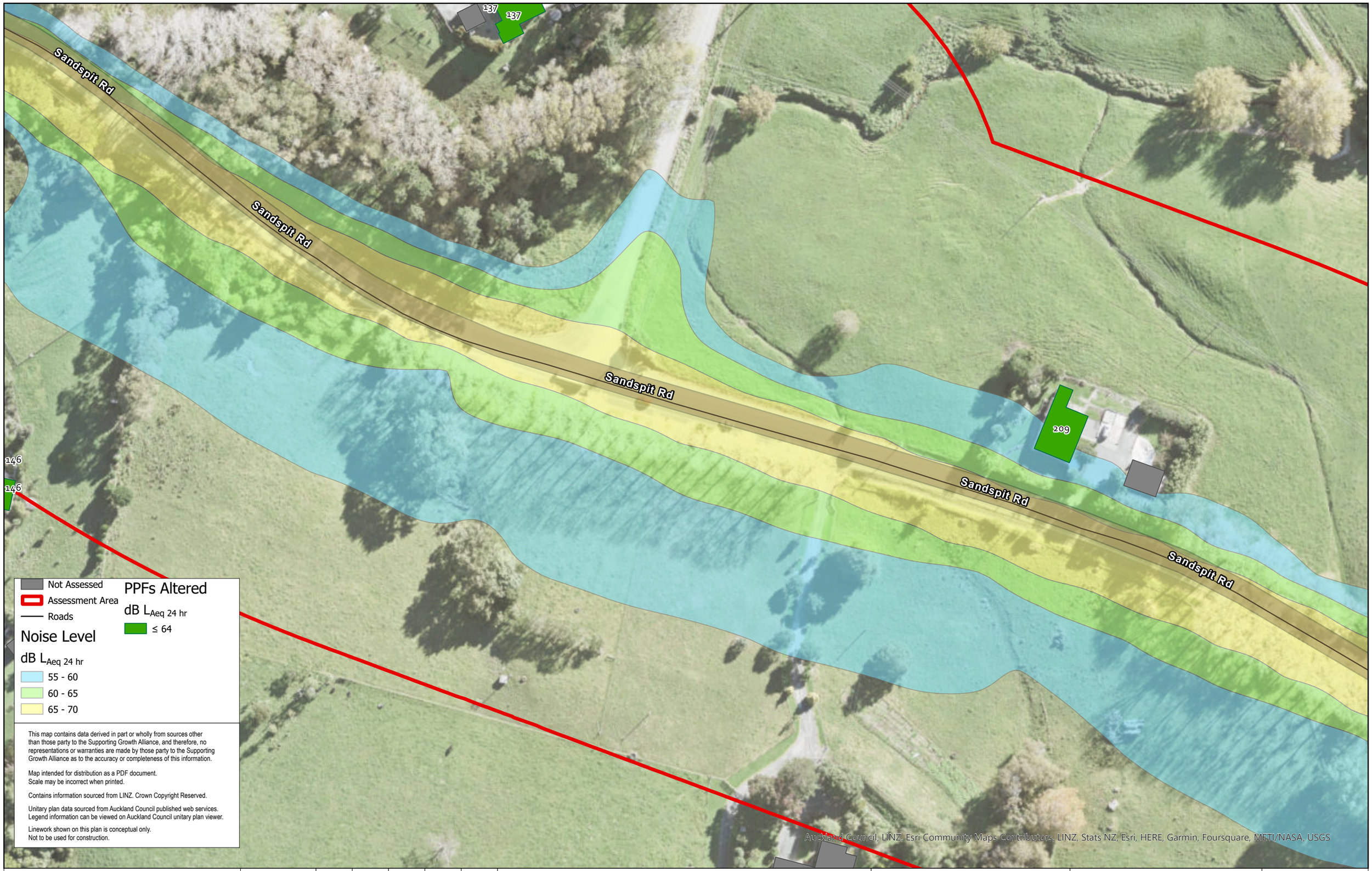

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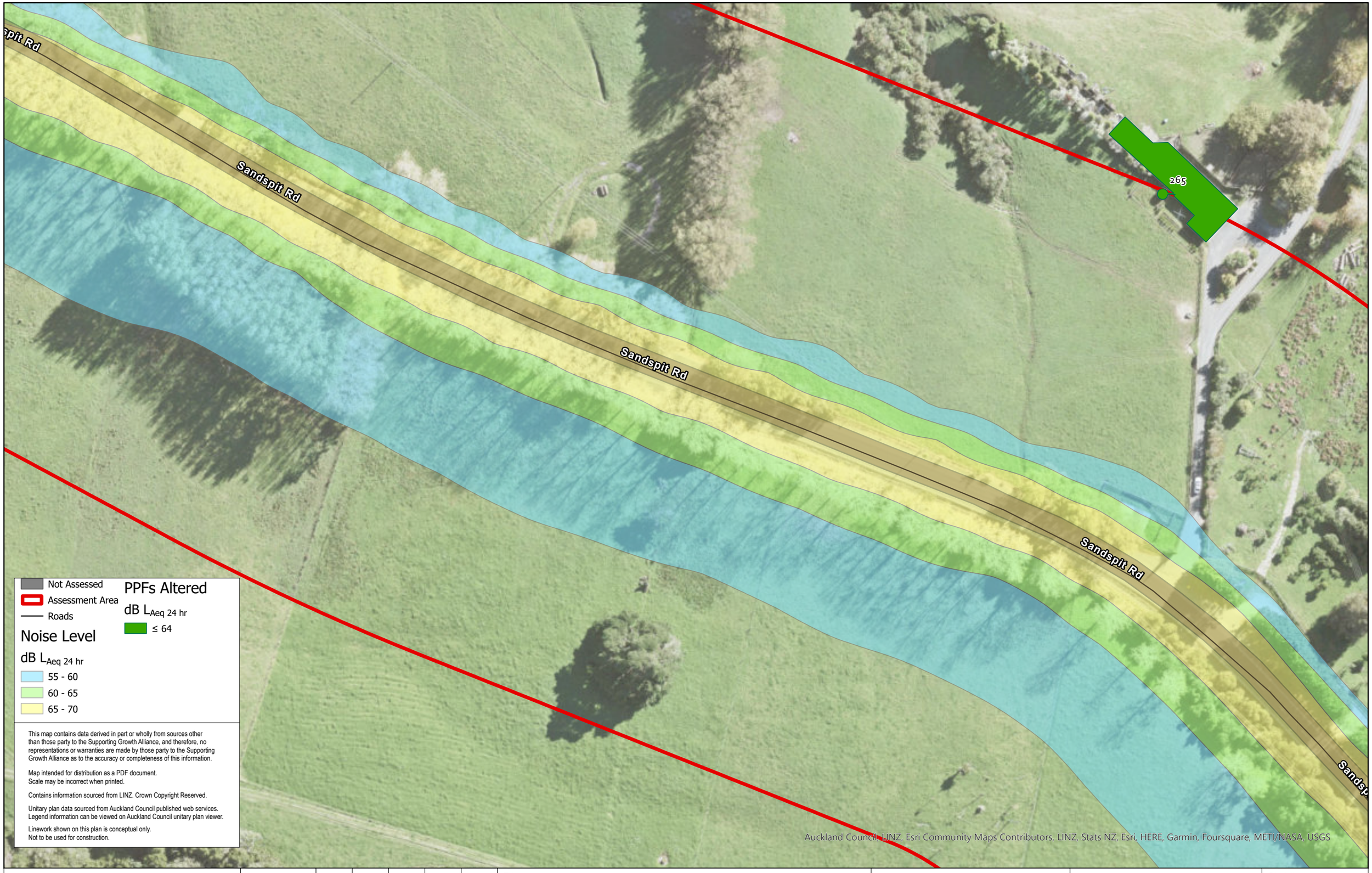

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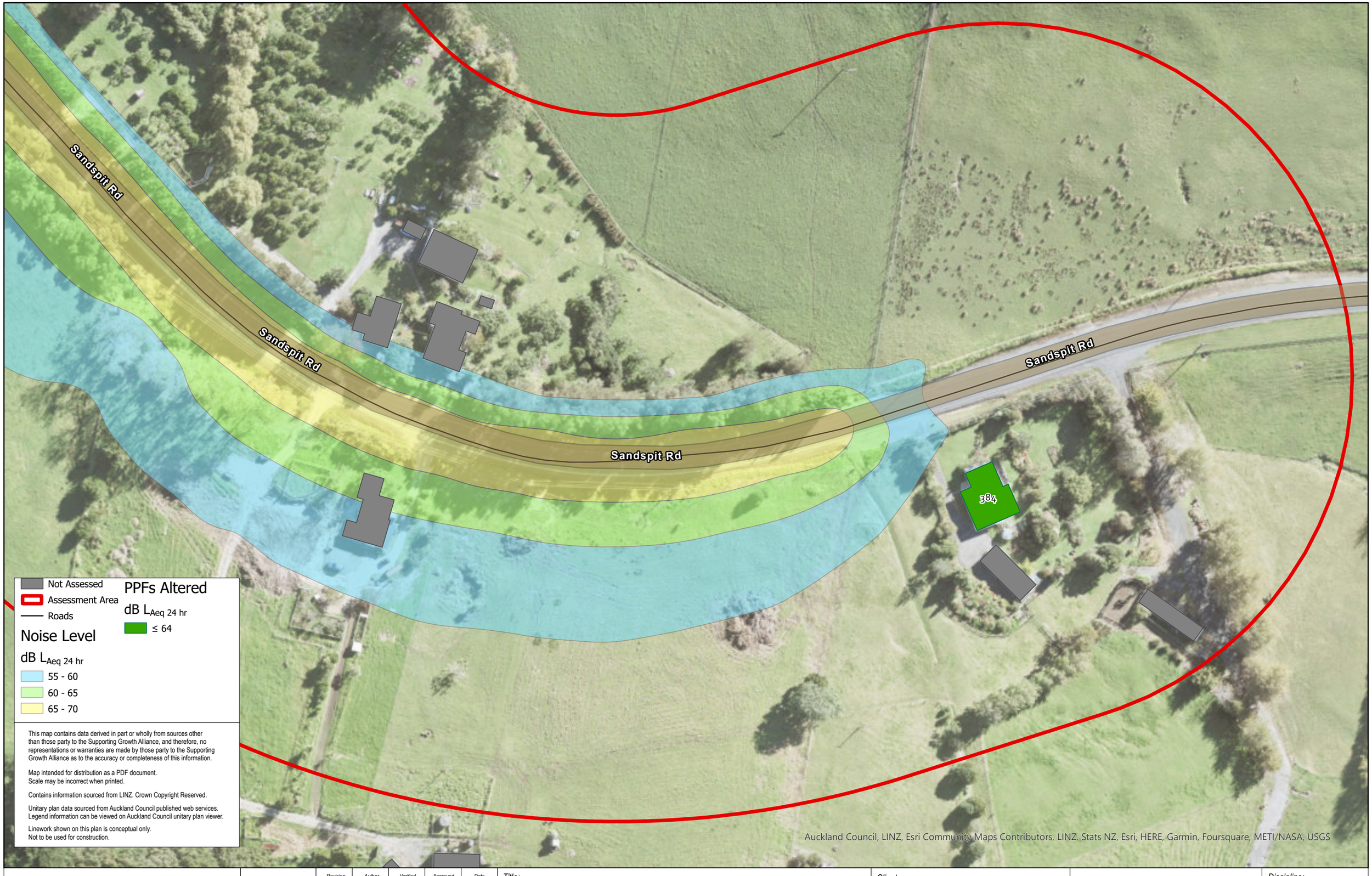

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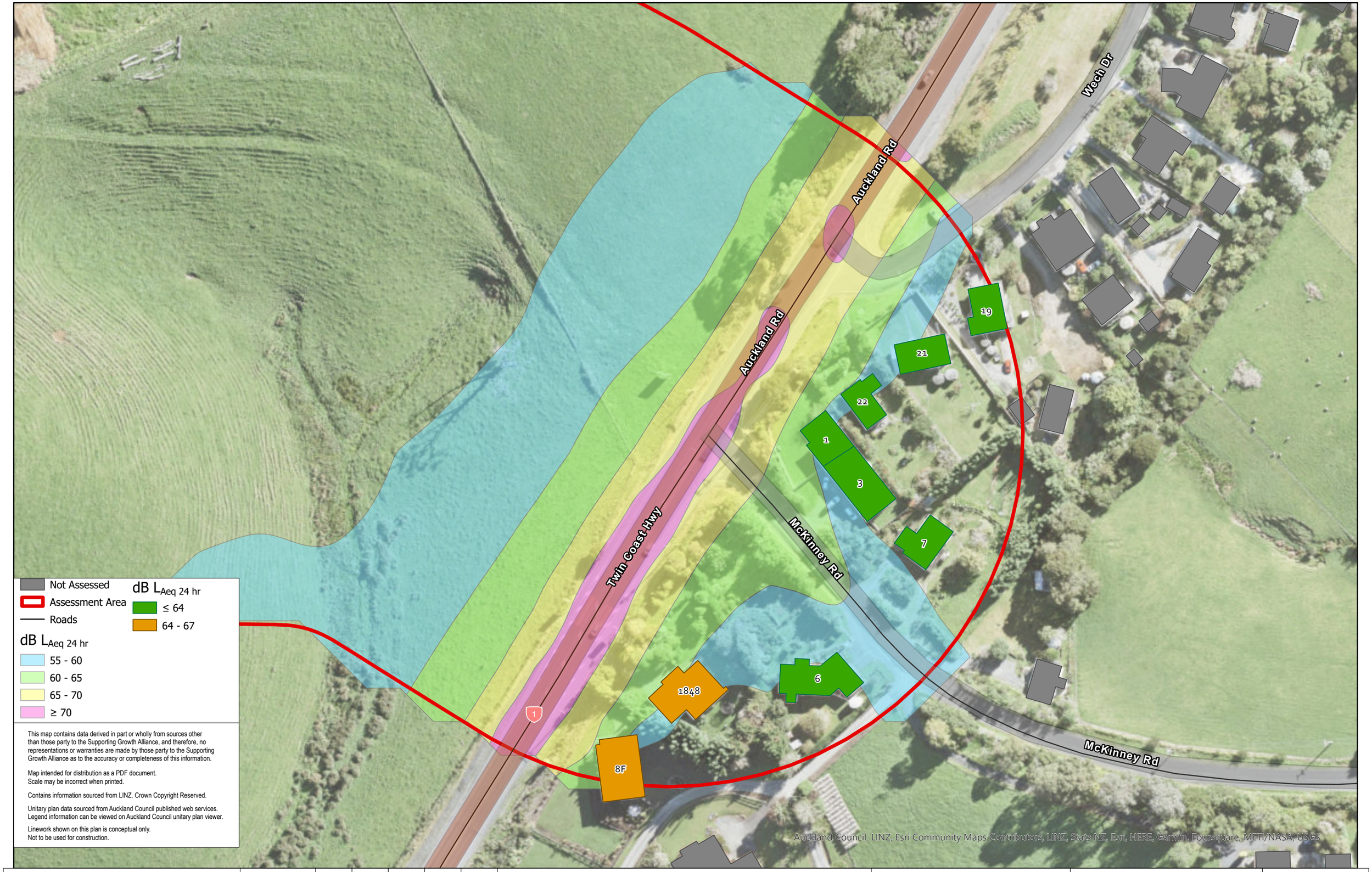

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Auckland Rd

Auckland Rd

Wech Dr

Twin Coast Hwy

McKinney Rd

McKinney Rd

19

21

22

1

3

7

1848

6

8F

1

Not Assessed

Assessment Area

Roads

dB $L_{Aeq\ 24\ hr}$

≤ 64

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

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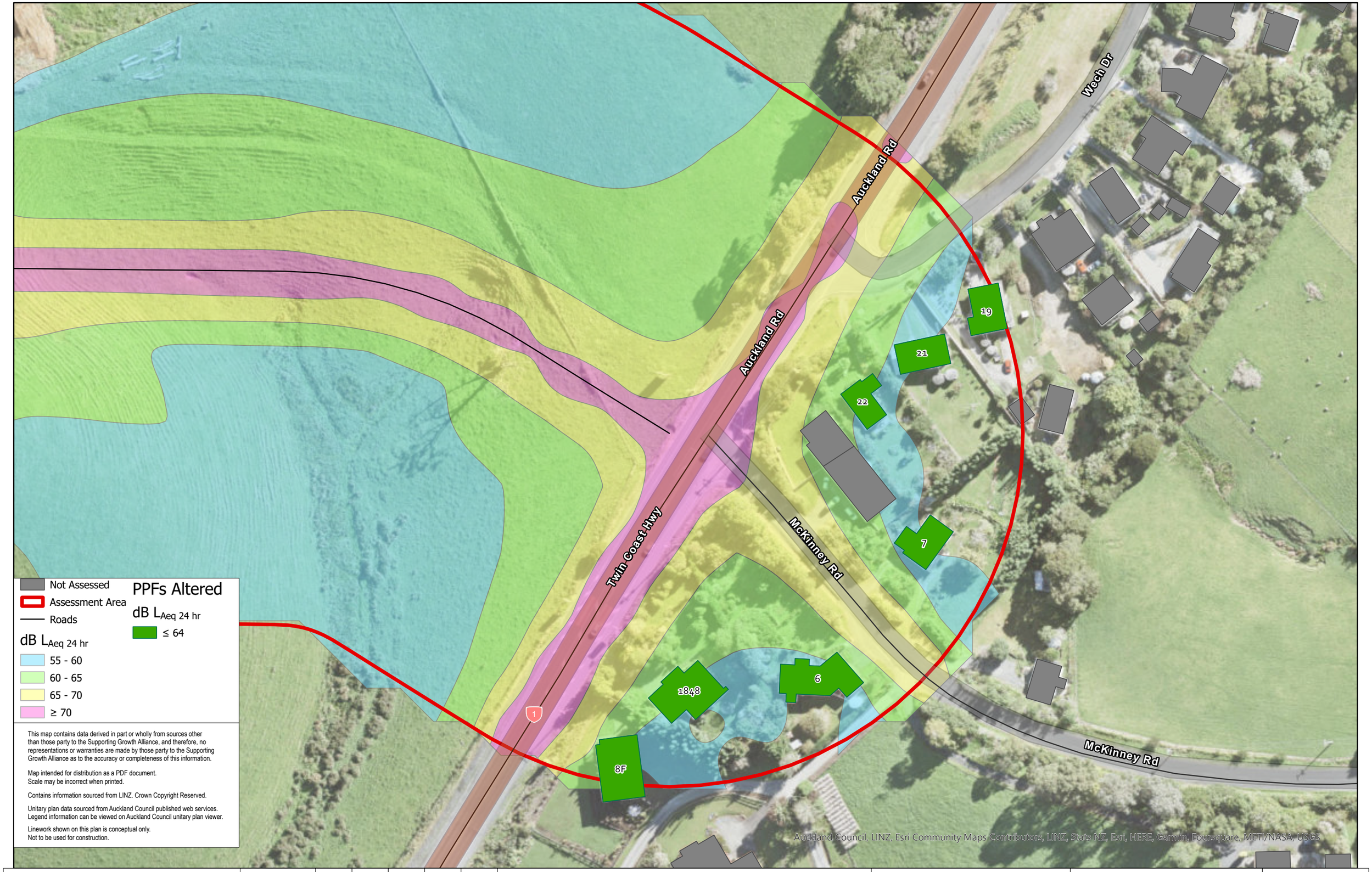

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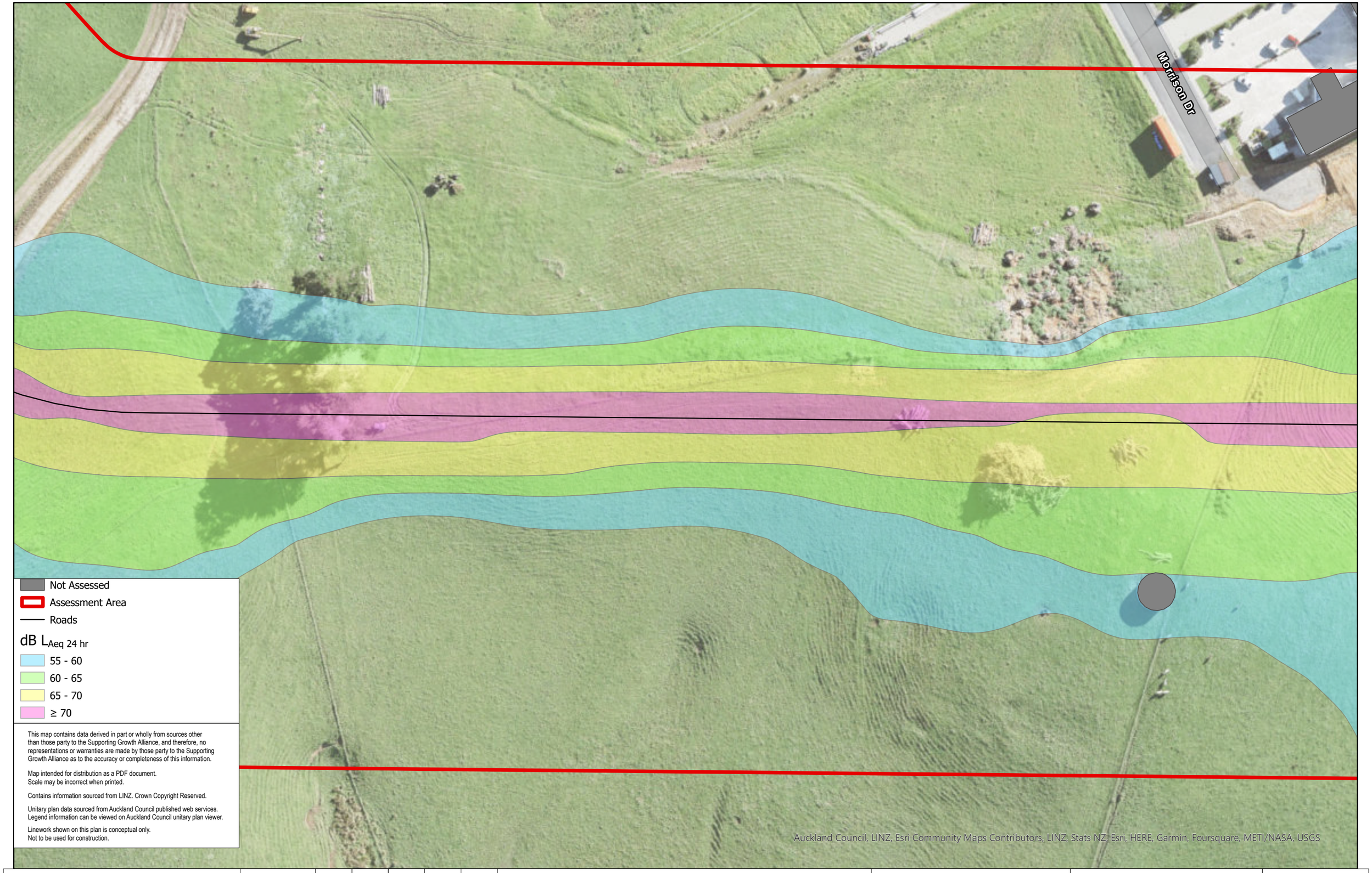

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ATTACHMENT 74

ASSESSMENT OF TRAFFIC NOISE AND VIBRATION EFFECTS PART 4 OF 4

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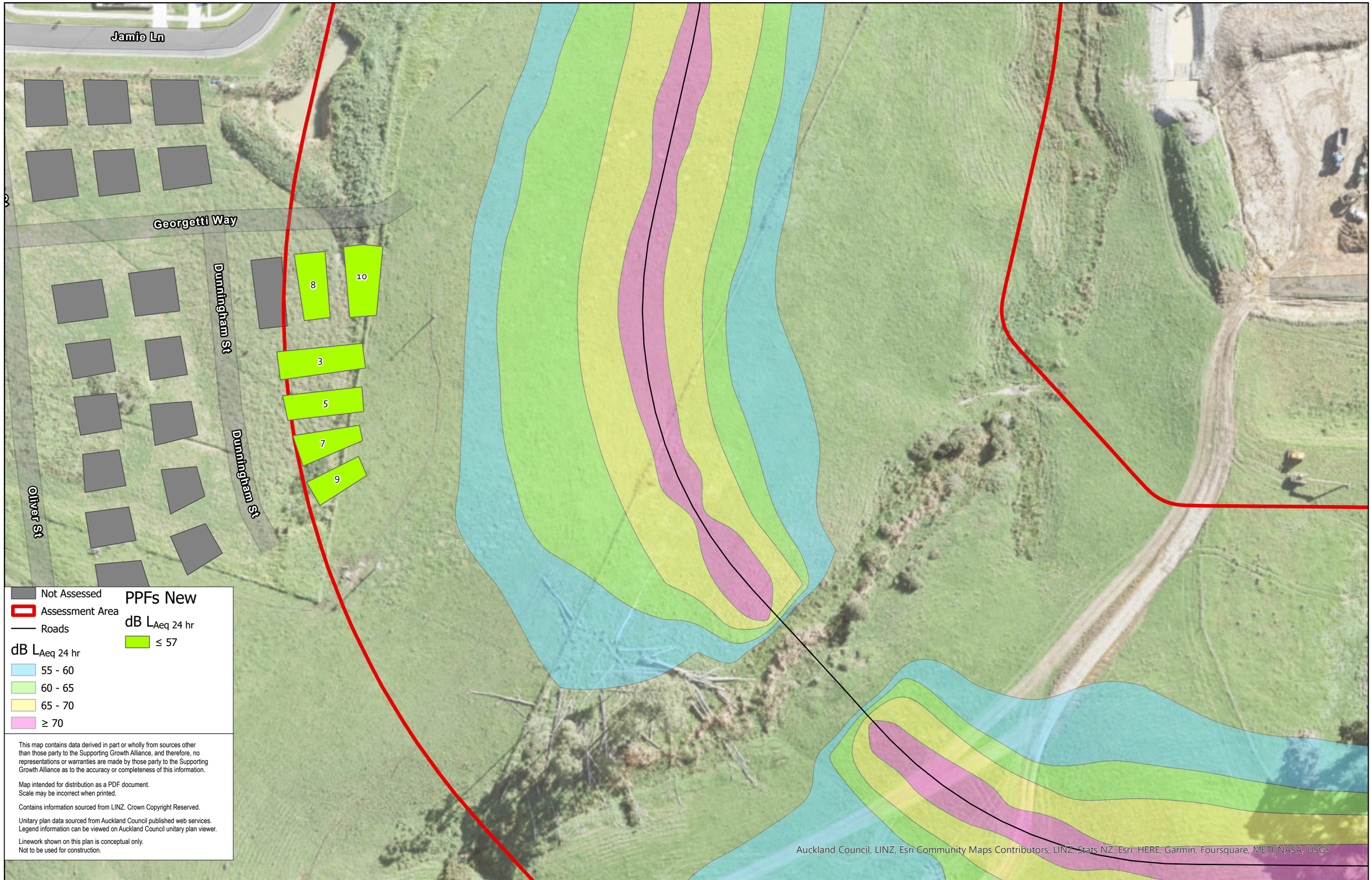

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Evelyn St

Oliver St

Christopher Ln

Jamie Ln

Not Assessed

Assessment Area

Roads

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

≥ 70

PPFs New

dB $L_{Aeq\ 24\ hr}$

≤ 57

57 - 64

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

≤ 64

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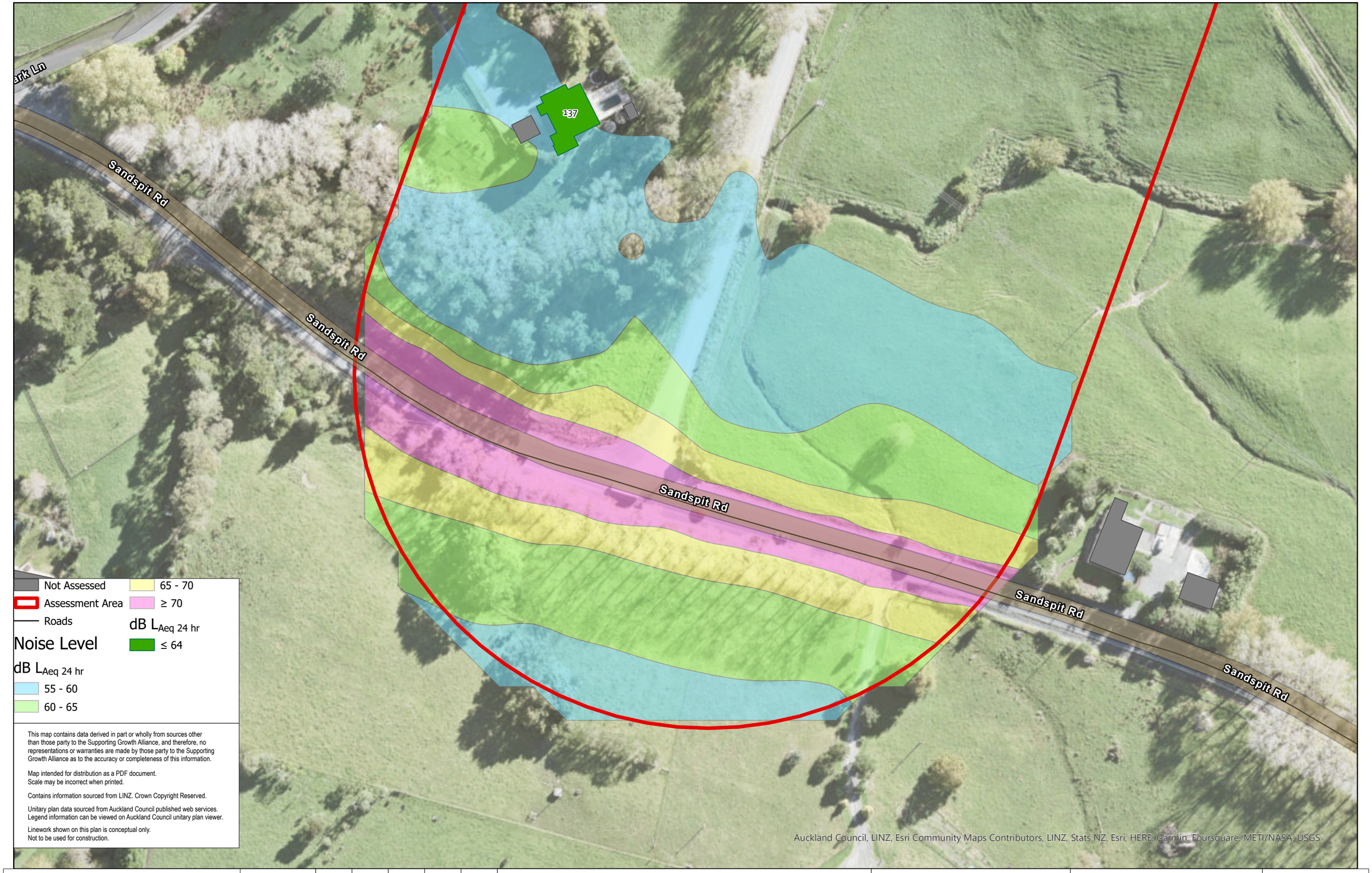

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Discipline: **GIS**

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

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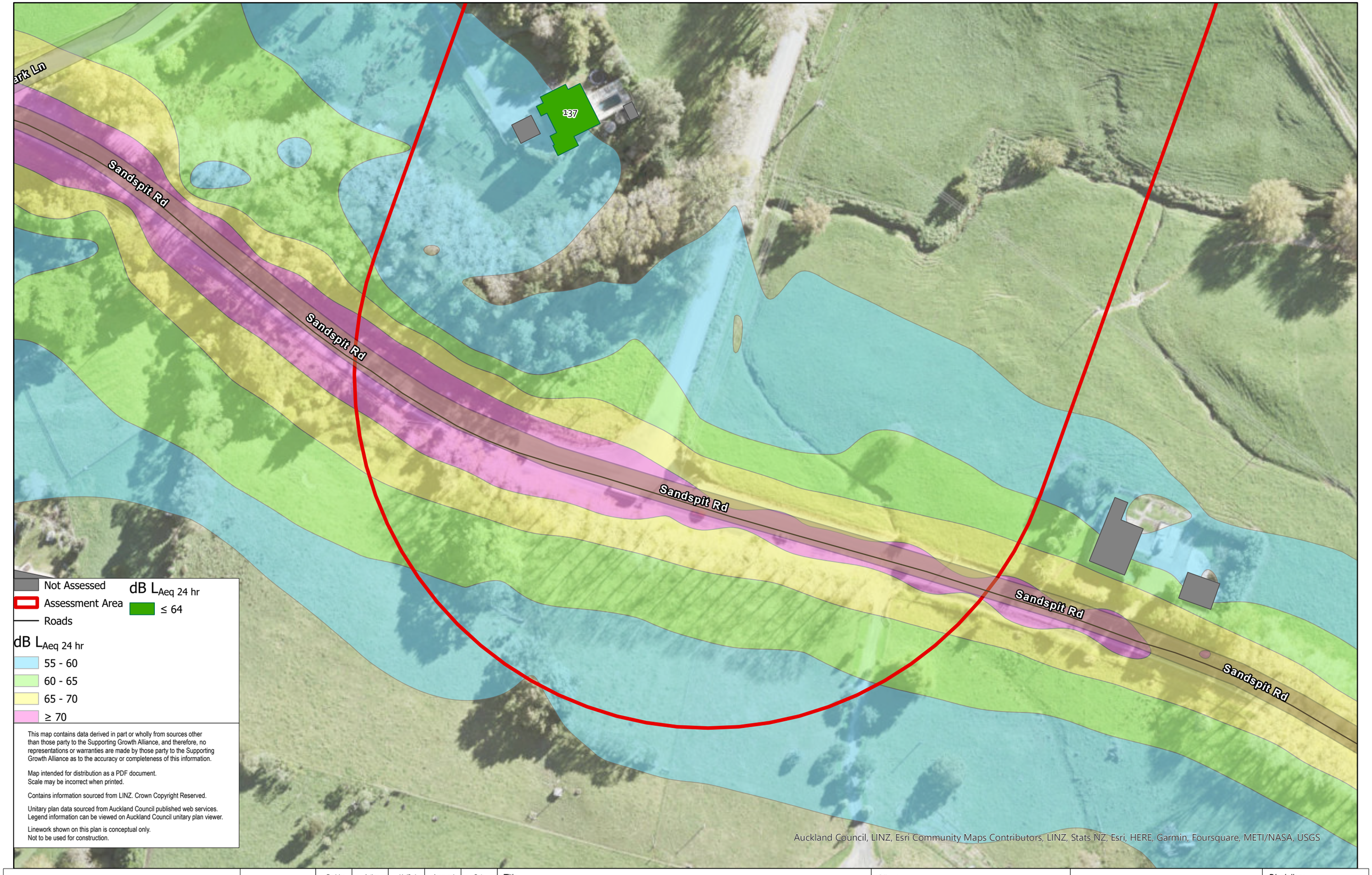

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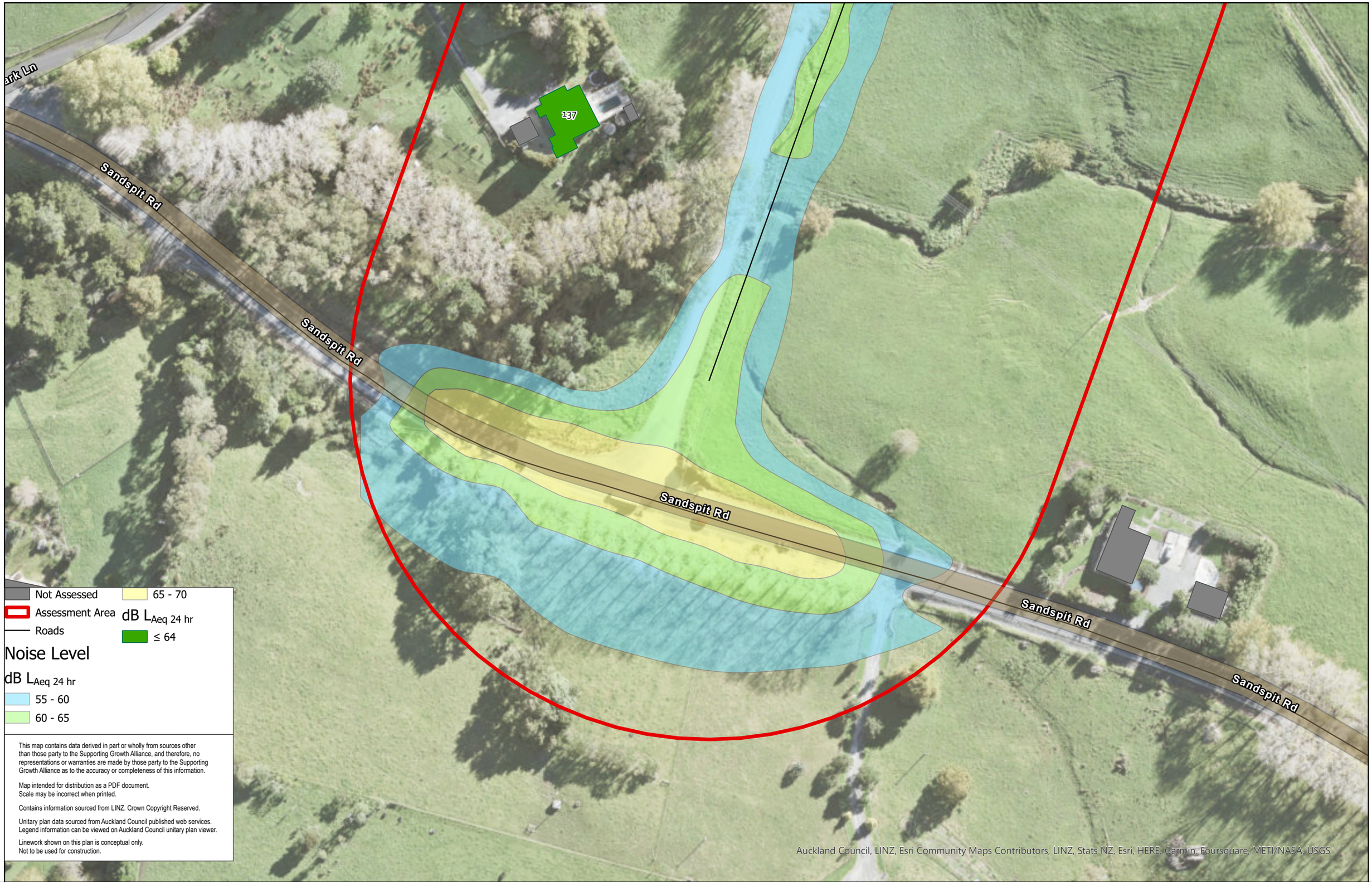

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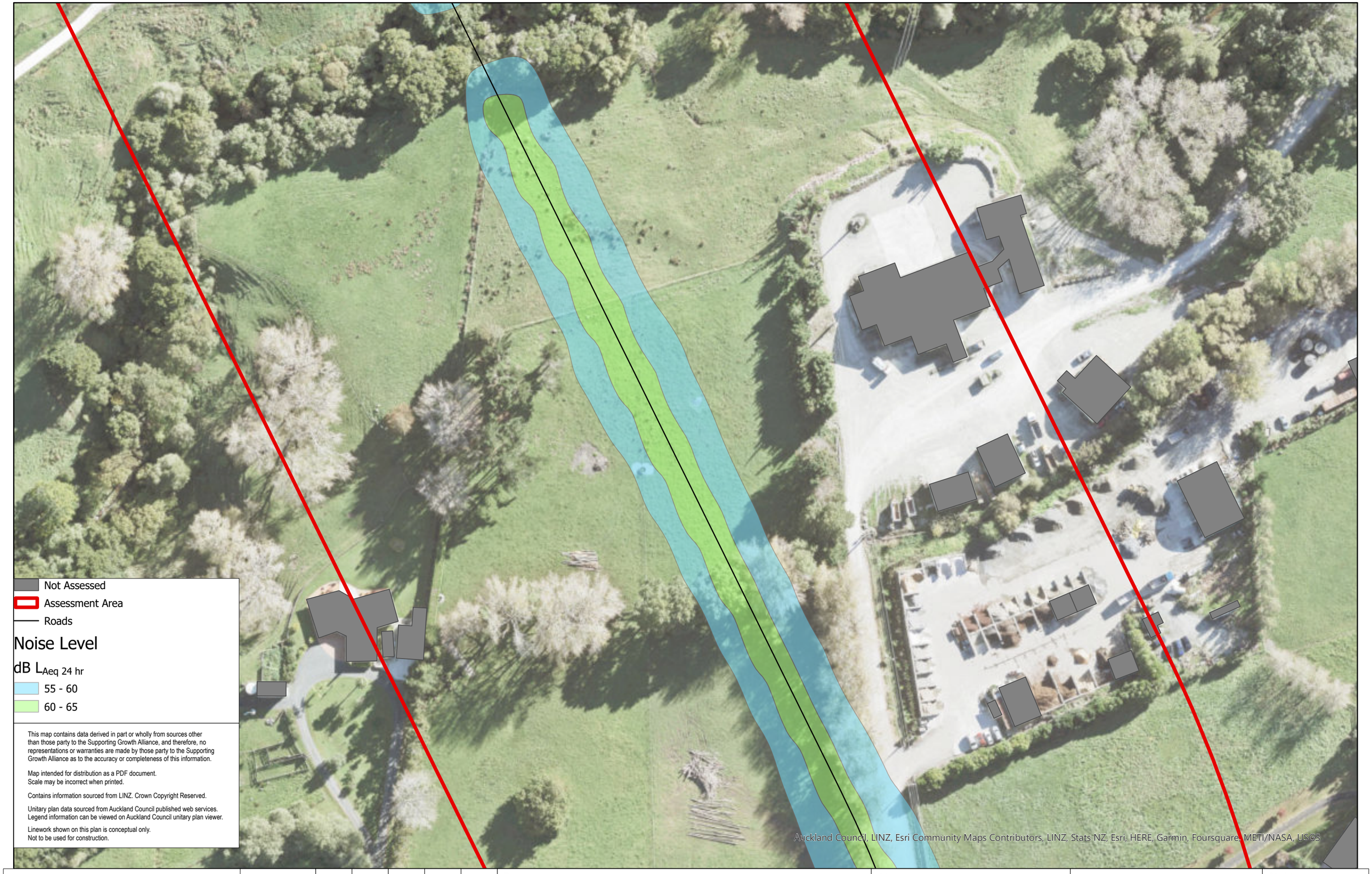

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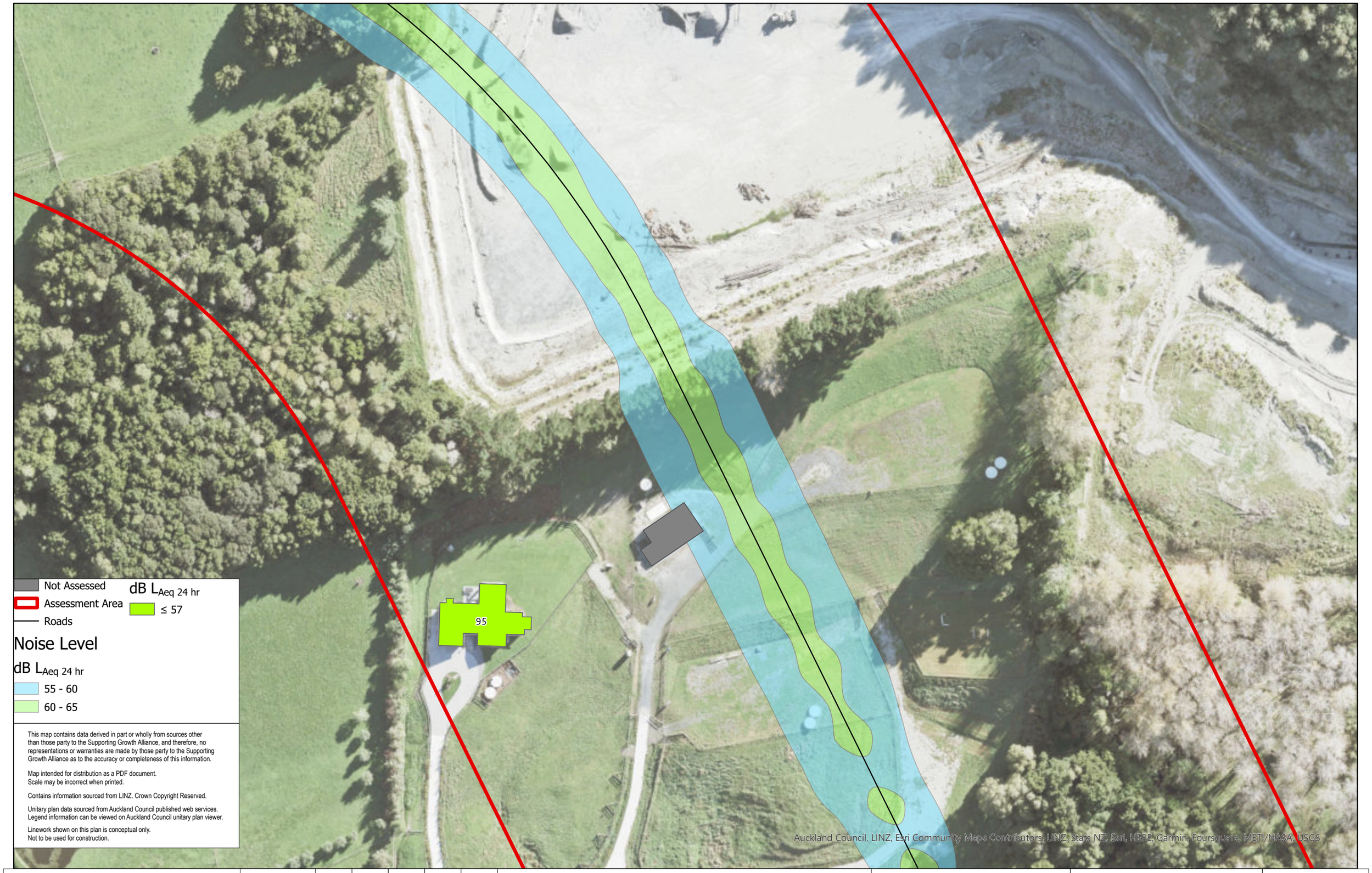

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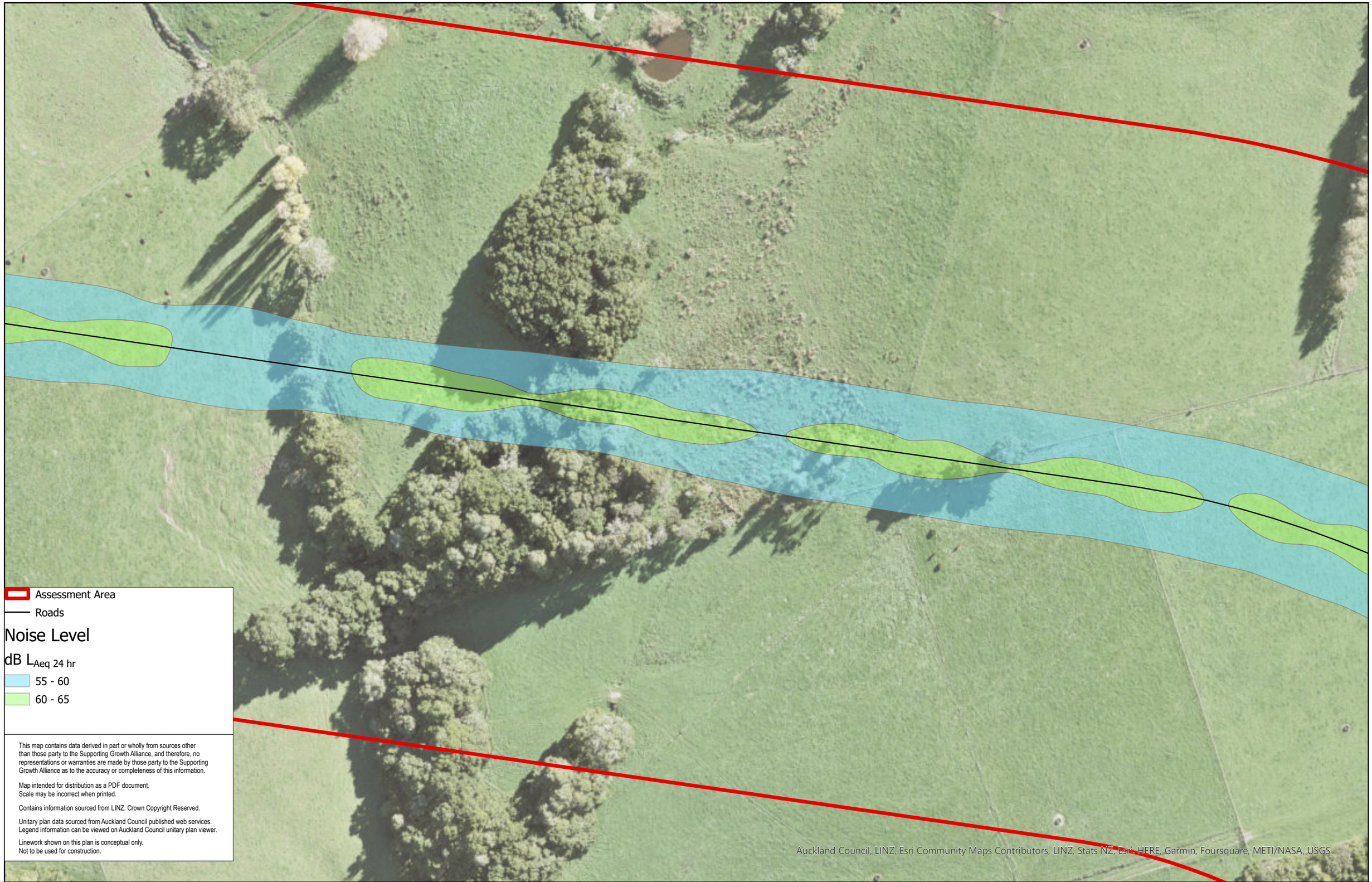

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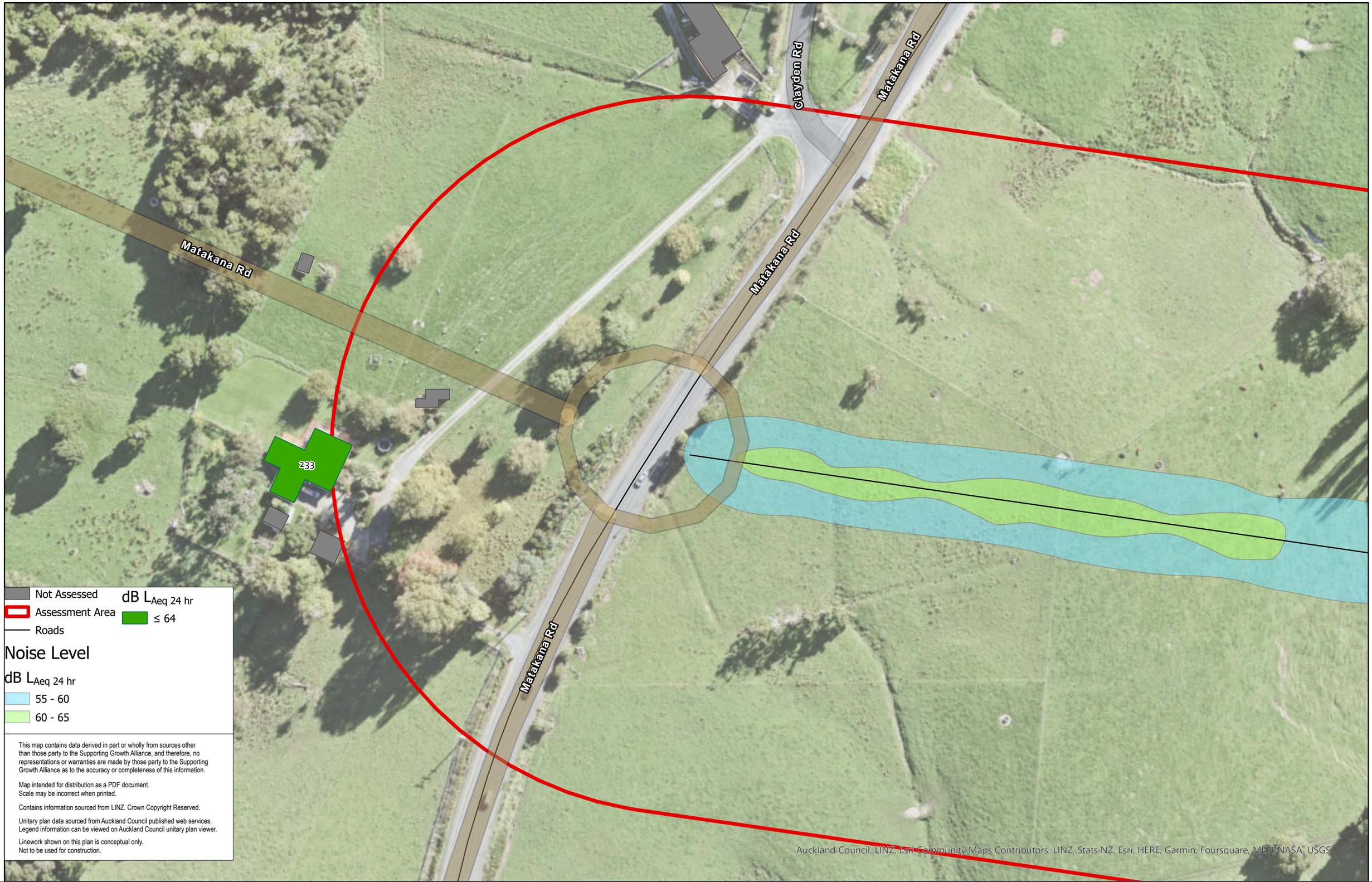

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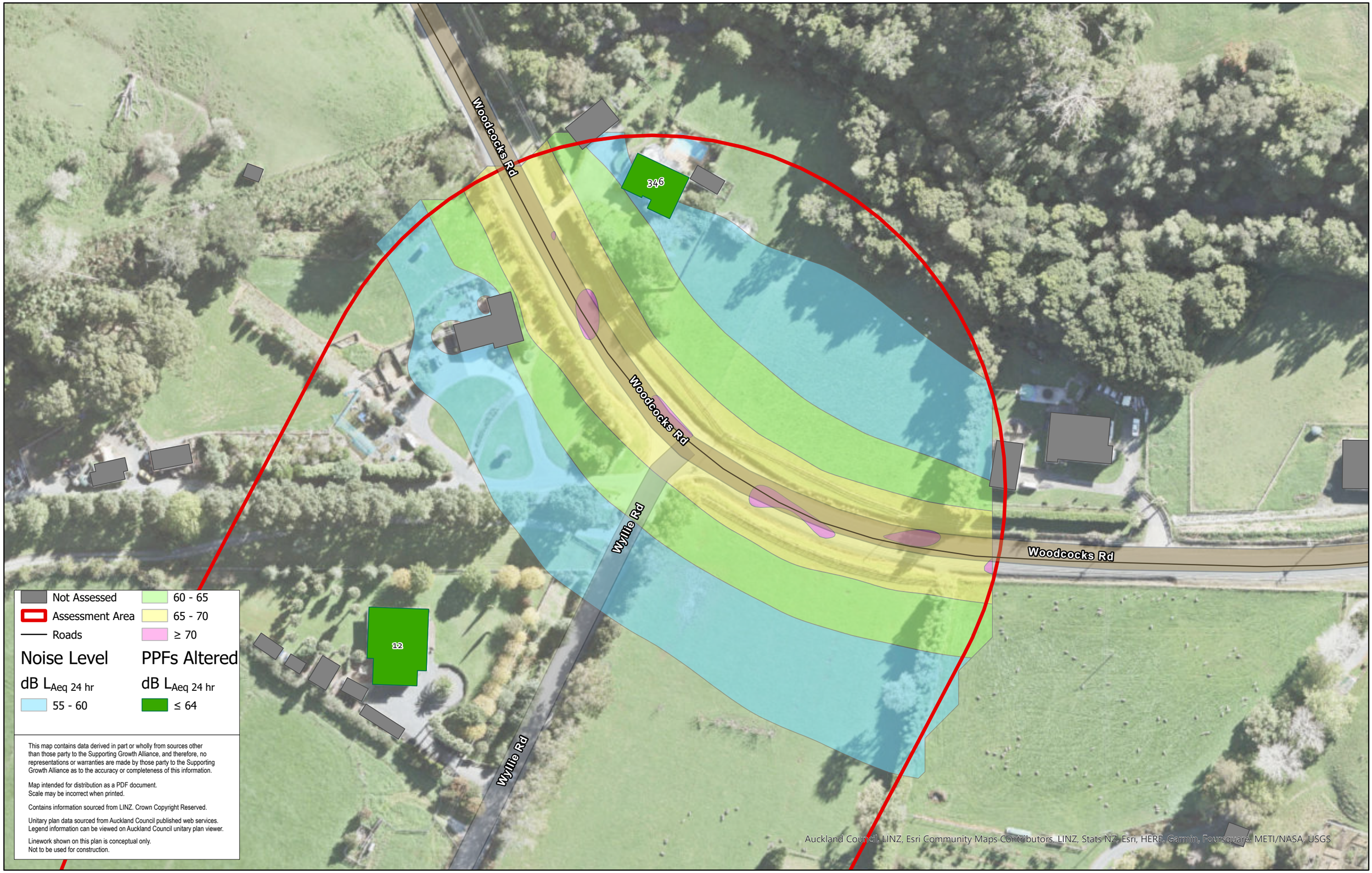

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Wyllie Rd

Wyllie Rd

Wyllie Rd

Not Assessed

Assessment Area

Roads

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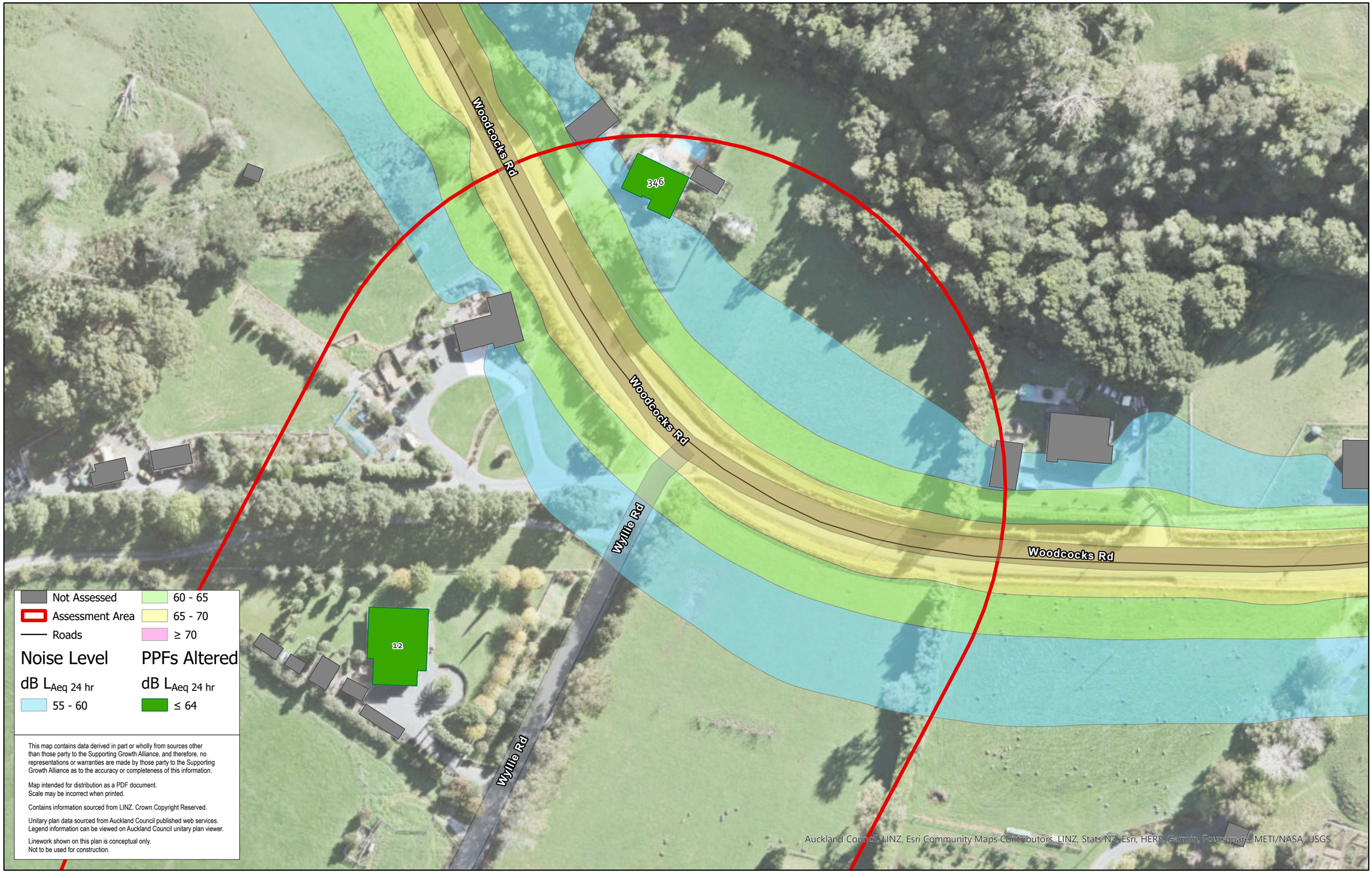

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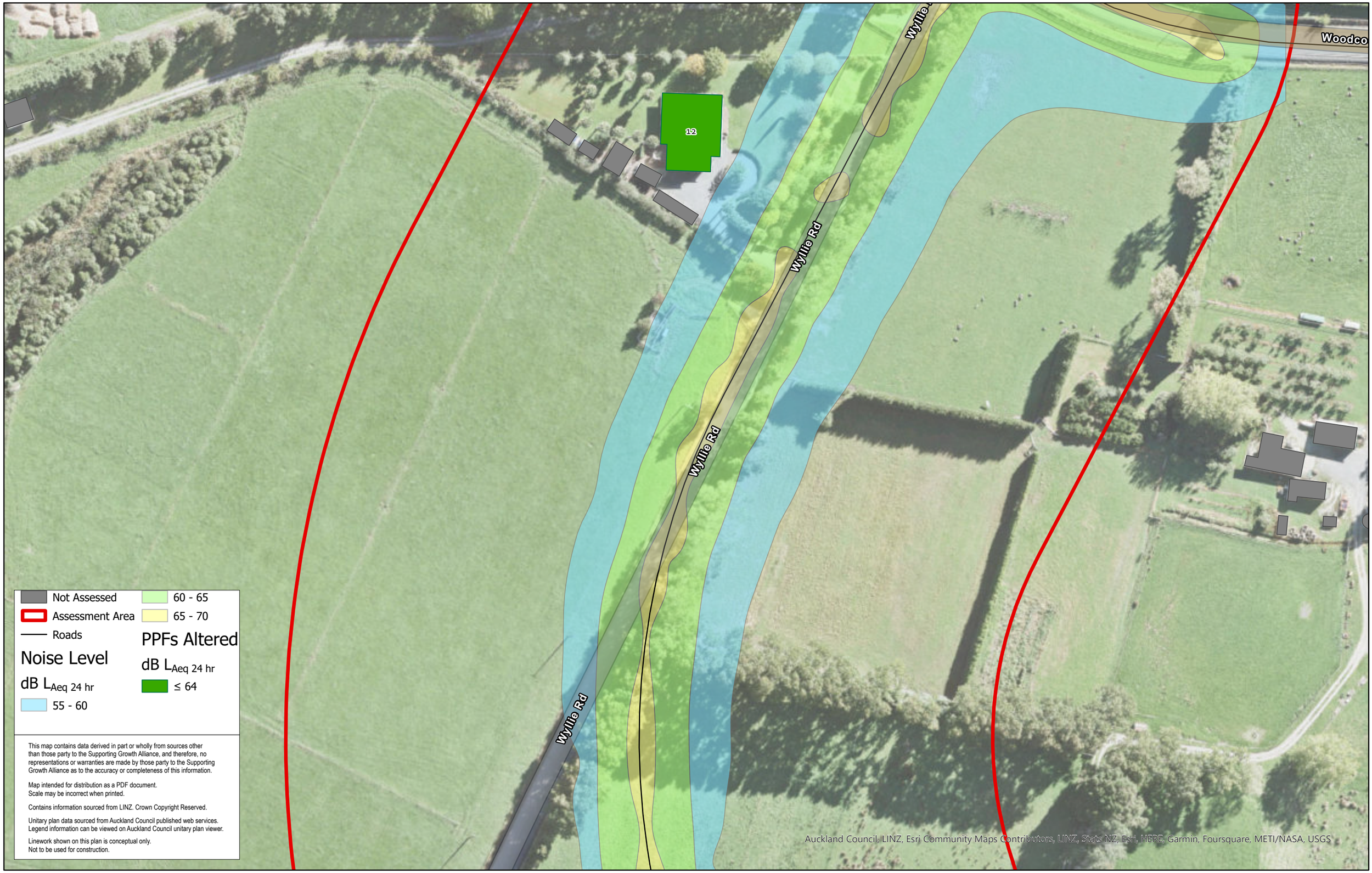

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Wyllie Rd

Wyllie Rd

Wyllie Rd

Not Assessed

Assessment Area

Roads

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

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Not Assessed

Assessment Area

Roads

Noise Level

dB $L_{Aeq\ 24\ hr}$

55 - 60

60 - 65

65 - 70

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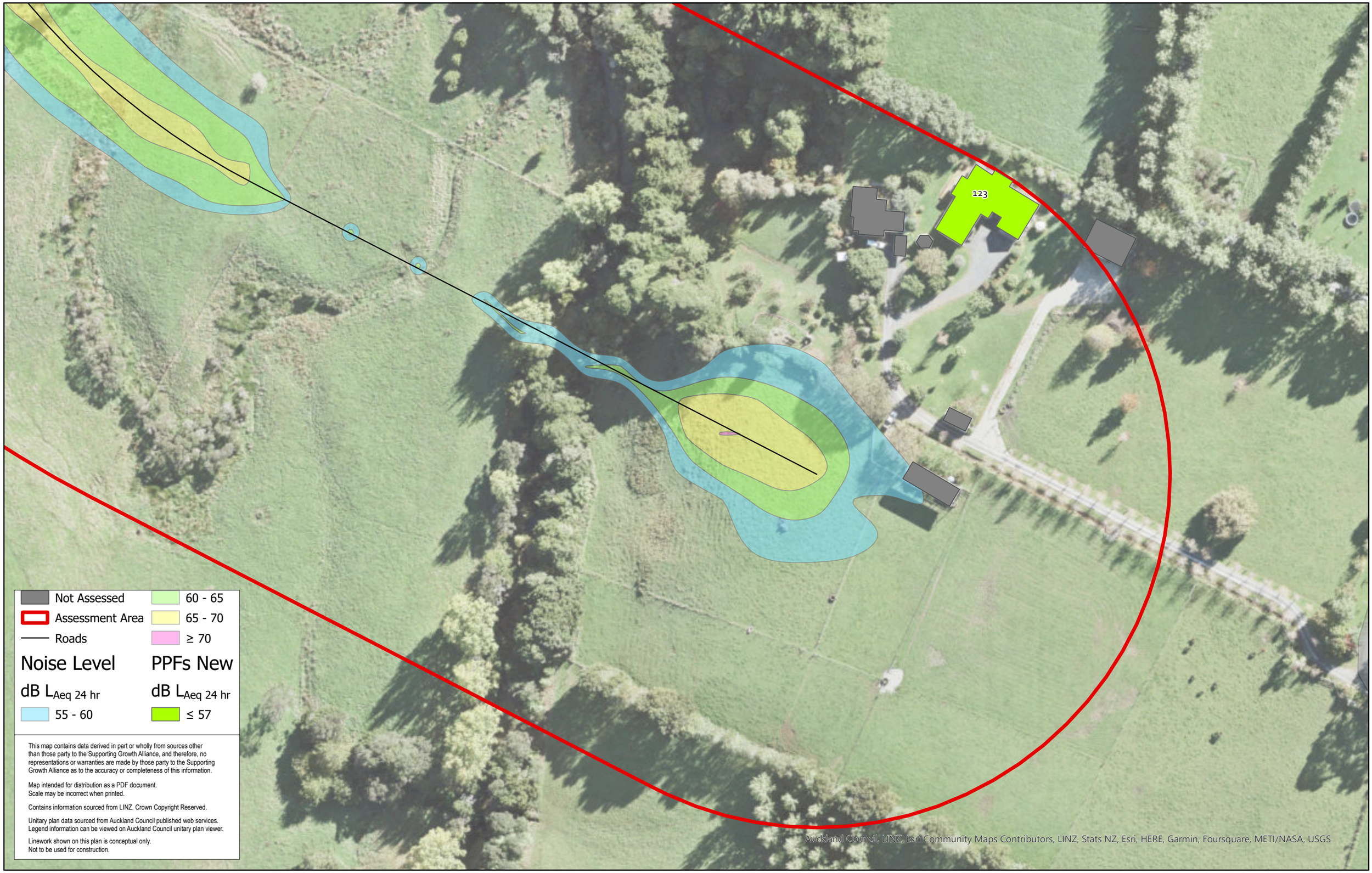

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ATTACHMENT 75

ASSESSMENT OF TRANSPORT EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Assessment of Transport Effects

May 2023

Version 1.0

Document Status

Responsibility	Name
Author	Varshen Pillay/ Michelle Seymour
Reviewer	Michelle Seymour
Approver	Andrew Murray

Revision Status

Version	Date	Reason for Issue
1.0	12/05/2023	Issue for lodgement

Table of Contents

Table of Figures

Table of Tables

Appendices

Appendix A: Roads and Street Framework Assessment

Appendix B: Existing Crash Records

Appendix C: Specific Transport Modelling Background Information

Glossary of Defined Terms and Acronyms

Acronym/Term	Description
ADT	Average Daily Traffic
AEE	Assessment of Effects on the Environment report
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
ATCOP	AT Code of Practice
AUP:OP	Auckland Unitary Plan: Operative in Part
CEDF	Cultural and Environmental Design Framework
CEMP	Construction Environmental Management Plan
CHI	Cultural Heritage Inventory
CIA	Cultural Impact Assessment
CLMP	Contaminated Land Management Plan
CNVMP	Construction Noise and Vibration Monitoring Plan
CoPTTM	Code of Practice for Temporary Traffic Management
CPTED	Crime Prevention through Environmental Design
CTMP	Construction Traffic Management Plan
DBC	Detailed Business Case
DEB	Decanting Earth Bunds
DSI	Death and Serious Injury
ECR	Auckland Council Environmental Compensation Ratio
EIANZ	Ecological Impact Assessment New Zealand: terrestrial and freshwater ecosystems
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
FESCP	Final Erosion and Sediment Control Plan
FTE	Full Time Equivalent staff
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone

Acronym/Term	Description
GD01	Auckland Council Guideline Document: Stormwater management devices in the Auckland region, GD2017/001 (an update of TP10)
GD05	Auckland Council Guideline Document: Erosion and Sediment Control Guide, GD2016/005
GHG	Greenhouse Gas emissions
GPS	Government Policy Statement
HAIL	Hazardous Activities and Industries List
HNZPT / Heritage NZ	Heritage New Zealand Pouhere Taonga
IBC	Indicative Business Case
LGA	Local Government (Auckland Council) Act 2009
MCA	Multi-Criteria Assessment
MHUD	Ministry of Housing and Urban Development
N/A	Not Applicable
NES	National Environmental Standard
NES:FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NES:Soil	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
NPS	National Policy Statement
NPS:FM	National Policy Statement on Freshwater Management
NPS:UD	National Policy Statement on Urban Development
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NOR	Notice of Requirement
NOR 1	Northern Public Transport Hub and Western Link - North
NOR 2	Woodcocks Road (Western Section)
NOR 3	State Highway 1 – South
NOR 4	Matakana Road Upgrade
NOR 5	Sandspit Road Upgrade
NOR 6	Western Link - South

Acronym/Term	Description
NOR 7	Sandspit Link
NOR 8	Wider Western Link - North
NZ	New Zealand
NZUP	New Zealand Upgrade Programme
ONF	Outstanding Natural Features
ONL	Outstanding Natural Landscapes
PBC	Programme Business Case
PSI	Preliminary Site Investigation
RCA	Road Controlling Authority
RLTP	Auckland Regional Land Transport Plan
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SEV	Stream Ecological Valuation
SH1	State Highway 1
SMAF	Stormwater Management Area: Flow
SQEP	Suitably Qualified and Experienced Practitioner
SL	Sandspit Link
SRP	Sediment Retention Pond
SSTMP	Site-Specific Traffic Management Plan
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
TDM	AT's Transport Design Manual: AT Engineering Design Codes – Transport Design Manual
UDEF	Urban Design Evaluation and Framework
ULDMP	Urban Landscape and Design Management Plan
Watercare	Watercare Services Limited
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
WL	Western Link
Zero Carbon Act	Climate Change Response (Zero Carbon) Amendment Act 2018

1 Executive Summary

1.1 Overview

The Warkworth Assessment Package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORS including new corridors, existing road upgrades, and a public transport interchange with park and ride.

Table 1-1. Warkworth Assessment Package – NOR and Project Overview

Notice	Project
NOR 1	**Northern Public Transport Hub and Western Link – North**
NOR 2	**Woodcocks Road Upgrade (Western Section)**
NOR 3	**State Highway 1 South – Upgrade**
NOR 4	**Matakana Road Upgrade**
NOR 5	**Sandspit Road Upgrade**
NOR 6	**Western Link - South**
NOR 7	**Sandspit Link**
NOR 8	**Wider Western Link – North**

This Transport assessment has been prepared as part of the Assessment of Environmental Effects (AEE), for the Warkworth Notices of Requirement (**NoRs**) for Auckland Transport (**AT**) (the "Warkworth Assessment Package"). The NORS are to designate land for new corridors, existing road upgrades, and a public transport interchange with park and ride as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in Warkworth.

In addition to the corridors detailed in this ITA, there are other identified projects in Warkworth that form part of the overall network solution for the area. These projects are not specifically included in this package of NORS but interface with the projects within this ITA and are discussed on a project basis in this report.

1.2 Methodology

This transport assessment has considered potential effects on the transport system both during construction as well as effects once the projects are operational. The focus of the Te Tupu Ngātahi is on long-term route protection of the transport systems required to support the planned growth areas. This means that implementation of the proposed projects is typically not imminent and would be preceded by updated implementation investment and design processes. This focus on longer-term route protection for longer-term implementation means that this assessment has focused less on detailed analysis of the existing environment and more on the likely future (urbanized) environment and potential effects of the proposed projects.

It is also noted that the Warkworth network has been designed as an overall integrated system, but in general individual projects can typically be delivered separately. As such this assessment considers the projects individually – with commentary on interdependencies where appropriate.

1.2.1 Approach to Assessment of Operational Transport Effects

Potential operational transport effects are assessed using: ·

- Transport planning assessment of expected outcomes and effects
- Transport modelling to inform demands and network performance
- Alignment with various policy documents

In respect to each individual NoR, a separate assessment has been undertaken, and the assessment criteria and methodology is summarised in Table 1-2 below.

Table 1-2: Summary of Assessment Methodology

Network Component	Information Source	Assessment Method
Safety	Crash Analysis (CAS) Database Project design drawings	Assessment to determine alignment with Vision Zero standards and design compliance with Transport Design Manual
Walking and Cycling	Walking and Cycling Network Plans Proposed Cross Sections	Assessment to determine alignment with walking and cycling strategic documents and design compliance with Transport Design Manual
Public Transport	Transport Model tools (MSM, SATURN and SIDRA) Supporting Growth Indicative Future Public Transport Network (Remix)[1]	Assessment to determine alignment with future network provisions and design compliance with the Transport Design Manual
General Traffic	Transport Model tools (MSM, SATURN and SIDRA) Project design drawings	Assessment using key model outputs including traffic volumes, levels of service for corridor midblock performance and intersection performance.

[1] SGA Remix file provided by Auckland Transport on the draft plan of the bus network to be implemented by 2048

Network Component	Information Source	Assessment Method
		Assessment of surrounding network connections
Property Access	Engineering Standards	Assessment identifying where there is a potential effect on access in the existing environment
Wider Network Effects	Transport Model tools (MSM, SATURN and SIDRA)	Assessment to consider how the corridor interacts with the surrounding road network
Note: A Road Safety and Audit and Safe System assessment with be done as part of the implementation business case/detailed design stage prior to implementation.		

1.2.2 Approach to Assessment of Construction Effects

Based on the indicative construction methodology an assessment of construction effects has been completed for the package sufficient to support each Notice of Requirement. This assessment considers:

- An overview of key considerations including speed, potential impacts to pedestrians and cyclists and property access
- Identification of any works that should not occur at the same time
- Assessment of potential conflict areas with vulnerable road users that will need specific mitigation within a Construction Traffic Management Plan (CTMP).

The impact of any temporary traffic management measures implemented to undertake the projects will be re-assessed in the future, prior to construction, when a greater level of detail is available in terms of the specific construction methodology and traffic environment.

1.3 Warkworth NORS Overall Network

Overall, the Warkworth Detailed Business Case identified a network that provides for a comprehensive transport solution that responds to planned growth. It is noted that this ITA considers these projects as a network and has an overall focus on the outcomes for the Warkworth area. The NORS are all proposed as separate projects and can be implemented progressively in coordination with progressive land use development.

The eight notices of requirement identified in this ITA are a core component of this network, with the proposed projects supporting the following transport outcomes:

- Long term development of a low carbon transport system to support future growth and facilitates mode shift from private vehicles to public transport and active modes to reduce greenhouse gas emissions.
- People living and working in Warkworth as part of the Satellite Town vision with direct freight connections to planned industrial land use and improved access to employment and social amenities.

- Transport corridors to maximise opportunities for walk up catchments to public transport interchanges and a high frequency local bus network.
- Increased reliability for public transport and additional resilience via urbanised alternative routes.
- Real travel choice with high quality, attractive alternatives to the private vehicle. This includes a continuous, legible active mode network that connects people to key destinations and encourages active mode trips within the compact urban area.
- An area wide focus on safety through a holistic set of measures including Road to Zero safety principles, fully separated cycling facilities, well designed intersections and sufficient space for all modes to interact safely.

1.4 Warkworth NORS – Individual Effects

Error! Reference source not found.**: Summary of the transport effects related to each proposed NOR within the Warkworth Package.**

NOR	Corridor	Summary of Operational and Construction Effects
1	Western Link - North and PT Hub	Overall, the project provides positive transport effects, in particular improved public transport outcomes, and active mode facility improvements, improving safety for those that walk and cycle. There are no identified adverse operational effects. There is considered to be a significant opportunity improve access to the cemetery adjacent to the project. In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.
2	Woodcocks Road Upgrade (Western Section)	Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects. At the time of implementation, the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network. For Woodcocks Road this will include consideration of the existing land use activities such as light industrial activities, residential and educational activities. The Urban Design and Landscape Plan condition requires that these matters be confirmed prior to implementation.

NOR	Corridor	Summary of Operational and Construction Effects
3	State Highway 1 Upgrade - South	Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects. In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.
4	Matakana Road Upgrade	Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects. In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.
5	Sandspit Road Upgrade	Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects. In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.
6	Western Link - South	Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects.

NOR	Corridor	Summary of Operational and Construction Effects
		In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.
7	Sandspit Link	Overall, the project provides positive transport effects, particular improved safety and active mode improvements. In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP. It is recommended that access considerations relating to the Quarry and the recycling plant should be specifically considered within the CTMP prior to construction and implementation of the project.
8	Wider Western Link – North	Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects. In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP

2 Introduction

This Transport assessment has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, Warkworth Package of Notices of Requirement (NoRs) for Auckland Transport (AT) as requiring authority under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the Warkworth area of Auckland.

2.1 Warkworth Growth Area

Warkworth is located at the northernmost extent of the Auckland Region, approximately 60km from the Auckland city centre, and 30km north of Orewa. It is identified as a satellite town in the Auckland Unitary Plan: Operative in Part (AUP: OP) and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Auckland.

The Warkworth growth area is approximately 5km north-south and east-west and will contribute to the future growth of Auckland's population. A 1,000 ha of currently rural land has been rezoned (Future Urban Zone) to support significant business and residential growth. At full build out it is anticipated to provide for approximately 7,300 new dwellings and employment activities that will contribute to 4,600 new jobs across Warkworth. This growth area is expected to be development ready in the stages outlined below:

- **Stage 1** Warkworth North – Predominantly Business land with some residential- already live zoned by 2022
- **Stage 2** Warkworth South – To be development ready between 2028 – 2032
- **Stage 3** Warkworth Northeast – To be development ready between 2033 – 2037

Furthermore, the Warkworth Structure Plan was adopted by the Council in 2019 and sets out the framework for transforming Warkworth from a rural environment to an urbanised community over the next 15 - 20 years.

It is noted that parts of these areas are experiencing earlier than anticipated growth pressure, with parts of Warkworth South subject to a lodged Private Plan Change, as well as sections of Warkworth Northeast[2].

The Warkworth Assessment Package will provide route protection for the local arterials, which include walking, cycling, and public transport linkages needed to support the expected growth in Warkworth. The Warkworth Package of projects is summarised in Section 3.

2.2 Purpose and scope of this Report

This transport assessment forms part of the suite of technical reports prepared to support the assessment of effects (AEE) for the Warkworth Package. Its purpose is to inform the AEE that accompanies the eight Warkworth Network NOR sought by AT.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Warkworth Package on the existing and likely future environment as it relates to

[2] https://www.aucklandcouncil.govt.nz/have-your-say/have-your-say-notified-resource-consent/Pages/resource-consent-public-notice.aspx?itemId=194&src=Search

transport 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:

a) Identify and describe the transport context of the Warkworth Assessment Package area;
b) Identify and describe the actual and potential transport effects of each project corridor within the Warkworth Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential transport effects (including any conditions/management plan required) for each project corridor within the Warkworth Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects for each project corridor within the Warkworth Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Warkworth project. The AEE also contains a detailed description of works to be authorised within each NOR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of transport effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

2.3 Report Structure

The report has been split into several sections, covering the following:

Sections 3 summarises the approach and methodology used for the assessment of operational transport effects

Sections 4 to 5 outlines the existing and future transport environment for each of the corridors on the Warkworth network. This is followed by an assessment of the positive effects and constructions effects of the overall Warkworth network.

Sections 5 to 13 includes an assessment of NOR specific details related to each of the projects in Warkworth.

There are several appendices to this report that provide additional details, specifically:

- Appendix A: RASF assessment of each of the corridors in Warkworth.
- Appendix B: Existing crash records for Warkworth
- Appendix C: Transport modelling background information

3 Warkworth Package Overview

The Warkworth package is a network of planned transport infrastructure with the purpose of responding to planned future growth in the Warkworth growth areas. The transport network is made of eight NORS including a public transport interchange, existing road upgrades, and new corridors.

These projects have been identified in the Warkworth Detailed Business Case and sit alongside several other projects in the Warkworth area that are underway or planned for this area. These projects are primarily needed to provide a transport system suitable for the planned urban growth, that provides for improved accessibility, resilience and land use integration within Warkworth. Further high-level information on these projects is included in Section 4.2.3.

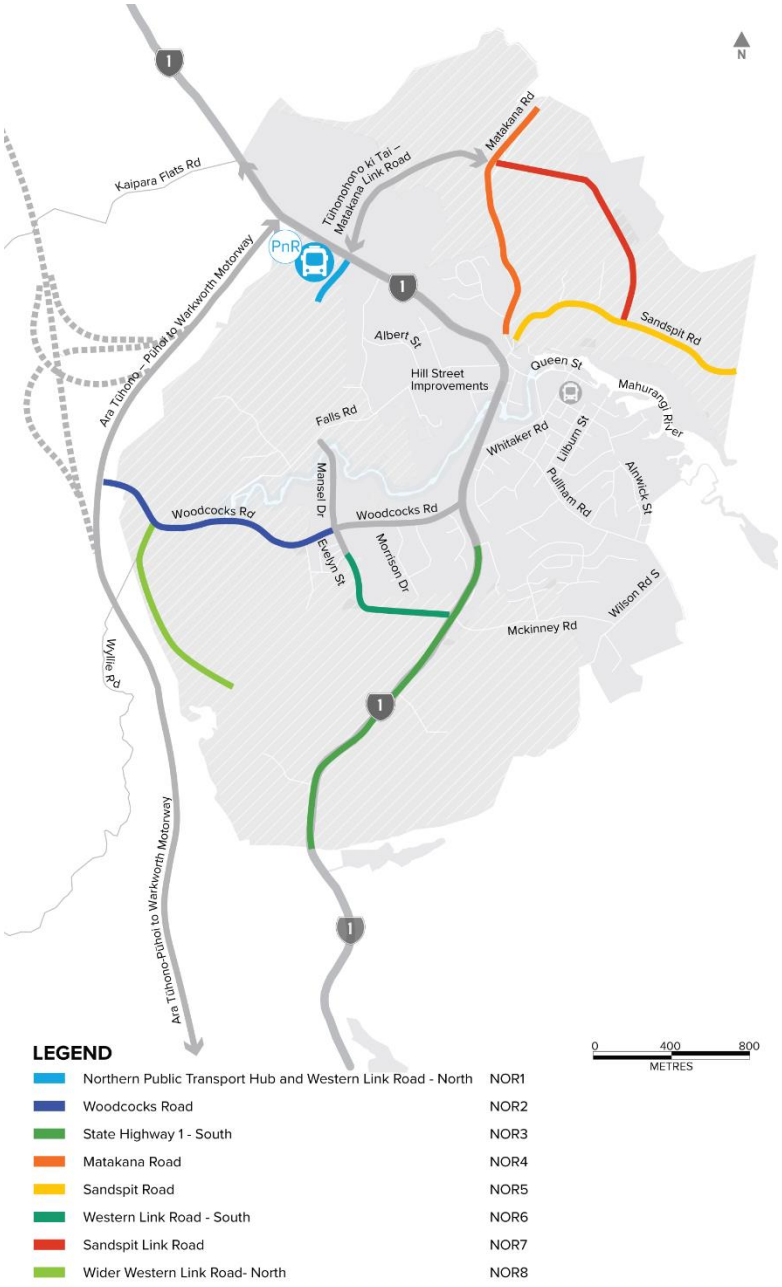
An overview of the Warkworth NOR package is set out in Table 3-1 and shown in Figure 3-1.

Table 3-1. Warkworth NOR Package

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Interchange + Park and Ride and Western Link – North	1	Construction of a public transport hub with associated facilities + park and ride facility (approximately 220 carparks). Construction of a four lane urban arterial cross-section with cycle lanes and footpaths on the corridor.	Auckland Transport
Woodcocks Road Upgrade (Western Section)	2	Upgrade of Woodcocks Road to a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.	Auckland Transport
State Highway 1 Upgrade (Southern Section)	3	Upgrade of State Highway to a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.	Auckland Transport
Matakana Road Upgrade	4	Upgrade of Matakana Road to a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor. It should be noted that the southern extent of Matakana Road (Hill Street to Melwood Drive) has a bidirectional facility for cyclists.	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor and an offline walking and cycling path at the western extent.	Auckland Transport
Western Link - South	6	Construction of a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.	Auckland Transport
Sandspit Link	7	Construction of a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Wider Western Link - (Northern Section)	8	Construction of a two lane urban arterial cross-section with cycle lanes and footpaths on the corridor.	Auckland Transport

Figure 3-1: Warkworth NOR package Overview



3.1 Assessment Methodology

Given the long-term nature of the designations being sought by the NORs, this assessment does not assess the interim staging of individual projects and development staged over the next three decades but instead places a greater focus on the 'full build out' of the future urban area in 2048+ to support future communities. Therefore, this assessment focusses on the likely future environment (full build out 2048+) and wider infrastructure upgrades.

The methodology for the operational and construction transport effects are applicable for each NOR specified within this document. Any nuances are specified throughout the assessment.

The Assessment of Transport Effects has two elements:

- Assessment of operational effects on the transport system
- Assessment of construction effects on the transport network

The assessment is targeted at route protection, rather than imminent implementation. As such, it:

- Makes greater use of generic cross-sections and design standards ·
- Focuses more on desired outcomes and footprints
- Takes a longer-term view, with its inherent uncertainties
- Assumes more use of recommended management plans and planning processes rather than specific design details to manage potential effects

A key element of the assessment is the definition of the 'existing/likely future environment', against which the effects are assessed. This is a complex issue as the proposed works are planned to support urban development and will be unlikely to occur without such development. Additionally, the source of the potential effects (such as people and vehicle movements), is generally from urban development itself, rather than from the planned infrastructure.

To isolate the effects of the planned works, the 'Existing Environment' includes the likely future urban development but does not include the planned projects for which designations are sought. The effects of the projects are then assessed using the same land use assumptions. Given the long-term perspective of the assessment, the analysis is based on the estimated 'full build out' for the future urban area. This is based on development yield estimates provided by Auckland Council through the Warkworth Structure Plan and the Auckland Forecast Centre.

3.2 Approach to Assessment of Operational Transport Effects

This transport assessment has considered potential effects on the transport system both during construction as well as effects once the projects are operational. The focus of the Te Tupu Ngātahi is on long-term route protection of the transport systems required to support the planned growth areas. This means that implementation of the proposed projects is typically not imminent and would be preceded by updated implementation investment and design decisions.

This focus on route protection for longer-term implementation has meant that this assessment has focused less on detailed analysis of the existing environment and more on the likely future (urbanised) environment and potential effects of the proposed projects.

It is also noted that the Warkworth network has been designed as part of an overall integrated system, but in general the projects can be delivered separately. As such this assessment considers the projects individually – with commentary on interdependencies where appropriate.

Section 3.2.3 outlines the methodology for the operational transport effects assessment.

3.2.1 Transport Modelling

Throughout the transport network analysis process, a range of different transport modelling tools have been used to undertake quantitative assessments of the transport system. These then inform decisions about planning the transport network, corridors, and intersections.

The impacts of the projects on the future transport environment are assessed using forecasting transport models, owned by the Auckland Forecasting Centre (AFC). The models include:

- The regional multi-modal model (MSM). This model creates estimates of car, truck and public transport movements at a regional level based on land use, network and policy inputs. This model is the primary tool to estimate future PT usage. Generally, this model is run using regional assumptions, but with scenario-specific inputs in the growth areas.
- A local traffic model (SATURN). This uses the traffic demands from MSM on a more detailed representation of the road network.
- A strategic active model (walk/cycling) model (SAMM). This tool gives strategic-level estimates of walking and cycling demands.

The assessment of operational effects will therefore be informed by network performance for a future full-build-out scenario based on the Future Urban Land Supply Strategy.

A key input to the models are regional land use forecasts, which influence the future quantum and location of travel. Regionally agreed land use forecasts are prepared by Auckland Council via the Auckland Forecasting Centre (AFC), with the most recent available forecasts (at the time of this assessment), referred to as Scenario I11.6. Those forecasts are based on regional population forecasts from Statistics NZ, with spatial allocation to individual spatial areas based on the AFCS land use model and known detail around specific land use planning processes.

Land use forecasts have inherent uncertainty, in terms of the specific rate of new growth in specific areas. Currently, there is additional uncertainty around the likely outcomes and rate and location of higher-density development sought through central Government policies such as the National Policy Statement on Urban Development (NPS-UD) and Auckland Council's Plan Change 78. A key intent of those policies is to enable higher density development, especially around high-quality public transport systems. The specific planning response to those policies is currently being progressed by Auckland Council, and revised land use forecasts reflecting any expected changes were not available at the time of preparing this assessment. Generally, it is considered that this Project is not inconsistent with such policy direction, regarding supporting higher density urban development via more sustainable travel modes. Given this context, the use of those available I11.6 forecasts is considered acceptable for this assessment.

In addition to the SATURN modelling, SIDRA modelling has been undertaken to assess the operational outputs of key intersections along the project corridors. The regional model (MSM) was used to inform assessment of the public transport network components.

In regard to local traffic modelling analysis used in this report, a Level of Service (LOS) metric has been used. This refers to a qualitative measure used to assess the quality of motor vehicle traffic service. LOS is used to analyse road corridors and intersections by categorising traffic flow and assigning quality levels of traffic based on a performance measure ranging from A to F and can be summarised as follows:

- **LOS A**: free flow. Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes.
- **LOS B**: reasonably free flow. LOS A speeds are maintained, manoeuvrability within the traffic stream is slightly restricted.
- **LOS C**: stable flow, at or near free flow. Ability to manoeuvre through lanes is noticeably restricted and lane changes require more driver awareness.
- **LOS D**: approaching unstable flow. Speeds slightly decrease as traffic volume slightly increase. Freedom to manoeuvre within the traffic stream is much more limited and driver comfort levels decrease.
- **LOS E**: unstable flow, operating at capacity. Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to manoeuvre in the traffic stream and speeds rarely reach the posted limit.
- **LOS F**: forced or breakdown flow. Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity.

3.2.2 Transport Guidance and Documents

Within this report, the projects have also been considered against the outcomes and objectives of applicable transport design guidance and policy directives including:

- AT's Transport Design Manual, which sets out outcomes, engineering design and construction requirements for the projects
- AT's Vision Zero, which adopts a "Safe System" approach to focus on road safety for all road users
- AT's Roads and Streets Framework (**RASF**)[3] was also used to qualitatively assesses the typology (movement and place value) and modal priority for each corridor. A 'mandate' for each road corridor is developed and approved by the Auckland Transport RASF Committee, comprising of senior officers from AT and AC. These are included in Appendix 1.

3.2.3 Assessment Methodology – Transport Mode

Table 3-2 summarises how each mode/element of transport has been assessed in terms of operational effects as a result of the projects.

Table 3-2: Assessment Methodology for Transport Elements/Modes

Network Component	Information Source	Assessment Method
Safety	Crash Analysis (CAS) Database Project design drawings	Assessment to determine alignment with Vision Zero standards and design compliance with Transport Design Manual

[3] https://at.govt.nz/about-us/transport-plans-strategies/roads-and-streets-framework/

Network Component	Information Source	Assessment Method
Walking and Cycling	Walking and Cycling Network Plans Proposed Cross Sections	Assessment to determine alignment with walking and cycling strategic documents and design compliance with Transport Design Manual
Public Transport	Transport Model tools (MSM, SATURN and SIDRA) SGA Remix File[4]	Assessment to determine alignment with future network provisions and design compliance with the Transport Design Manual
General Traffic	Transport Model tools (MSM, SATURN and SIDRA) Project design drawings	Assessment using key model outputs including traffic volumes, levels of service for corridor midblock performance and intersection performance. Assessment of surrounding network connections
Property Access	Engineering Standards	Assessment identifying where there is a potential effect on access in the existing environment
Wider Network Effects	Transport Model tools (MSM, SATURN and SIDRA)	Assessment to consider how the corridor interacts with the surrounding road network
Note: A Road Safety and Audit and Safe System assessment will be done as part of the implementation business case/detailed design stage prior to implementation.		

3.2.4 Intersection Form

To determine the intersection form an assessment process was undertaken as part of the Warkworth Detailed Business Case to identify likely intersection forms for the recommended network. The purpose of this process was to identify the indicative intersection controls and subsequent designation footprint implications.

However, it is noted that the final decision of the form and control of the intersections can be modified when further land use certainties are known at time of implementation. This is detailed in the Conditions, which confirms that intersection form will be confirmed as part of the Urban and Landscape Design Management Plan (ULDMP). The designation does allow for flexibility in this regard.

To determine the intersection form contained within the indicative designs the following factors were considered:

- Safety.
- Transport network function (movement) and land use function (place).
- Form and Level of Service (LOS) / Quality of service required for different modes.
- Land use integration.
- Site specific constraints.

[4] SGA Remix file provided by Auckland Transport on the draft plan of the bus network to be implemented by 2048

- Urban form.
- Design constraints.
- Roundabout vs signals guidance.
- Network staging and route protecting.
- Future land used assumptions.
- Future transport network assumptions.

For each intersection control chosen, design features were also considered to ensure that the intersection meets the needs of different users safely and effectively while responding to the site-specific factors. This check was completed by the engineering and urban design teams following the initial selection process completed by the transport planning team.

The guidance adopts a 'Safe System' approach and recommends roundabouts as the first choice for at-grade intersections due to the safety benefits for vehicular traffic resulting from slowing down through traffic and reducing the number of conflict points. However, where roundabouts are not considered appropriate, for example due to engineering constraints or land use implications, signalised intersections were then considered.

3.2.5 Assessment of Project Objectives

Each project included in the Warkworth Assessment Package has an identified set of project objectives. From a transport perspective, these objectives are focused predominantly on the themes of supporting growth, safety, urban form, mode shift/choice and connectivity. The assessment of these, and how they align with the project objectives are included in the AEE.

3.2.6 Approach to Assessment of Construction Effects

3.2.6.1 Construction Traffic Effects

In order to assess the potential construction traffic effects, an indicative construction methodology has prepared. This can be found in the AEE.

Based on the indicative construction methodology an assessment of construction effects has been completed for the package sufficient to support each Notice of Requirement. This assessment will consider:

- An overview of key considerations including speed, potential impacts to pedestrians and cyclists and property access
- Identification of any works that should not occur at the same time
- Assessment of potential conflict areas with vulnerable road users that will need specific mitigation within a Construction Traffic Management Plan (**CTMP**) and / or Site-Specific Traffic Management Plans (**SSTMP**).

The project specific construction effects will be managed via a CTMP and/or SSTMP which will be developed immediately prior to implementation when the greatest certainty is available.

3.2.6.2 Temporary Traffic Management

The impact of any temporary traffic management measures implemented to undertake the projects will be re-assessed in the future, prior to construction, when a greater level of detail is available in terms of the specific construction methodology and traffic environment.

It is noted that there may be some nuances between projects delivered ‘online’ as they are existing roads and those delivered ‘offline’ as new greenfield roads. There are also corridors that are both existing and new roads. In particular, any future assessment should be required to consider potential road closures, any capacity reductions on key corridors through lane closures, and any other ancillary effects such as shoulder closures.

4 Existing and likely receiving environment

4.1 Planning and Land Use Context

The projects encompassing the Warkworth NOR package will be constructed 15 - 20 years from now. The implementation timeframe for each project will vary and correspond with future land release within the area. Assessing the effects on the environment solely as it exists today (i.e., at the time of assessment) will not provide an accurate reflection of the environment in which some of the effects will be experienced. Accordingly, the assessment of effects considers both the existing environment, and the likely receiving environment in which the effects will likely occur.

The Warkworth NOR package will be constructed and will operate alongside existing urban environments or planned future environments (i.e. what can be built under the existing Auckland Unitary Plan: Operative in Part (AUP:OP) and what is identified in the Warkworth Structure Plan):

- **Existing environment:** A number of corridors comprising the Warkworth NOR package are partially located within/alongside existing urban areas.
  - Matakana Road Upgrade – residential land uses (single house zone, mixed housing suburban zone, mixed housing urban zone) comprise the western and north-western extents of the corridor.
  - Western Link South – residential land uses are situated to the north and northwest of the corridor and existing industrial land use on the eastern extent of the corridor.
  - State Highway 1 (Southern Section) – residential land uses are adjacent to the northwest and southeast of the northern extent of the corridor, additionally there are established business land uses to the northeast of the northern extent of the corridor.
  - Woodcocks Road – the eastern extent of the corridor has existing residential land uses to the north and south.
- **Future environment**: All the corridors in the Warkworth NOR package will partially or wholly be constructed and implemented on land identified for future growth (future urban zone) and as a result are anticipated to change to urban or industrial land uses.

In terms of specific corridors the below table summarises the likelihood for land use change and likely future environment.

Table 4-1: Summary of Future Land use Expectations

Corridor	Environment today	Zoning	Likelihood of Change for the environment[5]	Likely Future Environment[6]
Woodcocks Road	**Residential**	Residential	Low	Residential
	Undeveloped greenfield areas	Future Urban	High	Urban
	Residential	Single House	Low	Residential

[5] Based on AUP:OP zoning/policy direction
[6] Based on AUP:OP zoning/policy direction

Corridor	Environment today	Zoning	Likelihood of Change for the environment[5]	Likely Future Environment[6]
Matakana Road	**Undeveloped greenfield areas**	Future Urban	High	Urban
	Undeveloped greenfield areas	Mixed Housing Urban	High	Urban
Sandspit Road	**Residential**	Single House	Low	Residential
	Undeveloped greenfield areas	Future Urban	High	Urban
SH1	**Residential**	Single House	Low	Residential
	Undeveloped greenfield areas	Future Urban	High	Urban
Western Link South	**Undeveloped greenfield areas**	Future Urban	High	Urban
Wider Western Link - North Wider Western Link	**Undeveloped greenfield areas**	Future Urban	High	Urban
Sandspit Link	**Undeveloped greenfield areas**	Future Urban	High	Urban

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

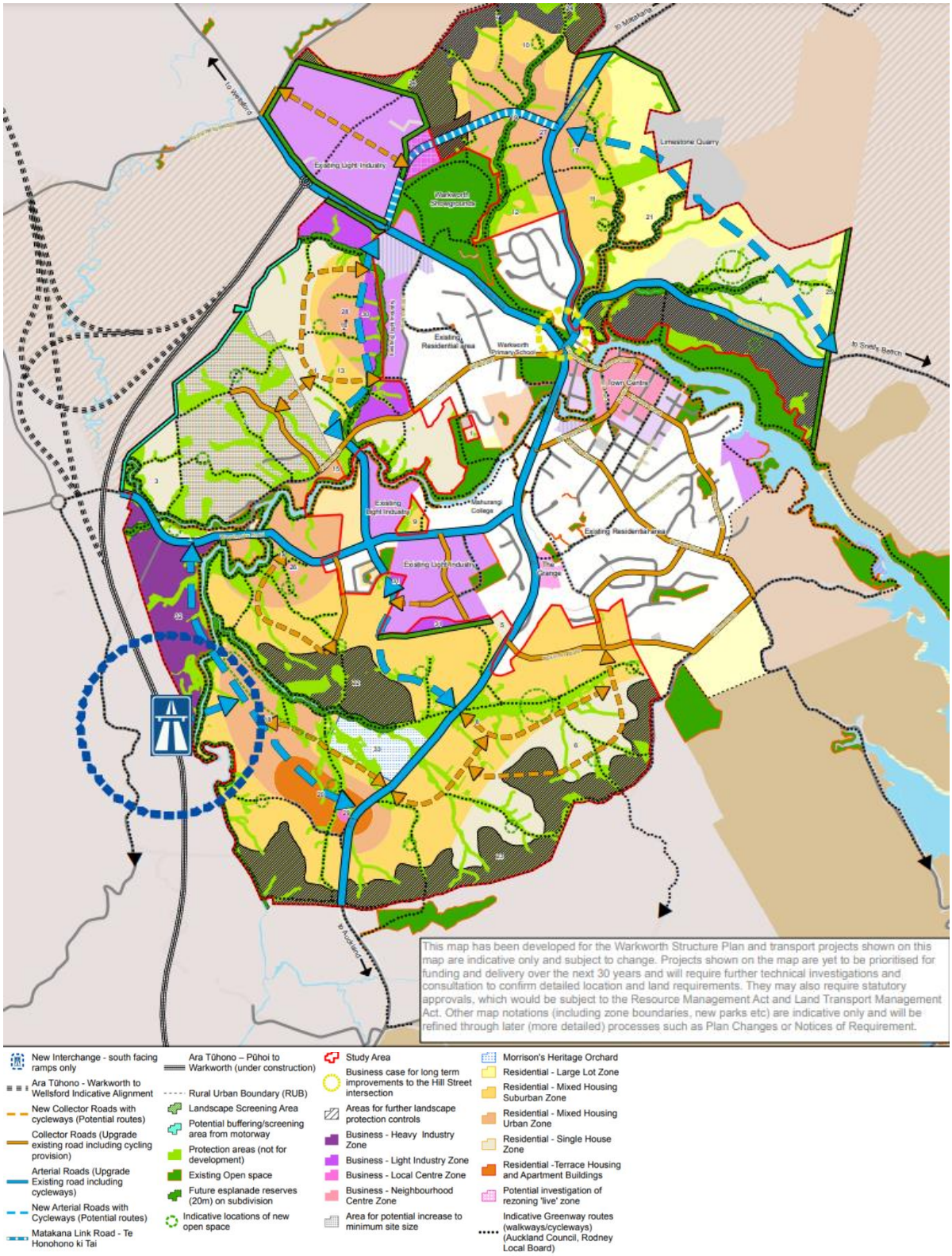
4.1.1 Warkworth Structure Plan

The Warkworth Structure Plan was completed and endorsed by Auckland Council in June 2019. The Warkworth Structure Plan sets out a pattern of land uses and the supporting infrastructure network for the Future Urban zoned land around Warkworth. The final land use proposed by the Structure Plan is shown below in Figure 4-1.

This land use scenario has been considered as the most likely land use outcome and has been used as the basis for determining the Warkworth transport network. The process was also iterative, noting that landuse and transport are inherently linked.

It is noted that the indicative cross sections used to inform the proposed designations may change in the future when there is greater certainty of landuse, however is it considered these changes can be accommodated within the footprint of the designation.

Figure 4-1: Warkworth Structure Plan



4.1.2 Warkworth North Precinct (AUP: PC25)

Subsequent to the development of the Warkworth Structure Plan, a private plan change (Plan Change 25) was approved. There are some differences between the Structure Plan and the eventual unitary plan zoning, including a zoning for a local centre higher residential densities and a reserve area. These land uses have since been incorporated into the Auckland Unitary Plan.

Figure 4-2: Warkworth North: Structure Plan

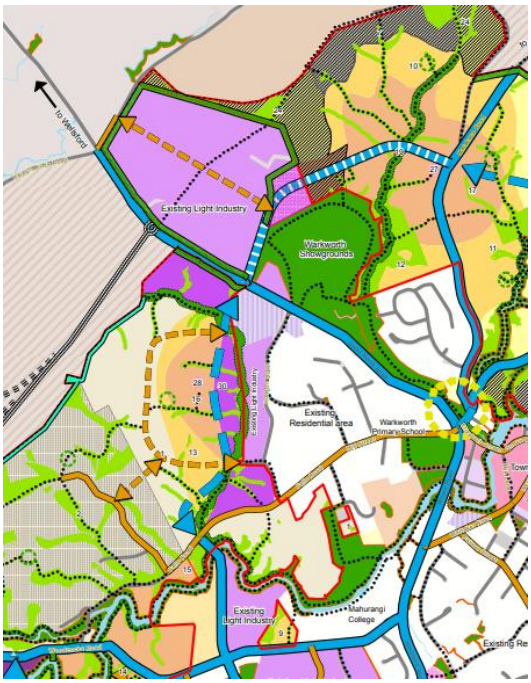
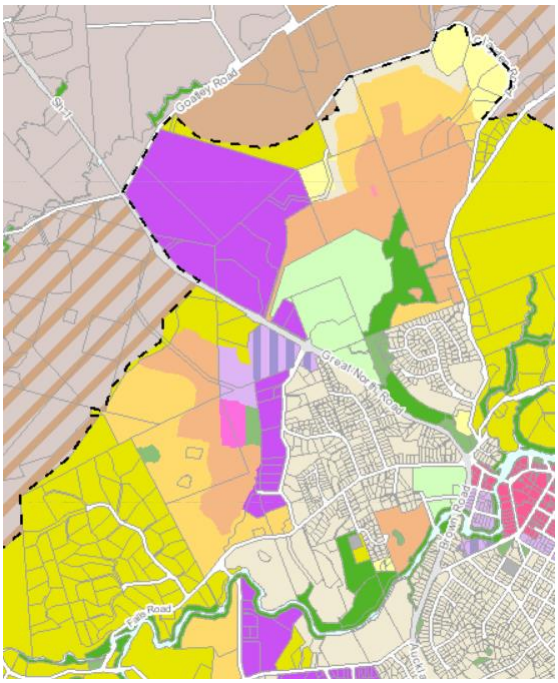


Figure 4-3: Warkworth North AUP



4.1.3 Claydon Road Precinct (AUP: PC40)

The Claydon Road precinct rezoned approximatly 102ha of Future Urban and Light Industrial land to a Residential – Single House, Residential – Mixed Housing Suburban, Residential – Mixed Housing Urban, Business Neighbourhood Centre and Rural – Countryside Living. This Plan Change was fully operative in June 2021.

4.2 Existing and Future Environment - Transport

4.2.1 Existing Transport Environment

The following table provides a summary of the existing road network as it relates to the proposed Notice of Requirements. Overall, the following conclusions can be made:

- Where urbanisation is yet to occur, corridors are predominantly rural in nature, including limited footpaths and cycle infrastructure and generally a higher speed environment.
- Intersections in the rural environment are predominantly uncontrolled, which is commensurate with traffic volumes and surrounding environment.
- Existing SH1 currently operates as the main north south route from Auckland. This will be imminently replaced by Ara Tūhono.

Table 4-2: Existing Transport Environment

NOR	Project	Existing Transport Characteristics

1	Northern Public Transport Interchange + Park and Ride and Western Link - North	• There is currently an interim local board funded PT Hub located at 80 Great North Road. This facility includes:
		  • 137 car parks, including 15 short term and four accessible parking
		  • a bus layover and
		  • bike parking
		• More information on the existing environment is provided in Section 14.

2	Woodcocks Road Upgrade (Western Section)	• The posted speed limit is currently 60 km/h between Mason Heights and Falls Road, the speed limit then becomes unrestricted through the remainder of the rural section.
		• Rural character with two general traffic lanes (one in each direction)
		• Corridor form is consistent, with no kerb and channel on either side of the corridor and no footpaths.
		• Connects to SH1 to the east of the corridor.
		• The latest traffic data for the rural portion of Woodcocks Road was obtained from Auckland Transport. The data was recorded in December 2020 and shows that the corridor has an Average Daily Traffic count of 4,529.
		• Intersections
		  • Woodcocks Road/ Wylie Road - priority controlled intersection.
		  • Woodcocks Road/ Falls Road - priority controlled intersection.
		  • Woodcocks Road/ Mason Heights - no control
		• Currently, no existing walking and cycling facilities along the majority of the corridor.
		• There are no existing bus services on Woodcocks Road.

3	State Highway 1 Upgrade (Southern Section)	• The posted speed limit is currently 100 km/h from the edge of the FUZ to McKinney Road. This changes to 60 km/h through the urban centre between McKinney Road and Woodcocks Road.

NOR	Project	Existing Transport Characteristics

		• Urban character with two general traffic lanes (one in each direction) between Woodcocks Road and Fairwater Road.
		• Rural character with two general traffic lanes (one in each direction) between Fairwater Road and Valerie Close.
		• The latest traffic data for SH1 was obtained from Waka Kotahi. The data was recorded in March 2021 and shows that the corridor has an Average Daily Traffic count of 18,700.
		• Intersections
		  • SH1/ Fairwater Road – priority-controlled intersection
		  • SH1/ Welch Drive – priority-controlled intersection
		  • SH1/ McKinney Road – priority-controlled intersection
		  • SH1/ Toovey Road – no control
		  • SH1/ Valerie Close – priority-controlled intersection
		• Currently, no existing walking and cycling facilities along the rural portion of the corridor extents between Fairwater Road and Valerie Close. There is a footpath on the eastern side of the corridor and on-road cycle lanes on both sides of the corridor between Fairwater Road and Woodcocks Road. The cycle lanes are incredibly narrow and have inconsistent markings to indicate priority.
		• There is one existing service along SH1. The 995 has a service frequency of every 30 minutes during the peak hour.

4	Matakana Road Upgrade	• The posted speed limit is currently 50 km/h between Hill Street and Melwood Drive, the speed limit then becomes 80 km/h through to the edge of the FUZ.
		• Rural character with two general traffic lanes (one in each direction)
		• Connects to Hill Street intersection to the south.
		• The latest traffic data for Matakana Road was obtained from Auckland Transport. The data was recorded in January 2021 and shows that the corridor has an Average Daily Traffic count of 10,000.
		• Intersections
		  • Matakana Road/Te Honohono ki tai Matakana Link Road– roundabout
		  • Matakana Road/ Sandspit Road - priority controlled intersection
		  • Matakana Road/ Melwood Drive – priority-controlled intersection
		  • Matakana Road/ Clayden Road - priority controlled intersection
		• Currently, no existing walking and cycling facilities along the majority of the corridor.
		• There is one existing service along Matakana Road. The 997 has a service frequency of every 2 hours all-day during the weekday.

5	Sandspit Road Upgrade	• The posted speed limit is currently 50 km/h on approach to the Hill Street intersection. This changes to 80 km/h to just after the access road to the Quarry, the speed limit then becomes unrestricted to the end of the FUZ.

NOR	Project	Existing Transport Characteristics

		• Rural character with two general traffic lanes (one in each direction)
		• Corridor form is consistent, with no kerb and channel on either side of the corridor and no footpaths.
		• Connects to SH1 to the west.
		• The latest traffic data for Sandspit Road was obtained from Auckland Transport. The data was recorded in January 2021 and shows that the corridor has an Average Daily Traffic count of 8,215.
		• Intersections
		  • Sandspit Road/ SH1 – signalised intersection
		  • Sandspit Road/ Elizabeth Street – priority-controlled intersection
		  • Sandspit Road/ Millstream Place – priority-controlled intersection
		  • Sandspit Road/ Matakana Road - priority controlled intersection
		  • Sandspit Road/ Withers Lane – no control
		  • Sandspit Road/ Park Lane – no control
		• Currently, no existing walking and cycling facilities along the majority of the corridor.
		• There is one existing service along Sandspit Road. The 996 has a service frequency of every 2 hours all-day during the weekday.

6	Western Link South	• This corridor does not currently exist.
7	Sandspit Link	• This corridor does not currently exist.
8	Wider Western Link - (Northern Section)	• This corridor does not currently exist.

4.2.2 Surrounding Road Network

Several significant roading infrastructure elements are currently under construction or investigation in the Warkworth area. These projects are expected to significantly change transport patterns once they are complete. In particular, the opening of Ara Tūhono and Te Honohono ki Tai is expected to remove traffic from Hill Street a known congestion point particularly in the summer periods and public holidays due to high demand to the east coast settlements.

4.2.2.1 Ara Tūhono – Puhoi to Warkworth

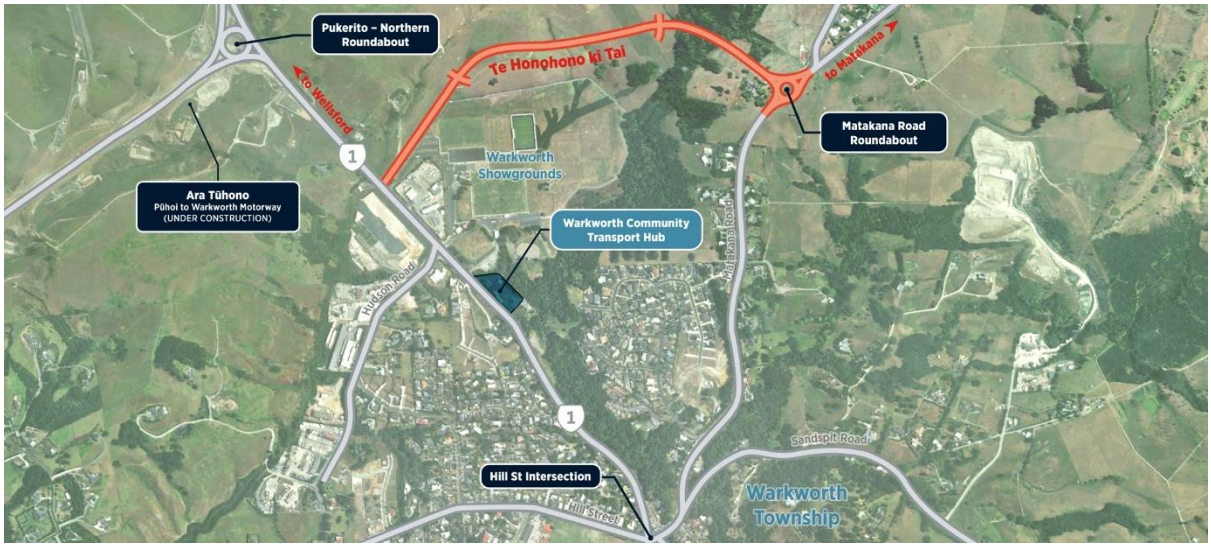
In November 2016, Waka Kotahi NZ Transport Agency awarded a Public Private Partnership (PPP) contract to the Northern Express Group (NX2) to extend the four-lane Northern Motorway (SH1) 18.5km from the Johnstones Hill Tunnels to just north of Warkworth. Under the PPP contract, the NX2 will finance, design, construct, manage and maintain the Pūhoi to Warkworth motorway for the 25 years that will follow the expected six-year period to build the motorway. Full ownership of the highway will remain with the public sector.

The Pūhoi to Warkworth section of Ara Tūhono is expected to open in the second quarter of 2023[7].

4.2.2.2 Te Honohono ki tai – Matakana Link Road

Te Honohono ki Tai is a new 1.3km road connecting Matakana Road and SH1. This project is under construction and will improve the improve the efficiency, resilience and safety of the local transport network including access to and from east coast settlements and beaches. The project is nearing completion and it is understood that the opening will be coordinated with the opening of Ara Tūhono.

Figure 4-4: Tūhonohono ki Tai - Matakana Link Road[8]



4.2.2.3 Hill Street Intersection

The Hill Street intersection has been a significant bottleneck for travellers between Auckland and Northland and for local residents in the Warkworth for a number of years. A Detailed Business Case was completed in 2019, identifying that that intersection would benefit from:

- New cycling and walking facilities
- A five-arm roundabout to improve traffic flow through Brown Road/Great North Road
- A three-arm roundabout to improve traffic flow through the Sandspit Road and Matakana Road intersection.

Detailed design is underway for this intersection and is expected to be completed by early 2023. Subsequent funding for implementation is still to be confirmed but is expected in the short to medium term. An upgrade of the intersection has been included within the SATURN modelling completed.

4.2.2.4 Ara Tūhono – Warkworth to Wellsford

The proposed designation for the second stage of Ara Tūhono – Warkworth to Wellsford was lodged with Auckland Council in April 2020.

[7] https://nx2group.com/

[8] https://at.govt.nz/projects-roadworks/te-honohono-ki-tai-matakana-link-road/

Following this, Auckland Council granted resource consents, and recommended that Waka Kotahi confirm the NOR which occurred in May 2021. Since then, several appeals have been lodged with the Environment Court and this process remains underway.

Given the longer delivery time frame, funding uncertainty and limited influence on the local network within Warkworth, the provision of this extension has not been included within the SATURN modelling completed.

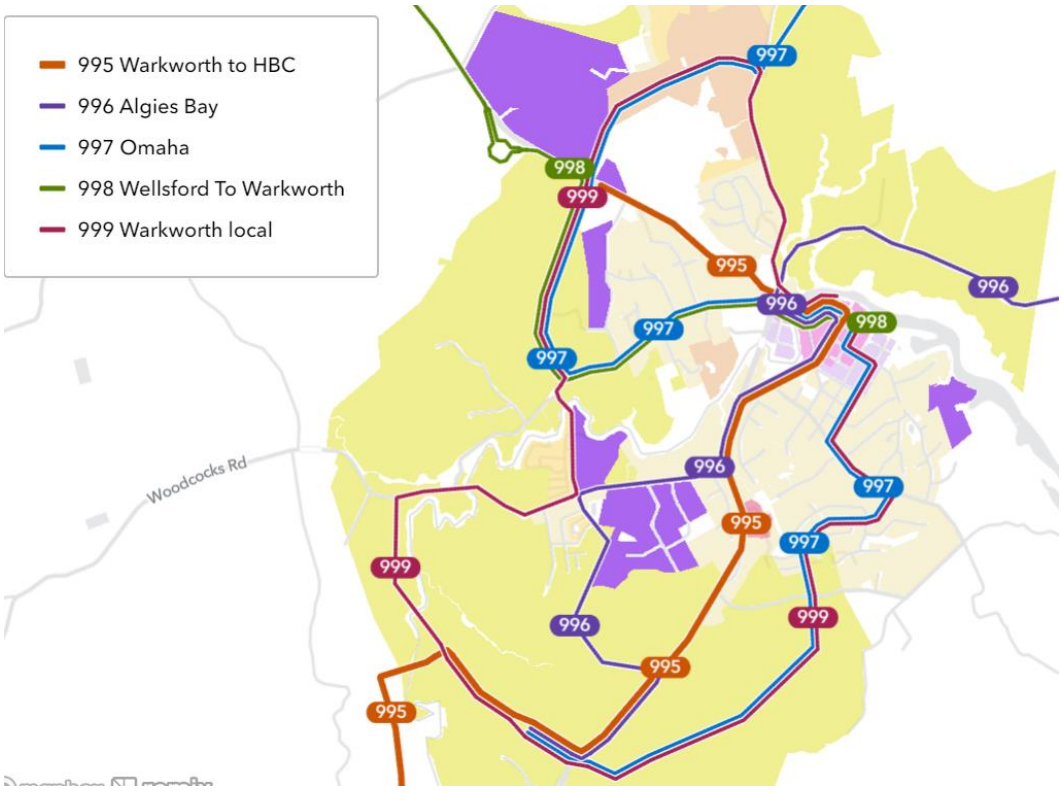
4.2.3 Future Transport Environment

The following table summarises the proposed future transport environment for each of the NoRs. The assessment below has been conducted on the basis that all the corridors in the Warkworth NOR are in place. A general overview for each corridor is also included in the subsequent assessments, including a conceptual cross section.

4.2.3.1 Future Modal Networks

The public transport network has been developed in coordination with Auckland Transport Subject Matter Experts. This indicative network is based on desired levels of service and existing and future expected land use activities.

Figure 4-5: Future Public Transport Network Warkworth

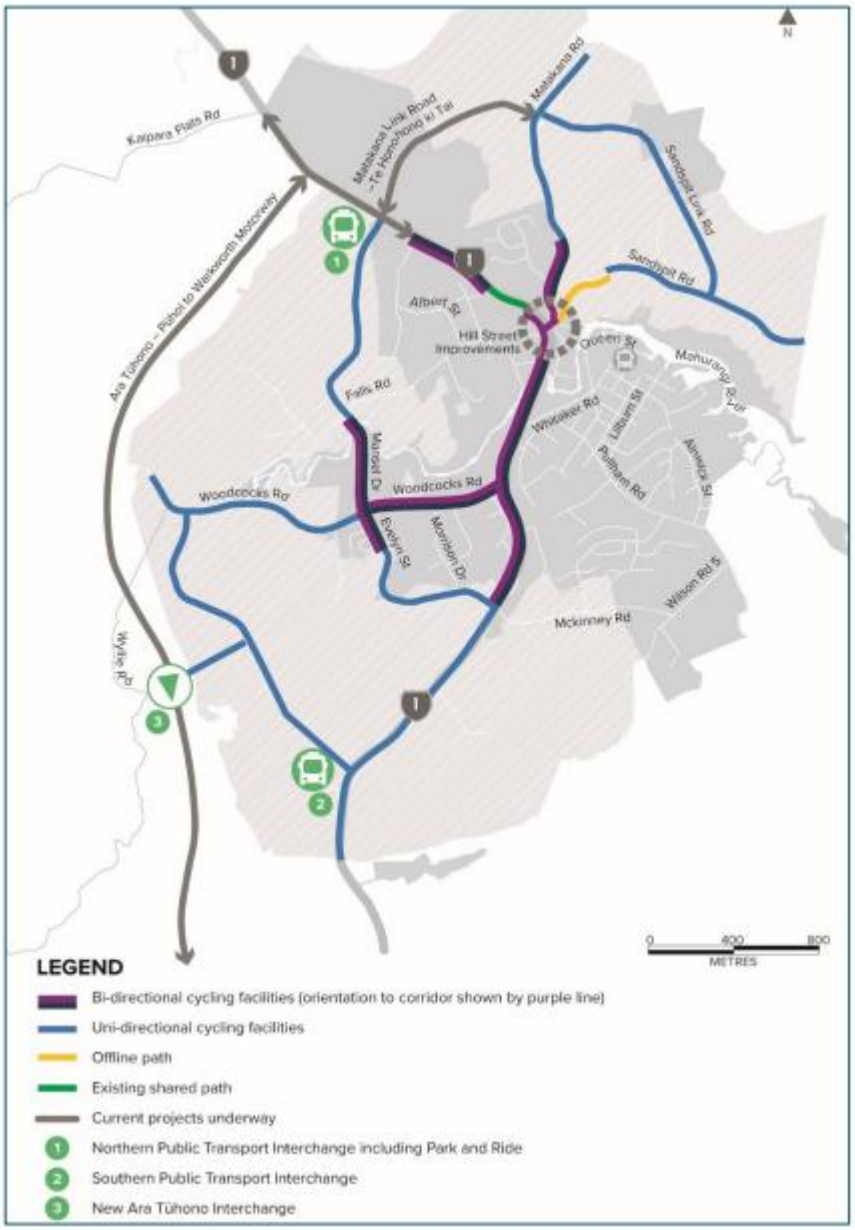


Route #	Route	Week days Headways	
		AM/PM Peak	IP
995	Warkworth to HBC	5 min	15min

Route #	Route	Week days Headways	
		AM/PM Peak	IP
996	Algies Bay to Warkworth	15min	30 min
997	Matakana to Warkworth	15min	30 min
998	Wellsford to Warkworth	15min	30 min
999	Local Warkworth	15min	15 min

In terms of walking and cycling the future network has been developed to enable the proposed NOR projects to integrate with projects that will require the reallocation of road space to upgrade connections. The final network outcome for walking and cycling is shown below in Figure 4-6.

Figure 4-6: Future Walking and Cycling network for Warkworth.



4.2.3.2 Future Environment by Corridor

The following table provides a summary of the future environment as identified by the Warkworth Detailed Business Case, by corridor,

Table 4-3: Future Transport Characteristics for each Notice of Requirement

NOR	Project	Future Transport Characteristics
1	Northern Public Transport Interchange + Park and Ride and Western Link - North	• 50kph speed limit. • Consistent corridor form with kerb and channels on both sides and continuous footpaths and cycle facilities. • Connects to SH1 in the north. • Connects to the Northern PT Interchange.

NOR	Project	Future Transport Characteristics

		• The forecast Average Daily Traffic (ADT) in 2048 is 11,600 vehicles on the Western Link North.
		• Intersections
		  • Western Link - North / SH1 – signalised intersection.
		• Cycle lanes and footpaths on both sides.
		• 12 buses forecast as part of the indicative 2048 AT bus network.
		• The Northern PT hub will provide sufficient space to provide:
		  • Four active bus stops
		  • Capacity for at least five services (terminating and through) Note: no reverse movements within the transport hub, so turning facilities to be considered in overall shape and dimensions.
		  • Two layover spaces - includes long distance coaches to Northland.
		  • Kiss and ride drop off facilities.
		  • Bus Driver/Staff facilities to be provided for including a break room and a toilet which could be integrated with public toilets potentially.
		  • Park and Ride for up to 250 spaces
		• Cycle parking integrated/built into buildings/shelters

2	Woodcocks Road Upgrade (Western Section)	• 50kph speed limit.
		• Urban character with two general traffic lanes (one in each direction) and a central median.
		• Consistent corridor form with kerb and channels on both sides and continuous footpaths and cycle facilities.
		• Connect to SH1 to the west.
		• Connect to Wider Western Link - North Wider Western Link Western Link to the south.
		• Connect to Western Link to the west.
		• The forecast Average Daily Traffic (ADT) in 2048 is 6,200 vehicles.
		• Intersections
		  • Woodcocks Road/ Wylie Road/ Wider Western Link - North Wider Western Link Western Link – single-lane roundabout
		  • Woodcocks Road/ Falls Road – closed-off
		  • Woodcocks Road/ Mason Heights – priority-controlled intersection
		• Cycle lanes and footpaths on both sides.
		• The indicative 2048 AT bus network forecasts 4 buses during the peak hour.

3	State Highway 1 Upgrade (Southern Section)	• 50kph speed limit. • Urban character with two general traffic lanes (one in each direction) and a central median. • Consistent corridor form with kerb and channels on both sides and continuous footpaths and cycle facilities.

NOR	Project	Future Transport Characteristics

		• Connects to the Western Link -South.
		• Connects to the Wider Western Link.
		• The forecast Average Daily Traffic (ADT) in 2048 is 15,400 vehicles.
		  • SH1/ Fairwater Road – signalised intersection
		  • SH1/ Welch Drive – priority-controlled intersection
		  • SH1/ Western Link/ McKinney Road – signalised intersection
		  • SH1/ Toovey Road – priority-controlled intersection
		  • SH1/ Wider Western Link - North Wider Western Link Western Link – single-lane roundabout
		  • SH1/ Valerie Close – priority-controlled intersection
		• Cycle lanes and footpaths on both sides.
		• The indicative 2048 AT bus network forecasts 10 buses during the peak hour.

4	Matakana Road Upgrade	• 50kph speed limit. • Urban character with two general traffic lanes (one in each direction) and a central median • The forecast Average Daily Traffic (ADT) in 2048 is 9,700 vehicles. • Intersections • Cycle lanes and footpaths on both sides, and a bidirectional facility along the southern portion of the corridor. • The indicative 2048 AT bus network forecasts 4 buses during the peak hour.

5	Sandspit Road Upgrade	• 50kph speed limit.
		• Urban character with two general traffic lanes (one in each direction) and a central median.
		• Connect to SH1 to the west.
		• The forecast Average Daily Traffic (ADT) in 2048 is 12,200 vehicles.
		• Intersections
		  • Sandspit Road/ SH1 – single-lane roundabout (Hill Street Improvements – AT)
		  • Sandspit Road/ Elizabeth Street – single-lane roundabout (Hill Street Improvements – AT)
		  • Sandspit Road/ Millstream Place – priority-controlled intersection
		  • Sandspit Road/ Matakana Road – single-lane roundabout (Hill Street Improvements – AT)
		  • Sandspit Road/ Withers Lane – priority-controlled intersection
		  • Sandspit Road/ Park Lane – priority-controlled intersection
		  • Sandspit Road/ Sandspit Link – single-lane roundabout
		• Cycle lanes and footpaths on both sides, and an offline facility between Vipond Culvert and Matakana Road

NOR	Project	Future Transport Characteristics
		• The indicative 2048 AT bus network forecasts 4 buses during the peak hour.

6	Western Link South	• 50kph speed limit.
		• Urban character with two general traffic lanes (one in each direction) and a central median.
		• Consistent corridor form with kerb and channels on both sides and continuous footpaths and cycle facilities.
		• Connects to Woodcocks Road in the north.
		• Connects to SH1 in the south.
		• The forecast Average Daily Traffic (ADT) in 2048 is 9,400 vehicles.
		• Intersections
		  • Western Link – South/ Jamie Lane – priority-controlled intersection
		  • Western Link – South/ SH1/ McKinney Road – signalised intersection
		• Cycle lanes and footpaths on both sides.
		• The indicative 2048 AT bus network forecasts 4 buses during the peak hour.

7	Sandspit Link	• 50kph speed limit.
		• Urban character with two general traffic lanes (one in each direction) and a central median.
		• Consistent corridor form with kerb and channels on both sides and continuous footpaths and cycle facilities.
		• Connects to Matakana Road in the north.
		• Connects to Sandspit Road in the south.
		• The forecast Average Daily Traffic (ADT) in 2048 is 3,600 vehicles.
		• Intersections
		  • Sandspit Link/ Matakana Road – single-lane roundabout
		  • Sandspit Link/ Sandspit Road – single-lane roundabout
		• Cycle lanes and footpaths on both sides.
		• No buses forecast as part of the indicative 2048 AT bus network.

8	Wider Western Link - (Northern Section)	• 50kph speed limit. • Urban character with two general traffic lanes (one in each direction) and a central median. • Consistent corridor form with kerb and channels on both sides and continuous footpaths and cycle facilities. • Connects to Woodcocks Road in the north. • Connects to SH1 in the south. • The forecast Average Daily Traffic (ADT) in 2048 is 6,100 vehicles. • Intersections • Wider Western Link/ Woodcocks Road/ Wylie Road – single-lane roundabout

NOR	Project	Future Transport Characteristics
		• Wider Western Link/ Link to Southern Interchange – single-lane roundabout • Cycle lanes and footpaths on both sides. • The indicative 2048 AT bus network forecasts 4 buses during the peak hour.

4.2.3.3 Ara Tūhono Southern Interchange

An additional motorway interchange with Ara Tūhono was identified by the Warkworth Detailed Business Case. This interchange provides south facing ramps to the Ara Tūhono motorway. The interchange provides additional access to the proposed industrial area in the southern growth area.

The proposed interchange has the opportunity to redistribute traffic across the Warkworth network, and as such commentary has been provided for each NOR below on the potential traffic effects with the Southern Interchange in place and without this infrastructure in place.

The southern interchange is not included within the Warkworth Package as concept designs indicate that sufficient land is available within existing Waka Kotahi designation and/or Waka Kotahi owned land.

4.2.3.4 Southern Public Transport Interchange

In order to support the expected growth in the southern part of Warkworth, a second public transport interchange is proposed in Warkworth Detailed Business Case. This public transport interchange would provide local catchment to public transport services, and in the longer term will connect to the new proposed Ara Tūhono interchange, providing access to the strategic network for longer distance commuters.

The best transport outcomes for this Public Transport interchange require a location integrated with the surrounding land uses. While the Structure Plan provides an indicative local centre location, the current future urban zoning results in a high degree of land use uncertainty. As such, the Southern PT interchange is not proposed to be designated as part the Warkworth package at this stage.

4.2.3.5 Other Future Corridor Upgrades

The full Warkworth network as identified in the Warkworth Detailed Business also identified a series of projects that include upgrades to existing roads and new roads. These are not subject to designations as part of the Warkworth package but will enable connections from the eight Warkworth NoRs. These include:

- Existing Road Upgrades to the following corridors within the road reserve primarily improving walking and cycling facilities.
  - Western Link Central
  - Woodcocks Road North:
  - State Highway 1 (North of Fairwater Avenue)
- New Arterial Roads
  - Western Link North: South of the PT Hub interface this corridor is proposed to be delivered by developers. The alignment and components of the corridor including walking and cycling and sufficient setback for future public transport priority measures are provide for within the provisions in the Warkworth North Precinct.

- Wider Western Link South: South of the crossing of the Mahurangi crossing, the Wider Western Link is likely to be enabled via Plan Change mechanisms.
- Interchanges
  - Southern PT Hub likely to be enabled via Plan Change mechanisms.
  - South facing ramps on Ara Tūhono – sufficient land holdings present to enable a connection in the future.

4.2.4 Future Transport Environment without the Projects

The following table has been prepared to summarise the transport implications in the case that the each respective NOR, and subsequently the project, does not proceed. This also provides some assessment of the interdependencies between the proposed NORs, with additional information provided under each NOR assessment further in this report.

4.2.4.1 Road Safety

The following table provides an assessment of the road safety implications for each corridor should the NOR / Project not proceed.

Table 4-4: Road Safety Effects without the NOR for each Project

Proposed NOR	Road Safety Effect if the NOR does not proceed
Northern Public Transport Interchange + Park and Ride and Western Link - North	Western Link is a new corridor from State Highway 1, that will in the longer term connect with Falls Road. From a road safety perspective, without the Project additional pressure will be placed on the existing network, in particular on State Highway 1 and Falls Road. Falls Road is a local road and provides access to residential properties and access to Warkworth Primary School. Increased vehicle movements on this corridor will increase exposure to potential conflict for vulnerable road users.
Woodcocks Road Upgrade (Western Section)	The existing Woodcocks Road is not fit for purpose to support the planned future urban growth, due to the high-speed environment, narrow carriageway, and significant increase in conflicts between through traffic, accessing/turning movements and vulnerable road users. These increases in conflicts will lead to increases in DSIs[9] The expected increase in safety issues is also likely to constrain the attractiveness of walking and cycling, further reinforcing use of vehicles with the resulting high-speed conflicts. Although the speed limit could be reduced, as a safety improvement measure, the existing Woodcocks Road will remain unsafe to safely accommodate future growth due to the type and number of conflicts expected. It is also noted that the Woodcocks Road NOR also provides for the replacement of a one-way bridge. Without the replacement of this bridge increased traffic volumes at this location poses an increased safety risk.
State Highway 1 Upgrade (Southern Section)	The existing State Highway 1 is not fit for purpose to support the planned future urban growth, due to the high-speed environment, narrow carriageway, and significant increase in conflicts between through traffic, accessing/turning movements and vulnerable road users. These increases in conflicts will lead to increases in DSIs. The southern section of State Highway 1 is consistent with a higher speed rural state highway and in order to support the corridor to function as an urban arterial, infrastructure change is needed in particular to support active modes to travel along the corridor.

[9] Death and Serious Injury Crashes

Proposed NOR	Road Safety Effect if the NOR does not proceed
	The expected increase in safety issues is also likely to constrain the attractiveness of walking and cycling, further reinforcing use of vehicles with the resulting high-speed conflicts.
Matakana Road Upgrade	The existing Matakana Road is not fit for purpose to support the planned future urban growth, due to the high-speed environment, narrow carriageway, and significant increase in conflicts between through traffic, accessing/turning movements and vulnerable road users. These increases in conflicts will lead to increases in DSIs. The expected increase in safety issues is also likely to constrain the attractiveness of walking and cycling, further reinforcing use of vehicles with the resulting high-speed conflicts. This is considered particularly relevant for this corridor given the proximity to the Warkworth Town Centre and the new developing areas surrounding Te honohono ki Tai.
Sandspit Road Upgrade	The existing Sandspit Road is not fit for purpose to support the planned future urban growth, due to the high-speed environment, narrow carriageway, and significant increase in conflicts between through traffic, accessing/turning movements and vulnerable road users. These increases in conflicts will lead to increases in DSIs. The expected increase in safety issues is also likely to constrain the attractiveness of walking and cycling, further reinforcing use of vehicles with the resulting high-speed conflicts. Although the speed limit could be reduced, as a safety improvement measure, the existing Sandspit Road will remain unsafe to safely accommodate future growth due to the type and number of conflicts expected. It is also noted that there is very limited sealed shoulders on this corridor, resulting in high levels of conflict within the road corridor.
Western Link South	Western Link South is an extension of Evelyn Street through to State Highway 1. From a road safety perspective, without the Project additional pressure will be placed on the existing network, in particular on Woodcocks Road and State Highway 1. These corridors and their appropriateness to accommodate growth from a road safety perspective are discussed under each respective corridor.
Sandspit Link	Sandspit Link is a new corridor from Woodcocks Road to State Highway. From a road safety perspective, without the Project additional pressure will be placed on the existing network, in particular on Matakana Road and Sandspit Road. These corridors and their appropriateness to accommodate growth from a road safety perspective are discussed under each respective corridor.
Wider Western Link - North	Wider Western Link is a new corridor from Woodcocks Road to State Highway 1. From a road safety perspective, without the Project additional pressure will be placed on the existing network, in particular on Woodcocks Road and State Highway 1. These corridors and their appropriateness to accommodate growth from a road safety perspective are discussed under each respective corridor.

4.2.4.2 Walking and Cycling

An assessment of walking and cycling outcomes without each NOR has been provided below in Table 4-6. This assessment considers that the existing facilities form the basis of the do minimum network. In the case of new arterial connections, the assessment considered existing alternatives that are in place and the outcomes for walking and cycling should alternative corridors be utilised.

Overall, walking and cycling demands are expected to significantly increase as a result of the expected growth. A summary of the expected active mode demands derived from the Strategic Active Mode Model is summarised below in Table 4-5.

Table 4-5: Predicted Walking and Cycling Daily trips in Warkworth

Number of Daily Active Mode Trips without NORS in place	Number of Active Mode Trips with NORS in Place
1,086 trips or 10% daily active mode share	1,633 trips or 15% of daily active mode share

Given that finer grain networks, including collector and local roads that are still in development, provision of these demands on an area basis is considered to be appropriate and can provide an indication of level of likely demands with the Projects in place.

Potential demand with the Projects in place is considered to reflect likely demand for facilities, without the suppression of active mode trips that occurs without the NORS (and supporting networks) due to absence facilities or facilities that have a low quality of service for users.

Table 4-6: Walking and Cycling Effects without the NOR for each Project

Proposed NOR	Existing Active Mode Facilities	Walking and Cycling Effect if the NOR does not proceed
Northern Public Transport Interchange + Park and Ride and Western Link - North	New Corridor	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses. In particular this corridor links to a new Local Centre, which includes significant employment, recreational and social infrastructure. • This corridor will provide walking and cycling access to the Northern PT Hub. Without the connection access to the PT hub will be significantly lower, reducing walking and cycling catchment opportunities.
Woodcocks Road Upgrade (Western Section)	Currently no facilities	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses. • In particular this includes access to Mahurangi College, and access to employment opportunities at the eastern extent of Woodcocks Road.
State Highway 1 Upgrade	Currently no facilities	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses.

Proposed NOR	Existing Active Mode Facilities	Walking and Cycling Effect if the NOR does not proceed
(Southern Section)		• In particular this corridor links to the Warkworth Town Centre in the north, which includes significant employment, recreational and social infrastructure. • Access south to a new local centre, including a southern Public transport interchange will be compromised. • Access to Mahurangi College at the intersection of Woodcocks Road and SH1 by walking and cycling will be impacted, reinforcing private vehicle mode choice.
Matakana Road Upgrade	Section of footpath between Melwood Drive and Hill Street intersection	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses. • In particular this corridor links to the Warkworth Town Centre, which includes significant employment, recreational and social infrastructure.
Sandspit Road Upgrade	Currently no facilities	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses. • In particular this corridor links to the Warkworth Town Centre, which includes significant employment, recreational and social infrastructure.
Western Link South	New Corridor	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses. In particular this corridor links to the employment opportunities and provides a north/south link through the proposed growth area. • Without this corridor in place walking and cycling connectivity will be via the local and collector network and will likely be less direct, resulting in longer travel times for pedestrians and cyclists.
Sandspit Link	New Corridor	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses. In particular this corridor provides a link through the north eastern proposed growth area. • Without this corridor in place walking and cycling connectivity will be via the local and collector network and will likely be less direct, resulting in longer travel times for pedestrians and cyclists. This is particularly key for this corridor given the stream environment and topography.
Wider Western Link - North	New Corridor	• Access to employment and social amenities will be compromised, especially for immediately adjacent land uses. In particular this corridor links to the employment opportunities and provides a north/south link through the southern proposed growth area. • Without this corridor in place walking and cycling connectivity will be via the local and collector network and will likely be less

Proposed NOR	Existing Active Mode Facilities	Walking and Cycling Effect if the NOR does not proceed
		direct, resulting in longer travel times for pedestrians and cyclists. • This link provides a direct connection between Woodcocks Road and the proposed local centre adjacent to SH1. This corridor will provide an legible, efficient route for pedestrians and cyclists.

4.2.4.3 Public Transport

In terms of public transport the most significant change to the public transport environment in Warkworth is the provision of the Northern Public Transport Interchange and Park and Ride.

Without this NOR in place the following public transport impacts are expected:

- Increased congestion in the Warkworth Town centre with limited available space for layovers or charging. This will result in network frequencies being limited in response to available capacity.
- Insufficient capacity at the interim park and ride at Warkworth will result in increased on street all day parking, which will impact on local business and street amenity. Future demands for park and ride facilities are predicted to be some 250 spaces, 120 spaces greater than the interim facility. There will also be an increase in 'hide and ride' parking behaviour where commuters utilise local streets to park and utilise more frequent bus services.
- Public transport network interchanges will be limited to the Warkworth town centre, and with limited space, this will make quick and efficient interchanges difficult.
- Additional bus vehicle lanes can be provided within the proposed NOR for the Western Link North. Without this opportunity, buses will mingle with the general traffic and will have reduce efficiency accessing the PT Hub.

Further information is provided in Section 6.

4.2.4.4 General Traffic

The following table provides a summary of the expected traffic volumes on the transport network in 2048+ both without and with the NORS / Projects, together with an assessment of the outcomes expected to arise in the case that each NOR does not proceed.

In the case of new corridors, the traffic effects of a new corridor not being implemented is largely on the existing road network. At an area-level, the growth areas has been assessed to consider the vehicle to capacity ratios. At a network-level, it can be seen that the overall transport effects for traffic are acceptable. These results are summarised below.

Table 4-7: Vehicle KM in Peak Congestion

	Vehicle Km Travelled in peak congestion (>90% v/c) in AM peak (no NORs) in 2048+	Vehicle Km Travelled in peak congestion (>90% v/c) in AM peak (with NORs) in 2048+
Network Performance	475 vehicle-km travelled in congested conditions	185 vehicle- km travelled in congested conditions

In addition to this, for all intersections Auckland Transport and Waka Kotahi (where applicable) will manage the network to achieve and balance a range of outcomes, including traffic efficiency, user safety (for all modes), and prioritising movement by more sustainable modes, such as public transport and active modes. This shift from a singular focus on traffic delay to broader outcomes and prioritisation of more sustainable movements is ongoing and driven by regional and national policy directives. This includes recent policy direction around reallocating road space to favour these broader outcomes, where practicable. Collectively, this requires a broader assessment of needs and priorities of the transport system than just localised vehicle delays at selected intersections. Notwithstanding this, intersection performance is provided per NOR further in this report.

Mode shift towards public transport is a key outcome of the overall Warkworth network packages, and modal priorities are expected to change with less priority given to general traffic flow. In this regard, the future operating environment is anticipated to tolerate increased delay and queuing for general traffic, at certain intersections, at certain times.

Table 4-8: General Traffic and Freight Effects without the NOR for each Project

Proposed NOR	Without the NOR in 2048+	With the NORS in 2048+	General Traffic and Freight Effect if the NOR does not proceed
Northern Public Transport Interchange + Park and Ride and Western Link - North	New Corridor	The forecast Average Daily Traffic (ADT) in 2048 is 11,600 vehicles.	As growth increases in the area the current lack of an arterial network will reduce connectivity and result in a heavy reliance on the existing network around Warkworth. Without an arterial network, there will be an increasing reliance on the local and collector network. This will result in longer, less efficient bus networks, and safe cycle connections on desire lines would be limited. Without providing for through movement functions on arterials, there will likely be an increase in traffic utilising lower order corridors such as local and collector roads, with potential adverse effects on amenity and capacity. The Western Link - North is a key link as part of the Western Link Route. The route provides an alternative north-south connection to SH1 on the Warkworth transport network. Without this corridor, there will be a substantial increase in traffic volumes along SH1. This is significant as SH1 will remain a two-lane corridor in the future, resulting in a corridor that is at capacity, and provides poor levels of

Proposed NOR	Without the NOR in 2048+	With the NORS in 2048+	General Traffic and Freight Effect if the NOR does not proceed
			service for general traffic and freight accessing the corridor.
Woodcocks Road Upgrade (Western Section)	The forecast Average Daily Traffic (ADT) in 2048 is 7,000 vehicles.	The forecast Average Daily Traffic (ADT) in 2048 is 6,200 vehicles.	There is little effect from a general traffic outcome should the Project not proceed. Expected traffic volumes with and without the NOR are similar and no additional capacity to that existing is proposed.
State Highway 1 Upgrade (Southern Section)	The forecast Average Daily Traffic (ADT) in 2048 is 17,800 vehicles.	The forecast Average Daily Traffic (ADT) in 2048 is 15,400 vehicles.	There is little effect from a general traffic outcome should the Project not proceed. Expected traffic volumes with and without the NOR are similar and no additional capacity to that existing is proposed.
Matakana Road Upgrade	The forecast Average Daily Traffic (ADT) in 2048 is 11,100 vehicles.	The forecast Average Daily Traffic (ADT) in 2048 is 9,700 vehicles.	There is little effect from a general traffic outcome should the Project not proceed. Expected traffic volumes with and without the NOR are similar and no additional capacity to that existing is proposed.
Sandspit Road Upgrade	The forecast Average Daily Traffic (ADT) in 2048 is 15,100	The forecast Average Daily Traffic (ADT) in 2048 is 12,200	There is little effect from a general traffic outcome should the Project not proceed. Expected traffic volumes with and without the NOR are similar and no additional capacity to that existing is proposed.
Western Link South	New Corridor	The forecast Average Daily Traffic (ADT) in 2048 is 9,400 vehicles.	As growth increases in the area the current lack of an arterial network will reduce connectivity and result in a heavy reliance on the existing network around Warkworth. Without an arterial network, there will be an increasing reliance on the local and collector network. This will result in longer, less efficient bus networks, and safe cycle connections on desire lines would be limited. Without providing for through movement functions on arterials, there will likely be an increase in traffic utilising lower order corridors such as local and collector roads, with potential adverse effects on amenity and capacity. The Western Link South is a key link as part of the Western Link Route. The route provides an alternative north-south connection to SH1 on the Warkworth transport network. Without this corridor, there will be a substantial increase in traffic volumes along SH1. This is significant as SH1 will remain a two-lane corridor in the future, resulting in a corridor that is at capacity, and provides poor levels of

Proposed NOR	Without the NOR in 2048+	With the NORS in 2048+	General Traffic and Freight Effect if the NOR does not proceed
			service for general traffic and freight accessing the corridor.
Sandspit Link	New Corridor	The forecast Average Daily Traffic (ADT) in 2048 is 3,600 vehicles.	As growth increases in the area the current lack of an arterial network will reduce connectivity and result in a heavy reliance on the existing network around Warkworth. Without an arterial network, there will be an increasing reliance on the local and collector network. This will result in longer, less efficient bus networks, and safe cycle connections on desire lines would be limited. Without providing for through movement functions on arterials, there will likely be an increase in traffic utilising lower order corridors such as local and collector roads, with potential adverse effects on amenity and capacity. While not part of the Warkworth package, the Hill Street improvements will be impacted by the timing of the Sandspit Link. An additional benefit of this new connection is to allow trips to and from the Kowhai Coast settlements to reach Matakana and the strategic network without the need to travel through Hill Street Intersection. Without Sandspit Link, the proportion of traffic travelling through the Hills Street intersection will increase significantly. This is likely to have an adverse effect on general traffic and freight due to increased congestion and delays.
Wider Western Link - North	New Corridor	The forecast Average Daily Traffic (ADT) in 2048 is 6,100 vehicles.	As growth increases in the area the current lack of an arterial network will reduce connectivity and result in a heavy reliance on the existing network around Warkworth. Without an arterial network, there will be an increasing reliance on the local and collector network. This will result in longer, less efficient bus networks, and safe cycle connections on desire lines would be limited. Without providing for through movement functions on arterials, there will likely be an increase in traffic utilising lower order corridors such as local and collector roads, with potential adverse effects on amenity and capacity. The Wider Western Link is linked to the Southern Interchange with Ara Tūhono. Accordingly, the Southern Interchange, will not be able to be provided until such time that that Wider Western Link is in place, to provide access to the interchange. Therefore without the Wider Western Link in place, traffic will shift to SH1, in particular freight from adjacent industrial areas that need to access Ara Tūhono. The increased traffic volumes on SH1is significant as SH1 will

Proposed NOR	Without the NOR in 2048+	With the NORS in 2048+	General Traffic and Freight Effect if the NOR does not proceed
			remain a two-lane corridor in the future, resulting in a corridor that is at capacity, and provides poor levels of service for general traffic and freight accessing the corridor.

4.2.4.5 Property Access

Without the provision of each respective NOR there is expected to be no change to the existing access provisions for properties that gain access from the corridors.

4.2.4.6 Wider Network Effects

This is discussed under each respective NoR.

5 Warkworth NORS – Overall network

This section assesses common or general transport matters across the overall Warkworth Project i.e. the combination of public transport interchanges, existing road upgrades and new corridors. This section also recommends measures to avoid, remedy, or mitigate actual or potential adverse effects for the overall network. Matters unique or specific to each NOR are in subsequent chapters, in particular Sections 6 to 13.

5.1 Assessment of Positive Effects

5.1.1 Overall Positive Network Effects

Overall, the Warkworth Detailed Business Case identified a network that provides for a comprehensive transport solution that responds to planned growth. It is noted that this ITA considers these projects as a network and has an overall focus on the outcomes for the Warkworth area. The NORS are all proposed as separate projects and can be implemented progressively in coordination with progressive land use development.

The eight notices of requirement identified in this ITA are a core component of this network, with the proposed projects supporting the following transport outcomes:

- Long term development of a low carbon transport system to support future growth and facilitates mode shift from private vehicles to public transport and active modes to reduce greenhouse gas emissions.
- People living and working in Warkworth as part of the Satellite Town vision with direct freight connections to planned industrial land use and improved access to employment and social amenities.
- Transport corridors to maximise opportunities for walk up catchments to public transport interchanges and a high frequency local bus network.
- Increased reliability for public transport and additional resilience via urbanised alternative routes.
- Real travel choice with high quality, attractive alternatives to the private vehicle. This includes a contiguous, legible active mode network that connects people to key destinations and encourages active mode trips within the compact urban area.
- An area wide focus on safety through a holistic set of measures including Road to Zero safety principles, fully separated cycling facilities, well designed intersections and sufficient space for all modes to interact safely.

5.1.2 Walking and Cycling

The majority of the projects indicatively propose separated walking and cycling facilities on both sides of the corridor, which connect with expected future adjacent facilities. There are some corridors indicatively proposed to have alternative facilities for walking and cycling due to environmental and engineering constraints. These include:

- Sandspit Road – a shared offline boardwalk path adjacent to Sandspit Road from Vipond Culvert to Matakana Road integrating with facilities at the Hill Street intersection (not within scope of NOR 5)
- Matakana Road – a bidirectional cycle facility to integrate with the Hill Street Intersection walking and cycling infrastructure (not within scope of NOR 4)

- State Highway 1 – a bidirectional cycling facility from Woodcocks Road to McKinney Road, which will integrate with the State Highway 1 facilities and intersection improvements at Woodcocks Road (not within this scope of NOR 3)

These variations remain consistent with the objectives of Auckland Transport Vision Zero and comply with AT Transport Design Manual Standards.

The proposed walking and cycling facilities have been designed in accordance with relevant AT standards and policies as summarised in Table 5-1.

Table 5-1: Walking and Cycling AT Standards and Policies for the Walking and Cycling Upgrades

Policy/Standard	Network Component	Assessment
Auckland Transport Vision Zero[10]	Segregated walking and cycling facilities	Segregated walking and cycling facilities are proposed to provide a safe modal choice in the future environment. Vision Zero specifies that indicative proposed designs should feature separated cycling facilities for arterial corridors in excess of 30km/hr. The traffic speeds on the corridor are proposed to be 50km/hr, therefore the indicative proposed design of the walking and cycling facilities is considered to be appropriate for these standards.
AT Transport Design Manual[11]	Segregated walking and cycling facilities	A 1.8m footpath is has been allowed for on all corridors and a 2.0m cycle path. The total width of 6.8m is provided from carriageway to road boundary. This is in accordance with the AT TDM requirements.
	Offline paths	A section of Sandspit Road is proposed to include a boardwalk walk that is indicatively 5.0m wide. This complies with the AT TDM requirements.
	Bidirectional cycle facilities	A section of Matakana Road and State Highway 1 is indicatively proposed to have bidirectional cycle facilities. This are indicatively shown as approximately 4.0m wide. This complies with the AT TDM requirements.

Exact provision of walking and cycling crossing facilities will be confirmed at the detailed design stage and will be guided by Vision Zero guidance.

Overall, the projects will have a number of significant positive effects on walking and cycling as they will:

- Significantly reduce the likelihood and exposure to potential crashes as it will enable safe movement for vulnerable road users along and across the corridor.
- Improve integration with the future walking and cycling network, resulting in improved east-west and north-south walking and cycling connectivity.
- Lead to environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
- Support growth adjacent to the corridor and significantly improve safety and access to employment and social amenities.

[10] Auckland Transport: Vision Zero: https://at.govt.nz/media/1980910/vision-zero-for-tamaki-makaurau-compressed.pdf
[11] Auckland Transport – Transport Design Manual: https://at.govt.nz/about-us/manuals-guidelines/roads-and-streetsframework-and-the-transport-design-manual/

5.1.3 Public Transport

Overall, is anticipated that the expected growth in Warkworth will be supported by incremental improvements in public transport services. This includes the provision of new public transport routes, and increased frequency on existing routes. This improved public transport offering is necessary to support a shift to alternative modes and increase the attractiveness of public transport as a mode choice.

The increased public transport services are predominantly operational, and for NOR 2 through to NOR 8, there are no specific components of the designation to enable infrastructure-based measures in the carriageway such as bus lanes or bus priority measures at intersections. Sufficient capacity is expected within the intersections and vehicle lanes of these projects, and as such dedicated facilities are not warranted. Sufficient berm space has also been allocated along the corridors to facilitate bus shelters and bus stops.

NOR 1: Northern PT Hub includes sufficient corridor width to enable public transport priority lanes if necessary and also provides for the designation for the PT Hub itself – this is discussed further in Section 6.

A summary of these increased service frequencies provided below in Table 5-2.

Table 5-2: Future Public Transport Services

NoR	Corridor	Proposed Bus Service Levels
1	Western Link North and PT Hub	See Section 6.4.1 for more detail.
2	Woodcocks Road Upgrade (Western Section)	One core proposed frequent bus service which will use this portion of Woodcocks Road. This service is forecast to operate every 15 minutes in the peak commute hours, and every 30 minutes outside of the peak.
3	State Highway 1 Upgrade (Southern Section)	For future public transport services, there are two core proposed frequent bus services which will use this portion of SH1. The first service (995) is forecast to operate every 10 minutes in the peak commute hours, and every 15 minutes outside of the peak. The second service (996) is forecast to operate every 15 minutes in the peak commute hours, and every 30 minutes outside of the peak.
4	Matakana Road Upgrade	For future public transport services, there is one core proposed frequent bus service which will use this portion of Matakana Road. This service is forecast to operate every 15 minutes in the peak commute hours, and every 30 minutes outside of the peak.
5	Sandspit Road Upgrade	For future public transport services, there is one core proposed frequent bus service which will use this portion of Sandspit Road. This service is forecast to operate every 15 minutes in the peak commute hours, and every 30 minutes outside of the peak.
6	Western Link South	For future public transport services there is one core proposed frequent bus service which will use the Western Link - South. This service is

NoR	Corridor	Proposed Bus Service Levels
		forecast to operate every 15 minutes in the peak commute hours, and every 30 minutes outside of the peak.
7	Sandspit Link	For future public transport services, no bus routes proposed under indicative 2048 AT bus network along the Sandspit Link. However, the cross-section will provide adequate spacing to facilitate public transport and associated bus stops if bus services are proposed in the future.
8	Wider Western Link - North	For future public transport services there is one core proposed frequent bus service which will use the Northern portion of the Wider Western Link. This service is forecast to operate every 15 minutes in the peak commute hours, and every 30 minutes outside of the peak.

The proposed indicative cross-section provides adequate spacing to facilitate public transport and associated bus stops. The exact location of bus stops will be identified as part of detailed design for the project. Once greater certainty is available on the location of key land use activities, more certainty on high demand locations for bus stops can be determined, i.e. around centres and schools for example.

The positive operational effects on public transport for the above corridors are:

- Improved accessibility for future frequent public transport network
- Improved integration with the future public transport network and improved east-west connectivity, as well as improved access to employment and social amenities.
- Increased attractiveness and uptake of public transport trips which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.

Specific public transport effects related to NOR 8 is provided in Section 14.

5.1.4 Safety

The design of all projects have been undertaken with consideration of the latest safety guidance. This includes AT's Vision Zero and Waka Kotahi's Road to Zero. The new corridor is expected to result in positive effects on safety due to the:

- New, walking and cycling facilities (including separation), resulting in improved protection for vulnerable road users.
- New, walking and cycling crossing facilities (crossing the arterial) and at key intersections, resulting in a significantly safer environment for all road users.
- Appropriate urban speeds (e.g. 50km/h) and consequential reductions in the risk of Death or Serious Injuries (**DSIs**).

It is anticipated walking and cycling demands will increase significantly as the area urbanises and develops. Given the expected traffic volumes along the corridors, there will be a safety risk for active mode users travelling along the corridor without appropriate facilities. Therefore, the project has been designed to 50km/h posted speed and provides segregated walking and cycling facilities to reduce the likelihood and severity in the event of a crash.

Existing crash records have been provided in Appendix 2. Itis critical to note that while this information has been provided, consideration should be given to several key matters when considering the relevance of this historic data to the future environment:

- An objective of each of the NORS is to support a safe transport network for all users. This is reflected in the indicative design with proposed designation footprint sufficient to deliver this.
- The context of the surrounding land use in these areas. In particular Warkworth growth area for the five years assessed has been a mix of rural, transitioning rural to urban and urban. Accordingly, the roading network reflects these changes, with some roads changing from urban to rural within the time period, and others predicted to change in the future
- Speed limit bylaw changes. Several key corridors have been subject to speed reductions as part of rolling safety initiatives implemented by Auckland Transport and Waka Kotahi
- The crash records are reflective of the current transport demand on these corridors. In general, current active mode (walking and cycling) use of these corridors is very low (due to the lack of safe and attractive facilities).
- At a regional level in Auckland between 2014 and 2020, 57% of all fatalities were people travelling outside vehicles (pedestrians 27%; cyclists 8.1%; motorcyclists 21.6%). Although it is difficult to get a clear trend from 2020 data due to Covid-19 lockdowns and incomplete finalising of reporting, there does not appear to have been any notable improvements to the relative safety of Vulnerable Transport Users on foot, bike and motorcycle since 2017, while there has been some improvement to the DSI for people inside motor vehicles[12].
- The count data from CAS also significantly underplays the true extent of serious harm to transport users outside motor vehicles, as identified by Ministry of Health hospital data.[13]

Overall, the indicative proposed design is well aligned with the transport safety principles from AT and Waka Kotahi. It will provide a safe transport corridor and reduce the risk of a DSI occurring, resulting in positive effects for all road users.

It is noted that the prior to implementation of the projects, further detailed design will be completed to confirm the walking and cycling facilities that will be provided. Accurate projections of DSI reductions require confirmation of the detailed design and an understanding of demands and certainty of landuse activities. As such, for the purpose of designation and footprint allocation, the approach of provision of segregated facilities compliant with the Auckland Transport Design Manual is considered appropriate and will maximise positive safety outcomes.

5.2 Assessment of Construction Effects

5.2.1 Construction Effects Related to All NORs

It is anticipated that the larger part of works required for this package of projects will likely be adjacent to or in the live carriageway, which means that temporary traffic management will be required. The scale of temporary traffic management to delineate live traffic away from the construction zones is largely dependent on the various stages and requirements of the construction activities. It is expected that short term temporary road closure for nights or weekends may be required for some specific activities, such as road surfacing, traffic switches and gas relocation. Other activities may require

[12] https://at.govt.nz/media/1986346/2021-report-on-auckland-road-safety-bir-2018-recommendations-implementation-final.pdf
[13] ViaStrada VRU Study, 2021

stop/go or contraflow traffic management, such as drainage, utility relocation, survey and investigation work.

The effect of temporary road closure or other traffic management methods to existing traffic on the specific corridor and adjacent road network should be confirmed in the future as part of the CTMP for each project on the basis of the current traffic environment. This will take into account the level of growth and activities that has occurred in Warkworth, the availability of the alternative routes, and any additional sensitive land use activities.

The construction of the projects will each likely require significant earthworks. Final cut and fill volumes will be confirmed following detailed design prior to construction. The construction traffic movements to accommodate the earthworks will likely result in the increase of traffic volumes on construction routes used during the construction period of each of the projects.

Given the construction timing and staging of the package has yet to be determined, there is a degree of uncertainty associated with any predicted construction methodology and associated traffic routes. This means:

- The routes that will be used by construction vehicles will depend on the location of quarries and disposal sites which are not yet certain.
- The exact location and extent of compound sites/lay down areas has yet to be determined.
- The timing of construction of other projects could impact on likely construction vehicle routes, for example, if the Wider Western Link – (Northern Section) is constructed prior or after to the upgrade of Woodcocks Road.

Notwithstanding this, it is considered that with available connectivity to the strategic network and available capacity in the network, construction traffic will be able to be readily accommodated.

It is noted that the access to compound sites/laydown areas and construction zone for construction vehicles, plant and materials will be via site access points identified as part of future CTMPs.

Details of the routes and time restrictions will need to be updated and refined as part of the CTMP process. It is anticipated that the routes for construction traffic will likely be limited to arterial corridors and intersections with the provision of adequate vehicle tracking. With State Highway 1 (SH1) as a Level 1A freight route, it is recommended that this corridor is used where practicable.

Speed Limits

In order to maintain the safety of all road users, it is recommended to implement a safe and appropriate temporary speed limit during the construction period on the network within the extent of works, and along the construction routes if needed. This should be in accordance with the latest traffic management standards at the time of construction. These recommended measures and other measures highlighted in the CTMP are expected to reduce the potential safety risks that may be associated with construction traffic.

Pedestrians and cyclists

The existing provision for pedestrian and cyclists is variable across the network. It is likely that the demand for these modes will increase if urbanisation occurs prior to construction, but future parallel collectors could also be used as alternative routes. Therefore, effects should be assessed again when a greater level of detail is available about surrounding facilities and land use activities prior to

construction. However, it is recommended that residents and stakeholders be kept informed of construction times and progress, and general observations of pedestrian and cyclist activity be used to inform appropriate traffic management measures in the CTMP.

Property access for residents and businesses

During the time of construction, there will be temporary traffic management controls such as temporary concrete or steel barriers. Existing driveways that remain during construction will be required to have temporary access provision. It is anticipated that the contractor should undertake a property specific assessment of any affected driveways and provide temporary access arrangements if required. The temporary access should ensure the ability for residents to safely access and exit the property. These requirements should be captured in the CTMP or SSTMP, if required. It is noted that significant land use change is expected along these key arterials, for example The Grange centre on SH1. As such, confirmation of traffic management controls will be required immediately prior to works to reflect the land use considerations at that time.

Construction Movements - Timing

Warkworth is located in proximity to the State Highway network and also in proximity to very popular recreational areas for the wider Auckland Area. The area currently experiences significant congestion in peak periods such as public holiday weekends and over the Christmas/New Year period.

As such, the development of the CTMP prior to construction of any of the projects will need to consider the implications on construction movements through the Hill Street Intersection. The CTMP will need to consider if the Hill Street intersection has been upgraded as planned, the performance of the intersection post opening of Ara Tūhono and Tūhonohono ki Tai and construction movement timings in peak periods including holiday periods. A specific condition is as such recommended to require these considerations once implementation timing and likely construction routes are confirmed.

Land use activities that will need further consideration in the CTMP

The following table provides a summary of the key land use or activities that are located adjacent to the corridors and will need consideration during the development of the CTMP. This could include restricted truck movements during school pick up and drop off, or additional controls at key access locations. The below is not a final or complete list, with land use changes likely, this list will change over time.

Table 5-3: Sites for Consideration within future CTMP

Corridor	NOR	Sites for Specific Consideration
Northern Public Transport Interchange + Park and Ride and Western Link - North	1	• No specific sites identified
Woodcocks Road Upgrade (Western Section)	2	• Mahurangi College • New MOE school site at 100 Woodcocks Road

Corridor	NOR	Sites for Specific Consideration
State Highway 1 Upgrade (Southern Section)	3	• No specific sites identified
Matakana Road Upgrade	4	• No specific sites identified
Sandspit Road Upgrade	5	• Quarry Site
Western Link South	6	• No specific sites identified
Sandspit Link	7	• Quarry Site
Wider Western Link - (Northern Section)	8	• No specific sites identified

5.2.2 Temporary Traffic Management Effects Assessment

It is considered that temporary effects from the construction activities on network can be adequately managed through the implementation of a CTMP during the construction phase of each Project. The purpose of the CTMP is to ensure the construction of each Project is managed in such a way that enables safe and efficient movement of local traffic throughout the construction period and to minimise disruption to road users, particularly the adjacent residential properties and local activities. If required, SSTMP should be developed to manage constraints on access to affected properties.

5.2.3 Recommended measures to avoid, remedy or mitigate construction effects

It is considered that the potential construction traffic effects can be accommodated and managed appropriately via a CTMP. Based on the assessment of transport construction effects, it is recommended:

Condition 18: Construction Traffic Management Plan (CTMP)

a. A CTMP shall be prepared prior to the Start of Construction for a Stage of Work.
b. The objective of the CTMP is to avoid, remedy or mitigate, as far as practicable, adverse construction traffic effects.
c. Particular consideration is to be given to the Hill Street intersection (being the intersection of State Highway 1, Hill Street, Elizabeth Street, Matakana Road, Sandspit Road and Millstream Place);
   To achieve this objective, the CTMP shall include:
   i. methods to manage the effects of temporary traffic management activities on traffic;
   ii. measures to ensure the safety of all transport users;
   iii. the estimated numbers, frequencies, routes and timing of traffic movements, including any specific non-working or non-movement hours to manage vehicular and pedestrian traffic near schools or to manage traffic congestion
   iv. site access routes and access points for heavy vehicles, the size and location of parking areas for plant, construction vehicles and the vehicles of workers and visitors;
   v. identification of detour routes and other methods to ensure the safe management and maintenance of traffic flows, including pedestrians and cyclists, on existing roads;
   vi. methods to maintain vehicle access to property and / or private roads where practicable, or to provide alternative access arrangements when it will not be;
   vii. the management approach to loads on heavy vehicles, including covering loads of fine material, the use of wheel-wash facilities at site exit points and the timely removal of any material deposited or spilled on public roads; and
   viii. methods that will be undertaken to communicate traffic management measures to affected road users (e.g. residents / public / stakeholders / emergency services).
   ix. Auditing, monitoring and reporting requirements relating to traffic management activities shall be undertaken in accordance with the Waka Kotahi Code of Practice for Temporary Traffic Management.

6 NOR 1 – Northern Public Transport Hub + Park and Ride and Western Link - North

This section assesses specific transport matters relating to NOR 1 – Northern Public Transport Hub, Park and Ride and Western Link – North.

6.1 Overview and description of works

The Northern Public Transport Hub is a new long-term public transport interchange located in the northern growth area. The key outcomes sought by the delivery of the hub include:

- a long-term public transport facility to support progressive development in the Northern growth area and expected brownfield development in the existing urban area in Warkworth.
- a facility to address Warkworth town centre constraints including a lack of layover facilities, staff facilities and limited bus stops.
- a key facility that can be utilised to achieve an integrated public transport connectivity without reliance on the implementation of the southern interchange with Ara Tūhono.

6.1.1 Northern Public Transport Hub

The Northern Public Transport Hub is anticipated to include the following facilities:

- Four active bus stops.
- Capacity for at least five services (terminating and through).
- Two layover spaces - includes long distance coaches to Northland.
- Kiss and ride drop off facilities.
- Bus Driver/Staff facilities to be provided for including a break room and a toilet which could be integrated with public toilets potentially.
- Cycle parking integrated/built into buildings/shelters.

In addition to providing for local bus services, walking and cycling trips, it is proposed that the PT Interchange is supplemented with park and ride facility with capacity for up to 250 vehicles.

6.1.2 Western Link - North

The PT hub will connect to the Western Link North. The portion of this corridor that is being assessed as part of this NOR extends from SH1/ Tūhonohono ki Tai through to the proposed bridge crossing, enabling a connection for development in the Warkworth Northern Precinct as provided for in the Warkworth North Precinct (AUP).

It is proposed that the new corridor will allow for an four lane urban arterial cross section with separated cycle lanes and footpaths on the corridor. An indicative cross section is shown below in Figure 6-1.

Figure 6-1: Indicative Design of the Western Link - North

6.2 Existing Public Transport Environment

In comparison to the other proposed NOR, further consideration of the existing public transport environment was considered pertinent to demonstrate the necessity of a new public transport hub. The following section provides an overview of the existing public transport network, with a particular focus on the northern growth area.

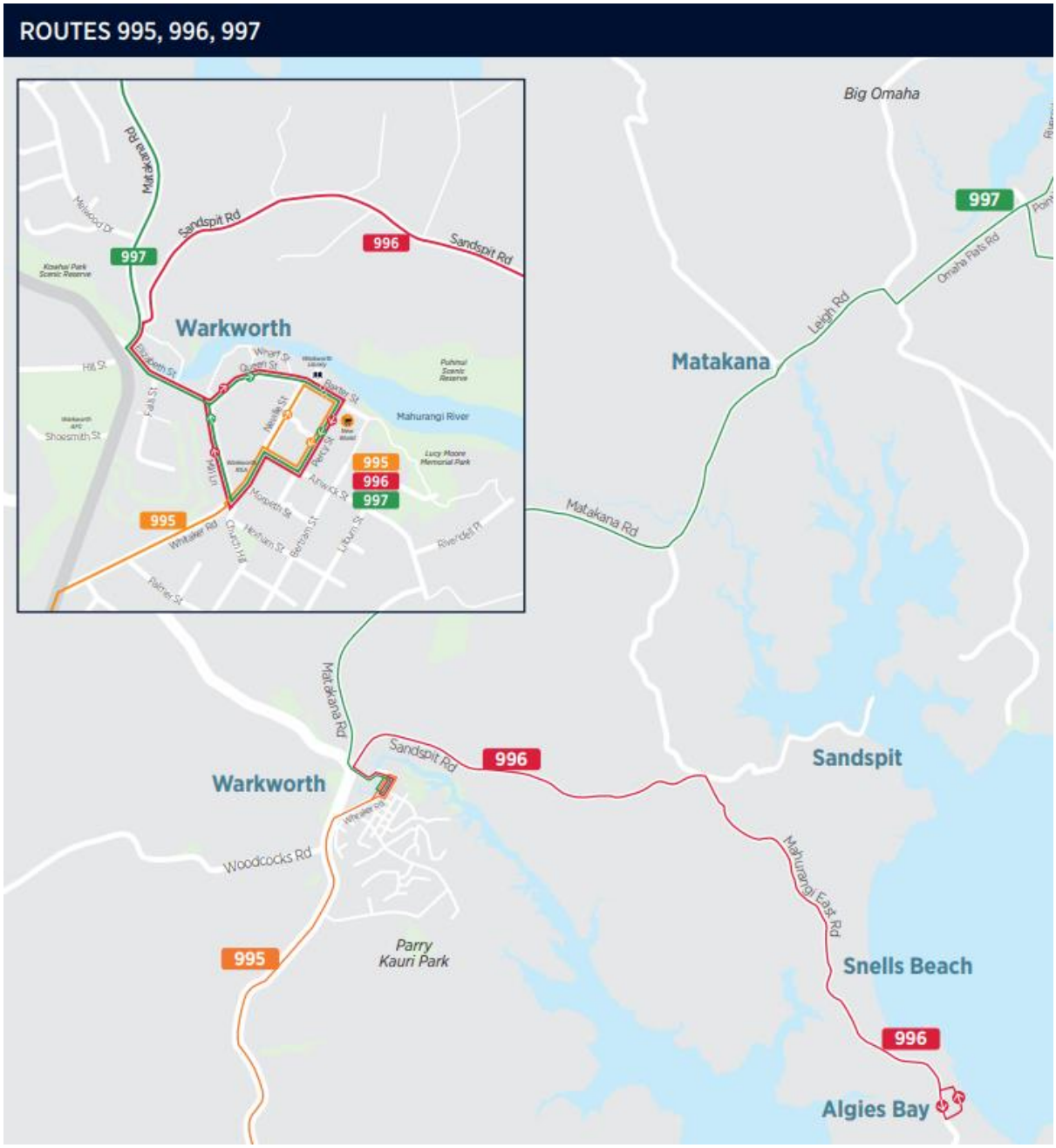
6.2.1 Existing Public Transport Network

The existing public transport network is largely reflective of the predominantly rural or semi-rural environment in Warkworth. The buses are relatively infrequent and in the case of Auckland City bound services – supplemented by private bus services (Mahu Express). Table 6-1 below and Figure 6-2 below summarise the existing public transport network.

Table 6-1: Existing Frequency of Public Transport Services

Service	Frequency
Route 995	Monday to Friday: Every 30mins in the peak, hourly in the day. Saturday and Sunday: Hourly services
Route 996, 997 and 998	Monday to Friday: Every 90minutes Saturday and Sunday: Every two hours
Mahu Express (Private Service)	Monday to Friday – two peak hour services in morning and evening

Figure 6-2: Existing Public Transport Services



6.2.2 Existing Public Transport Facilities

As can be seen in the network map, the core focus of the route services are focused on the Warkworth Town Centre. The current centre experiences significant congestion and has limited facilities for drivers, layover facilities and other ancillary activities such as electric charging.

To address this immediate need, the Rodney Local Board worked with Auckland Transport to provide an interim facility in the north of Warkworth. The interim facilities include 137 parking spaces, two bus stops and a bus layover.

Figure 6-3: Interim Warkworth Community Transport Hub

Through engagement with the Rodney Local Board, it has been confirmed that they have medium to long-term aspirations for land adjacent to the site, as part of wider redevelopments of Council land in the area, including a sports centre and other social infrastructure.

While the site has been designed to support an immediate need, it is bound by SH1 and the Mahurangi River with limited opportunities to expand. The site is not adequate to accommodate the forecasted increase in demand for park and ride, bus stops, bus layovers and charging facilities. It also does not provide sufficient space to provide for driver facilities required to support operational increases in bus services.

6.3 Future Public Transport Environment

The future public transport network in Warkworth is expected to include an increase in the number of routes and also the frequencies of all routes.

In the long term, Figure 6-5 shows the proposed routes based on current land use expectations. This includes the implementation of the southern interchange in the longer term. The network has also been developed to operate effectively without the southern interchange, as shown in Figure 6-4.

In terms of operational frequencies the following changes are expected

- Services 996, 997 and 998 to increase to every 15 minutes, 30 minutes off peak
- A new local service (999) linking Warkworth Town Centre and local centres in North Warkworth and South Warkworth every 15 minutes in the peak, 30 minutes off peak
- 995 service to increase to every 10 minutes in the peak, 30 minutes off peak

Figure 6-4: Long Term Public Transport Network without Ara Tūhono Southern Interchange

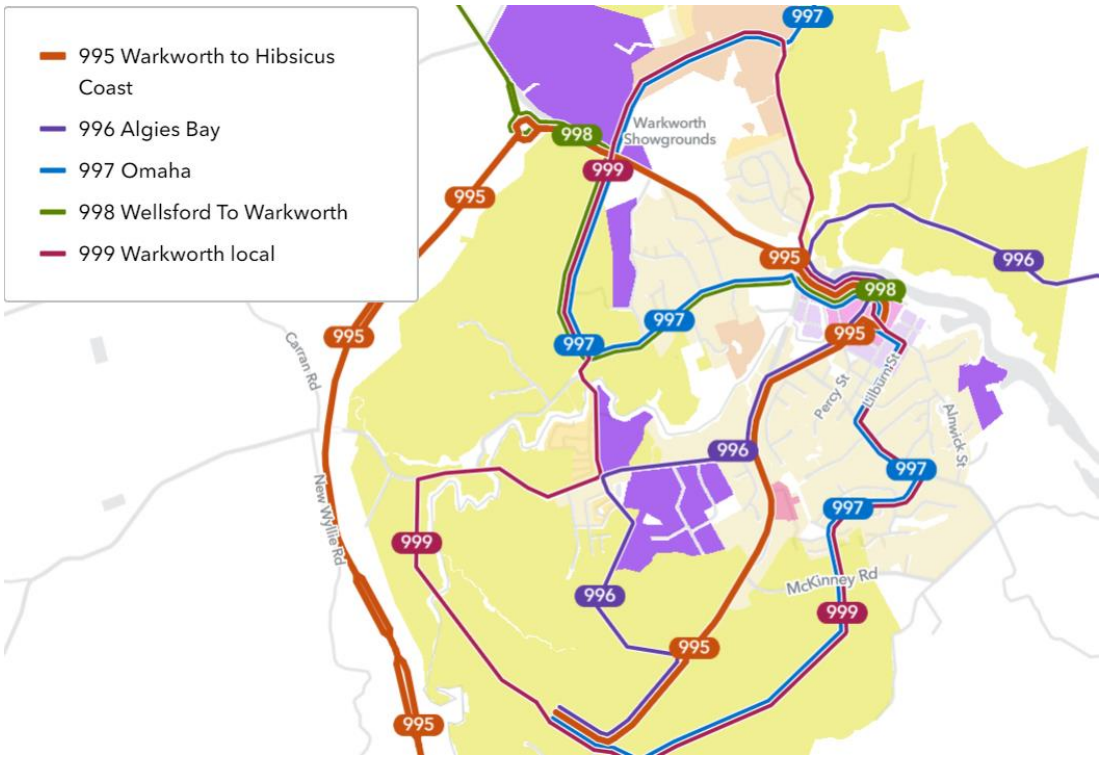
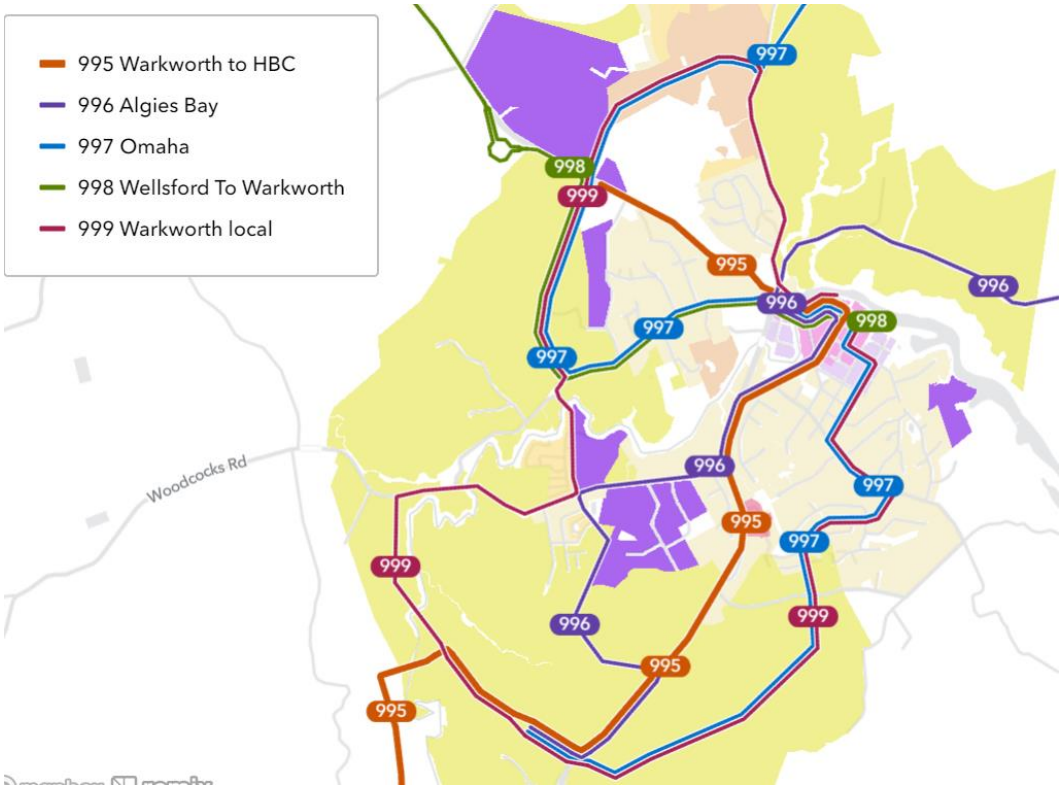


Figure 6-5: Long Term Public Transport Network with Ara Tūhono Southern Interchange



With the implementation of the southern interchange, the network will remain largely as existing with the exception of the 995 route. This will be reorientated to take advantage of access to the strategic network from the Southern Interchange. Interregional services are expected to continue utilising the northern Bus Hub/ Interchange and the motorway northern interchange with Ara Tūhono. The park and ride will remain with the northern station, consistent with the objectives of capturing hinterland trips, and locations on the edge of urban areas.

There will be a slight increase in bus journey times for those that travel by private vehicle to the Park and Ride. This is as a result of the rerouting of the 995. Overall, this is considered to be minor in the context of wider journey lengths to Auckland by bus, and the wider benefits to local residents that will catch the 995 without utilising park and ride facilities or needing to transfer from local services.

6.4 Assessment of Operational Transport Effects

6.4.1 Public Transport

For future public transport services there are three frequent bus services which will use the Western Link – North. These include:

- The 999, 889 and 997 services are forecast to operate every 15 minutes in the peak commute hours, and every 30 minutes outside of the peak.

The cross-section will provide adequate spacing to facilitate public transport and associated bus stops. The exact location of bus stops will be identified as part of detailed design for the project. Once greater certainty is available on the location of key land use activities, more certainty on high demand locations for bus stops can be determined, i.e. around centres and schools for example.

In order to maintain reliability and efficient bus movements, a four-lane corridor has been allowed for on the Western Link North.. This corridor with some 12,000 vehicle per day and 12 buses an hour will benefit from dedicated bus lanes in peak periods, enabling fast and reliable access to the PT Hub.

6.4.1.1 Northern Bus Hub / Interchange

An island hub arrangement is required to facilitate at least four services (terminating and through) with no reserving movements within the hub. This arrangement is similar to other northern busway hubs, consistent with AT's Transport Design Manual and has been developed in consultation with AT subject matter experts.

The Northern Bus Hub/Interchange is anticipated to include the following facilities:

- Four active bus stops
- Capacity for at least five services (terminating and through) Note: no reverse movements within the transport hub, so turning facilities to be considered in overall shape and dimensions
- Two layover spaces - includes long distance coaches to Northland
- Kiss and ride drop off facilities
- Bus Driver/Staff facilities to be provided for including a break room and a toilet which could be integrated with public toilets potentially.
- Cycle parking integrated/built into buildings/shelters

To accommodate the above facilities the spatial area required is between 2,000 – 2,400m². These areas are indicative and further design is recommended prior to implementation to refine the functionality of

the hub within the network. This may consider the immediate demands on the network, whilst also considering longer aspirations.

6.4.1.2 Park and Ride

Transport modelling indicates that once fully developed, private vehicle demand in Warkworth for a northern transport interchange and Park and Ride facility in the morning peak is approximately 300 trips. This includes a proportion of drop offs and kiss and rides, with approximately 70 – 80% of car-based demand expected to be seeking to utilise the park and ride.

Accordingly, a provision of a park and ride capacity of some 220 – 250 spaces is considered appropriate. This represents a 30% capture of people traveling south to Auckland from the hinterland around Warkworth. It should be noted that the hub will also accommodate a kiss and ride zone, cycle parking, and is anticipated to serve walk-up catchment. These attributes are expected to encourage more users through the hub as opposed to the car park facilities alone.

It is also noted that it is important to strike a careful balance between park and ride provision, and provision of higher frequency local services. Door to door travel by bus should be supported, and in some cases a high provision of Park and Ride spaces can be detrimental to local services, and work against encouraging travellers to use local services and transfer at the interchange. As such, an overall provision of 220 – 250 spaces is considered to be appropriate.

The current facility located on State Highway 1 provides for some 135 park and ride spaces and will be insufficient to support increasing demand resulting from projected urban growth.

6.4.1.3 Overall Public Transport Effects

The project's operational effects on public transport are:

- Improved accessibility for future frequent public transport network along the Western Link. This will facilitate access to the proposed medium-density residential growth and local town centre located along the corridor.
- Improved integration with the future public transport network and improved north-south connectivity, as well as improved access to employment and social amenities.
- Increased attractiveness and uptake of public transport trips which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.

In addition, there are several operational effects related to the provision of the Northern PT interchange and Park and Ride. These include:

- Improved access to public transport for communities to the north of Warkworth, maximising mode shift from the hinterland
- Improved opportunity to intercept vehicles from wider area, resulting in reduced travel through the urban of Warkworth

6.4.2 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The

Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 11,600 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 1,160 vehicles. A two-lane corridor can efficiently accommodate 11,600 vehicles and therefore the proposed corridor design meets the forecasted needs, with the additional lane provision to accommodate greater bus priority.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 6-2.

Table 6-2: Western Link - North Intersection Performance

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Western Link - North /SH1/ Matakana Link Road	Morning Peak	C	0.522	71.2
	Evening Peak	C	0.545	71.1

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

6.4.3 Property Access

The Western Link - North is expected to be a limited access corridor in the future. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to corridor where practicable.

The collector network has been indicatively identified by the Warkworth Structure Plan; however it is expected that these will be subject to change as developers progress these connections through the plan change process. These will be assessed by standard planning and approval processes through Council.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways. There are no specific properties that have been included within the designation for this purpose and all existing driveways are expected to be able to be reinstated.

In addition, an opportunity exists to improve access to a cemetery site located to the west of the PT Hub. Access to this cemetery is currently via State Highway 1 and turning movements are compromised by high traffic volumes and multiple lanes.

6.4.4 Freight

Given the adjacent medium-density residential growth and local town centre, the Western Link - North is not expected to be a key strategic freight route in the future. However, as the corridor connects to heavy industrial land use further south, a small proportion of freight may travel through the corridor to access Ara Tūhono in North Warkworth. It is expected that these freight numbers won't warrant any specific freight provisions in the future.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

6.4.5 Wider Network Effects

The Western Link - North provides a connection for all modes to access the planned growth within North Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. This will allow improved accessibility to the Northern PT Hub for those travelling by active modes. This will encourage the use of active mode trips as last mile trips from the adjacent residential growth within North Warkworth. Therefore, the development of this new connection will have an overall positive network effect on walking and cycling.

For freight, general traffic and PT, the location of the corridor has a positive network effect by facilitating access to the residential growth and local town centre adjacent to Northern PT Interchange. For PT, the development of the Western Link - North , includes bus priority lanes which is in response to the higher-frequency bus services expected along the corridor. This will provide sufficient priority for buses travelling along the corridor and improve access to wider Warkworth from the Northern growth area.

6.5 Project Interdependencies

The Northern Public Transport Hub, Park and Ride and Western Link - North has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network.

The project interfaces with three connections as part of the planned growth within North Warkworth, this includes Tūhonohono ki Tai, existing SH1 and the Western Link. The full benefits of the project, particularly for PT within North Warkworth will not be realised until all of these projects are completed. This is due the key role that the project plays by supporting local services travelling within North Warkworth.

In addition to the requirements of the Urban Design and Landscape Condition, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of any interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.
- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

6.6 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved public transport outcomes, and active mode improvements, improving safety for those that walk and cycle. There are no identified adverse operational effects. There is considered to be a significant opportunity improve access to the cemetery adjacent to the project.

In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

7 NOR 2 – Woodcocks Road Upgrade (Western Section)

This section assesses specific transport matters relating to NOR 2 – Woodcocks Road (Western Section).

7.1 Overview and description of works

Woodcocks Road is an existing arterial corridor on the Warkworth network. The corridor extends from SH1 in the east to Wylie Road in the west. In addition, the corridor connects to several key north-south links in south-west Warkworth such as the Wider Western Link – (Northern Section).

The Woodcocks Road upgrade extends along the rural portion of the corridor between Mansel Drive and Wylie Road. It is proposed that the existing rural corridor be upgraded to accommodate an indicative two lane urban arterial cross section with separated cycle lanes and footpaths the corridor. It includes upgrades to the intersection of Wylie Road, which will also form the connection point for the Wider Western Link.

Figure 7-1: Woodcocks Road Upgrade Indicative Design

Key features of the proposed new corridor include the following:

- Widening of the rural portion of Woodcocks Road to a 24m two-lane cross section, including separated cycle lanes and footpaths on both sides of the corridor.
- Localised widening around the existing intersections to accommodate new intersection forms.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

7.2 Assessment of Operational Transport Effects

7.2.1 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 6,200 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 620 vehicles. A two-lane corridor can efficiently accommodate 6,200 vehicles and therefore the proposed corridor design meets the forecasted needs.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 7-1.

Table 7-1: Woodcocks Road Upgrade Intersection Performances

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Woodcocks Road/Wider Western Link – (Northern Section) – Single-lane roundabout	Morning Peak	A	0.202	9.8
	Evening Peak	A	0.276	12.5

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

7.2.2 Property Access

As a future arterial corridor, Woodcocks Road is expected to be a limited access corridor. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to corridor where practicable.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways. There are no specific properties that have been included within the designation for this purpose and all existing driveways are expected to be able to be reinstated.

7.2.3 Freight

The urban section of Woodcocks Road (between SH1 and Mansell Drive) is currently a Level 1B freight route within Auckland Transport's Strategic Freight Network Map[14]. It is noted that with the continued industrial land use along the corridor, Woodcocks Road is expected to be a strategic freight route in the future. In addition the location of the Southern Interchange to the south of Woodcocks Road, will further encourage strategic freight trips to occur through the corridor to adjacent industrial areas. It is noted that there is an existing school on Woodcocks Road (Mahurangi College) and a new proposed school to the west adjacent to the proposed NoR. In this case, it is considered that the implementation of walking and cycling as part of the NOR are important to minimise potential conflicts as a result of the combination of land use on this corridor.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

7.2.4 Wider Network Effects

The Woodcocks Road (western section) upgrade provides a connection for all modes to access the planned growth within South-West Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. The facilities along this corridor will connect to adjacent north-south active mode facilities on the Wider Western Link – (Northern Section) and Western Link. In combination, these connections will provide a complete, legible active mode network within South-West Warkworth. This will allow improved accessibility for those travelling by active modes to local amenities and employment opportunities. Therefore, the upgrade to Woodcocks Road will have an overall positive network effect on walking and cycling.

For freight, general traffic and PT, the location of the corridor has a positive network effect by facilitating access to land use adjacent to the corridor as well as the strategic motorway network (via the Wider Western Link).

7.3 Project Interdependencies

The upgrade to Woodcocks Road (western section) has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network. The Urban Design and Landscape Plan condition requires that these matters be confirmed prior to implementation.

The two key projects within the Warkworth Package that integrate with this project include the Wider Western Link and Western Link (North and South). These two new corridors will connect with Woodcocks Road, providing alternative routes to Woodcocks Road. They are however unlikely to be

[14] https://mahere.at.govt.nz/portal/apps/webappviewer/index.html?id=53d7df8746c049a1a4f7872312190001

implemented prior to land use release in the south and are not required to be in place prior to the Woodcocks Road upgrade. The upgrade of Woodcocks Road can occur independent of these projects, and the walking and cycling benefits in particular are considered to be highly beneficial once land adjacent to Woodcocks Road is released.

These two projects interface with the Woodcocks Road project at key intersections and in order to support the implementation of these projects within the context of timing uncertainties, the designations are proposed to overlap. In addition to the overlapping designation at the intersections, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of any interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.
- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

Outside of the Warkworth Package, the proposed southern interchange with Ara Tūhono also influences transport movements in Warkworth. The table below provides a summary of the transport volumes expected on Woodcocks Road with and without the interchange in place. As can be seen, the provision on the interchange result in an increase of 700 vehicles per day on Woodcocks Road.

Traffic Volumes on Woodcocks Road with Southern Interchange	**Traffic Volumes on Woodcocks Road without Southern Interchange**
8,400 vehicles per day	7,800 vehicles per day

As noted above, the generally accepted capacity of a two-lane corridor is 1,500 to 2,400 vehicles per peak hour. While the southern interchange is predicted to increase the volumes of vehicles on the corridor, it remains within the overall capacity of the corridor. There is expected to be a corresponding increase in freight movements as a result of the interchange, however this is also expected to be within the operating capacity of the corridor.

7.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects.

At the time of implementation, the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network. For Woodcocks Road this will include consideration of the existing land use activities which will likely include light industrial activities, residential and educational activities. The Urban Design and Landscape Plan condition requires that these matters be confirmed prior to implementation.

8 NOR 3 – State Highway 1 (Southern Section)

This section assesses specific transport matters relating to NOR 3 – State Highway 1 (Southern Section).

8.1 Overview and description of works

State Highway 1 is an existing strategic motorway connection on the Warkworth network. The State Highway 1 (Southern Section) upgrade is for the portion of the corridor between Fairwater Road and the edge of the Future Urban Zone. It is proposed that the existing corridor be upgraded to accommodate an indicative two lane urban arterial cross section with separated cycle lanes and footpaths on the corridor. It includes upgrades to the intersections at Fairwater Road, McKinney Road and a new intersection with the Wider Western Link.

The indicative proposed design includes two general vehicle lanes and new facilities for walking and cycling as shown in Figure 8-1

Figure 8-1: SH1 (Southern Section) Upgrade Indicative Design

Key features of the proposed new corridor include the following:

- Widening of the existing road corridor to a 24m two-lane cross section, including separated cycle lanes and footpaths on both sides of the corridor.
- Localised widening around the existing intersections to accommodate new intersection forms.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

8.2 Assessment of Operational Transport Effects

8.2.1 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 15,400 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 1,540 vehicles. A two-lane corridor can efficiently accommodate 15,400 vehicles and therefore the proposed corridor design meets the forecasted needs.

It is noted that existing traffic volumes on State Highway 1 south of McKinney Road are currently in the vicinity of 18,700 vehicles per day, and in 2019 averaged 24,500. Given that the projected volumes are lower than existing, even with the introduction of intersections at McKinney Road and the Wider Western Link, a two lane corridor is considered to provide sufficient vehicle capacity.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 8-1.

Table 8-1: SH1 (Southern Section) Intersection Performances

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
SH1/ Fairwater Road – signalised intersection	Morning Peak	B	0.275	46.7
	Evening Peak	B	0.228	39.5
Western Link – South/ SH1/ Mckinney Road – signalised intersection	Morning Peak	C	0.738	84.5
	Evening Peak	C	0.829	107.3
SH1/ Wider Western Link – (Northern Section) – single lane roundabout	Morning Peak	A	0.413	26.8
	Evening Peak	A	0.540	34.1

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

8.2.2 Property Access

SH1 (southern section) is expected to be a limited access corridor in the future. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to corridor where practicable.

The collector network has been indicatively identified by the Warkworth Structure Plan; however it is expected that these will be subject to change as developers progress these connections through the plan change process. These will be assessed by standard planning and approval processes through Council.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways.

No specific access effects have been identified for this NOR.

8.2.3 Freight

This portion of SH1 is currently a Level 1A freight route within Auckland Transport's Strategic Freight Network Map[15]. This is due to the lack of alternative strategic motorway connections between Warkworth and the rest of Auckland. However, with the development of Ara Tūhono (Puhoi - Warkworth) motorway, SH1 will likely play a supplementary role in the future as the majority of freight gets re-routed to the new motorway.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

8.2.4 Wider Network Effects

The SH1 (southern section) upgrade provides a connection for all modes to access the planned residential growth within South Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. The facilities along this corridor will connect the residential growth adjacent to the corridor with the proposed town centre and Southern PT Interchange (not subject to NOR) adjacent to the Wider Western Link.

In addition, the corridor will connect with adjacent east-west active mode facilities along the Wider Western Link – (Northern Section) and Western Link - South. In combination, these connections will provide a complete, legible active mode network within South Warkworth. This will allow improved accessibility for those travelling by active modes to local amenities and employment opportunities Therefore, the upgrade to the southern section of SH1 will have an overall positive network effect on walking and cycling.

For freight, general traffic and PT, the upgrade of the corridor has a positive network effect by facilitating access to South Warkworth.

[15] https://mahere.at.govt.nz/portal/apps/webappviewer/index.html?id=53d7df8746c049a1a4f7872312190001

8.3 Project Interdependencies

The upgrade to SH1 (southern section) has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network.

The SH1 (southern section) upgrade connects with two new connections as part of the planned growth within South Warkworth, this includes the Wider Western Link and Western Link – South. While the upgrade to SH1 could be implemented prior to the delivery of these new connections with no adverse effect, the full network benefits particularly for walking and cycling within South Warkworth will not be realised until all of these projects are completed. To manage these effect overlapping designations are proposed for these key intersections.

The State Highway 1 and Western Link intersection are inherently linked due to the limited site distances at the intersection. This intersection location provides the best connectivity for all modes and supports an integrated network with direct links. However, sight lines to the north of the intersection are limited. As such, the State Highway 1 projects includes a lowering of the corridor in this location to enable clear visibility. To address this, the designation for the Western Link South and also includes a portion of State Highway network to ensure that these works are carried out as part of the connection.

In addition to the overlapping designation at the intersections, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of any interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.
- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

The development of the new Ara Tūhono (Puhoi - Warkworth) motorway is key to the future operation and function of the existing SH1. The new motorway is expected to carry a significant proportion of vehicle and freight traffic that would otherwise travel along SH1. Without the new motorway, traffic along the corridor would continue to significantly increase. This could have adverse effects on the overall congestion along the corridor and increase the risk for active mode users. However, Ara Tūhono is expected to be completed prior to the SH1 upgrade, therefore there is little risk of these operational effects occurring in the future.

Outside of the Warkworth Package, the proposed southern interchange with Ara Tūhono also influences transport movements in Warkworth. The table below provides a summary of the transport volumes expected on State Highway 1 with and without the interchange in place. This count is outside of the Future Urban Area so to identify demand changes from people travelling from outside of Warkworth. As can be seen, the provision on the interchange result in a decrease of some 4,000 vehicles on State Highway 1, south of the growth area.

Traffic Volumes on State Highway 1 (location of count south of the Future Urban Area) with Southern Interchange 2048+	Traffic Volumes on State Highway 1 (location of count outside of the Future Urban Area) without Southern Interchange 2048+
6,200 vehicles per day	10,100 vehicles per day

The southern interchange is predicted to decrease the volumes of vehicles on the corridor. There is also expected to be a corresponding decrease in freight movements as a result of the interchange, which will support the urbanisation of the corridor.

8.3.1 Interaction with Proposed Plan Change

It is understood that a Private Plan Change has be lodged with Auckland Council for an area within the southern growth area. A proposed connection location has been provided on State Highway 1 to provide for the future Wider Western Link. This currently allows for sufficient space for either a roundabout or a signalised intersection, with the use of roundabout forming the initial design footprint. It is also understood that location is in general accordance with the Private Plan Change location, with some flexibility in exact location.

Confirmation of the intersection form will be part of the Urban Design and Landscape Management Plan as identified in Condition 9.

8.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects.

In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

9 NOR 4 – Matakana Road Upgrade

This section assesses specific transport matters relating to NOR 4 – Matakana Road.

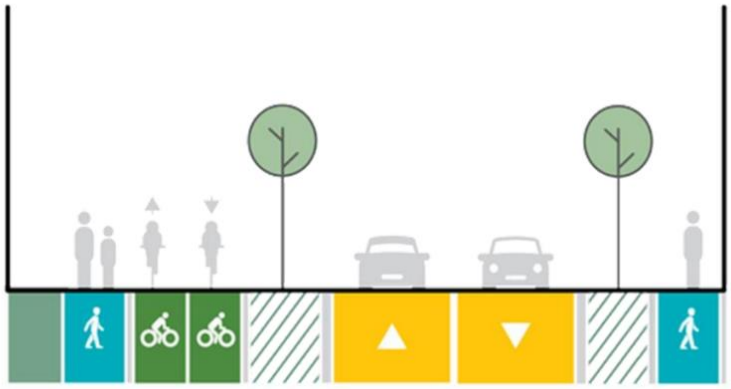
9.1 Overview and description of works

Matakana Road is an existing arterial corridor on the Warkworth network. The corridor extends from the Hill Street intersection in the south to the rural town of Matakana further north. In addition, the corridor is a key connection to rural settlements such as Omaha and Leigh. The Matakana Road upgrade is for the portion of the corridor between the Hill Street intersection and the edge of the FUZ. It is proposed that the existing rural corridor be upgraded to accommodate an indicative two lane urban arterial cross section with dedicated cycle lanes and footpaths. The portion of the corridor between Hill Street and Melwood Drive is proposed to have a bidirectional facility for cyclists, rather than separate cycle lanes on the corridor.

The project will integrate with the proposed intersection at Sandspit Road in the south and will tie into the intersection with Te Honohono ki tai in the north. It should be noted that the intersection upgrade with Sandspit Road forms part of the Hill Street intersection improvements which is a separate project led by Auckland Transport.

Figure 9-1: Matakana Road Upgrade Indicative Design

Figure 9-2: Matakana Road Upgrade Indicative Design (Southern Section)



Key features of the proposed new corridor include the following:

- Widening of the existing road corridor to a 18m-24m two-lane cross section, including separated cycle lanes and footpaths.
- Localised widening around the existing intersections to accommodate new intersection forms.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

9.2 Assessment of Operational Transport Effects

9.2.1 Walking and Cycling

As mentioned in the above description, the indicative design for Matakana Road varies along the corridor. In particular it is noted that walking and cycling facilities change from separated facilities on both sides of the road in the northern section to a two way cycling facility and footpath in the southern section.

These have been indicatively shown due to

- Enabling integration with the surrounding road network including facilities proposed as part of the Hill Street intersection upgrades and
- A significantly constrained environment limiting the corridor width available for upgrades without significant earthworks.

Although the facility type changes along the corridor, the proposed facilities meet current Transport Design Manual standards and as such the net effect for walking and cycling is positive, with a significant improvement over the existing facilities.

9.2.2 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 9,700 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 970 vehicles. A two-lane corridor can efficiently accommodate 9,700 vehicles and therefore the proposed corridor design meets the forecasted needs.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 9-1.

Table 9-1: Matakana Road Upgrade Intersection Performances

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Matakana Road/ Matakana Link Road/ Sandspit Link – single lane roundabout	Morning Peak	A	0.343	17.7
	Evening Peak	A	0.474	29.8

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

9.2.3 Property Access

As a future arterial corridor, Matakana Road is expected to be a limited access corridor. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to corridor where practicable.

The collector network has been indicatively identified by the Warkworth Structure Plan; however it is expected that these will be subject to change as developers progress these connections through the plan change process. These will be assessed by standard planning and approval processes through Council.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways. When considering access to existing properties, no specific access effects have been identified.

9.2.4 Freight

Given the adjacent urban residential land use, Matakana Road is not expected to be a key strategic freight route in the future. However, as the corridor is the main connection to rural settlements (i.e. Leigh and Omaha) further north, a small proportion of freight will travel through the corridor. It is expected that these freight numbers won't warrant any specific freight provisions in the future.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

9.2.5 Wider Network Effects

The Matakana Road upgrade provides a connection for all modes to access the planned growth within North Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. The facilities along this corridor will connect to adjacent east-west active mode facilities along Matakana Link and Sandspit Link. In combination, these connections will provide a complete, legible active mode network within North Warkworth. This will allow improved accessibility for those travelling by active modes to local amenities and employment opportunities Therefore, the upgrade to Matakana Road will have an overall positive network effect on walking and cycling.

For freight, general traffic and PT, the location of the corridor has a positive network effect by facilitating access to land use adjacent to the corridor as well as rural settlements further north.

9.3 Project Interdependencies

The upgrade to Matakana Road has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network.

The key projects that integrate with this project include Te Honohono ki Tai and Sandspit Link and Sandspit Road. These projects interface with the Matakana Road project at key intersections and in order to support the implementation of these projects within the context of timing uncertainties, the designations are proposed to overlap.

In addition to this, this project interfaces with the proposed upgrades to the Matakana Road and Sandspit Road intersection. The proposed walking and cycling facilities on Matakana Road are proposed to tie with the current proposed provision of facilities at this intersection. It is noted that the Hill Street Intersection upgrades are still under review with detailed design currently underway and under consultation. The proposed designation is considered flexible enough to respond to any changes and provide for a connected walking and cycling facility.

In addition to the overlapping designation at the intersections and the requirements of the Urban Design and Landscape Condition, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of any interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.
- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

9.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects.

In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

10 NOR 5 – Sandspit Road Upgrade

This section assesses specific transport matters relating to NOR 5 – Sandspit Road.

10.1 Overview and description of works

Sandspit Road is an existing arterial corridor on the Warkworth network. The corridor extends from the Hill Street intersection in the west to the rural town of Sandspit further east. In addition, the corridor is a key connection to rural settlements in Snells Beach and Algies Bay

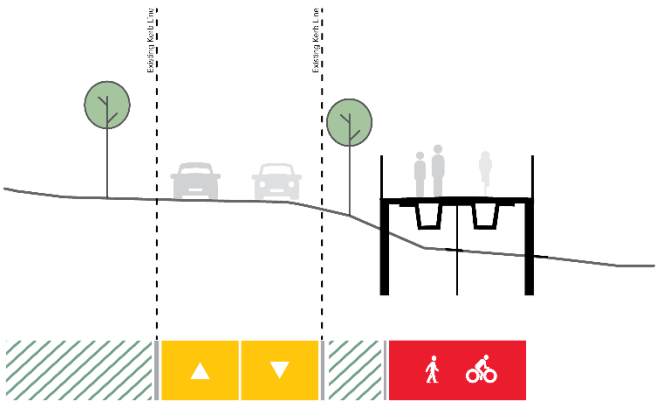
The Sandspit Road upgrade is for the portion of the corridor between the Hill Street intersection and the edge of the FUZ. It is proposed that the existing rural corridor be upgraded to accommodate an indicative two lane urban arterial cross section with separated cycle lanes and footpaths on the corridor (along the eastern portion only).

Along the western portion of Sandspit Road, the cross-section ranges between 18m and 20m, to accommodate active mode users, an offline shared walking and cycling facility has been proposed from the Hill Street intersection to the second bridge along the corridor.

The indicative proposed design also includes two general vehicle lanes and new facilities for walking and cycling as shown in Figure 10-1.

Figure 10-1: Sandspit Road Upgrade Indicative Design – Eastern Portion

Figure 10-2: Sandspit Road Upgrade Indicative Design – Western Portion



Key features of the proposed new corridor include the following:

- Widening of the existing road corridor to a 18m-24m two-lane cross section, including separated cycle lanes and footpaths.
- Provision of a boardwalk facility for walking and cycling on the southern side of the corridor at the eastern extent
- Localised widening around the existing intersections to accommodate new intersection forms.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

10.2 Assessment of Operational Transport Effects

10.2.1 Walking and Cycling

As mentioned in the above description, the indicative design for Sandspit Road varies along the corridor. In particular it is noted that walking and cycling facilities change from separated facilities on both sides of the road in the eastern section to a boardwalk facility on the southern edge of the western section

These have been indicatively shown due to

- Enabling integration with the surrounding road network including facilities proposed as part of the Hill Street intersection upgrades and
- A significantly constrained environment limiting the corridor width available for upgrades without significant earthworks and impact on environmental areas.

Although the facility type changes along the corridor, the proposed facility meets current Transport Design Manual standards and as such the net effect for walking and cycling is positive, with a significant improvement over no facilities as currently provided.

10.2.2 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 12,200 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 1,220 vehicles. A two-lane corridor can efficiently accommodate 12,200 vehicles and therefore the proposed corridor design meets the forecasted needs.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 10-1.

Table 10-1: Sandspit Road Upgrade Intersection Performances

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Sandspit Road/ Sandspit Link – single-lane roundabout	Morning Peak	A	0.407	24.5
	Evening Peak	A	0.374	20.2

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

10.2.3 Property Access

As a future arterial corridor, Sandspit Road is expected to be a limited access corridor. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to corridor where practicable.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways. When considering access to existing properties, no specific access effects have been identified.

10.2.4 Freight

Given the adjacent residential land use, Sandspit Road is not expected to be a key strategic freight route in the future. However, as the corridor is the main connection to rural settlements (i.e. Snells Beach and Algies Bay) further east, a small proportion of freight will travel through the corridor. In addition, it should be noted that access to the Quarry along Sandspit Road Link will generate some freight movements to and from the area. However, it is expected that these freight numbers do not warrant any specific freight provisions in the future.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

10.2.5 Wider Network Effects

The Sandspit Road upgrade provides a connection for all modes to access the planned growth within North-East Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. The facilities along this corridor will

connect to adjacent east-west active mode facilities along Sandspit Road Link. In combination, these connections will provide a complete, legible active mode network within North-East Warkworth. This will allow improved accessibility for those travelling by active modes to local amenities and employment opportunities Therefore, the upgrade to Sandspit Road will have an overall positive network effect on walking and cycling.

For freight, general traffic and PT, the upgrade of the corridor has a positive network effect by facilitating access to the land use adjacent to the corridor as well as rural settlements further east.

10.3 Project Interdependencies

The upgrade to Sandspit Road has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network.

The Sandspit Link is a key project that integrates with the Sandspit Road upgrade. These projects interface at a key intersections and in order to support the implementation of these projects within the context of timing uncertainties, the designations are proposed to overlap.

In regard to traffic volumes, the Sandspit Link corridor is expected to reduce traffic on Sandspit Road, through the provision of an alternative route connecting to Tūhonohono ki Tai. This connection is also expected to reduce volumes on Sandspit Road west of the Sandspit Link intersection and through the Hill Street intersection by 20 to 30%[16]. It is noted that in the event that the provision of the Sandspit Link is not delivered, additional capacity on Sandspit Road would not be required.

In addition to the overlapping designation at the intersections and the requirements of the Urban Design and Landscape Condition, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of any interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.
- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

10.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects.

[16] Hill Street SSBC, Appendix E, Modelling Technical Report

In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

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11 NOR 6 – Western Link South

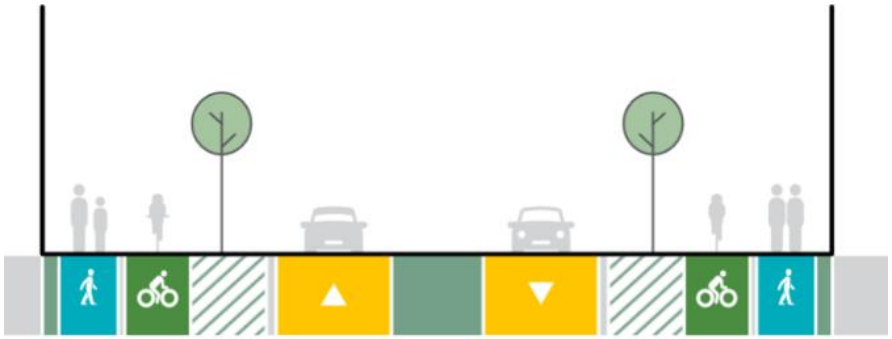
This section assesses specific transport matters relating to NOR 6 – Western Link South.

11.1 Overview and description of works

The Western Link South is a new arterial corridor on the Warkworth transport network. The proposed corridor will connect Woodcocks Road with SH1. It is proposed that the new corridor will accommodate an indicative two lane urban arterial cross section with separated cycle lanes and footpaths the corridor. It includes upgrades to the intersections at McKinney Road. The proposed alignment of the corridor will be through undeveloped greenfields within South Warkworth.

The indicative proposed design includes two general vehicle lanes and new facilities for walking and cycling as shown in Figure 11-1.

Figure 11-1: Western Link South Indicative Design



Key features of the proposed new corridor include the following:

- A new road corridor with a 24m two-lane cross section, including separated cycle lanes and footpaths on both sides of the corridor.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the new road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

11.2 Assessment of Operational Transport Effects

11.2.1 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 9,400 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 940 vehicles. A two-lane corridor can efficiently accommodate 9,400 vehicles and therefore the proposed corridor design meets the forecasted needs.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 11-1.

Table 11-1: Western Link South Intersection Performances

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Western Link – South/ SH1/ Mckinney Road – signalised intersection	Morning Peak	C	0.738	84.5
	Evening Peak	C	0.829	107.3

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

11.2.2 Property Access

Western Link - South is expected to be a limited access corridor in the future. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to corridor where practicable.

The collector network has been indicatively identified by the Warkworth Structure Plan; however it is expected that these will be subject to change as developers progress these connections through the plan change process. These will be assessed by standard planning and approval processes through Council.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways. There are no specific properties that have been included within the designation for this purpose and all existing driveways are expected to be able to be reinstated.

11.2.3 Freight

The Western Link South is not expected to be a strategic freight route in the future. In addition, the level of freight expected along the corridor is unlikely to warrant any specific freight provisions in the future. Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

11.2.4 Wider Network Effects

The Western Link South provides a connection for all modes to access the planned residential growth within South Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. The facilities along this corridor will allow access to the residential growth within South Warkworth.

In addition, the corridor will connect with adjacent active mode facilities along Woodcocks Road and SH1. In combination, these connections will provide a complete, legible active mode network within South Warkworth. This will allow improved accessibility for those travelling by active modes to local amenities and employment opportunities. Therefore, the development of this new connection will have an overall positive network effect on walking and cycling.

For freight, general traffic and PT, the location of the corridor has a positive network effect by facilitating access to social and employment opportunities within the planned growth in South Warkworth.

11.3 Project Interdependencies

The Western Link - South has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network.

The Western Link - South connects with two existing connections as part of the planned growth within South Warkworth, this includes SH1 and Woodcocks Road. The Western Link – South forms the southern section of the Western Link, which starts further north and provides an alternative north-south spine within the Warkworth network alleviating traffic congestion along SH1.

The State Highway 1 and Western Link intersection are inherently linked due to the limited site distances at the intersection. This intersection location provides the best connectivity for all modes and supports an integrated network with direct links. However, sight lines to the north of the intersection are limited. As such, the State Highway 1 projects includes a lowering of the corridor in this location to enable clear visibility. To address this, the designation for the Western Link South also includes an overlapping designation with the State Highway designation to ensure that these works are carried out as part of the connection.

In addition to the overlapping designation at the intersections and the requirements of the Urban Design and Landscape Condition, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of any interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.
- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

11.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects.

In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

12 NOR 7 – Sandspit Link

This section assesses specific transport matters relating to NOR 7 – Sandspit Link.

12.1 Overview and description of works

The Sandspit Link is a new arterial corridor on the Warkworth transport network. The proposed corridor will connect Matakana Road and Sandspit Road within North Warkworth. The corridor will facilitate access to the planned growth within this area as well as improve connectivity between Matakana and the Kowhai Coasts. It is proposed that the new corridor will accommodate an indicative two lane urban arterial cross section with separated cycle lanes and footpaths on the corridor. It includes new intersections at Matakana Road and Sandspit Road respectively. The proposed alignment of the corridor will predominately be through undeveloped greenfields within North Warkworth.

The indicative proposed design includes two general vehicle lanes and new facilities for walking and cycling as shown in Figure 12-1.

Figure 12-1: Sandspit Link Indicative Design

Key features of the proposed new corridor include the following:

- A new road corridor with a 24m two-lane cross section, including separated cycle lanes and footpaths on both sides of the corridor.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the new road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

12.2 Assessment of Operational Transport Effects

12.2.1 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 3,600 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 360 vehicles. A two-lane corridor can efficiently accommodate 3,600 vehicles and therefore the proposed corridor design meets the forecasted needs.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 12-1.

Table 12-1: Sandspit Link Intersection Performances

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Sandspit Link/ Matakana Road/ Matakana Link Road – single-lane roundabout	Morning Peak	A	0.343	17.7
	Evening Peak	A	0.474	29.4
Sandspit Link/ Sandspit Road – single-lane roundabout	Morning Peak	A	0.407	24.5
	Evening Peak	A	0.374	20.2

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

12.2.2 Freight

Given the adjacent residential land use, the Sandspit Link is not expected to be a key strategic freight route in the future. However, as the corridor does provide a connection for freight movements from Sandspit, Snells Beach and Algies Bay and as such a small proportion of freight will travel through the corridor. These volumes are expected to be readily accommodated within the proposed corridor.

Over-dimension and overweight routes are expected to be further reviewed by Auckland Transport, Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

12.2.3 Property Access

The Sandspit Link is expected to be a limited access corridor in the future. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to the corridor where practicable.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways. When considering access to existing properties, no specific access effects have been identified.

The proposed alignment of the Sandspit Link follows an existing driveway/access that currently services residential properties, a quarry and a recycling plant. Should these properties still require access at time of implementation there are several options to provide access, including construction staging from the northern extent of the corridor or provision of an access route adjacent to the corridor within the designation. The designation is considered sufficiently wider to provide for this. Notwithstanding this, two conditions are expected to manage any potential vehicle access impacts:

- the proposed UDLP condition that requires that the UDLMP shall include landscape and urban design details that cover reinstatement of construction and site compound areas, driveways, accessways and fences and
- the proposed CTMP condition that requires that the CTMP shall include:
  - methods to maintain vehicle access to property and / or private roads where practicable, or to provide alternative access arrangements when it will not be;
  - methods that will be undertaken to communicate traffic management measures to affected road users (e.g. residents / public / stakeholders / emergency services).

12.2.4 Wider Network Effects

The Sandspit Link provides a connection for all modes to access the planned residential growth within North-East Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. In addition, the corridor will connect with adjacent active mode facilities along Matakana Road and Sandspit Road. In combination, these connections will provide a complete, legible active mode network within North-East Warkworth. This will allow improved accessibility for those travelling by active modes to local amenities and employment opportunities. Therefore, the development of this new connection will have an overall positive network effect on walking and cycling.

For freight, general traffic and PT, the location of the corridor has a positive network effect by facilitating access to the land use adjacent to the corridor as well as rural settlements within Matakana and Sandpit. However, there are no specific measures within this upgrade that provides additional priority for these modes.

12.3 Project Interdependencies

Sandspit Link has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network.

While not part of the Warkworth package, the Hill Street improvements will be impacted by the timing of the Sandspit Link. An additional benefit of this new connection is to allow trips to and from the Kowhai Coast settlements to reach Matakana and the strategic network without the need to travel through Hill Street Intersection.

Additional SIDRA modelling completed as part of the Warkworth DBC tested two potential scenarios. The first scenario included the full recommended transport network for Warkworth (including the Sandspit Link), while the second scenario included the full recommended transport network without the Sandspit Link.

It was found that for a Hill Street/SH1 single-lane roundabout option, overall delay and LOS increases in the AM peak without the implementation of the Sandpit Link. For the PM peak there was no change in the overall LOS and a marginal difference in delay between the two scenarios. A summary of the results can be found in Table 12-2 below. The results indicate that without the Sandspit Link, there will be increasingly adverse effects on the performance of the Hill Street/SH1 roundabout during the AM peak in particular. This illustrates the role of Sandspit Link within the wider network.

Table 12-2: Hill Street/SH1 Roundabout Sidra Movement Summaries

Hill Street/SH1 Roundabout 2048+	
With Sandspit Road Link (AM peak)	**Without Sandspit Road Link (AM peak)**
LOS (Level of Service): E Delay: 61s	LOS (Level of Service): F Delay: 95s
With Sandspit Road Link (PM peak)	**Without Sandspit Road Link (PM peak)**
LOS (Level of Service): D Delay: 41s	LOS (Level of Service): D Delay: 39s

*It should be noted that there were negligible differences in performance for the Matakana Road/Sandspit Road roundabout.

In addition to the requirements of the Urban Design and Landscape Condition, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of these interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.

- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

12.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects.

In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

It is recommended that access considerations relating to the Quarry and the recycling plant should be specifically considered within the CTMP prior to construction and implementation of the project.

13 NOR 8 – Wider Western Link (Northern Section)

This section assesses specific transport matters relating to NOR 8 – Wider Western Link - (Northern Section).

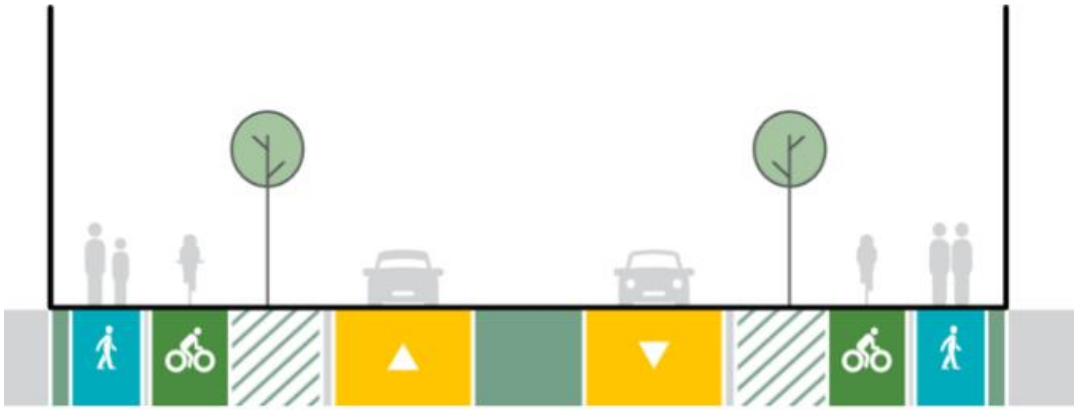
13.1 Overview and description of works

The Wider Western Link - North is a new arterial corridor on the Warkworth transport network. The proposed corridor will connect Woodcocks Road with SH1. It is proposed that the new corridor will accommodate an indicative two lane urban arterial cross section with separated cycle lanes and footpaths on the corridor. It includes new intersections at Woodcocks Road and SH1. The proposed alignment of the corridor will be through undeveloped greenfields within South Warkworth.

The corridor has been indicatively designed to enable future connectivity to the southern interchange with Ara Tūhono.

The indicative proposed design includes two general vehicle lanes and new facilities for walking and cycling as shown in Figure 13-1.

Figure 13-1: Wider Western Link (Northern Portion) Indicative Design



Key features of the proposed new corridor include the following:

- A new road corridor with a 24m two-lane cross section, including separated cycle lanes and footpaths on both sides of the corridor.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the new road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

13.2 Assessment of Operational Transport Effects

13.2.1 General Traffic

The theoretical capacity of a single lane with uninterrupted flow conditions is generally within the range of 1,500 to 2,400 vehicles per hour[5], noting these can be lower when considered at a corridor level due to various control features in the corridor (such as intersections, crossings etc). The peak period is generally accepted as 10% of the daily flow (vehicles per day (vpd)) of a corridor. The Transport Design Manual also provides indicative lane capacity for vehicles at 1,800 vehicles per hour. These considerations have been taken into account in the assessment provided below.

As identified above, the 2048 ADT for the corridor is 6,100 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 610 vehicles. A two-lane corridor can efficiently accommodate 6,100 vehicles and therefore the proposed corridor design meets the forecasted needs.

Intersection Performance

The performance of the road network within the project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LOS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 13-1.

Table 13-1: Wider Western Link – (Northern Section) Intersection Performances

Intersection (Intersection Control)	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Wider Western Link/ Woodcocks Road– single-lane roundabout	Morning Peak	A	0.202	9.8
	Evening Peak	A	0.276	12.5
Wider Western Link/ Link to the Southern Interchange – single-lane roundabout	Morning Peak	A	0.339	18.0
	Evening Peak	A	0.363	21.9

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048+ scenario.

13.2.2 Property Access

The Wider Western Link - North is expected to be a limited access corridor in the future. As the area develops, it is expected that future vehicle access to the network will be facilitated by collector road networks within the urbanised area adjacent to the road. Walking and cycling access will be provided to corridor where practicable.

The collector network has been indicatively identified by the Warkworth Structure Plan; however it is expected that these will be subject to change as developers progress these connections through the

plan change process. These will be assessed by standard planning and approval processes through Council.

In terms of existing properties, the overarching design philosophy for the project has been to maintain driveway access where practicable and minimise impacting land for access purposes other than where necessary to re-instate driveways. There are no specific properties that have been included within the designation for this purpose and all existing driveways are expected to be able to be reinstated.

The proposed alignment of the Wider Western Link connects with Wylie Road, replacing an existing cul de sac (resulting from Ara Tūhono). A small cul de sac will need to be formed to connect the residual Wylie Road corridor with the new proposed arterial. Sufficient space has been provided within the proposed designation to enable this connection.

13.2.3 Freight

It is noted that with the planned industrial land use along the corridor, the northern portion of the Wider Western Link is expected to be a strategic freight route in the future. However, the level of freight expected along the corridor is unlikely to warrant any specific freight provisions in the future and heavy vehicles can be accommodated within the capacity of the corridor.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the implementation of individual corridor upgrades and further land use certainty in the future.

13.2.4 Wider Network Effects

The Wider Western Link - North provides a connection for all modes to access the planned growth within South Warkworth. In terms of walking and cycling the project provides improved network options for active modes, through the provision of dedicated facilities. The facilities along this corridor will allow access to the employment opportunities within the industrial land use along the northern portion of the corridor.

In addition, the corridor will connect with adjacent active mode facilities along Woodcocks Road and SH1 further south. In combination, these connections will provide a complete, legible active mode network within South Warkworth. This will allow improved accessibility for those travelling by active modes to local amenities and employment opportunities. Therefore, the development of this new connection will have an overall positive network effect on walking and cycling.

The Wider Western Link integrated with the Wylie Road and reconnects Wylie Road to the wider network. Previously, Wylie Road continued further south, however the provision of Ara Tūhono severed this link, resulting in Wylie Road being reformed as a cul de sac. This proposed connection, will reconnect Wylie Road with the wider network and will continue on to eventually link with State Highway 1. By utilising the existing Wylie Road connection, this reduces the number of intersections on Woodcocks Road, improving safety and efficiency on the Woodcocks Road corridor.

13.3 Project Interdependencies

The Wider Western Link - North has been designed to integrate with several other key projects within the Warkworth transport network. The assessment of operational effects assumes that these projects are in place. The project as proposed therefore can be considered the long-term requirement for the corridor.

It is noted however that in the interim, the rate and sequencing of land use growth, wider growth pressures and timing of individual projects will change and evolve. As such, at the time of implementation the project should demonstrate how it will integrate with the prevailing urban form and surrounding road network.

The Wider Western Link - North connects to Woodcocks Road via Wylie Road in the north and will connect with State Highway 1 in the south in the longer term. The southern section is currently not proposed to be included within the NOR 6 works, however the bridge crossing over the Mahurangi River has been included to enable ready connections to be made by developers in the longer term.

The Wider Western Link is also linked to the Southern Interchange with Ara Tūhono. It is considered that the Wider Western Link can be implemented in such a way that does not preclude the provision of an interchange in the longer term. The Southern Interchange, however, will not be able to be provided until such time that that Wider Western Link is in place, to provide access to the interchange. As such, traffic volumes as utilised in this assessment, with the southern interchange in place, are considered to provide the most conservative assessment of capacity. Without the interchange in place, traffic volumes will be predominately related to immediately adjacent growth, and unrelated to access to the strategic network.

To address the arterial road interdependencies, the intersection of Wider Western Link with Woodcocks Road is proposed to be overlapping. In addition to the overlapping designation at the intersections and the requirements of the Urban Design and Landscape Condition, the following standard implementation measures will be undertaken by Auckland Transport to assist in the management of any interdependencies:

- Roads and Streets Framework and One Network reassessment to confirm modal priority.
- Integration with the Network Operating Plan as per standard procedures by Auckland Transport.
- Detailed Design commensurate with implementation works.
- Road Safety Audits to ensure appropriate and safe tie ins for all modes.

13.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Overall, the project provides positive transport effects, in particular improved active mode facilities which in turn provide safety improvements for those choose to walk and cycle. There are no identified adverse operational effects. In terms of construction traffic effects, it is considered that there is sufficient network capacity to enable construction traffic, and that any potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

1 Appendix A: Roads and Street Framework Assessment

The development of the corridor design has included the use of AT's Roads and Streets Framework (RASF), which qualitatively assesses the typology (movement and place value) and modal priority. The intent of that framework is to classify the expected movement and place functions from a consistent regional context and identify the likely priority applied to each mode.

The framework itself does not directly dictate a specific corridor design but provides context and guidance regarding the intended function of the corridor, that will be used to inform future development and operation of the corridor. For integrated land use and transport classification purposes, land use context uses Place Value (ranking from P1 'low' to P3 'high' importance) and for transport context uses Movement Value (ranking from M1 'low' to M3 'high' importance).

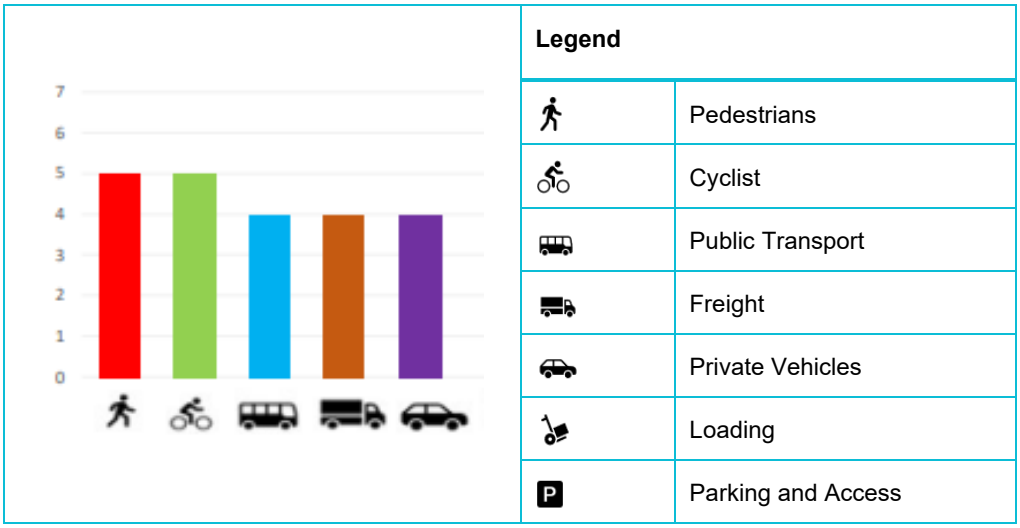
1.1 Western Link - North

The corridor is assessed to have the following RASF typology in the future:

- Place function – P2 (medium place significance) long term
- Movement function – M3 (high strategic network function) long term

The following Figure 13-2 indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-2: Western Link - North Future Modal Priorities



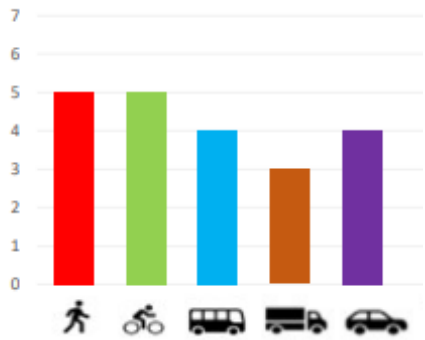
1.2 Woodcocks Road (Western Section)

The corridor is assessed to have the following RASF typology:

- Place function - transitioning from P1 (rural) to P1 (low place significance) long term
- Movement function - transitioning from M1 (low strategic network function) to M2 (medium strategic network function) long term

The following Figure 13-3 indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-3: Woodcocks Road (Western Section) Upgrade Future Modal Priorities



Legend	
	Pedestrians
	Cyclist
	Public Transport
	Freight
	Private Vehicles
	Loading
P	Parking and Access

1.3 State Highway 1 (Southern Section)

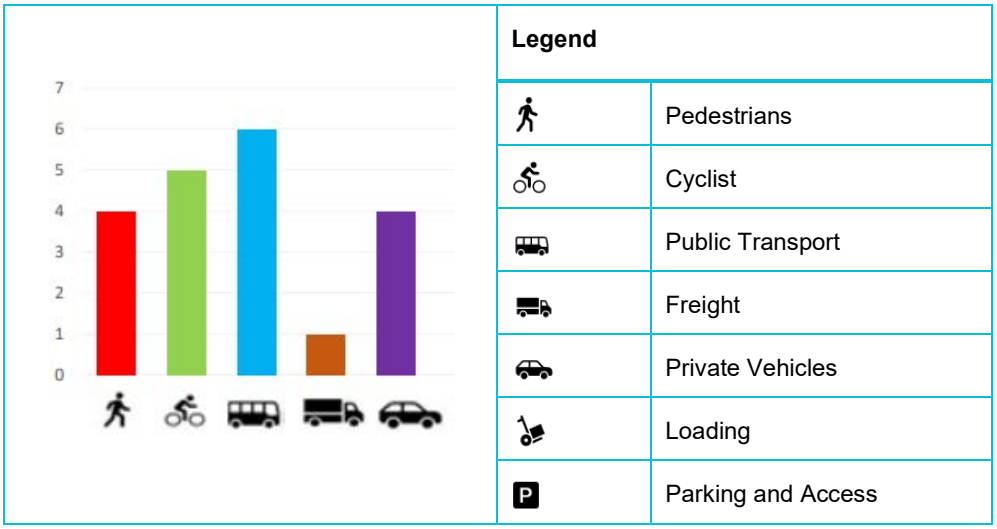
The corridor is assessed to have the following RASF typology:

- Place function - P1 (low place significance) long term
- Movement function - M3 (high strategic network function) long term

There is no change in the place and movement function between the existing environment and expected future environment. In regard to the movement function, SH1 is expected to remain a strategic corridor within the Warkworth transport network in the future. In addition, the place significance of the corridor is expected to remain the same due to the nature of change in land use from the existing rural environment to low-density residential in the future.

The following figure indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-4: SH1 (Southern Section) Upgrade Future Modal Priorities



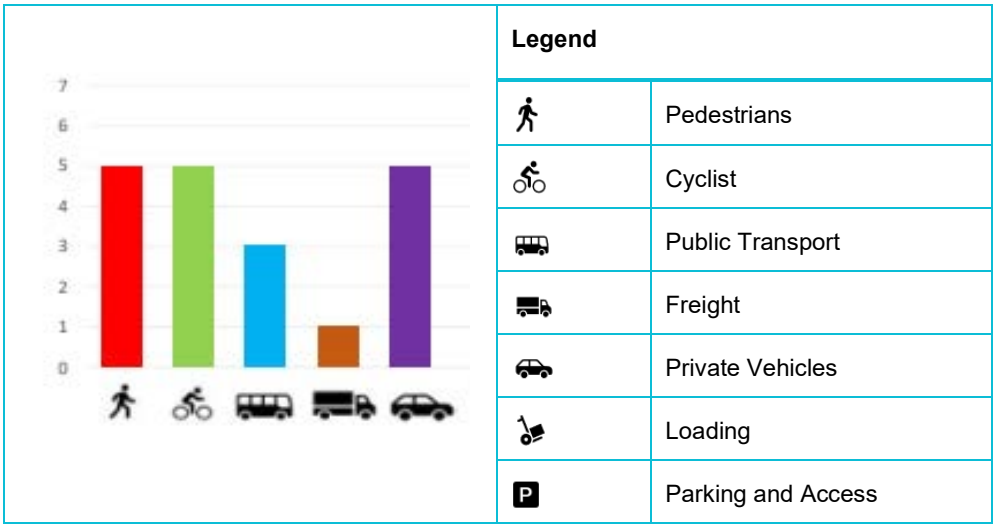
1.4 Matakana Road Upgrade

The corridor is assessed to have the following RASF typology:

- Place function - transitioning from P1 (low place significance) to P2 (medium place significance) long term
- Movement function - transitioning from M2 (medium strategic network function) to M3 (high strategic network function) long term

The following Figure 13-5 indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-5: Matakana Road Upgrade Future Modal Priorities



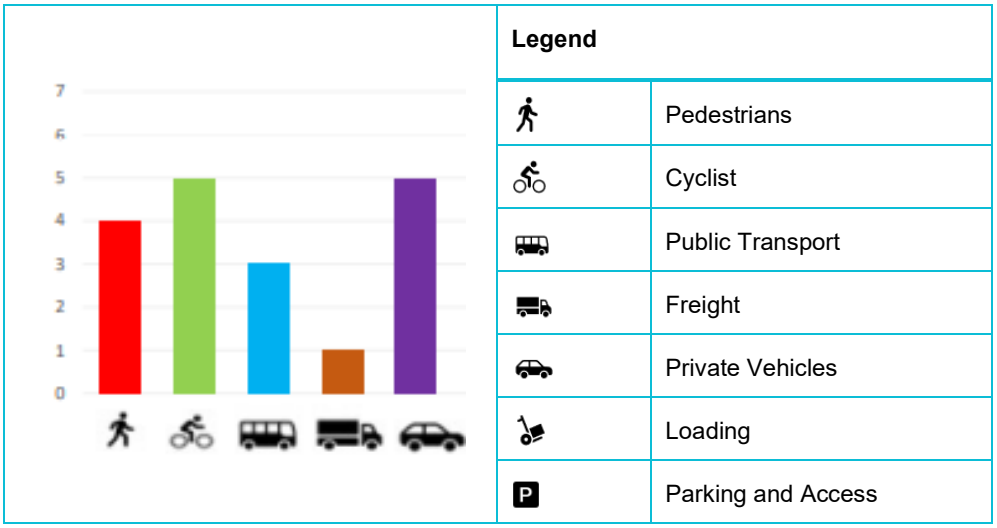
1.5 Sandspit Road Upgrade

The corridor is assessed to have the following RASF typology:

- Place function - transitioning from P1 (low place significance) to P1 (low place significance) long term
- Movement function - transitioning from M2 (medium strategic network function) to M3 (high strategic network function) long term

The following Figure 13-6 indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-6: Sandspit Road Upgrade Future Modal Priorities



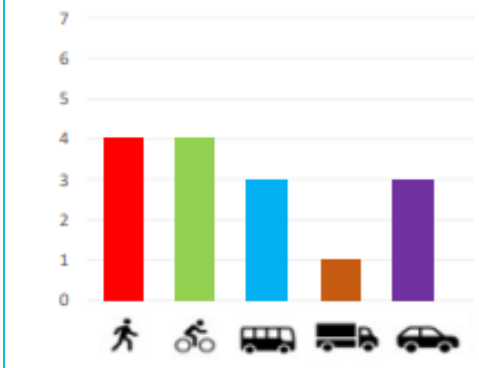
1.6 Western Link South

The corridor is assessed to have the following RASF typology in the future:

- Place function - P1 (low place significance) long term
- Movement function – M2 (medium strategic network function) long term

The following Figure 13-7 indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-7: Western Link South Future Modal Priorities



Legend	
	Pedestrians
	Cyclist
	Public Transport
	Freight
	Private Vehicles
	Loading
P	Parking and Access

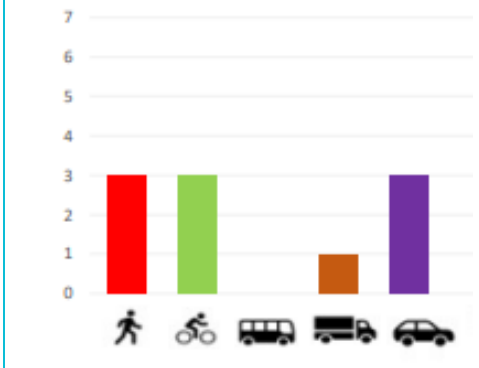
1.7 Sandspit Link

The corridor is assessed to have the following RASF typology in the future:

- Place function – P1 (low place significance) long term
- Movement function – M1 (low strategic network function) long term

The following figure indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-8: Sandspit Link Future Modal Priorities



Legend	
	Pedestrians
	Cyclist
	Public Transport
	Freight
	Private Vehicles
	Loading
P	Parking and Access

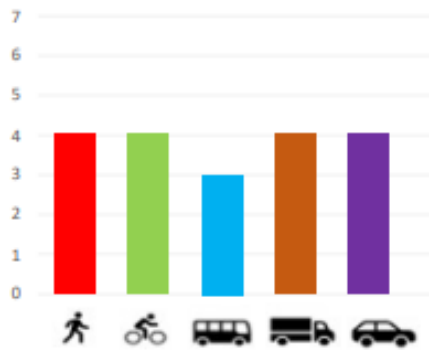
1.8 Wider Western Link - North

The corridor is assessed to have the following RASF typology in the future:

- Place function – P2 (medium place significance) long term
- Movement function – M3 (medium strategic network function) long term

The following figure indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to active modes and public transport.

Figure 13-9: Wider Western Link – (Northern Section) Future Modal Priorities



Legend	
	Pedestrians
	Cyclist
	Public Transport
	Freight
	Private Vehicles
	Loading
P	Parking and Access

2 Appendix B: Existing Crash Records

The tables below provide a summary of reported crashes on the existing road network subject to the Warkworth Package of NORs. These results are based on a search of the Waka Kotahi Crash Analysis System (CAS) between 2018 and 2022. These results should be considered within the context of several factors including:

- The CAS results are based only on reported crashes, and does not include any crashes that are not reported to the relevant authorities
- Crashes are reflective of the existing road environment, and the relevance within the context of an urban environment with greater traffic volumes, pedestrian and cyclist volumes, and lower speeds may be limited.
- There were a total of 5 DSI's on the existing corridors assessed.
- Out of the existing corridors within Warkworth, Sandspit Road and SH1 had the highest number of crashes. There were a total of 20 and 30 crashes respectively on these corridors.
- For Sandpit Road, the most common crash types were rear-end collisions (7 crashes) and loss of control on corners (4 crashes).
- For SH1, the most common crash types were rear-end collisions (7 crashes), loss of control on corners (5 crashes) and crossing/turning type crashes (4 crashes).
- There were no vulnerable road user DSI's on each of the existing corridors assessed for Warkworth

	Vehicle Crashes per year						Mid-Block (Total over 5 years)				Intersection (Total over 5 years)				Total DSI's
	2018	2019	2020	2021	2022	Total	F	S	M	N	F	S	M	N	
Mansell Drive	1	2	0	0	0	**3**	0	0	0	1	0	0	2	0	**0**
Sandspit Road	7	4	3	3	3	**20**	0	1	3	5	0	0	1	10	**1**

	Vehicle Crashes per year						Mid-Block (Total over 5 years)				Intersection (Total over 5 years)				Total DSI's
	2018	2019	2020	2021	2022	Total	F	S	M	N	F	S	M	N	
Matakana Road	2	1	1	1	0	**5**	0	0	1	3	0	0	0	1	**0**
Woodcocks Road (urban)	2	3	1	0	0	**6**	0	0	1	1	0	0	1	3	**0**
Woodcocks Road (rural)	1	2	3	0	0	**6**	0	1	2	1	0	0	2	0	**1**
SH1 (southern section)	6	10	5	5	4	**30**	2	1	7	5	0	0	7	8	**3**

	Vulnerable Road User Crashes per year						Pedestrian (Total over 5 years)				Cyclist (Total over 5 years)				Motorcyclist (Total over 5 years)				Total DSI's
	2018	2019	2020	2021	2022	Total	F	S	M	N	F	S	M	N	F	S	M	N	
Mansel Drive	0	1	0	0	0	**1**	0	0	1	0	0	0	0	0	0	0	0	0	**0**
Sandspit Road	0	1	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	1	0	**0**
Matakana Road	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Woodcocks Road (urban)	1	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	1	**0**
Woodcocks Road (rural)	0	1	0	0	0	**1**	0	0	1	0	0	0	0	0	0	0	0	0	**0**
SH1 (southern section)	0	1	0	1	0	**2**	0	0	0	0	0	0	0	0	0	0	1	1	**0**

3 Appendix C: Specific Transport Modelling Background Information

The Macro Strategic Model (MSM) is a region-wide model which analyses the forecast land use and informs trip generation, trip distribution and mode choice at regional level. The MSM model responds to the network assumptions, forecasted land use and regional economic policy inputs to predict regional traffic patterns and PT patronages. The outputs from the MSM model are used as:

- Demand inputs for the traffic simulation model SATURN, which analyses them at a mesoscopic level
- PT Patronage inputs for the MPT model, which analyses these at a strategic level
- Active mode inputs for the SAMM model, which analyses these at a mesoscopic level

The MSM is a four-step multi-modal model. This model was originally developed based on extensive data collected in 2006. Using observed data, and a full model validation exercise it was recently updated to reflect 2016 inputs and data. The MSM produces demands for five periods of the day, and separate assignment models exist for the morning (AM) and evening (PM) peak and weekday interpeak (IP) periods.

The model itself comprises of the following key modules:

- Trip generation: This is where the number of person-trips are estimated as a function of the land use data (population, employment, school roll etc.)
- Mode Choice: This is where the choice of recommended travel mode is determined, based on the relative costs of the various modes. The MSM modes for mode choice are car (driver and passenger combined) and passenger transport. Trips by car are converted into vehicle trips later in the model. The model also estimates the number of active mode trips, such as walking and cycling, although these are not fully modelled through to link flows.
- Trip Distribution: This is where the trips produced in each zone (generally by households), are matched to a recommended destination. This distribution is predicted as a function of the relative attractiveness for each destination zone and the travel costs to reach each destination.
- Time of Day: This is where the proportion of daily trip making occurring in each period is calculated. These proportions change in response to changes in travel costs to represent peak spreading.
- Trip Assignment: This is where the resulting travel demand, in the form of origin to destination trip tables, are loaded to the road and public transport networks. For the road assignment, an iterative process is used to firstly identify the lowest-cost route between each origin and destination followed by an estimation of the speeds and delays on each route between origin and destination, followed by an estimation of speeds and delays on each route associated with the predicted traffic flows on the route.

3.1 General Network Assumptions

The following general network assumption have been made in the MSM model:

- All committed developments and respective infrastructure upgrades planned as outlined in the ATAP (Auckland Transport Alignment Project) 2.0 and RLTP (Regional Land Transport Plan) have been coded in the future MSM model

- The access points (MSM zone connectors) for each model option scenarios in the Warkworth Detailed business case areas were reviewed and refined accordingly to reflect the future infrastructure upgrades
- The future local bus services for each model option scenarios, were updated based on inputs from the AT Metro, specifically related to routes, frequencies, bus capacities and bus speeds.

The proposed Warkworth DBC projects and improvements have been identified in order to support growth in Warkworth and unlock the future land use. In addition to these projects, there are several key strategic projects that integrate with this network including:

- Te Honohono ki Tai - Matakana link road
- Ara Tūhono – Pūhoi to Warkworth Motorway.
- Hill Street Roundabout Upgrade

It should be noted that the Warkworth to Wellsford portion of Ara Tūhono has not been included as part of the modelling.

It is the combination of these projects and the proposed Te Tupu Ngātahi projects that will enable the key transport and land use integration outcomes for the Warkworth community.

The inclusion of the key inter-dependent strategic projects in the Do-minimum network is to account for the fact that those projects are being developed by Waka Kotahi, so are not included as part of the Te Tupu Ngātahi improvements package.

The following changes between the Do-minimum (Do-min) and recommended transport network (Recommended Option) are noted below:

- **Road Network**: The Do-minimum network includes the existing arterial and local road connections within Warkworth. The recommended network includes the existing network and new links along the Wider Western Link, Western Link – South, Western Link – North and Sandspit Road Link.
- **PT Services**: The PT network within the Do-minimum consists of three routes that travel along SH1, Matakana Road and Sandspit Road respectively. The frequency of these routes ranges between 30 minutes and 60 minutes during the weekday. In comparison, there are several high-frequency routes (10 minutes to 15 minutes during the weekday) within the recommended transport network. These routes cover most of the urban area within Warkworth and travel along both the existing and new corridors within the network.
- **Active Mode Connections**: There is a full cycle network along both existing and new connections within the Warkworth recommended transport network. The connections present in the Do-minimum network are existing/planned facilities along SH1 between Hudson Road and Woodcocks Road.

3.2 MSM Outputs

There are a number of outputs from the transport modelling, including:

- Demand patterns (Origin-Destination travel) and facility usage (flows)
- Network performance
- Travel times and costs (real and perceived) for economic analysis
- Delays, queues and Level of Service (LoS) for design and assessment

- Aggregate travel statistics on travel such as Vehicle Kilometres Travelled (VKT), Passenger Kilometres Travelled (PKT) and total travel costs
- Flow and performance for environmental analysis
- Inputs to vehicle emissions models
- Inputs to noise analysis

3.3 SATURN

SATURN is a mesoscopic traffic simulation and assignment model used to undertake a variety of area wide strategic assessments through to more detailed local area assessments. It can be used as a conventional model for the analysis of traffic-management schemes over localised networks as well as for major investment improvements at a regional level. The SATURN model ensures factual representation of vehicle flow patterns and congestion on midblock sections and intersections in the form of 'arrival' flows rather than 'demand' flows. Additionally, it is used as a high-level junction simulation model that evaluates the traffic flow behaviour on junctions. It represents 'congested assignment' of multiple user classes modelled separately, including bus priority and high occupancy vehicle lanes.

3.3.1 SATURN Outputs

There are a number of outputs from the SATURN model, including:

- Vehicular flow pattern -Actual flow, Demand flow, Queued flow
- Network performance- Link and Node delays, Queue Statistics, V/C Ratios
- Mid-block capacities and speeds
- Aggregate travel statistics on travel such as Total Travel Time(hrs), Distance Travelled (kms)

3.4 SIDRA

Signalised (and unsignalised) Intersection Design and Research Aid (SIDRA) is a micro-analytical tool used for evaluating intersection performance. It has a comprehensive, lane-based network modelling approach applicable to all types on intersections-signal, priority or sign control and roundabouts. SIDRA allows the modelling of various movement classes (Light vehicle, Heavy vehicle, Buses, Bicycle, Large Trucks, Light Rail/ Trams) with distinctive vehicle features to be assigned to designated lanes, segments and signal phases.

The Te Tupu Ngātahi SIDRA model is used to analyse the form and function of proposed intersections along strategic corridors. Based on the demand flow outputs from the SATURN Model, the intersection turning flows are determined.

The performance measures of the intersection in terms of capacity, delay, Level of Service (LOS), queue length on approach lanes and optimum vehicle-pedestrian signal phasing is calculated.

It is noted that the SIDRA model is reliant on outputs from the SATURN model, with traffic distribution based on the network provided in SATURN. A finer grain network that includes all collectors and local roads is not provided in SATURN, and as such it can considered that intersection modelling in SIDRA results in a conservative assumption of performance.

3.5 SIDRA Results for 2048+ Intersection Modelling

Western Link - North /SH1/ Matakana Link Road

MOVEMENT SUMMARY

Site: 101 [Matakana Link Road - Western Link Road_AM]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Western Link Road - North												
1	L2	167	18.2	0.165	10.2	LOS B	2.4	19.0	0.41	0.66	0.41	50.4
2	T1	213	6.4	0.375	42.4	LOS D	4.8	35.5	0.94	0.75	0.94	35.5
3	R2	82	21.8	0.230	40.9	LOS D	3.3	27.8	0.86	0.76	0.86	35.2
Approach		462	13.4	0.375	30.4	LOS C	4.8	35.5	0.73	0.72	0.73	39.7
East: SH1												
4	L2	74	10.0	0.518	43.4	LOS D	8.8	69.5	0.93	0.79	0.93	35.6
5	T1	327	18.3	0.518	37.7	LOS D	8.8	71.2	0.93	0.78	0.93	36.9
6	R2	88	11.9	0.301	45.8	LOS D	3.9	29.9	0.92	0.77	0.92	33.9
Approach		489	15.9	0.518	40.0	LOS D	8.8	71.2	0.93	0.78	0.93	36.1
North: Matakana Link Road												
7	L2	89	28.2	0.087	8.3	LOS A	0.9	7.4	0.30	0.62	0.30	51.5
8	T1	131	10.5	0.236	41.3	LOS D	2.9	21.9	0.92	0.71	0.92	35.9
9	R2	195	8.1	0.499	43.2	LOS D	8.5	63.5	0.93	0.81	0.93	34.8
Approach		415	13.2	0.499	35.1	LOS D	8.5	63.5	0.79	0.73	0.79	37.8
West: SH1												
10	L2	248	14.0	0.188	6.8	LOS A	1.6	12.8	0.22	0.61	0.22	52.9
11	T1	318	22.2	0.420	36.8	LOS D	6.8	56.6	0.91	0.74	0.91	37.5
12	R2	146	19.4	0.522	47.9	LOS D	6.7	54.9	0.96	0.80	0.96	33.2
Approach		713	18.8	0.522	28.6	LOS C	6.8	56.6	0.68	0.71	0.68	40.5
All Vehicles		2079	15.8	0.522	33.0	LOS C	8.8	71.2	0.77	0.73	0.77	38.7

MOVEMENT SUMMARY

Site: 101 [Matakana Link Road - Western Link Road_PM]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Western Link Road - North												
1	L2	178	18.9	0.164	9.3	LOS A	2.2	18.0	0.37	0.65	0.37	51.0
2	T1	313	4.4	0.544	43.7	LOS D	7.3	52.9	0.97	0.79	0.97	35.1
3	R2	172	6.7	0.532	46.8	LOS D	7.8	57.8	0.96	0.81	0.96	33.5
Approach		662	8.9	0.544	35.2	LOS D	7.8	57.8	0.81	0.75	0.81	37.8
East: SH1												
4	L2	97	8.7	0.530	44.3	LOS D	8.6	68.4	0.94	0.79	0.94	34.9
5	T1	285	24.4	0.530	38.7	LOS D	8.6	68.4	0.94	0.78	0.94	36.4
6	R2	54	25.5	0.154	40.2	LOS D	2.1	18.3	0.84	0.73	0.84	35.6
Approach		436	21.0	0.530	40.1	LOS D	8.6	71.1	0.93	0.78	0.93	36.0
North: Matakana Link Road												
7	L2	120	7.9	0.110	9.3	LOS A	1.5	11.2	0.37	0.64	0.37	51.2
8	T1	175	3.6	0.303	41.8	LOS D	3.9	28.1	0.93	0.73	0.93	35.7
9	R2	129	13.0	0.419	45.9	LOS D	5.8	44.8	0.93	0.79	0.93	33.9
Approach		424	7.7	0.419	33.9	LOS C	5.8	44.8	0.77	0.72	0.77	38.4
West: SH1												
10	L2	388	5.7	0.289	7.2	LOS A	3.4	24.9	0.27	0.63	0.27	52.8
11	T1	353	11.6	0.458	37.9	LOS D	7.7	59.0	0.92	0.76	0.92	37.1
12	R2	206	12.8	0.545	43.8	LOS D	9.1	70.8	0.94	0.81	0.94	34.6
Approach		947	9.4	0.545	26.6	LOS C	9.1	70.8	0.66	0.72	0.66	41.5
All Vehicles		2469	11.0	0.545	32.5	LOS C	9.1	71.1	0.77	0.74	0.77	38.9

Woodcocks Road/Wider Western Link

MOVEMENT SUMMARY

Site: 101 [Woodcocks Road - Wider Western Link Road_AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Wider Western Link Road												
1	L2	32	10.0	0.152	3.7	LOS A	0.8	6.1	0.16	0.58	0.16	52.2
3	R2	187	10.7	0.152	9.4	LOS A	0.8	6.1	0.16	0.58	0.16	53.8
Approach		219	10.6	0.152	8.6	LOS A	0.8	6.1	0.16	0.58	0.16	53.6
East: Woodcocks Road												
4	L2	273	5.4	0.202	3.5	LOS A	1.3	9.8	0.14	0.40	0.14	56.0
5	T1	45	0.0	0.202	3.5	LOS A	1.3	9.8	0.14	0.40	0.14	57.9
Approach		318	4.6	0.202	3.5	LOS A	1.3	9.8	0.14	0.40	0.14	56.2
West: Woodcocks Road												
11	T1	75	0.0	0.080	4.4	LOS A	0.4	3.2	0.38	0.48	0.38	55.6
12	R2	23	13.6	0.080	10.4	LOS B	0.4	3.2	0.38	0.48	0.38	55.4
Approach		98	3.2	0.080	5.8	LOS A	0.4	3.2	0.38	0.48	0.38	55.6
All Vehicles		635	6.5	0.202	5.6	LOS A	1.3	9.8	0.18	0.47	0.18	55.2

MOVEMENT SUMMARY

Site: 101 [Woodcocks Road - Wider Western Link Road_PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Wider Western Link Road												
1	L2	29	3.6	0.276	3.9	LOS A	1.7	12.5	0.27	0.59	0.27	51.7
3	R2	357	8.0	0.276	9.7	LOS A	1.7	12.5	0.27	0.59	0.27	53.3
Approach		386	7.6	0.276	9.2	LOS A	1.7	12.5	0.27	0.59	0.27	53.1
East: Woodcocks Road												
4	L2	186	5.6	0.184	3.6	LOS A	1.2	9.0	0.20	0.39	0.20	55.7
5	T1	89	0.0	0.184	3.6	LOS A	1.2	9.0	0.20	0.39	0.20	57.6
Approach		276	3.8	0.184	3.6	LOS A	1.2	9.0	0.20	0.39	0.20	56.3
West: Woodcocks Road												
11	T1	49	0.0	0.087	5.3	LOS A	0.5	3.7	0.53	0.60	0.53	54.2
12	R2	39	18.9	0.087	11.5	LOS B	0.5	3.7	0.53	0.60	0.53	53.9
Approach		88	8.3	0.087	8.0	LOS A	0.5	3.7	0.53	0.60	0.53	54.1
All Vehicles		751	6.3	0.276	7.0	LOS A	1.7	12.5	0.28	0.52	0.28	54.3

SH1/ Fairwater Road

MOVEMENT SUMMARY

Site: 101vv [SH1 - Fairwater Road_AM Final]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
8	T1	193	3.8	0.127	2.6	LOS A	2.1	15.5	0.25	0.21	0.25	57.6
9	R2	27	11.5	0.263	57.5	LOS E	1.4	10.5	0.99	0.72	0.99	21.8
Approach		220	4.8	0.263	9.4	LOS A	2.1	15.5	0.34	0.27	0.34	51.3
East: Fairwater Road												
10	L2	23	13.6	0.071	40.4	LOS D	0.9	7.3	0.85	0.70	0.85	26.8
12	R2	38	16.7	0.205	49.7	LOS D	1.8	14.0	0.95	0.73	0.95	23.8
Approach		61	15.5	0.205	46.2	LOS D	1.8	14.0	0.91	0.72	0.91	24.8
North: SH1												
1	L2	45	14.0	0.041	12.3	LOS B	0.8	6.1	0.38	0.65	0.38	41.9
2	T1	346	3.6	0.275	6.6	LOS A	6.5	46.7	0.42	0.36	0.42	54.1
Approach		392	4.8	0.275	7.3	LOS A	6.5	46.7	0.41	0.40	0.41	53.1
All Vehicles		673	5.8	0.275	11.5	LOS B	6.5	46.7	0.43	0.39	0.43	49.3

MOVEMENT SUMMARY

Site: 101vv [SH1 - Fairwater Road_PM Final]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
8	T1	319	1.7	0.215	3.6	LOS A	4.4	31.0	0.31	0.27	0.31	56.6
9	R2	28	7.4	0.228	55.8	LOS E	1.4	10.4	0.98	0.72	0.98	30.7
Approach		347	2.1	0.228	7.9	LOS A	4.4	31.0	0.36	0.30	0.36	53.0
East: Fairwater Road												
10	L2	32	13.3	0.080	38.3	LOS D	1.2	9.5	0.82	0.71	0.82	36.0
12	R2	54	9.8	0.219	47.9	LOS D	2.4	18.2	0.92	0.75	0.92	32.9
Approach		85	11.1	0.219	44.4	LOS D	2.4	18.2	0.88	0.73	0.88	34.0
North: SH1												
1	L2	53	10.0	0.049	13.9	LOS B	1.0	7.7	0.42	0.66	0.42	47.5
2	T1	268	5.5	0.227	8.0	LOS A	5.4	39.5	0.45	0.38	0.45	53.0
Approach		321	6.2	0.227	8.9	LOS A	5.4	39.5	0.44	0.43	0.44	52.1
All Vehicles		754	4.9	0.228	12.5	LOS B	5.4	39.5	0.46	0.41	0.46	49.5

SH1/ Western Link -South/ Mckinney Road

MOVEMENT SUMMARY

Site: 101vv [SH1 - Western Link Road South_AM - Final]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
10	L2	343	3.4	0.728	33.6	LOS C	11.5	83.1	0.97	0.88	1.06	37.9
22	T1	180	3.5	0.327	21.6	LOS C	4.9	35.6	0.83	0.68	0.83	44.3
12	R2	91	10.5	0.605	42.3	LOS D	3.3	25.1	1.00	0.81	1.10	34.6
Approach		614	4.5	0.728	31.4	LOS C	11.5	83.1	0.93	0.81	1.00	39.0
East: Collector												
1	L2	82	15.4	0.737	42.3	LOS D	5.4	42.1	1.00	0.89	1.22	35.5
2	T1	65	8.1	0.737	36.6	LOS D	5.4	42.1	1.00	0.89	1.22	36.4
26	R2	35	9.1	0.125	33.9	LOS C	1.1	8.0	0.89	0.72	0.89	37.6
Approach		182	11.6	0.737	38.6	LOS D	5.4	42.1	0.98	0.86	1.16	36.2
North: SH1												
27	L2	37	11.4	0.686	30.9	LOS C	11.6	84.5	0.95	0.84	0.98	41.1
28	T1	329	3.5	0.686	25.2	LOS C	11.6	84.5	0.95	0.84	0.98	42.2
29	R2	4	0.0	0.026	38.5	LOS D	0.1	1.0	0.94	0.64	0.94	36.1
Approach		371	4.3	0.686	25.9	LOS C	11.6	84.5	0.95	0.83	0.98	42.0
West: Western Link Road South												
30	L2	4	0.0	0.301	36.9	LOS D	2.3	17.4	0.95	0.72	0.95	38.8
8	T1	67	7.8	0.301	31.4	LOS C	2.3	17.4	0.95	0.72	0.95	39.5
9	R2	209	5.5	0.738	39.6	LOS D	7.5	55.2	1.00	0.89	1.17	35.8
Approach		281	6.0	0.738	37.6	LOS D	7.5	55.2	0.99	0.85	1.11	36.7
All Vehicles		1447	5.6	0.738	32.1	LOS C	11.6	84.5	0.95	0.83	1.04	38.9

MOVEMENT SUMMARY

Site: 101vv [SH1 - Western Link Road South_PM - Final]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
10	L2	320	2.6	0.323	15.7	LOS B	7.0	49.8	0.60	0.73	0.60	40.8
22	T1	323	1.6	0.829	39.3	LOS D	13.7	97.6	1.00	1.00	1.24	32.5
12	R2	121	7.0	0.774	48.7	LOS D	5.2	38.7	1.00	0.92	1.29	29.7
Approach		764	2.9	0.829	30.9	LOS C	13.7	97.6	0.83	0.87	0.98	35.0
East: Collector												
1	L2	72	22.1	0.494	40.0	LOS D	4.7	37.0	0.96	0.78	0.96	32.6
2	T1	53	6.0	0.494	35.3	LOS D	4.7	37.0	0.96	0.78	0.96	33.0
26	R2	19	5.6	0.084	39.1	LOS D	0.7	5.0	0.91	0.69	0.91	32.2
Approach		143	14.0	0.494	38.2	LOS D	4.7	37.0	0.96	0.77	0.96	32.7
North: SH1												
27	L2	72	4.4	0.786	44.1	LOS D	11.5	84.6	1.00	1.02	1.58	31.9
28	T1	222	6.6	0.786	39.5	LOS D	11.5	84.6	1.00	1.02	1.58	32.1
29	R2	5	0.0	0.032	41.9	LOS D	0.2	1.4	0.94	0.64	0.94	31.5
Approach		299	6.0	0.786	40.6	LOS D	11.5	84.6	1.00	1.01	1.57	32.1
West: Western Link Road South												
30	L2	5	0.0	0.195	29.5	LOS C	3.1	22.4	0.79	0.65	1.06	36.9
8	T1	102	4.1	0.195	25.0	LOS C	3.1	22.4	0.79	0.65	1.06	37.2
9	R2	377	3.4	0.806	37.5	LOS D	14.9	107.3	0.96	0.93	1.13	32.9
Approach		484	3.5	0.806	34.7	LOS C	14.9	107.3	0.92	0.87	1.12	33.8
All Vehicles		1691	4.5	0.829	34.3	LOS C	14.9	107.3	0.90	0.89	1.12	33.9

SH1/ Wider Western Link

MOVEMENT SUMMARY

Site: 101v [SH1 - Wider Western Link Road_AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	57	3.7	0.296	6.8	LOS A	2.0	14.2	0.69	0.68	0.69	53.2
2	T1	227	4.2	0.296	7.0	LOS A	2.0	14.2	0.69	0.68	0.69	54.8
Approach		284	4.1	0.296	6.9	LOS A	2.0	14.2	0.69	0.68	0.69	54.5
North: SH1												
8	T1	154	4.1	0.413	3.7	LOS A	3.7	26.8	0.18	0.55	0.18	54.2
9	R2	522	3.8	0.413	9.4	LOS A	3.7	26.8	0.18	0.55	0.18	54.5
Approach		676	3.9	0.413	8.1	LOS A	3.7	26.8	0.18	0.55	0.18	54.4
West: Wider Western Link Road												
10	L2	269	8.2	0.256	4.8	LOS A	1.8	13.4	0.52	0.55	0.52	54.2
12	R2	25	4.2	0.256	10.6	LOS B	1.8	13.4	0.52	0.55	0.52	56.3
Approach		295	7.9	0.256	5.3	LOS A	1.8	13.4	0.52	0.55	0.52	54.4
All Vehicles		1255	4.9	0.413	7.2	LOS A	3.7	26.8	0.38	0.58	0.38	54.4

MOVEMENT SUMMARY

Site: 101v [SH1 - Wider Western Link Road_PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	47	0.0	0.321	5.0	LOS A	2.2	15.9	0.54	0.52	0.54	53.9
2	T1	331	2.5	0.321	5.2	LOS A	2.2	15.9	0.54	0.52	0.54	55.5
Approach		378	2.2	0.321	5.2	LOS A	2.2	15.9	0.54	0.52	0.54	55.3
North: SH1												
8	T1	267	4.3	0.362	4.0	LOS A	3.1	23.1	0.32	0.50	0.32	54.9
9	R2	260	10.9	0.362	9.7	LOS A	3.1	23.1	0.32	0.50	0.32	54.9
Approach		527	7.6	0.362	6.8	LOS A	3.1	23.1	0.32	0.50	0.32	54.9
West: Wider Western Link Road												
10	L2	524	5.0	0.540	6.1	LOS A	4.7	34.1	0.74	0.69	0.74	53.4
12	R2	69	0.0	0.540	11.7	LOS B	4.7	34.1	0.74	0.69	0.74	55.5
Approach		594	4.4	0.540	6.7	LOS A	4.7	34.1	0.74	0.69	0.74	53.6
All Vehicles		1499	5.0	0.540	6.4	LOS A	4.7	34.1	0.54	0.58	0.54	54.5

Matakana Road/ Matakana Link Road/ Sandspit Link

MOVEMENT SUMMARY

Site: 101 [Matakana Rd - Sandspit Rd Link _AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Matakana Road												
1	L2	195	4.9	0.343	6.4	LOS A	2.4	17.7	0.68	0.68	0.68	53.5
2	T1	122	14.7	0.343	6.7	LOS A	2.4	17.7	0.68	0.68	0.68	55.0
3	R2	13	0.0	0.343	12.0	LOS B	2.4	17.7	0.68	0.68	0.68	55.6
Approach		329	8.3	0.343	6.7	LOS A	2.4	17.7	0.68	0.68	0.68	54.1
East: Sandspit Road Link												
4	L2	17	0.0	0.230	6.2	LOS A	1.5	10.7	0.65	0.64	0.65	53.1
5	T1	192	1.6	0.230	6.3	LOS A	1.5	10.7	0.65	0.64	0.65	54.7
6	R2	15	0.0	0.230	12.0	LOS B	1.5	10.7	0.65	0.64	0.65	55.0
Approach		223	1.4	0.230	6.7	LOS A	1.5	10.7	0.65	0.64	0.65	54.6
North: Matakana Road												
7	L2	9	0.0	0.320	4.3	LOS A	2.3	17.6	0.42	0.56	0.42	52.8
8	T1	175	9.0	0.320	4.4	LOS A	2.3	17.6	0.42	0.56	0.42	54.1
9	R2	218	13.5	0.320	10.3	LOS B	2.3	17.6	0.42	0.56	0.42	54.1
Approach		402	11.3	0.320	7.6	LOS A	2.3	17.6	0.42	0.56	0.42	54.1
West: Matakana Road Link												
10	L2	185	18.8	0.263	4.6	LOS A	1.8	14.5	0.44	0.52	0.44	53.6
11	T1	68	12.3	0.263	4.5	LOS A	1.8	14.5	0.44	0.52	0.44	55.4
12	R2	59	5.4	0.263	10.1	LOS B	1.8	14.5	0.44	0.52	0.44	55.8
Approach		313	14.8	0.263	5.6	LOS A	1.8	14.5	0.44	0.52	0.44	54.4
All Vehicles		1267	9.6	0.343	6.7	LOS A	2.4	17.7	0.53	0.59	0.53	54.3

MOVEMENT SUMMARY

Site: 101 [Matakana Rd - Sandspit Rd Link _PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Matakana Road												
1	L2	157	6.0	0.309	5.6	LOS A	2.1	15.8	0.61	0.60	0.61	53.6
2	T1	146	6.5	0.309	5.6	LOS A	2.1	15.8	0.61	0.60	0.61	55.2
3	R2	20	0.0	0.309	11.2	LOS B	2.1	15.8	0.61	0.60	0.61	55.7
Approach		323	5.9	0.309	5.9	LOS A	2.1	15.8	0.61	0.60	0.61	54.4
East: Sandspit Road Link												
4	L2	16	0.0	0.125	6.5	LOS A	0.8	5.8	0.68	0.65	0.68	53.0
5	T1	84	6.3	0.125	6.7	LOS A	0.8	5.8	0.68	0.65	0.68	54.5
6	R2	7	0.0	0.125	12.2	LOS B	0.8	5.8	0.68	0.65	0.68	54.9
Approach		107	4.9	0.125	7.0	LOS A	0.8	5.8	0.68	0.65	0.68	54.3
North: Matakana Road												
7	L2	20	0.0	0.428	6.1	LOS A	3.2	24.5	0.72	0.72	0.72	51.6
8	T1	171	6.8	0.428	6.4	LOS A	3.2	24.5	0.72	0.72	0.72	53.0
9	R2	221	13.3	0.428	12.3	LOS B	3.2	24.5	0.72	0.72	0.72	52.9
Approach		412	10.0	0.428	9.6	LOS A	3.2	24.5	0.72	0.72	0.72	52.9
West: Matakana Road Link												
10	L2	228	7.8	0.474	4.8	LOS A	4.1	29.8	0.55	0.55	0.55	53.2
11	T1	232	0.9	0.474	4.7	LOS A	4.1	29.8	0.55	0.55	0.55	55.0
12	R2	141	1.5	0.474	10.5	LOS B	4.1	29.8	0.55	0.55	0.55	55.3
Approach		601	3.7	0.474	6.1	LOS A	4.1	29.8	0.55	0.55	0.55	54.4
All Vehicles		1443	6.1	0.474	7.1	LOS A	4.1	29.8	0.62	0.62	0.62	53.9

Sandspit Road/ Sandspit Link

MOVEMENT SUMMARY

Site: 101 [Sandspit Rd - Sandspit Rd Link _AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Sandspit Road												
5	T1	453	3.3	0.407	4.1	LOS A	3.4	24.5	0.39	0.46	0.39	55.5
6	R2	120	1.8	0.407	9.8	LOS A	3.4	24.5	0.39	0.46	0.39	55.8
Approach		573	2.9	0.407	5.3	LOS A	3.4	24.5	0.39	0.46	0.39	55.5
North: Sandspit Link												
7	L2	58	12.7	0.150	5.5	LOS A	0.9	6.7	0.53	0.65	0.53	51.8
9	R2	102	1.0	0.150	10.9	LOS B	0.9	6.7	0.53	0.65	0.53	53.8
Approach		160	5.3	0.150	8.9	LOS A	0.9	6.7	0.53	0.65	0.53	53.0
West: Sandspit Road												
10	L2	46	2.3	0.278	4.1	LOS A	1.9	14.9	0.37	0.42	0.37	54.7
11	T1	312	13.9	0.278	4.3	LOS A	1.9	14.9	0.37	0.42	0.37	56.2
Approach		358	12.4	0.278	4.3	LOS A	1.9	14.9	0.37	0.42	0.37	56.0
All Vehicles		1091	6.4	0.407	5.5	LOS A	3.4	24.5	0.41	0.48	0.41	55.3

MOVEMENT SUMMARY

Site: 101 [Sandspit Rd - Sandspit Rd Link _PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Sandspit Road												
5	T1	414	7.6	0.331	3.7	LOS A	2.7	19.9	0.23	0.40	0.23	56.3
6	R2	88	4.8	0.331	9.4	LOS A	2.7	19.9	0.23	0.40	0.23	56.6
Approach		502	7.1	0.331	4.7	LOS A	2.7	19.9	0.23	0.40	0.23	56.4
North: Sandspit Link												
7	L2	135	0.8	0.172	5.8	LOS A	1.1	7.5	0.60	0.64	0.60	53.4
9	R2	41	0.0	0.172	11.5	LOS B	1.1	7.5	0.60	0.64	0.60	55.4
Approach		176	0.6	0.172	7.1	LOS A	1.1	7.5	0.60	0.64	0.60	53.9
West: Sandspit Road												
10	L2	120	0.9	0.374	4.0	LOS A	2.8	20.2	0.33	0.40	0.33	55.0
11	T1	419	3.3	0.374	4.0	LOS A	2.8	20.2	0.33	0.40	0.33	56.6
Approach		539	2.7	0.374	4.0	LOS A	2.8	20.2	0.33	0.40	0.33	56.3
All Vehicles		1217	4.2	0.374	4.7	LOS A	2.8	20.2	0.33	0.44	0.33	56.0

Wider Western Link/ Link to the Southern Interchange

MOVEMENT SUMMARY

Site: 101v [Link to the Southern Interchange - Wider Western Link Road_AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Wider Western Link Road												
1	L2	218	8.7	0.339	4.8	LOS A	2.4	18.0	0.51	0.51	0.51	54.2
2	T1	199	2.1	0.339	4.9	LOS A	2.4	18.0	0.51	0.51	0.51	56.1
Approach		417	5.6	0.339	4.9	LOS A	2.4	18.0	0.51	0.51	0.51	55.1
North: Wider Western Link Road												
8	T1	74	2.9	0.219	4.4	LOS A	1.4	10.5	0.40	0.58	0.40	53.6
9	R2	208	5.1	0.219	10.1	LOS B	1.4	10.5	0.40	0.58	0.40	53.8
Approach		282	4.5	0.219	8.6	LOS A	1.4	10.5	0.40	0.58	0.40	53.8
West: Link to the Southern Interchange												
10	L2	113	12.1	0.223	4.7	LOS A	1.5	11.5	0.46	0.59	0.46	52.5
12	R2	147	14.3	0.223	10.6	LOS B	1.5	11.5	0.46	0.59	0.46	54.2
Approach		260	13.4	0.223	8.0	LOS A	1.5	11.5	0.46	0.59	0.46	53.4
All Vehicles		959	7.4	0.339	6.8	LOS A	2.4	18.0	0.46	0.55	0.46	54.2

MOVEMENT SUMMARY

Site: 101v [Link to the Southern Interchange - Wider Western Link Road_PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Wider Western Link Road												
1	L2	151	18.2	0.220	4.2	LOS A	1.5	11.5	0.34	0.42	0.34	54.7
2	T1	145	0.7	0.220	4.1	LOS A	1.5	11.5	0.34	0.42	0.34	56.9
Approach		296	9.6	0.220	4.1	LOS A	1.5	11.5	0.34	0.42	0.34	55.8
North: Wider Western Link Road												
8	T1	209	1.5	0.273	5.3	LOS A	1.9	13.4	0.56	0.59	0.56	54.5
9	R2	100	8.4	0.273	11.1	LOS B	1.9	13.4	0.56	0.59	0.56	54.6
Approach		309	3.7	0.273	7.2	LOS A	1.9	13.4	0.56	0.59	0.56	54.5
West: Link to the Southern Interchange												
10	L2	172	28.2	0.363	4.7	LOS A	2.7	21.9	0.44	0.58	0.44	51.8
12	R2	277	14.8	0.363	10.4	LOS B	2.7	21.9	0.44	0.58	0.44	53.8
Approach		448	20.0	0.363	8.2	LOS A	2.7	21.9	0.44	0.58	0.44	53.0
All Vehicles		1054	12.3	0.363	6.8	LOS A	2.7	21.9	0.44	0.54	0.44	54.2

ATTACHMENT 76

URBAN DESIGN EVALUATION

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Warkworth Urban Design Evaluation

May 2023

Version 1.0

4. Document Status

Responsibility	Name
Author	Ben Frost
Reviewer	Stuart Bowden
Approver	Simon Titter

5. Revision Status

Version	Date	Reason for Issue
1.0	12/05/2023	Final for Lodgement

6. Table of Contents

7. Tables

8. Figures

9. Glossary of Defined Terms and Acronyms

Table 1: Glossary of defined terms and acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
CEDF	Cultural and Environmental Design Framework
CPTED	Crime Prevention through Environmental Design
DBC	Detailed Business Case
FTN	Frequent Transit Network
MCA	Multi-Criteria Assessment
N/A	Not Applicable
NPS	National Policy Statement
NPS:UD	National Policy Statement on Urban Development
NOR	Notice of Requirement
NZ	New Zealand
NZUP	New Zealand Upgrade Programme
RLTP	Auckland Regional Land Transport Plan
RMA	Resource Management Act 1991
SH1	State Highway One
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
TDM	AT's Transport Design Manual
THAB	Terraced House and Apartment Building zone
ULDMP	Urban Landscape and Design Management Plan
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

10. Executive Summary

This Urban Design Evaluation (UDE) supports the Notices of Requirement (NoRs) for the suite of projects in Warkworth (the Project) lodged by Waka Kotahi NZ Transport Agency (WK) and Auckland Transport (AT) as requiring authorities under the Resource Management Act 1991 (RMA). The notices of requirement propose eight new designations.

Table 2: Outline of NORs

Corridor	NOR	Description	Requiring Authority
Northern Public Transport Interchange + Park and Ride and Western Link - North	1	Construction of a public transport hub with associated facilities + park and ride facility (approximately 228 carparks) Construction of a four lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Woodcocks Road Upgrade (Western Section)	2	Upgrade of Woodcocks Road to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Existing State Highway 1 Upgrade - Southern	3	Upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Matakana Road Upgrade	4	Upgrade of Matakana Road to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Sandspit Road Upgrade	5	Upgrade of Sandspit Road to a two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Western Link South	6	Construction of a new two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Sandspit Link	7	Construction of a new two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport
Wider Western Link - Northern	8	Construction of a new two lane urban arterial cross-section with cycle lanes and footpaths	Auckland Transport

This UDE contains an evaluation section for each NOR which has been prepared based on the guidance and principles established in Te Tupu Ngātahi Design Framework (Design Framework). The UDE provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design opportunities should be considered in future design stages. These recommendations should form the basis of an urban design specific designation condition, and where there is an overlap of urban design outcomes with other considerations (for

example ecological, landscape, visual or water quality related recommendations) they should be integrated within the relevant specialist conditions.

The recommendations are summarised as urban design outcomes sought and where additional urban design opportunities have been identified during the evaluation, they are also mapped for each NOR for consideration either by the requiring authorities or other parties at future stages of design and development of the Project. These opportunities are not however required to mitigate the anticipated urban design effects of the Projects.

11. Summary of urban design outcomes sought

Overall, the Project has been found to be generally supportive of the Design Framework principles.

The preparation of an Urban and Landscape Design Management Plan (ULDMP) in future delivery stages is recommended for all NORs to further develop the urban design outcomes recommended as summarised under each NOR evaluation.

Details of the urban design recommendations are included under each NOR and are not repeated in this summary for brevity.

1. Introduction

The Warkworth Strategic and Local Package is comprised of eight projects which will be provided for by eight NORs as a single Assessment of Effects on the Environment (AEE) package and include:

- Urbanisation of existing corridors – Woodcocks Road (western section), Matakana Road, Sandspit Road, State Highway 1 (southern section)
- New arterial corridors – Wider Western Link (northern section), Sandspit Link, Western Link - South
    - New Northern Public Transport Hub + Park and Ride and Western Link – North

Figure 1-1: Overview of the Warkworth Strategic and local Package

2. Purpose and scope of this evaluation

This **UDE** provides an overview of the urban design considerations and inputs as well as an evaluation and identification of future transport and land use integration opportunities for the Warkworth Strategic and Local Package (the Project).

This evaluation 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 within each NoR, and the typical methodologies that will be used to implement this work. These have been reviewed by the author of this evaluation and have been considered as part of this UDE. As such, they are not repeated here.

The key sections addressed for each project are outlined in Table 3: Evaluation Structure.

Table 3: Evaluation Structure

Sections	Location in document
Description of the Project	Page 6 - Project Description
Corridor form and function	Page 13 Corridor form and function
Corridor Design Context	Page 11 The Design Context
Existing and Likely future environment	Page 14 Existing and likely future environment
Summary of urban design evaluation and recommendations	Within each NOR section
Summary map of urban design outcomes and opportunities	Within each NOR section
Evaluation against Te Tupu Ngātahi Design Framework principles	

3. The Design Context

This evaluation which has been prepared for each of the NORs is based on the guidance and principles established in the Te Tupu Ngātahi programme wide document – *Te Tupu Ngātahi Design Framework (**Design Framework or Design Framework Principles** – refer to Appendix A)*

The Design Framework takes a systems approach as the basis on which urban areas are organised and understood and pulls these apart as a series of layers; environment, social, built form, movement and land use, with cultural and sustainability values underpinning and spanning across these. In this way transport networks are not seen in isolation rather in terms of how they can contribute to the urban system as a whole.

There are twenty design principles that have been established (as part of the Design Framework) within these layers to provide high level guidance on the attributes of responsive, resilient, sustainable, vibrant and high-quality urban environments. Each of the principles describe what 'good looks like' and what to aim for in the design of transport networks. The principles sit within an integrated system across the various layers, to be prioritised and applied according to desired outcomes articulated in the strategic policy direction and the unique needs of each context.

The Design Framework principles are relevant across the Projects within the Te Tupu Ngātahi Supporting Growth Programme as they contribute to the understanding of the development of route options in terms of; place context, built form interfaces, movement functions and modal priorities. They also inform the design development of route options at each phase with specific urban design considerations including;

- Land use and corridor interface
- Connectivity and access
- Character and sense of place
- Integration with future development
- Response to topography

The Design Framework sits within the context of a range of established strategic plans, policies and design guidance that guide urban development outcomes at the:

- National level (e.g. National Policy Statement (NPS) on Urban Development, Government Policy Statement (GPS) on Land Transport, Medium Density Housing Standards (MDRS), NZ Transport Agency Bridging the Gap, Regional Land Transport Plan); and
- Local level (e.g. Auckland Plan 2050, Auckland Transport Alignment Project (ATAP), Auckland Transport Roads and Streets Framework, Transport Design Manual, Auckland Unitary Plan (AUP:OP), AT Sustainability Framework, Auckland Transport Code of Practice).

The established strategic plans and guidance outlined above informed the development of the Design Framework content and they are referenced in general terms as they relate to the attributes that will contribute to healthy, connected and sustainable communities. Where design guidance was not available, the Design Framework included more detail, e.g. the approach to the location of rail, rapid transit and the role of active modes.

National Policy Statement on Urban Development 2020 (NPS:UD)

The NPS:UD came into effect on 20 August 2020 and sets out a list of things that local authorities must do to give effect to the objectives and policies defined within the NPS:UD. The NPS:UD does not explicitly address or refer to urban design but sets out the characteristics and rationale for well-

functioning urban environments that enable all communities to provide for their social, economic, and cultural well-being and for their health and safety, now and into the future. This includes, amongst other requirements, the enabling of increased commercial and residential activity around:

- centre zones;
- areas with employment opportunities; and
- areas that are well serviced by existing or planned public transport or where there is high demand for housing or business.

This aligns with the Design Framework principle of increasing density in and around centres to create vibrant walkable/cyclable communities that support public transport, have compact urban forms, a strong sense of place and a community focal point.

Auckland Council

At a local level, the key urban design considerations and provisions of the AUP:OP relevant to the Project include:

- Regional Policy Statement B2: Urban Growth and Form;
- Regional Policy Statement B3: Infrastructure Transport and Energy;
- Regional Policy Statement B4: Natural Heritage (E38: Urban Subdivision);
- Chapter E38: Subdivision;
- Chapter H: Zones (including structure planned zones);
- Chapter M: Appendix 1 Structure plan guidelines.

The specific urban design commentary within the corridor evaluations (outlined in the sections below) broadly address the objectives and policies of the relevant sections of the Regional Policy Statement and Chapters of the AUP:OP as listed above.

In addition, the Auckland Plan 2050 sets the vision and direction for Auckland and the Design Framework directly references this plan. It illustrates how the outcomes of the Auckland Plan are linked to the design principles set out in the Design Framework.

The urban design commentary also refers to the Warkworth Structure Plan (June 2019) which sets out a pattern of land uses and the supporting infrastructure network for the Future Urban zoned land around Warkworth. The plan was been prepared in the context of the existing town of Warkworth and seeks to weave new development areas back into the fabric of the existing urban area.

The structure plan sets opportunities and constraints in and around the Future Urban zone. Some of the key high-level features of the Warkworth Structure Plan relevant to this evaluation include:

- Ecological and stormwater areas are set aside from any built urban development.
- The new residential areas across the Future Urban zone enable around 7,500 dwellings and offer a range of living types from spacious sections around the fringe to more intensive dwellings such as town houses and apartments around the new small centres and along public transport routes.
- Warkworth's local and rural character is protected through various measures including provisions to protect the bush-clad town centre backdrop by the Mahurangi River and retaining the Morrison's Heritage Orchard as a rural feature of the town.
- New employment areas are identified, comprising land for new industry (e.g. warehousing, manufacturing, wholesalers, repair services) and land for small centres (e.g. convenience retail,

local offices, restaurants/cafés). The existing Warkworth town centre by the Mahurangi River will remain as the focal point of the town.

The land uses are supported by infrastructure including:

- Prioritising active transport in Warkworth through a walking and cycling network providing connectivity to new and existing centres, employment areas, schools and public transport stations.
- A roading network including a potential southern interchange on Ara Tūhono – Pūhoi to Warkworth (south facing ramps only).
- A public transport network that connects with a bus station/interchange in Warkworth's southern Local Centre and a Park and Ride connected to the strategic network.

4. Project Description

The projects have been combined into one lodgment package (**Warkworth Strategic and Local Package**) which will be lodged with Auckland Council. The package is comprised of eight projects which will be provided for by eight NORs as a single Assessment of Effects on the Environment **(AEE)** package and include:

- Urbanisation of existing corridors within a predominantly urban environment – Woodcocks Road (western section), Matakana Road, Sandspit Road, State Highway 1 (southern section). This primarily involves the upgrade and widening of existing transport corridors to provide for a high-quality walking and cycling facilities and urban geometric standards.
- New arterial corridors to provide access to future growth areas – Wider Western Link (northern section), Sandspit Link, Western Link - South
- New Northern Public Transport Hub and Park and Ride and Western Link – North

The Project comprises eight NOR's including:

- Northern Public Transport Hub + Park and Ride and Western Link – North (NOR 1)
- Woodcocks Road Upgrade (NOR 2)
- State Highway 1 (Southern Section) Upgrade (NOR 3)
- Matakana Road Upgrade (NOR 4)
- Sandspit Road Upgrade (NOR 5)
- Western Link - South (NOR 6)
- Sandspit Link (NOR 7)
- Wider Western Link (Northern Section) (NOR 8)

12. Corridor form and function

Section 8 and 9 of the AEE outlines the key physical elements of the Project across each of the NOR sections and how the different elements of the Project will operate once the Project is implemented.

The design of the Project is commensurate with the 'route protection' phase of the Project, as such, only a concept level of design has been undertaken. The design will be further refined through subsequent 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.

Each NOR section is described in the AEE under the key feature headings:

- Public Transport
- Walking and Cycling Facilities;
- General Traffic;
- Access;
- Speed Environment;
- Signalised intersections; and
- Stormwater infrastructure.

13. Existing and likely future environment

Section 9 of the AEE outlines the key attributes of the existing and likely future environment of the Project across each of the NOR sections. Each section is described in the AEE under key features of:

Planning context and land use

- Current land use and urban form
- Current zoning
- Likely future zoning – Warkworth Structure Plan
- Overlays
- Controls
- Existing designations

Human environment

- Transport
- Historic heritage and archaeological values
- Community and recreational facilities
- Noise and vibration
- Areas of cultural value

Natural and physical environment

- Geology
- Hydrology and natural hazards, including watercourses
- Terrestrial ecology
- Topography and landscape context

14. Preparation for this evaluation

Work undertaken for this evaluation commenced in June 2022. In summary, the preparation for this work has included:

- Review of the Warkworth specialist briefing package, the Detailed Business Case (**DBC**) design drawings and the Te Tupu Ngātahi GIS viewer;
- A review of the statutory setting of the project and surrounding context;
- A review of the base map data such as contours and aerial photography;
- A detailed site visit including taking representative photographs along the route was undertaken on 23 June and again on 5 October 2022 by Ben Frost to understand the nature of the receiving environment and its physical and visual relationship to the surrounding environment, as well as the context, character and urban setting from the wider area.
- A site visit with Auckland Council representatives was undertaken on 21st February 2023 by Ben Frost prior to soft lodgement.

15. All Warkworth NoRs

16. Introduction

This section evaluates common or general urban design matters across all Warkworth NOR's against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where common urban design outcomes should be considered in future design stages. These recommendations could form the basis of an urban design specific designation condition. Where there is an overlap between urban design and other discipline outcomes ie. ecological, landscape, visual or water quality recommendations, these could be integrated in the designation conditions.

17. Urban design matters common to all NORs

Table 4: Common urban design matters

Principle	Explanation	Application common to all NORs
ENVIRONMENT		
1.1 **Support and enhance ecological corridors and biodiversity**	Mitigate the effects on or enhance existing ecological corridors through the placement and design of movement corridors	– It is noted that detailed water quality and detention / retention requirements for the corridor will be decided in the future consenting stage of the Project. – The proposed corridor and associated designation boundary provide spatial provisions (within the cross section and wider boundary) that have the potential to support ecological connectivity and biodiversity in the local environment by providing contiguous space for diverse planting responses. – Opportunities within the immediate landscape of the corridors to support and enhance indigenous biodiversity are detailed in the Warkworth Package: Assessment of Ecological Effects. – There are twelve water course bridge crossings proposed along the various corridors. All crossings should incorporate bridging structures to reinforce broader connectivity outcomes for ecology and water quality by minimising stream interruptions and ensuring a connected natural system. – Stream crossings where existing culverts are to be upgraded or lengthened will be improved so that fish passage is provided.
1.2 **Support water conservation and enhance water quality in a watershed**	Take into account and work with the existing watershed as part of a whole system.	– An Integrated Stormwater Strategy is proposed that identifies preferred treatment approaches within each corridor / interchange. This identifies a preference for the use of green infrastructure for new treatment devices across the corridor such as wetland ponds, linear treatment as well as the use and / or enhancement of existing public stormwater treatment ponds. – The proposed typical corridor cross sections and designation boundaries allows spatial provisions to provide natural drainage

Principle	Explanation	Application common to all NORs
		to stormwater raingardens to address water quality and reduce hard engineering solutions. – Further refinement of the wetland pond configuration and arrangements during the detailed design stage is recommended to define the wetland final form and interface with the surrounding land uses. For example, wetland edges may be configured in a naturally shaped manner and fully integrated with existing natural drainage features and vegetation – particularly adjacent the Mahurangi River and tributaries. – Future development and definition of the proposed stormwater treatment devices, swales and ponds is recommended to provide an appropriate interface with the surrounding context and amenity for the corridor. – Integrate amenity and recreational aspects into stormwater elements.
1.3 **Minimise land disturbance, conserve resources and materials**	Respect the existing topography, landforms and urban structure in the placement of strategic corridors. Minimise the quantity of hard engineering materials required. Minimise, mitigate any adverse effects of activities on the environment.	– The proposed corridors demonstrate a generally efficient alignment in relation to existing property boundaries along each corridor / interchanges minimising land impacts and inefficient residual land portions. – The proposed corridor upgrades generally follow the vertical geometry of the existing corridor, minimising land disturbance. Further vertical integration adjacent to stream crossings and bridging structures should be developed at a detailed design stage to allow an appropriate transition and interface to adjacent built form. An assessment of natural landform modification and mitigation recommendations are outlined in the Warkworth Strategic and Local Package *of Landscape and Visual Effects.* – If practicable, opportunities should be explored at future detailed design stages to redefine and integrate residual land along the corridor frontage with the expected future land use function. – The proposed corridor cross section has the potential to impact tree and vegetation cover within the designation. An assessment of the potential losses and mitigation recommendations are outlined in the Warkworth Strategic and Local Package *of Arboricultural Effects and the* Warkworth Strategic and Local Package *of Landscape and Visual Effects,* however further definition and design of the corridor landscape should be developed in future design stages and should address how the proposed corridor landscape: o Responds to pedestrian amenity outcomes; o Provides replacement and augmented canopy shading to each corridor; o Mitigates urban heat island effects within the environment of each corridor; o Contributes to biodiversity values within the corridor; and o Responds to and improves landscape character and values within each corridor.

Principle	Explanation	Application common to all NORs
1.4 **Adapt to a changing climate and respond to the microclimatic factors of each area**	Design for predicted future regional climatic impacts in the corridor location. Consider the positive contribution that the orientation of transport corridors can make to the local climate of future places and streets.	– The proposed corridor designs, including identified watercourse and stream crossings, adopt a vertical geometry that accommodates future stormwater events including the applied climate change factors as stated in Auckland Council Stormwater Code of Practice. – The proposed corridors provide space for street tree planting that, when delivered, will contribute to the amenity of the area by providing shade and microclimatic cooling qualities to demonstrate consideration of urban heat island effects in this future urbanized area. – Further definition and design of the corridor landscape should be developed in future design stages. – The proposed corridors provide for active modes and prioritises public transport options to support modal shift and reduce transport related climate change contributions.
SOCIAL		
2.1 **Identity and place**	The identity or spirit of place is generally acknowledged as the unique amalgam of the inherent built, natural and cultural qualities of a place. Responding to identity in the location and type of new corridors can provide a sense of continuity and contribute to our collective memory. **Local Identity** Locate the public transport facilities to maximise the placemaking potential and enhance local identity.	– The proposed corridors pass through highly varied future and existing urban environment that is planned to change to mixed and denser residential land uses, the proposed cross sections have spatial flexibility that is capable of responding to a range of characteristics (identity drivers) that may arise from this change. In these areas the cross section can provide support for active edges (where there is visual engagement between the built form and the street), permeable access for pedestrians, and vegetation appropriately scaled to built form. – There is opportunity to improve connectivity and interface with watercourse crossings to enhance their distinctive landscape qualities (character drivers) for their local communities. – Consideration of street tree selection and placement provides the opportunity to reflect and enhance the unique local character inherent in the built, natural and cultural qualities of the location.
2.2 **Respect culturally significant sites and landscapes**	Acknowledge significant sites and features in the layout of movement corridors including ridgelines or horizons.	– Under the AUP:OP, there are no known sites of significance to Mana Whenua that have been identified along or in close proximity to the proposed corridor. – Manawhenua have been involved in regular hui and site visits with the Project team to share sites/areas that are of significance to Manawhenua and identify opportunities within and adjacent to the Project to acknowledge, respond, protect and incorporate their cultural narrative. – In future design stages, Manawhenua will be invited as Partners to provide input into other relevant cultural landscape and design matters including how desired outcomes reflect their identity and values. This could include but is not limited to: o Opportunities for the betterment of Mahurangi River and its interface with the corridor

Principle	Explanation	Application common to all NORs
2.3 **Adaptive corridors**	Corridors should demonstrate flexibility to respond to changes in their function and physical interfaces. Consider an adaptive approach in the way strategic corridors are designed to be able to respond to changes in land use, the way we move around and utilise technology over time. **Future Growth** Consider the existing and future movement and place context that will be supported by the Project and the ability of the design to accommodate change over time.	– The proposed typical corridor cross sections have the spatial provisions to be flexible, re-configurable and adaptable for changing transport needs. For example, modal changes, future bus priority measures at intersections, bus stations integration with future walking and cycling networks can be accommodated within the corridor. – The proposed typical cross sections provide space for all modes, with spatial provisions at the corridor edges that accommodate active frontages, provide permeability for access to adjacent land use types and movement corridors.
2.4 **Social cohesion**	Provide clear, effective and legible connectivity between community and social functions.	– The proposed typical corridor cross sections support the creation of spaces where corridor access can be provided through a permeable interface at the corridor boundary. – The proposed corridor alignments and various functions can deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to existing local, neighbourhood and town centres and open spaces. Refer to individual NOR sections for specific focus areas. – To enable equitable local connectivity and cross corridor access to commercial centres and areas of high density, further development at the detailed design stage should be undertaken of crossing points for multi-lane intersections and potential midblock crossings.
2.5 **Safety**	Provide a safe and convenient network of routes accessible to people of all ages and abilities. **Universal Access** Focus on the needs of the customer by placing importance on the spatial requirements that provide for universally inclusive and safe facilities with good physical and visual links.	– The proposed corridor will deliver a greater level of access and movement to future local communities, with the provision of fully segregated active travel solutions. – The proposed corridor accommodates the universal design approach and accessibility to all parts of user journeys. – The proposed functionality and configuration of the public transport interchanges provides for walking and cycling access to each bus hub which supports a greater level of access and movement for future local communities, promoting a sense of personal safety for pedestrians and cyclists. – The future design and functional layout of the bus interchanges/hubs as well as future corridor design stages should respond to and incorporate CPTED principles, including clear sightlines, good levels of lighting, passive surveillance, and avoidance of entrapment zones.

Principle	Explanation	Application common to all NORs
		– There is opportunity for future adjacent development to provide additional passive surveillance and activation improving CPTED outcomes for the project. – A CPTED audit of each NOR project should be carried out against the proposed design and should address, at a minimum, the current identified CPTED risks outlined in each NOR evaluation. – Future development and detailed design of the final crossing points to all bus platforms is required to confirm and reinforce a sense of personal safety and provide for equitable local connectivity and access. – Further design detail of safe prioritised active modes crossings across the corridor and intersections addressing: o Legibility; o Directness; o Eliminating modal conflicts; and o Minimising crossing times and distances – Future design of intersections such as and will need to ensure crossings are accessible to people of all ages and abilities.
BUILT FORM		
3.1 **Align corridors with density**	Locate stations/stops and corridors within walking distance of higher density development to facilitate modal shift, support commercial and mixed-use centres and contribute to vibrant, active urban environments. **Active Mode Catchments** Locate stations and interchange facilities in places that align with areas of greater density and is centered on the active mode catchment.	– The proposed bus interchange / hub locations will provide the core transport function of a new multi modal transport network that will support the requirements of Policies 1 and 3 of the NPS:UD for co-locating public transport networks in areas of planned higher density residential development. – All corridors prioritise active modes to provide direct access to both housing and employment areas. The combination of the core corridor functions and alignment to key destinations will maximise the benefits of modal shift and provide a positive contribution to the vibrancy and activation of the varied urban environments within Warkworth.
3.2 **Corridor scaled to the surrounding context and urban structure**	Align the speed, type and scale of transport corridors and infrastructure with the environment that it moves through (appropriate scale to the context). **Respond to Land Use** The size, design and location of the facilities should respond to the adjacent land use and respect natural	– The majority of the NOR corridors traverse the Future Urban Zone. Woodcocks Road, Western Link - South and Matakana Road all have varying degrees of interface with Mixed Housing Suburban and Mixed Housing Urban which are subject to change as a result of the increased development capacity requirements of the NPS:UD. – Overall, the proposed corridor configuration and scale provides an appropriate response to the potential needs of the adjacent area functions (access to and from adjacent built form and general spatial layout). Examples include efficient localised

Principle	Explanation	Application common to all NORs
	features. This minimises any 'left over' spaces and disconnected pockets of land that need integration.	movement using single lanes for the majority of proposed corridors and alignment with known higher density housing land uses, and the provision of mixed mode travel.
3.3 Facilitate an appropriate interface between place and movement	Facilitate the opportunity for place as well as movement in corridors (people-oriented streets)	– The proposed corridor cross sections provide a flexible platform to address the opportunity for place as well as movement function with clear allocation of street space, for example separated pedestrian and cycle facilities and potential road berm spaces that provide safe waiting zones for pedestrians. – In the absence of medians, signalised or legal crossings, spaced appropriately for the adjacent land-uses and pedestrian desire routes involved, should be considered. – Direct private vehicular access is generally not accommodated onto the corridor, however a pedestrian permeable interface or active frontage interface is supported at all locations along the corridor. – An urban integration strategy should be developed to coordinate with landowners in future stages to address interface issues. This will enable an appropriate interface with adjacent land uses that will provide for active edge permeability and ensure local access and connectivity can be achieved.
MOVEMENT		
4.1 Connect nodes	Provide tangible connectivity between identified activity nodes. **Cross Corridor Connectivity** Balance the functional access requirements across the Project corridor with the optimal location to provide connections into the surrounding area.	The proposed corridors provide tangible and direct connectivity between existing and future industrial / employment areas, suburban communities and local centres. There are opportunities in the future development of each NOR to provide direct connections across the corridors: o between local, neighbourhood and town centre functions and the communities they serve. o between open spaces and reserves along the wider blue-green network.
4.2 Connect modes	Provide for choice in travel and the ability to connect at interchanges between modes. **Permeability** Provide a level of permeability for stations that supports access into the surrounding streets/corridors.	– The proposed corridors provide future connectivity for all modes (walking, cycling, public transport and private vehicles). – All corridors provide a direct and prioritised active mode connection to the proposed bus interchanges / hubs. – Connectivity to the surrounding street network and access to the wider area is generally identified and accommodated, however it is recommended that further consideration in future design stages is given to the detailed connections to any future active mode network design as per the Warkworth cycling and micro mobility strategy.

Principle	Explanation	Application common to all NORs
4.3 **Support access to employment and industry**	Align the corridor location and typology to provide direct and efficient access to areas of employment and industry.	– The proposed corridors prioritise active modes to provide direct access to and support for existing and planned commercial, industrial and employment areas including along: o Woodcocks Road; and o Wider Western Link. – The proposed bus interchange/ hubs prioritises public transport connectivity to support local trips and trips from the broader hinterland to areas of employment including: o Future local centres in the west and south including areas of o mixed use development; o Warkworth Town Centre, o North Harbour / Albany via express bus services
4.4 **Prioritise active modes and public transport**	Provision of quality active mode corridors and dedicated public transport corridors to enable a modal shift away from private vehicle use. **Walkability** Locate the station and interchange facility within or in close proximity and walking distance of local activity hubs/town centres. **Modal Priority** Consider efficient connectivity between transport modes by: Providing access that is aligned with the desired modal hierarchy; 1) pedestrians, 2) cyclists/micro-mobility, 3) public transport, 4) drop off/pick up/taxis, and 5) private vehicles / parking. Minimising the interchange time and distance between transport modes by designing direct, safe and self – explaining linkages.	– The corridor design and designation boundary provides access for active modes, and public transport through the provision of: o High quality walking and cycling facilities, space for cycle parking close to Bus hubs/interchanges. There is an opportunity to provide additional cycle parking in future design stages. o Bus hubs/interchanges adjacent to both housing, commercial and employment land and destinations along the corridor. – Further development of dedicated active mode connections at intersections and the provision of mid-block crossings at the future detailed design stage will provide a higher level of service to active and micro modes and further encourage modal shift. – Potential priority conflicts between active modes / public transport and freight function of sections of the corridor should be further identified and addressed in the future design of the Project.

Principle	Explanation	Application common to all NORs
	Minimising the conflicts between modes.	
4.5 Support inter-regional connections and strategic infrastructure	Consider the location and alignment of significant movement corridors and placement of infrastructure (power, wastewater, water) to the network.	– Existing and future freight-related operations are located along specific corridors due to competitive advantages that proximity affords adjacent Ara Tuhono and SH1, including shorter transit times to end destinations and improving overall supply chain efficiency.
4.6 Support legible corridor function	Consider how the corridor can be clearly navigated and understood by users moving from place to place. **Legible Connections** To achieve a positive and engaging street presence provide clear physical and visual connection between station and interchange facilities and surrounding corridors.	– The typical cross sections accommodate a range of modes with clear allocation of street spaces that inherently supports future community connectivity, mobility and travel choice. – Further development of active mode midblock crossings and along each corridor at the detailed design stage will provide clear and legible cross corridor access and connectivity between areas of high density, centres and community amenties.
LANDUSE		
5.1 Public transport directed and integrated into centres	Locate rapid transit interchanges within centres (local, town and metro) to support a mix of uses and provide modal choice to a larger number of users.	– The bus interchanges / hubs provide a direct and prioritised public transport connection as part of the local and strategic network that connects existing and future neighbourhood centres within Warkworth, surrounding coastal settlements, and supports regional trips through to Orewa, Albany, and beyond.
5.2 Strategic corridors as urban edges	Strategic corridors as potential definers of a land use edge.	– This principle relates only to the new southern interchange on Ara Tūhono which while part of the of the wider network is not subject to an NOR as part of this package.

18. All Warkworth NoRs

19. Summary of urban design evaluation and recommendations for all NORs

A summary of the recommended urban design outcomes and opportunities for all NORs are outlined below. These are recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

For the full list of urban design commentary common to all NORs, refer to *Table 4: Common urban design matters* above. The ULDMP should address the following outcomes for all NoRs:

ENVIRONMENT

- A landscape plan that considers recommendations from the landscape and visual, arboriculture, flooding and ecological assessments including street tree and stormwater raingarden and wetland planting, construction compound and private property reinstatement and treatment of batter slopes. The landscape plan should also demonstrate integration of Mahurangi River and its tributaries where the corridor intersects or sits adjacent with the existing Blue-Green Network. The landscape outcomes should support the principles of Auckland's Urban Ngahere Strategy and reinforce the wider vegetation patterns of the local landscape and create connections to proposed greenways and the wider walking and cycling network.
- Integration of wetlands to ensure an appropriate interface with adjacent land uses.
- Measures to demonstrate that the project has adapted to the changing climate such as reducing urban heat island effects in future urbanised areas, supporting modal shift and accounting for flood hazard risks.

SOCIAL

- In future design stages, Manawhenua shall be invited as Partners to provide input into relevant cultural, landscape and design matters including how desired outcomes reflect their identity and values.

BUILT FORM

- Resolution of any potential conflict between placemaking aspirations within local communities and the scale and operating speed of the proposed movement functions of the corridor should be addressed.
- Known or planned changes of land use and residential density that have the potential to alter the perceived scale and impact of the proposed corridor functions should be identified and addressed.
- Resolution of any potential conflict between placemaking aspirations within local communities and the scale and operating speed of the proposed movement functions of the corridor should be addressed.

MOVEMENT

- A modal integration strategy that addresses the movement and place function of the corridor that incorporates placemaking opportunities arising from adjacent landuse

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function.

20. NOR 1 – Northern Public Transport Hub and Western Link - North

21. Introduction

This evaluation considers the proposed NOR 1 –Northern Public Transport Hub and Western Link - North against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 12: Urban Design Evaluation for NOR 1 Northern Public Transport Hub + park and Ride and Western Link - North in Appendix A only outlines urban design commentary specific to NOR 1. For commentary common to all NoRs, refer to *Table 4: Common urban design matters*.

22. Summary of urban design evaluation and recommendations for NOR 1

Overall, the proposed corridor design and configuration for NOR 1 is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 1 are outlined below and illustrated in Figure 42-1: 1 urban design outcomes and opportunities which is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 1:

ENVIRONMENT

- Integration of wetlands to ensure an appropriate interface with the Public Transport Hub. The layout and composition of any wetlands should be reviewed for landscape integration opportunities and creating a positive interface with adjacent urban form and the Public Transport Hub.
- Measures to demonstrate that the project has adapted to the changing climate such as reducing urban heat island effects in future urbanised areas, supporting modal shift and accounting for flood hazard risks. The large Park and Ride carpark in particular should demonstrate consideration of urban heat island effects in this future urbanized area. Proposed amenity planting and water sensitive design elements should be incorporated at future design stages to provide relief for people walking to and from vehicles and from the street.
- Two new road bridges across the a permanent stream, will require significant resource and materials to construct, however the exact details of the earthworks required for the corridor are not fully resolved and should be reviewed for landscape integration opportunities to minimise land disturbance and conserve materials.

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 1 should be demonstrated. Key NOR 1 local identity community functions to be addressed include:
  - The Future Business – Local Centre Zone on the Western Link.
  - The large Future Mixed Housing Urban Zone surrounding the Local Centre.
  - Warkworth Showgrounds.
  - The two proposed bridge crossings with the first 250m of the Western Link.
- Future design stages should demonstrate the project response to both the locational drivers outlined above and placemaking drivers including:
  - Improved pedestrian and cyclist connectivity to the Local Centre and Mixed Housing Urban areas outlined above.
  - Interface, modal priority and access arrangements along the Western Link.
  - Cultural values and narratives
- To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including:
  - Woodcocks Road
  - North-South thru the Southern Interchange
  - At the southern end of NOR 1 before the bridge crossing.
- The future freight function of NOR 1 that connects an area of future industrial land to the south (via Woodcocks Road and the Wider Western Link) a potential conflict between placemaking aspirations within local communities and the scale and speed of the proposed movement function. A NOR 1 place specific response to integrating these functions should be identified and addressed in future design states of the project.
- A CPTED audit of the corridor within NOR 1 should address, at a minimum, the current identified CPTED risks including:
  - The future carpark facility adjacent mixed use landuse.
  - The public transport hub.
  - Active mode connections from the Western Link and any side roads to the Public Transport Hub.

BUILT FORM

- An urban interface approach within the corridor that:
  - Responds to the spatial character of proposed mixed use and nearby local centre environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.
  - Demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
  - Recognises the transition of densities from future Business – General Business Zone, Business – Mixed Use Zone, Residential – Mixed Housing Urban Zone to the Business – Local Centre further south and provides a corridor interface that supports permeable pedestrian access and

responds to the changing built form interface and spatial character of adjacent future development.

- Key focus areas within NOR 1 that require further resolution in future design stages to demonstrate the potential scale and urban structure response include:
  - The walk-up catchments of the proposed Public Transport Hub within NOR 1 and for the length of the Western Link.
  - The corridor edges and interfaces with Business – Local Centre Zone, Business Mixed Use Zone and Business – General Business Zone land.
  - The built form interface with the FUZ that remains.
  - Further vertical integration adjacent to bridging structures along the Western Link developed at a detailed design stage to allow an appropriate transition and interface to adjacent built form.

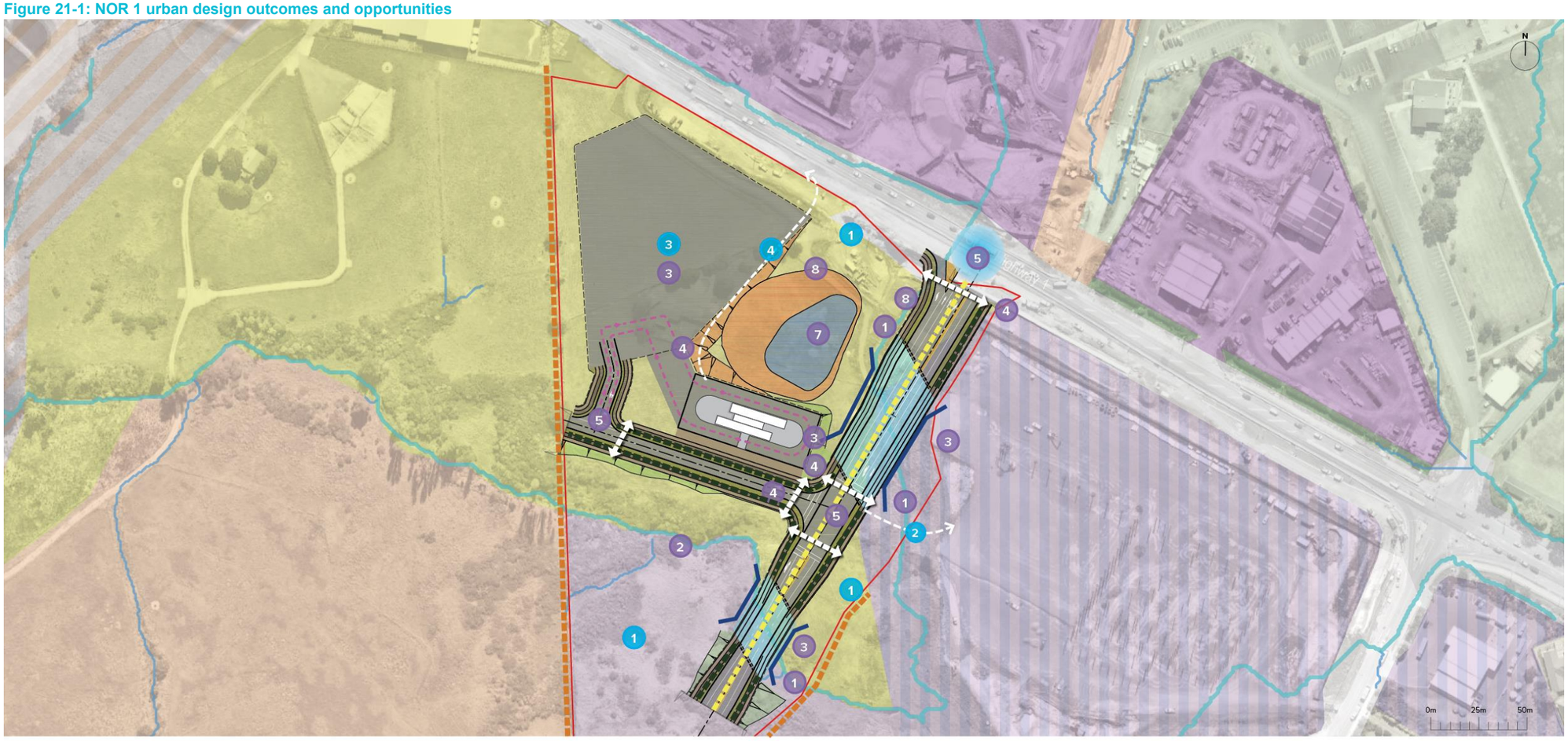
MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, Public Transport Hub, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:
  - SH1 / Western Link.
  - Western Link / Local access road to Park and Ride.
  - SH1 / Western Link through to the Public Transport Hub (offroad).
- Legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within NOR 1. Demonstration of specific intersection responses to ensure connectivity between the Public Transport Hub, Warkworth Showgrounds to the north, and the Business – Local Centre Zone to the south – see intersection locations above.
- A modal integration strategy that addresses:
  - The potential conflict between the continued freight function of the corridor and placemaking opportunities arising from the introduction of the Public Transport Hub.
  - The functional layout of the Public Transport Hub area to provide for legibility and clear wayfinding for active modes through and around the park and ride area and from the Western Link.
  - The potential conflict between the future high movement function of the corridor and placemaking opportunities arising from the surrounding Business – Mixed Use Zone.

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated to support a landuse transition buffer and/or any proposed development / redevelopment together to the Public Transport Hub, park and ride facility and the northern end of the Western Link., in particular areas:
  - Surrounding the Park and Ride.
  - On the north side of the Western Link, particularly where large cut/fill batters are indicated.
  - Any residual land adjacent SH1 intersection and proposed wetlands.

Figure 21-1: NOR 1 urban design outcomes and opportunities



NOR 1 - NORTHERN PUBLIC TRANSPORT HUB + PARK AND ROUTE

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity in the local environment.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as future schools, employment and bussiness land, open spaces and community facilities.
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the Hudson road intersection which connects employment land to medium density development.
7. **Wetlands -** Consider integration outcomes for wetland/s such as setbacks, arrangement and scale of planting to support an appropriate interface to reserve / parks.
8. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuses.
1. **Land post construction -** Opportunity to demonstrate how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Walking and Cycling -** Opportunity to connect key landuse / destinations with Public Transport Hub
3. **Climate Change -** Opportunity to show consideration of urban heat island effects. Proposed amenity planting and water sensitive design elements should be incorporated at future design stages to provide relief for people walking to and from vehicles and from the street.
4. **Public Transport -** Opportunity to connect express service directly with SH1 to avoid backtracking.

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/1

Outcomes

- Residential and mixed-use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structure.
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.
- Consideration of potential modal conflicts between the future freight movement, placemaking and active mode functions.

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Open Space - Informal Recreation Zone
- Open Space - Sport and Active Recreation Zone
- Business - Mixed Use
- Business - Light Industry
- Business - General Business Zone
- Bus Traffic Flow Path
- Fill
- Cut

23. NOR 2 – Woodcocks Road Upgrade - West

24. Introduction

This section considers the proposed NOR 2 – Woodcocks Road Upgrade (Mansell Drive to Wyllie Road) against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 5: Urban design evaluation for 2 – Woodcocks Road Upgrade in Appendix A only outlines urban design commentary specific to NOR 2. For commentary common to all NORs, refer to *Table 4: Common urban design matters*.

25. Summary of urban design evaluation and recommendations for NOR 2

Overall, the proposed NOR 2 corridor design and configuration is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 2 are outlined below and illustrated in Figure 2: 2 urban design outcomes and opportunities which is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 2:

ENVIRONMENT

- Integration of wetlands to ensure an appropriate interface with adjacent land uses, specifically where these are proposed in the Residential Mixed Housing Urban Zone.

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 2 should be demonstrated. Key NOR 2 local identity community functions to be addressed include:
    - The Business – Heavy Industry Zone at the future Wider Western Link – future residential development.
    - Future Primary School and connections through to Mahurangi College.
    - The landscape character drivers of the tributaries of the Mahurangi River.
    - The urban space qualities of medium density land uses adjacent the Mahurangi River, areas of established native vegetation, and the transition to industrial/business landuse at the eastern end of Woodcocks Road.
- Key NOR 2 distinctive landscape character qualities of open spaces, stream and conservation zones include:
    - Open space linkages along the Mahurangi River.

- Mature indigenous vegetation marking the alignment of the Mahurangi River.
- Constructed wetlands and their integration with riparian corridors.

- The proposed corridor alignment and function can deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to existing and future local, neighbourhood and town centres, schools, community functions and open spaces. Key school, community and business functions within NOR 2 to be addressed include:
  - Mahurangi College and a proposed future Primary School (opposite Mason Heights)
  - Industrial and employment land at the eastern and western ends of Woodcocks Road.

- The connection of this corridor to the future industrial land and its proximity to the future Southern Interchange will change the function and nature of the corridor. The potential conflict between the existing high movement and freight function of the corridor which connects existing and future employment, residential land, and educational facilities will require careful and deliberate consideration in future design stages of the project. A modal integration strategy should outline how this is addressed. The strategy should address intersection design to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes.

- Intersection design in particular requires refinement at further design stages to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes. The following intersections require further attention:
  - Mansell Drive.
  - Mason Heights.
  - Wider Western Link.

- A CPTED audit of the NOR 2 project should address, at a minimum, the current identified CPTED risks including:
  - The corridor interface with the Business – Heavy Industrial Zone at the western end of NOR 2,
  - The two proposed bridges near the Wider Western Link and Falls Road
  - The frontage on to proposed wetlands near the Wider Western Link and Falls Road.

BUILT FORM

- An urban interface approach within the corridor that:
  - responds to the spatial character of proposed centre environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.
  - demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
  - recognises the transition of densities from future Residential – Mixed Housing Suburban Zone to Business – Light Industry and Heavy Industrial Zones and provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.

MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, transport interchanges, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:
  - Mahurangi College and a proposed future Primary School.
  - Industrial and employment land at the eastern and western ends of Woodcocks Road.

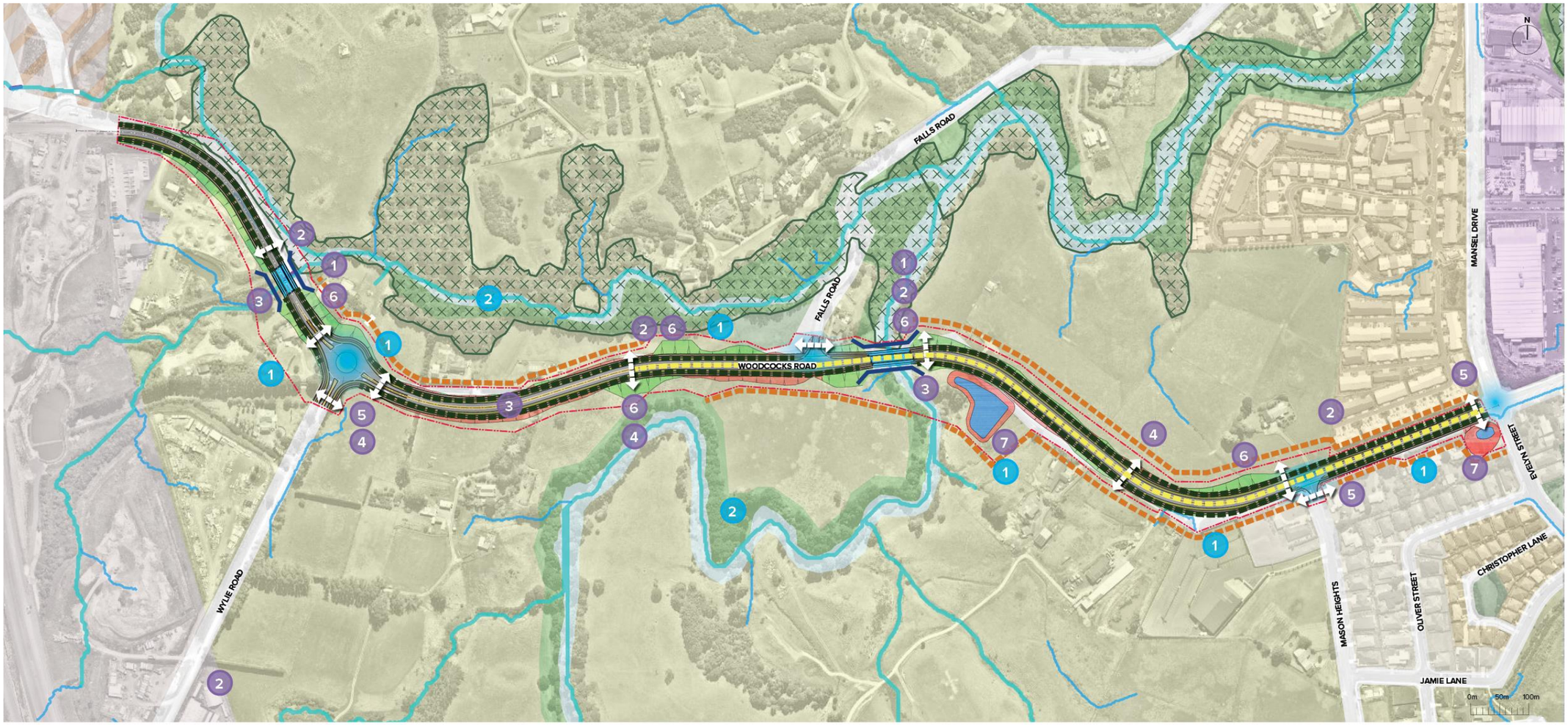
- Legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within NOR 2. Demonstration of specific intersection responses to ensure connectivity between the Residential – Mixed Housing Urban Zone and the schools, employment land, and town centre further east including:
  - Mansell Drive.
  - Mason Heights intersection.
  - Falls Road.
  - Wider Western Link.

- A modal integration strategy that addresses the potential conflict between the continued freight function of the corridor and placemaking opportunities arising from Residential – Mixed Housing Urban Zone.

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas:
  - On both sides of Matakana Road within NOR 2, particularly where large cut/fill batters are indicated.
  - Any residual land adjacent the intersection with Woodcocks Road and proposed wetlands.

Figure 24-1: NOR 2 urban design outcomes and opportunities



NOR 2 - WOODCOCKS ROAD UPGRADE (WESTERN SECTION)

Outcomes Opportunities

1. **Ecological connectivity -** support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as future schools, employment and bussiness land, open spaces and community facilities.
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the Wyllie road roundabout which connects employment land to medium density development.
6. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuses and established native forest along the Mahurangi River corridor
7. **Wetlands -** Consider integration outcomes for wetland/s such as setbacks, arrangement and scale of planting to support an appropriate interface to the road corridoor and future urban zones.
1. **Land post construction -** Opportunity to demonstrate how any land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Wider connectivity -** Opportunity to reinforce visual connections to the wider community and landscape features.

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/1

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structure
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.
- Consideration of potential modal conflicts between the future freight movement, placemaking and active mode functions

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Open Space - Informal Recreation Zone
- Open Space - Conservation Zone
- Rural - Rural Production Zone
- Business - Light Industry
- SEA - Terrestrial
- Fill
- Cut

26. NOR 3 – State Highway 1 Upgrade - South

27. Introduction

This evaluation considers the proposed NOR 3 State Highway 1 Upgrade – South against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 8: Urban Design Evaluation for State Highway 1 Upgrade (southern section) in Appendix A only outlines urban design commentary specific to NOR 3. For commentary common to all NoRs, refer to *Table 4: Common urban design matters*.

28. Summary of urban design evaluation and recommendations for NOR 3

Overall, the proposed corridor design and configuration for NOR 3 is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 3 are outlined below and illustrated in Figure 6: 3 urban design outcomes and opportunitieswhich is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 3:

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 3 should be demonstrated. Key NOR 3 local identity community functions to be addressed include:
  - The landscape character drivers of permanent stream crossings flowing to the Mahurangi River.
  - The urban space qualities of future THAB and local centre land use at the intersection with the Wider Western Link.
  - Morrisons Heritage Orchard.
  - Constructed wetlands and their integration within the FUZ.
  - The threshold between the future urban zone and rural landuse at the southern end of NOR 3

- The proposed corridor alignment and function can deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to existing and future local, neighbourhood and town centres, schools, community functions and open spaces. Key school, community and business functions within NOR 3 to be addressed include:
  - Mahurangi College at the Intersection with SH1 and Woodcocks Road.
  - Interface with industrial and employment land north of the Western Link.
  - Future THAB and local centre land use at the intersection with the Wider Western Link.

- To enable equitable local connectivity and cross corridor access between existing residential areas which have been orientated away from SH1, industrial land to the west and FUZ to the south, further development at the detailed design stage should be undertaken of crossing points at intersections and potential midblock crossings including:
  - Fairwater Road.
  - Wech Drive including a safe and legible connection through to Fairwater Road intersection providing access to the bidirectional cycleway on the west side of the corridor.
  - McKinney Road and Western Link.
  - Valerie Close.
  - Wider Western Link. The proposed roundabout at the intersection of SH1 and Wider Western Link is a key connection between communities with future THAB and local centre landuse planned. An outcome that would support this is to reduce the scale of the roundabout to suit this context and provide safe and comfortable crossing points for people walking and cycling.

- Ara Tūhono and the future Southern Interchange will change the function and nature of the SH1 corridor. The potential conflict between the existing high movement and freight function of the corridor which connects existing and future employment, residential land, and educational facilities will require careful and deliberate consideration in future design stages of the project. A modal integration strategy should outline how this is addressed. The strategy should address intersection design to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes

- Intersection design in particular requires refinement at further design stages to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes. The following intersections require further attention:
  - Fairwater Road.
  - Wech Drive including a safe and legible connection through to Fairwater Road intersection providing access to the bidirectional cycleway on the west side of the corridor.
  - McKinney Road and Western Link.
  - Valerie Close.
  - Wider Western Link.
- A CPTED review of the NOR 2 project should address, at a minimum, the current identified CPTED risks including:
  - The existing side road along Wech Drive and corridor interface through to Fairwater Road.
  - The corridor interface with the future local centre and its connection with the Wider Western Link and Bus Hub.
  - The frontage on to proposed wetlands between the Wider Western Link and the Western Link.

BUILT FORM

- An urban interface approach within the corridor that:
  - responds to the spatial character of proposed centre environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.

- demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
- recognises the transition of densities from future Residential – Mixed Housing Urban and Suburban Zones, THAB through to Business – Light Industry and provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.

MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, transport interchanges, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:
  - The intersection with the Wider Western Link providing access to the local centre and southern public transport interchange.
  - Permanent Stream crossings and connections with future open space corridors.
  - Morrisons Heritage Orchard.
  - Employment land with access off the Western Link.

- Demonstration of specific intersection response between THAB and Residential – Mixed Housing Urban Zone and the future local centre and public transport interchange on the Wider Western Link is required to provide legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within NOR 3.

- A modal integration strategy that addresses the potential conflict between the continued freight function of the corridor and placemaking opportunities arising from proximity to THAB and local centre at the intersection with the Wider Western Link. The strategy should address intersection design to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas:
  - On both sides of SH1 within NOR 3, particularly where large cut/fill batters are indicated.
  - Any residual land adjacent intersections and proposed wetlands.

Figure 27-1: NOR 3 urban design outcomes and opportunities (Sheet 1 / 2)

NOR 3 - STATE HIGHWAY 1 (NORTHERN SECTION)

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/2

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity in the local environment.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as employment land, bussiness land, open spaces and community facilities
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the Fairwater road roundabout and McKinney Road intersection
6. **Wetlands -** Consider integration outcomes for the wetland such as setbacks, arrangement and scale of planting to support an appropriate interface to the road corridoor and future urban zones.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuse.

1. **Land post construction -** Opportunity to demonstrate how any land portions following the construction of the Project are redefined and integrated with the expected future land use function.

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Interface and visual / landscape buffer considerations for beween industrial, business and mixed use residential and rural landuse/zones.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structures
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.
- Consideration of potential modal conflicts between the future freight movement, placemaking and active mode functions

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Fill
- Cut
- Open Space - Sport and active recreation zone
- Business - Local centre zone
- Business - Light Industry
- Rural - Rural Production zone
- SEA - Terrestrial
- Bi-Directional cycling facilities

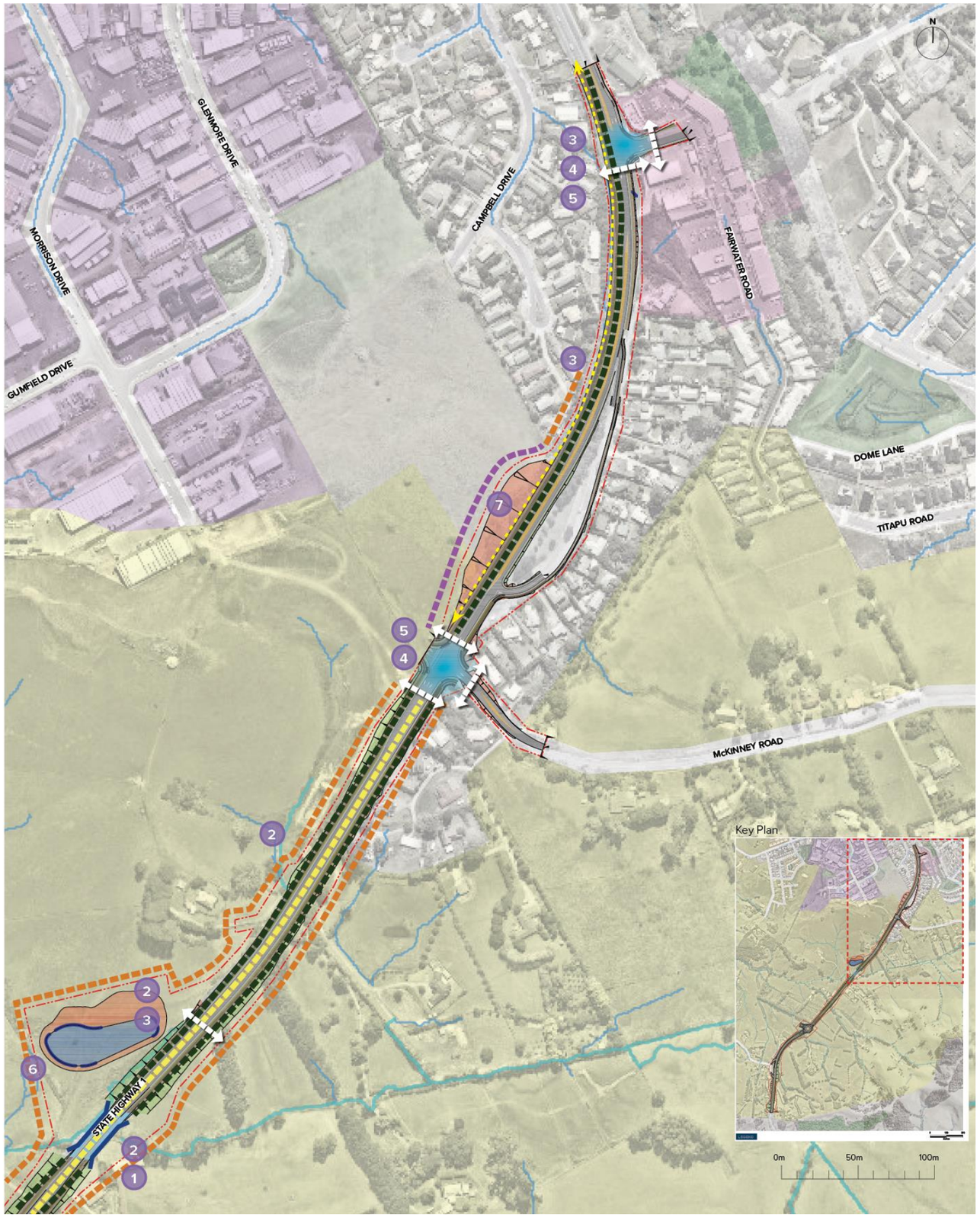


Figure 27-2: NOR 3 urban design outcomes and opportunities (Sheet 2 / 2)

NOR 3 - STATE HIGHWAY 1 (SOUTHERN SECTION)

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 2/2

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity in the local environment.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as employment land, bussiness land, open spaces and community facilities
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the SH1 road roundabout and McKinney Road intersection
6. **Wetlands -** Consider integration outcomes for the wetland such as setbacks, arrangement and scale of planting to support an appropriate interface to the road corridoor and future urban zones.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuse.

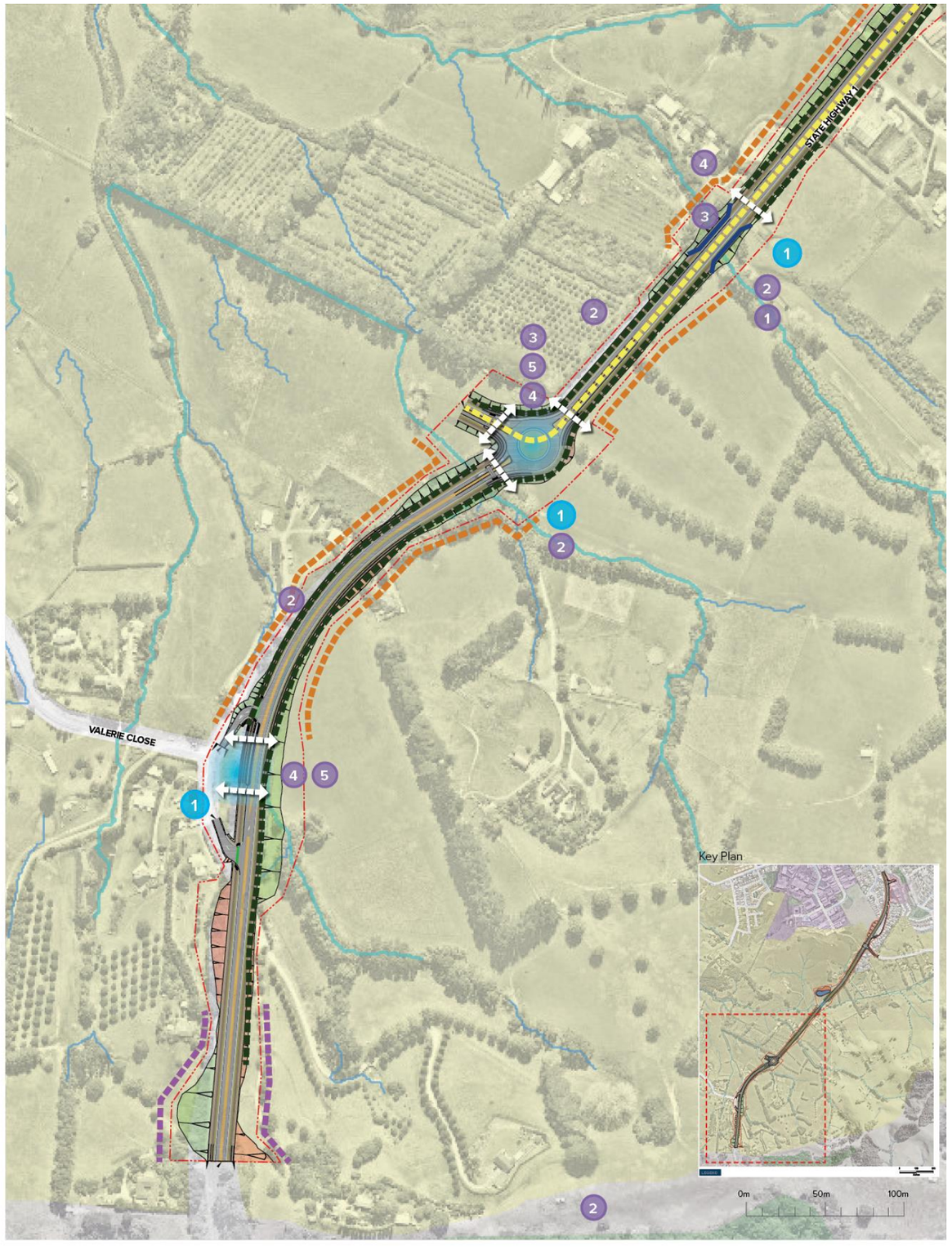
1. **Land post construction -** Opportunity to demonstrate how any land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Wider connectivity -** Opportunity to reinforce visual connections to the wider community and landscape features.

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Interface and visual / landscape buffer considerations for industrial, business and rural landuse/zones.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structures
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.
- Consideration of potential modal conflicts between the future freight movement, placemaking and active mode functions

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Fill
- Cut
- Open Space - Sport and active recreation zone
- Business - Local centre zone
- Business - Light Industry
- Rural - Rural Production zone
- SEA - Terrestrial



29. NOR 4 – Matakana Road Upgrade

30. Introduction

This section considers the proposed NOR 4 – Matakana Road Upgrade against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 6: Urban Design Evaluation for Matakana Road Upgrade in Appendix A outlines urban design commentary specific to NOR 4. For commentary common to all NORs, refer to *Table 4: Common urban design matters.*

31. Summary of urban design evaluation and recommendations for NOR 4

Overall, the proposed NOR 4 corridor design and configuration is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 4 are outlined below and illustrated in Figure 30-1: 4 urban design outcomes and opportunities (Sheet 1 / 2) which is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 4:

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 4 should be demonstrated. Key NOR 4 local identity community functions to be addressed include:
  - The interface between existing residential development and future residential development
  - The interface and transition between rural and urban landuse at the northern end of the corridor.
  - The landscape character drivers of the tributaries of the Mahurangi River.
  - The urban space qualities of medium density land uses adjacent to areas of established vegetation, areas of established native vegetation, and the transition towards Hill Street Intersection.
- Key NOR 4 distinctive landscape character qualities of open spaces, stream and conservation zones include:
  - Open space linkages and connection with the riparian corridor adjacent to NOR 4.
  - Constructed wetlands and their integration with riparian corridors.
- Enable equitable local connectivity and cross corridor access to employment land and areas of high density, further development at the detailed design stage should be undertaken of crossing points at potential midblock crossings including:
  - Te Honohono ki Tai (Matakana Link Road)

- Sandspit Road.
- Clayden Road.
- Melwood Drive including connectivity between residential areas Northwood Close, Matakana Road, and future residential development to the north.

– To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including:

- The transition between the proposed bi-directional and uni directional cycleway close to Hill Street Intersection.
- Te Honohono ki Tai (Matakana Link Road)
- Sandspit Road.

– A CPTED audit of the NOR 4 project should address, at a minimum, the current identified CPTED risks including:

- Limited passive surveillance along the southern portion of the corridor due to areas of vegetation and steep topography.
- Future active mode connections to Northwood Close.
- Future active mode connections to Open Space – Conservational Zone.

BUILT FORM

– An urban interface approach within the corridor that:

- responds to the spatial character of proposed residential environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.
- demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
- Recognises the interface with FUZ and Open Space – Conservational Zone on the eastern side of the corridor up to Sandpit Link.
- recognises the transition of densities from future Residential – Mixed Housing Suburban Zone , Residential – Mixed Housing Urban Zone, Residential - Single House Zone, and Residential - Large Lot Zone and provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.

MOVEMENT

– Demonstration of specific intersection responses to ensure connectivity between the Residential – Mixed Housing Urban Zone and Town Centre including the following locations:

- Te Honohono ki Tai (Matakana Link Road).
- Sandspit Road.
- Clayden Road.
- Melwood Drive including connectivity between residential areas Northwood Close, Matakana Road, and future residential development to the north.

– Legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within NOR 4. As the surrounding area is progressively urbanised the intersection

with Te Honohono ki Tai (Matakana Link Road) in particular requires redesign to fit the medium to high density residential landuse that is already been structure planned. The intersection is currently a roundabout scaled to a rural high speed corridor context. Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations.

- Demonstration of place specific active mode cross corridor solutions should include:
  - At the northern end of Northwood Close (between the Residential – Single House Zone and Residential – Mixed Housing Urban Zone.
  - The Open Space – Conservation Zone approximately 250m south of Te Honohono ki Tai (Matakana Link Road).
  - Melwood Drive

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas:
  - On both sides of Matakana Road within NOR 4, particularly where large cut/fill batters are indicated.
  - Any residual land adjacent the intersection with Te Honohono ki Tai (Matakana Link Road) and proposed wetlands.

Figure 30-1: NOR 4 urban design outcomes and opportunities (Sheet 1 / 2)

NOR 4 - MATAKANA ROAD UPGRADE

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/2

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity along the Mahurangi River.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as future schools, open spaces and community facilities
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the clayden road ixntersection which connects residential large lot land to medium density development.
6. **Wetlands -** Consider integration outcomes for wetland/s such as setbacks, arrangement and scale of planting to support an appropriate interface to the road corridoor and Future Urban zones.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuses.

1. **Land post construction -** Opportunity to demonstrate how any land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Wider connectivity -** Opportunity to reinforce visual connections to the wider community and landscape features.
3. **Walking and cycling -** As the surrounding area is progressively urbanised the intersection with Matakana Link Road in particular requires redesign to fit the medium to high density residential landuse that is already been structure planned

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Cross corridor active mode connection.
- Interface and visual / landscape buffer considerations for industrial, business and rural landuse/zones.
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Large Lot
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Residential - Mixed Housing urban Zone
- Precincts
- Fill
- Cut
- Open Space - Sport and active recreation zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Special Purpose Zone
- Rural - Mixed Rural Zone
- SEA - Terrestrial

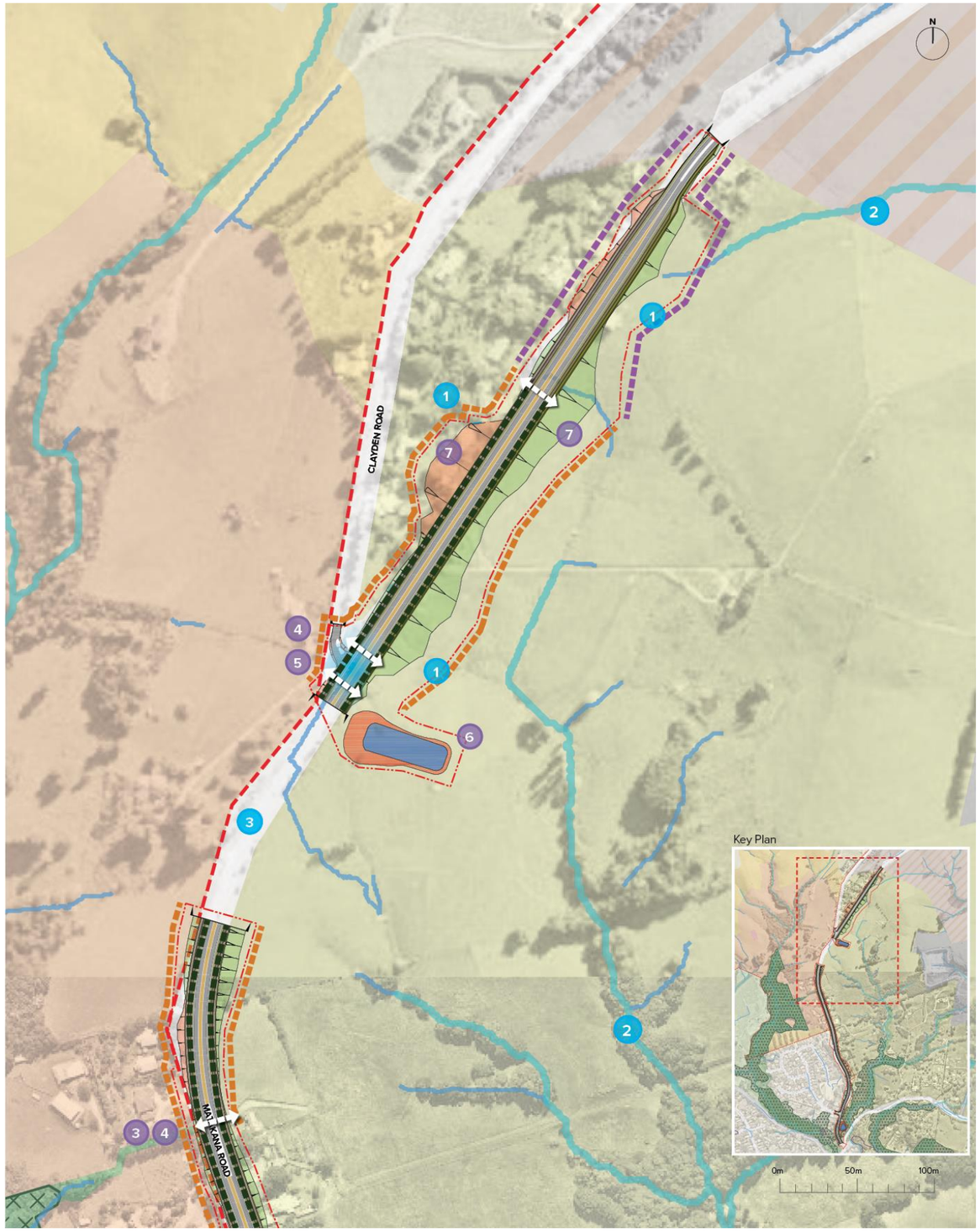


Figure 30-2: NOR 4 urban design outcomes and opportunities (Sheet 2 / 2)

NOR 4 - MATAKANA ROAD UPGRADE

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 2/2

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity along the Mahurangi River.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as future schools, open spaces and community facilities
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the sandspit road intersection which connects residential large lot land to medium density development.
6. **Wetlands -** Consider integration outcomes for wetland/s such as setbacks, arrangement and scale of planting to support an appropriate interface to the road corridoor and Future Urban zones.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuses.

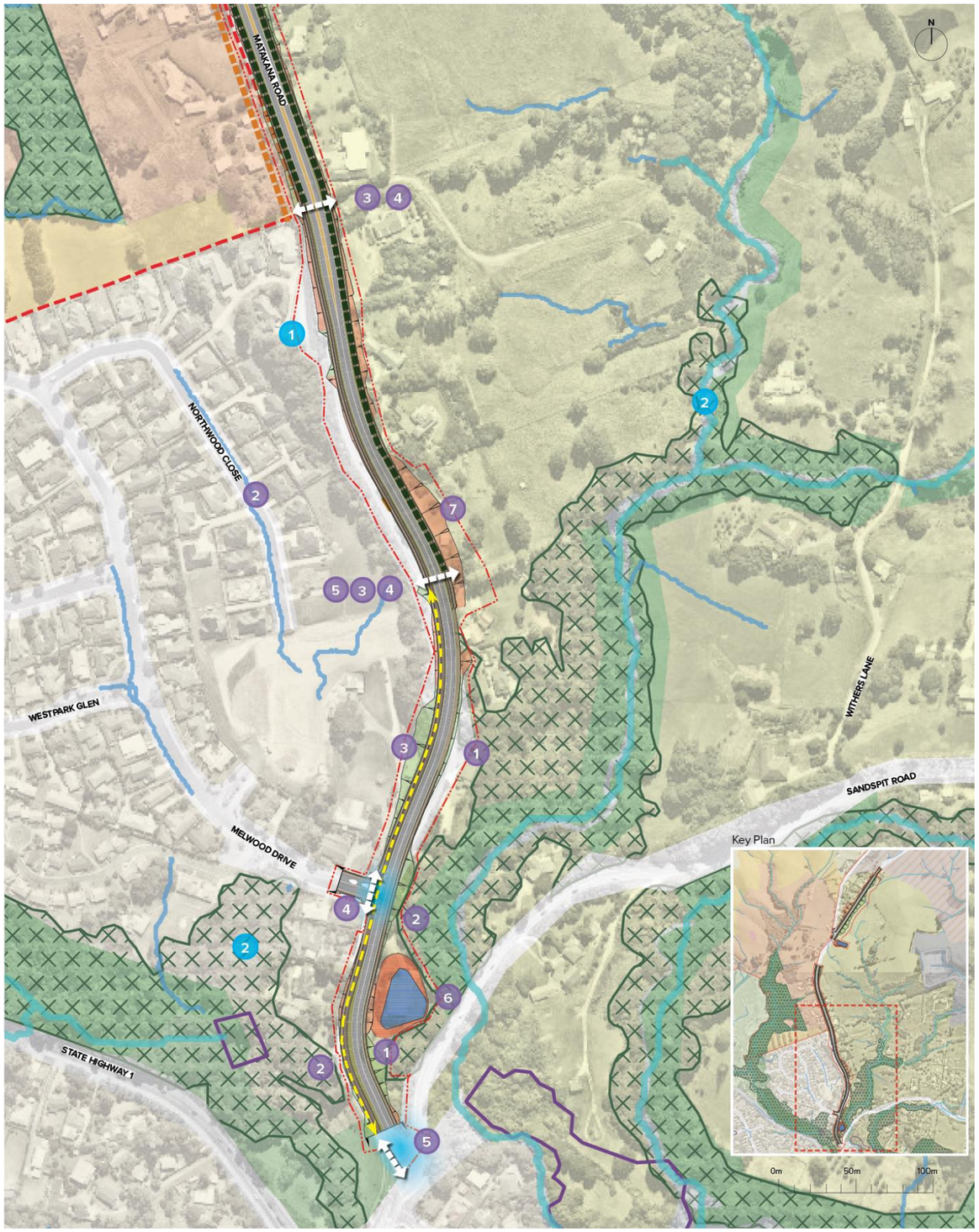
1. **Land post construction -** Opportunity to demonstrate how any land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Wider connectivity -** Opportunity to reinforce visual connections to the wider community and landscape features.

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Cross corridor active mode connection.
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Large Lot
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Residential - Mixed Housing urban Zone
- Historic Heritage Overlay
- Precincts
- Fill
- Cut
- Open Space - Sport and active recreation zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Special Purpose Zone
- Rural - Mixed Rural Zone
- SEA - Terrestrial
- Bi-Directional cycling facilities



32. NOR 5 – Sandspit Road Upgrade

33. Introduction

This evaluation considers the proposed NOR 5 – Sandspit Road Upgrade against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 7: Urban Design Evaluation for 5 – Road Upgrade in Appendix A only outlines urban design commentary specific to NOR 5. For commentary common to all NoRs, refer to *Table 4: Common urban design matters*.

34. Summary of urban design evaluation and recommendations for NOR 3

Overall, the proposed NOR 3 corridor design and configuration is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 5 are outlined below and illustrated in Figure 5: 5 urban design outcomes and opportunities which is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 5:

ENVIRONMENT

- Integration of wetlands with adjacent indigenous vegetation.
- New structures minimise disturbance and maintain a connected natural system where the corridor runs adjacent to indigenous forest between Park Lane and Millstream Place.

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 5 should be demonstrated. Key NOR 5 local identity community functions to be addressed include:
    - The landscape character drivers of the tributaries of the Mahurangi River.
    - The landscape protection area on the south side of the corridor.
    - The urban space qualities of residential land use adjacent the Mahurangi River, areas of established native vegetation, and the transition via Hill Street intersection between the town centre to the west and residential landuse to the north.
- Key NOR 5 distinctive landscape character qualities of open spaces, stream and conservation zones include:
    - Open space linkages along the Mahurangi River and its tributaries including the landscape protection area between Sandspit Road and the Mahurangi River.
    - Mature indigenous vegetation marking the alignment of the riparian corridors.
    - Constructed wetlands and their integration with riparian corridors.

- Intersection design in particular requires refinement at further design stages to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, prioritise active modes by reducing the time and distance to cross vehicle lanes and enables access for people of all ages and abilities. The following intersections require further attention:
  - Matakana Road and Elizabeth Street (access to town centre)
  - The transition points between the bi-directional cycleway / offroad multi user path and uni directional cycleway.
  - Sandspit link
- To enable equitable local connectivity and cross corridor access between areas of medium and high density, further development at the detailed design stage should be undertaken of crossing points at intersections and potential midblock crossings including:
  - Sandspit Link.
  - Withers Lane.
  - Matakana Road – with a strong focus on creating a seamless connection between the community in the north east quadrant of the town (along Sandspit Road) with the Warkworth Town centre.
- A CPTED audit of the NOR 5 project should address, at a minimum, the current identified CPTED risks including:
  - Limited passive surveillance along the western portion of the corridor due to areas of vegetation and steep topography.
  - Cycle and walking bridge at the western end of NOR 5.
  - Limited passive surveillance along the corridor between the Landscape Protection Zone (identified in the Structure Plan) and the Residential – Single House Zone.

BUILT FORM

- An urban interface approach within the corridor that:
  - Responds to the spatial character of proposed environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.
  - Responds to the established native riparian vegetation and steep topography between Matakana Road and Sandspit Link.
  - demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
  - Recognises the transition of densities from the town centre at the western end to future Residential – Single House and Large Lot Zone.
  - Provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.

MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, transport interchanges, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:

- The transition points between the bi-directional cycleway / offroad multi user path and uni directional cycleway.
- Matakana Road
- Sandspit Link
- Approx 400m east of Sandspit Link

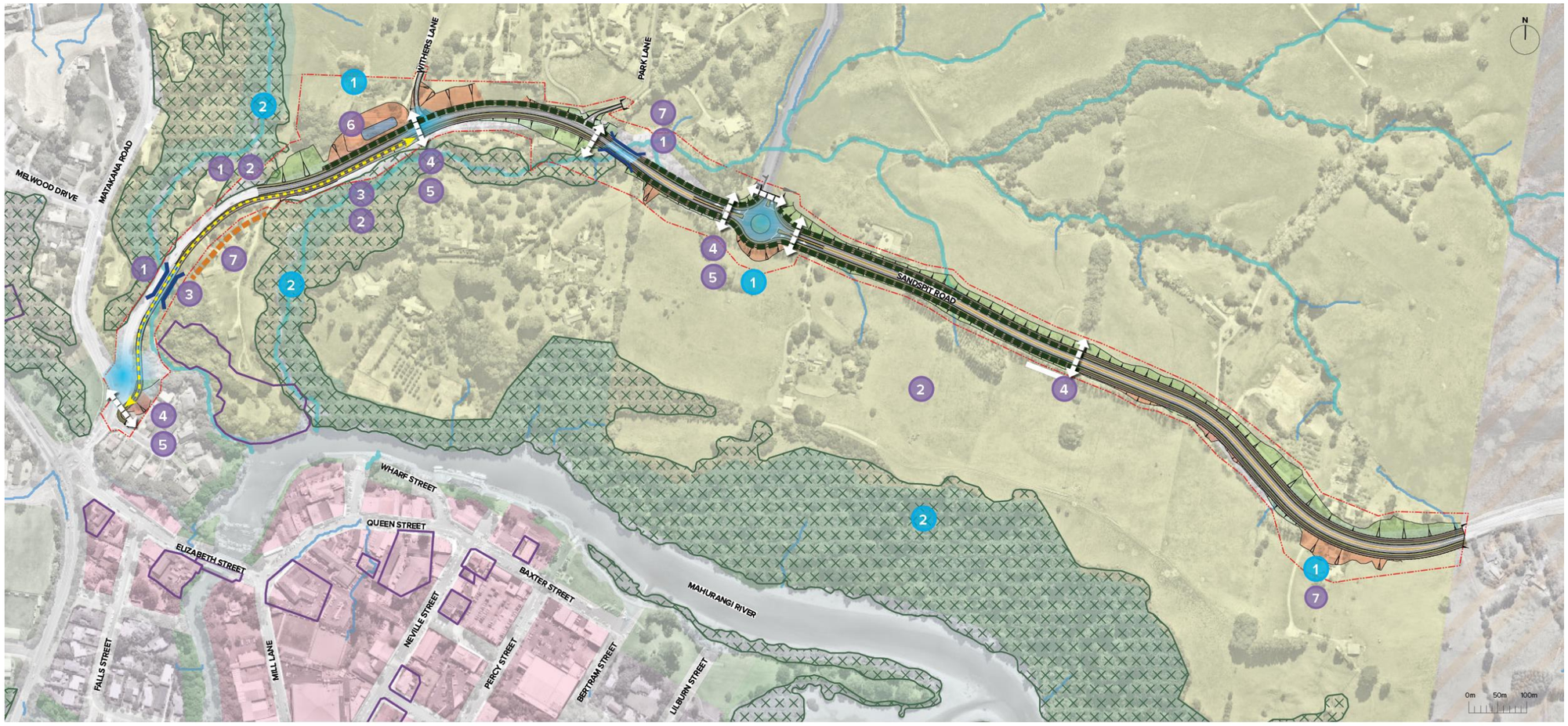
– The high movement function of the corridor and placemaking opportunities arising from the Future Urban Zone to the north and landscape protection to the south requires a modal integration strategy that outlines how this is addressed. The strategy should address intersection design to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes.

LANDUSE

– Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas:

- On both sides of Sandspit Road within NOR 5, particularly where large cut/fill batters are indicated.
- Any residual land adjacent the intersection with Sandspit Link and proposed wetlands.

Figure 33-1: NOR 5 urban design outcomes and opportunities



NOR 5 - SANDSPIT ROAD UPGRADE

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity along the Mahurangi River.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as future schools, employment and bussiness land, open spaces and community facilities.
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections.
6. **Wetlands -** Consider integration outcomes for wetland/s such as setbacks, arrangement and scale of planting to support an appropriate interface to the road corridoor and future urban zones.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuse.

1. **Land post construction -** Opportunity to demonstrate how any land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Wider connectivity -** Opportunity to reinforce visual connections to the wider community and landscape features.

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/1

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structures
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Single House Zone
- Open Space - Informal Recreation Zone
- Open Space - Conservation Zone
- Rural - Mixed Rural Zone
- Rural - Rural Production Zone
- Business - Mixed use Zone
- Business - Town Centre Zone
- SEA - Terrestrial
- Bi-Directional cycling facilities
- Historic Heritage Overlay
- Fill
- Cut

35. NOR 6 – Western Link - South

36. Introduction

This evaluation considers the proposed NOR 6 Western Link South against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 8: Urban Design Evaluation for Western Link - South in Appendix A only outlines urban design commentary specific to NOR 6. For commentary common to all NORs, refer to *Table 4: Common urban design matters*.

37. Summary of urban design evaluation and recommendations for NOR 6

Overall, the proposed corridor design and configuration for NOR 6 is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 6 are outlined below and illustrated in Figure 8: 6 urban design outcomes and opportunities which is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 6:

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 6 should be demonstrated. Key NOR 6 local identity community functions to be addressed relate to interface issues between potential opposing landuses on either side of the corridor.
- To enable equitable local connectivity and cross corridor access between future residential (FUZ) to the south, employment land to the north, and through to key destinations at either of the corridor further development will be required at future design stages. Further development of crossing points at intersections and potential midblock crossings are required including:
    - Evelyn St / Jamie Lane intersection
    - SH1 / McKinney Road intersection
- Intersection design in particular requires refinement at further design stages to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes. The following intersections require further attention:
    - Woodcocks Road (links to Mahurangi College)
    - SH1 (links to local centre to the south and town centre to the north)
- The future freight function of NOR 6 associated with existing and future industrial land on the north side of the corridor poses a potential conflict between placemaking aspirations within local communities on the south side of the corridor and the scale and speed of the proposed movement function. An NOR 6 place specific response to integrating these functions should be identified and

addressed in future design states of the project. Reducing the number of access points to industrial land on the north side of the corridor will help reduce the number of conflict locations.

- A CPTED audit of the NOR 6 corridor should address, at a minimum, the current identified CPTED risks including:
  - The corridor interface with the Business – Light Industrial on the north side and Residential – Mixed Housing Suburban.
  - The frontage on to the proposed wetland at the north end and its location adjacent to an existing wetland.
  - Surveillance restrictions due to large cut/fill batters throughout the corridor.

BUILT FORM

- An urban interface approach within the corridor that:
  - responds to the spatial character of both residential/employment land environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.
  - demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
  - recognises the transition of landuse typology from future Residential – Mixed Housing Suburban Zone to Business – Light Industry and provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.

MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, transport interchanges, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:
  - Jamie Lane (transition from bidirectional cycleway to uni directional).
  - Morrison Drive.
  - Woodcocks Road (links to Mahurangi College
  - SH1 (links to local centre to the south and town centre to the north)
- Legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within NOR 6. Demonstration of specific intersection responses to ensure connectivity between the Residential – Mixed Housing Suburban Zone, Business – Light Industry and key destinations at either end of the NOR 6 corridor pertain to the same intersection/crossing locations as above.
  The potential conflict between the continued freight function of the corridor and placemaking opportunities arising from the introduction of residential land on the south side of the corridor and walking and cycling facilities connection to nearby schools along the Western Link will require careful and deliberate consideration in future design stages of the project.

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas:

- On both sides of the Western Link within NOR 6, particularly where large cut/fill batters are indicated.
- Any residual land adjacent the intersection with Western Link and proposed wetlands.

Figure 36-1: NOR 6 urban design outcomes and opportunities

NOR 6 - NEW WESTERN LINK ROAD SOUTH

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity in the local environment.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as future schools, employment and bussiness land, open spaces and community facilities.
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the Evelyn St and SH1 roundabout which connects residential land to medium density development.
6. **Wetlands -** Consider integration outcomes for the wetland such as setbacks, arrangement and scale of planting to support an appropriate interface to reserve / parks and the adjacent light industry.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuses.

1. **Land post construction -** Opportunity to demonstrate how any land portions following the construction of the Project are redefined and integrated with the expected future land use function.

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/1

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Interface and visual / landscape buffer considerations for industrial, business and rural landuse/zones.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structures.
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.
- Consideration of potential modal conflicts between the future freight movement, placemaking and active mode functions.

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Open Space - Informal Recreation Zone
- Open Space - Sport and active recreation zone
- Business - Light Industry
- Fill
- Cut

38. NOR 7 – Sandspit Link

39. Introduction

This evaluation considers the proposed NOR 7 Sandspit Link against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 11: Urban Design Evaluation for NOR 7 Sandspit Link in Appendix A only outlines urban design commentary specific to NOR 7. For commentary common to all NORs, refer to *Table 4: Common urban design matters*.

40. Summary of urban design evaluation and recommendations for NOR 7

Overall, the proposed corridor design and configuration for NOR 7 is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 7 are outlined below and illustrated in Figure 8: 7 urban design outcomes and opportunities which is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 7:

ENVIRONMENT

- Integration of the three proposed wetlands to ensure an appropriate interface with adjacent land uses, specifically where these are proposed in the Residential - Mixed Housing Urban Zone at the western end of the corridor.

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 7 should be demonstrated. Key NOR 7 local identity community functions to be addressed include:
  - The tributaries of the Mahurangi River and adjacent areas of established native vegetation.
  - The Residential - Mixed Housing Urban Zone
  - The Hinterland beyond the FUZ to the north
- Key NOR 7 distinctive landscape character qualities of open spaces, stream and conservation zones include;
  - Open space linkages along the Mahurangi River
  - Mature riparian vegetation marking the alignment of the Mahurangi River.
  - Constructed wetlands and their integration with the catchment
- The proposed corridor alignment and function can deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to existing

and future local, neighbourhood and town centres, schools, community functions and open spaces. Key community functions within NOR 7 to be addressed include:

- Open Space - Conservation Zone and Landscape Protection area identified in the Structure Plan.

- Intersection design in particular requires refinement at further design stages to ensure walking and cycling facilities are legible, direct, minimise potential negative intersections between modes, and prioritise active modes by reducing the time and distance to cross vehicle lanes. The following intersections require further attention.
  - Sandspit Link
  - Matakana Road.
  - Within 50m of each bridge crossing

BUILT FORM

- An urban interface approach within the corridor that:
  - responds to the spatial character of proposed centre environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.
  - demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
  - recognises the transition of densities from future Residential – Mixed Housing Urrban Zone to Residential – Mixed Housing Suburban and Single House Zones and provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.
  - Recognises the interface between the Residential – Mixed Housing Urban / Suburban Zones adjacent large cut/fill batters and the road corridor.
  - Recognises the built form interface, any visual or landscape buffers and development controls proposed for the operational or retired Limestone Quarry.

MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, transport interchanges, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:
  - Sandspit Link
  - Matakana Road.
  - Within 50m of each bridge crossing

- Legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within NOR 7. Demonstration of specific intersection responses to ensure connectivity between the Residential – Mixed Housing Urban Zone and the schools, employment land, further west, specifically Te Honohono ki Tai (Matakana Link Road).

- A modal integration strategy that addresses the potential conflict between the high movement function of the corridor and placemaking opportunities arising from Residential – Mixed Housing Urban Zone.

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas:
    - On both sides of Sandspit Link within NOR 7, particularly where large cut/fill batters are indicated.
    - Any residual land adjacent the intersection with Sandpit Road and the three proposed wetlands.

Figure 39-1: NOR 7 urban design outcomes and opportunities

NOR 7 - NEW SANDSPIT LINK ROAD

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/1

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity in the local environment.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as open spaces and community facilities
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections.
6. **Wetlands -** Consider integration outcomes for wetland/s such as setbacks, arrangement and scale of planting to support an appropriate interface to the corridoor and Future urban Zone.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuses.

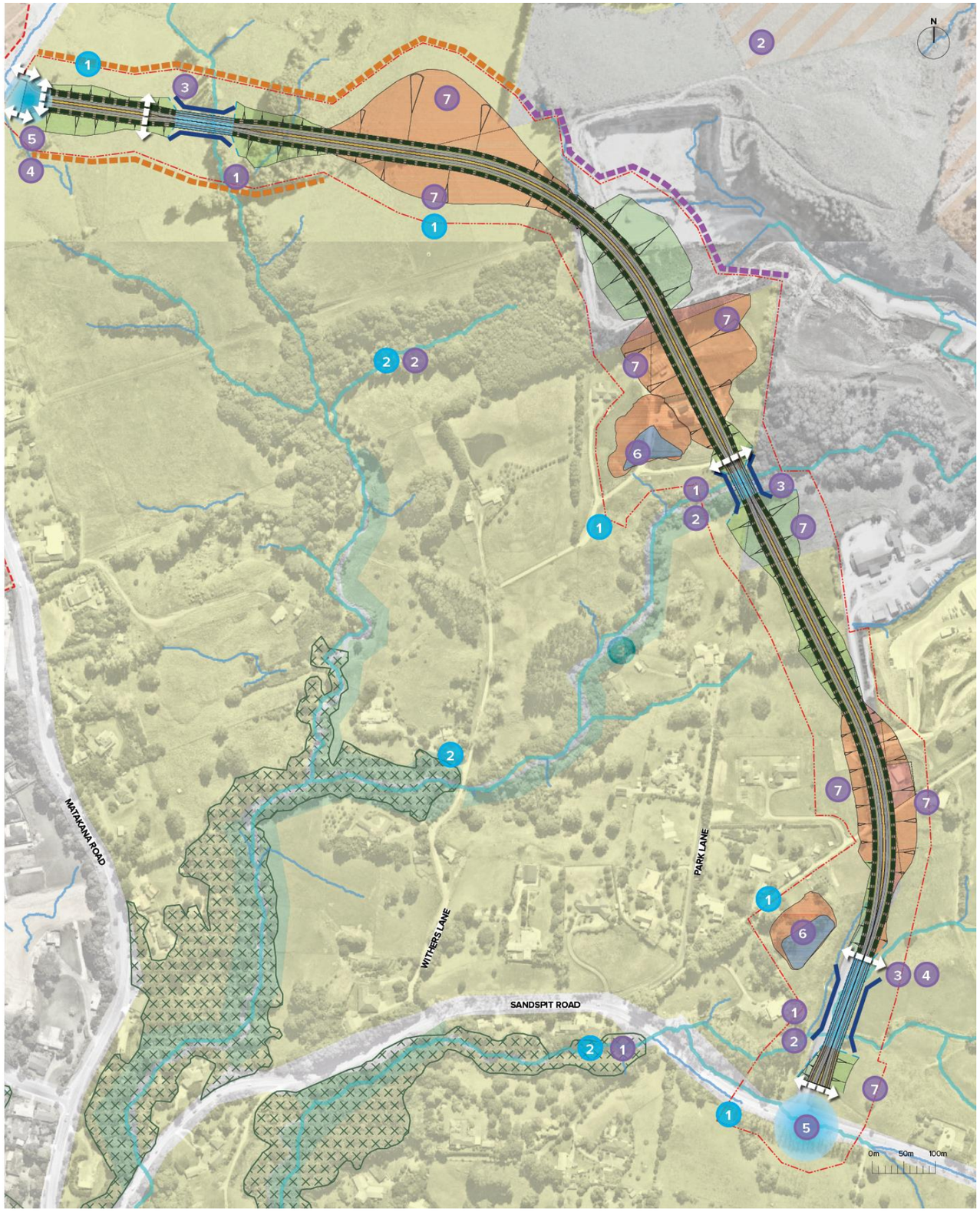
1. **Land post construction -** Opportunity to demonstrate how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Wider connectivity -** Opportunity to reinforce visual connections to the wider community and landscape features.

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structure.
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.
- Interface and visual / landscape buffer considerations for industrial, business and rural landuse/zones.

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Large Lot
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Residential - Mixed Housing urban Zone
- Fill
- Open Space - Sport and active recreation zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Special Purpose Zone
- Strategic Transport Corridor
- SEA - Terrestrial
- Cut



41. NOR 8 – Wider Western Link - North

42. Introduction

This evaluation considers the proposed NOR 8 – Wider Western Link against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where any urban design outcomes should be considered in future design stages.

Table 8: Urban Design Evaluation for Western Link (northern section) in Appendix A only outlines urban design commentary specific to NOR 8. For commentary common to all NORs, refer to *Table 4: Common urban design matters*.

43. Summary of urban design evaluation and recommendations for NOR 8

Overall, the proposed corridor design and configuration for NORs 8 is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities for NOR 8 are outlined below and illustrated in Figure 9: 8 urban design outcomes and opportunities which is recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) to assist with in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes for NOR 8:

ENVIRONMENT

- Integration of wetlands to ensure an appropriate interface with adjacent land uses, specifically where these are proposed in both the Business – heavy Industry Zone and Residential Mixed Housing Urban Zone.
- The intersection with Ara Tūhono and new road bridge across the right branch of the Mahurangi River will require significant resource and materials to construct, however the exact details of the earthworks required for the corridor are not fully resolved and should be reviewed for landscape integration opportunities to minimise land disturbance and conserve materials.

SOCIAL

- The identification, development and integration of key local community and identity drivers within NOR 8 should be demonstrated. Key NOR 8 local identity community functions to be addressed include:
  - The bridge across the Mahurangi River (right branch) which forms the transition between Business - Heavy Industry Zone on the north side and residential landuse on the south side.
  - The landscape character drivers of the tributaries of the Mahurangi River (right branch)
  - The Business – Heavy Industry Zone.
  - Proximity to Ara Tūhono
- Key NOR 8 distinctive landscape character qualities of open spaces, stream and conservation zones include:

- Open space linkages along the Mahurangi River and its tributaries including area of indigenous forest.
- Constructed wetlands and their integration with the Mahurangi River catchment.

- The proposed corridor alignment and function can deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to existing and future local, neighbourhood and town centres, schools, community functions and open spaces. Key business functions within NOR 8 to be addressed include the Industrial and employment land along NoR8.
- To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including:

  - Woodcocks Road
  - North-South thru the Southern Interchange
  - At the southern end of NOR 8 before the bridge crossing.
  - The Residential – Mixed Housing Suburban and Urban Zones immediately east of the corridor across the Mahurangi River. In addition this provides more direct access to Mahurangi College and a proposed future Primary School on Woodcocks Road.

- The future freight function of NOR 8 that connects the large future industrial land and its proximity to the future Southern Interchange poses a potential conflict between placemaking aspirations within local communities and the scale and speed of the proposed movement function. An NOR 8 place specific response to integrating these functions should be identified and addressed in future design states of the project.
- A CPTED audit of the corridor within NOR 8 should address, at a minimum, the current identified CPTED risks including:

  - The Business – Heavy Industry Zone south of the bridge crossing.
  - The overbridge environment across and below the Mahurangi River (right branch).

BUILT FORM

- An urban interface approach within the corridor that:

  - responds to the spatial character of proposed centre environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity.
  - demonstrates the proposed modal connections, modal hierarchy, built form interfaces and arrangements along the corridor.
  - recognises the transition of densities from future Business –Heavy Industry Zones to Residential – Mixed Housing Urban Zone and provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.
  - considers the scale, visual integration, interface and sense of place qualities of the bridge structure across the Mahurangi River and adjacent future development.

MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, transport

interchanges, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:

  - Mahurangi College and a proposed future Primary School.
  - Industrial and employment land at the eastern and western ends of Woodcocks Road.
  - The Residential – Mixed Housing Suburban and Urban Zones immediately east of the corridor across the Mahurangi River.

- Legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within NOR 8. Demonstration of specific intersection responses to ensure connectivity between the Residential – Mixed Housing Urban Zone and the schools, employment land, bus hub local centre to the north including:

  - Woodcocks Road
  - The Southern Interchange
  - SH1

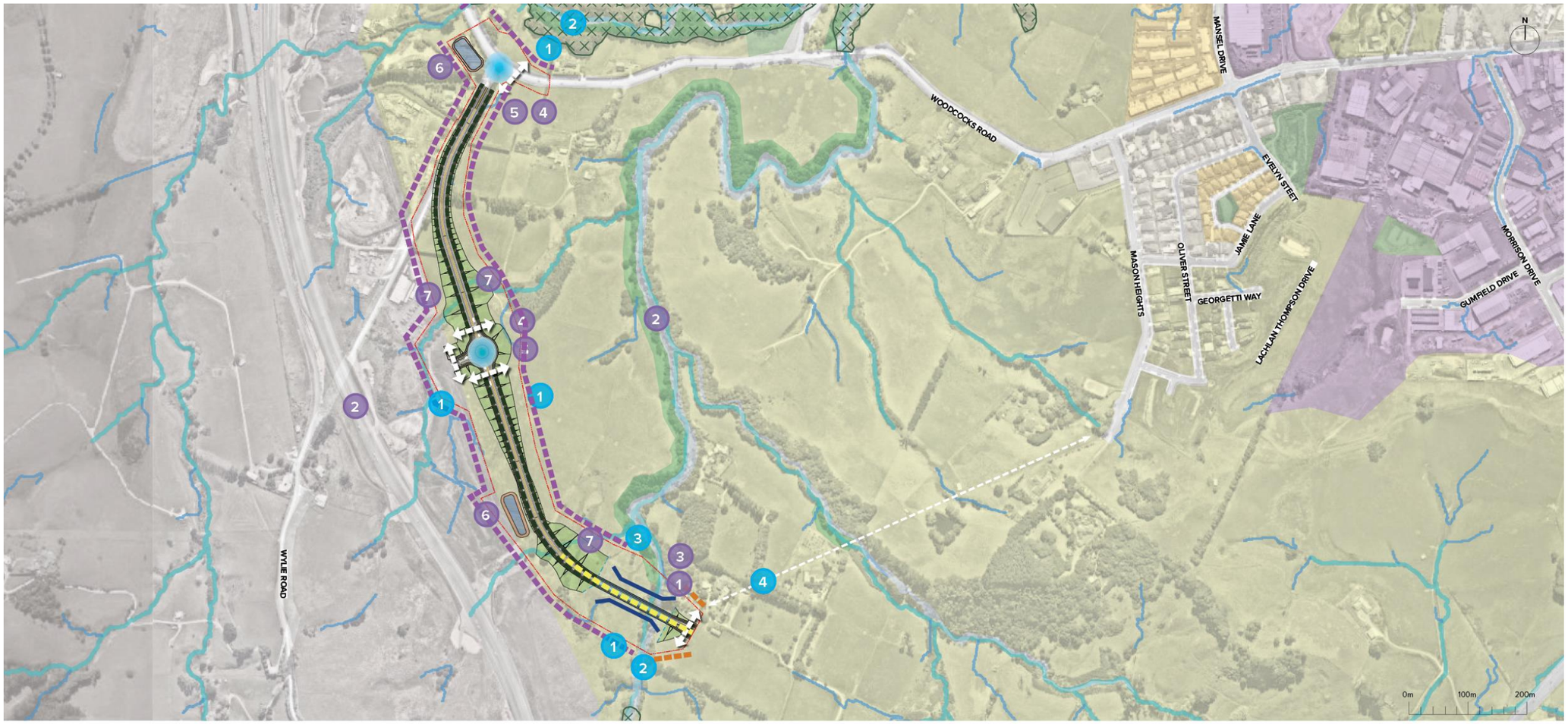
- A modal integration strategy that addresses the potential conflict between the continued freight function of the corridor and placemaking opportunities arising from Residential – Mixed Housing Urban Zone and its proximity to the future local centre to the north.

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas:

  - On both sides of the Wider Western Link within NOR 8, particularly where large cut/fill batters are indicated.
  - Any residual land adjacent the intersection with the Southern Interchange and proposed wetlands.

Figure 42-1: NOR 8 urban design outcomes and opportunities



NOR 8 - NEW WIDER WESTERN LINK ROAD

Outcomes Opportunities

1. **Ecological connectivity -** Landscape outcomes should reinforce the wider vegetation patterns of the local open spaces and support ecological connectivity and biodiversity in the local environment.
2. **Identity drivers -** Key local community, landscape character and identity drivers should be identified, developed and integrated with the adjacent land use functions and future design response.
3. **CPTED -** Future design should incorporate CPTED principles including clear sightlines, good levels of lighting and passive surveillance.
4. **Active mode permeability -** Corridor permeability for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as employment and bussiness land, open spaces and community facilities.
5. **Active mode legibility and priority -** Legibility, connectivity demands, safety and modal priority for active modes should be addressed at intersections, particulary at the Wider western link road roundabout which connects to medium density development.
6. **Wetlands -** Consider integration outcomes for wetland/s such as setbacks, arrangement and scale of planting to support an appropriate interface to the road corridoor and Future Urban Zone.
7. **Earthworks -** Minimise Earthworks & Level changes at corridor boundaries & Interfaces with future development areas to enable integration with adjoining future landuse. Use retaining structures in areas where space in insufficent to deploy earthworks batters or where earthworks negatively impacts the efficieny of adjacent landuses.

1. **Land post construction -** Opportunity to demonstrate how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function.
2. **Wider connectivity -** Opportunity to reinforce visual connections to the wider community and landscape features.
3. **Betterment of the Mahurangi River -** betterment of Mahurangi River interface with road corridor. Through a cultural intergration strategy that reinforces identity drviers of the local area.
4. **Walking and cycling -** improve connectivity to Mixed Housing Suburban and Urban Zones and education facilities on Woodcocks Road immediately east of the corridor across the Mahurangi River.

OUTCOMES AND OPPORTUNITIES PLAN - SHEET 1/1

Outcomes

- Residential (Mixed Housing Urban / THAB) and Buisness - Mixed-Use integration / interface that enables buildings and spaces to positively address and integrate with the corridor.
- Intersection arrangement that addresses multi-modal priority, safety and legibility.
- Cross corridor active mode connection.
- Consideration of visual integration, interface and sense of place for the bridge structure.
- Landscape outcomes should provide replace and augment canopy shading to the corridor. Outcomes to reflect and enhance the local character inherent in the built, natural and cultural qualities of the location within the corridor.
- Consideration of potential modal conflicts between the future freight movement, placemaking and active mode functions.
- Interface and visual / landscape buffer considerations for industrial, business and rural landuse/zones.

LEGEND

- Designation Boundary
- Future Urban Zone - FUZ
- Residential - Single House Zone
- Residential - Mixed Housing Suburban Zone
- Open Space - Informal Recreation Zone
- Open Space - Conservation Zone
- Open Space - Sport and Active Recreation Zone
- Rural - Rural Production Zone
- Business - Light Industry
- Strategic Transport Corridor Zone
- SEA - Terrestrial
- Fill
- Cut

1 Urban design evaluation tables

For urban design commentary common to all NORs, refer to *Table 4: Common urban design matters*.

44. NOR 1 – Northern Public Transport Hub and Western Link - North | Urban Design Matters

Table 12: Urban Design Evaluation for NOR 1 Northern Public Transport Hub + park and Ride and Western Link - North

Principle	Application to NOR 1
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 1 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include: o Artificial wetland at the corner of SH1 and Western Link o The permanent stream adjacent to the Western Link. o The proposed bridges across two permanent streams Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetlands or raingardens to address water quality and reduce hard engineering solutions. There is a large wetland situated between SH1, the Western Link and the Park and Ride. This presents an opportunity for the wetland and associated plantings to be integrated and provide additional amenity and outlook for users of the Public Transport Hub.
1.3 Minimise land disturbance, conserve resources and materials	The location and composition of the Public Transport Hub and park and ride has been refined to minmise earthworks. The site slopes to the east toward a tributary and large culvert under SH1. The layout and composition of any wetlands should be reviewed for landscape integration opportunities and creating a positive interface with adjacent urban form and the Public Transport Hub.
1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	The Park and Ride carpark should demonstrate consideration of urban heat island effects in this future urbanized area. Proposed amenity planting and water sensitive design elements should be incorporated at future design stages to provide relief for people walking to and from vehicles and from the street.
2.1 Identity and place	The existing setting of the Public Transport Hub and Park and Ride is expected to change significantly with the realisation of the Local Centre Zone land to the south and the Future Urban Zone to the south currently identified as Residential – Mixed Housing Suburban Zone. The further identification, development and integration of key local community and identity drivers within NOR 1 should be addressed in future design stages. Key NOR 1 local identity locations and functions include: o The Future Business – Local Centre Zone on the Western Link.

Principle	Application to NOR 1
	o The large Future Mixed Housing Urban Zone surrounding the Local Centre. o Warkworth Showgrounds. o The two proposed bridge crossings with the first 250m of the Western Link. Future design stages should demonstrate the project response to both the locational drivers outlined above and placemaking drivers including: o Improved pedestrian and cyclist connectivity to the Local Centre and Mixed Housing Urban areas outlined above. o Interface, modal priority and access arrangements along the Western Link. o Cultural values and narratives In order to create a sense of identity and place, the future architectural design response of the public transport hub and associated facilities will need to consider the underlying identity drivers of the surrounding context such as: o Cultural values and narratives of Mana Whenua and other community members; o Any identified landscape character drivers of the public transport hub location; and o Urban space qualities of the potential high to medium density land uses surrounding the public transport hub location.
2.2 **Respect culturally significant sites and landscapes**	Refer to Table 4: Common urban design matters in relation to this design principle.
2.3 **Adaptive corridors**	If practicable, future land integration post construction should be considered in the following areas to support a landuse transition buffer and/or any proposed development / redevelopment together to the Public Transport Hub, park and ride facility and the northern end of the Western Link. o Surrounding the Park and Ride. o On the north side of the Western Link, particularly where large cut/fill batters are indicated. o Any residual land adjacent SH1 intersection and proposed wetlands.
2.4 **Social cohesion**	To enable equitable local connectivity and cross corridor access between future residential (FUZ) to the south, employment land to the south-west, and through to key destinations at either end of the corridor further development of crossing points at intersections and potential midblock crossings are required including: o SH1 / Western Link o Western Link / Local access road to Park and Ride o Western Link through to the Public Transport Hub (offroad)
2.5 **Safety**	To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including: o Woodcocks Road o North-South thru the Southern Interchange o At the southern end of NOR 1 before the bridge crossing.

Principle	Application to NOR 1
	The future freight function of NOR 1 that connects an area of future industrial land to the south (via Woodcocks Road and the Wider Western Link) a potential conflict between placemaking aspirations within local communities and the scale and speed of the proposed movement function. Reducing heavy vehicle through traffic along the Western Link will assist in mitigating this safety issue – this can be achieved by designing the corridor for light vehicles with appropriate horizontal and vertical deflection to prevent through put. SH1 should remain the primary through for delivery and heavy vehicles accessing commercial and industrial land south of Woodcocks Road from Ara Tuhono. A NOR 1 place specific response to integrating these functions should be identified and addressed in future design states of the project. A CPTED audit of the corridor within NOR 1 should address, at a minimum, the current identified CPTED risks including: o The future carpark facility adjacent mixed use landuse. o The public transport hub. o Active mode connections from the Western Link and any side roads to the Public Transport Hub.
3.1 **Align corridors with density**	The PT hub directly supports the requirements of Policies 1 and 3 of the NPS:UD for enabling increased development capacity adjacent to frequent PT network and centres. It is recommended that future design stages demonstrate the proposed modal connections, hierarchy, built form interfaces and arrangements that support the creation of vibrant, active urban environments.
3.2 **Corridor scaled to the surrounding context and urban structure**	For approximately 1.2km along the full length of the Western Link the landuse is Mixed Housing Suburban and Mixed Housing Urban which is subject to change as a result of the increased development capacity requirements of the NPS-UD – particularly given its proximity to a large Local Centre. This possible land use and residential density change has the potential to alter the perceived scale and impact of the proposed corridor functions. Any potential conflict between placemaking aspirations within local communities and the scale and speed of the proposed movement functions of the corridor should be addressed in future design stages. Key focus areas within NOR 1 that require further resolution in future design stages to demonstrate the potential scale and urban structure response include: o The walk-up catchments of the proposed Public Transport Hub within NOR 1 and for the length of the Western Link ; o The corridor edges and interfaces with Business – Local Centre Zone, Business Mixed Use Zone and Business – General Business Zone land; o The built form interface with the FUZ that remains Further vertical integration adjacent to bridging structures along the SH1 crossing should be developed at a detailed design stage to allow an appropriate transition and interface to adjacent built form.
3.3 **Facilitate an appropriate interface between place and movement**	Key focus areas within NOR 1 that require further resolution in future design stages to demonstrate the place interface / response to the proposed movement functions include: o The key intersections and mid-block crossings outlined for NOR 1 under principle 2.4 – Social Cohesion;

Principle	Application to NOR 1
	o The wetland and where batter slopes are potentially required; and o The proposed bridge and interface with adjacent supermarket carpark. Relationship to the grain of adjacent residential and commercial landuses requires resolution and coordination with adjacent landowners in future stages to ensure local access and connectivity can be achieved, particularly where higher density housing is likely to occur.
4.1 Connect nodes	There are opportunities in the future development of the Project to consider wider active mode network connections to: o The Supermarket complex immediately east of the Public Transport Hub o The Warkworth Showgrounds immediately north of the Public Transport Hub o The proposed Buisess - Local Centre Zone immediately south of the Public Transport Hub
4.2 Connect modes	The station location and layout should consider legibility and clear wayfinding for all modes between the Public Transport Hub, carpark, and the Western Link. Further development of the functional layout of the bus facility is recommended.
4.3 Support access to employment and industry	Refer to Table 4: Common urban design matters in relation to this design principle.
4.4 Prioritise active modes and public transport	Refer to Table 4: Common urban design matters in relation to this design principle.
4.5 Support inter-regional connections and strategic infrastructure	The potential conflict between the high movement function of the corridor and placemaking opportunities arising from the introduction of the Public Transport Hub along the Western Link will require careful and deliberate consideration in future design stages of the project. Further urban design commentary on this issue is included under Principles 2.1, 2.4, 2.5, 3.3, and 4.1.
4.6 Support legible corridor function	Refer to Table 4: Common urban design matters in relation to this design principle.
5.1 Public transport directed and integrated into centres	Refer to Table 4: Common urban design matters in relation to this design principle.
5.2 Strategic corridors as urban edges	This principle is not directly relevant to the NOR 1 corridor as set out in Table 4.

45. NOR 2 – Woodcocks Road upgrade | Urban design matters

Table 5: Urban design evaluation for NOR 2 – Woodcocks Road Upgrade

Principle	Application to NOR 2
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 2 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include: o Artificial wetlands and swales within the corridor. o Where the corridor crosses the Mahurangi River near Falls Road and Wider Western Link. Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities. There are two watercourse bridge crossing in NOR 2 at the Mahurangi River (Right Branch) and a tributary off the Left Branch of the Mahurangi River that presents an opportunity to reinforce broader connectivity outcomes for ecology and water quality by minimising the river interruption and ensuring a connected natural system.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetland or raingardens to address water quality and reduce hard engineering solutions. The wetlands locations are located: o Adjacent Mason Heights Road. o Near the crossing of the right branch of the Mahurangi River. o Adjacent the Wider Western Link.
1.3 Minimise land disturbance, conserve resources and materials	Refer to Table 4: Common urban design matters in relation to this design principle.
1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	Refer to Table 4: Common urban design matters in relation to this design principle.
SOCIAL	
2.1 Identity and place	The further identification, development and integration of key local community and identity drivers within NOR 2 should be addressed in future design stages. Key NOR 2 local identity locations and functions include: o The Business - Heavy Industry Zone at the future Wider Western Link – Future Residential development with the FUZ.

Principle	Application to NOR 2
	o Future Primary School and connections through to Mahurangi College. o The landscape character drivers of the tributaries of the Mahurangi River. o The urban space qualities of medium density land uses adjacent the Mahurangi River, areas of established native vegetation, and the transition to industrial/business landuse at the eastern end of Woodcocks Road. o Cultural values and narratives.
2.2 Respect culturally significant sites and landscapes	Refer to Table 4: Common urban design matters in relation to this design principle.
2.3 Adaptive corridors	If practicable, future land integration post construction should be considered in the following areas to support any proposed development / redevelopment adjacent to the NOR 2 corridor: o On both sides of Woodcocks Road within NOR 2, particularly where large cut/fill batters are indicated. o The intersection with Wider Western Link and proposed wetlands.
2.4 Social cohesion	The proposed corridor alignment and function can deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to existing local, neighbourhood and town centres, schools, community functions and open spaces. Examples of school, community and business functions that will benefit from improved connectivity delivered by the project within NOR 2 include: o Mahurangi College and a proposed future Primary School. o Industrial and employment land at the eastern and western ends of Woodcocks Road. To enable equitable local connectivity and cross corridor access to employment land and areas of high density, further development at the detailed design stage should be undertaken of crossing points at intersections and potential midblock crossings including: o Mansell Drive. o Mason Heights intersection. o Falls Road. o Wider Western Link.
2.5 Safety	To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including: o Woodcocks Road between the proposed bi-directional and uni directional cycleway at Mansell Drive intersection; o adjoining side roads; and o any identified adjacent future community function or movement attractors. In addition to the common matters comment on intersection and crossing point design in Section 2.5 of Table 4, the following locations in NoR2 should be specifically addressed in future design stages: o Mansell Drive. o Mason Heights.

Principle	Application to NOR 2
	o Wider Western Link. The future freight function of NoR1 that connects the large future industrial land and its proximity to the future Southern Interchange poses a potential conflict between placemaking aspirations within local communities and the scale and speed of the proposed movement function. An NoR1 place specific response to integrating these functions should be identified and addressed in future design states of the project. A CPTED audit of the NOR 2 project should address, at a minimum, the current identified CPTED risks including: o The corridor interface with the Business – Heavy Industry Zone at the western end of NOR 2, o The two proposed bridges near the Wider Western Link and Falls Road o The frontage on to proposed wetlands near the Wider Western Link and Falls Road.
MOVEMENT	
3.1 Align corridors with density	Refer to Table 4: Common urban design matters in relation to this design principle.
3.2 Corridor scaled to the surrounding context and urban structure	Refer to Table 4: Common urban design matters in relation to this design principle.
3.3 Facilitate an appropriate interface between place and movement	Key focus areas within NOR 2 that require further resolution through the recommended urban integration strategy outlined in Section 3.3 of Table 4 include: o The Residential – Mixed Housing Urban Zone between Falls Road and Mason Heights Road. o The interface between the Business – Heavy Industry Zone and Residential – Mixed Housing Urban Zone just west of Falls Road. o The Business – Heavy Industry Zone between the Wider Western Link and Falls Road.
4.1 Connect nodes	In addition to the common matters comment on cross corridor connections in Section 4.1 of Table 4, the following locations in NoR1 should be specifically addressed in future design stages: o midway between Wylie Road and Falls Road o Adjacent to Mahurangi River crossing o Approx 400m west of Mansel Drive
4.2 Connect modes	Refer to Table 4: Common urban design matters in relation to this design principle.
4.3 Support access to employment and industry	Refer to Table 4: Common urban design matters in relation to this design principle.

Principle	Application to NOR 2
4.4 Prioritise active modes and public transport	Refer to Table 4: Common urban design matters in relation to this design principle.
4.5 Support inter-regional connections and strategic infrastructure	Woodcocks Roads will become a key arterial corridor that connects existing industrial/commercial land use activities within Warkworth to the Southern Interchange. The potential conflict between the continued and future freight function of the corridor and placemaking opportunities arising from the introduction of residential land and walking an cycling facilities connection adjacent schools along Woodcocks Road will require careful and deliberate consideration in future design stages of the project. Further urban design commentary on this issue is included under Principles 2.1, 2.4, 2.5, 3.3, 4.1 and 4.4.
4.6 Support legible corridor function	Refer to Table 4: Common urban design matters in relation to this design principle.
LANDUSE	
5.1 Public transport directed and integrated into centres	Refer to Table 4: Common urban design matters in relation to this design principle.
5.2 Strategic corridors as urban edges	This principle is not directly relevant to NOR 2.

46. NOR 3 – State Highway 1 - South | Urban Design Matters

Table 8: Urban Design Evaluation for NOR 3 State Highway (Southern Section Upgrade)

Principle	Application to NOR 3
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 3 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include*:* o Artificial wetlands between the Wider Western Link and the Western Link including integration with adjacent tributaries. Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities.

Principle	Application to NOR 3
	The corridor sits adjacent to and crosses several vegetated tributaries within eth central portion of NOR 3 that feed into the Mahurangi River that presents an opportunity to reinforce broader connectivity outcomes for ecology and water quality by minimising disturbance and ensuring a connected natural system.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetlands or raingardens to address water quality and reduce hard engineering solutions. There are two wetlands near the central portion of the corridor which are located adjacent to a series of tributaries flowing down from steep hill country. This presents an opportunity for the wetland and associated plantings to seamlessly connect with the natural stream system.
1.3 Minimise land disturbance, conserve resources and materials	Refer to Table 4: Common urban design matters in relation to this design principle.
1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	Refer to Table 4: Common urban design matters in relation to this design principle.
2.1 Identity and place	The existing setting of the corridor is expected to change significantly with the realisation of the Business – Light Industry Zone land at the north west end of the corridor and the Future Urban Zone to the south. The future design response of the corridor will need to consider the underlying identity drivers of the surrounding context such as; o The landscape character drivers of permanent stream crossings flowing to the Mahurangi River. o The urban space qualities of future THAB and local centre land use at the intersection with the Wider Western Link. o Morrisons Heritage Orchard. o Constructed wetlands and their integration within the FUZ. o The threshold between the future urban zone and rural landuse at the southern end of NOR 3
2.2 Respect culturally significant sites and landscapes	Refer to Table 4: Common urban design matters in relation to this design principle.
2.3 Adaptive corridors	If practicable, future land integration post construction should be considered in the following areas to support any proposed development / redevelopment adjacent to the NOR 4 corridor: o On both sides of SH1 within NOR 3 where large cut/fill batters are indicated. o Around Wech Drive and the intersection with the Western Link.

Principle	Application to NOR 3
	o The intersection with Sandspit Link. o Proposed wetlands.
2.4 **Social cohesion**	To enable equitable local connectivity and cross corridor access between existing residential areas which have been orientated away from SH1, industrial land to the west and FUZ to the south, further development at the detailed design stage should be undertaken of crossing points at intersections and potential midblock crossings including: o Fairwater Road. o Wech Drive including a safe and legible connection through to Fairwater Road intersection providing access to the bidirectional cycleway on the west side of the corridor. o McKinney Road and Western Link. o Valerie Close. o Wider Western Link.
2.5 **Safety**	To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including: o Transition between sections of bi-directional and unidirectional cycleway near McKinney Road. o McKinney Road and Western Link. o Valerie Close. o Wider Western Link. Detuning the existing SH corridor to reflect its future form and function (more balanced movement and place function) will contribute to the safety of the corridor. In addition to the common matters comment on intersection and crossing point design in Section 2.5 of Table 4, the following locations in NoR1 should be specifically addressed in future design stages: o Fairwater Road. o Wech Drive including a safe and legible connection through to Fairwater Road intersection providing access to the bidirectional cycleway on the west side of the corridor. o McKinney Road and Western Link. o Valerie Close. o Wider Western Link. The proposed roundabout at the intersection of SH1 and Wider Western Link is a key connection between communities with future THAB and local centre landuse planned. An outcome that would support this is to reduce the scale of the roundabout to suit this context and provide safe and comfortable crossing points for people walking and cycling. A CPTED audit of the NOR 3 corridor should address, at a minimum, the current identified CPTED risks including: o The existing side road along Wech Drive and corridor interface through to Fairwater Road. o The corridor interface with the future local centre and its connection with the Wider Western Link and Bus Hub.

Principle	Application to NOR 3
	o The frontage on to proposed wetlands between the Wider Western Link and the Western Link.
3.1 **Align corridors with density**	Refer to Table 4: Common urban design matters in relation to this design principle.
3.2 **Corridor scaled to the surrounding context and urban structure**	Refer to Table 4: Common urban design matters in relation to this design principle.
3.3 **Facilitate an appropriate interface between place and movement**	Key focus areas within NOR 3 that require further resolution through the recommended urban integration strategy outlined in Section 3.3 of Table 4 include: o Areas of future medium/high density land use adjacent to the corridor between o Interface with residential and industrial/business areas particularly at the Western Link intersection. o The rural urban boundary interface at the southern end of NOR 3. The future retrofit and urbansisation of existing rural corridor will need to balance high movement / limited access, lateral connectivity, property access together with pockets of higher place function adjacent active landuse ie. local centre at the Western Link intersection.
4.1 **Connect nodes**	In addition to the common matters comment on cross corridor connections in Section 4.1 of Table 4, the following locations in NOR 3 should be specifically addressed in future design stages: o The transition points between the bi-directional cycleway and uni directional cycleway near McKinney Road. o Approx 400m north of the Wider Western Link. o Valerie Close. o Fairwater Road. See also 2.4 and 2.5.
4.2 **Connect modes**	Further development of the functional layout of the SH1 and Wider Western Link intersection is recommended to provide for legibility and clear wayfinding for active modes between the Business – Local Centre / bus hub and THAB and Residential – Mixed Housing Urban Zones to the east.
4.3 **Support access to employment and industry**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.4 **Prioritise active modes and public transport**	Refer to Table 4: Common urban design matters in relation to this design principle. See also 2.5 in relation to proposed intersections and crossing points.
4.5	Refer to Table 4: Common urban design matters in relation to this design principle.

Principle	Application to NOR 3
Support inter-regional connections and strategic infrastructure	
4.6 Support legible corridor function	Refer to Table 4: Common urban design matters in relation to this design principle.
5.1 Public transport directed and integrated into centres	Refer to Table 4: Common urban design matters in relation to this design principle.
5.2 Strategic corridors as urban edges	This principle is not directly relevant to the NOR 3 corridor as set out in Table 4.

47. NOR 4 – Matakana Road Upgrade | Urban Design Matters

Table 6: Urban Design Evaluation for Matakana Road Upgrade

Principle	Application to NOR 4
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 4 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include: o Artificial wetlands near the intersection with Sandpit Road and Sandspit Link o Where the corridor runs adjacent to indigenous forest at its southern end. Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities. The corridor sits adjacent to several vegetated tributaries that feed into the Mahurangi River at its southern end that presents an opportunity to reinforce broader connectivity outcomes for ecology and water quality by minimising disturbance and ensuring a connected natural system.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetlands or raingardens to address water quality and reduce hard engineering solutions. The southernmost wetland is located adjacent a tributary feeding the River and is enclosed by established riparian vegetation. This presents an opportunity for the wetland and associated plantings to seamlessly connect with the natural stream system.
1.3	Refer to Table 4: Common urban design matters in relation to this design principle.

Principle	Application to NOR 4
Minimise land disturbance, conserve resources and materials	
1.4 **Adapt to a changing climate and respond to the microclimatic factors of each area**	Refer to Table 4: Common urban design matters in relation to this design principle.
SOCIAL	
2.1 **Identity and place**	The further identification, development and integration of key local community and identity drivers within NOR 4 should be addressed in future design stages. Key NOR 4 local identity locations and functions include: o The interface between existing residential development and Future Residential development with the FUZ. o The landscape character drivers of the tributaries of the Mahurangi River. o The urban space qualities of medium density land uses adjacent to areas of established vegetation, areas of established native vegetation, and the transition towards Hill Street Intersection. o Cultural values and narratives.
2.2 **Respect culturally significant sites and landscapes**	Refer to Table 4: Common urban design matters in relation to this design principle.
2.3 **Adaptive corridors**	If practicable, future land integration post construction should be considered in the following areas to support any proposed development / redevelopment adjacent to the NOR 4 corridor: o On both sides of Matakana Road within NOR 4, particularly where large cut/fill batters are indicated. o Any residual land adjacent the intersection with Te Honohono ki Tai (Matakana Link Road) and proposed wetlands.
2.4 **Social cohesion**	To enable equitable local connectivity and cross corridor access between areas of medium and high density, further development at the detailed design stage should be undertaken of crossing points at intersections and potential midblock crossings including: o Te Honohono ki Tai (Matakana Link Road). o Sandspit Road. o Clayden Road. o Melwood Drive including connectivity between residential areas at Northwood Close and Matakana Road, and the FUZ to the north.

Principle	Application to NOR 4
2.5 **Safety**	To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including: o The transition between the proposed bi-directional and uni directional cycleway close to Hill Street Intersection. o Te Honohono ki Tai (Matakana Link Road) o Sandspit Road. In addition to the common matters comment on intersection and crossing point design in Section 2.5 of Table 4, the recently constructed roundabout at Te Honohono ki Tai (Matakana Link Road) adjacent NoR1 should be specifically addressed in future design stages. A CPTED audit of the NOR 4 project should address, at a minimum, the current identified CPTED risks including: o Limited passive surveillance along the southern portion of the corridor due to areas of vegetation and steep topography. o Future active mode connections to Northwood Close. o Future active mode connections to Open Space – Conservational Zone.
BUILT FORM	
3.1 **Align corridors with density**	Refer to Table 4: Common urban design matters in relation to this design principle.
3.2 **Corridor scaled to the surrounding context and urban structure**	Refer to Table 4: Common urban design matters in relation to this design principle.
3.3 **Facilitate an appropriate interface between place and movement**	The urbanisation of the existing rural corridor will need to balance high movement / limited access with lateral connectivity and property access together with pockets of higher place function. As such key focus areas within NOR 4 that require further resolution through the recommended urban integration strategy outlined in Section 3.3 of Table 4 include: o The FUZ and Open Space – Conservational Zone on the eastern side of the corridor up to Sandpit Link. o The existing Melwood Drive community. o The Residential – Mixed Housing Urban on the western side of the corridor between Te Honohono ki Tai (Matakana Link Road) and Melwood Drive community.
MOVEMENT	
4.1 **Connect nodes**	In addition to the common matters comment on cross corridor connections in Section 4.1 of Table 4, the following locations in NOR 4 should be specifically addressed in future design stages:

Principle	Application to NOR 4
	o At the northern end of Northwood Close (between the Residential – Single House Zone and Residential – Mixed Housing Urban Zone. o The Open Space – Conservation Zone 45pprox. 250m south of Te Honohono ki Tai (Matakana Link Road). o Melwood Drive See also 2.4 and 2.5.
4.2 Connect modes	Refer to Table 4: Common urban design matters in relation to this design principle.
4.3 Support access to employment and industry	Refer to Table 4: Common urban design matters in relation to this design principle.
4.4 Prioritise active modes and public transport	Refer to Table 4: Common urban design matters in relation to this design principle. See also 2.5, 3.3, and 4.5.
4.5 Support inter-regional connections and strategic infrastructure	The corridor has predominantly been scaled to fit within the topographical and existing land use constraints. In addition to the commentary in 2.5, the recently constructed roundabout at Te Honohono ki Tai (Matakana Link Road) is a specific opportunity for further development as the surrounding area is progressively urbanised. The roundabout is scaled to a rural high speed corridor context and will require redesign to fit the medium to high density residential landuse that is already been structure planned.
4.6 Support legible corridor function	Refer to Table 4: Common urban design matters in relation to this design principle.
LANDUSE	
5.1 Public transport directed and integrated into centres	Refer to Table 4: Common urban design matters in relation to this design principle.
5.2 Strategic corridors as urban edges	This principle is not directly relevant to NOR 4.

48. NOR 5 – Sandspit Road Upgrade | Urban Design Matters

Table 7: Urban Design Evaluation for NOR 5 – Sandspit Road Upgrade

Principle	Application to NOR 5
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 5 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include*:* o Artificial wetlands near Withers Lane. o Where the corridor runs adjacent to indigenous forest between Park Lane and Millstream Place. Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities. The corridor sits adjacent to and crosses several vegetated tributaries that feed into the Mahurangi River at its eastern end that presents an opportunity to reinforce broader connectivity outcomes for ecology and water quality by minimising disturbance and ensuring a connected natural system.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetlands or raingardens to address water quality and reduce hard engineering solutions. The wetland near Wuthers Lane is located adjacent to tributaries feeding the Mahurangi River and are enclosed by established riparian vegetation. This presents an opportunity for the wetland and associated plantings to seamlessly connect with the natural stream system.
1.3 Minimise land disturbance, conserve resources and materials	Refer to Table 4: Common urban design matters in relation to this design principle.
1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	Refer to Table 4: Common urban design matters in relation to this design principle.
2.1 Identity and place	The future design response of the corridor will need to consider the underlying identity drivers of the surrounding context such as: o The landscape character drivers of the tributaries of the Mahurangi River. o The urban space qualities of residential land uses adjacent the Mahurangi River, areas of established native vegetation, and the transition via Hill Street intersection between the town centre to the west and residential landuse to the east. o Cultural values and narratives.

Principle	Application to NOR 5
2.2 **Respect culturally significant sites and landscapes**	Refer to Table 4: Common urban design matters in relation to this design principle.
2.3 **Adaptive corridors**	If practicable, future land integration post construction should be considered in the following areas to support any proposed development / redevelopment adjacent to the NOR 5 corridor: o On both sides of Sandspit Road within NOR 5 particularly where large cut/fill batters are indicated. o Any residual land adjacent to the intersection with Sandspit Link and proposed wetlands.
2.4 **Social cohesion**	To enable equitable local connectivity and cross corridor access between areas of medium and high density, further development at the detailed design stage should be undertaken of crossing points at intersections and potential midblock crossings including: o Sandspit Link. o Withers Lane. o Matakana Road – with a strong focus on creating a seamless connection between the community in the north east quadrant of the town (along Sandspit Road) with the Warkworth Town centre.
2.5 **Safety**	To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including: o The transition points between the bi-directional cycleway / offroad multi user path and uni directional cycleway. o Matakana Road o Sandspit Link In addition, a CPTED audit of the NOR 5 project should address, at a minimum, the current identified CPTED risks including: o Limited passive surveillance along the western portion of the corridor due to areas of vegetation and steep topography. o Cycle and walking bridge at the western end of NOR 5. o Limited passive surveillance along the corridor between the Landscape Protection Zone (identified in the Structure Plan) and the Residential – Single House Zone.
3.1 **Align corridors with density**	Refer to Table 4: Common urban design matters in relation to this design principle.
3.2 **Corridor scaled to the surrounding context and urban structure**	Refer to Table 4: Common urban design matters in relation to this design principle.

Principle	Application to NOR 5
3.3 **Facilitate an appropriate interface between place and movement**	Key focus areas within NOR 5 that require further resolution through the recommended urban integration strategy outlined in Section 3.3 of Table 4 include: o The key intersections and mid-block crossings outlined under principle 2.4 – Social Cohesion. o The built form interface with areas of established native riparian vegetation and steep topography between Matakana Road and Sandspit Link.
4.1 **Connect nodes**	In addition to the common matters comment on cross corridor connections in Section 4.1 of Table 4, the following locations in NOR 5 should be specifically addressed in future design stages: o The transition points between the bi-directional cycleway / offroad multi user path and uni directional cycleway. o Matakana Road o Sandspit Link o Approx 400m east of Sandspit Link See also 2.4 and 2.5.
4.2 **Connect modes**	Further development of the functional layout of the Matakana Road intersection is recommended to provide for legibility and clear wayfinding for active modes through to the Warkworth Town Centre.
4.3 **Support access to employment and industry**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.4 **Prioritise active modes and public transport**	Potential priority conflicts between active modes / public transport and the high vehicle movement across Matakana, Sandspit Road Intersections should be further identified and addressed in future design states of the project.
4.5 **Support inter-regional connections and strategic infrastructure**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.6 **Support legible corridor function**	Refer to Table 4: Common urban design matters in relation to this design principle.
5.1 **Public transport directed and integrated into centres**	Refer to Table 4: Common urban design matters in relation to this design principle.

Principle	Application to NOR 5
5.2 Strategic corridors as urban edges	This principle is not directly relevant to NOR 5 corridor.

49. NOR 6 – Western Link | Urban Design Matters

Table 9: Urban Design Evaluation for NOR 6 Western Link

Principle	Application to NOR 6
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 6 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include: o Artificial wetlands at the northern and southern ends of the corridor. Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetlands or raingardens to address water quality and reduce hard engineering solutions. There are two wetlands at the northern and southern ends of the corridor which are located adjacent to a series of tributaries flowing down from steep hill country. This presents an opportunity for the wetland and associated plantings to seamlessly connect with the natural stream system.
1.3 Minimise land disturbance, conserve resources and materials	Refer to Table 4: Common urban design matters in relation to this design principle.
1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	Refer to Table 4: Common urban design matters in relation to this design principle.
2.1 Identity and place	The existing setting of the corridor is expected to change significantly with the realisation of the Business – Light Industry Zone land on the north side of the corridor

Principle	Application to NOR 6
	and the Future Urban Zone to the south currently identified as Residential – Mixed Housing Suburban Zone. The further identification, development and integration of key identity drivers within NOR 6 should address the interface issues between potential opposing landuses on either side of the corridor.
2.2 **Respect culturally significant sites and landscapes**	Refer to Table 4: Common urban design matters in relation to this design principle.
2.3 **Adaptive corridors**	If practicable, future land integration post construction should be considered in the following areas to support a landuse transition buffer and/or any proposed development / redevelopment together to the NOR 6 corridor o On the north side of the Western Link, particularly where large cut/fill batters are indicated. o Residual land adjacent intersections and proposed wetlands.
2.4 **Social cohesion**	Due to the contrast in landuse on either side of the corridor (Light Industry Zone land on the north side of the corridor and the Future Urban Zone to the south identified as Residential – Mixed Housing Suburban Zone) To enable equitable local connectivity and cross corridor access between future residential (FUZ) to the south, employment land to the north, and through to key destinations at either of the corridor further development will be required at future design stages. Further development of crossing points at intersections and potential midblock crossings are required including: o Evelyn St / Jamie Lane intersection o SH1 / McKinney Road intersection
2.5 **Safety**	The future freight function of NOR 6 associated with existing and future industrial land on the north side of the corridor poses a potential conflict between placemaking aspirations within local communities on the south side of the corridor and the scale and speed of the proposed movement function. An NOR 6 place specific response to integrating these functions should be identified and addressed in future design states of the project. Reducing the number of access points to industrial land on the north side of the corridor will help reduce the number of conflict locations. A CPTED audit of the NOR 6 corridor should address, at a minimum, the current identified CPTED risks including: o The corridor interface with the Business – Light Industry on the north side and Residential – Mixed Housing Suburban. o The frontage on to the proposed wetland at the north end and its location adjacent to an existing wetland. o Surveillance restrictions due to large cut/fill batters throughout the corridor.
3.1 **Align corridors with density**	This principle is not directly relevant to the NOR 6 corridor as the area is predominantly zoned Business – Light Industry Zone and Future Urban Zone.

Principle	Application to NOR 6
3.2 **Corridor scaled to the surrounding context and urban structure**	Refer to Table 4: Common urban design matters in relation to this design principle.
3.3 **Facilitate an appropriate interface between place and movement**	Key focus areas within NOR 6 that require further resolution through the recommended urban integration strategy outlined in Section 3.3 of Table 4 include: o The built form interface between the opposing Business – Light Industry Zone and Residential – Mixed Housing Suburban Zone. o Visual or landscape buffers and development controls proposed for the Business – Light Industry Zone. o Large cut/fill batters throughout the corridor. The interface with residential and commercial landuse requires resolution and coordination with adjacent landowners in future stages to ensure local access and connectivity can be achieved, particularly where higher density housing is likely to occur.
4.1 **Connect nodes**	In addition to the common matters comment on cross corridor connections in Section 4.1 of Table 4, the following locations in NOR 6 should be specifically addressed in future design stages: o Mason Heights community at the transition point between the bi-directional cycleway and uni directional cycleway at the north end of the corridor. o Employment land off Morrison Drive See also 2.4 and 2.5.
4.2 **Connect modes**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.3 **Support access to employment and industry**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.4 **Prioritise active modes and public transport**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.5 **Support inter-regional connections and strategic infrastructure**	The Western Link will become a key arterial corridor that connects existing industrial/commercial land use activities within Warkworth to the Southern Interchange. The potential conflict between the continued freight function of the corridor and placemaking opportunities arising from the introduction of residential land on the south side of the corridor and walking and cycling facilities connection to nearby schools along Woodcocks Road will require careful and deliberate consideration in future design stages of the project. Further urban design commentary on this issue is included under Principles 2.1, 2.4, 2.5, 3.3, 4.1 and 4.4.

Principle	Application to NOR 6
4.6 Support legible corridor function	Refer to Table 4: Common urban design matters in relation to this design principle.
5.1 Public transport directed and integrated into centres	Refer to Table 4: Common urban design matters in relation to this design principle.
5.2 Strategic corridors as urban edges	This principle is not directly relevant to the NOR 6 corridor as set out in Table 4.

50. NOR 7 – Sandspit Link | Urban Design Matters

Table 11: Urban Design Evaluation for NOR 7 Sandspit Link

Principle	Application to NOR 7
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 7 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include: o Artificial wetlands and swales within the corridor. o Bridge crossings. Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities. There are three bridge crossings in NOR 7 across tributaries that flow directly in to the upper tidal zone of the Mahurangi River. The bridges present an opportunity to reinforce broader connectivity outcomes for ecology and water quality by minimising the river interruption and ensuring a connected natural system.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetlands or raingardens to address water quality and reduce hard engineering solutions. These locations are proposed at: o The northern end of NOR 7 adjacent Matakana Road. o The centre of the corridor adjacent at bridge crossing. o The southern end of the corridor near Sandspit Road.
1.3 Minimise land disturbance, conserve	The corridor traverse's steep topography and required large cut and fill batters (up to 75m wide in places) together with three new road bridges. This will require significant resource and materials to construct relative to the lower density residential developed

Principle	Application to NOR 7
resources and materials	indicated in the structure plan. Identify further landscape integration opportunities to minimise earthworks and structures. In addition, landuse change may be required to reduce the need for infrastructure.
1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	Refer to Table 4: Common urban design matters in relation to this design principle.
2.1 Identity and place	The further identification, development and integration of key local community and identity drivers within NOR 7 should be addressed in future design stages. Key NOR 7 local identity locations and functions include: o The bridges across stream tributaries including the landscape character drivers of the Mahurangi River catchment o The predominately low density residential landuse anticipated. o Cultural values and narratives.
2.2 Respect culturally significant sites and landscapes	Refer to Table 4: Common urban design matters in relation to this design principle
2.3 Adaptive corridors	If practicable, future land integration post construction should be considered in the following areas to support any proposed development / redevelopment adjacent to the NOR 7 corridor: o On both sides of the corridor within NOR 7, particularly where large cut/fill batters are indicated. o Any residual land adjacent the Sandspit Road intersection.
2.4 Social cohesion	Refer to Table 4: Common urban design matters in relation to this design principle.
2.5 Safety	To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including: o Sandspit Link o Matakana Road. o Within 50m of each bridge crossing The through function of the corridor which provides a bypass around the Hill Street Intersection combined with a low activation environment due to the lower density residential environment anticipated may create safety issues for people walking and cycling. An NOR 7 place specific response to integrating these functions should be identified and addressed in future design states of the project.
3.1 Align corridors with density	Refer to Table 4: Common urban design matters in relation to this design principle.

Principle	Application to NOR 7
3.2 **Corridor scaled to the surrounding context and urban structure**	Refer to Table 4: Common urban design matters in relation to this design principle.
3.3 **Facilitate an appropriate interface between place and movement**	Key focus areas within NOR 7 that require further resolution through the recommended urban integration strategy outlined in Section 3.3 of Table 4 include: o The key intersections and mid-block crossings outlined for NOR 2 under principle 2.4 – Social Cohesion. o The interface between the Residential – Mixed Housing Suburban Zones adjacent large cut/fill batters and the road corridor. o The built form interface, any visual or landscape buffers and development controls proposed for the operational or retired Limestone Quarry.
4.1 **Connect nodes**	There are opportunities in the future development of the Project to consider wider active mode network connections to Matakana Road near Norwood Close.
4.2 **Connect modes**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.3 **Support access to employment and industry**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.4 **Prioritise active modes and public transport**	Refer to Table 4: Common urban design matters in relation to this design principle. See also 2.5.
4.5 **Support inter-regional connections and strategic infrastructure**	Refer to Table 4: Common urban design matters in relation to this design principle.
4.6 **Support legible corridor function**	Refer to Table 4: Common urban design matters in relation to this design principle.
5.1 **Public transport directed and integrated into centres**	Refer to Table 4: Common urban design matters in relation to this design principle.
5.2 **Strategic corridors as urban edges**	This principle is not directly relevant to NOR 7.

51. NOR 8 – Wider Western Link - North | Urban Design Matters

Table 10: Urban Design Evaluation for NOR 8 Wider Western Link (Northern Section)

Principle	Application to NOR 8
ENVIRONMENT	
1.1 Support and enhance ecological corridors and biodiversity	Opportunities within the immediate environment of NOR 8 to support ecological connectivity and biodiversity are identified in the Warkworth local and strategic packages: *Assessment of Ecological Effects* and include*:* o Artificial wetlands immediately south of the Southern Interchange and at the intersection with Woodcocks Road. o Mahurangi River (Right Branch) crossing. o Where the corridor runs adjacent to indigenous forest. Refer to the Warkworth local and strategic package: Assessment of Ecological Effects for details of these opportunities. There is one major bridge crossing in NOR 8 at the Mahurangi River (Right Branch) that presents an opportunity to reinforce broader connectivity outcomes for ecology and water quality by minimising the river interruption and ensuring a connected natural system.
1.2 Support water conservation and enhance water quality in a watershed	The proposed typical corridor cross section and designation boundary allows spatial provision to provide natural drainage to constructed wetlands or raingardens to address water quality and reduce hard engineering solutions. These locations are proposed at: o South of the Southern Interchange on the western side of the corridor. o West of the Intersection with Woodcocks Road
1.3 Minimise land disturbance, conserve resources and materials	The intersection with Ara Tūhono and new road bridge across the right branch of the Mahurangi River will require significant resource and materials to construct. Identify further landscape integration opportunities with the southern interchange to minmise earthworks and structures.
1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	Refer to Table 4: Common urban design matters in relation to this design principle.
2.1 Identity and place	The further identification, development and integration of key local community and identity drivers within NOR 8 should be addressed in future design stages. Key NOR 8 local identity locations and functions include: o The bridge across the Mahurangi River (right branch) which forms the transition between Business - Heavy Industry Zone on the north side and residential landuse on the south side.

Principle	Application to NOR 8
	o The landscape character drivers of the tributaries of the Mahurangi River (right branch) o The Business – Heavy Industry Zone. o Proximity to Ara Tūhono
2.2 **Respect culturally significant sites and landscapes**	Refer to Table 4: Common urban design matters in relation to this design principle.
2.3 **Adaptive corridors**	If practicable, future land integration post construction should be considered in the following areas to support any proposed development / redevelopment adjacent to the NOR 8 corridor: o On both sides of the corridor within NOR 8, particularly where large cut/fill batters are indicated. o Any residual land adjacent the intersection with the Southern Interchange, Woodcocks Road and proposed wetlands. o Approach batters to the proposed bridge across the Mahurangi River
2.4 **Social cohesion**	To enable equitable local connectivity between areas of residential development north of the Mahurangi River (right branch) and existing residential/commercial landuse on Woodcocks Road, further offroad connections should be explored to avoid traversing the Heavy Industry Zone through to Woodcocks Road or Mason Heights. The current Structure Plan does not identified any road connections between these communities. While not part of the NOR 8, the corridor extends further south through to SH1 connecting a larger area of THAB, a Local Centre, and future bus hub. Ensure continuity and legibility between NOR 8 and the following: o The interface between Morrisons Heritage Orchard o Proposed THAB and local centre o The urban space qualities of THAB density land use adjacent to the corridor together with the proposed local centre, and the transition towards the intersection with SH1.
2.5 **Safety**	To reinforce the sense of personal safety and enable equitable local connectivity and access for active modes future development at the detailed design stage should be undertaken of the final crossing points including: o Woodcocks Road o North-South thru the Southern Interchange o At the southern end of NOR 8 before the bridge crossing. The future freight function of NOR 8 that connects the large future industrial land and its proximity to the future Southern Interchange poses a potential conflict between placemaking aspirations within local communities and the scale and speed of the proposed movement function. An NOR 8 place specific response to integrating these functions should be identified and addressed in future design states of the project. A CPTED audit of the corridor within NOR 8 should address, at a minimum, the current identified CPTED risks including: o The Business – Heavy Industry Zone south of the bridge crossing.

Principle	Application to NOR 8
	o The overbridge environment across and below the Mahurangi River (right branch).
3.1 Align corridors with density	Refer to Table 4: Common urban design matters in relation to this design principle.
3.2 Corridor scaled to the surrounding context and urban structure	Refer to Table 4: Common urban design matters in relation to this design principle. See also 2.5.
3.3 Facilitate an appropriate interface between place and movement	Key focus areas within NOR 8 that require further resolution through the recommended urban integration strategy outlined in Section 3.3 of Table 4 include: o The key intersections and mid-block crossings outlined for NOR 8 under principle 2.4 – Social Cohesion. o The interface between the Business – Heavy Industry Zone and Residential – Mixed Housing Urban / Suburban Zones near the proposed Mahurangi River Bridge. o The built form interface, any visual or landscape buffers and development controls proposed for retained Business – Heavy Industry Zone.
4.1 Connect nodes	There are opportunities in the future development of the Project to consider wider active mode network connections to: o The Residential – Mixed Housing Urban Zone on Woodcocks Road o The Residential – Mixed Housing Surburban Zone west of the Mahurangi River (right branch) o The Local Centre, Bus Hub, and THAB Zone at the southern end of the Wider Western Link.
4.2 Connect modes	Refer to Table 4: Common urban design matters in relation to this design principle.
4.3 Support access to employment and industry	Refer to Table 4: Common urban design matters in relation to this design principle.
4.4 Prioritise active modes and public transport	Refer to Table 4: Common urban design matters in relation to this design principle. See also 2.4 and 2.5.
4.5 Support inter-regional connections and strategic infrastructure	The potential conflict between the future freight function of the corridor and placemaking opportunities arising from the interface between the Business – Heavy Industry Zone and Residential – Mixed Housing Urban / Suburban Zones will require careful and deliberate consideration in future design stages of the project. Further

Principle	Application to NOR 8
	urban design commentary on this issue is included under Principles 2.1, 2.4, 2.5, 3.3, and 4.1.
4.6 Support legible corridor function	Refer to Table 4: Common urban design matters in relation to this design principle.
5.1 Public transport directed and integrated into centres	Refer to Table 4: Common urban design matters in relation to this design principle.
5.2 Strategic corridors as urban edges	This principle is not directly relevant to NOR 8.

2 Design Framework Principles

The adopted Design Framework principles, outcomes and measures are summarised here for reference and have been extracted from the full Te Tupu Ngātahi Design Framework.

ENVIRONMENT

1.1 Support and enhance ecological corridors and biodiversity

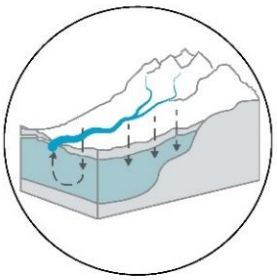
In the placement and design of movement corridors mitigate the effects on or enhance existing ecological corridors.

Outcome:

- The preservation of the biosphere, continuity of natural systems (at a range of scales) and contribution to climate change mitigation through emissions uptake.
- Contribution to the legibility of an area, open space corridors for movement and community use and increased community connection to natural habitats.
- Supports and rehabilitates the natural landscape.

Measure:

- Continuity/ severance of ecological corridors and enhanced biodiversity.
- Protection and enhancement of significant ecological areas (SEA's).



1.2 Support water conservation and enhance water quality in a watershed

Take into account and work with the existing watershed and aquifers as part of a whole system.

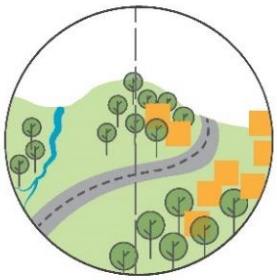
It is important that the mauri of waterways is restored, maintained and preserved for future generations. Connection to the Māori world view is described in the Te Aranga Principles - Mauri Tu: Environmental Health

Outcome:

- Use of natural systems to support design outcomes, reduces hard engineering solutions and thereby carbon emissions.
- Supports natural water cycles that the biosphere and communities depend on.
- Reduces the cost of water quality treatment.
- Supports and restores the coastal landscape.

Measure:

- Continuity/ severance of watershed.
- Allocation of land area for water quality treatment.
- Water quality treatment systems - swales, rain gardens, bioswales and wetlands are to be located within the corridor and not reliant on out of corridor treatment



1.3 Minimise land disturbance, conserve resources and materials

Respect the existing topography, landforms and urban structure in the placement of strategic corridors. Minimise the quantity of hard engineering materials required. Minimise, mitigate any adverse effects of activities on the environment.

Landforms and built heritage including movement networks can embody a history and create a distinctive sense of place. They help to provide an understanding and connection to the former natural and cultural history.

Connection to the Māori world view is described in the Te Aranga Principles - Tohu: The wider cultural landscape

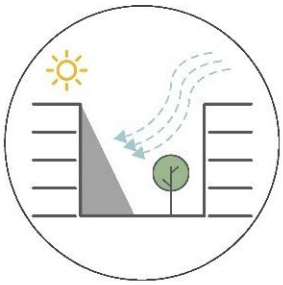
Outcome:

- Reduces carbon emissions, waste of resources and impact on the biosphere.
- Protection of elite soils that support food production.

Measure:

- Works with/ against land, topography or urban structure.
- Utilisation of existing corridors to minimise land disturbance.

SOCIAL



1.4 Adapt to a changing climate and respond to the microclimatic factors of each area

Design for predicted future regional climatic impacts in the corridor location. Consider the positive contribution that the orientation of transport corridors can make to the local climatic environment of future places and streets.

Outcome:

- Long term planning in regard to climate change such as sustainable management of resources and development and adoption of renewable energy.
- Maintains key corridors and infrastructure resilience.
- Creates a streetscape environment that considers the quality of the experience for people. Supports and encourages foot traffic to local destinations.

Measure:

- Corridor provides for active modes and public transport options to support modal shift and reduce climate change impacts.
- Consideration of future flood levels.
- Responds to the microclimatic conditions and characteristics of the area.
- Accommodates amenity measures such as space for shade, trees, wind protection, orientation of connections.

2.1 Identity and place

The identity or spirit of place is generally acknowledged as the unique amalgram of the inherent built, natural and cultural qualities of a place.

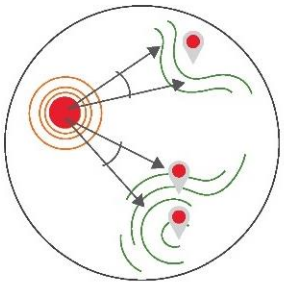
Responding to identity in the location and type of new corridors can provide a sense of continuity and contribute to our collective memory.

Outcome:

- Supports social cohesion, sense of belonging and pride in an area through clear connection to history and identity of a place.
- Supports outstanding natural landscapes and features.

Measure:

- Considers, respects and/ or enhances the established identity/ form/ layout of a place.
- Preserves the amenity values and quality of a place.
- Responds to the underlying topography and natural characteristics of a place.
- Contributes to the placemaking drivers of its context.



2.2 Respect culturally significant sites and landscapes

Acknowledge significant sites and features in the layout of movement corridors including ridgelines or horizons.

Protecting or featuring these vistas or landmarks acknowledges the wider cultural or natural landscape and provides context and orientation for people who are either moving through or living within an area.

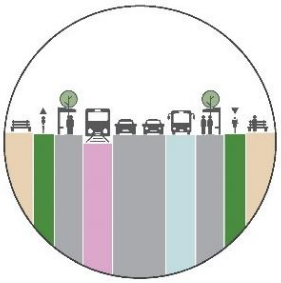
Connection to the Māori world view is described in the Te Aranga Principles - Tohu: The wider cultural landscape.

Outcome:

- Supports the cultural context of places.

Measure:

- Location of strategic corridor considers, respects and/or enhances significant sites and features.
- Establishes or acknowledges viewshafts and terminating vistas.



2.3 Adaptive corridors

Corridors should demonstrate flexibility to respond to changes in their function and physical interfaces.

Consider an adaptive approach in the way strategic corridors are designed to be able to respond to changes in land use, the way we move around or utilise technology over time.

Outcome:

- Look to preserve, repurpose existing corridors over time to support long term whole of life beneficial use.
- Reduce the need to update and replace corridors, saving emissions and materials
- Minimise social disruption.
- Minimise significant and permanent engineering interventions/solutions.

Measure:

- Utilisation and adoption of existing corridors.
- Corridor configuration that does not preclude active modes or public transport.
- Accommodate variations and future changes in noise levels generated by corridor function.
- Provision of space function for non transport functions such as ecological diversity, water management and recreation.

2.4 Social cohesion

Provide clear, effective and legible connectivity between community and social functions.

Outcome:

- Deliver a positive contribution to the sense of belonging and participation, as well as community resilience.
- Establish and support a positive spatial relationship to the grain of future development.
- Supports the creation of spaces where people can seamlessly connect.
- Support modal shift to allow a diversity of choices to more of the population.

Measure:

- Address potential severance issues between areas through the network layout and providing universal access.
- Avoid isolated or fragmented areas of Future Urban Zones.
- Provision of modal choices.
- Provides connectivity and equitable access to community facilities and open spaces.

2.5 Safe corridors

Provide a safe and convenient network of routes accessible to people of all ages and abilities.

Outcome:

- Supporting a greater level of movement that promotes a sense of personal safety.
- Provide safe crossings for people crossing roads and railways.
- Illustrates the universal design approach and accessbility in to all parts of user journeys.
- Reduce deaths and injuries on the road network.

Measure:

- Support personal safety in the environment (CPTED) in the layout or colocation of different modes/ land uses.
- Clear and legible mixed modal zones.
- Grade separated crossings for pedestrians and cyclists.
- Corridor configuration that supports safe pedestrian enironments.

BUILT FORM

3.1 Align corridors with density

Locate stations/stops and corridors within walking distance of higher density development to facilitate modal shift, support commercial and mixed use centres and contribute to vibrant, active urban environments.

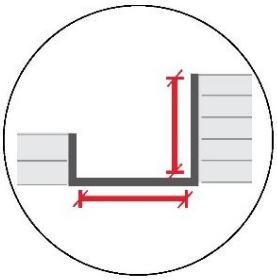
Density (and a diversity of housing choices) gives people the opportunity to live in neighbourhoods that meet their lifestyle preferences and economic means. Residents should be provided with the choice to live in amenity-rich neighbourhoods where they are a short walk or bike ride away from shopping, parks, schools and cafés and are encouraged to take public transport to work and regional destinations.

Outcome:

- Provides opportunity for greater housing diversity and choice.
- Reduces car dependency and emissions, linear servicing infrastructure and climate change impacts.
- Align appropriate corridor typologies with public private interfaces that support density.

Measure:

- Corridors aligned/ not aligned to areas of higher density.
- Corridors located near/through interchanges and centres.



3.2 Corridor scaled to the surrounding context and urban structure

Align the speed, type and scale of transport corridors and infrastructure with the environment that it moves through (appropriate scale to the context).

Corridor configuration should respond to contextual drivers and support different functional requirements at a regional, sub-regional and neighbourhood scale. Corridor functions should support efficient movement, higher density living, mixed mode travel and placemaking.

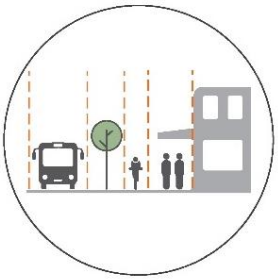
Refer to Locational Principles in Appendix E.

Outcome:

- Corridors should demonstrate support for economic outcomes through efficient regional movement.
- Corridors should enable mass rapid transit and multi modal options that contribute to climate change mitigation.
- Maintain or improve amenity of the environment through which the corridor passes.
- Corridor should minimise impacts of widening in relation to existing land use patterns.

Measure:

- Scale is/ isn't appropriate to the surrounding context.
- Corridor arrangement supports adjacent land use and provides an appropriate interface.



3.3 Facilitate an appropriate interface between place and movement

Facilitate the opportunity for place as well as movement in corridors (people oriented streets)

Corridors should deliver street typologies scaled to the adjoining land use that provide a clear movement function as well as an appropriate interface to built form.

Refer to Locational Principles Appendix E.

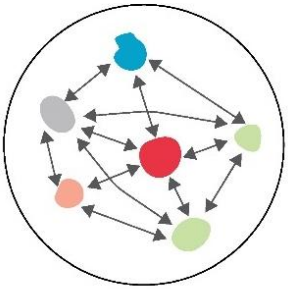
Outcome:

- Social cohesion and economic benefit for local businesses.
- Opportunity for people oriented streets, potential for streets as public spaces.
- Supports connectivity and interface to open spaces and public spaces.

Measure:

- Supports appropriate public private interfaces.
- Appropriate allocation of street space between competing uses.
- Provides connectivity at a fine grain (pedestrian) level
- Appropriate and positive influence on future urban form.

MOVEMENT



4.1 Connect nodes

Provide tangible connectivity between identified activity nodes.

Corridors should provide direct and legible connections between key destinations.

Corridors should consider connectivity for all modes (walking, cycling, public transport, freight transport and private vehicle). Connect between areas as well as through central corridors.

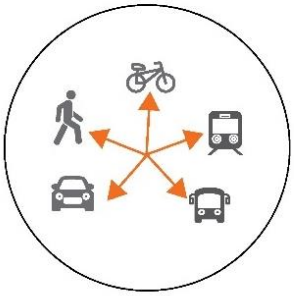
Corridors should accommodate any identified cross connections between nodes outside of strategic corridors.

Outcome:

- Provides community connectivity, mobility and choice.
- Reduces car dependency and emissions as well as climate change impacts.
- Reduces travel times. between destinations.

Measure:

- Provides clear and tangible connectivity between complementary destinations.



4.2 Connect modes

Provide for choice in travel and the ability to connect at interchanges between modes.

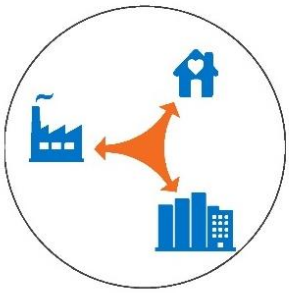
Provide access to multiple travel modes. Corridors can contribute to outcomes for a wider cross section of the community (including elderly, children and mobility-impaired users) when they support safe, comfortable and attractive multi-modal transport for all users.

Outcome:

- Provides community connectivity, mobility and choice.
- Provides economic benefit at interchanges.
- Reduces car dependency and emissions as well as climate change impacts.

Measure:

- Modal connections and interchange is/ isn't accommodated.
- Transition between modes is easy, convenient, safe and smooth,
- Clear and legible interchanges.



4.3 Support access to employment and industry

Align the corridor location and typology to provide direct and efficient access to areas of employment and industry.

Outcome:

- Supports the efficient movement of resources.
- Provision of modal choices to enable equitable access to areas of employment and industry.

Refer to Locational Principles in Appendix E.

Measure:

- Provides tangible connectivity to areas of employment and industry.

4.4 Prioritise active modes and public transport

Provision of quality active mode corridors and dedicated public transport corridors to enable a modal shift away from private vehicle use.

Dedicated and connected active mode networks provide choices for people walking and cycling, reduces land consumption, and improves overall network efficiency.

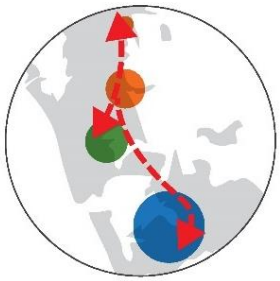
Dedicated and efficient public transport corridors provide modal choice to a larger number of users and reduces the impact on the environment.

Outcome:

- Supports community connectivity, mobility and choice.
- Reduction of car dependency and emissions, reduces climate change impacts.
- Supporting healthy lifestyles of the community by replacing short motor vehicle trips by alternative modes.
- Reduce environmental impact of travel.

Measure:

- Connectivity and quality of active paths.
- Prioritised network for public transport.



4.5 Support inter-regional connections and strategic infrastructure

Consider the location and alignment of significant movement corridors and placement of infrastructure (power, waste water, water) to the network.

Locate significant infrastructure in appropriate locations and away from primarily residential areas.

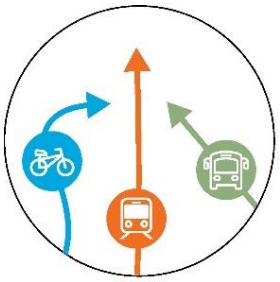
Identify corridor heirarchies and functions to allow for differentiation between inter-regional trips and local trips.

Outcome:

- Supports strategic infrastructure planning.
- Considers a coordinated approach between freight and passenger rail services.

Measure:

- Alignment of significant infrastructure along strategic corridors.
- Provide direct connections to rail, port and airport.
- Minimise the number of local trip movements from inter-regional routes.



4.6 Support legible corridor function

Consider how areas can be clearly navigated and understood by users moving from place to place.

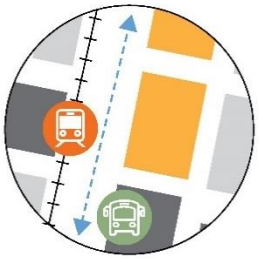
Outcome:

- Corridors designed and developed to suit the corridor function.
- Supports community connectivity, mobility and choice.

Measure:

- Provides clear gateways into areas.
- Provides direct connections between destinations.
- Corridor configuration provides clear modal interactions and priorities.

LAND USE



5.1 Public transport directed and integrated into centres

Locate rapid transit interchanges within centres (local, town and metro) to support a mix of uses and provide modal choice to a larger number of users.

Bringing public transport into a centre that has a higher level of density will cater for a greater number of users as well as providing accessible and viable alternatives to private vehicles.

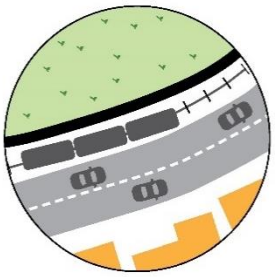
Refer to Locational Principles in Appendix E.

Outcome:

- Supports community connectivity, mobility and choice.
- Supports higher densities in and around interchanges and centres.
- Reduction of car dependency and emissions, reduces climate change impacts.

Measure:

- Public transport is/ isn't directed and integrated into centres.
- Interchanges are located in centres.
- Clear modal interactions at interchanges.



5.2 Strategic corridors as urban edges

Strategic corridors as potential definers of a land use edge.

Providing an edge that supports the containment of land use and restricts unwanted development outside of the identified urban areas.

Outcome:

- Supports connectivity but restricts unwanted development.
- Minimises land take, disturbance and biodiversity impacts.

Measure:

- Enables/ does not enable a land use edge.
- Provides appropriate corridor configuration with limited access.