Auckland Council
Te Kaunihera o Tāmaki Makaurau

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

Date:	**Mondays through Thursdays from 18 September until 12 October 2023**
Time:	**9:30am**
Meeting Room:	**Council Chambers**
Venue:	**Level 2, Henderson Civic, 3 Smythe Road, Henderson, Auckland 0612**

NOTIFICATION MATERIAL

VOLUME 07

NORTH-WEST LOCAL PROJECTS

TE TUPU NGĀTAHI SUPPORTING GROWTH

AUCKLAND TRANSPORT & WAKA KOTAHI NZ TRANSPORT AGENCY

COMMISSIONERS

Chairperson	**Richard Blakey (Chairperson)**
Commissioners	**Mark Farnsworth**
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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 05	TABLE OF CONTENTS	PAGE NO.

LOC-PART 1

North-West Local: Whenuapai and Redhills – Part 1

ATTACHMENT 52

NORTH-WEST WHENUAPAI
ASSESSMENT OF FLOODING EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Whenuapai Assessment of Flooding Effects

December 2022

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

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Revision Status

Version	Date	Reason for Issue
1.0	16/12/2022	Notice of Requirement Lodgement

Table of Contents

Appendices

No table of contents entries found.

Table of Tables

Abbreviations

Acronym/Term	Description
AC	Auckland Council
AEE	Assessment of Effects on the Environment
ARI	Average Recurrence Interval
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
CC	Climate change
CEMP	Construction Environmental Management Plan
FTN	Frequent Transit Network
FUZ	Future Urban Zone
MfE	Ministry of the Environment
MPD	Maximum Probable Development
NoR	Notice of Requirement (under the Resource Management Act 1991)
RCP	Representative Concentration Pathways
RL	Reduced level
RMA	Resource Management Act 1991
SH16	State Highway 16
SH18	State Highway 18
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

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.
ARI	Average Recurrence Interval
Dry Pond	A permanent pond that is dry between storm events but during rainfall events temporarily stores stormwater runoff to control discharges. Dry ponds provide limited water quality treatment.
Flood difference map	The difference between the pre-development and post-development flood levels as shown on the map
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 ponds.
MPD	Maximum Probable Development according to the AUP:OP zonings
Pre-development	Prior to construction of the Project
Post-development	After construction of the Project
Terrain	An elevation model which includes the ground levels based on 2016 LiDAR and the concept design ground levels.
Stormwater Wetland	Constructed wetlands that temporarily store runoff in shallow pools 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.
Wet Pond	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 erosion protection.
Whenuapai Assessment Package	Four Notices of Requirement and one alteration to an existing designation for the Whenuapai Arterial Transport Network for Auckland Transport.

1 Executive Summary

This report provides an assessment of flood effects associated with the construction, operation and maintenance of the Projects that comprise the Whenuapai Assessment Package. The Projects are shown on Figure 1-1 below.

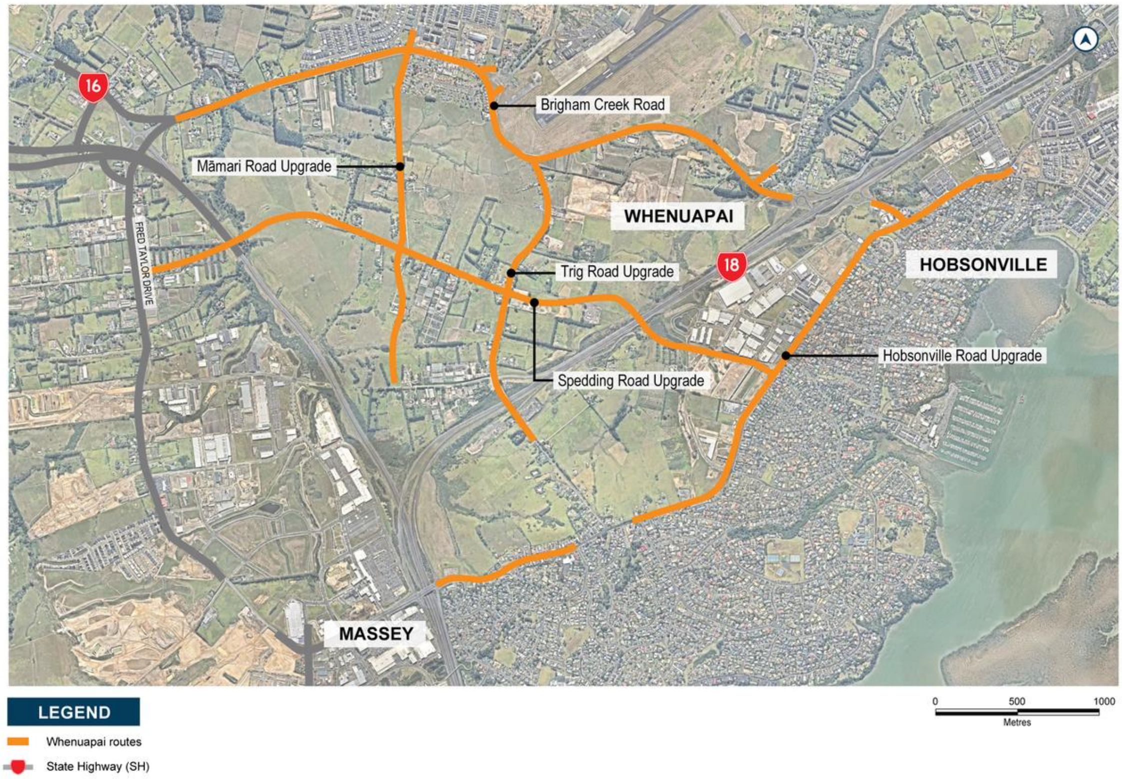

Figure 1-1: Location of the projects in the Whenuapai assessment package

Flooding is a natural hazard and has therefore been considered as part of the Whenuapai Package Notices of Requirement. The works required for the Whenuapai Package have the potential to lead to flooding effects and an assessment of predicted flood effects is provided to demonstrate that these effects can be appropriately mitigated in the future. It is also acknowledged that there will be a subsequent process for seeking regional resource consents which will address a wider range of potential stormwater quantity and quality effects.

In the context of this assessment, flood hazard effects 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;
- the effects considered relate to existing habitable buildings / infrastructure and potential future effects on upstream and downstream properties.

Methodology

The assessment of flooding effects for the Whenuapai Package has involved the following steps:

- Desktop assessment to identify potential flooding locations from Auckland Council Geomaps.
- Modelling of the pre-development and post-development terrain with Maximum Probable Development (MPD) and 100year Average Recurrence Interval (ARI) plus climate change rainfall.
- Two climate scenarios were modelled, one allowing for 2.1°C of temperature increase and one for 3.8°C of temperature increase. The higher climate change scenario has been used to undertake a sensitivity analysis to understand the increased risk of greater climate change impacts.
- Producing flood level maps for pre-development and post-development scenarios and flood difference maps to show the change in flood levels and extents (greater than 50mm) as a result of the Project.
- Inspection and review of flood difference maps at key locations such as bridges and where there are noticeable changes in flood extents or flood levels.

While stormwater effects apart from flooding are 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 drainage channels and ponds) and incorporating land for that purpose into the proposed designation boundaries. These devices have been designed to attenuate the 100year ARI event using 10% of the total roading impervious catchment area (proposed and existing) in accordance with Council and Waka Kotahi guidance[1,2]. Note for existing roads being widened this allows for greater impervious area than the road widening alone.

The assessment considers that flooding effects will be subject to further assessment at a detailed design stage. It is expected that coordination and integration of the corridor design with future urban zone (FUZ) development will be undertaken to confirm and address potential future adverse effects.

Positive Effects

There is the potential for also be a number of positive effects associated with the projects. These include where new bridges are proposed which raise the existing road levels reducing the potential for flood levels to overtop the road and reducing flood hazard.

Additional positive effects can be realised through upgrades to existing culverts or new culvert crossings to improve overland and stream flow under the proposed project corridor. The scale of these effects will be determined at detailed design stage.

Water quality treatment allowances will result in reduced environmental impacts as the total road area, and not just the added road area, for existing roads have been included for treatment.

Construction phase effects

The potential construction flooding effects can be appropriately managed with the measures set out in Section 7.1 and with a Construction Environmental Management Plan (CEMP) addressing flood risk in place, flooding effects are likely to be negligible.

Operational phase effects

NoR W1: Trig Road North Upgrade

[1] Auckland Council's Stormwater Management Devices in the Auckland Region, Guideline Document 2017/001 (December 2017)
[2] Waka Kotahi NZTA's Stormwater Design Philosophy Statement (May 2010)

Flooding risk associated with the operation of the Project is considered negligible. The results for the flood difference map for the 100 year ARI range between -0.05 m and +0.05 m along Trig Road corridor shows little change in the pre and post development predicted flood levels.

NoR W2: Māmari Road Upgrade

The corridor upgrade will obstruct the existing overland flow path at northern section of Māmari Road causing the water to pond upstream. The flood difference map shows an increase in flood level between 0.05 m and 0.5 m which is considered a minor effect. Culvert crossings at northern section of Māmari Road show an increase in flood level both upstream and downstream of the crossings. These effects are considered negligible except for upstream of Chainage 120 which is considered to be a minor effect prior to mitigation. Following mitigation, it is anticipated there would be a negligible effect for all crossings as culverts would be designed to achieve flood neutrality.

NoR W3: Brigham Creek Road Upgrade

The construction and operation of a new bridge across Waiarohia Stream has the potential to increase the freeboard between the road and the flood level resulting in a positive effect for road users by having to raise the road level. This bridge also improves the water flow resulting in decreased flood water levels upstream but there is an increase in flood water levels downstream resulting in a minor effect (>50 mm increase) at one existing property. This can be mitigated by adding an additional culvert alongside the existing culvert to create a balance between the flood level differences upstream and downstream thus aiming for flood neutrality.

There are three proposed crossings in NoR W3. At two of these crossings there is an increase in flood water level between 0.05 m and 0.5 m upstream which is considered a minor effect although this can be mitigated by increasing the culvert size under the proposed road. The third crossing has a light reduction in predicted water levels.

Further modelling at a detailed design stage is proposed to confirm the effectiveness of these mitigation measures, however with mitigation in place it is anticipated flood effects would be minimiseed.

NoR W4: Spedding Road

For Totara Creek there is no effect on nearby properties as there is no difference in predicted flood water levels between the pre and post development scenarios.

At the new culvert crossings there was a minor to moderate effect on flood levels. These effects are able to be minimiseed in the final design by raising the road or upgrading the culverts including upsizing or extending the culverts to optimise their design with the aim of achieving flood neutrality. Further modelling at a detailed design stage is proposed to confirm the effectiveness of these mitigation measures.

NoR W5: Hobsonville Road FTN Upgrade

There are two key stream crossings at Chainage 3060 and Chainage 3800 which have the potential minor and moderate flood effect respectively. These effects are able to be minimised during detailed design which could include upsizing or extending the culverts to optimise the design and achieve flood neutrality.

Sensitivity Analysis

A sensitivity analysis has been undertaken to consider the effects of additional rainfall under a more severe climate change scenario. The sensitivity analysis identified an increased risk of flooding at some locations. However, this increased risk can be addressed through the mitigation measures described in the report.

Conclusion

The assessment found that there was unlikely to be adverse flood risk effects during construction as nearly all proposed lay down areas are outside of the flood plain and overland flow paths. Construction impacts will be mitigated through a CEMP (see Section).

Potential operational effects include increased flood water levels upstream and downstream of crossings and bridges. Effects were assessed as negligible to moderate. Operational impacts will likely be resolved during detailed design by optimising the design of culverts and bridges to minimise flood effects upstream and downstream of crossings.

Further assessment at detailed design stage will be aimed at achieving flood neutrality.

2 Introduction

This flooding assessment has been prepared for the North West Local Arterial Network Notices of Requirement (**NoRs**) for Auckland Transport (**AT**) (the "Whenuapai Assessment Package"). The NoRs are to designate land for future corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West Whenuapai area of Auckland.

The North West growth area is approximatively 30 kilometres north west of Auckland's central city. It makes a significant contribution to the future growth of Auckland's population by providing for approximately 42,355 new dwellings and employment activities that will contribute 13,000 new jobs across the North West. Whenuapai is one of these growth areas, located between State Highway 16 (**SH16**) and State Highway 18 (**SH18**) and at present is largely rural (but Future Urban Zoned) with an existing community consisting of new and more established residential, business and local centre land uses.

This growth area is expected to be development ready by 2018-2022 with 401 hectares to accommodate 6,000 dwellings. Furthermore, a Whenuapai Structure Plan was adopted by the Council in 2016 and sets out the framework for transforming Whenuapai from a semi-rural environment to an urbanised community over the next 10 to 20 years.

The Whenuapai Assessment Package will provide route protection for the transport corridors, which include walking, cycling and public transport (including the Frequent Transit Network (**FTN**)), needed to support the expected growth in Whenuapai.

This report assesses the flooding effects of the North West Whenuapai Assessment Package identified in Figure 4-1 and Table 2-1 below.

The Whenuapai Assessment Package comprises five separate projects which together form the North West Whenuapai Arterial Network. The network includes provision for general traffic, walking and cycling, and frequent public transport

Refer to the main AEE for a more detailed project description.

Table 2-1: North West Whenuapai Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR W1	Trig Road North
NoR W2	Māmari Road
NoR W3	Brigham Creek Road
NoR W4	Spedding Road
NoR W5	Hobsonville Road (alteration to existing designation 1437)

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Whenuapai Assessment Package. Its purpose is to inform the AEE that accompanies the four NoRs and one alteration to an existing designation for the Whenuapai Assessment Package sought by AT.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Whenuapai Assessment Package on the existing and likely future environment as it relates to flooding effects and recommends measures that may be implemented to minimise, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

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

This report draws a distinction between stormwater effects and flood hazard effects, which are a subset of potential stormwater effects.

Stormwater effects are broadly divided into:

- Quantity effects (such as flooding, erosion and changes to hydrology - which may cause effects on stream habitat, baseflow and sediment movement in streams),
- Quality (including the discharge of contaminants – which may cause effects on aquatic fauna, public health and amenity values) and the effects on streams due to the presence of in-stream structures.

These effects are considered through RMA section 13, 14 and 15 consents and are administered by regional councils (or, in the case of Auckland, as regional consents by the Auckland Council as a Unitary Authority).

Provision is made for the future management of the stormwater effects (stormwater quantity, stormwater quality and instream structures) by identifying the space required for stormwater management devices (for example drainage channels and wetlands) and incorporating land for that purpose into the NoRs. In identifying the land required for these devices, preliminary sizing and siting has been undertaken and offset allowances made for construction phase works.

The designation is a land use or district planning mechanism. Hence, the assessment of effects has been limited to flood hazard matters as they are the only matters that would trigger a District Plan consent requirement under the AUPOIP. In presenting information on flood hazard effects, it is therefore acknowledged that there will be a subsequent process for seeking regional council consents.

Flood hazard effects include changes to; the flood freeboard to buildings, the depth of flooding on property, the creation of new overland flow paths, the ability to access property by residents and emergency vehicles and potential flood prone areas caused by blockage of culverts.

2.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines,
b) Description of each Project corridor and project features within the Whenuapai Assessment Package as it relates to stormwater,
c) Identification and description of the existing and likely future flooding environment,
d) Description of the actual and potential positive flooding effects of the Project,
e) Description of the actual and potential adverse flooding effects of construction of the Project,
f) Description of the actual and potential adverse flooding effects of operation of the Project,
g) Recommended measures to minimise, remedy or mitigate potential adverse flooding effects, and
h) Overall conclusion of the level of potential adverse flooding effects of the Project after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Project, likely staging 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 flooding effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

2.3 Preparation for this Report

In preparation of this report several resources were used to support the assessment. These included technical specialist inputs, previous reports, catchment flood models and team workshops.

The Whenuapai Structure Plan and AUPOP were used to identify the existing and likely future environment. Information from the Project Team and SGA Whenuapai model were used to assess the relative changes to predicted flood water levels and extents between the existing (pre-development) and future (post-development) terrain.

It should be noted the existing terrain (based on AC 2016 LiDAR) has been used for flood modelling of the pre-development and post-development scenarios as there is no information about what future landforms will take.

3 Assessment Methodology

3.1 Chapter Summary

The assessment of flooding effects has involved the following steps using the AC and SG GIS to identify where:

- Desktop assessment to identify potential flooding locations, namely:

– Existing buildings appear to be near/within the existing flood plains.
– Where the Projects involve work near stream crossings and major overland flow paths.

- Flood modelling of the pre-development (without SGA) and post-development (with SGA) terrain, including:

– Flood modelling of the proposed future land use using Maximum Probable Development (MPD) development with the 100year ARI plus climate change rainfall
– Model results were used to identify changes in the flood water levels to create flood difference maps.

- Inspection of the flood difference 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.

- A sensitivity analysis to assess the potential risk of extreme climate change (3.8°) compared to the existing projected climate change temperature increase (2.1°).

3.2 Outcomes based approach

The stormwater and flooding considerations are based on an indicative design and proposed designation boundary which incorporate flexibility for design changes to respond to the future environment. The effects assessment is based on the Project being able to meet the requirements of the proposed designation condition and provide any required mitigation within the designation boundary.

The proposed condition requires the Project be designed to achieve the following outcomes:

- No increase in flood levels for existing authorised habitable floors that are already subject to flooding (that is, no increase in flood level where the flood level using the pre project model scenario is above the habitable floor level)
- No more than a 10% reduction in freeboard for existing authorised habitable floors (that is, if existing freeboard was 500mm, an acceptable change would be to reduce freeboard to 450mm)
- No increase of more than 50mm in flood level on land zoned for urban or future urban development where there is no existing habitable dwelling

- No new flood prone areas (with a flood prone area defined as a potential ponding area that relies on a single culvert for drainage and does not have an overland flow path)
- No more than a 10% average increase of flood hazard (defined as flow depth times velocity) for main access to authorised habitable dwellings.

Compliance with the recommended flooding outcomes, secured by the proposed condition, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

Where the above outcomes can be achieved through alternative measures outside of the designation such as flood stop banks, flood walls and overland flow paths, this may be agreed with the affected property owner and Auckland Council.

This assessment identifies where flood effects require consideration and the types of mitigation measures that could be implemented to address the effect. The designation boundary has been confirmed to provide sufficient land to accommodate those potential mitigation measures identified.

Compliance with these flooding outcomes would be demonstrated through a detailed stormwater design and further flood modelling of the pre-development and post-development 100year ARI flood levels (with allowances for full development according to the AUP:OP zonings with associated imperviousness and climate change) at the resource consent stage.

3.3 Desktop Assessment

To identify locations considered to be at risk of flooding effects a desktop study was carried out to identify areas where:

- Existing buildings are near/within the existing flood plains
- The project involves carrying out significant work near the stream crossings/major overland flow paths
- The project may alter the existing flood plains, ponding volumes, and natural drainage paths.

The following reference materials were used to perform the desktop study:

- Whenuapai Structure Plan
- Auckland Unitary Plan Operative in Part
- Auckland Council GIS resources (Auckland GeoMaps)
- Design Drawings
- Flood maps created by the SGA modelling team
- Indicative Construction Methodologies
- NZTA Stormwater Specification P46
- New Zealand Bridge Manual (SP/M/022) for freeboard allowance.

A full list of references is provided in Section 13.

3.4 Flood Modelling

3.4.1 Stormwater Catchment Overview

The projects are situated within the Whenuapai stormwater catchment. The catchment size is 1,931Ha and is drained by numerous creeks and streams, including Brigham Creek that forms the area's north-western boundary and Waiarohia Inlet which forms the area's north-eastern boundary. The catchment has two primary stream catchments, namely Totara Creek flowing to Brigham Creek and Waiarohia Stream flowing to the Waiarohia Inlet.

Other major streams in the northern part, namely Riverlea Stream, Ratara Stream and Orchard Stream and in the southern part namely, Waiarohia Stream which feed into the Upper Waitematā Harbour via Brigham Creek and Totara Creek and other tidal inlets.

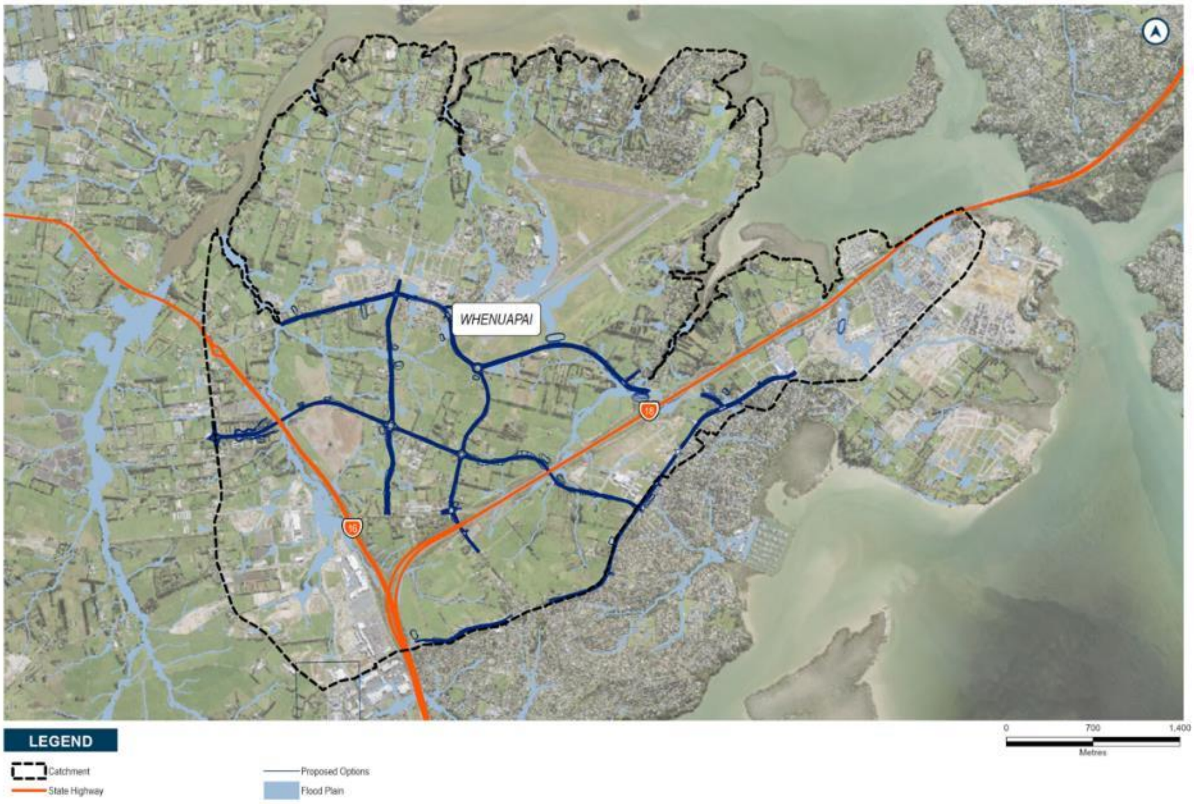

Figure 3-1: Existing 100year ARI flood plain for Whenuapai Catchment (Auckland Council GIS)

3.4.2 Modelling Parameters

Auckland Council had produced a Whenuapai Rapid Flood Hazard Assessment catchment model which was adapted for this assessment. To assess the flooding effects of the Projects on the Whenuapai catchment two scenarios were considered for each NoR.

The two scenarios modelled for the assessment of effects are:

Scenario 1: pre-development

- Future 100year ARI rainfall event with 2.1°C of warming and future land-use without the project in place

Scenario 2: post-development

- Future 100year ARI rainfall event with 2.1°C of warming and future land-use with the project in place

For the sensitivity analysis a further two scenarios were modelled:

Scenario 3: pre-development increased climate change

- Future 100year ARI rainfall event with 3.8°C of warming and future land-use without the project in place

Scenario 4: post-development increased climate change

- Future 100year ARI rainfall event with 3.8°C of warming and future land-use with the project in place
- The proposed imperviousness for the maximum probable development (MPD) land use was applied i.e. the model assumes the maximum impervious surface limits of the current zone or, if the land is zoned Future Urban in the Auckland Unitary Plan, the probable level of development arising from zone changes.

The modelling used an indicative design for the road which is not the final design. The type and size of cross drainage structures are not fixed and will be assessed further for subsequent regional consenting and design phases. Changes to these structures will alter the model outputs and upsizing the crossings may be required to reduce upstream and downstream flood risk.

The models include the existing roads and existing culverts where the culverts are 600mm or greater and details could be located. In the models existing culverts < 600 mm diameter are considered to be fully blocked although larger culverts are considered to be fully working. This approach is a refinement of the AC rapid flood hazard modelling approach where pipes smaller than 1,200mm are excluded from the model. The reason for selecting 600mm is that the risk of blockage is much greater.

New culverts have been added to convey flows at existing overland flow paths that are crossed by new road alignments and some existing culverts have been extended to allow for the proposed road widening. To extend the culverts the existing grade has been extrapolated and the inlet and outlet invert levels have been established.

New bridges are incorporated into the model by leaving a gap in the terrain to replicate the bridge opening. Piers are not modelled specifically.

3.4.3 Climate Change

Climate change is accounted for in the model runs as per the revised Auckland Council (AC) Code of Practise (CoP) version 3 dated January 2022, which allows for 2.1°C of warming and a 16.8% increase on rainfall. A sensitivity analysis to understand the risk of climate change by comparing the results of 2.1°C of warming to 3.8°C of warming see Section 3.5.

The modelling outputs were used to identify changes in predicted flood water levels and flooding extents. Increased flood hazard is associated with higher risk effects, for example a change in flood water level on land can result in the loss of use of the land or a reduction in the performance of drainage systems.

The assessment criteria for the flooding assessment are shown in Table 3-1.

Table 3-1: Flooding effects assessment criteria

Effect	Change in flood water level on neighbouring property	Change in flood water level at habitable buildings
Positive	A reduction in flood level	A reduction in flood level
Negligible	Less than 0.05 m	Less than 0.05 m
Minor	0.05m to 0.5 m	0.05m to 0.15 m
Moderate	Greater than 0.5 m	Greater than 0.15 m

For more vulnerable land uses, including dwellings, if less than 0.5m freeboard is available there is a greater risk of damage to property. The effects of properties identified as potentially at risk of flooding considers the flood water level only. Surveyed floor levels of the existing habitable buildings are not available and should be done during the detailed design stage.

The required freeboard for bridges and culverts used to assess the suitability of the indicative design is set out in Table 3-2.

Table 3-2 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

3.4.4 Future Urban Zone

Development within the FUZ areas will change catchment hydrology, the terrain, building and property types that are potentially exposed to flooding. The assessment has therefore considered specific effects on existing properties and more generally considered effects on potential future development. It is anticipated that future developments will take account of flood risk and manage that risk within their development.

The model does not include the additional runoff generated by the increased impervious area from the new road as stormwater devices have been designed to adequately capture this additional runoff (see

Section 3.6). However, the model does account for the increased impervious area as a result of development within the FUZ area.

Hence, the model output incorporates a high degree of conservatism around future flood effects as it is anticipated that future developments outside the designation will need to design, construct and operate their own stormwater devices to ensure they can mitigate the stormwater generated by additional impervious areas to the pre-development scenario.

It is expected that coordination and integration of the corridor design with FUZ development will be required to confirm and address potential future effects. Mitigation measures in the future detailed design will reflect the actual development in the FUZ areas. See Section 3.4.4.1 for more detail of the limitations of this assessment.

3.4.4.1 Model Limitations

All of the corridors have upstream and/or downstream catchments in the FUZ area. The modelled scenarios use imperviousness assumptions associated with the future land use(s) shown in the Auckland Plan, Whenuapai Structure Plan and relevant Precinct Plans. However, it is probable that significant change in the catchments will take place before or shortly after the corridor is constructed. Therefore, it is expected that further modelling will be required during the corridor detailed design phase to take account of catchment characteristics at that time.

Rapid Flood Hazard Assessment models have a relatively coarse terrain grid and do not include stormwater drainage pipes smaller than 600mm diameter. Culverts have been added at selected crossings of the project corridors. However, the results from the models are considered appropriate to assess the relative or overall flooding effects due to the project corridors for the current stage of design.

The SGA design model is based on a preliminary design. The new culverts and bridges are indicative they may not be the final solution as this will be determined by the detailed design. Future modelling will be used to ensure flood effects will be adequately mitigated and flood neutrality can be achieved.

The culvert sizes are an initial estimate used to assess the relative effects of flooding outside the corridors. Larger culverts can be constructed if required to mitigate effects with the size or levels of service. New or upgraded culverts will be confirmed at the detailed design stage and will consider matters such as consent requirements, asset owner requirements, level of service, stream simulation design, fish passage, blockage.

3.5 Sensitivity Analysis

Sensitivity is the degree to which a system is affected, adversely or beneficially, by a given exposure[3]. In this instance the sensitivity of the designation to increased rainfall as a result of climate change has been considered.

As set out in Section 3.4.3 the flood model has allowed for 2.1°C of warming and a 16.8% increase on rainfall based on the AC CoP. However, given the uncertainty of climate change effects in the future

[3] Intergovernmental Panel on Climate Change. (2007). Climate Change 2007: Contribution of Working Group II to the Fourth Assessment Report. Cambridge, UK: Cambridge University Press.

the assessment has also considered a more severe climate change scenario based on 3.8°C of warming and a 32.7% increase on rainfall.

The results for 3.8°C of warming have been compared to those reported in the flood assessment for 2.1°C of warming and areas where higher rainfall may increase flooding risk have been identified. Further mitigation at these locations has been included where necessary to encourage flood resilience.

In the future it is possible there may be different requirements for climate change, however, at this time a pragmatic approach has been taken and the sensitivity analysis has been prepared to better understand the risk of climate change and enable decision makers to respond to this.

3.6 Stormwater devices

While stormwater effects apart from flooding are not assessed, provision is made for the future management of potential stormwater effects (stormwater quantity and stormwater quality) by identifying the space required for stormwater management devices (SWMDs, i.e. treatment swale and wetlands) and incorporating land for that purpose into the NORs. In identifying the land required for these devices, preliminary sizing and siting has been undertaken and extra space allowed for constructing the works.

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 100 year peak flows from the corridor (as of the required stormwater wetland sizing criteria this gives the largest 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 consents and implementation processes.

In general, the approach has been to avoid SWMDs in floodplains where possible. If this is not possible, the design has sought to employ offline systems located in low velocity flood zones where has minimal risk of scour for resilient and maintainable systems.

The flood model does not account for the flood water storage capacity provided by the proposed SWMDs (wetlands or swales) even though they are designed with attenuation capacity for the additional runoff generated by the increased impervious area from the new road infrastructure.

While the project is not intended to remediate existing flood hazards, it is anticipated the proposed SWMDs will provide improvements in water quality and attenuation where practicable.

4 Projects Overview

An overview of the Whenuapai Assessment Package is provided in Figure 4-1 below, with a brief summary of the projects provided in Table 4-1 below.

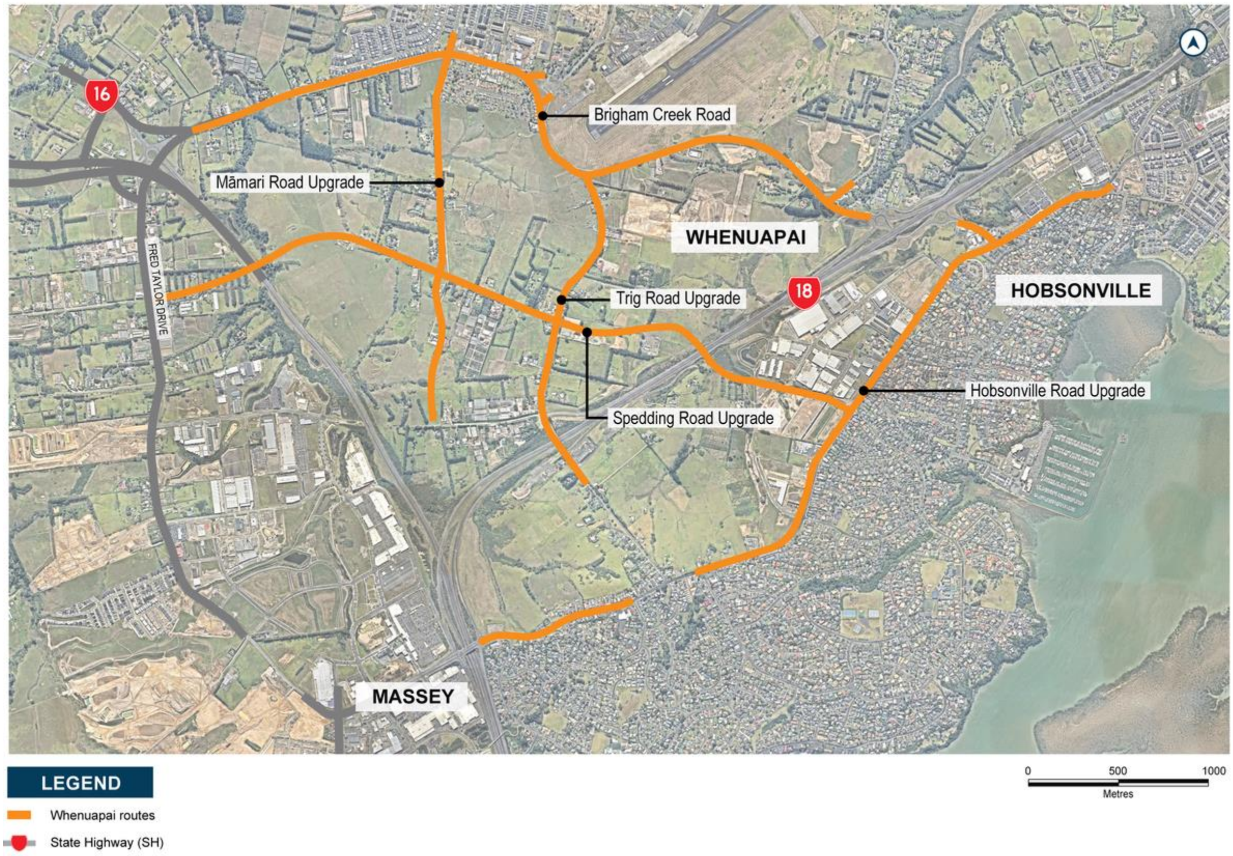

Figure 4-1: North West Projects – Overview of NoRs for Assessment

Table 4-1: Projects Project Summary

Corridor	NOR	Description	Requiring Authority
Trig Road North	NoR W1	Upgrade of Trig Road corridor to a 24m wide 2 lane local arterial cross-section with separated cycle lanes and footpaths on both sides of the corridor	Auckland Transport
Māmari Road	NoR W2	Upgrade of Māmari Road corridor to a 30m urban arterial cross-section Frequent Transit Network (FTN) with separated cycle lanes and footpaths on both sides of the corridor	Auckland Transport
Brigham Creek Road	NoR W3	Upgrade of Brigham Creek Road to a 30m wide four-lane arterial cross-section with walking and cycling facilities on both sides	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Spedding Road	NoR W4	Spedding Road West: the upgrade of the existing Spedding Road and new extension of Spedding Road to a 24m wide two-lane arterial with separated active modes. Spedding Road East: A new extension of Spedding Road to a two-lane arterial with separated active modes. Note the NoR extends the length of Spedding Road East and West.	Auckland Transport
Hobsonville Road (alteration to existing designation 1437)	NoR W5	To alter the existing Hobsonville Road designation 1437 to allow for the proposed widening of the Hobsonville Road corridor: Upgrade of sections of Hobsonville Road to accommodate a 30m wide four-lane cross section with separated cycle lanes and footpaths on both sides of the corridor, and Upgrade of sections of Hobsonville Road to accommodate a 24m wide two-lane cross section with separated cycle lanes and footpaths on both sides of the corridor.	Auckland Transport

Please refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

5 Summary of Modelling Results

A summary of the operational effects for each of the corridors is set out in Table 5-1 below and discussed in more detail in Section 8.

Indicative mitigation measures have been provided in in Section 8 which will minimise flooding effects and help enable the outcomes set out in Section 3.2 to be met. The outcomes generally reflect a negligible up to minor flood effect i.e. <0.05m increase in flood depth.

The outcomes set out in Section 3.2 will form part of the designation conditions and compliance with those conditions will ensure the residual flood effects for all NoRs will be negligible up to minor.

Table 5-1: Summary of flood modelling results

Corridor name	Location	Potential effect without mitigation	Potential effect with implementation of the recommended flooding outcomes
NoR W1	n/a	n/a	No more than 0.05 m increase in flood level, Negligible up to minor effect
NoR W2	41-43 Brigham Creek Road (Chainage 340, Point 42 in Figure 10-1) Existing overland flow path	+0.17 m increase in flood level Minor effect	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Adjacent to 9 Spedding Road (Chainage 120 Māmari South, Points 9 and 10 in Figure 10-2)	+0.28 m upstream, +0.40 m downstream, Minor effect upstream and downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Adjacent to 7 Spedding Road (Chainage 380 Māmari South, Points 11 and 12 in Figure 10-2)	+0.71 m upstream, +0.03 m downstream, Moderate effect upstream, negligible effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
NoR W3	Adjacent to 36 Brigham Creek Road (Chainage 1260, Points 1 and 2 in Figure 11-1)	+0.03 m upstream, -0.02 m downstream, Negligible effect upstream and positive effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Adjacent to 141 Brigham Creek Road (Chainage 2700, Points 36 and 37 in Figure 11-1)	+0.24 m upstream, -0.18 m downstream, Minor effect upstream, positive effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect

Corridor name	Location	Potential effect without mitigation	Potential effect with implementation of the recommended flooding outcomes
	Adjacent to 150-152 Brigham Creek Road (Chainage 3620, Points 3 and 4 in Figure 11-2)	-0.02m upstream, +0.16m downstream Positive effect upstream and minor effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
	162 Brigham Creek Road (Chainage 3980, Points 27 and 29 in Figure 11-3)	-1.1m upstream, +0.15m downstream Positive effect upstream and minor effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Point BR3 (Figure 11-3) Building/ house/ driveway	+0.14 m Minor effect	No more than 0.05 m increase in flood level, Negligible up to minor effect
NoR W4	Adjacent to 27 Trig Road (Chainage 800, Spedding Rd East, Points 21 and 22 in Figure 12-2)	0.00m upstream, 0.00m downstream No effect upstream and downstream	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Adjacent to 14 Spedding Road (Chainage 1080, Spedding Rd West, Points 38 and 39 in Figure 12-3)	+0.17m upstream, -0.57m downstream Minor effect upstream, positive effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Point SW1 (Figure 12-3) Building / house, driveway	+0.06 m Minor effect	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Adjacent to 6 Rawiri Place (Chainage 1040, Spedding Rd East, Points 23 and 24 in in Figure 12-2)	+0.01m upstream, +0.03m downstream Negligible effect both upstream and downstream	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Adjacent to 49 Trig Road (Chainage 300 Spedding Rd East, Points 15 and 16 in Figure 12-4)	+0.93m upstream, +0.15m downstream Moderate effect upstream, minor effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Westpoint Drive (Chainage 1180, Spedding Rd East, Points 25 and 26 in Figure 12-2)	+0.20m upstream, +0.09m downstream Minor effect upstream and downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect

Corridor name	Location	Potential effect without mitigation	Potential effect with implementation of the recommended flooding outcomes
NoR W5	283 Hobsonville Road (Chainage 3060, Point 32 and 33 in Figure 13-1)	+0.16m upstream, -0.08m downstream Minor effect upstream and positive effect downstream Design road level has the potential to overtop	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Intersection of Hobsonville Road and Brigham Creek Road (Chainage 3800, Point 30 and 31 in Figure 13-1)	+0.47m upstream, -0.02m downstream Minor effect upstream, positive effect downstream Design road level is outside of flood plain	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Point HR6 (Figure 13-2) Building / house	+0.23 m Moderate effect	No more than 0.05 m increase in flood level, Negligible up to minor effect

6 Positive Effects

The positive effects for projects are those where the predicted 100year ARI flood level difference map shows a decrease in water levels and an increase in freeboard for bridges, culverts and habitable buildings using the criteria set out in Table 3-1 and Table 3-2. There are positive flooding effects for NoR W2 – NoR W5. NoR W1 does not have any identified positive flooding effects.

Positive flooding effects for the projects include raising the existing road levels which will have a positive effect for road users by preventing flood flows across the road and reducing flood hazard.

Where new bridges are proposed, the maximum freeboard requirement has been adopted to provide flood resilience. The positive effects from the proposed new bridges identified by the model include:

- All proposed new bridges have a freeboard of 1.2 m, including over Sinton Stream, Waiarohia Stream, Trig Stream, Rawiri Stream and Totara Creek.
- New bridges over Sinton Stream, Waiarohia Stream, Trig Stream which have been confirmed to increase the freeboard for the road and decrease water levels upstream and downstream of the bridge crossing for the 100year ARI flood level.
- The new bridge over Totara Creek will increase the freeboard for the road but will not affect water levels upstream and downstream of the bridge crossing the 100year ARI flood level.

The projects create the opportunity to improve existing culvert capacities and/or propose new culvert crossings to improve overland and stream flow in the area. For example, following the Hobsonville Road upgrade and the extension of the culvert crossing and new inlet the flood levels at surrounding properties zoned for future urban land are lower compared to the pre-development flood levels.

It is noted that the proposed culverts and bridges form part of the indicative design and the final design may include different crossings. The final design will be subject to further flood modelling at the detailed design stage. The final design will ensure that adequately mitigated and flood neutrality can be achieved.

7 Construction Effects

Construction effects apply to the entire project, however, are more likely at locations within or adjacent to overland flows or flood prone areas, the proposed construction works which could result in flooding effects include:

- Construction of new culvert crossings or upgrading of existing culvert crossings
- Construction of new bridges over streams or overland flow paths
- Installation of diversion drains / realignment of existing overland flow paths
- Construction of new dry ponds or wetlands / upgrading of existing dry ponds or wetlands
- Temporary use of lay down areas.

These effects are particularly for NoR W1, NoR W3 and NoR W5 where there is an increased flood risk for the proposed construction works. The potential effects of these are:

- Bulk earthworks to complete the contouring for new landscape features e.g., dry ponds or stormwater wetlands and new or upgraded culverts require a dry works area and can alter overland flow paths or generate erosion and sediment effects
- The construction of new bridges over streams will require temporary staging platforms for piling rigs and cranes to be constructed on the banks and possibly over the stream bed and potentially causing a constriction to flood flows and raising upstream flood levels
- The siting of dry ponds or stormwater wetlands within an existing overland flow path can obstruct runoff and result in flows being diverted towards existing properties.

Section 7.1 below describes methods for minimising/mitigating these potential effects.

7.1 Recommended Measures to Minimise, Remedy or Mitigate Construction Effects

The management and mitigation measures for construction effects are:

General:

- Carrying out earthworks during the summer / dry months to reduce the risk of flooding
- Locating lay down areas outside of existing overland flow paths
- Managing the overland flow paths to make sure flows are not diverted toward existing buildings or properties
- Construction Environmental Management Plan (CEMP) be developed prior to construction by an experienced Stormwater Engineer and shall consider the effects of temporary works, earthworks, storage of materials and temporary diversion and drainage on flow paths, flow level and velocity. Including:
  - Siting construction yards and stockpiles outside the flood plain
  - 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 high flow events

- Methods to reduce the conveyance of materials and plant that is considered necessary to be stored or sited within the flood plain (e.g., actions to take in response to the warning of heavy rainfall events).

Construction of new and existing culvert crossings, stormwater wetlands and dry ponds:

- 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 or to allow flows to be maintained while new culverts, stormwater wetlands and dry ponds 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 a working clearance of ± 20m from the upstream extent and ± 15m from the downstream extents should be provided.

Construction of new bridges:

- Temporary platforms should generally be set back as far as practicable from the stream banks and main channel to minimise the risk of flooding
- Staging of earthworks for the abutments and stockpiling of materials outside the flood plain to mitigate the potential for blocking flow paths and flood plains.

8 Operational Effects

There are a range of operational effects particularly from proposed new bridges and crossings. The model is based on an indicative design which will respond to the future environment, and it may be that some of these structures are modified in the future. Future detailed design will be subject to a separate flooding assessment at the resource consent stage. For the project the assessment of operational flooding effects considered:

- New culvert crossings (≥ 600 mm diameter)
- New bridge structures at Sinton Stream, Waiarohia Stream, Trig Stream, Rawiri Stream and Totara Creek
- Significant areas where the new road embankment encroaches existing flood prone areas
- The extent 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 towards existing properties
- 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.

The new bridge structures resulted in positive effects (see Section 6). For the culverts the effects were considered to be negligible to moderate prior to mitigation. This includes NoR W2, NoR W3, NoR W4 and NoR W5 (see Table 5-1).

The mitigation measures set out in Section 8.1 have been designed to assist in minimising flood effects. There are a range of potential mitigation measures that can be applied and additional modelling during detailed design will consider which measures are most appropriate to ensure adverse flood effects are minimised, remedied or mitigated. The detailed design would then need to demonstrate compliance with outcomes set out in Section 3.2 as required by an appropriate condition of consent.

8.1 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

It is recommended that during detailed design additional flood modelling is carried out and mitigation measures implemented as required to achieve the outcomes set out in Section 3.2. Compliance with these outcomes will be required as a condition of consent. Based on the interim design potential mitigation measures have been identified in order to show that the feasibility to meet these outcomes has been considered.

Mitigation measures which may be implemented include:

- 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
- Increasing culvert sizes so that the upstream and downstream water level differences do not increase by more than 0.05m on land zoned for urban and future urban development
- Upgrading culverts by adding smaller culverts to create a balance between the flood level differences upstream and downstream
- Installing drains at the toe of embankment sloping towards the culverts can also allow for additional storage to decrease the velocity and peak flow through the culvert crossings
- Optimising the proposed bridge span and freeboard during detailed design
- Integrating development design requirements for FUZ upstream and downstream of the proposed corridor.

9 NoR W1: Trig Road North Upgrade

9.1 Project Corridor Features

9.1.1 Catchment Characteristics

The project corridor lies on a ridge with several overland flow paths draining west of the corridor towards Sinton Stream and east of the corridor towards Waiarohia Stream. Existing minor culvert crossings drain the low-lying areas located next to the road.

Existing flood prone areas have been identified from Auckland GeoMaps at Chainage 20 and further downstream of the catchment on the western and eastern side of Trig Road.

The existing cross drainage for this project corridor consists of two culvert crossings. The interim design is based on the existing culverts being upgraded either by upsizing or extending the culverts. The cross-drainage structures for this corridor are smaller than 600 mm and therefore not assessed.

9.2 Existing and Likely Future Environment

9.2.1 Planning Context

The Trig Road corridor runs through an existing rural environment, with the land either side of the Trig Road corridor currently zoned FUZ under the AUPOP. The Whenuapai Structure Plan indicates that the FUZ area land will be re-zoned for Business use.

Table 9-1 below provides a summary of the North West existing and likely future environment

Table 9-1: Trig Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[4]	Likely Future Environment[5]
Undeveloped greenfield areas	Future Urban Zone	High	Urban
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Urban

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

[4] Based on AUPOP zoning/policy direction
[5] Based on AUPOP zoning/policy direction

9.3 Proposed works

Along NoR RW1 it is proposed to upgrade Trig Road from an existing rural two-lane road to a lower-speed urban two-lane arterial. The proposed design includes two general traffic lanes and new facilities for walking and cycling on both sides.

Two stormwater catchments are created along the transport corridor and runoff from the catchment flows into two proposed stormwater wetlands, as shown in the Indicative Design Drawings, for treatment and attenuation.

9.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

9.4.1 Positive Effects

There are no positive effects associated with NoR W1.

9.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

9.4.3 Recommended Measures to Minimise, Remedy or Mitigate Construction Effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes.

The potential flooding effects during construction will be considered by, and managed through, flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

All other mitigation measures as set out in Section 7.1 apply.

9.4.4 Assessment of Operational Effects

The results for the flood difference map for the 100year ARI range between -0.05m and +0.05m along the Trig Road corridor. Flooding risk associated with the Project is therefore negligible.

9.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

No specific measures have been identified as there is only a small risk of flooding from culvert blockages. All other mitigation measures as set out in in Section 8.1 apply. The detailed design will still need to demonstrate compliance with the outcomes set out in Section 3.2 as required by the conditions of consent.

9.5 Conclusions

The potential construction flooding effects can be appropriately managed with the measures set out in Section 7.1 and with a CEMP addressing flood risk in place, flooding effects will continue to be negligible.

Based on the results of the flood modelling the Trig Road upgrade will have a negligible effect on flooding. To mitigate operational flood effects recommended mitigation measures set out in Section 8.1 should be adopted.

10 NoR W2: Māmari Road Upgrade

10.1 Project Corridor Features

10.1.1 Catchment Characteristics

The corridor crosses two streams, Sinton Stream and Pikau Stream, and an existing pond west of Māmari Road South that discharges in Pikau Stream.

The 100year ARI flood maps from the model with MPD and existing terrain show existing flooding issues at the proposed culvert crossings, Sinton Stream bridge crossing and flooding of properties upstream of Ngahue Crescent, Whenuapai.

10.2 Existing and Likely Future Environment

10.2.1 Planning Context

The northern section of Māmari Road to Spedding Road is an existing road corridor (although a section of the road is a 'paper road'). The eastern side of this section is predominantly zoned under the AUPOP as FUZ, with a portion of Residential – Single House Zone. The western side of this section is also predominantly FUZ. The Whenuapai Structure Plan indicates that the FUZ land will be re-zoned medium residential to the north (east side of Māmari only) and business to the south.

Table 10-1 below provides a summary of the North West existing and likely future environment.

Table 10-1: Māmari Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[6]	Likely Future Environment[7]
Residential	Residential	Low	Residential
Undeveloped greenfield areas	Future Urban	High	Urban
Timatanga Community School	Special Purpose - School Zone	Low	Urban

[6] Based on AUP:OP zoning/policy direction
[7] Based on AUP:OP zoning/policy direction

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

10.3 Proposed works

The project proposes that the function of Māmari Road will change from an existing rural two-lane road to an urban four-lane arterial. The proposed design includes the same number of general traffic lanes (two), with two bus lanes, and new facilities for walking and cycling.

Other proposed works in NoR W2 which can result in flooding effects include:

- Construction of a new bridge over Sinton Stream
- Construction of a new culvert crossings at Chainages 120, 380 and 560 (Māmari South)
- Construction of a diversion drains / realignment of existing overland flow paths
- Construction of three new dry ponds

Additional flood storage using attenuation ponds is required for NoR W2 to attenuate and discharge the 100year ARI pre-development peak flow. Stormwater catchments and features are shown in the Indicative Design Drawings.

10.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

10.4.1 Positive Effects

10.4.1.1 Sinton Stream Bridge

The proposed 95m Sinton Stream bridge spans across a 60m wide 100year ARI flood plain with bridge piers set outside the main channel.

The results show a reduction in the predicted water level of RL 17.52m (-0.16m) upstream and to RL 16.77m (-0.04m) downstream (refer to Points 19 and 20 in Figure 8-1). The structure has a freeboard of ± 1.44m between the 100year ARI flood level and bridge soffit. There are no flood effects on any nearby buildings under the post-development scenario. Overall, the effects of the bridge on flood hazards are considered positive.

It should be noted that the overland flow, impeded by the proposed corridor upgraded between Chainage 660 and 820, is not able to discharge into Sinton Stream and can create ponding. Despite this, as noted above, the freeboard between the soffit level and 100year ARI flood level is adequate.

10.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

Stream crossings are key sites for potential flooding effects during construction, this includes:

- Sinton Stream
- Existing overland flow path at Chainage 340 Māmari North

10.4.3 Recommended Measures to Minimise, Remedy or Mitigate Construction Effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes. Various culverts need to be installed or upgraded. There could be increased flood levels or new flow paths created during construction if adequate flow diversions are not provided.

The potential flooding effects during construction will be considered by, and managed through, flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

All other mitigation measures as set out in Section 7.1 apply.

10.4.4 Assessment of Operational Effects

10.4.4.1 Māmari Road North

An existing overland flow path adjacent to 41-43 Brigham Creek Road (Chainage 340, Point 42 in Figure 10-1) is obstructed by the corridor upgrade causing water to pond upstream. The flood difference map shows an increase in flood level between 0.05m and 0.5m which is considered a minor effect. However, the difference between the proposed road RL and the 100year flood level is 0.67m providing adequate freeboard > 0.5m. The effect could potentially be minimised by refining the size of the culvert during detailed design.

Figure 10-1: 100year flood difference map for Māmari Road (North) and Sinton Stream bridge crossing

10.4.4.2 Māmari Road South

The new proposed culvert crossing near 9 Spedding Road, Whenuapai (Chainage 120, Māmari Road South) shows an increase in the 100year ARI flood level upstream and downstream of the crossing. The level between the road level centre line and the flood level is ± 2.72m freeboard which is above the ± 0.5m freeboard required over a culvert. The flood difference map shows an increase between

0.05m and 0.5m upstream and downstream which is considered a minor effect (Point 9 and Point 10 in Figure 10-2).

The new proposed culvert crossings near 7 Spedding Road (Chainage 380 Māmari South) and 80 Trig Road, Whenuapai (Chainage 560 Māmari South) show an increase in the 100year ARI flood levels upstream and downstream of the crossings. The flood difference map shows an increase greater than 0.5m upstream which is considered a moderate effect and less than 0.5 and 0.05 downstream which is considered minor and negligible effect (Point 11 and Point 12 in Figure 10-2). However, the level between the road level centre lines and the flood levels are 2.4m and 1.85m respectively, resulting in adequate freeboard.

These effects can potentially be minimised by designing the culverts to achieve flood neutrality during the detailed design phase. This is possible within the current designation boundary and a final solution can be addressed at a future stage of design.

Figure 10-2: 100year flood difference map for Māmari Road (South)

10.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

The potential mitigation measures could be adopted as set out in Section 8.1. Specifically, the following has been considered:

- Diverting the existing overland flow path at the northern section of Māmari Road to discharge to Sinton Stream.
- Upsizing culverts in the southern section of Māmari Road so that the upstream and downstream water level differences do not increase by more than 0.05m on land zoned for urban and future urban development.

While the potential operational effects were assessed as moderate these are likely to be significantly reduced with the mitigation measures above. Further assessment at the detailed design stage can be used to confirm the potential effects following mitigation.

Compliance with the recommended flooding outcomes set out in Section 3.2 to be included in the designation conditions, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

10.5 Conclusions

No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

The assessment of operational effects found negligible to moderate flood effects during the operational phase of the corridor.

Effects could be mitigated by providing new channels or drains next to corridor to increase attenuation and lower the peak flow and diverting flows to discharge to new inlet/pipe. Mitigation will be confirmed at detailed design stage.

Potential flooding effects can be appropriately managed and will be negligible up to minor effect subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

11 NoR W3: Brigham Creek Road Upgrade

11.1 Project Corridor Features

11.1.1 Catchment Characteristics

The corridor crosses several overland flow paths and the Waiarohia Stream. Existing flood prone areas from Auckland GeoMaps are evident where overland flow paths and streams traverse the road. The 100year ARI flood maps from the model show existing flooding issues at the proposed culvert crossings and flooding of properties at: 36, 41-43, 44-48, 45, 115, 117, 119, 121 and 141 Brigham Creek Rd. The existing culvert crossing over Waiarohia Stream shows overtopping of the road.

11.2 Existing and Likely Future Environment

11.2.1 Planning Context

The land adjacent to the majority of Brigham Creek Road is zoned under the AUP:OP as FUZ, except within the Whenuapai urban area (which is zoned under the AUP:OP as a range of residential and business zones) and the Whenuapai New Zealand Defence Force (NZDF) airbase. The Whenuapai Structure Plan indicates that the FUZ land will be re-zoned mostly medium density residential with an area of high density residential near SH16.

Table 11-1 below provides a summary of the North West existing and likely future environment.

Table 11-1: Brigham Creek Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[8]	Likely Future Environment[9]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
	Business (Local centre)	Low	Business (Local centre)
Residential	Residential	Low	Residential
Open Space	Open Space –Informal Recreation Zone	Low	Open Space
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Special Purpose – Airports and Airfields Zone

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

[8] Based on AUP:OP zoning/policy direction

[9] Based on AUP:OP zoning/policy direction

11.3 Proposed works

The project proposes that the function of Brigham Creek Road will change from an existing rural two-lane road to an urban four-lane arterial. The proposed design includes four traffic lanes and new facilities for walking and cycling. The cross section will change along the length of the Brigham Creek Road corridor, reallocating the 30m corridor to best accommodate vehicles, PT, active modes and freight in relation to the adjacent land use.

Other proposed works in NoR W3 which can result in flooding effects include:

- Construction of a new bridge over Waiarohia Stream
- Upgrade of an existing culvert crossing at Chainage 3230
- Construction of new culvert crossings at Chainages 1260, 3620 and 3800
- Construction of diversion drains / realignment of existing overland flow paths
- Construction of a new wetland and two new dry ponds, upgrade of two existing attenuation ponds

Additional flood storage using attenuation ponds is required for NoR W3 to attenuate and discharge the 100year ARI pre-development peak flow. Stormwater catchments and features are shown in the Indicative Design Drawings.

11.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

11.4.1 Positive Effects

The proposed new bridge over Waiarohia Stream provides a significant improvement to flood conveyance upstream of the bridge and a decrease in flood levels has been identified through modelling. Upstream of the proposed new bridge shows a reduction of 0.58m in the 100year ARI flood levels post-development and an associated increase in freeboard between the habitable building floor level and the 100year ARI flood level see Section 11.4.4.3.

The 100year ARI flood difference map for the upgraded culvert crossing adjacent to 153 Brigham Creek Road (Point 5 and 6 in Figure 11-2) show a decrease in water levels of -1.97m upstream and -0.22m downstream due to the upsizing of culverts at this location. This will result in positive effects through increasing the freeboard of the road.

11.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

Stream crossings are key sites for potential flooding effects during construction, this includes:

- Waiarohia Stream
- Overland flow path at Brigham Creek Road Chainage 2700

The proposed upgraded Brigham Creek Wetland 1 and Dry Pond 2 are partially encroaching into the existing 100year flood plain

11.4.3 Recommended Measures to Minimise, Remedy or Mitigate Construction Effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes.

The potential flooding effects during construction will be considered by, and managed through, flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

All other mitigation measures as set out in Section 7.1 apply.

11.4.4 Assessment of Operational Effects

11.4.4.1 Brigham Creek Road West of Trig Road

The new proposed culvert crossing adjacent to 36 Brigham Creek Road (Chainage 1260) has a negligible effect in terms of increased flood level (see Points 1 and 2 in Figure 11-1). Moreover, there is adequate freeboard (0.67 m).

11.4.4.2 Brigham Creek Road East of Trig Road

Existing overland flow paths on both sides of the corridor adjacent to 141 Brigham Creek Road (Chainage 2700, Points 36 and 37 in Figure 11-1) are impeded by the proposed corridor upgrade, causing the water to pond and flood levels to increase. The increase in flood levels upstream is considered a minor effect (+0.24 m) and the flood level decreases downstream. The detailed design could consider installing new diversion drains on both sides of the corridor to discharge to nearby overland flow paths or streams and a final solution can be addressed at a future stage of design.

Figure 11-1: 100year flood difference map for Brigham Creek Road East of Trig Road

Adjacent to 150-152 Brigham Creek Road (Chainage 3620, Points 3 and 4 in Figure 11-2 flood levels show a decrease in the 100year ARI flood level upstream of the crossing and an increase downstream which is considered minor (+0.16 m). The road level centre line has a freeboard which is adequate (0.8 m).

Figure 11-2: 100year flood difference map for Brigham Creek Road East of Trig Road

11.4.4.3 Waiarohia Stream bridge

The proposed 10m bridge over Waiarohia Stream spans across a ±10m wide 100year ARI flood plain with bridge piers set outside the main river channel. The results for the 100year ARI pre-project development scenario show that the water level at the location of the proposed bridge structure is RL 10.56m upstream and RL 9.03m downstream (refer to Points 27 and 29 in Figure 11-3) with the water overtopping the existing road.

The results for the post-development scenario have the water level decreasing to RL 9.46m (-1.10 m) upstream and increase to RL 9.18m (+0.15 m) downstream (refer to Points 27 and 29 in Figure 11-3). The improved stream flow allows more water to pass through resulting in an increase of water levels of properties further downstream at 162 Brigham Creek Road (refer to Point BR3 in Figure 11-3).

The proposed road design level of RL 13.26m allows for a 1.2m freeboard between the bridge soffit and the 100year ARI flood level. The detailed design should consider optimizing the flood levels upstream and downstream of the cross drainage structure by either revising the proposed bridge span or adding an additional culvert to the existing. This is possible within the current designation boundary.

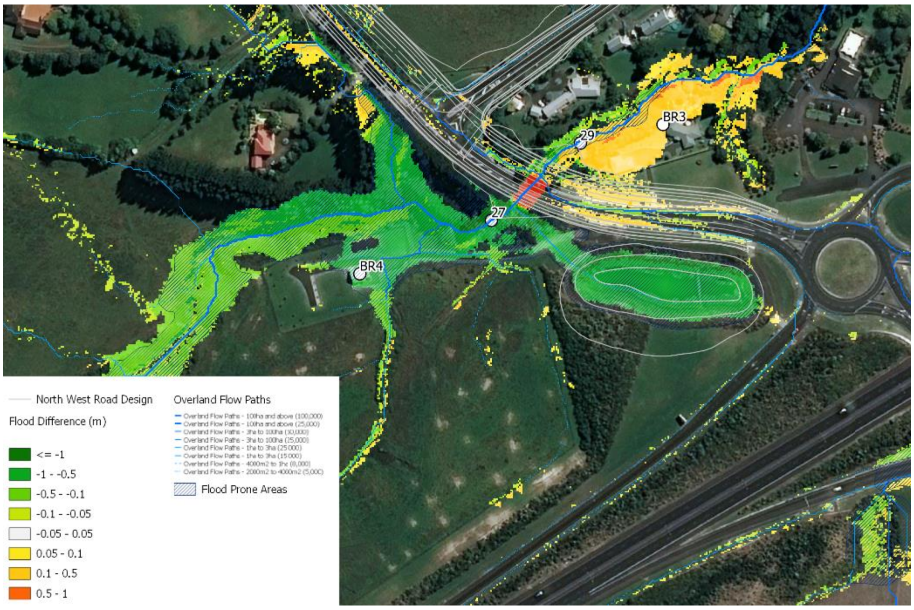

Figure 11-3: 100year flood difference map for Brigham Creek Road and Waiarohia Stream bridge crossing

11.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

The potential mitigation measures could be adopted as set out in Section 8.1. Specifically, the following has been considered:

- Creating new overland flow path diversions on both sides of the corridor to discharge to nearby overland flow paths or streams to mitigate ponding and decrease flood levels at affected properties
- Sizing the culvert at 150-152 Brigham Creek Road (Chainage 3620) so that the upstream and downstream water level differences do not increase by more than 0.05m on land zoned for urban and future urban development
- Design check dams in the proposed diversion drain between Chainage 3100 and 3620 to decrease the peak flow towards the culvert inlet adjacent to 150-152 Brigham Creek Road (Chainage 3620)
- Upgrading the culvert at Waiarohia Stream by adding smaller culverts to create a balance between the flood level differences upstream and downstream or optimizing the proposed bridge span and freeboard.

While the potential operational effects were assessed as moderate these are likely to be significantly reduced with the mitigation measures above. Further assessment at the detailed design stage can be used to confirm the preferred mitigation.

Compliance with the recommended flooding outcomes set out in Section 3.2, to be included in the designation conditions, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

11.5 Conclusions

No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

During operation model results found Brigham Creek Road upgrade will have a minor effect on flooding prior to mitigation measures being applied. The proposed bridge improves the stream flow so that it decreases flood levels upstream, however, by allowing water to travel more easily under the road it is likely to increase the flood levels downstream. Flood effects can be addressed at detailed design stage of the development to require the crossing to minimise flood level differences upstream and downstream.

For other crossings, the increase in flood levels could be mitigated through the measures set out in Section 8.1 including diversion drains, culvert sizes and integrating corridor and upstream development design requirements e.g., requiring buildings to be built with sufficient freeboard. Mitigation will be confirmed at detailed design stage.

Potential flooding effects can be appropriately managed and will be negligible up to minor effect subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

12 NoR W4: Spedding Road

12.1 Project Corridor Features

12.1.1 Catchment Characteristics

The corridor crosses a number of overland flow paths and three streams, namely Totara Creek, Trig Stream and Rawiri Stream.

Existing flood prone areas from Auckland GeoMaps are evident where overland flow paths and streams traverse the road. The 100year ARI flood maps from the latest Auckland Whenuapai catchment model with MPD and existing terrain show flooding at the proposed Trig Stream bridge crossing, the new culvert crossing at Chainage 1180 and potential flooding of property at 121 Fred Taylor Drive.

12.2 Existing and Likely Future Environment

12.2.1 Planning Context

The land on either side of Spedding Road is zoned under the AUPOP as FUZ, with Business – Light Industry Zone land at the eastern end of the proposed Spedding Road corridor. Proposed Plan Change 5 (PPC5) proposes to rezone the surrounding FUZ land to Business – Light Industry Zone in the north and Residential - Mixed Housing Urban Zone and Open Space – Informal Recreation zone in the south.

Table 12-1 below provides a summary of the North West existing and likely future environment.

Table 12-1: Spedding Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[10]	Likely Future Environment[11]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
Residential	Residential	Low	Residential
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

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

12.3 Proposed works

[10] Based on AUP:OP zoning/policy direction
[11] Based on AUP:OP zoning/policy direction

The project proposes that the function of Spedding Road will change from an existing rural two-lane road to an urban two-lane arterial. The proposed design includes two general traffic lanes and new facilities for walking and cycling.

Other proposed works in NoR W4 which can result in flooding effects include:

- Construction of new bridges over Totara Creek, Trig Stream and Rawiri Stream
- Construction of new culvert crossing at Chainage 1080, Spedding Road West, and Chainages 80, 300 and 1180, Spedding Road East
- Construction of diversion drains / realignment of existing overland flow paths
- Construction of six new wetlands and upgrading of one existing stormwater pond; Spedding Road East Wetland 3 (shared in NoR W4 and NoR W5)

Additional flood storage using attenuation ponds is required for NoR W3 to attenuate and discharge the 100year ARI pre-development peak flow. Stormwater catchments and features are shown in the Indicative Design Drawings.

12.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

12.4.1 Positive Effects

12.4.1.1 Totara Creek bridge

The proposed 255m Totara Creek bridge spans across a 60m wide 100year ARI flood plain with bridge piers set outside the main river channel.

The results for the 100year ARI pre-project development scenario show that the flood level at the location of the proposed bridge structure is RL 14.18m upstream and RL 14.06m downstream (refer to Points 43 and 44 in Figure 12-1). The structure has a freeboard of 7.69m between the 100year ARI flood level and bridge soffit which is above the 1.2m required freeboard. There are no effects on any nearby buildings.

12.4.1.2 Trig Stream bridge

The proposed 155m Trig Stream bridge spans across a 60m wide 100year ARI flood plain with bridge abutments / piers set outside the main river channel.

The results for the 100year ARI pre-development scenario show that the flood level at the location of the proposed bridge structure is RL 19.91m upstream and RL 19.82m downstream. Post-development the flood level remains unchanged upstream and downstream (refer to Points 21 and 22 in Figure 12-2).

The structure has a freeboard of 7.26m between the 100year ARI flood level and bridge soffit which is above the 1.2m required freeboard and also crosses over Upper Harbour Motorway. There are no effects on any nearby buildings.

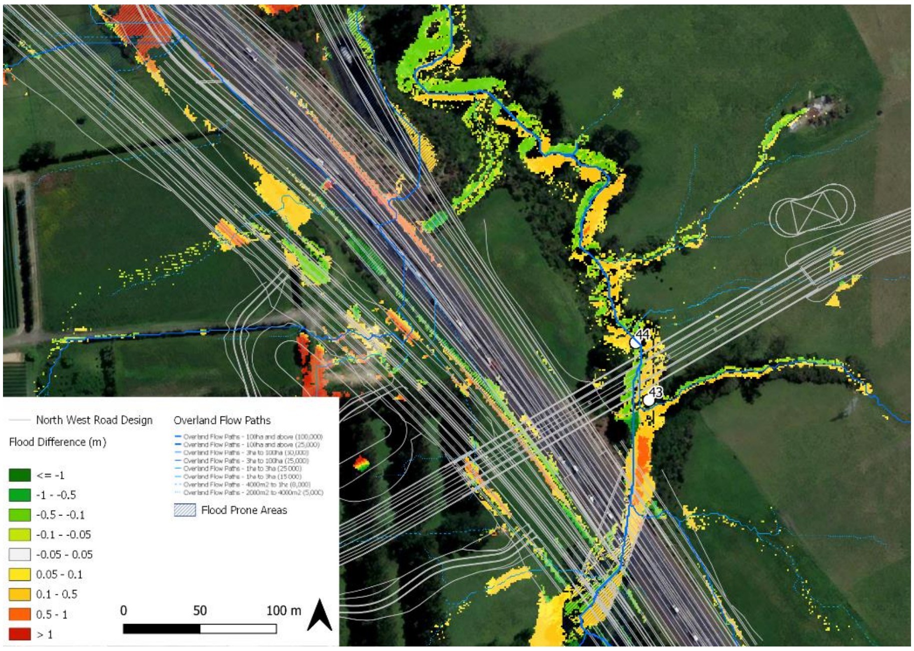

Figure 12-1: 100year flood difference map for Totara Creek Bridge

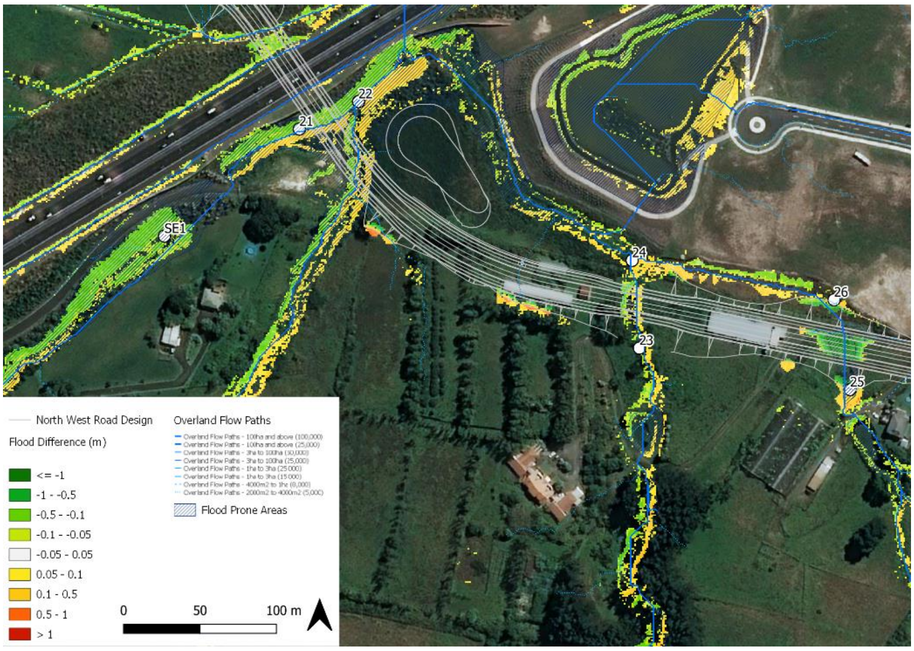

Figure 12-2: 100year flood difference map for Spedding Road East, Trig Stream and Rawiri Stream crossings

12.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

Stream crossings are key sites for potential flooding effects during construction, this includes:

- Rawiri Stream
- Totara Creek

12.4.3 Recommended Measures to Minimise, Remedy or Mitigate Construction Effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes.

The potential flooding effects during construction will be considered by, and managed through, flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

All other mitigation measures as set out in Section 7.1 apply.

12.4.4 Assessment of Operational Effects

Spedding Road West culvert crossing

The new proposed culvert crossings adjacent to 14 Spedding Road (Chainage 1080) show an increase of +0.15m in the 100year ARI flood levels upstream of the crossing and a decrease of -0.79m downstream. The 100year flood difference map shows an increase between 0.05m and 0.5m upstream which is considered a minor effect (see Points 38 and 39 in Figure 12-3). The edge of road is the same as the flood level of RL 27.53 m. There is also insufficient freeboard.

There is an existing flooding issue in this area. Despite this not being a designated flood plain or flood prone area depths of flooding in the pre-development scenario are approximately 1.2 m. The installation of additional stormwater infrastructure including a culvert or other cross-drainage will alleviate this flooding. This is possible within the current designation boundary.

Flood levels at 14 Spedding Road (Point SW1 in Figure 12-3) shows an increase in flood level between 50 mm and 150 mm which is a minor effect. Mitigation could include creating a new diversion for an existing overland flow path to connect to the culvert at Points 38 and 39.

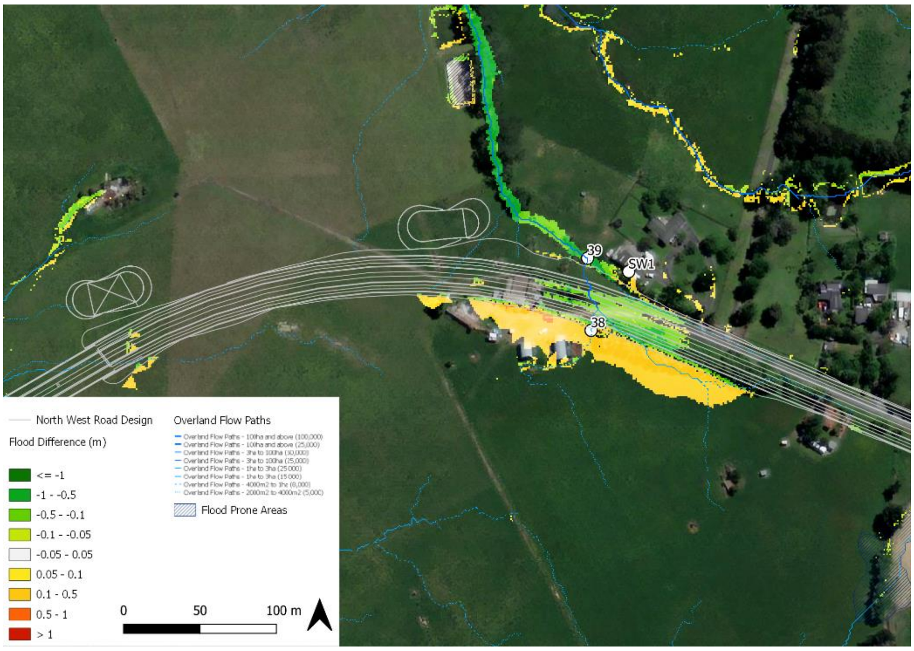

Figure 12-3: 100year flood difference map for Spedding Road West

12.4.4.1 Rawiri Stream bridge

The proposed 35m Rawiri Stream bridge spans across a 15m wide 100year ARI flood plain with bridge abutments / piers set outside the main river channel.

The results for the 100year ARI pre-development scenario show that the flood level at the location of the proposed bridge structure is RL 24.17m upstream and RL 22.68m downstream. Post-development the flood level increases to RL 24.18m (+0.01 m) upstream and to RL 22.71m (+0.03 m) downstream (refer to Points 23 and 24 in Figure 12-2).

The structure has a freeboard of 5.78m between the 100year ARI flood level and bridge soffit which is above the ± 1.2m required freeboard. There are no effects on any nearby buildings. The potential effects of the bridge on flood hazards are considered negligible.

12.4.4.2 Spedding Road East culvert crossings

The new proposed culvert crossings adjacent to 49 Trig Road show:

- At Chainage 80 an increase of +0.80m in the 100year ARI flood levels upstream of the crossing and a decrease of -0.05m downstream (see Points 13 and 14 in Figure 12-4). However, the road centre line is 1m above the flood level, resulting in adequate freeboard. The flood level increase is between 0.05m and 0.5m upstream which is considered a minor effect.
- At Chainage 300 show an increase of +0.93m in the 100year ARI flood levels upstream of the crossing and +0.14m downstream (see Points 15 and 16 in Figure 12-4). The road centre line is 4.27m above the flood level, resulting in adequate freeboard. The flood difference map shows an increase greater than 0.5m upstream which is considered a moderate effect.

These effects are likely due to the culverts being undersized restricting flow. During detailed design upsizing the culverts and increasing the flow through the culverts could reduce flood levels upstream.

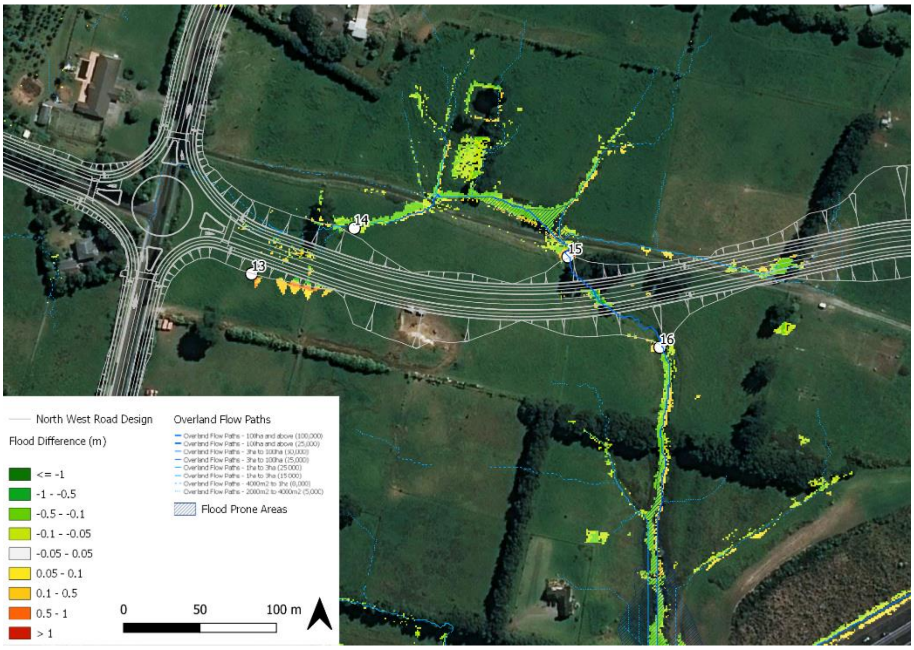

Figure 12-4: 100year flood difference map for Spedding Road East at Chainage 80 and 300

The new proposed culvert crossing adjacent to 43 Westpoint Drive (Chainage 1180, Points 25 and 26 in Figure 12-2) shows an increase of +0.20m in the 100year ARI flood levels upstream of the crossing and +0.09m downstream. The increased flooding is considered a minor effect upstream and downstream. The vertical alignment between Chainage 1060 and 1573 is proposed to change to allow for a developer to connect the new proposed West Point Drive road to Spedding Road. An existing temporary overland flow path north of the culvert outlet, discharges to the existing pond by means of an 1800 mm diameter pipe. The corridor intercepts this overland flow path and there is the potential for this overland flow path to be made permanent.

12.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

- The potential mitigation measures could be adopted as set out in Section 8.1. Specifically the following has been considered: Designing the proposed culvert crossings adjacent to 6 Rawiri Place (Chainage 1040, Spedding Rd East) and adjacent to 49 Trig Road (Chainage 80 and Chainage 300, Spedding Rd East) to achieve flood neutrality
- Realign overland flow path north of corridor and optimize culvert design at Chainage 1180 (Spedding East) to discharge into overland flow path
- Lift the vertical alignment of the road to increase freeboard adjacent to 43 Westpoint Drive (Chainage 1180, Spedding Rd East) and realign an overland flow path to discharge into culvert to reduce flood risk
- Creating a new diversion for an existing overland flow path to discharge into the stream and decrease flood levels at the property on 14 Spedding Road

While the potential operational effects were assessed as moderate these are likely to be significantly reduced with the mitigation measures above. Further assessment at the detailed design stage can be used to confirm the preferred mitigation.

Compliance with the recommended flooding outcomes set out in Section 3.2, to be included in the designation conditions, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

12.5 Conclusions

Based on the results of the flood modelling the Spedding Road upgrade will have a positive to moderate effect on flooding.

No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

The assessment of operational effects found positive to moderate flood effects during the operational phase of the corridor. A range of proposed mitigation measures are set out in Section 8.1 and the mitigation measures will be confirmed at detailed design stage.

Potential flooding effects can be appropriately managed and will be negligible up to minor effect subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

13 NoR W5: Hobsonville Road FTN Upgrade

13.1 Project Corridor Features

13.1.1 Catchment Characteristics

The project corridor lies mostly on a ridge, crossing a few overland flow paths and an existing pond outlet upstream of the road that discharges towards Waiarohia Stream.

Existing flood prone areas from Auckland GeoMaps are evident where overland flow paths traverse the road. The 100year ARI flood maps from the latest Auckland Whenuapai catchment model with MPD and existing terrain show flooding at the existing pond at Chainage 3800 and flooding of properties at, 281, 283 and 285 Hobsonville Road, 11 and 15 Starlight Cove.

13.2 Existing and Likely Future Environment

13.2.1 Planning Context

The Hobsonville Road corridor runs through an existing rural environment, with the land either side of the Trig Road corridor currently zoned FUZ under the AUPOP.

Table 13-1 below provides a summary of the North West existing and likely future environment.

Table 13-1: Hobsonville Road FTN Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[12]	Likely Future Environment[13]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
	Business (Local centre)	Low	Business (Local centre)
Residential	Residential	Low	Residential
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

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

[12] Based on AUP:OP zoning/policy direction
[13] Based on AUP:OP zoning/policy direction

13.3 Proposed works

The Project proposes that the function of Hobsonville Road will change from an existing two lane road to an urban two to four lane arterial with mixed components for vehicles, public transport, active modes, and freight. The proposed design includes three types of cross sections specifically:

- A generally 30m corridor that provides two vehicle lanes, two public transport lanes, and improved walking and cycling facilities.
- A generally 24m corridor that provides two vehicle lanes and new facilities for walking and cycling.
- A generally 30m corridor that provides four vehicle lanes, as well as new facilities for walking and cycling.

Other proposed construction works in NoR W5 which can result in flooding effects include:

- Realign the existing culvert crossing at Chainage 3800
- Construction of an inlet structure connecting to existing drainage network
- Construction of diversion drains / realignment of existing overland flow paths
- Upgrade of one existing stormwater pond; Hobsonville Rd Wetland 5
- Construction of five new wetlands

Additional flood storage using attenuation ponds is required for NoR W3 to attenuate and discharge the 100year ARI pre-development peak flow. Stormwater catchments and features are shown in the Indicative Design Drawings.

13.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

13.4.1 Positive Effects

Following the Hobsonville Road upgrade the flood levels at surrounding properties zoned for future urban land are lower compared to the pre-development flood levels (refer to Section 13.4.4).

13.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

Wetland 4A is on top of an existing overland flow path and an existing culvert crossing at Chainage 3800 that drains the existing pond located south of the corridor. This may obstruct and divert flow elsewhere. The upgrade of the existing wetland also lies within a flood prone area and the existing 100year flood plain.

13.4.3 Recommended Measures to Minimise, Remedy or Mitigate Construction Effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes.

The potential flooding effects during construction will be considered by, and managed through, flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

All other mitigation measures as set out in Section 7.1 apply.

13.4.4 Assessment of Operational Effects

13.4.4.1 Hobsonville Road south of Suncrest Drive

The proposed drainage for NoR W5 Hobsonville Road is an inlet structure on property 283 Hobsonville Road, with a new pipe connecting to the existing underground pipe network. The area has been identified as a flood prone area as it relies on a single culvert for drainage and does not have an overland flow path.

The proposed road centre line level will increase from RL 40.32m to RL 40.72m (+0.3 m). The 100year flood difference map shows an increase in upstream flood levels of +0.16m which is considered a minor effect, however the proposed new road will still flood. Refer to Points 32 and 33 in Figure 13-1 for the flood difference map.

Properties at 277 Hobsonville Road and 285 Hobsonville Road, Hobsonville was identified as having an increase in flood level greater than 150 mm which would be a moderate effect. This could be mitigated by upgrading the underground pipe network to allow more inflow which will reduce water levels upstream. This is possible within the current designation boundary and a final solution can be addressed at a future stage of design.

Figure 13-1: 100year flood difference map for Hobsonville Road FTN at Chainage 3060

13.4.4.2 Intersection of Hobsonville Road and Brigham Creek Road

The existing culvert crossing at the intersection of Hobsonville Road and Brigham Creek Road (Chainage 3800) is an outlet pipe for the existing pond upstream of Hobsonville Road. It is proposed to retain the size and realign the culvert to minimise impeding on Wetland 4A.

The 100year flood level difference map shows an increase of +0.47m upstream which is considered a moderate effect (Point 30 in Figure 13-1).The new road centre line level has increased from RL 30.50m to RL 31.60m however, the freeboard between edge of corridor and flood level is 0.43m which is less than the 0.5m required freeboard.

Flood effects at 18 Williams Road (Point HR6 in Figure 13-1) show an increase in flood level greater than 150 mm which is a moderate effect. This is likely due to the culvert being undersized / modelled as blocked. Upsizing the culvert during detailed design should minimise this effect, which is possible within the current designation boundary.

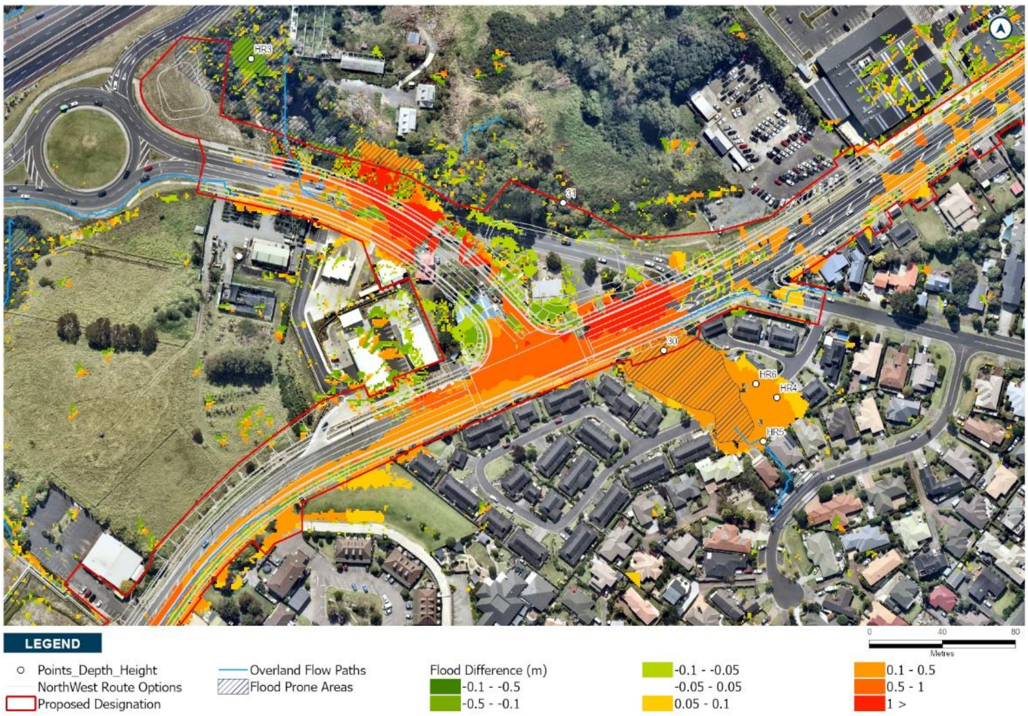

Figure 13-2: 100year flood difference map for Hobsonville Road at the intersection of Brigham Creek Road

At 397 Hobsonville Road, Hobsonville (Point HR7, Figure 13-3) flood difference maps show an increase in flood level between 50 mm and 150 mm which is a minor effect. The effects is due to the road widening interfering with the overland flow path. Realigning the overland flow path to discharge into existing pipe network downstream could minimise this effect. This is possible within the current designation boundary and a final solution can be addressed at a future stage of design.

At 1 Wiseley Road, Hobsonville (Point HR8, Figure 13-3) flood difference maps show an increase in flood level greater than 150 mm. The majority of the flooding is located in the carparking area however a building in the south west of the site may be affected so the effect is considered moderate. Upgrading the drainage for carpark area is considered likely to minimise this effect. This is possible within the current designation boundary and a final solution can be addressed at a future stage of design.

Figure 13-3: 100year ARI level difference map for Hobsonville Road FTN

13.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

The potential mitigation measures could be adopted as set out in Section 8.1. Specifically, the following has been considered:

- Upgrading the proposed inlet and pipe capacities at 283 Hobsonville Road (Chainage 3060) to discharge to the existing underground drainage network to reduce the flood levels off-site.
- Increasing the pond outlet capacity at the intersection of Hobsonville Road and Brigham Creek Road (Chainage 3800) to allow more flow to discharge downstream

While the potential operational effects were assessed as moderate these are likely to be significantly reduced with the mitigation measures above. Further assessment at the detailed design stage can be used to confirm the potential effects following mitigation.

Compliance with the recommended flooding outcomes set out in Section 0, to be included in the designation conditions, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

13.5 Conclusions

No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

The assessment of operational effects found positive to moderate flood effects during the operational phase of the corridor. The increased flood levels at 283 Hobsonville Road (Chainage 3060) can be mitigated by upgrading the proposed inlet and pipe capacities and discharging into the existing underground drainage network. The increase in flood levels at intersection of Hobsonville Road and Brigham Creek Road (Chainage 3800) could be mitigated by upsizing the culvert crossing or increasing the existing pond attenuation capability. The proposed mitigation has the potential to reduce the flood levels of properties upstream. Mitigation will be confirmed at detailed design stage.

Potential flooding effects can be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

14 Sensitivity Analysis

The sensitivity analysis identified those locations where a flood risk under a more sever climate change scenario (3.8 degree temperature change) would increase the flood risk. These results have been used to justify the designation and it is expected that revised modelling at the detail design stage will consider the appropriate RCP, or any additional climate change requirements for the final design to achieve the appropriate outcome(s).

1.1 NoR W2: Māmari Road Upgrade

For Māmari Road Upgrade (NoR W2) there was no change to flood risk for the southern section of this road (Table 14-1). No further mitigation is proposed beyond that already recommended.

The northern section of the road was likely to be influenced by the Alternative State Highway which is being considered under a separate package so sensitivity results are not reported here.

Table 14-1: Flood levels at key crossings NoR W2: Māmari Road Upgrade

Chainage	**2.1 degree temperature change**	**3.8 degree temperature change**	**Flood level change**	**Change in potential effect without mitigation**
	100year flood level (RL) post development	**100year flood level (RL) post development**		
Chainage 120, Māmari South (Points 9 and 10)	32.73m upstream 31.77m downstream	32.94m upstream 31.81m downstream	+0.21m upstream +0.04m downstream	No change – minor effect
Chainage 380, Māmari South (Points 11 and 12	36.96 upstream 35.90m downstream	37.11m upstream 35.94m downstream	+0.15m upstream +0.04m downstream	Upstream no change – moderate effect Downstream no change – minor effect
Chainage 560, Māmari South (Points 7 and 8)	40.10m upstream 36.32m downstream	40.48m upstream 36.34m downstream	+0.38m upstream +0.02m downstream	Upstream no change – moderate effect Downstream no change – minor effect

1.2 NoR W3: Brigham Creek Road

There was a flood level change of +0.09m upstream of Chainage 1260 (Point 2) and +0.10m upstream of Chainage 3620 (Point 3) for the upgrade of Brigham Creek Road (NoR W3) resulting in a minor effect. No specific measures have been identified as flooding can be managed through mitigation measures as set out in in Section 8.1 including sizing of culverts to achieve flood neutrality. For all other crossings there was no increase in flood risk (Table 14-2).

Table 14-2: Flood levels at key crossings NoR W3: Brigham Creek Road

Chainage	2.1 degree temperature change	3.8 degree temperature change	Flood level change	Change in potential effect without mitigation
	100year flood level (RL) post development	100year flood level (RL) post development		
Chainage 1260, Points 1 and 2	26.48m upstream 26.26m downstream	26.57m upstream 26.26m downstream	+0.09m upstream No change downstream	Upstream negligible changes to minor effect Downstream no change – negligible effect
Chainage 2700, Points 36 and 37	32.34m 31.45m	32.34m 31.45 m	No change	Upstream no change – minor effect Downstream no change – positive effect
Chainage 3230, Points 5 and 6	25.08m upstream 22.53m downstream	25.16m upstream 22.69m downstream	+0.08m upstream +0.16m downstream	No change – positive effect
Chainage 3620, Points 3 and 4	17.60m upstream 15.60m downstream	17.70m upstream 15.79m upstream	+0.10m upstream +0.19m downstream	Upstream positive changes to minor effect Downstream no change – minor effect
Chainage 3980, Points 27 and 29	9.46m upstream 9.18m downstream	9.84m upstream 9.40m downstream	+0.38m upstream +0.22m downstream	Upstream no change – positive effect Downstream no change – minor effect

For properties assessed there was no change to flood risk (Table 14-3). No further mitigation is proposed beyond that already recommended.

Table 14-3: Consideration of flooding at key locations identified NoR W3: Brigham Creek Road

Point on flood difference map	2.1 degree temperature change		3.8 degree temperature change		Flood depth change (m)
	Water Level (m)	Potential Effect	Water Level (m)	Potential Effect	
Point BR3	9.07	Minor	9.27	Minor	+0.2
Point BR4	10.11	Positive effect	10.50	Positive effect	+0.4

1.3 NoR W4: Spedding Road

There was an increased risk of flooding upstream of Chainage 800 and upstream of Chainage 1040 in Spedding Rd East. The model output for 3.8 degree temperature change resulted in a minor effect at both locations. No specific measures have been identified as flooding can be managed through mitigation measures as set out in in Section 8.1 including sizing of culverts to achieve flood neutrality. For all other crossings there was no increase in flood risk (Table 14-4).

Table 14-4: Flood levels at key crossings NoR W4: Spedding Road

Chainage	2.1 degree temperature change	3.8 degree temperature change	Flood level change	Change in potential effect without mitigation
	100year flood level (RL) post development	100year flood level (RL) post development		
Chainage 80, Spedding Rd East (Points 13 and 14)	47.22m upstream 41.96m downstream	47.34m upstream 41.98m downstream	+0.12m upstream +0.02m downstream	Upstream no change – moderate effect Downstream no change – positive effect
Chainage 300 (Spedding Rd East (Points 15 and 16)	38.43m upstream 35.33m downstream	38.62m upstream 35.47m downstream	+0.19m upstream +0.14m downstream	Upstream no change – moderate effect Downstream no change – minor effect
Chainage 800, Spedding Rd East (Points 21 and 22)	19.91m upstream 19.82m downstream	20.43m upstream 20.516m downstream	+0.12m upstream +0.02m downstream	Upstream negligible changes to minor effect Downstream no change – negligible effect
Chainage 1040, Spedding Rd East (Points 23 and 24)	24.18m upstream 22.71m downstream	24.32m upstream 22.85m downstream	+0.12m upstream +0.02m downstream	Upstream negligible changes to minor effect Downstream no change – negligible effect
Chainage 1180, Spedding Rd East (Points 25 and 26)	29.22m upstream	29.419m upstream	+0.12m upstream +0.02m downstream	Upstream no change – minor effect Downstream no change – minor effect

For properties assessed there was no change to flood risk (Table 14-5). No further mitigation is proposed beyond that already recommended.

Table 14-5: Consideration of flooding at key locations identified NoR W4: Spedding Road

Point on flood difference map	2.1 degree temperature change		3.8 degree temperature change		Flood depth change (m)
	Water Level (m)	Potential Effect	Water Level (m)	Potential Effect	
Point SE1	21.43	Positive effect	22.09	Positive effect	+0.66

1.4 NoR W5: Hobsonville Road

Upstream of Chainage 3800 (Point 30) flood depth increased by 0.29m resulting in an increased effect for the model output for 3.8 degree temperature change. The moderate effect can be mitigated by upsizing the proposed culvert crossings to increase flow. In addition to this all other mitigation measures as set out in Section 8.1 apply. Downstream of Chainage 3800 and at Chainage 3060 there was no increase in flood risk (Table 14-6).

Table 14-6: Flood levels at key crossings NoR W5: Hobsonville Road

Chainage	Proposed cross drainage	2.1 degree temperature change	3.8 degree temperature change	Flood level change	Change in potential effect without mitigation
		100year flood level (RL) post development	100year flood level (RL) post development		
Chainage 3060, (Point 32 and 33)	450 mm diameter underground pipe network crossing the road	40.83m upstream 39.83m downstream	40.85m upstream 39.85m downstream	+0.02m upstream +0.02m downstream	Upstream no change – minor effect Downstream no change – positive effect
Chainage 3800 (Point 30 and 31)	600 mm diameter culvert crossing	31.20m upstream 27.12m downstream	31.49m upstream 27.15m downstream	+0.29m upstream +0.03m downstream	Upstream minor changes to moderate effect Downstream positive changes to negligible effect

For properties assessed there was at increased flood risk identified at Point HR3, Point HR4, Point HR5 and Point HR6 (Table 14-7). Future development within the open space at HR3 should take notice of the potential increase of 0.58m in flood level to achieve the required freeboard for habitable floor levels. No further mitigation is proposed beyond that already recommended.

Table 14-7: Consideration of flooding at key locations identified NoR W5: Hobsonville Road

Point on flood difference map	2.1 degree temperature change		3.8 degree temperature change		Flood depth change (m)
	Water Level (m)	Potential Effect	Water Level (m)	Potential Effect	
Point HR1	40.83	Moderate effect	40.85	Moderate effect	+0.02
Point HR2	40.83	Moderate effect	40.84	Moderate effect	+0.01
Point HR3	17.82	Positive effect	18.40	Moderate effect	+0.58
Point HR4	31.20	Moderate effect	31.49	Moderate effect	+0.29
Point HR5	31.20	Negligible effect	31.49	Moderate effect	+0.29
Point HR6	31.20	Moderate effect	31.49	Moderate effect	+0.29
Point HR7	34.41	Moderate effect	34.45	Moderate effect	+0.04
Point HR8	33.53	Minor effect	33.57	Minor effect	+0.04

15 Conclusions

The assessment of the potential flood effects for the Projects was based on an indicative design of the new road.

There will be a number of positive effects associated with the development particularly where new bridges are proposed which raise the existing road levels reducing the potential for flood levels to overtop the road and reducing flood hazard. Additional positive effects can be realised through upgrades to existing culverts or new culvert crossings to improve overland and stream flow under the roads.

The assessment found that there was unlikely to be additional risk of flood effects during construction as nearly all proposed lay down areas are outside of the flood plain and overland flow paths. For those areas where there is an increased risk mitigation measures such as carrying out construction works during dry weather and using diversion drains will be adequate to manage this risk.

Potential operational effects included increased flood levels upstream and downstream of crossings and bridges. Some of the effects were assessed as moderate based on an increase in flood level of greater than 0.15m for habitable buildings and 0.5m for general property. These effects are a result of the changing terrain, based on the spatial land take for the new infrastructure, which obstructs existing overland flows and flood plains. These effects are likely overstated as they can be addressed through detailed design of the bridges, culverts and crossings to manage flows upstream and downstream to minimise flooding effects.

A number of management and mitigation measures have been considered to minimise flood effects during detailed design. Further assessment at the detailed design stage can be used to confirm the potential effects following mitigation.

A sensitivity analysis has been undertaken to consider the effects of additional rainfall under a more severe climate change scenario. The sensitivity analysis identified an increased risk of flooding at some locations. However, this increased risk can be addressed through the mitigation measures described in the report.

16 References

Auckland Council (Nov 2011) Auckland Council Stormwater Modelling Specification

Auckland Council GeoMaps (accessed 2021)

Te Tupu Ngātahi flood models, as follows:

Available Models	North West Whenuapai Package projects within the catchment models
Whenuapai Rapid Flood Hazard Assessment	Trig Road North Upgrade (NoR W1), Māmari Road Upgrade (NoR W2), Brigham Creek Road Upgrade (NoR W3), Spedding Road (NoR W4) and Hobsonville Rd FTN Upgrade (NoR W5)

New Zealand Transport Agency (April 2016) NZTA P46 Stormwater Specification

New Zealand Transport Agency (2013) Bridge Manual SP/M/022 third edition

1 Appendix 1 – Flood model results

1.1 NoR W2: Māmari Road Upgrade

Table 16-1: Māmari Road Upgrade existing and future flood levels at key crossings

Chainage	Existing cross drainage	Modelled cross drainage	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Adjacent to 41-43 Brigham Creek Road (Chainage 340 Māmari North, Point 42 in Figure 8-1)	n/a Existing overland flow path	n/a	22.51m upstream Existing ground level 22.32 m	22.68m upstream Design road level 23.35 m	+0.17m	Minor effect	Diverting the existing overland flow path to Sinton Stream
Adjacent to 7 Māmari Road (Chainage 500 Māmari North, Points 19 and 20 in Figure 8-1)	n/a	Sinton Stream Bridge, 95m long	17.53m upstream, 16.78m downstream Existing ground level 16.2 m	17.52m upstream, 16.77m downstream Modelled bridge soffit level 19.17 m	-0.01m upstream, -0.01m downstream	Positive effect upstream and downstream	
Adjacent to 9 Spedding Road (Chainage 120 Māmari South, Points 9 and 10 in Figure 8-2)	n/a	3500 mm x 1000 mm box culvert	32.45m upstream, 31.37m downstream Existing ground level 31.59 m	32.73m upstream, 31.77m downstream Design road level 35.45 m	+0.28m upstream, +0.40m downstream	Minor effect upstream and downstream	Upsizing the proposed culvert crossings to increase flow

Chainage	Existing cross drainage	Modelled cross drainage	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Adjacent to 7 Spedding Road (Chainage 380 Māmari South, Points 11 and 12 in Figure 8-2)	n/a	3500 mm x 1000 mm box culvert	36.25m upstream, 35.87m downstream Existing ground level 24.22 m	36.96 upstream, 35.90m downstream Design road level 39.36 m	+0.71m upstream, +0.03m downstream	Moderate effect upstream, negligible effect downstream	Upsizing the proposed culvert crossings to increase flow
Adjacent to 80 Trig Road (Chainage 560 Māmari South, Points 7 and 8 in Figure 8-2)	n/a	750 mm diameter culvert	38.70m upstream, 36.26m downstream Existing ground level 37.35 m	40.10m upstream, 36.32m downstream Design road level 41.95 m	+1.40m upstream, +0.06m downstream	Moderate effect upstream, minor effect downstream	Upsizing the proposed culvert crossings to increase flow

1.2 NoR W3: Brigham Creek Road Upgrade

Table 1-2: Brigham Creek Road Upgrade existing and future flood levels at key crossings

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Adjacent to 36 Brigham Creek Road (Chainage 1260, Points 1 and 2 in Figure 11-1)	n/a	600 mm diameter culvert	26.45m upstream, 26.26m downstream Existing road level 26.47 m	26.48m upstream, 26.24m downstream Design road level 27.15 m	+0.03m upstream, -0.02m downstream	Negligible effect upstream and positive effect downstream	n/a
Adjacent to 141 Brigham Creek Road (Chainage 2700, Points 36 and 37 in Figure 11-1)	n/a Existing overland flow path both sides of the road	n/a Existing overland flow path both sides of the road	32.10m (upstream), 31.63m (downstream) Existing road level 31.88 m	32.34m (upstream), 31.45m (downstream) Design road level 32.89 m	+0.24m upstream, -0.18m downstream	Minor effect upstream, positive effect downstream	New diversion drains for the overland flow path alongside the corridor
Adjacent to 153 Brigham Creek Road (Chainage 3230, Points 5 and 6 in Figure 11-2)	600 mm diameter culvert	1050 mm diameter culvert	27.04m upstream, 22.75m downstream Existing road level (Chainage 3220) 23.50 m	25.08m upstream, 22.53m downstream Design road level (Chainage 3220) 25.80 m	-1.96m upstream, -0.22m downstream	Positive effects both upstream and downstream	n/a

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Adjacent to 150-152 Brigham Creek Road (Chainage 3620, Points 3 and 4 in Figure 11-2)	n/a	(x3) 750 mm diameter culverts	17.62m upstream, 15.44m downstream Existing road level 16.17 m	17.60m upstream, 15.60m downstream Design road level 18.409 m	-0.02m upstream, +0.16m downstream	Positive effect upstream and minor effect downstream	Upsizing the proposed culvert crossings to increase flow
162 Brigham Creek Road (Chainage 3980, Points 27 and 29 in Figure 11-3)	4000 mm x 3600 mm box culvert	Waiarohia Stream Bridge, 10m wide opening	10.56m upstream, 9.03m downstream Existing road level 10.16 m	9.46m upstream, 9.18m downstream Design road level 13.26 m, bridge soffit level 11.46 m	-1.1m upstream, +0.15m downstream	Positive effect upstream and minor effect downstream	Optimize proposed bridge span or retain existing box culvert and include additional culverts
Point BR3 (Figure 11-3)	162 Brigham Creek Road, Hobsonville	Building / house, site level RL9.26 m	8.93 m	9.07m	+0.14 m	Increase in flood level between 50 mm and 150 mm, minor effect	Optimize proposed bridge span or retain existing box culvert and include additional culverts
Point BR4 (Figure 11-3)	Brigham Creek Road, Hobsonville	Building, FUZ, site level RL10.41 m	10.78 m	10.11 m	-0.67 m	Reduction in flood level, Positive effect	n/a

1.3 NoR W4: Spedding Road

Table 1-3: Spedding Road existing and future flood levels at key crossings

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Adjacent to 15-19 Spedding Road (Chainage 600, Spedding Rd West, Points 43 and 44 in Figure 12-1)	n/a	Totara Creek bridge, 255m long	14.18m upstream, 14.06m downstream Existing ground level 12.04 m	14.19m upstream, 14.09m downstream Bridge soffit level 21.88 m	+0.01m upstream, +0.03m downstream	Negligible effect upstream and downstream	n/a
Adjacent to 14 Spedding Road (Chainage 1080, Spedding Rd West, Points 38 and 39 in Figure 12-3)	n/a	450 mm diameter culvert (modelled as blocked)	27.33m upstream, 24.83m downstream Existing ground level 25.95 m	27.50m upstream, 24.26m downstream Design road CL level 27.42 m	+0.17m upstream, -0.57m downstream	Minor effect upstream, positive effect downstream	Lift the vertical alignment of the road to increase freeboard and optimize culvert design to allow more inflow
Adjacent to 49 Trig Road (Chainage 80, Spedding Rd East, Points 13 and 14 in Figure 12-4)	n/a	750 mm diameter culvert	46.42m upstream, 42.01m downstream Existing ground level 44.58 m	47.22m upstream, 41.96m downstream Design road CL level 48.40 m	+0.20m upstream, -0.05m downstream	Minor effect upstream, positive effect downstream	Upsizing the proposed culvert crossings to increase flow

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Adjacent to 49 Trig Road (Chainage 300 Spedding Rd East, Points 15 and 16 in Figure 12-4)	n/a	2500 mmx 1000 mm box culvert	37.50m upstream, 35.18m downstream Existing ground level 36.33 m	38.43m upstream, 35.33m downstream Design road CL level 42.70 m	+0.93m upstream, +0.15m downstream	Moderate effect upstream, minor effect downstream	Upsizing the proposed culvert crossings to increase flow
Adjacent to 27 Trig Road (Chainage 800, Spedding Rd East, Points 21 and 22 in Figure 12-2)	n/a	Trig Stream Bridge, 155m long	19.91m upstream, 19.82m downstream Existing ground level 18.70 m	19.91m upstream, 19.82m downstream Bridge soffit level 27.17 m	0.00m upstream, 0.00m downstream	No effect upstream and downstream	n/a
Adjacent to 6 Rawiri Place (Chainage 1040, Spedding Rd East, Points 23 and 24 in in Figure 12-2)	n/a	Rawiri Stream Bridge, 35m long	24.17m upstream, 22.68m downstream Existing ground level 22.35 m	24.18m upstream, 22.71m downstream Bridge soffit level 29.96 m	+0.01m upstream, +0.03m downstream	Negligible effect both upstream and downstream	Upsizing the proposed culvert crossings to increase flow
Adjacent to 43 Westpoint Drive (Chainage 1180, Spedding Rd East, Points 25 and 26 in in Figure 12-2)	n/a	3000 mmx 1000 mm box culvert	29.02m upstream, 29.02m downstream Existing ground level 26.88 m	29.22m upstream, 29.11m downstream Modelled Road level 32.30 m	+0.20m upstream, +0.09m downstream	Minor effect upstream and downstream	Optimizing culvert design and realigned overland flow path

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Point SE1 (in Figure 12-2)	25 Trig Road, Whenuapai	Open Space, FUZ	21.59 m	21.44 m	-0.15 m	Reduction in flood level, Positive effect	n/a
Point SW1 (Figure 12-3)	14 Spedding Road, Whenuapai	Building / house, driveway site level RL26.23 m	25.91 m	25.97 m	+0.06 m	Increase in flood level between 50 mm and 150 mm, minor effect	Further assessment during detailed design

1.4 NoR W5: Hobsonville Road FTN Upgrade

Table 1-4: Hobsonville Road FTN Upgrade existing and future flood levels at key crossings

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
283 Hobsonville Road (Chainage 3060, Point 32 and 33 in Figure 13-1)	450 mm diameter underground pipe network crossing the road	No culvert crossing modelled.	40.67m upstream, 39.91m downstream Existing road CL level 40.32 m	40.83m upstream, 39.83m downstream Design road CL level 40.72 m	+0.16m upstream, -0.08m downstream	Minor effect upstream and positive effect downstream	Upgrade pipe network to allow more inflow
Intersection of Hobsonville Road and Brigham Creek Road (Chainage 3800, Point 30 and 31 in Figure 13-1)	600 mm diameter culvert crossing	600 mm diameter culvert crossing	30.73m upstream, 27.14m downstream Existing road CL level 30.50 m	31.20m upstream, 27.12m downstream Design road CL level 31.60 m	+0.47m upstream, -0.02m downstream	Minor effect upstream, positive effect downstream	Upgrade existing culvert size
Point HR1 (Figure 13-1)	277 Hobsonville Road, Hobsonville	Building / house, site level RL40.77 m	40.67 m	40.83 m	+0.16 m	Increase in flood level greater than 150 mm, moderate effect	Upgrade pipe network to allow more inflow
Point HR2 (Figure 13-1)	285 Hobsonville Road, Hobsonville	Building / house, driveway, site level RL40.32 m	40.67 m	40.83 m	+0.16 m	Increase in flood level greater than	Upgrade pipe network to allow more inflow

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
						150 mm, moderate effect	
Point HR3 (Figure 13-2)	174 Brigham Creek Road, Hobsonville	Open space, Business	18.15 m	17.82 m	-0.33 m	Reduction in flood level, positive effect	n/a
Point HR4 (Figure 13-2)	11 Starlight Cove, Hobsonville	Building / house, site level RL31.60 m	31.06 m	31.20 m	+0.14 m	Increase in flood level greater than 150 mm, moderate effect	Upsize existing culvert
Point HR5 (Figure 13-2)	15 Starlight Cove, Hobsonville	Building / house, site level RL31.62 m	30.96 m	31.20 m	+0.24 m	Increase in flood level greater than 150 mm, moderate effect	Upsize existing culvert
Point HR6 (Figure 13-2)	18 Williams Road, Hobsonville	Building / house, site level RL30.98 m	30.97 m	31.20 m	+0.23 m	Increase in flood level greater than 150 mm, moderate effect	Upsize existing culvert
Point HR7 (Figure 13-3)	397 Hobsonville Road, Hobsonville	Building/carpark, site level RL	34.21 m	34.41 m	+0.20 m	Increase in flood level greater than 150 mm, moderate effect	Upgrade drainage for carpark area

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	Pre-development 100year ARI flood level	Post development 100year ARI flood level	Level difference for 100year post minus pre-development	Potential effect without mitigation	Recommended mitigation
Point HR8 (Figure 13-3)	1 Wiseley Road, Hobsonville	Building/carpark, site level RL	33.46 m	33.53 m	+0.07 m	Increase in flood level between 50 mm and 150 mm, minor effect	Realign overland flow path to discharge into existing pipe

ATTACHMENT 53

NORTH-WEST WHENUAPAI
ASSESSMENT OF ECOLOGICAL EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Whenuapai Assessment of Ecological Effects

December 2022

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

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1.0	16/12/2022	Notice of Requirement Lodgement

Table of Contents

Appendices

Table of Figures

Table of Tables

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
ED	Ecological District
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
Project Area	Area that is located within the designation footprint (including all its associated NoRs)
RMA	Resource Management Act 1991
RHA	Rapid Habitat Assessment
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SG	Te Tupu Ngātahi Supporting Growth
SH16	State Highway 16
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency
ZOI	Zone of Influence

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Whenuapai Assessment Package	Four Notices of Requirement and one alteration to an existing designation for the Whenuapai Arterial Transport Network for Auckland Transport.
Current ecological baseline	Means the prevailing ecological state at the time of the assessment.
Likely Future Ecological Environment	The likely future environment informed by the Auckland Unitary Plan (AUP).
Ecological Feature	Specific aspects of an ecosystem that are described and evaluated; the term includes components such as species and habitats and related processes and functions, such as habitat buffers and roosting and feeding habitat.
Greenfields	Generally rural land identified to be urbanised over time.
Hydroperiod	Flow and or soil saturation period of streams or wetlands
Project Area	Area of land that is within the proposed designation boundary.
Primary Study Area	Area associated with the designation boundary.
Secondary Study Area	Area associated with a 100 m radius from the designation boundary.
Project Footprint	Area of land that is within the road design.
Significant Ecological Area	An overlay within the Auckland Unitary Plan Operational in Part, whereby areas of terrestrial, freshwater or marine habitat of significant indigenous vegetation or significant habitats of indigenous fauna are identified and protected from the adverse effects of subdivision, use or development.
Wetland	Defined in the Resource Management Act 1991 as “includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions”.
Zone of Influence	The Zone of Influence is defined in the EIANZ Guidelines as “the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities.”
Rapid Habitat Assessment	The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015)

1 Executive Summary

This Ecological impact assessment (EcIA) has been prepared for the North West Local Arterial Network Notices of Requirement (**NoRs**) for Auckland Transport (**AT**) (the "Whenuapai Assessment Package"). This report assesses the ecological effects of the North West Whenuapai Assessment Package including: Trig Road, Māmari Road, Brigham Creek Road, Spedding Road and Hobsonville Road.

As the Whenuapai Assessment Package relates to proposed designations, this EcIA assesses district plan matters only. Regional matters (along with Wildlife Act (1953) compliance) will be subject to a future consenting phase along with a supporting EcIA. As such regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the designation boundary and future regional resource consents.

In order to inform the ecological baseline, ecological features within each Notice of Requirement (NoR) boundary were identified, mapped and their value assessed in terms of representativeness, rarity/distinctiveness, diversity/pattern and ecological context. A summary of the ecological values are provided for terrestrial vegetation (Table 1-1), District plan trees[1] (Table 1-2), terrestrial fauna (Table 1-3), streams (Table 1-4) and wetlands (Table 1-5).

Table 1-1 Ecological values of terrestrial vegetation types for each NoR

Vegetation Type	Abbrev.	Trig Road	Māmari Road	Brigham Creek Road	Spedding Road	Hobsonville Road
Brown Field	BF	-	-	-	-	-
Exotic Grassland	EG	Low	Low	Low	Low	Low
Exotic Scrub	ES	Low	Low	Low	Moderate	Low
Planted Vegetation – Native (recent)	PL.1	Moderate	-	Moderate	High	Low
Planted Vegetation – Native (mature)	PL.2	-	-	-	Moderate	-
Planted Vegetation – Exotic (amenity)	PL.3	Moderate	Moderate	Moderate	Low	Low
Treeland – Mixed Native/Exotic	TL.2	-	-	-	-	-
Treeland – Exotic-Dominated	TL.3	Moderate	Moderate	High	High	Low

[1] Only district plan vegetation (trees >4m in high and or in open space) were included as it is an NoR application.

Table 1-2 Ecological values of District Plan trees for each NoR

Vegetation Type	Trig Road	Māmari Road	Brigham Creek Road	Spedding Road	Hobsonville Road
District Plan trees	Moderate	Low	High (TL.3) Low (TL.2)	High	Low (TL.1 and TL.3) Negligible (Notable tree)

Table 1-3 Ecological values of terrestrial fauna for each NoR

Fauna Type	Trig Road	Māmari Road	Brigham Creek Road	Spedding Road	Hobsonville Road
Bats	Very High	Very High	Very High	Very High	-
Birds	Low	High	High	Low	Low
Lizards	High	High	High	High	High

Table 1-4 Ecological values of streams for each NoR

Stream	Site	Trig Road	Māmari Road	Brigham Creek Road	Spedding Road	Hobsonville Road
Trig Stream tributary	W1-S3	Low	-	-	-	-
Sinton Stream	W2-S1	-	Moderate	-	-	-
Pikau Stream tributary	W2-S6	-	Moderate	-	-	-
Pikau Stream	W2-S7	-	Moderate	-	-	-
Totara Creek tributary	W2-S8	-	Low	-	-	-
Totara Creek	W3-S1	-	-	Moderate	-	-
Totara Creek	W3-S2	-	-	High	-	-
Sinton Stream tributary	W3-S3	-	-	Low	-	-
Waiarohia Stream	W3-S4	-	-	Moderate	-	-
Unnamed tributary	W3-S5	-	-	Low	-	-
Waiarohia Stream	W3-S7	-	-	Moderate	-	-
Waiarohia Stream tributary	W3-S8	-	-	Moderate	-	-
Totara Creek	W4-S1	-	-	-	Moderate	-
Totara Creek tributary	W4-S2	-	-	-	Moderate	-

Stream	Site	Trig Road	Māmari Road	Brigham Creek Road	Spedding Road	Hobsonville Road
Sinton Stream tributary	W4-S3	-	-	-	Moderate	-
Waiarohia Stream tributary	W4-S4	-	-	-	Moderate	-
Waiarohia Stream tributary	W4-S5	-	-	-	Moderate	-
Waiarohia Stream tributary	W4-S6	-	-	-	Moderate	-
Trig Stream tributary	W4-S7	-	-	-	Moderate	-
Trig Stream	W4-S8	-	-	-	Moderate	-
Rawiri Stream	W4-S9	-	-	-	High	-
Rawiri Stream tributary	W4-S10	-	-	-	Low	-
Waiarohia Inlet tributary	W5-S4	-	-	-	-	Moderate
Waiarohia Inlet tributary	W5-S5	-	-	-	-	Low

Table 1-5 Ecological values of wetlands for each NoR

Wetland	NPS-FM	Trig Road	Māmari Road	Brigham Creek Road	Spedding Road	Hobsonville Road
W1-W1	Natural	Moderate*	-	-	-	-
W2-W1	Natural	-	High	-	-	-
W2-W2	Natural	-	Moderate*	-	-	-
W2-W3	Natural	-	Moderate*	-	-	-
W2-W3A	Artificial	-	Moderate*	-	-	-
W3-W2	Natural	-	-	Moderate	-	-
W3-W4	Natural	-	-	Low	-	-
W3-W5A	Natural	-	-	High*	-	-
W3-W5	Natural	-	-	Moderate*	-	-
W3-W7	Natural	-	-	Moderate*	-	-
W3-W8	Artificial	-	-	High	-	-
W4-W1	Natural	-	-	-	Low	-

Wetland	NPS-FM	Trig Road	Māmari Road	Brigham Creek Road	Spedding Road	Hobsonville Road
W4-W2	Natural	-	-	-	Low	-
W4-W3	Natural	-	-	-	Moderate*	-
W4-W3A	Natural	-	-	-	Moderate*	-
W4-W4	Natural	-	-	-	Moderate	-
W4-W5	Natural	-	-	-	Moderate	-
W4-W6	Artificial	-	-	-	Negligible	-
W5-W1	Natural	-	-	-	-	Low*

Notes: * = Wetland directly impacted by road alignment.

Construction Effects

Table 1-6 to Table 1-9 provides a summary of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and likely future ecological environment activities as one where they are the same[2]. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Construction effect mitigation measures will include:

- A Bat Management Plan (BMP) for Trig Road North, Māmari Road, Brigham Creek Road and Spedding Road. Details of the BMP will depend on bat habitat within the FUZ and is likely to include bat habitat surveys prior to construction, siting of compounds and laydown areas to avoid bat habitat, lighting design to reduce light levels and spill from construction areas and restriction of nightworks around treeland bat habitat.
- Bird management will be required for Brigham Creek Road (the existing Brigham Creek stormwater pond). Considerations for bird management will include a bird survey prior to construction to confirm Threatened or At Risk (TAR) species are not present and to provide guidance if TAR species are present, including the avoidance of the bird breeding season (September to February) during construction (as it relates to the existing stormwater pond).

Table 1-6 Summary of ecological effects during construction prior to mitigation for district plan trees

Construction - Terrestrial vegetation (district plan vegetation only)	
NoR	**Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)**
Trig Road North	Low
Māmari Road	Very Low
Brigham Creek Road	Low (TL.3), Very Low (TL.2)
Spedding Road	Low

[2] The effects assessment considered the baseline and the likely future environment as the construction of the road will only occur more than 20 years in the future.

Construction - Terrestrial vegetation (district plan vegetation only)	
Hobsonville Road	Very Low

Table 1-7 Summary of ecological effects during construction prior to mitigation for bats

Construction - Bats			
NoR	**Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)**	**Loss of foraging habitat due to removal of district plan vegetation**	**Mortality or injury to bats due to removal of district plan vegetation**
Trig Road North	**Moderate**	Low	**Moderate**
Māmari Road	**Moderate**	Low	Low
Brigham Creek Road	**Moderate**	Low	**Moderate**
Spedding Road	**Moderate**	Low	**Moderate**
Hobsonville Road	N/A	N/A	N/A

Table 1-8 Summary of ecological effects during construction prior to mitigation for birds

Construction - Birds					
NoR	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.) - Non-TAR birds**	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.) – TAR birds**	**Loss of foraging habitat due to removal of district plan vegetation**	**Nest loss due to removal of district plan vegetation**	**Mortality or injury to birds due to removal of district plan vegetation**
Trig Road North	Low	N/A	Low	Low	Low
Māmari Road	Low	Low	Very Low	Very Low	Very Low
Brigham Creek Road	Low	**High**	Low	Low	Low
Spedding Road	Low	N/A	Low	Low	Low
Hobsonville Road	Very Low	N/A	Very Low	Very Low	Very Low

Table 1-9 Summary of ecological effects during construction prior to mitigation for lizards

Construction – Lizards	
NoR	**Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)**
Trig Road North	Very Low
Māmari Road	Very Low
Brigham Creek Road	Very Low
Spedding Road	Low
Hobsonville Road	Very Low

The residual (post-mitigation) level of effect for all construction effects are considered **Negligible** or **Low**.

Operational Effects

Table 13-5 to Table 13-7 provides summary of district plan matter operational effects due to the presence of the road resulting in disturbance or loss in connectivity to bats, birds and lizards. The summary represents the level of effect for the baseline and FUZ as one where they are the same and with a * where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Operational effects mitigation measures will include a BMP. The BMP will include buffer planting along road corridors associated with stream crossings[3], lighting design along strategic location of the road (stream crossings) and retention of large, mature trees (specifically TL.3 stands) where practicable.

Table 1-10 Summary of ecological effects during operation prior to mitigation for bats

Operation - Bats		
NoR	**Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration**	**Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape**
Trig Road North	Low	**Moderate** *Negligible
Māmari Road	**Moderate**	**High**

[3] The extent of buffer planting is not specifically defined in this report as the requirements may change in the future. For example, stream corridors may have no or immature buffer planting under present conditions that may change in the future. The requirement to provide buffer planting and/or retain trees (that already meet the function of buffer planting) is likely to include the area between the road embankment and the designation boundary to a minimum distance of 10 m on either side of stream crossings (noting that buffer planting can occur on the road embankments).

Operation - Bats		
Brigham Creek Road	**Moderate**	**High**
Spedding Road	**High**	**Very High**
Hobsonville Road	N/A	N/A

Notes: * = Indicates a level of effect associated with the FUZ that is different from the baseline level of effects

Table 1-11 Summary of ecological effects during operation prior to mitigation for birds

Operation - Birds		
NoR	**Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)**	**Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
Trig Road North	Very Low	Very Low
Māmari Road	Low	Low
Brigham Creek Road	Very Low	Very Low
Spedding Road	Very Low	Very Low
Hobsonville Road	Very Low	Very Low

Table 1-12 Summary of ecological effects during operation prior to mitigation for lizards

Operation - Lizards		
NoR	**Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road**	**Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
Trig Road North	Low	Low
Māmari Road	Low	Low
Brigham Creek Road	Low	Low
Spedding Road	Low	Low
Hobsonville Road	Very Low	Very Low

The residual level of effect for operational effects are considered **Low** or **Very Low**.

2 Introduction

This Ecological assessment has been prepared for the North West Local Arterial Network Notices of Requirement (NoRs) for Auckland Transport (AT) (the "Whenuapai Assessment Package"). The NoRs are to designate land for future local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (Te Tupu Ngātahi) to enable the construction, operation and maintenance of transport infrastructure in the North West Whenuapai area of Auckland.

The North West growth area is approximatively 30 kilometres north west of Auckland's central city. It makes a significant contribution to the future growth of Auckland's population by providing for approximately 42,355 new dwellings and employment activities that will contribute 13,000 new jobs across the North West. Whenuapai is one of these growth areas, located between State Highway 16 (SH16) and State Highway 18 (SH18) and at present is largely rural (but Future Urban Zoned) with an existing community consisting of new and more established residential, business and local centre land uses. This growth area is expected to be development ready by 2018-2022 with 401 hectares to accommodate 6,000 dwellings. Furthermore, a Whenuapai Structure Plan was adopted by the Council in 2016 and sets out the framework for transforming Whenuapai from a semi-rural environment to an urbanised community over the next 10 to 20 years.

The Whenuapai Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport (including the Frequent Transit Network (FTN)), needed to support the expected growth in Whenuapai.

This report assesses the ecological effects of the North West Whenuapai Assessment Package identified in Figure 5-1 and Table 2-1 below.

The Whenuapai Assessment Package comprises five separate projects which together form the North West Whenuapai Arterial Network. The network includes provision for general traffic, walking and cycling, and frequent public transport.

Refer to the main AEE for a more detailed project description.

Table 2-1 North West Whenuapai Assessment Package – Notices of Requirement and Projects

Notice of Requirement	Project
Trig Road North	Trig Road North
Māmari Road	Māmari Road
Brigham Creek Road	Brigham Creek Road
Spedding Road	Spedding Road
Hobsonville Road	Hobsonville Road (alteration to existing designation 1437)

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Whenuapai Assessment Package. Its purpose is to inform the AEE that accompanies the four NoRs and one alteration to an existing designation for the Whenuapai Assessment Package sought by AT.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Whenuapai Assessment Package on the existing and likely future environment as it relates to ecological 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 ecological context/baseline of the Whenuapai Assessment Package area;
b) Identify and describe the actual and potential ecological effects of each Project corridor, resulting from activities which relate to district matters in the AUP:OP, within the Whenuapai Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential ecological effects (including any conditions/management plan required) for each Project corridor within the Whenuapai Assessment Package;
d) Set out ecological considerations that will need to be considered and assessed as part of a future regional resource consent.
e) Present an overall conclusion of the level of actual and potential ecological effects for each Project corridor within the Whenuapai Assessment Package after recommended measures are implemented.

2.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Whenuapai Assessment Package as it relates to Ecology;
c) A discussion on area wide positive effects;
d) An area wide desktop assessment;
e) Identification and description of the existing and likely future ecological environment for each NoR;
f) Description of the actual and potential adverse ecological effects of construction and operation of each NoR as they relate to district plan matters, including recommended measures to avoid, remedy or mitigate potential adverse ecological effects; and
g) Description of potential adverse ecological effects for consideration during resource consenting;
h) Overall conclusion of the level of potential adverse ecological effects for each NoR after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Project, likely staging 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 ecological effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

3 Assessment Approach

3.1 EcIA Assessment

The approach followed in this study is consistent with the approach outlined in the Ecological Impact Assessment (EcIA) Guidelines (EIANZ, 2018). The overarching goal of the ecological assessment is to determine the ecological effects of specific Project features or activities. The requirements for such an assessment are outlined within the EcIA Guidelines (EIANZ, 2018) and forms the basis of this report. This process is summarised in Figure 3-1 below. Note that for the impact assessment (Stage 2) and impact management (Stage 3) additional consideration was also given to the likely future ecological environment (refer Section 3.2).

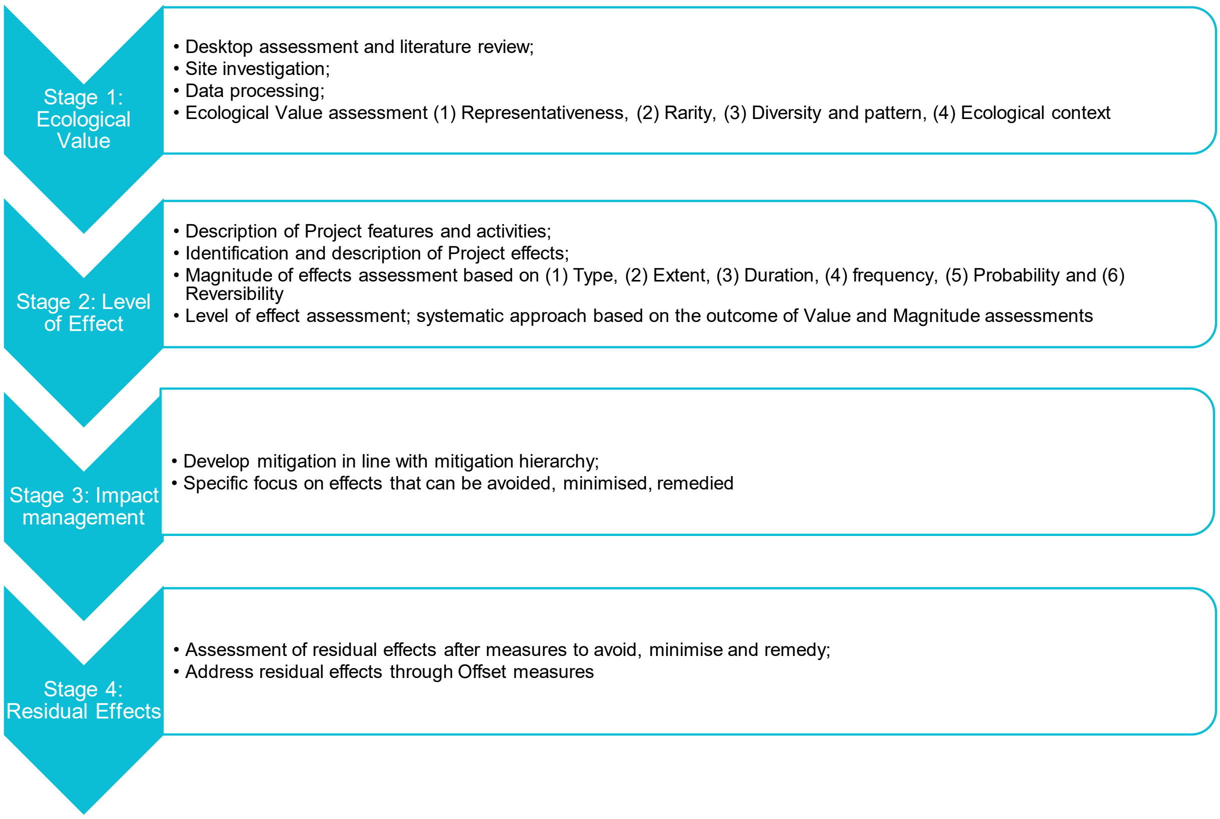


Figure 3-1 EcIA process followed for this assessment

3.2 EcIA and the Likely Future Ecological Environment

The EcIA Guidelines (EIANZ, 2018) provides guidance to assist with the assessment of the likely future ecological environment in this report. The assessment states:

"The ecologist needs to consider the permitted baseline in order to describe the potential "future ecological environment" and to assess effects at that time, and should discuss this with the project planner or legal advisor if in any doubt".

The NW Planning Teams have advised of the following to inform the assessment of project construction and operation effects for the 'likely future ecological environment':

- The purpose of the NoRs within the Whenuapai Assessment Package is to protect the transport corridors that will support the future urbanisation of Whenuapai. Construction and operation of the new and upgraded corridors will not occur until urbanization has at least been confirmed by way of a plan change or is under development. Guidance on the future urbanization can be taken from the Whenuapai Structure Plan.
- In addition the AUP:OP permits activities for infrastructure and urbanisation, which will also change the likely future environment within and adjacent to the NORs. These activities include vegetation clearance and the removal of trees, excluding notable trees and street trees. The relevant permitted activities for ecology provisions are set out in Appendix 2.
- Given the planned urbanization of Whenuapai, assessing the effects on the environment solely as it exists today (i.e. the current ecological baseline) will not provide an accurate reflection of the environment in which ecological effects, resulting from the construction and operation of each of the NoRs, will be experienced.
- Alongside of an assessment based upon the current ecological baseline (irrespective of permitted activities), the assessment of ecological effects should therefore also take account of the likely future ecological environment within and adjacent to the NORs, which takes account of permitted activities for infrastructure and the planned urbanisation within the FUZ.

A summary of the likely future ecological environment is provided in the assessment section of each NoR (Sections 8.2, 9.2 10.2, 11.2 and 12.2).

3.3 Assessment of District Plan Matters and Approach to Regional Matters

Designations are a form of 'spot zoning' over a route in a district plan. The designation authorises AT, as requiring authority, to undertake work and activity without the need for land use consent. The designated area is still subject to restrictions on land use under regional matters in the AUP:OP.

As the Whenuapai Assessment Package relates to proposed designations, the ecological effects assessment assesses district plan matters only. Regional matters will be subject to a future consenting phase along with a supporting ecological impact assessment (EcIA). As such regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the designation boundary and future regional resource consents and are presented in Section 8.4, 9.4, 10.4, 11.4 and 12.4.

Appendix 3 sets out the split between District and Regional matters in the AUP:OP.

3.4 Wildlife Act

The Wildlife Act (1953) includes specific provisions for activities that may disturb, injure or kill native animals. Wildlife Act (1953) matters have been considered in relation to the future construction phase of work and are discussed in Section 8.4, 9.4, 10.4, 11.4 and 12.4. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 3.

4 Assessment Methodology

Desktop and site investigations were undertaken for ecological features within all five NoRs. Ecological features within the proposed designation boundary and a distance of approximately 100 m[4] radius of the designation have been mapped and included onto this assessment. Vegetation, stream and wetland features were investigated and mapped to provide context for potential adjustments to the proposed designation boundary. In addition to the secondary study area, potential habitat for native fauna was considered within the Zone of Influence (ZOI) (see Section 4.1).

4.1 Zone of Influence

The ZOI of the Project relates to an area occupied by habitats and species that are adjacent to and may go beyond the boundary of the Project Area. It is defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities." The distance of the ZOI and type of effect from the Project can be different for different species and habitat types. ZOI is used throughout this report to describe the impacts of the Project (construction and operation) on adjacent or connected terrestrial, freshwater and wetland habitats and associated native species. For example, all Significant Ecological Area's (SEA's) within 2 km of each Project Area has been included in the desktop review, along with their connectivity to each Project Area. This is to ensure that important habitat within the wider landscape has been taken into consideration and can be used to inform the potential for flora and fauna to be present within each of the Project Areas and also whether the Project ZOI extends out to these SEA's.

The ZOI of the Project on different species differs depending on how they use their environment e.g. mobile species such as long-tailed bats have a larger home range and more diverse habitat requirements compared to lizards and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Projects and this was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or dispersal ability within each of the Project Areas, varying search distances were used depending on the species context.

4.2 Desktop Review

A desktop review of existing ecological records was undertaken to gain an understanding of the species and habitats that could be present within the ZOI of each of the five NoRs.

The sources of information that were reviewed to determine the likelihood of a species or habitat occurring within or adjacent to each of the NoRs include:

- Auckland Council Geomaps[5];
- Department of Conservation (DOC) Bioweb records[6];
- Department of Conservation Threat Classification Series[7];
- Ecological Regions and Districts of New Zealand (McEwen, 1987);

[4] The designation boundary has undergone several rounds of refinement. The ecological mapping was undertaken on the initial designation boundary and is considered sufficiently wide to provide a contingency for relatively small adjustment during refinement. The 100 m area mapping was included to provide additional context regarding the nature and extent of ecological features (including wetlands).

[5] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

[6] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/

[7] All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text and in Section 12. https://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/

- iNaturalist records[8] (research grade observations), records within approximately 5 km radius of the overall study area (including all NoRs);
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al., 2017);
- National Institute of Water and Atmospheric Research (NIWA) freshwater fish database[9];
- New Zealand Bird Atlas eBird database[10]; recorded within 10 km^2 grid squares. Results from grid square AB66, positioned over the Whenuapai area; and
- NZ River Name Lines (LINZ Data Service[11]).

4.3 Site Investigations

Site investigations were undertaken in order to:

- Prepare an ecological baseline of terrestrial, freshwater and wetland ecology;
- Inform the assessment of each of the NoRs against the relevant district matters (terrestrial ecology);
- Set out freshwater and wetland matters which may be considered as part of a future regional resource consent, or under relevant wildlife legislation;
- Inform the designation footprint.

4.3.1 Terrestrial Habitat

Site investigations were undertaken between November 2021 and January 2022 by experienced ecologists; to map and describe the habitats[12] present within and adjacent to each of the five NoRs. Habitats were classified into ecosystem type based on those described in Singers et al. (2017). The habitats were also assessed as to their potential to support indigenous fauna, including birds, bats, and lizards.

The habitat assessment focused on areas of potentially significant value, such as habitat that was identified as a SEA, classified as forest habitat on Auckland Council's Geomaps – Ecosystems Current Extent (Singers et al., 2017) or appears to be wetland or forest habitat based on aerial photos and during site investigation. Species records from relevant literature and biodiversity databases were utilised to focus search efforts on certain areas within the NoRs.

Broad indigenous vegetation communities were mapped on recent aerial photography and incorporated into the Project's GIS database. The vegetation assessment included recording the dominant or characteristic species present and the general quality described, including structure, maturity, presence of weeds and evidence of grazing and foliar dieback. Vegetation survey work also included searches for any rare or threatened plant species, previously recorded within each of the NoRs boundaries.

Common plant names are predominantly used within this report. Maps showing the vegetation cover along the NoRs are provided in Appendix 5. Terrestrial ecological value assessment methodology is discussed in Section 4.4.

8 https://www.inaturalist.org/
9 https://nzffdms.niwa.co.nz/search
10 https://ebird.org/atlasnz/home
11 https://data.linz.govt.nz/layer/103632-nz-river-name-lines-pilot/
12 Ecosystem codes from Singers et al. (2017) were used.

4.3.2 Bat Surveys

A bat survey was undertaken for the wider North West study area (Appendix 12). Two bat monitors were located within the Whenuapai ZOI. These were located upstream of Totara Creek and at the Brigham Creek crossing and downslope of Waiarohia Stream and Brigham Creek crossing. The stream corridors associated with both Totara Creek and Waiarohia catchments are considered the most likely to indicate bat activity. The bat monitors were deployed between November 2021 and January 2022. Monitoring data for 14 suitable days (weather conditions not constraining bat activity) were analysed and used for the report.

4.3.3 Freshwater Habitat

Where possible to access, streams within each of the five NoRs that had been identified on Auckland Council Geomaps ('Named Streams') were ground truthed and classified as permanent, intermittent or ephemeral, according to the stream definitions described by Storey and Wadhwa (2009). Any additional streams observed during site investigations were also classified. Streams are mapped in Appendix 5.

Freshwater assessments were undertaken by ecologists on all streams identified on site. In addition to stream classifications the Rapid Habitat Assessment (RHA) protocol was implemented. The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015). Stream Ecological Valuation (SEV) assessments were not undertaken but are expected to be completed during the Resource consent phase. Macroinvertebrate and fish surveys were not undertaken as part of this assessment. However, NIWA fish records (Franklin et al., 2018) were used to inform potential ecological value of streams. Access was restricted at several locations and as such stream assessments were based solely on desktop information. Freshwater ecological value assessment methodology is discussed in Section 4.4.

4.3.4 Wetland Habitat

Potential wetland habitat areas were identified by experienced ecologists based on Auckland Council Geomaps contours and the presence of wetland vegetation on aerial maps (including a review of historical images). These areas were then ground truthed during the site investigation either through the application of the rapid test where vegetation indicators were apparent or sample plots where vegetation was ambiguous. The wetland delineation followed the method outlined within the wetland delineation guidelines (Clarkson, 2018), noting limitations in terms of access and scope discussed in more detail below. Areas conforming with the delineation guidelines were mapped and described in terms of vegetation cover, soil and hydrology. Instances where wetland delineation relied on desktop assessment, due to access constraints, were noted and a more conservative delineation was adopted. Ambiguous areas were assumed to be wetlands, where these areas were not accessible. It is important to note that the scope of the specialist study, for route protection, did not provide for a detailed wetland delineation (i.e. mapping accuracy of <1:10 000). The key focus was to confirm wetland presence and approximate extent. This approach is considered practical for the purposes of route protection, while it is expected that a more detailed wetland assessment will be undertaken during the resource consenting phase.

Wetlands were assessed based on the RMA definition of a wetland[13] and classified into ecosystem type based on those described in Singers et al. (2017). If the habitat present met this definition, it was then further evaluated against the provisions of the NPS-FM for natural wetlands (assessed for

[13] Wetland includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions"

potential exclusion on the basis of being artificial or pasture dominated and temporary rain derived ponding). Details regarding the wetland value assessment is outlined in Section 4.4.

4.4 Ecological Value Assessment

The ecological value of ecological features were assessed by assigning a score of 0 (None), 1 (Low), 2 (Moderate), 3 (High) or 4 (Very High) based on professional judgement (with justification) to aspects associated with each of the four ecological matters: (1 Representativeness 2) Rarity/distinctiveness 3) Diversity and pattern 4) Ecological context. Considerations in relation to the four matters and corresponding aspects for terrestrial, freshwater and wetland features are detailed below:

Terrestrial Ecology

1) **Representativeness**: Typical structure, species composition and indigenous representation
2) **Rarity/distinctiveness**: Species of conservation significance, distinctive ecological values
3) **Diversity and pattern**: Habitat diversity, species diversity and patterns in habitat use
4) **Ecological context**: Size, shape and buffering function, sensitivity to change, ecological networks (linkages, pathways, migration)

Freshwater Ecology

1) **Representativeness**: RHA score for accessible sites and riparian habitat modification based on desktop stream and catchment assessments
2) **Rarity/distinctiveness**: Species of conservation significance informed by the potential occurrence of Threatened and At-Risk (TAR) fish species
3) **Diversity and pattern**: Level of natural diversity informed by the habitat diversity subsection of the RHA. Stream order, slope and hydroperiod were applied as desktop proxies to judge the likely habitat diversity for streams where access was constraint
4) **Ecological context**: Stream order and hydroperiod

Wetland Ecology

1) **Representativeness**: Hydrological modification based on observations of drains, ponds and catchment land use. Native vegetation informed by site visit and review of landcover information;
2) **Rarity/distinctiveness**: Wetland type (rare or distinctive); distinctive ecological values (ecosystem services) in a larger catchment context;
3) **Diversity and pattern**: Representation of different hydroperiods (permanent, seasonal or temporary) and the structural complexity of vegetation cover
4) **Ecological context**: flood attenuation, streamflow regulation, sediment trapping, water purification, connectivity and migration.

The score for each matter was constrained to the highest score for each aspect (for example a High score allocated to a wetland for flood attenuation will result in a High score for the Ecological context matter). The combined ecological value score (ranging from **Very High** to **Negligible**), for the four matters, was determined in accordance with the EcIA guidelines (EIANZ, 2018) and was recorded within a matrix spreadsheet for use within the ecological impact assessment (refer Appendix 9).

5 Whenuapai Assessment Package Overview

An overview of the Whenuapai Package is provided in Figure 5-1 below, with a brief summary of the Whenuapai Assessment Package projects provided in Table 5-1.

Readers should refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

Figure 5-1 North West Whenuapai Assessment Package – Overview of NoRs for Assessment

Table 5-1 Whenuapai Assessment Package Project Summary

Corridor	NoR	Description	Requiring Authority
Trig Road North	Trig Road	Upgrade of Trig Road corridor to a 24m wide two-lane urban arterial cross-section with separated active mode facilities on both sides of the corridor.	Auckland Transport
Māmari Road	Māmari Road	Extension and upgrade of Māmari Road corridor to a 30m wide four-lane urban arterial cross-section providing bus priority lanes and separated active mode facilities on both sides of the corridor.	Auckland Transport
Brigham Creek Road	Brigham Creek	Upgrade of Brigham Creek Road corridor to a 30m wide four-lane arterial cross-section with separated active mode facilities on both sides of the corridor.	Auckland Transport
Spedding Road	Spedding Road	Upgrade of the existing Spedding Road corridor and new east and west extensions to form a 24m wide two-lane arterial with separated active mode facilities on both sides of the corridor.	Auckland Transport

Corridor	NoR	Description	Requiring Authority
Hobsonville Road (alteration to existing designation 1437)	Hobsonville Road	Alteration of the existing Hobsonville Road designation 1437 to provide for the widening of the Hobsonville Road corridor between Oriel Avenue and Memorial Park Lane. Upgrade of sections of Hobsonville Road corridor to a 30m wide four-lane cross section with separated active mode facilities on both sides of the corridor Upgrade of sections of Hobsonville Road corridor to a 24m wide two-lane cross section with separated active mode facilities on both sides of the corridor.	Auckland Transport

6 Area Wide Ecological Desktop Review

This section presents the findings of an area wide desktop study. The study covers all the habitats and species ('ecological features') present within the ZOI of each of the NoRs.

NoR specific ecological baselines have also been set out in Sections 8.2.2, 9.2.2, 10.2.2, 11.2.2 and 12.2.2.

6.1 Historical Ecological Context

Each of the NoRs are present within the Tamaki Ecological District, which has a warm humid climate and is characterised by volcanic cones, isthmus, harbours and volcanic terrain (McEwen, 1987).

Originally forested, the landscape would have been dominated by northern North Island lowland broadleaved forest with abundant taraire (*Beilschmiedia tarairi*) and pūriri (*Vitex lucens*) (Singers, 2017). Now only 7% of the native land cover and 1% of freshwater wetlands and wetland forests remain in the Tamaki Ecological District (Auckland Regional Council, 2013). For context, a reduction to around 20% of former extent is usually considered to be significant. A reduction to below 5% is considered to be severe (Walker et al., 2008).

6.2 Terrestrial Habitat and Fauna

6.2.1 Terrestrial Vegetation

Where natural habitat remains, the AUP:OP has mapped and classified habitats as terrestrial or marine SEAs (where such habitat meets the SEA criteria at that time). SEAs which occur within 2 km of the NoRs, are presented and described in Table 6-1. A distance of 2 km was selected as the potential ZOI for each of the five NoRs.

Table 6-1 Significant Ecological Areas present within 2 km of the NoR

SEA	Relevant NoR	Distance from Relevant NoR (km)	SEA Type Terrestrial/ Marine	SEA Description
SEA_M2_57b	Brigham Creek Road	0 km	Marine	This area covers the inner Waitematā Harbour, and it contains various mudflats and mangrove-lined inlets and creeks, with a natural succession between terrestrial, freshwater and marine habitats. These habitats are an important migration corridor for indigenous freshwater fish and for coastal fringe bird species.
SEA_T_2034	Brigham Creek Road, Spedding Road	0 km	Terrestrial	An area of riparian vegetation, which is an important migration pathway for threatened fish species including īnanga (*Galaxias maculatus*)

SEA	Relevant NoR	Distance from Relevant NoR (km)	SEA Type Terrestrial/ Marine	SEA Description
SEA_T_4733	Brigham Creek Road	0 km	Terrestrial	Area buffers a marine environment, with presence of threatened fish species longfin eel (*Anguilla dieffenbachii*) and īnanga (*Galaxias maculatus*)
SEA_T_4811A	Hobsonville Road	0.3 km	Terrestrial	Terrestrial habitat with threatened plant species *Epilobium hirtigerum* present.
SEA_T_2028	Hobsonville Road	0.5 km	Terrestrial	Requested data – no data available
SEA_T_4729	Hobsonville Road	0.5 km	Terrestrial	Area with threatened plant species *Picris burbidgeae* present.
SEA_T_2050	Hobsonville Road	0.7 km	Terrestrial	Area of WF4 (Pohutukawa-pūriri-broadleaved forest) that buffers an SEA. Threatened ecosystem with threatened terrestrial species *Picris burbidgeae*, and rare bird species Black shag (*Phalacrocorax carbo novaehollandiae*). Diverse habitat, including UC, WF4 and SA1. Less than 10% indigenous cover left.

6.2.2 Bats

The Department of Conservation (DOC) and SGA desktop records confirm the presence of long-tailed bats (*Chalinolobus tuberculatus*) within a 10 km radius of the five NoRs. The conservation status of this species is 'Nationally Critical' (O'Donnell et al., 2017). There are records of bats within 3 km to the southwest of the five NoRs, near Redhills; and 6 km to the north of the five NoRs in the Riverhead Forest (Figure 6-1). The presence of bats has been confirmed along Totara Creek by the T+T ecological assessment for the Spedding Block Whenuapai Plan Change (T+T, 2020) (Figure 6-2). The T+T report concludes that riparian margins across the Plan Change area (Spedding Block) are likely to support bats foraging and movement between known bat populations in the Waitakere ranges and Riverhead Forest.

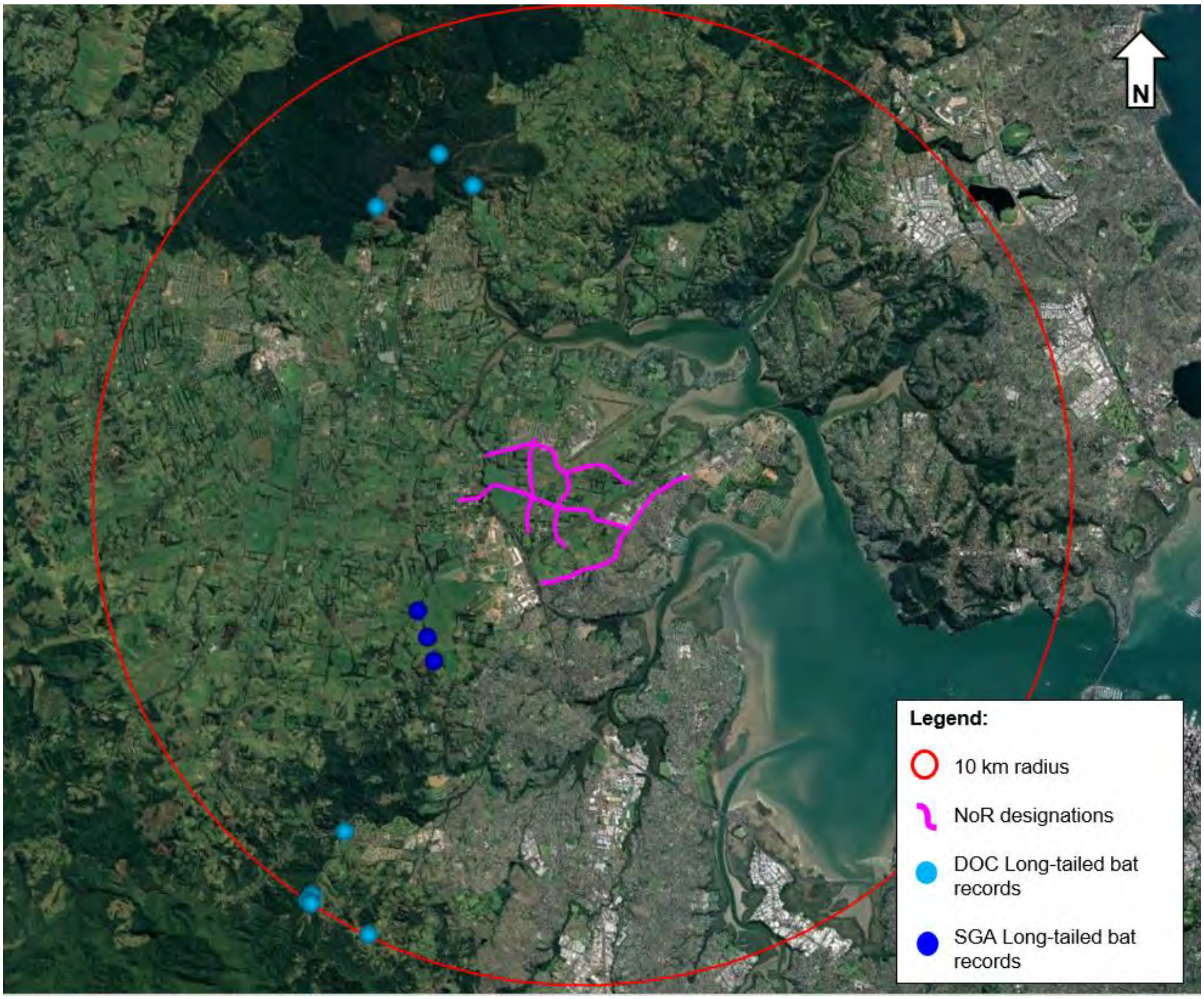


Figure 6-1 DOC and SGA historical long-tailed bat records within 10 km radius of the Project Area.

Figure 6-2 Map showing the ABM deployment locations (dots) from the T + T ecology assessment for the Spedding Block Plan (T + T, 2020). Blue and green dots indicate bat activity. Red indicates failed instruments and white indicate no bat activity detected birds.

The area wide desktop review identified 67 forest, freshwater, and coastal bird species (44 of which are indigenous) within a 2 km radius of each of the five NoRs. The full species list can be found in Appendix 2.

This included 23 indigenous bird species which are listed as TAR species (Robertson et al., 2021) (Table 6-2). The majority of these indigenous bird species are associated with coastal and marine habitats which are located <1 km from the NoRs, while spotless crake (At Risk – Declining) may utilise wetland and stormwater ponds at locations within the five NoRs.

Table 6-2 Desktop study TAR bird species records and their conservation status (Robertson et al., 2021)

Common Name	Māori Name	Scientific Name	Conservation Status
Australasian bittern	Matuku-hūrepo	*Botaurus poiciloptilus*	Threatened - Nationally Critical
Banded dotterel	Tūturiwhatu	*Charadrius bicinctus bicinctus*	Threatened - Nationally Vulnerable
Banded rail	Mioweka	*Gallirallus philippensis assimilis*	At Risk - Declining
Bar-tailed godwit	Kuaka	*Limosa lapponica bauer*	At Risk - Declining
Black shag	Kawau	*Phalacrocorax carbo novaehollandiae*	At Risk - Naturally Uncommon
Black-billed gull	Tarāpuka	*Larus bulleri*	Threatened - Nationally Critical

Common Name	Māori Name	Scientific Name	Conservation Status
Brown teal	Pāteke	*Anas chlorotis*	At Risk - Recovering
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened - Nationally Vulnerable
Grey duck	Pārera	*Anas superciliosa*	Threatened - Nationally Critical
Lesser knot	Huahou	*Calidris canutus rogersi*	Threatened - Nationally Vulnerable
Little black shag	Kawau tūī	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon
New Zealand Dabchick	Weweia	*Poliocephalus rufopectus*	At Risk - Recovering
North Island Fernbird	Mātātā	*Bowdleria punctata vealeae*	At Risk - Declining
North Island Kākā	Kākā	*Nestor meridionalis septentrionalis*	At Risk - Recovering
Northern New Zealand Dotterel	Tūturiwhatu	*Charadrius obscurus aquilonius*	At Risk - Recovering
Pied shag	Kāruhiruhi	*Phalacrocorax varius varius*	At Risk - Recovering
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk - Declining
Royal Spoonbill	Kōtuku ngutupapa	*Platalea regia*	At Risk - Naturally Uncommon
South Island pied oystercatcher	Tōrea	*Haematopus finschi*	At Risk - Declining
Spotless crake	Pūweto	*Porzana tabuensis tabuensis*	At Risk - Declining
Variable oystercatcher	Tōrea pango	*Haematopus unicolor*	At Risk - Recovering
White-fronted tern	Tara	*Sterna striata striata*	At Risk - Declining
Wrybill	Ngutuparore	*Anarhynchus frontalis*	Threatened - Nationally Vulnerable

6.2.3 Herpetofauna

A review of the DOC Bioweb database found six indigenous lizard records within a 10 km radius of the NoR boundaries (Table 6-3). No records were found within the NoR boundaries. This is likely to indicate that lizard surveys have not been completed in the local area, rather than lizards are not present. Four of the six indigenous lizard species identified in the DOC Bioweb search have a threat status of ‘At Risk’ (Hitchmough et al. 2021).

Copper skink (At Risk – Declining) is widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. The closest record is less than 1 km from one of the NoR boundaries. As such, this species is highly likely to occur within and adjacent to all of the NoR areas.

Table 6-3 Indigenous lizard species records within 10 km of the boundary of the NoRs

Common Name	Scientific Name	Threat Class (Hitchmough et al., 2021)
Auckland green gecko	*Naultinus elegans*	At Risk - Declining
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened - Taxonomically indeterminate
Raukawa gecko	*Woodworthia maculata*	Not Threatened - Taxonomically indeterminate
Copper skink	*Oligosoma aeneum*	At Risk - Declining
Forest skink	*Mokopirirakau granulatus*	At Risk - Declining
Ornate skink	*Oligosoma ornatum*	At Risk - Declining

6.3 Freshwater Habitat and Fauna

6.3.1 Streams

The NZ River Name Lines (LINZ Data Service) map indicated that the five NoRs will intercept a number of named rivers and streams (Table 6-4). Various tributaries will also be affected in each NoR, these are detailed in the relevant NoR sections (8.2.3.4, 9.2.3.4, 10.2.3.4, 11.2.3.4 and 12.2.3.4)

Table 6-4 Desktop assessment of streams that will be crossed Project wide (LINZ Database)

Relevant NoR	Stream Name
Māmari Road	Sinton Stream
	Pikau Stream
	Pikau Stream tributary
Brigham Creek Road	Totara Creek
	Waiarohia Stream
Spedding Road	Totara Creek
	Sinton Stream tributary
	Waiarohia Stream
	Trig Stream
	Rawiri Stream
	Waiarohia Stream tributary

6.3.2 Fish

The NIWA freshwater fish database was reviewed for fish records within stream catchments affected by the five NoRs. Of the fish recorded, two species - īnanga (*Galaxias maculatus*) and longfin eel (*Anguilla australis*), are classed as At Risk – Declining (Dunn et al., 2017). The desktop review results are presented in Table 6-5.

Table 6-5 Freshwater fish species recorded within the catchments associated with the NoRs

Common Name	Scientific Name	Conservation Status (Dunn et al., 2017)	Streams and relevant NoRs					
			W4	W2, W3	W2, W3	W4	W3	W4, W5
			Brigham Creek	Rarawaru Creek pond	Totara Creek	Totara Creek tributary	Waiarohia Stream	Waiarohia Stream tributary
Banded kokopu	*Galaxias fasciatus*	Not Threatened	x		x	x	x	x
Common bully	*Gobiomorphus cotidianus*	Not Threatened	x		x			
Crans bully	*Gobiomorphus basalis*	Not Threatened	x					
Gambusia	*Gambusia affinis*	Introduced and Naturalised					x	x
Īnanga	*Galaxias maculatus*	At Risk - Declining	x		x		x	
Koura	*Paranephrops*	NA	x					
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	x		x		x	
Redfin bully	*Gobiomorphus huttoni*	Not Threatened					x	
Rudd	*Scardinius erythrophthalmus*	Introduced and Naturalised	x			x		
Shortfin eel	*Anguilla australis*	Not Threatened	x	x		x	x	x
Unidentified eel	*Anguilla*	NA				x	x	

6.4 Wetland Habitat

Some wetlands, within the Whenuapai area, have been cited in various reports; notably the Whenuapai Stream Assessment report (Golder, 2014) which assessed areas north of the existing Brigham Creek Road, however they do not have any overlap with this assessment. T+T completed an assessment of ecological effects for the Spedding Block proposed plan change (T+T, 2020) which includes a portion of the study. The T +T assessment included a wetland delineation. However, none of the wetlands within the NoR boundaries have been extensively assessed. However, based on landuse most are likely to be highly modified by grazing, drainage and or the creation of stock ponds (T+T, 2020).

7 Whenuapai Positive Effects

The following section outlined the positive effects of the proposed alignment for each NoR in relation to specific ecological features (Table 7-1). The statement regarding positive effects assumes that native planting will occur on the roadsides as part of the landscape management.

There is the potential for positive effects which apply to each of the NoRs. These include:

- The ability for future landscape planting within each NoR to tie into stream and riparian corridors. Most notably for the NoRs associated with Totara Creek, Sinton Stream, Trig Stream, Rawiri Stream and Waiarohia Stream
- Net increase in green infrastructure and associated habitats within each of the NoRs. The net increases are associated with street trees, berm and stormwater plantings and planted stormwater wetlands
- There are stream and wetland crossing upgrades identified for individual NoRs, most notably culvert upgrade associated with Waiarohia Stream crossing where the existing undersized culvert will be upgrades to a bridge resulting in a positive effect on stream habitat and stream connectivity

Table 7-1 Summary of positive effects associated with each NoR

NoR	Ecological Feature	Positive Effect
Māmari Road (NoR W2)	Sinton Stream	Riparian corridor of Sinton Stream associated with proposed downstream green corridor (T + T 2020). Native landscaping of the roadside upslope and downslope of the stream crossing can have a positive effect on the riparian features and associated ecological functions of the Sinton Stream.
Māmari Road (NoR W2)	Farm pond (7 Spedding Rd)	Decommissioning the farm pond will have a positive effect the stream water quality of Sinton Stream tributary.
Brigham Creek Road (NoR W3)	Waiarohia Stream	Existing undersized culvert upgrade to bridge crossing at Brigham Creek Rd and Waiarohia Stream crossing. This will have a positive effect on the ecological integrity of the Waiarohia Stream and improve connectivity through the Waiarohia catchment.
Spedding Road (NoR W4)	Trig Stream complex (Rawiri, Trig Tributary, Trig Stream and associated wetlands)	These features will be bridged. However, native landscaping will tie into existing restoration efforts on Rawiri Stream and roadside planting on the State Highway. Positive effects relate to a decrease in pest plants and an increase in native plants along the riparian corridors associated with these streams.

8 Trig Road North Upgrade

8.1 Project Corridor Features

The Trig Road North corridor features a north-south alignment, running on a watershed between the Totara Creek and Waiarohia catchments. This corridor does not cross any watercourses or transect any areas of native vegetation (with the exception of a row of mature Pohutukawa's on the roadside of 92 Trig Road and native planting associated with the Upper Harbour Motorway crossing). The proposed corridor includes a natural wetland west of Trig Road near the existing Brigham Creek interchange.

8.2 Existing and Likely Future Environment

8.2.1 Planning Context

The Trig Road corridor runs through an existing rural environment, with the land either side of the corridor currently zoned FUZ under the AUP:OP. Proposed Plan Change 5 (PPC5) proposes to rezone the eastern side of Trig Road north of SH18 and the western side of Trig Road between Brigham Creek Road and Spedding Road as Business – Light Industry Zone. A heritage overlay is proposed at 92 Trig Road and 4 Spedding Road.

PPC5 does not extend to the west side of the corridor south of Spedding Road, however the Whenuapai Structure Plan identifies this area for business zoning. The Whenuapai Structure Plan identifies a potential Sports Park at the corner of Trig Road and Spedding Road.

The NZDF Air Base (Special Purpose - Airports and Airfields Zone) is located to the north of Trig Road on Brigham Creek Road. The airbase is designated (Designation 4310) for defence purposes by the Minister of Defence.

Table 8-1 below provides a summary of the Trig Road existing and likely Future Environment.

Table 8-1 Trig Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[14]	Likely Future Environment[15]	Implications of Future Environment on Ecological Features
Undeveloped greenfield areas	Future Urban Zone (FUZ)	High	Urban	Mature trees adjacent to the NOR, associated with the roadside and shelterbelt will be lost in the likely Future Environment, but may be present

[14] Based on AUP:OP zoning/policy direction
[15] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[14]	Likely Future Environment[15]	Implications of Future Environment on Ecological Features
				during the construction phase of the Trig Road corridor. These trees may assist ecological connectivity between the Totara Creek and Waiarohia catchments.
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Urban	N/A

8.2.2 Permitted Activities and the Future Ecological Environment

The existing undeveloped greenfields adjacent to Trig Road are zoned FUZ in the AUP:OP, and as such is planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding street trees and notable trees), are identified as permitted activities within Chapters E26 and E15 of the AUP: OP. As such the ecological features (i.e. terrestrial habitat), excluding natural wetlands, streams and riparian edges, which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

8.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') currently present within the proposed Trig Road North designation boundary.

All features within the study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within this NoR.

8.2.3.1 Terrestrial Habitat

Table 8-2 summarises the vegetation types and their classification (Singers et al., 2017) associated with the Trig Road North Upgrade. Maps are presented in Appendix 5.

Table 8-2 Vegetation types present within the Trig Road North Upgrade, categorised according to Singers et al. (2017)

Vegetation Type	Abbreviation	Habitat Description
Brown Field (includes cropland)	BF	This definition includes industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites. Consists of small areas patches of rural homesteads.
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, gardens for most of the Trig Road North.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Generally growing along historical farm drains. Dominant species include gorse, woolly nightshade and privet species.
Planted Vegetation – Exotic (amenity)	PL.3	Exotic amenity plantings. This includes parks and gardens and roadside vegetation dominated by exotic species.
Planted Vegetation – Native (recent)	PL.1	Native restoration plantings with <50% exotic biomass. Planted native scrub and forest <20 years old or wetland <10 years old.
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. This includes tree lined streams, gardens and mature trees within amenity plantings and shelter belts.

8.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for the five NoRs (including Trig Road North Upgrade). The results of the bat survey are detailed in Appendix 12. Although bats were detected in the wider North West study area, no bats were detected from the ABMs located within the Whenuapai Assessment Package ZOI, including Trig Road North Upgrade.

The T+T Structure Plan study (T+T, 2020) detected low levels of bat activity along Totara Creek (approximately 600 m from the Trig Road North NoR), mature shelterbelt vegetation (mostly represented by TL.3) may provide bat habitat, roost potential and enable bat movement between the Totara Creek and Waiarohia catchments. As such the occasional utilisation of mature shelterbelt vegetation by bats within and adjacent to the NoR cannot be excluded.

Birds

No dedicated bird surveys were undertaken for Trig Road North; however, incidental observations of bird species were noted. The birds seen or heard within and adjacent to the study area for Trig Road North are set out in Table 8-3.

Trig Road North is located away from coastal areas and therefore is not associated with notable coastal habitats or areas of ponded water, or inundated wetlands that may be of value for TAR bird species.

No TAR species were observed during site investigations. The most commonly noted birds were introduced species, including blackbirds, thrushes, sparrows, and mallard ducks. The structure of habitat associated with exotic scrub vegetation (ES), more mature exotic treeland (TL.3) and native plantings (PL.1) present along the existing corridor may provide localised value for birds.

Table 8-3 Incidental bird observations at Trig Road North and conservations status (Robertson et al., 2021)

Common Name	Māori Name	Scientific Name	Conservation Status
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised
Myna	-	*Acridotheres tristis*	Introduced and Naturalised
Pūkeko	Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened
Swamp Harrier	Kāhu	*Circus approximans*	Not Threatened
Tūī	Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened
Welcome swallow	Warou	*Hirundo neoxena neoxena*	Not Threatened
White-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened

Lizards

Indigenous lizards were not identified during opportunistic searches completed during the site investigation. However, the introduced plague skink was identified within the Trig Road North study area. Copper skink have been recorded within 3 km of the Trig Road North NoR. Copper skink is likely to be associated with most of the vegetation units presented in Table 8-2 where there is appropriate understorey. However, habitat with a higher potential to support copper skink within Trig Road North NoR is represented by isolated patches of exotic scrub (ES) (near the Trig Road and Brigham Creek interchange) as well as the native planting (PL.1) north and south of the Upper Harbour Motorway). Other vegetation types on Trig Road North that are potentially associated with lizard refuge includes exotic grass (ES), treeland (TL.3) as well as the margins of exotic wetlands (EW).

8.2.3.3 Terrestrial Ecological Value

Table 14-9 in Appendix 6 describes the terrestrial vegetation observed within Trig Road North NoR and their ecological value in accordance with the EcIA Guidelines (EIANZ, 2018). The ecological value for exotic grassland (EG) and exotic scrub (ES) was assessed as **Low**, while the ecological value was assessed as **Moderate** for exotic plantings (PL.3), native plantings (PL.1) and exotic treeland (TL.3)[16].

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with the EcIA Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk – Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments of for individual species are considered **Very High** for long-tailed bats and **High** for copper skink (Table 8-4).

Table 8-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification system)	Ecological Value
Bats	Long-tailed bat	TL.3	Threatened - Nationally Critical	Very High
Herpetofauna – lizards	Copper skink	EG, ES, PL.3, PL.1 and TL.3	At Risk - Declining	High

8.2.3.4 Freshwater Habitat

All potential streams within the proposed designation boundary for Trig Road North Upgrade were numbered, classified (permanent, intermittent or ephemeral) and mapped (Appendix 5).

Stream classification and description

Three stream branches were identified within a 100 m buffer of Trig Road North upgrade, however only one stream was identified within the Trig Road North proposed designation boundary (W1-S3). This was based on desktop evaluation because stream access was not possible to enable site surveys. The streams are mapped in Appendix 5 and are listed in Table 8-5.

[16] The ecological value of brown fields was considered less than negligible and therefore was not assessed.

Table 8-5 Summary of Trig Road North Upgrade stream classifications and descriptions

Stream Number	Classification	Barrier type	Upstream fish habitat
W1-S3*	Intermittent	Total barrier to fish migration	Unlikely

Notes: * = Stream assessed at a desktop level.

Rapid Habitat assessment

The stream within the Trig Road North Trig designation could not be accessed, so an RHA was not undertaken. As such ecological value was assessed at a desktop level (Section 8.2.3.6).

8.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however 'At Risk – Declining' species īnanga has been recorded upstream of W1-S2 as part of the desktop surveys (Table 6-5).

8.2.3.6 Freshwater Ecological Value

Table 14-14 in Appendix 7 presents the ecological value for the freshwater habitat (W1-S3) identified within the Trig Road North proposed designation boundary. Information obtained for the ecological baseline (Section 8.2.3.4 and 8.2.3.5), as well as the area wide desktop assessment (Section 6.3), was used to score the matters that inform the ecological value. Stream W1-S3 was assessed as a **Low** value feature.

8.2.3.7 Wetland Habitat

The detailed results of vegetation cover, wetland soil and hydrology indicators are provided in Appendix 11. One wetland (W1-W1) associated within the Trig Road North designation has been identified and assessed (Appendix 5).

W1-W1 (96 Trig Road)

A shallow perched depression wetland approximately 100 m^2 west of Trig Road near Brigham Creek junction. The wetland extent was indicated by the dominance of exotic facultative wetland (*Persicaria maculosa* and *Juncus effusus*) and facultative species (*Ranunculus repens*). The wetland is characterised by a shallow mineral soil profile with matrix and mottle colours indicative of seasonal saturation. The wetland is not connected to the downslope area through channelled flow. The direct catchment of the wetland mainly consists of agriculture and the existing Trig Road. The wetland meets the definition of a natural wetland under the NPS-FM.

8.2.3.8 Wetland Ecological Value

Table 14-19 in Appendix 8 presents the ecological value for the wetland habitat identified within Trig Road North. Information obtained for the ecological baseline (Section 8.2.3.7) was used to score the matters that inform the ecological value. The value category for W1-W1 was assessed as **Moderate**.

8.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 8.3 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP. Refer to Section 3.2 for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

8.3.1 Construction Effects - Terrestrial Ecology

The following potential construction effects (direct and indirect) to the terrestrial habitat and species within and adjacent to Trig Road North (as they relate to district matters) have been identified:

- Vegetation removal that is subject to district controls (refer Appendix 3).
- Disturbance and displacement to roosts/nests and individual (existing) bats, birds and lizards due to construction activities (noise, light, dust etc.). It is assumed that this effect will occur after vegetation clearance within the NoR has been implemented, but urbanisation may not yet have occurred on surrounding greenfield land. As such, there is the potential for the effect to occur in habitats adjacent to the proposed designation for Trig Road North.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.3.1.1 Terrestrial Vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and detailed in the table below. The effects of district plan vegetation removal on fauna i.e., bats and birds (as it relates to loss in foraging habitat, and mortality and injury) are assessed in sections 8.3.1.2 and 8.3.1.3.

Table 8-6 Trig Road North: Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**<u>TL.3 (total area of 3019 m²)</u>** **<u>Pohutukawa row - PL.1 (total area of 1085.9 m²)</u>** The magnitude of effect is assessed as **Low** due to the relatively low likelihood that edge effect and additional fragmentation will occur. The ecological value of TL.3 and the row of Pohutukawa is assessed to be **Moderate**, and the overall level of effect is assessed as **Low** prior to	It is assumed that urbanisation (and the associated tree removal) may not have occurred at the time of road construction. As such the level of effects will be the same as the Baseline.

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	Likely Future Ecological Environment
	mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

8.3.1.2 Bats

Bats may utilise the habitats associated with the proposed designation boundary for the Trig Road North Upgrade for roosting or foraging. Specifically, mature trees associated with exotic treeland stands (TL.3) and shelterbelts. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. At present, bat roosts have not been confirmed for potential habitat adjacent to the designation boundary, but mature trees that could be used as roosts are known to be present within the NoR.

A portion of the TL.3 habit falls within the existing road corridor and may provide bat habitat. Bats may therefore be impacted by the removal of district plan vegetation through the following effects[17]:

- Loss of foraging habitat
- Mortality or injury to bats

Table 8-7 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

[17] Roost lost has been considered but discounted as an effect as the **consequence** of roost loss (if it does occur at all) is considered less than **Negligible** in the context of this NoR.

Table 8-7 Trig Road North: Assessment of construction effects and impact management for bats

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.).		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to relatively short period of construction related effects, and the low baseline bat activity rate (infrequent or occasional). The ecological value of bats is assessed to be **Very High** and the overall level of effect is assessed as **Moderate** prior to mitigation.	It is assumed that urbanisation (and the associated **adjacent** tree removal) may not have occurred at the time of road construction. As such the level of effects will be the same as the Baseline.	**Loss of foraging habitat** The magnitude of effect is assessed as **Negligible** for the loss in foraging habitat (district plan vegetation only) due to the unlikely probability if this effect occurring. The ecological value of bats is assessed as **Very High** and the overall level of effect is assessed as **Low** prior to mitigation. **Mortality or injury to bats** The magnitude of effect is assessed as **Low** due to the slightly higher probability of this effect occurring. The ecological value of bats is assessed to be **Very High,** and the overall level of effect is assessed as **Moderate** prior to mitigation.	**Loss of foraging habitat** The importance of district plan trees in providing foraging habitat in the future environment need to be considered along with the likely need for foraging habitat in the future (increase vs. decrease in bat foraging). Overall, it is assumed that urbanisation may not have occurred at the time of road construction and that bat activity will remain comparable to the baseline and as such the level of effects will be the same as the baseline. **Mortality or injury to bats** The probability of the effect occurring in the future is expected to be comparable to the Baseline and the level of effect will be the same as the Baseline.

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.).		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Surveys prior to construction confirm activity to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Siting of compounds and laydown areas to avoid treeland (TL.3) habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around TL.3 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., Bat Management Plans) that may be required for regional compliance. The post mitigation level of effect can be reduced to **Negligible.**	Same as the Baseline, but subject to the presence of suitable adjacent bat habitat.	**Loss of foraging habitat** N/A **Mortality or injury to bats** The BMP should also include (as related to district plan vegetation): • Consideration to the provisions of the Wildlife Act. • Design and implementation of a vegetation removal protocol. • The protocol should provide for roost potential and ABM surveys prior to vegetation removal and timing of vegetation removal should be constraint to avoid the maternity period (vegetation removal should occur during October or between March and April). The post mitigation level of effect related to mortality or injury to bats due to district plan vegetation removal can be reduced to **Negligible.**	**Loss of foraging habitat** N/A **Mortality or injury to bats** Same as Baseline.

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.).		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

8.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace indigenous birds from suitable nesting and foraging habitat adjacent to the Trig Road North NoR. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Table 8-8 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 8-8 Trig Road North: Assessment of construction effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features within and adjacent to the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.	Assuming urbanisation has not yet occurred at the time of road construction the level of effects will be the same as the Baseline.	The magnitude of effect is assessed as **Moderate** for all three effects associated with district plan tree removal. This is due to a relatively high probability of these effects occurring during the removal of district plan vegetation. The ecological value of birds is assessed as **Low**, and the overall level of effect due district plan vegetation removal is assessed as **Low** prior to mitigation.	The probability of all three effects occurring in the future is expected to be comparable to the Baseline and the level of effect will be the same as the Baseline.
Impact management and residual level of effect	N/A	N/A	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February) or pre-clearance	Same as Baseline.

Effect description	**Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)**		**Effects due to removal of district plan vegetation:** - **Loss of foraging habitat** - **Nest loss** - **Mortality or injury to birds**	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
			inspections should be undertaken prior to vegetation removal.	
Management of residual effect	N/A	N/A	N/A	N/A

8.3.1.4 Lizards

Construction effects on lizards within habitat adjacent to the NoR associated with noise, light and vibration are presented in Table 8-9. In the context of this assessment district plant trees do not provide habitat for lizards.

Construction activity relates to the upgrade of an existing road and as such lizards are likely to be habituated to noise and vibration from the existing road. It is expected that the effects on lizards due to vegetation removal (other than district plan vegetation) within the NoR footprint will be assessed under Regional matters and is further discussed in Section 8.4.1.4.

Table 8-9 Trig Road North: Assessment of construction effects and impact management for lizards

Effect description	**Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)**	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to unlikely probability of lizard disturbance due to construction related noise and vibration. The ecological value of copper skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

8.3.2 Operational Effects - Terrestrial Ecology

The Project involves the upgrading of an existing road in a rural landscape and future urban environment, and although some impacts may increase from the current baseline, many operational effects such as fragmentation and noise and lighting are likely to be pre-existing. In general, potential operational effects from the Project that relate to district plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.3.2.1 Bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat and can impact on bat movement in the broader landscape. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The level of effect on bats due to operational impacts associated with loss in connectivity should be assessed in the context of confirmed bat activity in the broader landscape (with the nearest confirmed bat activity associated with the Ngongetepara Stream. Refer to Appendix 12), the existing degree of fragmentation and that of the future urban environment. Table 8-10 outlines the operational effects assessment and impact management for bats during operation.

Table 8-10 Trig Road North: Assessment of operational effects and impact management for bats

Effect description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to relatively local extent of disturbance and the low baseline bat activity rate (infrequent or occasional). The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** disturbance of individual bats and roosts. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** due to relatively low likelihood (existing fragmentation) and low baseline bat activity rate (infrequent or occasional). The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for loss in connectivity.	Level of effect assessed as **Negligible** within the FUZ as bat habitat (TL.3) will likely be removed and the NoR does not cross any riparian corridors or ecological features of value to bats that will be present in the FUZ. As such no impact management is required.
Impact management and residual level of effect	N/A	N/A	A Bat Management Plan should be developed to include consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • Retention of large, mature trees (specifically TL.3 stands) where practicable, to act as hop overs.	N/A

Effect description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			The implementation of the proposed impact management measures will reduce the level of effect to **Low.**	
Management of residual effect	N/A	N/A	N/A	N/A

8.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Trig Road North, while noise light and vibration may also affect connectivity in the broader landscape. Table 8-11 outlines the operational effect assessment and impact management for birds.

Table 8-11 Trig Road North: Assessment of operational effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low**, as Trig Road North is along the existing Trig Rd and birds are likely to be habituated to noise, light and vibration from the road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to operational disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low**, due to the likely probability and local and permanent impact. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

8.3.2.3 Lizards

Suitable habitat (exotic scrub, exotic treeland edge and rank grassland) was identified within the NoR boundary which could potentially support native copper skink (At Risk – Declining). Native lizards require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

Trig Road North corridor includes upgrading the existing Trig Roads. The proposed upgrade is therefore not expected to result in the additional fragmentation of lizard habitat. Similarly, resident (existing and future) copper skink are likely to be habituated to disturbance such as noise, vibration and lighting and no additional effect on copper skink is expected provided the post-upgraded road will not result in higher levels of noise and vibration.

Table 8-12 outlines the operational effect assessment and impact management for lizards.

Table 8-12 Trig Road North: Assessment of operational effects and impact management for lizards

Effect description	Disturbance and displacement of existing and future copper skink due to light, noise and vibration effects from the presence of the road		Further loss in connectivity for existing and future copper skink populations due to the presence of the road	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** as the Project is not expected to further exacerbate existing disturbance adjacent to the NoR. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** as the Project is not expected to further exacerbate existing and future restrictions on lizard dispersal adjacent to the NoR. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

8.3.3 Conclusions

The ecological level of effects assessed as more than **Moderate** for Māmari Road Trig Road North include:

- **Moderate** level of effect for noise and light disturbance of individual bats or roosts during construction for the Ecological Baseline and the Future Ecological Environment (assuming the presence of potential bat habitat around areas not yet developed within the FUZ at the time of construction).
- **Moderate** level of effect associated with the killing or injuring of individual bats due to the removal of district plan vegetation for Baseline and the Future Ecological Environment.
- **Moderate** level of effect for the loss in connectivity to bats due the presence of the road during operation for the Ecological Baseline only.

The post mitigation level of effect is considered to be **Negligible** for construction related disturbance effects, **Negligible** for killing or injuring individual bats due to the removal of district plan vegetation, and **Low** for connectivity effects.

8.4 Design and Future Regional Resource Consent Considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the section below. This section has informed the proposed designation boundary of Trig Road North.

8.4.1.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the NoRs, including suitable habitat that is potentially being used by indigenous fauna (bats, birds and lizards). This includes vegetation clearance which is a permitted activity for infrastructure under the AUP:OP.

The amounts and types of all terrestrial habitat and vegetation[18] (including habitat used by indigenous fauna) that could be lost as a result of the Project is presented in Table 8-13. For context, the extent the same habitat features are provided for the designation boundary.

The terrestrial vegetation to be lost (temporary and permanent) mostly comprised of exotic vegetation which are of **Low** or **Moderate** ecological value (Section 8.2.3.3). Some of these areas are likely to provide habitat to native fauna, as discussed in Sections 8.4.1.2 to 8.4.1.4 below.

Table 8-13 Potential area of permanent terrestrial vegetation loss within the road footprint and designation footprint respectively for Trig Road North

Feature	Classification	Footprint (m^2)	Designation (m^2)
Brown Field	BF	657	2,258
Exotic Grassland	EG	14,230	26,048

18 Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

Feature	Classification	Footprint (m²)	Designation (m²)
Exotic Scrub	ES	0	526
Planted Vegetation – Native (recent)	PL.1	2,318	2,969
Planted Vegetation – Exotic (amenity)	PL.3	6,287	977
Treeland – Exotic-Dominated[19]	TL.3	5,772	4,835

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent and wildlife permit applications (if required).

8.4.1.2 Bats

Mature hedgerow and shelterbelt vegetation (mostly represented by exotic treeland – TL.3) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats should be re-assessed prior to obtaining any regional resource consents and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

8.4.1.3 Birds

Not Threatened indigenous birds are likely within the NoR. Vegetation clearance required for construction will result in the loss of vegetation features (ES, PL.1, PL.3, TL.3) of local value to native birds. Any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

8.4.1.4 Lizards

Indigenous copper skink are likely to be present within vegetation within the proposed designation boundary. There is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species and result in the removal of their habitat. Any vegetation clearance where copper skink are likely to occur will also need to be managed in accordance with the Wildlife Act 1953.

8.4.1.5 Wetland Ecology

Construction of the Trig Road North will result in loss of a 330 m^2 depression wetland (W1-W1) which cannot be avoided. The value of this wetland was assessed as **Moderate**. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

[19] TL.3 and PL.1 (row of planted Pohutukawa's 92 Trig Road) include District plan trees.

9 Māmari Road Upgrade

9.1 Project Corridor Features

The Māmari Road corridor features a north-south alignment, with upgrades to existing road (including sections which area a paper road) between Brigham Creek and Spedding Road and an extension between Spedding Road and Northside Drive. The corridor falls within the Totara Creek catchment and will transect several watercourses, with Sinton Stream being the most notable. This corridor does not cross areas of native vegetation. The proposed corridor includes natural wetlands associated with the Sinton and Pikau streams.

9.2 Existing and Likely Future Environment

9.2.1 Planning Context

The northern section of Māmari Road to Spedding Road is an existing road corridor (although a section of the road is a 'paper road'). The eastern side is predominantly zoned under the AUP:OP as FUZ, with a portion of Residential – Single House Zone. The Single House Zone forms part of the NZDF Air Base designation (Designation 4310, Minister of Defence). The western side is also predominantly FUZ. The Whenuapai Structure Plan indicates that the FUZ land will be re-zoned medium residential to the north (east side of Māmari only) and business to the south.

The southern extension to Māmari Road extends across land which is zoned FUZ and is currently undeveloped and in rural use. The Whenuapai Structure Plan indicates that the FUZ land will be re-zoned for business.

Table 9-1 below provides a summary of the Māmari Road existing and likely Future Environment.

Table 9-1 Māmari Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[20]	Likely Future Environment[21]	Implications of Future Environment on Ecological Features
Residential	Residential	Low	Residential	N/A
Undeveloped greenfield areas	Future Urban	High	Urban	Loss of residual vegetation units (mostly exotic grass and plantings). Mature trees and shelterbelts adjacent to the NoR also likely to

[20] Based on AUP:OP zoning/policy direction

[21] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[20]	Likely Future Environment[21]	Implications of Future Environment on Ecological Features
				be lost in Future Environment. Stream and wetlands likely to persist in Future Environment.
Timatanga Community School	Special Purpose - School Zone	Low	Urban	N/A

9.2.2 Permitted Activities and the Future Ecological Environment

The existing undeveloped greenfields adjacent to Māmari Road are zoned FUZ in the AUP:OP, and as such is planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding street trees and notable trees), are identified as permitted activities within Chapters E26 and E15 of the AUP: OP. As such the ecological features (i.e., terrestrial habitat), excluding natural wetlands, streams and riparian edges, which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

9.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') currently present within the proposed Trig Road North designation boundary.

All features within the study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within this NoR.

9.2.3.1 Terrestrial Habitat

Table 9-2 summarises the vegetation units associated with Māmari Road. These habitats and their value were classified according to Singers et al. (2017) (Table 9-2) and mapped in Appendix 5.

Table 9-2 Vegetation types present within Māmari Road, categorised according to Singers et al. (2017)

Habitat	Abbreviation	Description of Habitat
Brown Field (includes cropland)	BF	Includes industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites.

Habitat	Abbreviation	Description of Habitat
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, and gardens.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Generally growing along stream and roadside corridors. Dominant species include gorse and privet. Most notable areas of ES are located around the Sinton Stream crossing.
Planted Vegetation – Exotic (amenity)	PL.3	Exotic amenity plantings. This includes gardens and roadside vegetation dominated by exotic species.
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. For W2 treeland features are mostly present as shelter belts.

9.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for the five NoRs (including Māmari Road). The results of the bat survey are detailed in Appendix 12. Although bats were detected in the wider North West study area, no bats were detected from the ABMs located within the Whenuapai Assessment Package ZOI, including the Māmari Road NoR.

Terrestrial habitat of potential value for bats includes exotic treeland (TL.3) habitat around Sinton Stream and to the north of the proposed Māmari and existing Spedding Rd junction. The T+T Structure Plan study (T+T, 2020) detected low levels of bat activity along Totara Creek and as such the occasional utilisation of mature shelterbelt vegetation by bats within and adjacent to the NoR cannot be excluded.

Birds

No dedicated bird surveys were undertaken for the Project, however incidental observations of bird species were noted. Birds seen or heard within the proposed designation boundary for Māmari Road are set out in Table 9-3.

Māmari Road is located away from coastal areas, and therefore is not associated with notable coastal habitats. A pond located on a small tributary of Pikau Stream may provide potential habitat for spotless crake (At Risk – Declining). The most commonly noted birds were introduced species (Table 9-3). The structure of habitat associated with exotic scrub vegetation (ES), more mature exotic treeland (TL.3) and plantings (PL.3) present with the NoR may provide localised value for birds.

Table 9-3 Incidental bird observations at Māmari Road and conservations status (Robertson et al., 2021)

Common Name	Māori Name	Scientific Name	Conservation Status
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised

Common Name	Māori Name	Scientific Name	Conservation Status
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised
Myna	-	*Acridotheres tristis*	Introduced and Naturalised
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened

Lizards

Indigenous lizards were not identified during opportunistic searches completed during the site investigation. Copper skink have been recorded within 4 km of Māmari Road corridor. Habitat with a higher potential to support copper skink within the Māmari Road NoR is represented by isolated patches of rank grass (EG), exotic scrub (ES) (Sinton Stream) and exotic wetland (EW) habitat where there is appropriate understorey. Other vegetation types potentially associated with lizard refuge includes exotic grass (ES) and treeland (TL.3) where there is appropriate understorey.

9.2.3.3 Terrestrial Ecological Value

Table 14-10 in Appendix 6 describes the terrestrial vegetation observed within Māmari Road NoR and their ecological value in accordance with the EcIA Guidelines (EIANZ, 2018). The ecological value for exotic grassland (EG) and exotic scrub (ES) was assessed as **Low**, while the ecological value was assessed as **Moderate** for exotic plantings (PL.3), and exotic treeland (TL.3)[22].

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with the EcIA Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk – Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments of for individual species are considered **Very High** for long-tailed bats and **High** for copper skink (Table 9-4).

[22] The ecological value of brown fields was considered less than negligible and therefore was not assessed.

Table 9-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Bats	Long-tailed bat	TL.3	Threatened - Nationally Critical	Very High
Birds	Spotless crake	Pond at 7 Spedding Rd	At Risk - Declining	High
Herpetofauna – lizards	Copper skink	EG, ES, PL.3, PL.1 and TL.3	At Risk - Declining	High

9.2.3.4 Freshwater Habitat

All streams within Māmari Road designation boundary were numbered, classified (permanent, intermittent or ephemeral) and mapped.

Stream classification and description

Eight stream branches were identified during the desktop within a 100 m buffer of Māmari Road, however only four streams are within the proposed designation boundary. These were assessed against the stream classification criteria developed by Storey and Wadhwa, 2009. The streams are mapped in Appendix 5 and are listed in Table 9-5.

In summary, streams within the Māmari Road designation were classified [23] as follows:

- One stream branch was identified as intermittent
- Three stream branches were identified as permanent.

The barrier to fish migration was assessed for each stream, to describe any fragmentation or loss of connectivity. This is described as either total barrier, partial barrier or no barrier to fish migration.

Table 9-5 Summary of Māmari Road stream classifications and descriptions

Stream Number	Classification	Barrier type	Upstream fish habitat
W2-S1*	Permanent	Partial barrier to fish migration	Likely
W2-S6*	Permanent	Partial barrier to fish migration	Likely
W2-S7*	Permanent	Partial barrier to fish migration	Likely
W2-S8*	Intermittent	Partial barrier to fish migration	Likely

Notes: * = Streams assessed at a desktop level.

National Rapid Habitat assessment

All four intermittent and permanent streams were not able to be accessed, therefore an RHA was not able to be undertaken, so ecological value was assessed at a desktop level (Section 4.4).

[23] using the overland flow path layer from the Auckland Council Geomaps website (https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html)

9.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however 'At Risk – Declining' species īnanga has been recorded upstream of W2-S1 (Table 6-5).

Appendix 7 presents the ecological value for the freshwater habitats identified within Māmari Road proposed designation boundary (Appendix 1). Information obtained for the ecological baseline (Section 9.2.3.4 and 9.2.3.5), as well as the area wide desktop assessment (Section 6.3), was used to score the matters that inform the ecological value. The ecological value was assessed as **Moderate** for W2-S1 and W2-S4 and **Low** for W2-S2 and W2-S3.

9.2.3.6 Freshwater Ecological Value

Table 14-15 in Appendix 7 presents the ecological value for the freshwater habitat identified within the Māmari Road NoR. Information obtained for the ecological baseline (Section 9.2.3.4 and 9.2.3.5), as well as the area wide desktop assessment (Section 6.3), was used to score the matters that inform the ecological value. Streams W2-S2, W2-S3, W2-S5, and W2-S8 were assessed as **Low** value, and streams W2-S1, W2-S4, W2-S6, and W2-W7 were assessed as **Moderate** value.

9.2.3.7 Wetland Habitat

The detailed results of vegetation cover, wetland soil and hydrology indicators are provided in Appendix 11. Four natural wetlands associated with Māmari Road designation have been identified and assessed. All of the Māmari Road wetlands were assessed at desktop level. However, wetland areas upslope of W2-W1 was accessible and therefore allowed some inferences.

W2-W1 (28A Māmari Rd)

A relatively large, channelled valley bottom system with well-defined hillslope seeps. The wetland drains the upper reached of the Sinton Stream catchment. The presence of hillslope hydrology indicated by the lateral extent of facultative wetland species. Access to parts of the same system (upslope of the designation boundary) indicated that wetland vegetation is mainly represented by *J. effusus*, *J. articulates*, and *Paspalum distichum*. Observed obligate species included *Eleocharis acuta*. In the accessible areas, the wetland was characterised by a mineral soil profile with matrix and mottle colours indicative of permanent and seasonal saturation. The direct catchment of the wetland mainly consists of agriculture, while the northern portion is urban (immediately south Brigham Creek Road). The wetland meets the definition of a natural wetland under the NPS-FM. The wetlands associated with the upper parts of the Sinton catchment retain a relatively high degree of hydrological integrity despite historical attempts the drain the local catchments. The rehabilitation potential of these wetlands is therefore considered to be good.

W2-W2 (5 Spedding Rd)

Wetland represented a valley bottom system with hillslope seeps associated with a stream channel forming a small tributary of the Pikau Stream. The desktop delineation was informed by structural differences in vegetation. The direct catchment of the wetland is affected by pasture and horticulture. The wetland is affected by historical attempts to drain the local catchment and straighten the stream. The wetland is considered an NPS-FM natural wetland.

W2-W3A (7 Spedding Rd)

Wetland extent represented by emergent vegetation around the farm pond. A review of historical images indicates that the form pond has been constructed post 1959 (Figure 9-1) and is therefore considered as artificial and is not a natural wetland under the NPS-FM. The parts of the wetland upslope of the red circle in the 1959 image indicate structural differences in vegetation consistent with historical wetland extent. The upper part of the wetland is separately assessed as W2-W3.

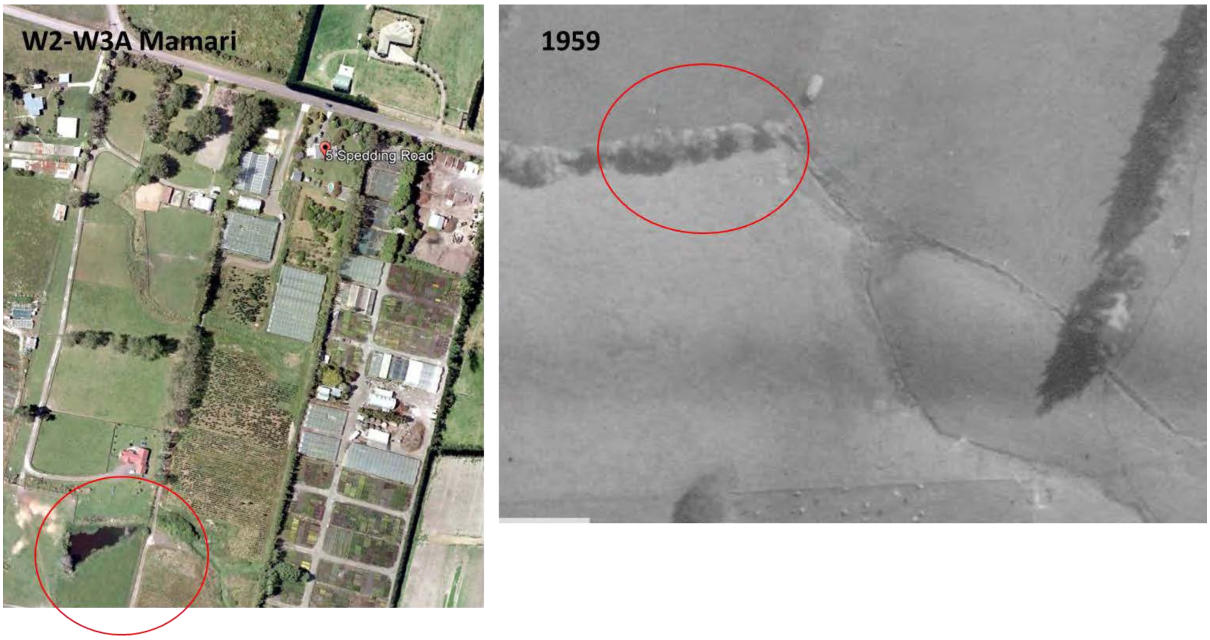


Figure 9-1 Comparison of W2-W3A during 2017 and 1959.

W2-W3 (3 Spedding Rd)

The wetland consists of riparian (maintained by annual flood) and hillslope seep characteristics. The present-day extent is relatively consistent with historical extent (Figure 9-1). The relatively steep hillslope suggests that the main hydrology (under present day condition) may be more consistent with stream flows. However, the presence of wetland habitat cannot be excluded based on a desktop assessment. Catchment conditions are modified by agriculture and there is evidence of historical realignment of upper parts of the wetland. The stand of trees to the south of the wetland and to the east of the designation have been removed. The wetland is considered a natural wetland under the NPS-FM.

9.2.3.8 Wetland Ecological Value

Appendix 8 represents the ecological value for the wetland habitats identified within Māmari Road. Information obtained for the ecological baseline (Section 9.2.3.7) was used to score the matters that inform the ecological value. Further detail on how the matters assessment was undertaken is included in Appendix 1. The value categories applied ranged from **High** for W2-W1 to **Moderate** for W2-W2, W2-W3A and W2-W3.

9.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 9.3 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP. Refer to Section 3.2 for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

9.3.1 Construction Effects - Terrestrial Ecology

The potential construction effects (direct and indirect) to the terrestrial habitat and species within Māmari Road (as they relate to district matters) were the same as detailed for Trig Road North (Section 8.3.1).

9.3.1.1 Terrestrial vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and also detailed in the table below. The effects of district plan vegetation removal on fauna i.e., bats and birds (as it relates to loss in foraging habitat, and mortality and injury) are assessed in sections 9.3.1.2 and 9.3.1.3.

Table 9-6 Māmari Road: Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**TL.3 (total area of 337.6 m²)** The magnitude of effect is assessed as **Low** due to the relatively low likelihood that edge effect and additional fragmentation will occur. The ecological value of TL.3 is assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	It is assumed that urbanisation (and the associated tree removal) may not have occurred at the time of road construction. As such the level of effects will be the same as the baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

9.3.1.2 Bats

Bats may utilise the designation boundary associated with Māmari Road for roosting or foraging. Specifically, mature trees associated with exotic treeland stands (TL.3) and shelterbelts in and around the Sinton Stream corridor. Most notably the mature stands of exotic *Pinus radiata* to the south of Sinton Stream crossing and the treeland shelterbelt to the east of the designation and north of Northside Drive. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. At present, bat roosts have not been confirmed within the designation boundary, but mature trees that could be used as roosts are known to be present within the NoR boundary.

Additionally, bats may be impacted by removal of district plan vegetation through the following effects[24]:

- Loss of foraging habitat
- Mortality or injury to bats

[24] Roost lost has been considered but discounted as an effect as the **consequences** of roost loss (if it does occur) is less than **Negligible** in the context of this NoR.

Table 9-7Table 9-7 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

Table 9-7 Māmari Road: Assessment of construction effects and impact management for bats

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to relatively short period of construction related effects, and the low baseline bat activity rate (infrequent or occasional). The ecological value of bats are assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation.	Assuming urbanisation has not yet occurred at the time of road construction the level of effects will be the same as Baseline.	The magnitude of effect is assessed as **Negligible** for both effects due to small extent and low bat habitat quality (i.e., very unlikely probability of this effect occurring) of district plan trees for bats. The ecological value of bats is assessed as **Very High** and the overall level of effect is assessed as **Low** prior to mitigation.	Same as Baseline.
Impact management and residual level of effect	Mitigation measures are the same as for Trig Road North outlined in Table 8-7. The post mitigation level of effect can be reduced to **Negligible.**	Same as Baseline, but subject to the presence of suitable bat habitat.	Impact management may still be required under the Wildlife Act to prevent killing or injuring of bats. Management might include: inspection of trees to confirm potential roost features, constraining the timing of vegetation removal, pre-clearance inspections prior to vegetation removal.	Same as Baseline.
Management of residual effect	N/A	N/A	N/A	N/A

9.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace indigenous forest birds from suitable nesting and foraging habitat adjacent to the proposed designation boundary for Māmari Road. The same impact has been considered for spotless crake (At Risk – Declining) potentially using the pond on 7 Spedding Road. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Table 9-8 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 9-8 Māmari Road: Assessment of construction effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to definite presence of birds associated with several habitat features of the Māmari Road NoR The ecological value of birds in the context of the Māmari Road habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. **TAR bird (spotless crake)** The magnitude of effect is assessed as **Low** due to a lower probability (potential occurrence, single small pond to be affected and nearby ponds providing alternative habitat if disturbance occurs) and short duration of effect if disturbance occurs for spotless crake. The ecological value of spotless crake is **High**, and the overall level	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** for all three effects associated with district plan tree removal. This is due to the small extent of district plan vegetation present and the low probability of these effects occurring. The ecological value of birds is assessed as **Low**, and the overall level of effect due district plan vegetation removal is assessed as **Very Low** prior to mitigation. **TAR bird (spotless crake)** Will not be affected by district plan vegetation removal.	Same as Baseline.

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.			
Impact management and residual level of effect	N/A	N/A	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February), or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.
Management of residual effect	N/A	N/A	N/A	N/A

9.3.1.4 Lizards

Construction effects on lizards associated with noise, light and vibration is assessed as **Low** (Table 9-9). It is expected that the effects on lizards due vegetation removal within riparian areas will be assessed under Regional matters and is further discussed in Section 9.4.1.4.

Table 9-9 Māmari Road: Assessment of construction effects and impact management for lizards

Effect description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the low probability of lizard disturbance due to construction related noise and vibration. The ecological value of copper skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no additional mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

9.3.2 Operational Effects - Terrestrial Ecology

Māmari Road involves the upgrading of an existing road and the construction of a new road within a rural landscape and future urban environment, crossing several small watercourses (Sinton and Pikau streams). Potential operational effects from the Project that relate to district plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

9.3.2.1 Bats

The loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat and can impact on bat movement in the broader landscape. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The level of effect on bats due to operational impacts associated with loss in connectivity was assessed in the context of confirmed bat activity in the broader landscape, the existing degree of fragmentation and that of the future urban environment. Table 9-10 outlines the operational effects assessment and impact management for bats.

Table 9-10 Māmari Road: Assessment of operational effects and impact management for bats

Effect description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively small amount of vegetation (TL.3) directly adjacent to the road footprint with bat habitat potential. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation.	Future disturbance will depend on the nature of vegetation associated with Sinton Stream, and may occur in the future. The level of effect is assessed as the same as Baseline.	The magnitude of effect is assessed as **Moderate** due to new fragmentation of the Sinton Stream corridor and likely use of this corridor by bats. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** prior to mitigation.	Same as Baseline. Sinton Stream corridor will persist in FUZ.
Impact management and residual level of effect	Mitigation measures are the same as for Trig Road North outlined in Table 8-10, with the addition of buffer planting both sides of road corridor associated with the Sinton Stream crossing to further reduce noise and light resulting in disturbance from the road. The post mitigation level of effect can be reduced to **Low** for both effects.	Same as Baseline.	Mitigation measures are the same as for Trig Road North outlined in Table 8-10, with the addition of buffer planting both sides of road corridor associated with the Sinton Stream crossing to further reduce noise and light resulting in disturbance from the road. The post mitigation level of effect can be reduced to **Low** for both effects.	Same as Baseline.

Effect description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

9.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the proposed designation boundary for Māmari Road, while noise light and vibration may also affect connectivity in the broader landscape. The pond associated with the potential occurrence of spotless crake (At Risk – Declining) will not be present during the operation of the road and the effects assessment in Table 9-11 only pertains to Non-TAR birds. Table 9-11 outlines the operational effect assessment and impact management for birds.

Table 9-11 Māmari Road: Assessment of operational effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance and loss in connectivity is assessed as **Low** prior to mitigation. **TAR birds** N/A	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to the highly likely probability and local extent of effect. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance and loss in connectivity is assessed as **Low** prior to mitigation. **TAR birds** N/A	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

9.3.2.3 Lizards

Exotic scrub, exotic treeland edge rank grassland, riparian and wetland habitat suitable for copper skink have been identified within the designation for Māmari Road, which could potentially support native copper skink (At Risk – Declining). Māmari Road. The Project includes extending and connecting existing parts of Māmari Road through habitat units suitable for copper skink. Table 9-12 outlines the operational effect assessment and impact management for lizards.

Table 9-12 Māmari Road: Assessment of operational effects and impact management for lizards

Effect description	**Disturbance and displacement of existing and future copper skink due to light, noise and vibration effects from the presence of the road**		**Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** as copper skinks are adaptable to road noise and vibration. The ecological value of copper skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** as copper skinks are relatively resident with low requirement for movement between habitat units. The ecological value of copper skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

9.3.3 Conclusions

The ecological level of effects assessed as more than **Moderate** for Māmari Road include:

- **Moderate** level of effect for noise and light disturbance of individual bats or roosts during construction and operation for the Baseline and the Future Environment (assuming the presence of potential bat habitat around Sinton Stream and areas not yet developed within the FUZ at the time of construction).
- **High** level of effect for the loss in connectivity to bats due the presence of the road for Baseline and Future Environment as Sinton Stream corridor will be present within the FUZ.

The post mitigation level of effect is considered to be **Negligible** for construction related disturbance effects and **Low** for the same effect during operation. The post mitigation level of effect for loss in connectivity to bats during operation is considered to be **Low.**

9.4 Design and Future Regional Resource Consent Considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for Māmari Road.

9.4.1.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the NoR associated Māmari Road, including suitable habitat that is potentially being used by indigenous fauna (bats, birds and lizards). This includes vegetation clearance which is a permitted activity for infrastructure under the AUP:OP.

The amounts and types of terrestrial habitat and vegetation[25] (including habitat used by indigenous fauna) that could be lost as a result of the Project is presented in Table 9-13 under the footprint column. For context, the extent of similar habitat features are provided for the designation boundary.

The terrestrial habitats to be lost mostly comprised of exotic vegetation which are of **Low** or **Moderate** ecological value (Section 9.2.3.1). Some of these areas are likely to provide habitat to native fauna, as discussed in sections 9.4.1.2 to 9.4.1.4 below. As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support the resource consent application and should include any impact management requirements.

Table 9-13 Potential area of permanent terrestrial vegetation loss within the road footprint and designation footprint respectively for Māmari Road

Feature	Classification*	Footprint (m²)	Designation (m²)
Brown Field	BF	1064	2661

[25] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

Feature	Classification*	Footprint (m²)	Designation (m²)
Exotic Grassland	EG	70,609	44,937
Exotic Scrub	ES	848	712
Planted Vegetation – Native (recent)	PL.1	0	0
Planted Vegetation – Exotic (amenity)	PL.3	11,405	4,776
Treeland – Exotic-Dominated[26]	TL.3	3,000	500

9.4.1.2 Bats

Mature hedgerow and shelterbelt vegetation (mostly represented by exotic treeland – TL.3 represented by mature stands of pine trees south of Sinton Stream and north of Northside Drive) may provide potential habitat for bat roosts and facilitated bat movement in the broader landscape. The presence of bats in the wider area and potential effect of removing habitat of value to bats should be re-assessed prior to obtaining any regional resource consents for vegetation removal with 10 m of riparian strips and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

9.4.1.3 Birds

No threatened indigenous forest birds are likely within most of the proposed designation boundary, however spotless crake (At Risk – Declining) may be present associated with stormwater ponds. Vegetation clearance required for construction could result in the loss of vegetation features (ES, PL.3, TL.3) of local value to native birds, and will result in the loss of the pond. Vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because district plan trees include some TL.3.

9.4.1.4 Lizards

Copper skink are likely to be present within vegetation impacted by the Māmari Road project. There is the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953.

9.4.1.5 Freshwater Ecology

Notably the Sinton stream (and associated wetlands) will be bridged. However, based on the indicative design for the Project it appears that at least some of the streams will be culverted, resulting in a loss of instream and riparian habitat (Table 9-14). It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

[26] TL.3 includes district plan trees.

Table 9-14 Potential stream loss within the proposed designation boundary for Māmari Road

Stream ID	Hydroperiod	Active channel width (m)**	Length to be lost (m)**	Loss (m^2)
W2-S6	Permanent	1	65	65
W2-S7	Permanent	1.5	90	135

Notes: ** = Many assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, widths, lengths and areas are indicative.

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed as well as details regarding fish passage requirements. Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

9.4.1.6 Wetland Ecology

Construction of the Māmari Road project will result in the small loss of wetland extent associated with W2-W2 (approximately 30 m^2), a complete loss of pond W2-W3A (approximately 230 m^2) and a small portion of W2-W3 (approximately 60 m^2). Wetland loss is largely unavoidable with alternative alignments discounted due to additional effects on streams and wetlands. Additionally, hydrological inputs to wetlands can also be affected by construction activities due to construction phase stormwater management. Realignment may further reduce the loss of wetland extent associated with W2-W2 and W2-W3. However, complete avoidance of W2-W3A is unlikely. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

10 Brigham Creek Road Upgrade

10.1 Project Corridor Features

The Brigham Creek Road corridor features an east-west alignment, running on a watershed between the Totara Creek, Waiarohia and Ratara stream catchments. The corridor extents from an SEA (M2-57b and T_2034) associated with Totara Creek, to an SEA associated with Waiarohia Stream (T_4733). The corridor section east of the Trig Road interchange cross two small streams with associated wetlands, while the eastern section of the corridor runs parallel to a tributary of the Waiarohia Stream. The same tributary also presents a mature exotic treeline that is considered of relative ecological importance.

10.2 Existing and Likely Future Environment

10.2.1 Planning Context

The land adjacent to Brigham Creek Road is zoned under the AUP:OP as FUZ, except within the existing Whenuapai Centre (which is zoned under the AUP:OP for a range of residential and business zones) and the Whenuapai NZDF airbase. The airbase is designated (Designation 4310) for defence purposes by the Minister of Defence. The designation also includes the Residential – Single House Zone within the Whenuapai Centre.

PPC5 proposes to rezone the eastern portion of Brigham Creek Road on the south of the corridor to Business – Light Industrial zoning. The Whenuapai Structure Plan identifies medium density residential and business land uses to the south of Brigham Creek Road, with medium density residential land uses identified to the north.

Table 10-1 below provides a summary of the Brigham Creek Road existing and likely Future Environment.

Table 10-1 Brigham Creek Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[27]	Likely Future Environment[28]	Implications of Future Environment on Ecological Features
Business	Business (Light Industrial)	Low	Business (Light Industrial)	N/A
	Business (Local centre)	Low	Business (Local centre)	N/A
Residential	Residential	Low	Residential	N/A

[27] Based on AUP:OP zoning/policy direction
[28] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[27]	Likely Future Environment[28]	Implications of Future Environment on Ecological Features
Open Space	Open Space – Informal Recreation Zone	Low	Open Space	Potential increase in ecological in the future
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban	Loss or decrease of existing features. However, stream and wetland corridors are likely to persist in the Future Environment Mature exotic trees adjacent to the NoR, associated with the roadside and shelterbelt will be lost in the likely Future Environment, but may be present during the construction phase of the Brigham Creek corridor. These trees may assist ecological connectivity between the Totara Creek and Waiarohia catchments.
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Special Purpose – Airports and Airfields Zone	N/A

10.2.2 Permitted Activities and the Future Ecological Environment

The existing undeveloped greenfields adjacent to Brigham Creek Road are zoned FUZ in the AUP:OP are planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding street trees and notable trees), are identified as permitted activities within Chapters E26 and E15 of the AUP: OP. As such the ecological features (i.e. terrestrial habitat), excluding natural wetlands, streams and riparian edges, which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

10.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') currently present within the proposed designation boundary. All features within both study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within this NoR.

10.2.3.1 Terrestrial Habitat

Table 10-2 summarises the vegetation units associated with Brigham Creek Road. These habitats were classified according to Singers et al. (2017) and mapped in Appendix 5.

Table 10-2 Vegetation types present within Brigham Creek Road, categorised according to Singers et al. (2017)

Vegetation Type	Abbreviation	Description of Habitat
Brown Field (includes cropland)	BF	Industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, and gardens.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Generally growing along stream and roadside corridors. Dominant species include gorse and privet.
Planted Vegetation – Native (recent)	PL.1	Native planted vegetation mostly around the existing Brigham Creek and SH18 roundabout
Planted Vegetation – Exotic (amenity)	PL.3	Exotic amenity plantings. This includes parks and gardens and roadside vegetation dominated by exotic species and young shelter belt plantings
Treeland – Mixed Native/Exotic	TL.2	Mature treeland characterized by a mixture of native and exotic species. This habitat type was represented by a relatively small area north of Brigham Creek crossing the Waiarohia Stream
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. Treeland features are mostly present as shelter belts and riparian vegetation associated with the tributary of the Waiarohia Stream

10.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for the five NoRs (including Brigham Creek Road). The results of the bat survey are detailed in Appendix 12. Although bats were detected in the wider North

West study area, no bats were detected from the ABMs located within the Whenuapai Assessment Package ZOI, including Brigham Road Upgrade.

The Totara Creek-Brigham Creek crossing and the Waiarohia Stream-Brigham Creek crossing and their associated habitat may enable bat movement in the larger area and provide potential bat roosts and foraging habitat. Mature exotic shelterbelt and roadside planting link to habitat units such as exotic treeland (TL.3) may also provide bat refuge and maintain connectivity within an area with relatively high baseline fragmentation.

Birds

No dedicated bird surveys were undertaken for the Project. Incidental observations of bird species were noted and are presented in Table 10-3. The large stormwater pond to the south of Brigham Creek near the Upper Harbour Motor way offramp (167A Brigham Creek Road) may provide potential habitat for spotless crake (At Risk – Declining).

Table 10-3 Incidental bird observations at Brigham Creek Road and conservations status (Robertson et al., 2021)

Common Name	Māori Name	Scientific Name	Conservation Status
Myna	-	*Acridotheres tristis*	Introduced and Naturalised
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened
Swamp Harrier	Kāhu	*Circus approximans*	Not Threatened
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened

Lizards

Indigenous lizards were not identified during opportunistic searches completed during the site investigation. Copper skink have been recorded within 2 km of Brigham Creek Road. Copper skink habitat includes fragmented/modified treeland, exotic scrub, exotic wetland and rank grassland.

10.2.3.3 Terrestrial Ecological Value

Table 14-11 in Appendix 6 describes the terrestrial vegetation observed within Brigham Creek Road NoR and their ecological value in accordance with the EcIA Guidelines (EIANZ, 2018). The

ecological value for exotic grassland (EG) and exotic scrub (ES) was assessed as **Low**, while the ecological value was assessed as **Moderate** for exotic plantings (PL.3), native plantings (PL.1) and **High** for exotic treeland (TL.3)[29].

[29] The ecological value of brown fields was considered less than negligible and therefore was not assessed.

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with the EcIA Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk – Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments of for individual species are considered **Very High** for long-tailed bats and **High** for copper skink (Table 10-4).

Table 10-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Bats	Long-tailed bat	TL.3	Threatened - Nationally Critical	Very High
Birds	Spotless crake	Pond on 7 Spedding Rd	At Risk - Declining	High
Herpetofauna – lizards	Copper skink	EG, ES, PL.3, PL.1 and TL.3	At Risk - Declining	High

10.2.3.4 Freshwater Habitat

All streams within the proposed designation boundary for Brigham Creek Road were numbered, classified (permanent, intermittent or ephemeral) and mapped (Appendix 5). A Rapid Habitat Assessment was completed for all permanent and intermittent streams that could be accessed within Brigham Creek Road corridor.

Stream classification and description

Eight stream branches were identified during the desktop and site investigations within a 100 m buffer of Brigham Creek Road, however only six of these are within the Brigham Creek Road designation boundary. The streams are mapped in Appendix 5 and are listed in Table 10-5.

Table 10-5 Summary of Brigham Creek Road stream classifications and descriptions

Stream Number	Classification	Barrier type	Upstream fish habitat
W3-S1*	Permanent	Partial barrier to fish migration	Very Likely
W3-S3*	Intermittent	Total barrier to fish migration	Unlikely
W3-S4	Permanent	Total barrier to fish migration	Likely
W3-S5	Intermittent	Partial barrier to fish migration	Likely

Stream Number	Classification	Barrier type	Upstream fish habitat
W3-S7	Permanent	Partial barrier to fish migration	Very Likely
W3-S8	Permanent	Partial barrier to fish migration	Very Likely

Notes: * = Streams assessed at a desktop level.

National Rapid Habitat assessment

Six intermittent or permanent stream branches were assessed during site investigations and surveyed using the RHA. Two streams were not accessible, and their ecological value was assessed at a desktop level (Section 10.2.3.6). The results of the RHA values are presented Appendix 10 and measured a **Moderate** habitat quality score for sites W3-S2, W3-S6, W3-S7 and a **Poor** score for the remainder in Table 14-24.

10.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however two 'At Risk – Declining' species, īnanga and longfin eel have been recorded in Waiarohia Stream and Totara Creek (Table 6-5).

The freshwater habitats within the NoR were assessed for their potential to support indigenous fish during the RHA. Potential habitat, such as undercut banks, overhanging vegetation and macrophytes were observed at the time of survey.

As longfin eels are a climbing species which can survive for short periods outside of water, the barriers within the existing stream were identified as unlikely to prevent their migration.

10.2.3.6 Freshwater Ecological Value

Table 14-16 Appendix 6 presents the ecological value for the freshwater habitats identified within Brigham Creek Road (Appendix 1). Information obtained for the ecological baseline (Section 10.2.3.4 and 10.2.3.5), as well as the area wide desktop assessment (Section 6.3), was used to score the matters that inform the ecological value. Further detail on how the matters assessment was undertaken is included in Table 14-2 Appendix 1.1. The ecological value was assessed as **Moderate** for W3-S1, W3-S4, W3-S7 and W3-S8 and **Low** for W3-S3 and W3-S5.

10.2.3.7 Wetland Habitat

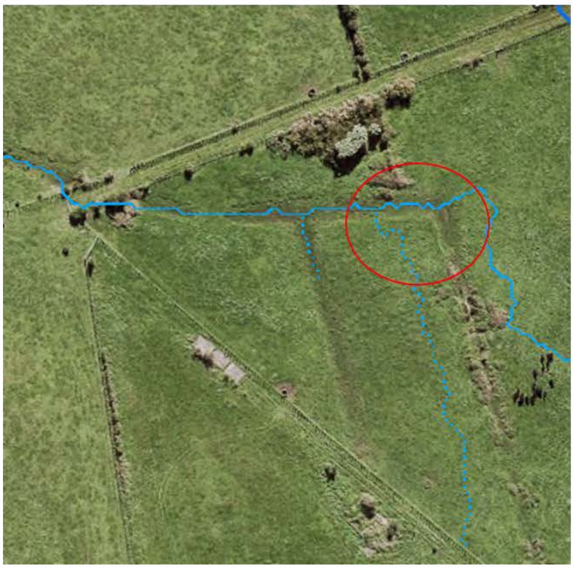
The detailed results of vegetation cover, wetland soil and hydrology indicators are provided in Appendix 11. Five wetlands directly associated with Brigham Creek Road designation have been identified and assessed. Wetland W3-W2 and W3-W4 were assessed at desktop level. While all other wetlands were subject to a site assessment.

W3-W2 (20-22 Brigham Creek Road)

A relatively large seep system to the north of Brigham Creek draining a small sub-catchment of the Slaughter House Stream. The wetland was assessed at desktop level with the extent indicated by structural differences in vegetation cover between terrestrial and wetland areas. The wetland is likely to meet the definition of a natural wetland under the NPS-FM. The wetland is affected by historical draining and vegetation clearance associated with agricultural practices.

W3-W4 (96 Trig Rd)

Wetland represented a narrow valley bottom system with hillslope seeps to the south-west of the Brigham Creek and Trig Road roundabout. The wetland is associated with a headwater stream that has been historically drained. The desktop delineation was informed by structural differences in vegetation. The direct catchment of the wetland is affected by pasture and horticulture. The wetland is affected by historical attempts to drain the local catchment and straighten the stream. A review of historical images could not confirm the historical wetland presence and it may therefore be possible to exclude the feature from an NPS-FM natural wetland as artificial (Figure 10-1). A site visit will be required at the regional consent stage to confirm the status of the wetlands.



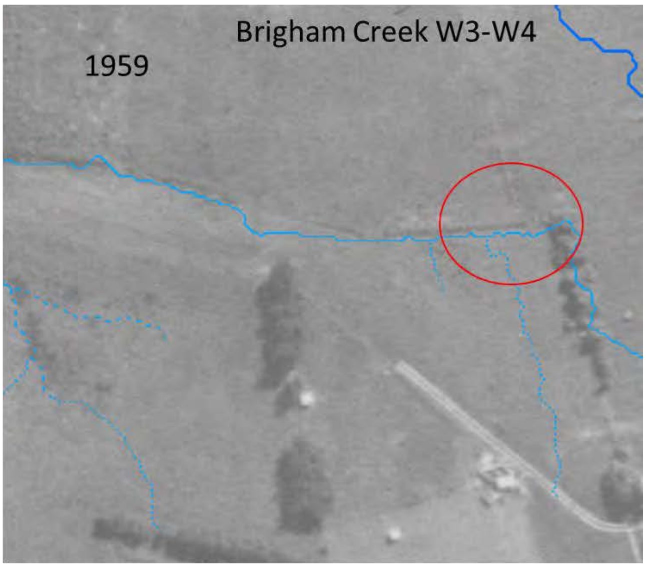


Figure 10-1 Comparison of W3-W4 during 2017 and 1959.

W3-W5 & W3-W5A (153 Brigham Creek Rd)

The wetland represents a channelled valley bottom system with areas of permanent and seasonal saturation. The wetland drains the upper catchment of a relatively large tributary of the Waiarohia Stream. The wetland extent was mainly consistent with the distribution of facultative (*Cordyline australis*) and facultative wetland (*J. effusus*) vegetation. Native sedges represent a relatively large portion of the vegetation cover. W3-W5A wetland vegetation was classified as WL11 and represents a Critically Endangered vegetation type. Areas with permanent saturation were indicated by an increase in organic matter in the topsoil layer associated with an underlying gleyic (mineral wetland) soils. The upslope catchment mainly drains the airfield and portions of the existing Brigham Creek Road. The hydrology of the wetland has been modified by a large upslope dry detention pond. The wetland is considered an NPS-FM natural wetland.

W3-W7 (150-152 Brigham Creek)

The wetland situated north-east of Brigham Creek Road and 250 m north-west of Kauri Road. The wetland is historically represented by an unchanneled valley bottom system but have been modified by a large upslope pond and a present-day channel. The wetland drains a relatively small first order catchment which is part of the larger Waiarohia Stream catchment. The wetland extent was indicated by facultative wetland species including *J. effusus, Persicaria maculosa* and *Cyperus eragrostis*. permanent and seasonal wetland soils were indicated by organic matter accumulation, gleyic and mottle soils. The wetland is considered an NPS-FM natural wetland.

W3-W8 (167A Brigham Creek)

Wetland W3-W8 is an artificial stormwater wetland. The ecological functions of this feature are consistent with that of a depression wetland. The wetland features associated with the stormwater pond is excluded from being NPS-FM natural wetland due to it being artificial.

10.2.3.8 Wetland Ecological Value

Table 14-21 in Appendix 8 represents the ecological value for the wetland habitats identified within Brigham Creek Road. Information obtained for the ecological baseline (Section 10.2.3.7) was used to score the matters that inform the ecological value. Further detail on how the matters assessment was undertaken is included in Appendix 1. The value categories were assessed as **Moderate** for W3-W2, W3-W5 and W3-W7 and **Low** for W3-W4. The stormwater wetland (W3-W8) and W3-W5A (WL11) were assessed as **High** value.

10.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 10.3 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP. Refer to Section 3.2 for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

10.3.1 Construction Effects - Terrestrial Ecology

The potential construction effects (direct and indirect) to the terrestrial habitat and species within Brigham Creek Road (as they relate to district matters) were the same as for Trig Road North (Section 8.3.1).

10.3.1.1 Terrestrial vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and also detailed in the table below. The effects of district plan vegetation removal on fauna i.e., bats and birds (as it related to loss in foraging habitat, mortality and injury) are discussed in sections 10.3.1.2 and 10.3.1.3.

Table 10-6 Brigham Creek Road: Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction

Effect Description	Baseline Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	TL.2 (total area of 148.5 m²) The magnitude of effect is assessed as **Negligible** due to the small extent of TL.2 within the existing road corridor and the unlikely probability that the vegetation loss will result in	Treeland vegetation mostly associated with Waiarohia tributary and Waiarohia Stream. These features will likely remain in the Future Environment and as such the effect is expected to be the same as Baseline

Effect Description	Baseline Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
	additional fragmentation and edge effect. The ecological value of TL.2 is assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **TL.3 (total area of 3220.83 m²)** The magnitude of effect is assessed as **Low** due to the relatively large extent of TL.3 within the existing road corridor and the likelihood that this effect may occur. The ecological value of TL.3 is assessed to be **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

10.3.1.2 Bats

Bats may utilise the land within the proposed designation boundary for Brigham Creek Road for roosting, foraging or commuting. Specifically, mature trees associated with mixed and exotic treeland stands (TL.2 and TL.3 respectively). Most notably the following:

- Mature stands of exotic *Pinus radiata* to the south of Brigham Creek Road and 190 m east of Totara Creek (31 Brigham Creek Road);
- Stand of pine trees located on the airfield, north of Brigham Creek Road and opposite 155-157 Brigham Creek Road;
- Areas of mature poplar, willow and pine stands associated with the Waiarohia Stream tributary where this tributary runs parallel and to the south of Brigham Creek Road (155 to 163 Brigham Creek Road;
- The mixed native and exotic treeland associated with Waiarohia Stream riparian area, north-east of the Brigham Creek and Waiarohia Stream crossing.

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. The results of the bat survey did not confirm the presence of bats associated with the Waiarohia Stream corridor.

Additionally, bats may be impacted by removal of district plan vegetation through the following effects[30]:

- Loss of foraging habitat
- Mortality or injury to bats

Table 10-7 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

30 Roost lost has been considered but discounted as an effect as the **consequences** of roost loss (if it does occur) is less than **Negligible** in the context of this NoR.

Table 10-7 Brigham Creek Road: Assessment of construction effects and impact management for bats

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to relatively short period of construction related effects, the localised extent of any disturbance and the low baseline bat activity rate (infrequent or occasional). The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation.	Same as Baseline. Waiarohia and Totara Creek riparian features may provide potential bat habitat within the FUZ.	**Loss of foraging habitat** The magnitude of effect is assessed as **Negligible** due to small contribution of district plan trees to the available foraging habitat. The ecological value of bats is assessed as **Very High** and the overall level of effect is assessed as **Low** prior to mitigation. **Mortality or injury to bats** The magnitude of effects is assessed as **Low** due to a higher likelihood associated with the roost potential of the district plan trees and the overall level of effect is assessed as **Moderate** prior to mitigation.	**Loss of foraging habitat** District plan tree features are associated with stream corridors for this NoR and likely to remain in the future environment, as such the level of effects will be the same as the Baseline. **Mortality or injury to bats** The likelihood of the effect occurring in the future is expected to be the same as for the Baseline (i.e., trees with roost potential will remain present) and therefore the level of effect will be the same as the Baseline.
Impact management and residual level of effect	Mitigation measures are the same as for Trig Road North outlined in Table 8-7.	Same as Baseline, but subject to the presence of suitable bat habitat.	Mitigation measures are the same as for Trig Road North outlined in Table 8-7.	**Loss of foraging habitat** N/A **Mortality or injury to bats** Same as Baseline.

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	The post mitigation level of effect can be reduced to **Negligible.**		The post mitigation level of effect can be reduced to **Negligible.**	
Management of residual effect	N/A	N/A	N/A	N/A

10.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the proposed designation boundary for Brigham Creek Road. While the same impact may occur for spotless crake (At Risk – Declining) potentially using the stormwater pond on 167A Brigham Creek Road. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Table 10-8 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation. The effect assessment is presented for non-TAR birds (or forest birds) and for TAR birds (spotless crake separately.)

Table 10-8 Brigham Creek Road: Assessment of construction effects and impact management for birds

Effect description	**Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)**		**Effects due to removal of district plan vegetation:** - **Loss of foraging habitat** - **Nest loss** - **Mortality or injury to birds**	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the Brigham Creek Road NoR. The ecological value of birds in the context of the Brigham Creek Road habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. **TAR bird (spotless crake)** The magnitude of effect is assessed as **Moderate** due to a higher probability (likely association of spotless crake with the habitat and the extent of construction disturbance to the habitat). The ecological value of spotless crake is **High**, and the overall level of effect due to construction	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** for all three effects associated with district plan tree removal. This is due to the extent of district plan vegetation present and the high likelihood of these effects occurring. The ecological value of birds is assessed as **Low**, and the overall level of effect due district plan vegetation removal is assessed as **Low** prior to mitigation. **TAR bird (spotless crake)** Will not be affected by district plan vegetation removal	Same as Baseline.

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	disturbance is assessed as **High** prior to mitigation.			
Impact management and residual level of effect	The Bird Management Plan should consider the following: • Bird survey prior to construction to confirm presence/likely absence of any TAR species. • Where practical, construction works for the stormwater pond should commence prior to the bird breeding season (September to February) on order to discourage bird nesting. • Bird management should be consistent with any regional consent conditions that may be required for regional compliance. The residual impact is assessed as **Low** post mitigation.	Same as Baseline.	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February), or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.
Management of residual effect	N/A	N/A	N/A	N/A

10.3.1.4 Lizards

Construction effects on lizards associated with noise, light and vibration is assessed as **Negligible** (Table 10-9). It is expected that the effects on lizards due to vegetation removal will be assessed under Regional matters and is further discussed in Section 10.4.1.4.

Table 10-9 Brigham Creek Road: Assessment of construction effects and impact management for lizards

Effect description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the unlikely probability of lizard disturbance linked to construction related noise and vibration. The ecological value of copper skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no additional mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

10.3.2 Operational Effects - Terrestrial Ecology

The Brigham Creek Road Project involves the upgrade the existing Brigham Creek Road within a mixed rural and urban landscape under present conditions and a future urban environment. The corridor will be urbanised, however some greenfields may remain within the airbase. Potential operational effects from the Project that relate to district plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

10.3.2.1 Bats

The loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can negatively influence bat behaviour. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

The level of effect on bats due to operational impacts associated with loss of connectivity was assessed in the context of confirmed bat activity in the broader landscape, the existing degree of fragmentation and that of the future urban environment. The effects assessment considered both the Baseline and the Future Environment. Table 10-10 outlines the operational effects assessment and impact management for bats.

Table 10-10 Brigham Creek Road: Assessment of operational effects and impact management for bats

Effect description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively localised extent of additional disturbances to individual bats and roosts. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for disturbances to individual bats and roosts.	Same as Baseline. Waiarohia and Totara Creek riparian features with bat habitat potential will remain present within the FUZ.	The magnitude of is assessed as **Moderate** due the increased probability of additional fragmentation specifically associated with the Project around the Waiarohia Stream. The ecological value of bats is assessed to be **Very High**, and the level of effect is assessed as **High** for loss in connectivity due to the presence of the road.	Same as Baseline. Waiarohia and Totara Creek riparian features with bat habitat potential will remain present within the FUZ.
Impact management and residual level of effect	Mitigation measures are the same as for Trig Road North outlined in Table 8-10, with the addition of buffer planting both sides of the road corridor associated with Waiarohia stream crossing to further reduce noise and light resulting in disturbance from the road. The post mitigation level of effect can be reduced to **Low** for both effects.	Same as Baseline.	Mitigation measures are the same as for Trig Road North outlined in Table 8-10, with the addition of buffer planting both sides of the road corridor associated with Waiarohia stream crossing to further reduce noise and light resulting in disturbance from the road. The post mitigation level of effect can be reduced to **Low** for both effects.	Same as Baseline.

Effect description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

10.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Brigham Creek Road. The stormwater pond on 167A Brigham Creek will remain in place and functional during, as such no noise, vibration, and lighting disturbance effects on TAR birds are expected. Table 10-11 outlines the operational effect assessment and impact management for birds.

Table 10-11 Brigham Creek Road: Assessment of operational effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low**, as Brigham Creek Road is along the existing Brigham Creek Rd and birds are likely to be habituated to noise, light and vibration from the road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **TAR birds** Stormwater pond will be upgraded and operational.	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Low** due to the likely probability and local extent of effect. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **TAR birds** Stormwater pond will be upgraded and operational.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A

Effect description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

10.3.2.3 Lizards

Exotic scrub, exotic treeland edge rank grassland, riparian and wetland habitat suitable for copper skink have been identified within the Brigham Creek Road NoR, which could potentially support native copper skink (At Risk – Declining). Brigham Creek Road corridor includes upgrading the existing Brigham Creek Road. The proposed upgrade is therefore not expected to result in the additional fragmentation of lizard habitat. Similarly, resident (existing and future) copper skink are likely to be habituated to disturbance such as noise, vibration and lighting and no additional effect on copper skink is expected provided the post-upgraded road will not result in higher levels of noise and vibration. Table 10-12 outlines the operational effect assessment and impact management for lizards.

Table 10-12 Brigham Creek Road: Assessment of operational effects and impact management for lizards

Effect description	Disturbance and displacement of existing and future copper skink due to light, noise and vibration effects from the presence of the road		Additional loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** as skinks are likely to be acclimatised to the existing disturbances emanating from Brigham Creek Road. The ecological value of copper skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** as skinks are relatively resident with low requirement for movement between habitat units. The ecological value of copper skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

10.3.3 Conclusions

The ecological level of effects assessed as more than **Moderate** for Brigham Creek Road include:

- **Moderate** level of effect for noise and light disturbance of individual bats or roosts during construction and operation for Baseline and Future Environment (assuming the presence of potential bat habitat around Waiarohia Stream and areas not yet developed within the FUZ at the time of construction).
- **Moderate** level of effect associated with the killing or injuring of individual bats due to the removal of district plan vegetation for Baseline and the Future Ecological Environment.
- **High** level of effect for noise and vibration disturbance to TAR birds (spotless crake) or nests during construction at the stormwater pond for both the Baseline and Future Environment.
- **High** level of effect for the loss in connectivity to bats due to the presence of the road for both the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Negligible** for disturbance to bats during construction and operation, and **Negligible** for killing or injuring bats due to removal of district plan vegetation. The construction disturbance effect on birds is considered **Negligible** post mitigation (and is only relevant for the construction phase). The post mitigation level of effect for loss in connectivity to bats during operation is considered to be **Low**.

10.4 Design and Future Regional Resource Consent Considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for Brigham Creek Road.

10.4.1.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the proposed designation boundary for Brigham Creek Road, including suitable habitat that is potentially being used by indigenous fauna (bats, birds and lizards). This includes vegetation clearance which is a permitted activity for infrastructure under the AUP:OP.

The amounts and types of all terrestrial habitat and vegetation[31] (including habitat used by indigenous fauna) that could be lost as a result of the Project is presented in Table 10-13 under the footprint column. For context, the extents of similar habitat features are provided for the secondary study area.

The terrestrial vegetation to be lost mostly comprised of **Low** value exotic grassland, while woody vegetation was assessed as **Moderate** value. However, ecological value of the mature exotic treeland (TL.3) associated with Waiarohia Stream requires separate mention as is it plays an important role in buffering and connectivity (Appendix 5.1.3). Some of these areas are likely to provide habitat to native fauna, as discussed in sections 10.4.1.2 to 10.4.1.4 below. As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support the resource consent application and should include any impact management requirements.

[31] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

Table 10-13: Potential area of permanent terrestrial vegetation loss within the road footprint and designation footprint respectively for Brigham Creek Road

Feature	Classification*	Footprint (m²)	Designation (m²)
Exotic Grassland	EG	59,422	52,845
Exotic Scrub	ES	614	758
Planted Vegetation – Native (recent)	PL.1	6,764	3,373
Planted Vegetation – Exotic (amenity)	PL.3	3,637	4,244
Treeland – Exotic-Dominated[32]	TL.3	1,868	1,922

10.4.1.2 Bats

Mature hedgerow, shelterbelt and riparian vegetation represented by TL.3 may provide potential habitat for bat roosts and facilitated bat movement in the broader landscape. The presence of bats in the wider area and potential effect of removing habitat of value to bats should be re-evaluated as part of the resource consent phase, prior to obtaining any regional resource consents for vegetation with 10 m of riparian strips and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

10.4.1.3 Birds

No threatened indigenous birds are likely within most of the NoR. However, spotless crake (At Risk – Declining) is likely to use the stormwater pond habitat on 167A Brigham Creek Rd. Vegetation clearance required for construction could result in the loss of vegetation features (PL.1, PL.3, and TL.3) of local value to native birds. Any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. To mitigate TAR species mortality and habitat removal, a Bird Management Plan may be developed during the future resource consent process to minimise any such effects. The loss of some of this habitat is already assessed because they are district plan trees.

10.4.1.4 Lizards

Indigenous copper skink are likely to be present for most of the vegetation impacted by Brigham Creek Road. Therefore, there is potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953.

10.4.1.5 Freshwater Ecology

The existing Waiarohia Stream and Brigham Creek Road crossing will be upgraded to a bridge Figure 10-2 (the existing structure is undersized and does not conform with New Zealand Fish Passage Guidelines (2018)).

[32] TL.3 includes district plan trees.

During the detailed design phase culvert design will be confirmed. The road upgrade will result in loss of instream and riparian habitat specifically around the stream crossing on 150-152 and 163 Brigham Creek Road (Table 10-14). It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 10-14 Potential stream loss within Brigham Creek Road

Stream ID	Hydroperiod	Active channel width (m)**	Length to be lost (m)**	Loss (m^2)**
W3-S4	Permanent	1.5	100	150
W3-S5	Intermittent	1	25	25

Notes: ** = Many assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, widths, lengths and areas are indicative.

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed as well as details regarding fish passage requirements. Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

Figure 10-2 Under sized Waiarohia culvert

10.4.1.6 Wetland Ecology

Construction of the Brigham Creek Road will result in the temporary impact of a **High** value wetland (W3-W5) due to the construction of pipe/drain in order to facilitate stormwater runoff around the Spark network property. The effect on wetland extent and value is expected to be temporary as the wetland will be reinstated after construction.

The road upgrade will result in the permanent loss of a portion of wetland W3-W5A and W3-W7 (in total approximately 1300 m^2). Wetland loss is largely unavoidable as the MCA considered the overall effects on wetland extent and value for alternative designation boundaries. Additionally, hydrological inputs to wetlands can also be affected by construction activities due to construction phase stormwater management.

It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

11 Spedding Road Upgrade

11.1 Project Corridor Features

The Spedding Road corridor features an east-west alignment, running roughly parallel to Brigham Creek Road. The eastern section of the corridor roughly fragments the Waiarohia catchment in half and crosses the Trig, Rāwiri streams and associated tributaries. The western section includes an upgrade of Northside Drive and an extension over Totara Creek (upslope from an SEA M2-57b and T_2034) prior to crossing SH16 and transecting several mature exotic shelterbelts. A number of wetlands will be affected by the corridor most notably by the eastern portion, while the exotic scrub (ES) between the Trig and Rawiri stream confluence may provide relatively high value lizard habitat. Native vegetation associated with the corridor consists of road site planting along the Upper Harbour Highway.

11.2 Existing and Likely Future Environment

11.2.1 Planning Context

The land on either side of Spedding Road is zoned under the AUP:OP as FUZ, with the exception being the Business – Light Industry Zone within the Hobsonville Corridor Precinct.

On the eastern end of the corridor PPC5 proposes to rezone the surrounding FUZ land to Business – Light Industry Zone in the north and Residential - Mixed Housing Urban Zone and Open Space – Informal Recreation zone in the south. The remainder of the land to the south of falls within the Hobsonville Corridor Precinct.

PPC5 proposes a heritage overlay 4 Spedding Road and 92 Trig Road, which has legal effect under section 86B (3) (d) of the RMA. The overlay relates to four concrete gun emplacements and command post that made up the Whenuapai Aerodrome Heavy Anti-Aircraft Battery and are buried underground.

The Whenuapai Structure Plan identifies the land surrounding the existing central section and proposed western end of the corridor for business.

The western section of the proposed corridor extends across SH16 and the eastern section across SH18, both SH16 and SH18 are designated by Waka Kotahi for State Highway purposes (Designation 6741).

Table 11-1 below provides a summary of the Spedding Road existing and likely future environment.

Table 11-1 Spedding Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[33]	Likely Future Environment[34]	Implications of Future Environment on Ecological Features
Business	Business (Light Industrial)	Low	Business (Light Industrial)	N/A
Residential	Residential	Low	Residential	N/A
Undeveloped greenfield areas (Future UrbanZone)	Future Urban	High	Urban	Mature trees associated with roadside and shelterbelt will be lost in the Future Environment. These trees may assist ecological connectivity between the Totara Creek and Waiarohia catchments. The stream corridors are likely to remain intact within the Future Environment and will therefore play an important role in ecological connectivity within the post developed landscape.

11.2.2 Permitted Activities and the Future Ecological Environment

The existing undeveloped greenfields adjacent to Spedding Road are zoned FUZ in the AUP:OP, and as such is planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding street trees and notable trees), are identified as permitted activities within Chapters E26 and E15 of the AUP: OP. As such the ecological features (i.e. terrestrial habitat), excluding natural wetlands, streams and riparian edges, which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

[33] Based on AUP:OP zoning/policy direction
[34] Based on AUP:OP zoning/policy direction

11.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') present within Spedding Road designation boundary. All features within both study areas were investigated and mapped to provide context within potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within the study areas.

11.2.3.1 Terrestrial Habitat

Table 11-2 summarises the vegetation units associated with Spedding Road. These habitats are spatially represented in Appendix 5.

Table 11-2 Vegetation types present within Spedding Road, categorised according to Singers et al. (2017)

Vegetation Type	Abbreviation	Description of Habitat
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. The largest extent of ES was found between Trig and Rawiri streams, near their confluence. ES was also associated with wetland units W4-W1 and W4-W2 near Totara Creek (Section 5.1.4).
Planted Vegetation – Native (recent)	PL.1	Native planted vegetation mostly around parts of Rawiri and Totara Creek stream corridors, including the Rawiri Place stormwater pond (north of the designation). Extensive native planting around SH18 and the Spedding Road crossing.
Planted Vegetation – Native (mature)	PL.2	Relatively small patch of native planting with exotic pioneers along parts of SH18.
Planted Vegetation – Exotic (amenity)	PL.3	For Spedding Road, PL.3 mainly represent gardens and young shelter belt plantings.
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. TL.3 represented by mature shelter belts, roadside planting and stream vegetation (notable around Totara Creek).

11.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for the five NoRs (including Spedding Road Upgrade). The results of these are detailed in Appendix 12. Exotic treeland (TL.3) habitat associated with roadsides, shelter belts and with Totara Creek, Trig and Rawiri Streams may provide bat habitat and play an important role in ecological connectivity for bats within the broader landscape.

Birds

No dedicated bird surveys were undertaken for the Project. Incidental observations of birds for Spedding Road are noted in Table 11-3. No TAR species were observed during site investigations and no TAR species are expected to be associated with the habitat affected by the Spedding Road corridor.

Table 11-3 Incidental bird observations at Spedding Road and conservations status (Robertson et al., 2021)

Common Name	Māori Name	Scientific Name	Conservation Status
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened
Silvereye	Tauhou	*Zosterops lateralis*	Not Threatened
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised
Tūī	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened

Lizards

Indigenous lizards were not identified during opportunistic searches completed during the site investigation. Copper skink have been recorded within 3 km of Spedding Road. Copper skink may utilise most of the habitat associated with Spedding Road, but the extent of exotic scrub (ES) between the Trig and Rawiri streams confluence may be more productive for copper skink compared to other habitats of the NoR due to the extent of exotic scrub and connectivity to the stream corridors.

11.2.3.3 Terrestrial Ecological Value

Table 14-12 in Appendix 6 describes the terrestrial vegetation observed within Spedding Road NoR and their ecological value in accordance with the EcIA Guidelines (EIANZ, 2018). The ecological value for exotic grassland (EG) was assessed as **Low**, and exotic scrub (ES) and mixed planting (PL.2) was assessed as **Moderate**. Native plantings (PL.1), and exotic treeland (TL.3) were assessed as **High**[35].

[35] The ecological value of brown fields was considered less than negligible and therefore was not assessed.

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with the EcIA Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk – Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments of for individual species are considered **Very High** for long-tailed bats and **High** for copper skink (Table 11-4).

Table 11-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Bats	Long-tailed bat	TL.3	Threatened - Nationally Critical	Very High
Herpetofauna – lizards	Copper skink	EG, ES, PL.3, PL.1 and TL.3	At Risk - Declining	High

11.2.3.4 Freshwater Habitat

All streams within Spedding Road were numbered, classified (permanent, intermittent or ephemeral) and mapped (Appendix 5). A RHA was completed for all permanent and intermittent streams that could be assessed within the Spedding Road corridor.

Stream classification and description

Ten stream branches were identified during the desktop and site investigations within the designation boundary of Spedding Road and a 100 m radius therefore. The streams are mapped in Appendix 5 and are listed in Table 11-5.

In summary, streams within the Spedding Road designation were classified[36] as follows:

- Four stream branches were identified as intermittent
- Six stream branches were identified as permanent.

The barrier to fish migration was assessed at each stream, to describe any fragmentation or loss of connectivity. This is described as either total barrier, partial barrier or no barrier to fish migration.

[36] using the overland flow path layer from the Auckland Council Geomaps website https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

Table 11-5 Summary of Spedding Road stream classifications and descriptions

Stream Number	Classification	Barrier type	Upstream fish habitat
W4-S1*	Permanent	Partial barrier to fish migration	Very Likely
W4-S2*	Permanent	Partial barrier to fish migration	Very Likely
W4-S3*	Intermittent	Total barrier to fish migration	Likely
W4-S4	Intermittent	Total barrier to fish migration	Likely
W4-S5	Permanent	Partial barrier to fish migration	Likely
W4-S6*	Intermittent	Partial barrier to fish migration	Likely
W4-S7	Permanent	Partial barrier to fish migration	Very Likely
W4-S8	Permanent	Partial barrier to fish migration	Very Likely
W4-S9	Permanent	Partial barrier to fish migration	Very Likely
W4-S10	Intermittent	Partial barrier to fish migration	Likely

Notes: * = Streams assessed at a desktop level

National Rapid Habitat assessment

Seven of the ten intermittent or permanent stream branches were assessed during site investigations and surveyed using the RHA. Three streams could not be accessed, therefore an RHA was not completed for these streams and the ecological value was assessed at a desktop level (Section 11.2.3.6). The results of the RHA values are presented Appendix 10 and measured a **Good** habitat quality score for site W4-S9, a **Moderate** habitat quality score for W4-S5 and a **Poor** score for the remaining in Table 14-25.

11.2.3.5Freshwater Fauna

Fish surveys were not carried out during site investigations, however two ‘At Risk – Declining’ species, īnanga and longfin eel have been recorded upstream of all W4-S1, W4-S2 and W4-S3 in Totara Creek, and īnanga recorded upstream of W4-S4 to S10, in Waiarohia Stream (Table 6-5).

11.2.3.6Freshwater Ecological Value

Table 14-17 in Appendix 7 shows the ecological value for the freshwater habitats identified within Spedding Road. Information obtained for the ecological baseline (Section 11.2.3.4 and 11.2.3.5), as well as the area wide desktop assessment (Section 6.3), was used to score the matters that inform the ecological value. The ecological value was assessed as **Moderate** for W4-S1 to W4-S8, **High** for W4-S9 and **Low** for W4-S10.

11.2.3.7Wetland Habitat

The detailed results of vegetation cover, wetland soil and hydrology indicators are provided in Appendix 11. Seven wetlands directly associated with Spedding Road designation have been identified and assessed. Wetlands W4-W1 and W4-W2 was assessed at desktop level due.

W4-W1 and W4-W2 (15-19 Spedding Rd)

Wetlands were assessed at a desktop level due to access constraints. The extent of both wetlands was based on structural differences in vegetation and differences in exposed soils (through ploughing) assessed through comparing historical images. Both wetlands drain relatively small sub-catchments of the receiving Totara Creek. Total Creek and associated riparian features downslope of Spedding Road represents an SEA (M2-57b and T_2034). Wetlands are modified by agricultural activity and historical drainage. Wetland hydrology is likely to be consistent with that of a seasonal seep based on catchment size and slope. Both wetlands are likely to meet the NPS-FM wetland definition.

W4-W3 (15-19 Spedding Rd)

Wetland W4-W3 was located south of Spedding Road and represents a depression wetland and was assessed on site. The wetland extent was mainly consistent with the distribution of facultative (*Ranunculus repens*), facultative wetland (*J. effusus*) vegetation and a stand of Willow trees. The mineral soil was indicative of permanent saturation. Based on the small catchment, it is likely that the wetland is spring fed. Attempts at draining the wetland has been unsuccessful. The wetland is considered a natural wetland under the NPS-FM.

W4-W3A (49 Trig Rd)

Valley bottom wetland associated with a stream channel and lateral seeps (i.e., the wetland extent is independent from flows within the stream) draining one of four sub catchments of the Waiarohia Stream. Wetland dominated by exotic species. Wetland vegetation indicators were generally ambiguous, with a dominance of *Pennisetum clandestinum*. Areas of more pronounced seepage was indicated by *J. effusus*. The wetland extent more accurately informed the seasonally saturated mineral soils. Portions of the valley bottom indicated permanently saturated soils. The wetland is impacted by pastural activity, a road crossing, recent infilling within the direct catchment (to the south). The wetland is considered an NPS-FM natural wetland.

W4-W4

Wetland W4-W4 is similar to W4-W3A in landform and hydrology. The wetland represents the hillslope seeps associated with Trig Stream and Waiarohia tributary at and upslope of their confluence approximately where the SH18 cross the system. The lateral extent of the wetland was indicated by *Glyceria* sp. and *Juncus* sp., while the soils were indicative of seasonal and permanent saturation. Areas of leached iron were sporadically located within the stream channel indicated the contribution hillslope seepage to stream flows. The wetland was realigned for SH18 and was historically greater in extent.

W4-W5 (100 Hobsonville Rd)

Wetland W4-W5 is consistent with an induced wetland. A review of historical images suggest that the system was more riverine (Rawiri Stream). The wetland extent was influence by upslope ponding at the existing SH18 crossing and drains all of the Rawiri catchment prior to its confluence with the Trig Stream. The wetland is dominated by *Glyceria* and is considered a natural wetland under the NPS-FM.

W4-W6 (4-6 Rawiri Pl)

Wetland W4-W6 is an induced wetland formed due to the realignment of a tributary of the Rawiri Stream for development around Rawiri Place. The tributary was piped from the south eastern corner of 4 Rawiri Pl and drains west prior to discharging into the Rawiri Stream at the south western corner of 6 Rawiri Pl. It is possible (although uncertain at the time writing) that the wetland is part of the stormwater management of the development around Rawiri Pl, in which instance it may be considered as artificial under the NPS-FM. The intentional use of the feature as part of stormwater will have to be confirmed before confirming exclusion as a natural wetland.

11.2.3.8 Wetland Ecological Value

Table 14-22 in Appendix 8 presents the ecological value for the wetland habitats identified within Spedding Road corridor. Information obtained for the ecological baseline (Section 11.2.3.7) was used to score the matters that inform the ecological value. The value categories were **Negligible** for W4-W6, **Moderate** for W4-W3, W4-W3A, W4-W4 and W4-W5 and **Low** for W4-W1 and W4-W2.

11.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 11.3 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP. Refer to Section 3.2 for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

11.3.1 Construction Effects - Terrestrial Ecology

The potential construction effects (direct and indirect) to the terrestrial habitat and species within Spedding Road (as they relate to district matters) were the same as for Trig Road North (Section 8.3.1).

11.3.1.1 Terrestrial vegetation

Vegetation to be removed that is subject to district plan controls is presented in Appendix 5 and also detailed in the table below. The effects of district plan vegetation removal on fauna i.e. bats and birds (as it relates to loss in foraging habitat, and mortality and injury) are assessed in sections 11.3.1.2 and 11.3.1.3.

Table 11-6 Spedding Road: Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**TL.3 (total area of 1009.77 m²)** The magnitude of effect is assessed as **Low** due to the relatively large extent of TL.3 within the existing road corridor and the likelihood that this effect may occur. The ecological value of TL.3 is assessed to be **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	It is assumed that urbanisation (and the associated tree removal) may not have occurred at the time of road construction. As such the level of effects will be the same as the Baseline.

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	Likely Future Ecological Environment
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

11.3.1.2 Bats

Bats may utilise the area associated with Spedding Road for roosting, foraging or commuting. Specifically, mature trees associated with exotic treeland stands (TL.3). Most notably the following:

- Mature exotic trees around Totara Creek;
- Mature exotic trees forming the shelter belt and roadside planting north of the existing Spedding Road near the Trig Road intersection (4-6 Spedding Rd and 92 Trig Rd);
- Mature trees associated with Waiarohia tributary (49 Trig Rd and the shelterbelt on 53 Trig road)

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works.

Additionally, bats may be impacted by removal of district plan vegetation through the following effects[37]:

- Loss of foraging habitat
- Mortality or injury to bats

Table 11-7 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

[37] Roost lost has been considered but discounted as an effect as the **consequences** of roost loss (if it does occur) is less than **Negligible** in the context of this NoR.

Table 11-7 Spedding Road: Assessment of construction effects and impact management for bats

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** despite a higher probability compared to other NoRs (the high probability relates to the relationship between the Spedding Road alignment with Totara Creek, and Waiarohia tributaries). The Low magnitude score can be attributed to the short period of construction related effects, the localised extent of any disturbance and the relatively low baseline bat activity rate (albeit relatively higher than for other NoRs). The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation.	Same as for Baseline.	**Loss of foraging habitat** The magnitude of effect is assessed as **Negligible** for the loss in foraging habitat due to the unlikely probability if this effect occurring. The ecological value of bats is assessed as **Very High** and the overall level of effect is assessed as **Low** prior to mitigation. **Mortality or injury to bats** The magnitude of effect is assessed as **Low** for mortality or injury to bats. The ecological value of bats is assessed to be **Very High,** and the overall level of effect is assessed as **Moderate** prior to mitigation.	The importance of district plan trees in providing foraging habitat in the future environment need to be considered along with the likely need for foraging habitat in the future (increase vs. decrease in bat foraging). Overall, it is assumed that urbanisation may not have occurred at the time of road construction and that bat activity will remain comparable to the baseline and as such the level of effects will be the same as the baseline. **Mortality or injury to bats** The probability of the effect occurring in the future is expected to be comparable to the Baseline and the level of effect will be the same as the Baseline.
Impact management and residual	Mitigation measures are the same as for Trig Road North outlined in Table 8-7.	Same as for Baseline.	Mitigation measures are the same as for Trig Road North outlined in Table 8-7.	**Loss of foraging habitat** N/A **Mortality or injury to bats**

Effect description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
level of effect	The post mitigation level of effect can be reduced to **Negligible.**		The post mitigation level of effect can be reduced to **Negligible.**	Same as Baseline.
Management of residual effect	N/A	N/A	N/A	N/A

11.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Spedding Road NoR. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Incidental bird observations indicated the presence of native species common to rural and urban areas. In general, the habitat to be affected by the proposed alignment is not considered suitable for potentially occurring TAR species.

Table 11-8 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 11-8 Spedding Road: Assessment of construction effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the Spedding Road. The ecological value of non-TAR birds in the context of the Spedding Road habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. No additional mitigation is therefore required.	Same as Baseline.	The magnitude of effect is assessed as **Moderate** for all three effects associated with district plan tree removal. This is due to the extent of district plan vegetation present and the high likelihood of these effects occurring. The ecological value of birds is assessed as **Low**, and the overall level of effect due district plan vegetation removal is assessed as **Low** prior to mitigation.	Same as Baseline.
Impact management and residual level of effect	N/A	Same as Baseline.	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constraint to avoid the key nesting period (September to February), or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

11.3.1.4 Lizards

Construction effects on lizards associated with noise, light and vibration is assessed as **Low** for Spedding Road (Table 11-9) prior to mitigation. This level of effect is one class higher than for other NoRs linked to existing road upgrades. The greenfield construction for sizable portions of the Spedding Road corridor and the naivety of lizards in these areas to noise and vibration increases the likelihood of this effect occurring. It is expected that the effects on lizards due to vegetation removal will be assessed under Regional matters and is further discussed in Section 11.4.1.4.

Table 11-9 Spedding Road: Assessment of construction effects and impact management for lizards

Effect description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low,** despite the higher likelihood assigned to this effect due to the quality of lizard habitat around exotic scrub (ES) at Trig and Rawiri confluence and a higher probability of occurrence. The ecological value of copper skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. No additional mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

11.3.2 Operational Effects - Terrestrial Ecology

Spedding Road mostly involves the construction of a new road within a rural landscape and a future urban environment, crossing several watercourses (Rawiri Stream, Trig Stream, Trig Stream Tributary, Totara Creek). Potential operational effects from the Project that relate to district plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how the magnitude of effect was determined are provided in Appendix 1). Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

11.3.2.1 Bats

The loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can negatively influence bat behaviour. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The level of effect on bats due to operational impacts associated with loss in connectivity was assessed in the context of confirmed bat activity around Totara Creek (and therefore likely to occur in the broader landscape), the existing degree of fragmentation and that of the future urban environment. Table 11-10 outlines the operational effects assessment and impact management for bats.

Table 11-10 Spedding Road: Assessment of operational effects and impact management for bats

Effect description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Moderate** due to the relatively high likelihood of this effect occurring around Totara Creek (albeit with local extent of additional disturbances to individual bats and roosts). The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** for disturbances to individual bats and roosts.	Same as Baseline.	The magnitude is assessed as **High** due the increased probability of additional fragmentation specifically associated with the area around the Totara Creek. Additional fragmentation may influence bat movement throughout and beyond the Totara Creek catchment. The ecological value of bats is assessed to be **Very High**, and the level of effect is assessed as **Very High** for loss in connectivity due to the presence of the road.	Same as Baseline. Totara Creek, Trig and Rawiri stream riparian features with bat habitat potential will remain present within the FUZ.
Impact management and residual level of effect	Buffer planting both sides of road corridor associated with the Totara Stream crossing to further reduce noise and light resulting in disturbance from the road. The post mitigation level of effect can be reduced to **Low** for both effects.	Same as Baseline.	Mitigation measures are the same as for Trig Road North outlined in Table 8-10, with the addition of: Landscaped design under bridge where the Proposed Spedding Road will cross Totara Creek and SH16 to facilitate hop-unders.	Same as Baseline.

Effect description	**Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration**		**Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape**	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Management of residual effect	N/A	N/A	N/A	N/A

11.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Spedding Road NoR, while noise light and vibration may also affect connectivity in the broader landscape. No TAR species are expected to be associated with Spedding Road NoR habitat. Table 11-11 outlines the operational effect assessment and impact management for birds.

Table 11-11 Spedding Road: Assessment of operational effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** as potentially occurring species are fairly local and habituates to urban sounds etc. No "high" value habitat further up in Trig and Rawiri catchments. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to operation disturbance is assessed as **Very Low** prior to mitigation. No additional mitigation is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** as potentially occurring species are fairly local and the Waiarihia catchment is already fragmented by Brigham Creek Road and SH18. No "high" value habitat further up in Trig and Rawiri catchments. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to operation disturbance is assessed as **Very Low** prior to mitigation. No additional mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

11.3.2.3 Lizards

Exotic scrub (notably around the Trig and Rāwiri stream confluence), exotic treeland, rank grassland, riparian and wetland habitat suitable for copper skink have been identified within the Spedding Road NoR, which could potentially support native copper skink (At Risk – Declining).

Spedding Road corridor includes upgrading and extending Spedding Road. The proposed upgrade will result in additional fragmentation of lizard habitat. However, copper skink are likely to habituate to disturbance such as noise, vibration and lighting and the exotic scrub and wetland habitat associated with the Trig Stream crossing will remain intact during operation. no additional effect on copper skink is therefore expected. Table 11-12 outlines the operational effect assessment and impact management for lizards.

Table 11-12 Spedding Road: Assessment of operational effects and impact management for lizards

Effect description	Disturbance and displacement of existing and future copper skink due to light, noise and vibration effects from the presence of the road		Loss in connectivity for existing and future copper skink populations due to the presence of the road	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** as skinks are likely to be acclimatised to operation disturbances. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. No additional mitigation is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** as skinks are relatively resident with low requirement for movement between habitat units. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. No additional mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

11.3.3 Conclusions

The ecological level of effects assessed as more than **Moderate** for Spedding Road include:

- **Moderate** level of effect for noise and light disturbance of individual bats or roosts during construction for the Baseline and Future Environment.
- **Moderate** level of effect associated with the killing or injuring of individual bats due to the removal of district plan vegetation for Baseline and the Future Ecological Environment.
- **High** level of effect for noise and light disturbance of individual bats or roosts during operation for the Baseline and Future Environment.
- **Very High** level of effect for the loss in connectivity to bats due the presence of the road for the Baseline and the Future Environment.

The post mitigation level of effect is considered to be **Negligible** for construction related disturbance effects and **Low** for the same effect during operation. The post mitigation level effect for killing or injuring bats due to removal of district plan vegetation is considered to be **Negligible**. The post mitigation level of effect for loss in connectivity to bats during operation is considered to be **Low.**

11.4 Design and Future Regional Resource Consent Considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the section below. This section has informed the proposed designation boundary of Spedding Road.

11.4.1.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the proposed designation for Spedding Road including suitable habitat that is potentially being used by indigenous fauna (bats, birds and lizards). This includes vegetation clearance which is a permitted activity for infrastructure under the AUP:OP.

The amounts and types of all terrestrial habitat and vegetation[38] (including habitat used by indigenous fauna) that could be lost as a result of the Project is presented in Table 11-13 under the footprint column (road alignment). For context, the extents of similar habitat features are provided for the designation boundary.

The terrestrial vegetation to be lost mostly comprised of exotic vegetation which are of **Low** or **Moderate** ecological value, while mature mixed native and exotic treeland (TL.3) associated with Waiarohia Stream are of more notable ecological value (Section 11.2.3.3). Some of these habitats are likely to provide habitat for native fauna, as discussed in sections 11.4.1.2 to 11.4.1.4 below.

Table 11-13 Potential area of permanent terrestrial vegetation loss within the road footprint and designation footprint respectively for Spedding Road

Feature	Classification*	Footprint (m²)	Designation (m²)
Exotic Grassland	EG	20,949	35,178

[38] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

Feature	Classification*	Footprint (m²)	Designation (m²)
Exotic Scrub	ES	1,078	4,899
Planted Vegetation – Native (recent)	PL.1	15,611	500
Planted Vegetation - Native (mature)	PL.2	0	0
Planted Vegetation – Exotic (amenity)	PL.3	2,624	4,497
Treeland – Mixed Native/Exotic	TL.2	0	0
Treeland – Exotic-Dominated[39]	TL.3	1,526	667

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent and wildlife permit applications (if required).

11.4.1.2 Bats

Mature hedgerow, shelterbelt and riparian vegetation represented by TL.3 (around Totara Creek, Trig Stream and 10 Spedding Road) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats should be re-assessed prior to obtaining any regional resource consents for vegetation with 10 m of riparian strips and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

11.4.1.3 Birds

Vegetation clearance required for construction could result in the loss of vegetation features (PL.1, PL.3 and TL.3) of local value to native birds. Any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

11.4.1.4 Lizards

Copper skink are likely to be present for most of the vegetation impacted by the Spedding Road. The exotic scrub between Trig and Rawiri streams are of particular value and will mostly remain intact under the current design. However, lizards are likely to be associated with all the habitat units within NoR4, there is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953.

11.4.1.5 Freshwater Ecology

The construction of Spedding Road will cross ten existing streams (W4-S1 to W4-S10). W4-S1, W4 S7, W4-S8 and W4-S9 are permanent streams, and W4-S6 is an intermittent stream. The Trig and

[39] TL.2 and TL.3 includes district plan trees.

Rawiri streams (site label) as well as the Totara Creek will be bridged and will therefore not require additional mitigation. Streams W4-S3, W4-S4 and W4-S10 are intermittent streams, and W4-S5 is a permanent stream and will be culverted. W4-S2 is a permanent stream that will have riparian margin loss due to construction of the new road. The predicted permanent and intermittent stream losses for the Project is presented in Table 11-14. These calculations will require re-evaluation as part of the future regional consent process. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 11-14 Potential stream loss (permanent and intermittent) within Spedding Road

Stream ID	Hydroperiod	Active channel width (m)**	Length to be lost (m)**	Loss (m^2)**
W4-S2	Permanent	2	30	60
W4-S3	Intermittent	1	40	40
W4-S4	Intermittent	1	37	37
W4-S5	Permanent	2	60	120
W4-S6	Intermittent	1.5	52	78
W4-S7	Permanent	2	30	60
W4-S10	Intermittent	1	35	35

Notes: ** = Many assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, widths, lengths and areas are indicative.

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed as well as details regarding fish passage requirements. Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

11.4.1.6 Wetland Ecology

Construction of the Spedding Road will result in a partial loss (approximately 1100 m^2) of wetland (W4-W3). The value of this wetland was assessed as **Moderate**. Constraining the upgrade on the southern side of Spedding Road will avoid the wetland with no further impact expected.

The proposed alignment will clip a small portion of the headwater section associated with W4-W3A (100 m^2) on 49 Trig Road, while approximately 800 m^2 of the same wetland will be reclaimed due to culverting further downslope. The wetland value was assessed **Moderate**. Most of the direct wetland effects for the culverted section can be avoided by the bridging the system. As mentioned, the existing designation already includes a relatively large portion of wetland specifically around the Trig and Rawiri steam and wetland complex.

Wetland W4-W6 was assessed as **Negligible** value and considered to be artificial. The existing alignment may have a small indirect effect in this wetland. However, no loss in extent or value is expected.

It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

12 Hobsonville Road FTN Upgrade

12.1 Project Corridor Features

Hobsonville Road relates to an upgrade and widening of the existing Hobsonville Road corridor. Land cover to the south of the corridor is developed. The area south of the corridor drains into the Waipareira stream which is associated with several SEAs. Sections of the north are currently undeveloped greenfields with development west of Trig Road and development is progressing within the Hobsonville Corridor.

On the north side of the corridor, the more noteworthy ecological features include exotic treeland and stream habitat associated with a Waiarohia tributary on 174-178 Brigham Creek Road. The rest of the Corridor runs on a watershed and does not cross any permanent or intermitted streams. A stormwater pond is next to the designation on 118 Williams Road. A headwater seep wetland located on 4-6 Hobsonville Road occurs within the designation boundary.

A single notable tree in the AUP:OP is located at the corner of Hobsonville Road and Williams Road, and three notable trees are located at 104A Hobsonville Road.

12.2 Existing and Likely Future Environment

12.2.1 Planning Context

Hobsonville Road is an existing urban corridor with land zoned under the AUP:OP as follows:

- The southern side of Hobsonville Road is largely zoned Residential – Mixed Housing Urban Zone, with a Business – Local Centre Zone located adjacent to the intersection of Hobsonville Road, Wiseley Road and Clark Road at the eastern end of the corridor; and
- The northern side of Hobsonville Road contains a variety of land uses. Adjacent land on the western end of the corridor is currently zoned Residential – Mixed Housing Zone between SH16 and Trig Rd (proposed for up zoning as part pf PPC5), with FUZ land behind. Land to the east of Trig Road to Westpark Drive is currently zoned FUZ, with land then zoned Business – Light Industrial Zone to the east of Westpark Drive.

PPC5 proposes to re-zone the existing FUZ area to Residential – Mixed Housing Zone and Residential – Terrace and Apartment Building Zone.

The Hobsonville Road corridor is currently designated by AT for Transport Purposes (Designation 1437). Designation 1437 has been given effect to and it is proposed to alter this designation.

Table 12-1 below provides a summary of the Hobsonville Road existing and likely future environment.

Table 12-1 Hobsonville Road FTN Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[40]	Likely Future Environment[41]	Implications of Future Environment on Ecological Features
Business	Business (Light Industrial)	Low	Business (Light Industrial)	N/A
	Business (Local centre)	Low	Business (Local centre)	N/A
Residential	Residential	Low	Residential	N/A
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban	Loss of exotic vegetation north of the existing corridor. Roadside and garden planting likely to be retained or regained in Future Environment.

12.2.2 Permitted Activities and the Future Ecological Environment

The existing undeveloped greenfields for portions of Hobsonville Road (mostly to the north of the existing alignment) are zoned FUZ in the AUP:OP, and as such is planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding street trees and notable trees), are identified as permitted activities within Chapters E26 and E15 of the AUP: OP. As such the ecological features (i.e., terrestrial habitat), excluding natural wetlands, streams and riparian edges, which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

12.2.3 Ecological Baseline

This section presents the findings of the site investigations and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') present within Hobsonville Road. All features within the study areas were investigated and mapped to provide context within potential adjustments to the proposed designation boundary. Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within the study area.

12.2.3.1 Terrestrial Habitat

Table 12-2 summarises the vegetation units associated with Hobsonville Road. The entire southern section of Hobsonville Road is urbanised. These habitats are mapped in Appendix 5.

[40] Based on AUP:OP zoning/policy direction
[41] Based on AUP:OP zoning/policy direction

Table 12-2 Vegetation types present within Hobsonville Road, categorised according to Singers et al. (2017)

Vegetation Type	Abbreviation	Description of Habitat
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, and gardens- mostly occurring to the north of Hobsonville Rd.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Gorse dominated and include two notable areas (1) 178 Brigham Creek Rd and 86 Hobsonville Rd.
Planted Vegetation – Native (recent)	PL.1	Native planted vegetation mostly around the exotic treeland habitat associated with the Waiarohia inlet tributary (172 Brigham Creek Rd).
Planted Vegetation – Exotic (amenity)	PL.3	Exotic amenity plantings. This includes gardens and roadside vegetation dominated by exotic species.
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. (1) Waiarohia Inlet north of Brigham Creek Rd just before the Hobsonville Rd Junction and mature roadside trees on 78 and 91 Hobsonville Rd.

12.2.3.2 Terrestrial Fauna

Bats

Terrestrial habitat associated with Hobsonville Road is considered to be of negligible value to bats. Due to the negligible value of bat habitat and the absence of any obvious ecological corridors, bats are not further considered for this NoR.

Birds

No dedicated bird surveys were undertaken for the Project. Incidental observations of bird species were noted, and the following birds were seen or heard throughout Hobsonville Road (Table 12-3).

Table 12-3 Incidental bird observations at Hobsonville Road and conservations status (Robertson et al., 2021)

Common Name	Māori Name	Scientific Name	Conservation Status
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised
Myna	-	*Acridotheres tristis*	Introduced and Naturalised
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened

Common Name	Māori Name	Scientific Name	Conservation Status
Silvereye	Tauhou	*Zosterops lateralis*	Not Threatened
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened

Lizards

Indigenous lizards were not identified during opportunistic searches completed during the site investigation. Copper skink have also been recorded within 1 km of Hobsonville Road. Although copper skink presence cannot be excluded from most of the habitat features within the NoR, the relative value of exotic scrub (ES) habitat is considered more notable that other vegetation units.

12.2.3.3 Terrestrial Ecological Value

Table 14-13 in Appendix 6 describes the terrestrial vegetation observed within Hobsonville Road NoR and their ecological value in accordance with the EcIA Guidelines (EIANZ, 2018). The ecological value for all habitat units was assessed as **Low**[42].

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with the EcIA Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk – Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments of for individual species are considered **Very High** for long-tailed bats and **High** for copper skink (Table 12-4).

Table 12-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Herpetofauna – lizards	Copper skink	EG, ES, PL.3, PL.1 and TL.3	At Risk - Declining	High

12.2.3.4 Freshwater Habitat

All streams within Hobsonville Road were numbered, classified (permanent, intermittent or ephemeral) and mapped (Appendix 172). A rapid habitat assessment was completed for all permanent and intermittent streams that could be assessed within Hobsonville Road.

42 The ecological value of brown fields was considered less than negligible and therefore was not assessed.

Stream classification and description

Five stream branches were identified during the desktop and site investigations within a 100 m buffer of Hobsonville Road, however only two are within the designation boundary of Hobsonville Road. The streams are mapped in Appendix 5 and are listed in Table 12-5.

In summary, streams within Hobsonville Road were classified as follow:

- One stream branch was identified as intermittent.
- One stream branch was identified as permanent, with the stream becoming intermittent further downstream of survey point.

The barrier to fish migration was assessed at each stream, to describe any fragmentation or loss of connectivity. This is described as either total barrier, partial barrier or no barrier to fish migration.

Table 12-5 Summary of Hobsonville Road stream classifications and descriptions

Stream Number	Classification	Barrier type	Upstream fish habitat
W5-S4	Permanent & Intermittent	Partial barrier to fish migration	Very likely
W5-S5	Intermittent	Partial barrier to fish migration	Likely

Notes: * = Streams assessed at a desktop level

National Rapid Habitat assessment

The two streams within the designation boundary were assessed during site investigations and surveyed using the RHA. The results of the RHA values are presented Appendix 10 and measured a **Good** habitat quality score for site W5-S4 and a **Poor** score for W5-S5.

12.2.3.5Freshwater Fauna

Fish surveys were not carried out during site investigations. The freshwater habitats within Hobsonville Road were assessed for their potential to support indigenous fish during the RHA. Potential habitat, such as undercut banks, overhanging vegetation and macrophytes were observed at the time of survey.

12.2.3.6Freshwater Ecological Value

Table 14-18 in Appendix 7 presents the ecological value for the freshwater habitats identified within Hobsonville Road. Information obtained for the ecological baseline (Section 12.2.3.4 and 12.2.3.5), as well as the area wide desktop assessment (Section 6.3), was used to score the matters that inform the ecological value. The ecological value was assessed as **Moderate** for W5-S4 and **Low** for W5-S5.

12.2.3.7 Wetland Habitat

One wetland directly associated with Hobsonville Road designation have been identified and assessed at desktop level due to access constraints.

W5-W1 (6 Hobsonville Rd)

Wetland W5-W1 was assessed at desktop level due to access constraints. The extent of the wetland was informed by the structural differences in vegetation. Wetland W5-W1 represents a valley head seep, partially modified by historical attempts to drain it. The wetland is likely dominated by exotic species with the immediate catchment mostly consisting of pasture. Based on the relatively small catchment the hydroperiod of the wetland is expected to be seasonal. The wetland is likely to be a NPS-FM natural wetland.

12.2.3.8 Wetland Ecological Value

Table 14-23 in Appendix 8 presents the ecological value for the wetland habitats identified within Hobsonville Road. Information obtained for the ecological baseline (Section 12.2.3.7) was used to score the matters that inform the ecological value. The value categories applied was **Low** for W5-W1.

12.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 12.3 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP. Refer to Section 3.2 for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

12.3.1 Construction Effects - Terrestrial Ecology

The potential construction effects (direct and indirect) to the terrestrial habitat and species within Hobsonville Road (as they relate to district matters) were the same as for Trig Road North (Section 8.3.1).

12.3.1.1 Terrestrial vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and also detailed in the table below. The effects of district plan vegetation removal on fauna (birds) (as it relates to loss in foraging habitat, and mortality and injury) is assessed in section 12.3.1.2.

Table 12-6 Hobsonville Road: Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**TL.3 (total area of 20.13 m^2)** The magnitude of effect is assessed as **Negligible** due to the small extent and low likelihood that edge effect and additional fragmentation will occur. The ecological value of both vegetation units is assessed to be **Negligible** (in the context of this NoR), and the overall level of effect is assessed as **Very Low** prior to	Same as Baseline.

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
	mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

12.3.1.2 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Hobsonville Road NoR. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Incidental bird observations indicated the presence of native species common to rural and urban areas. In general, the habitat to be affected by the proposed alignment is not considered suitable for potentially occurring TAR species.

Table 12-7 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 12-7 Hobsonville Road: Assessment of construction effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to as expected species using habitat PL.3 and TL.3 are likely to be habituated to baseline disturbances related to noise and light. The ecological value of non-TAR birds in the context of the Hobsonville Road habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. No additional impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Negligible** due to the small extent and low likelihood of the effect occurring. The ecological value of non-TAR birds in the context of the Hobsonville Road habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. No additional impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constraint to avoid the key nesting period (September to February), or pre-clearance inspections should be	Same as Baseline.

Effect description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
			undertaken prior to vegetation removal.	
Management of residual effect	N/A	N/A	N/A	N/A

12.3.1.3 Lizards

Construction effects on lizards associated with noise, light and vibration is assessed as **Very Low** for Hobsonville Road (Table 12-8) prior to mitigation due to the existing baseline. It is expected that the effects on lizards due to vegetation removal will be assessed under Regional matters and is further discussed in Section 12.4.1.3.

Table 12-8 Hobsonville Road: Assessment of construction effects and impact management for lizards

Effect description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the unlikely probability of lizard disturbance linked to construction related noise and vibration within the context of the baseline. The ecological value of copper skink in is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. No additional mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

12.3.2 Operational Effects - Terrestrial Ecology

The Hobsonville Road involves the upgrade the existing Hobsonville Road within a predominantly urban baseline. In general, potential operational effects from the Project that relate to district plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how the magnitude of effect was determined are provided in Appendix 1). Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

12.3.2.1 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Hobsonville Road NoR, while noise light and vibration may also affect connectivity in the broader landscape. Table 12-9 outlines the effect assessment for disturbance and displacement of bird roosts and individual birds due to construction activities related to noise and light.

Table 12-9 Hobsonville Road: Assessment of operational effects and impact management for birds

Effect description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the existing baseline informing an unlikely probability of additional noise and light disturbances. The ecological value of birds in the context of habitat features are assessed to be **Low**. The overall level of effect due to operation disturbance resulting in an additional loss in connectivity is assessed as **Very Low** prior to mitigation. No further mitigation is required.	Same as Baseline.	The magnitude of effect is assessed as **Negligible** as any additional fragmentation will be localised. The ecological value of birds in the context of habitat features are assessed to be **Low**. The overall level of effect due to operation disturbance resulting in an additional loss in connectivity is assessed as **Very Low** prior to mitigation. No further mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

12.3.2.2 Lizards

Exotic scrub, exotic treeland and edge rank grassland associated with Hobsonville Road may provide habitat suitable for copper skink. Table 12-10 outlines the operational effect assessment and impact management for lizards.

Table 12-10 Hobsonville Road: Assessment of operational effects and impact management for lizards

Effect description	Disturbance and displacement of existing and future copper skink due to light, noise and vibration effects from the presence of the road		Loss in connectivity for existing and future copper skink populations due to the presence of the road	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** as lizards are likely to be acclimatised to the existing disturbances emanating from Hobsonville Rd and surrounding urban environment. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. No further mitigation is required.	Same as Baseline.	The magnitude of effect is assessed as **Negligible** as lizards are relatively resident with low requirement for movement between habitat units. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Very Low** prior to mitigation. No further mitigation is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

12.3.3 Conclusions

Hobsonville Road does not present any ecological effects that are more than **Low** prior to mitigation.

12.4 Design and Future Regional Resource Consent Considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections. This section has informed the proposed designation boundary of Hobsonville Road.

12.4.1.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the NoRs associated Hobsonville Road, including suitable habitat that is potentially being used by indigenous fauna (birds and lizards). This includes vegetation clearance which is a permitted activity for infrastructure under the AUP:OP.

The amounts and types of terrestrial habitat and vegetation[43] (including habitat used by indigenous fauna) that could be lost as a result of the Project is presented in Table 12-11 under the footprint column (road alignment). For context, the extents of similar habitat features are provided for the designation boundary.

The terrestrial vegetation to be lost mostly comprised of exotic vegetation which are of **Low** ecological value (Section 12.2.3.3). Some of these areas are likely to provide habitat to native fauna, as discussed in sections 12.4.1.2 to 12.4.1.3 below.

Table 12-11 Potential area of permanent terrestrial vegetation loss within the road footprint and designation footprint respectively for Hobsonville Road

Feature	Classification*	Footprint (m^2)	Designation (m^2)
Brown Field	BF	108,408	51,698
Exotic Grassland	EG	16,748	14,270
Exotic Scrub	ES	2,487	1,824
Planted Vegetation – Native (recent)	PL.1	< 50	306
Planted Vegetation – Exotic (amenity)	PL.3	9,485	6,111
Treeland – Exotic-Dominated[44]	TL.3	-	-

12.4.1.2 Birds

Vegetation clearance required for construction could result in the loss of vegetation features (PL.1, P.L3, and TL.3) of local value to native birds. The stormwater pond (W5-W3) provides potential

[43] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.
[44] TL.3 includes district plan trees.

habitat for spotless crake, but will remain intact based on the current design and unaffected by construction activity. Any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

12.4.1.3 Lizards

Indigenous copper skink may be present for most of the vegetation impacted by the Hobsonville Road. The exotic scrub (ES) associated with the location of a proposed stormwater wetland on 178 Brigham Creek Rd is of particular value. However, lizards may be associated with all the habitat units within Hobsonville Road, there is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skinks are likely to occur will need to be managed in accordance with the Wildlife Act 1953.

12.4.1.4 Freshwater Ecology

Streams W5-S4, W5-S1, W5-S2, W5-S3 and W5-S5 are directly adjacent to NoR, however it is assumed that these features can be avoided, and no stream loss will occur at these locations. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features. Under a future regional consent for earthworks, impact management would also be required to ensure sediment discharge to streams is controlled appropriately.

12.4.1.5 Wetland Ecology

Construction of the Hobsonville Road will result in a partial loss (approximately 27 m^2) of wetland (W5-W1). The value of this wetland was assessed as **Low**. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

13 Conclusion

Construction Effects

Table 13-1 to Table 13-4 provides a summary of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and likely future ecological environment as one where they are the same. Construction effect mitigation measures will include:

- A Bat Management Plan (BMP) for Trig Road North, Māmari Road, Brigham Creek Road and Spedding Road. Details of the BMP will depend on bat habitat within the FUZ and is likely to include bat habitat surveys prior to construction, siting of compounds and laydown areas to avoid bat habitat, lighting design to reduce light levels and spill from construction areas and restriction of nightworks around treeland bat habitat.
- Bird management will be required for Brigham Creek Road (the existing Brigham Creek stormwater pond). Considerations for bird management will include avoiding the bird breeding season (September to February) during construction (as it relates to the existing stormwater pond), or bird survey prior to construction to confirm TAR species are not present and to provide guidance if TAR species are present.

Table 13-1 Summary of ecological effects during construction prior to mitigation for district plan terrestrial vegetation

Construction - Terrestrial vegetation (district plan vegetation only)	
NoR	**Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)**
Trig Road North	Low
Māmari Road	Very Low
Brigham Creek Road	Low (TL.3), Very Low (TL.2)
Spedding Road	Low
Hobsonville Road	Very Low

Table 13-2 Summary of ecological effects during construction prior to mitigation for bats

Construction - Bats			
NoR	**Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)**	**Loss of foraging habitat due to removal of district plan vegetation**	**Mortality or injury to bats due to removal of district plan vegetation**
Trig Road North	**Moderate**	Low	**Moderate**
Māmari Road	**Moderate**	Low	Low
Brigham Creek Road	**Moderate**	Low	**Moderate**

Construction - Bats			
Spedding Road	**Moderate**	Low	**Moderate**
Hobsonville Road	NA	N/A	N/A

Table 13-3 Summary of ecological effects during construction prior to mitigation for birds

Construction - Birds					
NoR	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.) - Non-TAR birds**	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.) – TAR birds**	**Loss of foraging habitat due to removal of district plan vegetation**	**Nest loss due to removal of district plan vegetation**	**Mortality or injury to birds due to removal of district plan vegetation**
Trig Road North	Low	NA	Low	Low	Low
Māmari Road	Low	Low	Very Low	Very Low	Very Low
Brigham Creek Road	Low	**High**	Low	Low	Low
Spedding Road	Low	N/A	Low	Low	Low
Hobsonville Road	Very Low	N/A	Very Low	Very Low	Very Low

Table 13-4 Summary of ecological effects during construction prior to mitigation for lizards

Construction – Lizards	
NoR	**Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)**
Trig Road North	Very Low
Māmari Road	Very Low
Brigham Creek Road	Very Low
Spedding Road	Low
Hobsonville Road	Very Low

The residual (post-mitigation) level of effect for all construction effects are considered **Negligible** or **Low.**

Operational Effects

Table 13-5 to Table 13-7 provides summary of district matter operational effects due to the presence of road resulting in disturbance or loss in connectivity to bats, birds and lizards. The summary represents the level of effect for the baseline and FUZ as one where they are the same and with a * where they differ.

Operational effects mitigation measures will include a BMP. The BMP will include buffer planting along road corridors associated with stream crossings, lighting design along strategic location of the road (stream crossings) and retention of large, mature trees (specifically TL.3 stands) where practicable.

Table 13-5 Summary of ecological effects during operation prior to mitigation for bats

Operation - Bats		
NoR	**Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration**	**Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape**
Trig Road North	Low	**Moderate** *Negligible
Māmari Road	**Moderate**	**High**
Brigham Creek Road	**Moderate**	**High**
Spedding Road	**High**	**Very High**
Hobsonville Road	N/A	N/A

*Indicates a level of effect associated with the FUZ that is different from the baseline level of effects

Table 13-6 Summary of ecological effects during operation prior to mitigation for birds

Operation - Birds		
NoR	**Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)**	**Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
Trig Road North	Very Low	Very Low
Māmari Road	Low	Low

Operation - Birds		
Brigham Creek Road	Very Low	Very Low
Spedding Road	Very Low	Very Low
Hobsonville Road	Very Low	Very Low

Table 13-7 Summary of ecological effects during operation prior to mitigation for lizards

Operation - Lizards		
NoR	**Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road**	**Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
Trig Road North	Low	Low
Māmari Road	Low	Low
Brigham Creek Road	Low	Low
Spedding Road	Low	Low
Hobsonville Road	Very Low	Very Low

The residual level of effect for operational effects are considered **Low** or **Very Low**.

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1 Appendix 1 - Ecological Impact Assessment Methodology

The standard by which this EcIA was undertaken follows the guidelines published by the Environment Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al. 2018).

1.1 Assessment of Ecological Value

The first step in the EcIA approach is to assess the value of ecological features in terms of Representativeness, Rarity, Diversity and Pattern, and Ecological context. Details on each matter and its associated considerations are provided in Table 14-1 for terrestrial ecological value and Table 14-2 freshwater ecological value.

Table 14-1 Matters and considerations for the assessment of terrestrial ecological value

Representativeness
Typical structure and composition
Indigenous representation
Rarity/distinctiveness
Species of conservation significance
Range restricted or endemic species
Distinctive ecological values
Diversity and pattern
Habitat diversity
Species diversity
Patterns in habitat use
Ecological context
Size, shape and buffering
Sensitivity to change
Ecological networks (linkages, pathways, migration)

Table 14-2 Matters and considerations for the assessment of freshwater ecological value

Representativeness (including SEV, RHA and ecological integrity)
Extent to which site/catchment is typical of characteristic
Instream habitat modification
Riparian habitat modification

Representativeness (including SEV, RHA and ecological integrity)
Hydrological modification
Catchment conditions
Geomorphological modification
Water quality modification
Presence of alien and invasive species
Invertebrate assemblage representation
Fish assemblage representation
Rarity/descriptiveness
Pool characterisation
Species of conservation significance
Range restricted or endemic species
Stream type (rare or distinctive)
Diversity and pattern
Distinctive ecological values
Level of natural diversity
Diversity metrics
Complexity of community
Ecological context (Ecosystem services, importance sensitivity)
Stream order
Catchment size
Hydroperiod
Sensitivity to flow modification
Sensitivity water quality modification
Sensitivity to sedimentation/erosion
Connectivity and migration

1.2 Assessment of Ecological Effects

The ecological effects assessment includes several steps that collectively assess the way the Project will interact with elements of the physical and biological, environment to produce effects to habitat and receptors. The method for determining the level of effect is outlined in the following sections.

Basic impact characteristic terminology and respective descriptors are incline with the EcIA guidelines (Roper-Lindsay at al., 2018) and are provided in Table 14-3.

Table 14-3 Magnitude of effect assessment terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct
		Indirect
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local
		Regional
		National
Duration	The time period over which a resource/receptor is affected	Temporary (days or months)
		Short-term (<5 years)
		Long-term (15-25 years)
		Permanent (>25 years)
Frequency	A measure of the constancy or periodicity the receptor will be affected	Infrequently
		Periodically
		Frequently
		Continuously
Likelihood	The probability of an effect occurring if it is unplanned	Highly Unlikely
		Unlikely
		Likely
		Highly Likely
		Definite
Reversibility	The degree to which the ecological effect can be reversed in a reasonable time scale through natural processes or mitigation	Totally
		Partially
		Irreversible
		Not applicable

Based on the above-mentioned descriptors, the characteristics of each effect are used to assign a magnitude to the specific effect. Magnitude designations are provided in Table 14-4.

Table 14-4 Magnitude of effect designations

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and or attributes will be fundamentally changed and may be lost from the site altogether; and/or loss of very high proportion of the known population or range of the elements/features
High	Major loss or major alteration to key elements/features of the existing baseline such that the post-development character, composition and/or attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline such that the post-development character, composition and/or attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from the existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline conditions will be similar or pre-development circumstances or patterns; and or having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; and/or having negligible effect on the known population or range of the element/feature

The magnitude of an effect is considered in relation to the ecological value of the habitat or receptor to be impacted on (Section). The ecological value of habitat or receptors are the primary focus of the ecological assessment. The ecological value of habitat or receptors are typically expressed on a local, district, regional or national scale. The ecological value designations are provided in Table 14-5.

Table 14-5 Ecological value designations

Value	Description
Very High	Area rates High for three or all the four assessment matters. Likely to be of National importance and recognised as such
High	Area rates High for two of the assessment matters, Moderate and Low for the remainder or Area rates High for 1 so the assessment matters, moderate for the remainder. Likely to be regionally important and recognised as such
Moderate	Area rates High for one matter, Moderate and Low Dortha remainder, or Area rates Moderate for 2 or more assessment matters Low or Very low for the remainder. Likely to be important at the level of the Ecological District
Low	Area rates Low or Very low for most assessment matters and Moderate for one. Limited ecological value other as local habitat for tolerant species
Negligible	Area rates Very low for three matters and Moderate, Low or Very low for the remainder

Once magnitude of effect and the ecological value of the habitat or receptor have been determined, the level of effect can be assigned for each effect using the matrix shown in Table 14-6.

Table 14-6 Ecological effect matrix

		Ecological Values				
		Very High	High	Moderate	Low	Negligible
Magnitude	Very High	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Negligible	Negligible	Negligible	Negligible	Negligible

From Table 14-6, the level of effect designations are defined below:

- **Negligible**: An effect of negligible consequence is one where habitat or receptors will not be affected in any meaningful way by a Project activity or the predicted effect is indistinguishable from natural background variations;
- **Low**: An effect of minor consequence is one where habitat or receptors will experience a noticeable effect, but the effect magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low ecological value. In either case, the magnitude should be well within applicable standards;
- **Moderate**: An effect of moderate consequence has an effect magnitude that is within applicable standards but higher than that of a minor effect. The emphasis for moderate effects is to show that the effect has been reduced or minimised in line with the mitigation hierarchy;
- **High**: A high level of effect of is one where an accepted limit or standard may be exceeded, or moderate magnitude of effect will occur to moderate or high value habitat or receptors;
- **Very High**: A very high level of effect will occur when the magnitude and value of effects are assessed as high or very high. Typically, very high level of effects notably exceeds standard limits.

1.3 Impact Management

Informed by the level of effects suitable impact management measures are provided consistent with the mitigation hierarchy. The priority in mitigation is to first apply mitigation measures to the source of the impact (avoid) and then to address the resultant effects (reduce or minimise) of the impact.

1.4 Residual Impacts

Once mitigation measures are declared, the next step in the effect assessment process was to assign residual impact significance. This is a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional recommended mitigation measures.

1.5 Managing Uncertainty

Biophysical impacts are difficult to predict with certainty, but uncertainty stemming from on-going development of the Project design and implementation is inevitable, and the environment is variable over time. If uncertainties are relevant to the effect assessment, they were stated and approached conservatively, to identify a range of likely residual effects and relevant mitigation measures.

1.6 Cumulative effects

Cumulative impacts and effects are those that arise because of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects. No structed methods were employed to assess cumulative impacts, but where relevant descriptions of potential cumulative effects have been provided.

2 Appendix 2 - Auckland Unitary Plan Activities

Auckland Unitary Plan – E26 Infrastructure

Table E26.4.3.1 below is relevant for considering effects and recommending mitigation in relation to tree removal. Note that, except for Trees in Roads, in Open Space Zones and Notable Trees, trees are not protected under the AUP.

Table E26.4.3.1 Activity table - Network utilities and electricity generation – Trees in roads and open space zones and the Notable Trees Overlay

Activity	Activity Status			Permitted Standards or Matters of Discretion / Control
	Trees in roads [dp]	Open space zones [dp]	Notable trees [dp]	
(A89) Tree removal of Notable Trees	N/A	N/A	Discretionary	N/A
(A90) Tree trimming, alteration or removal on roads adjoining rural zones and on roads adjoining the Future Urban Zone	Permitted	N/A	N/A	N/A
(A91) Tree alteration or removal of any tree less than 4m in height and/or less than 400mm in girth	Permitted	Permitted	Restricted Discretionary	N/A
(A92) Tree alteration or removal of any tree greater than 4m in height and/or greater than 400mm in girth	Restricted Discretionary	Restricted Discretionary	N/A	N/A
(A93) Tree trimming, alteration and removal not otherwise provided for	D	D	D	N/A

Auckland Unitary Plan – E26 Infrastructure

The table below is relevant for considering effects and recommending mitigation in relation to vegetation clearance. Also refer to Table E15.4.1.

Table E26.3.3.1 Activity table – Network utilities and electricity generation and vegetation management

Activity	Activity Status						Permitted Standards
	Rural zones, coastal areas and riparian areas [rp]	SEA [rp]	ONF [dp]	HNC [dp]	ONL [dp]	ONC [dp]	
(A76) Vegetation alteration or removal	P	P	P	P	P	P	Refer to E26.3.5.4. Vegetation alteration or removal for Permitted Activity Standards
(A77) Vegetation alteration or removal that does not comply with Standards E26.3.5.1 to E26.3.5.4	RD	RD	RD	RD	RD	RD	
(A78) Vegetation alteration or removal not otherwise provided for	D	D	D	D	D	D	

Note: Greyed-out boxes relate to Regional Activities which are not considered as part of the NoR and will be relevant for future Regional Resource Consents.

Auckland Unitary Plan – E15 Vegetation management and biodiversity

Table E15.4.1 below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to vegetation clearance in urban and FUZ zones, and adjacent to riparian areas.

Table E15.4.1 Activity table - Auckland-wide vegetation and biodiversity management rules

Activity	Activity Status	Permitted Standards
Riparian areas (as described below)		
(A16) Vegetation alteration or removal within 20m of rural streams, other than those in Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A
(A17) Vegetation alteration or removal within 10m of rural streams in the Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A

Activity	Activity Status	Permitted Standards
(A18) Vegetation alteration or removal within 20m of a natural wetland, in the bed of a river or stream (permanent or intermittent), or lake	RD	N/A
(A19) Vegetation alteration or removal within 10m of urban streams	RD	N/A
All other zones and areas not covered above (i.e. Urban Zones and FUZ)		
(A22A) Vegetation alteration or removal	P	Refer to E15.6. Vegetation alteration or removal for Permitted Activity Standards
All areas		
(A23) Permitted activities in Table E15.4.1 that do not comply with one or more of the standards in E15.6	RD	N/A

Auckland Unitary Plan – E26 Infrastructure - Earthworks

The table below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to earthworks.

Table E26.5.3.1 Activity table - Earthworks all zones and roads [dp]

Activity	Activity Status	Permitted Standards
(A95) Earthworks up to 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A96) Earthworks up to 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A97) Earthworks greater than 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	
(A97A) Earthworks greater than 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	

3 Appendix 3 - Regional Plan, District Plan and Wildlife Act Matters

Table 14-7 Ecological effects of road infrastructure construction broken down into AUP OiP Regional and District Plan matters

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Construction					
Terrestrial habitat	Vegetation removal (including trees) outside of roads and public spaces in: a) a rural zone b) riparian margins c) coastal areas d) SEAs This also includes other terrestrial habitat of value identified in the EcIA.	Permanent loss of habitat/ecosystem, fragmentation and edge effects.		✓	
	Vegetation removal (including trees) in: a) Roads b) Public spaces c) ONFs d) ONLs e) HNCs f) ONCs	Permanent loss of habitat/ecosystem, fragmentation and edge effects.	✓		
	Earthworks – leading to invasion of bare earth surfaces with weeds and transfer of weeds (seeds and fragments) between earthworks areas.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
Bats	Vegetation removal.	Roost loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	
	Construction activities (Noise, light, dust etc.).	Disturbance and displacement to roosts and to individuals (existing).	✓		✓
Birds (native)	Vegetation removal.	Nest loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Construction activities (noise, light, dust etc).	Disturbance and displacement of roosts and individuals (existing).	✓		✓
Herpetofauna (native)	Vegetation removal.	Lizard habitat loss		✓	
	Vegetation removal.	Kill or injure individual			✓
	Construction activities (noise, light, dust etc).	Disturbance and displacement of individuals (existing).	✓		✓
Freshwater habitat – wetland or stream (including riparian margins)	Reclamation/culverting/other structures e.g., bank armouring.	Permanent loss/modification of habitat/ecosystem.		✓	
	Vegetation removal.	Permanent loss of habitat/ecosystem, fragmentation and edge effects.		✓	
	Construction activities – earthworks (leading to sediment discharge), machinery use and chemical storage (leading to leaks/spills).	Uncontrolled discharge leading to habitat and water quality degradation.		✓	
	Diversion, abstraction or bunding of watercourses and water level/flow/ periodicity changes.	Detrimental effects on habitats including plant composition and fauna.		✓	
Fish (native)	Reclamation/diversion /other structures e.g., bank armouring.	Loss of aquatic habitat.		✓	
	Reclamation/diversion /culverting/other structures e.g., bank armouring.	Kill or injure individual.			✓
Operation					
Terrestrial habitat	Presence of the road - use of road edges as dispersal corridors by invasive plant species.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
	Road maintenance - increased use of herbicides.	Increased weed incursion, unintentional spray of indigenous vegetation.		✓	
Bats	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat	✓		✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
		loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.			
	Lighting and noise/vibration.	Disturbance and displacement of (new and existing) roosts and individuals.	✓		✓
Birds (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting and noise/vibration.	Disturbance and displacement of (new and existing) nests and individuals.	✓		✓
Herpetofauna (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting.	Disturbance of nocturnal lizard behaviour.	✓		✓
Freshwater habitat – wetland or stream (including riparian margins)	Vehicle (cartage) movement - risk of spills of potential toxins (oil, milk, chemicals).	Temporary degradation of instream/wetland habitat and water quality.		✓	
	Presence of bridge.	Shading leading to change in ecosystem structure.		✓	
	Gradual change in hydrology from presence of the road/stormwater, including reclamations.	Effect on downstream habitat (including erosion/sediment discharge) due to change in hydrology (increase or decrease).		✓	
	Stormwater discharges - pollutants (such as heavy metals and herbicides).	Permanent degradation of wetland or instream habitat and water quality.		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Fish (native)	Presence of culvert.	Loss of connectivity due to culvert preventing fish passage up and downstream.		✓	

4 Appendix 4 - Desktop Bird Records

Table 14-8 Desktop bird records within 5 km of the NoRs

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Australasian bittern	Matuku-hūrepo	*Botaurus poiciloptilus*	Threatened - Nationally Critical	eBird (Bird Atlas)
Australasian gannet	Tākapu	*Morus serrator*	Not Threatened	eBird (Bird Atlas)
Banded dotterel	Tūturiwhatu	*Charadrius bicinctus*	Threatened - Nationally Vulnerable	eBird (Bird Atlas)
Banded rail	Mioweka	*Gallirallus philippensis assimilis*	At Risk - Declining	eBird (Bird Atlas)
Barbary dove	-	*Streptopelia risoria*	Introduced and Naturalised	eBird (Bird Atlas)
Bar-tailed godwit	Kuaka	*Limosa lapponica bauer*	At Risk - Declining	eBird (Bird Atlas)
Black shag	Kawau	*Phalacrocorax carbo novaehollandiae*	At Risk - Naturally Uncommon	eBird (Bird Atlas), iNaturalist
Black swan	Kakīānau	*Cygnus atratus*	Not Threatened	eBird (Bird Atlas)
Black-billed gull	Tarāpuka	*Larus bulleri*	Threatened - Nationally Critical	eBird (Bird Atlas)
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised	eBird (Bird Atlas)
Brown teal	Pāteke	*Anas chlorotis*	At Risk - Recovering	eBird (Bird Atlas)
California quail	-	*Callipepla californica*	Introduced and Naturalised	eBird (Bird Atlas)
Canada goose	-	*Branta canadensis*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened - Nationally Vulnerable	eBird (Bird Atlas)
Chaffinch	Pahirini	*Fringilla coelebs*	Introduced and Naturalised	eBird (Bird Atlas)
Common pheasant	Peihana	*Phasianus colchicus*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Dunnock	-	*Prunella modularis*	Introduced and Naturalised	eBird (Bird Atlas)
Eastern rosella	-	*Platycercus eximius*	Introduced and Naturalised	eBird (Bird Atlas)
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened	eBird (Bird Atlas)
Fork-tailed swift	-	*Apus pacificus*	Vagrant	eBird (Bird Atlas)

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised	eBird (Bird Atlas)
Graylag goose	Kuihi	*Anser anser*	Introduced and Naturalised	eBird (Bird Atlas)
Greenfinch	-	*Carduelis chloris*	Introduced and Naturalised	eBird (Bird Atlas)
Grey duck	Pārera	*Anas superciliosa*	Threatened - Nationally Critical	eBird (Bird Atlas)
Grey teal	Tētē moroiti	*Anas gracilis*	Not Threatened	eBird (Bird Atlas)
Grey warbler	Riroriro	*Gerygone igata*	Not Threatened	eBird (Bird Atlas), iNaturalist
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised	eBird (Bird Atlas)
Kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened	eBird (Bird Atlas)
Lesser knot	Huahou	*Calidris canutus rogersi*	Threatened - Nationally Vulnerable	eBird (Bird Atlas)
Little black shag	Kawau tūī	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	eBird (Bird Atlas)
Little pied cormorant	Kawau paka	*Phalacrocorax melanoleucos*	Vagrant	eBird (Bird Atlas)
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Mallard	-	*Anas platyrhynchos*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Morepork	Ruru	*Ninox novaeseelandiae*	Not Threatened	eBird (Bird Atlas)
Muscovy duck	-	*Cairina moschata*	Introduced, Not Established	eBird (Bird Atlas)
Myna	-	*Acridotheres tristis*	Introduced and Naturalised	eBird (Bird Atlas)
New Zealand Dabchick	Weweia	*Poliocephalus rufopectus*	At Risk - Recovering	eBird (Bird Atlas), iNaturalist
New Zealand Pigeon	Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
North Island Fernbird	Mātātā	*Bowdleria punctata vealeae*	At Risk - Declining	eBird (Bird Atlas)
North Island Kākā	Kākā	*Nestor meridionalis septentrionalis*	At Risk - Recovering	eBird (Bird Atlas)
Northern New Zealand Dotterel	Tūturiwhatu	*Charadrius obscurus aquilonius*	At Risk - Recovering	eBird (Bird Atlas), iNaturalist
Paradise shelduck	Pūtangitangi	*Tadorna variegata*	Not Threatened	eBird (Bird Atlas)

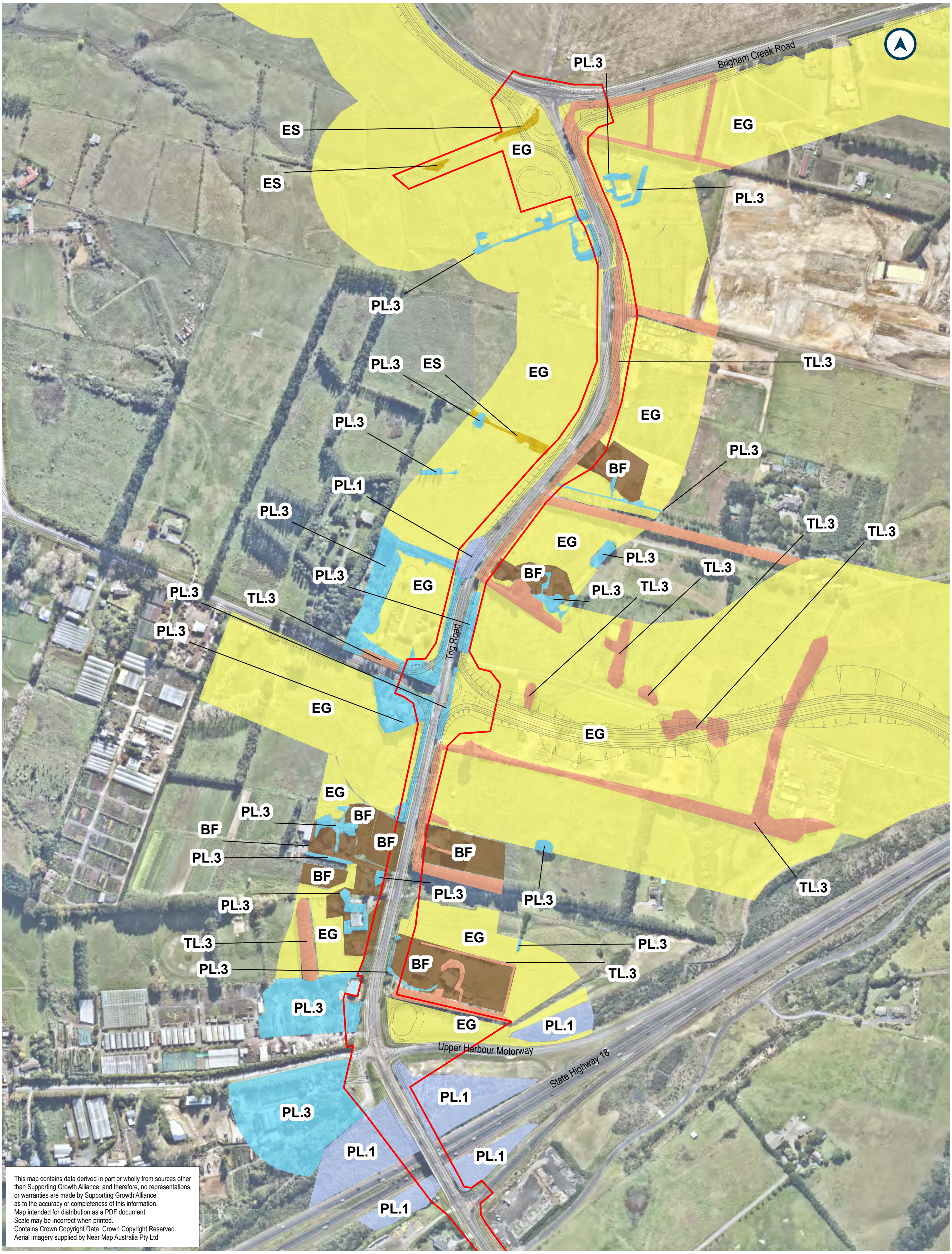
Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Pied shag	Kāruhiruhi	*Phalacrocorax varius*	At Risk - Recovering	eBird (Bird Atlas)
Pied stilt	Poaka	*Himantopus himantopus leucocephalus*	Not Threatened	eBird (Bird Atlas)
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened	eBird (Bird Atlas), iNaturalist
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk - Declining	eBird (Bird Atlas)
Redpoll	-	*Carduelis flammea*	Introduced and Naturalised	eBird (Bird Atlas)
Rock pigeon	-	*Columba livia*	Introduced and Naturalised	eBird (Bird Atlas)
Royal Spoonbill	Kōtuku ngutupapa	*Platalea regia*	At Risk - Naturally Uncommon	eBird (Bird Atlas)
Shining cuckoo	Pīpīwharauroa	*Chrysococcyx lucidus*	Not Threatened	eBird (Bird Atlas)
Silvereye	Tauhou	*Zosterops lateralis*	Not Threatened	eBird (Bird Atlas)
Skylark	Kaireka	*Alauda arvensis*	Introduced and Naturalised	eBird (Bird Atlas)
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised	eBird (Bird Atlas)
South Island pied oystercatcher	Tōrea	*Haematopus finschi*	At Risk - Declining	eBird (Bird Atlas), iNaturalist
Southern Black-backed gull	Karoro	*Larus dominicanus*	Not Threatened	eBird (Bird Atlas), iNaturalist
Spotless crake	Pūweto	*Porzana tabuensis*	At Risk - Declining	eBird (Bird Atlas)
Spotted dove	-	*Streptopelia chinensis tigrina*	Introduced and Naturalised	eBird (Bird Atlas)
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
Starling	-	*Sturnus vulgaris*	Introduced and Naturalised	eBird (Bird Atlas)
Swamp Harrier	Kāhu	*Circus approximans*	Not Threatened	eBird (Bird Atlas), iNaturalist
Tūī	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
Variable oystercatcher	Tōrea pango	*Haematopus unicolor*	At Risk - Recovering	eBird (Bird Atlas)
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened	eBird (Bird Atlas)
White-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
White-fronted tern	Tara	*Sterna striata*	At Risk - Declining	eBird (Bird Atlas)
Wrybill	Ngutuparore	*Anarhynchus frontalis*	Threatened - Nationally Vulnerable	eBird (Bird Atlas)
Yellowhammer	-	*Emberiza citrinella*	Introduced and Naturalised	eBird (Bird Atlas)

5 Appendix 5 - Whenuapai Ecological Habitat Maps

5.1 Terrestrial Habitat

5.1.1 Trig Road North



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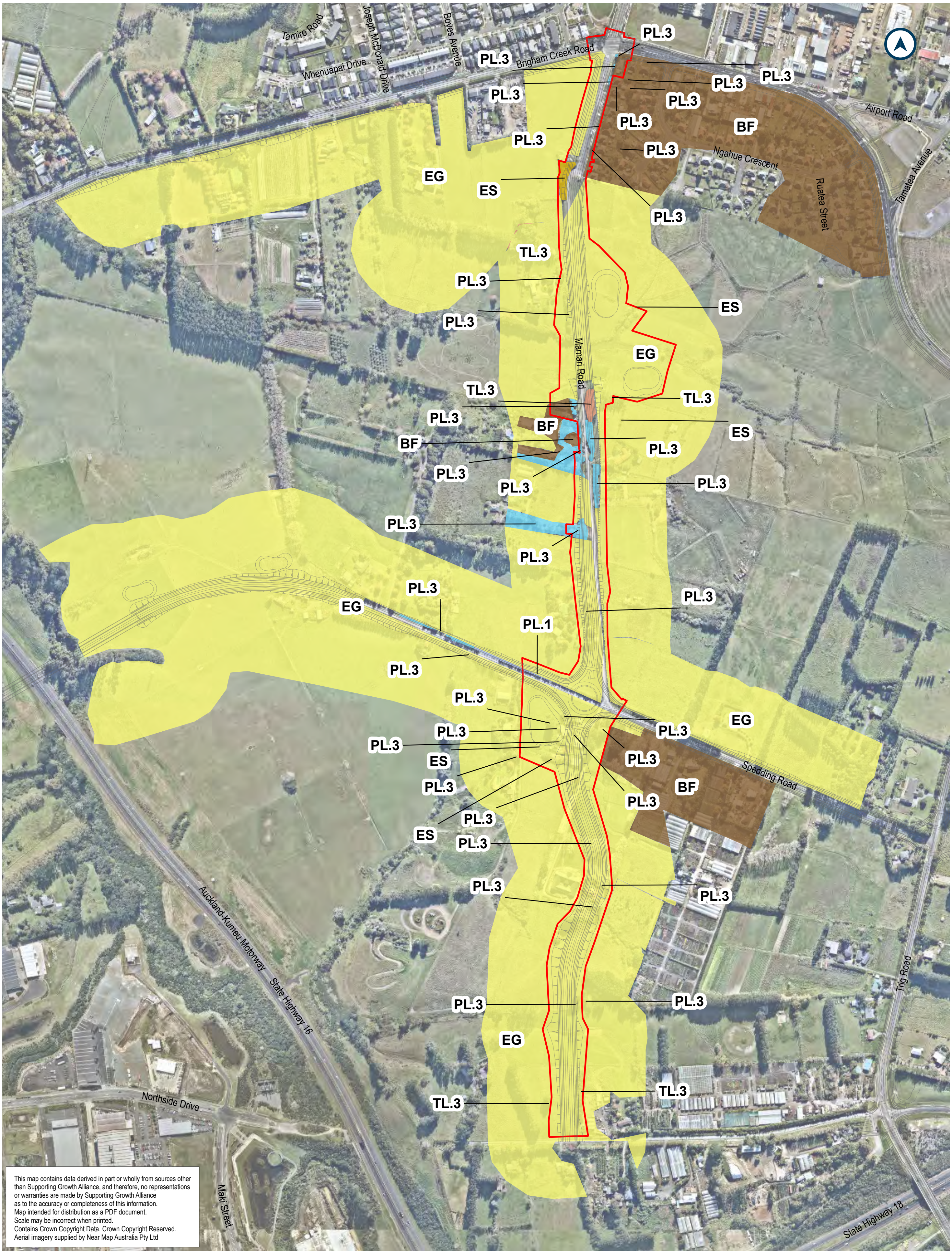
LEGEND

0 150 300
Metres

Route Options
Designations

Habitat Mapping
PL.3
ES
PL.1
TL.3
EG
BF

5.1.2 Māmari Road



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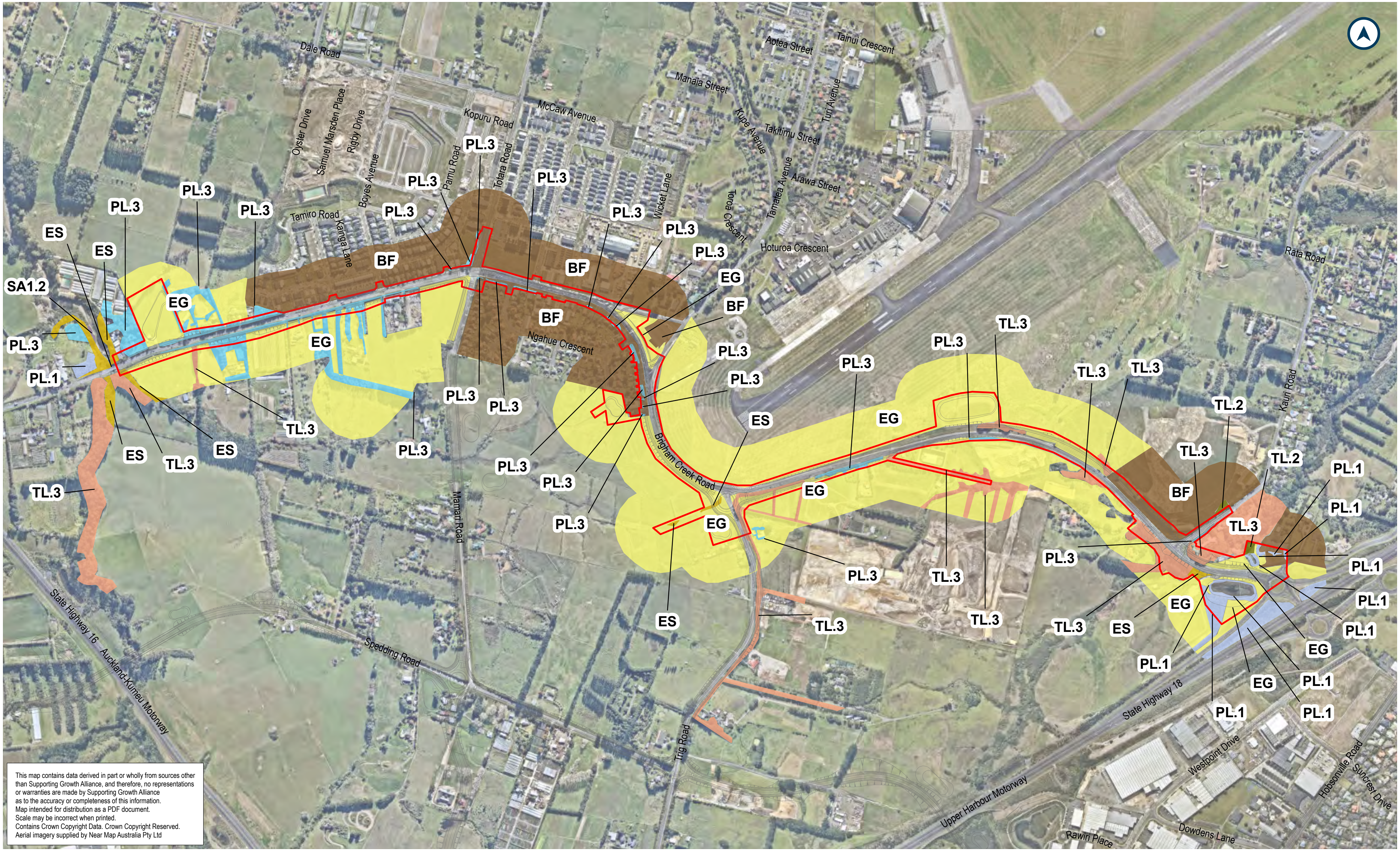
0 250 500
Metres

LEGEND

Route Options
Designations
Habitat Mapping
EG
BF
ES
PL.1
PL.3
TL.3

5.1.3 Brigham Creek Road



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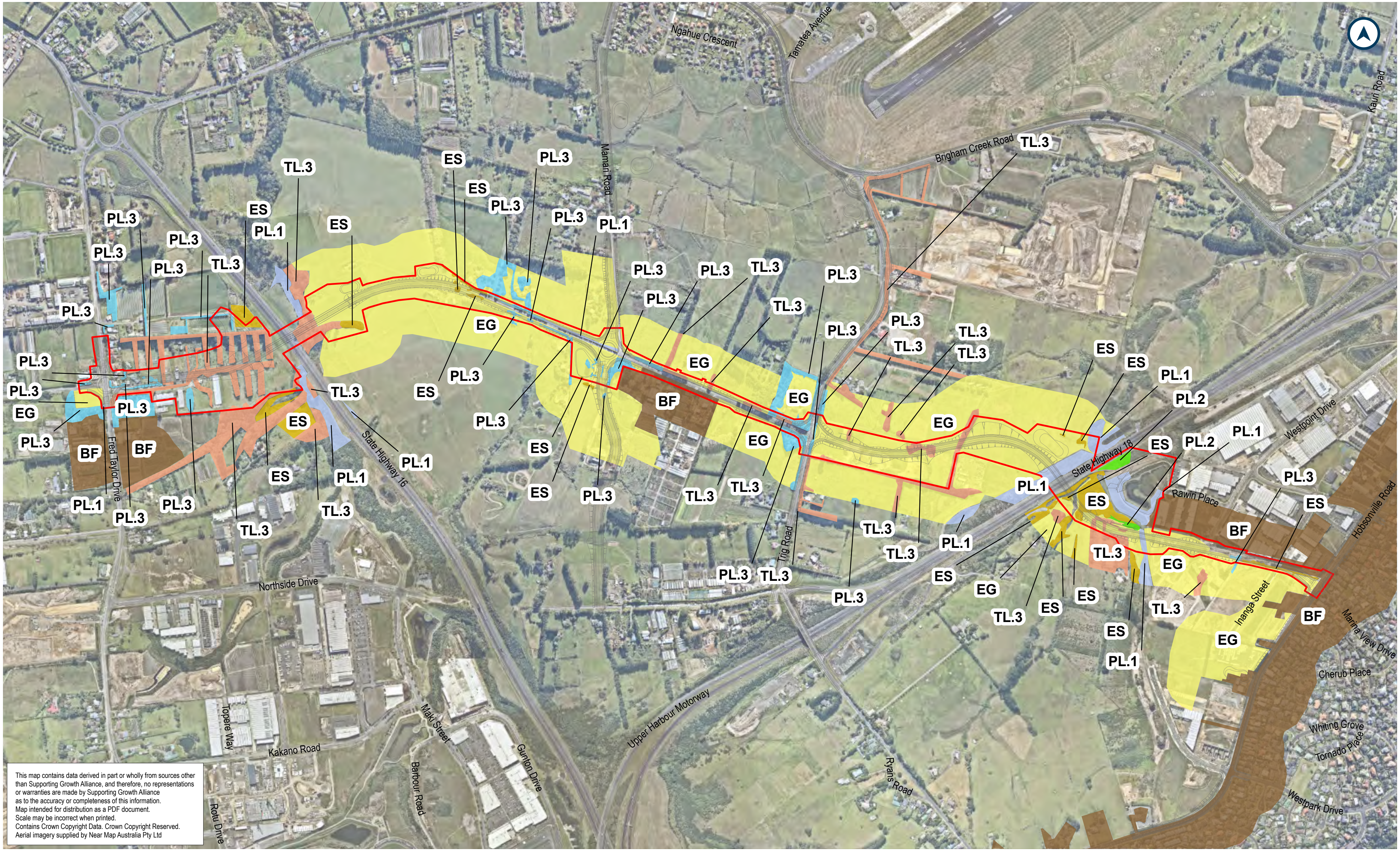
LEGEND

Route Options
Designations

Habitat Mapping
BF
EG
ES
PL.1
PL.3
SA1.2
TL.2
TL.3

5.1.4 Spedding Road



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0 250 500
Metres

LEGEND

Route Options
Designations

Habitat Mapping
BF
EG

ES
PL.1
PL.2

PL.3
TL.3

5.1.5 Hobsonville Road

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LEGEND

- Route Options
- Designations

Habitat Mapping
- EG
- ES
- PL.1
- PL.3
- TL.1
- TL.3
- BF

0 250 500
Metres

5.2 Terrestrial Habitat (District Plan Vegetation)

5.2.1 Trig Road North

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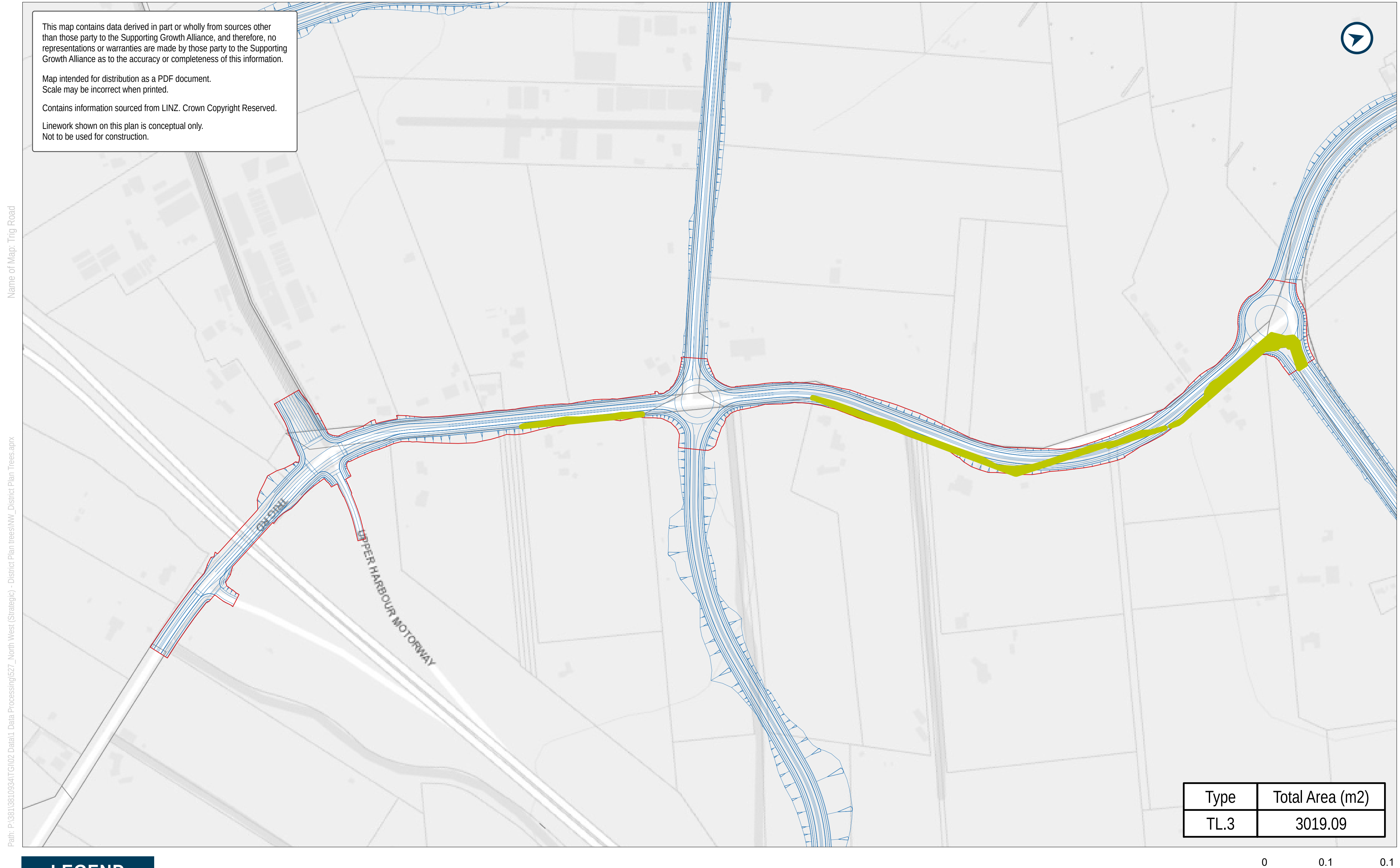

Type	Total Area (m2)
TL.3	3019.09

LEGEND

- TL.3_DPT
- Route Option
- Design Boundary
- Road

5.2.2 Māmari Road

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Type	Total Area (m2)
TL.3	337.6

Name of Map: Mamari Road

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LEGEND

- TL.3_DPT
- Route Option
- Design Boundary
- Road

5.2.3 Brigham Creek Road

Name of Map: Brigham Creek Road

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Type	Total Area (m2)
TL.2	148.5
TL.3	3220.83

LEGEND

- TL.2_DPT
- TL.3_DPT
- Route Option
- Design Boundary
- Road

0 0.1 0.2
Kilometres

5.2.4 Spedding Road

Name of Map: Spedding Road

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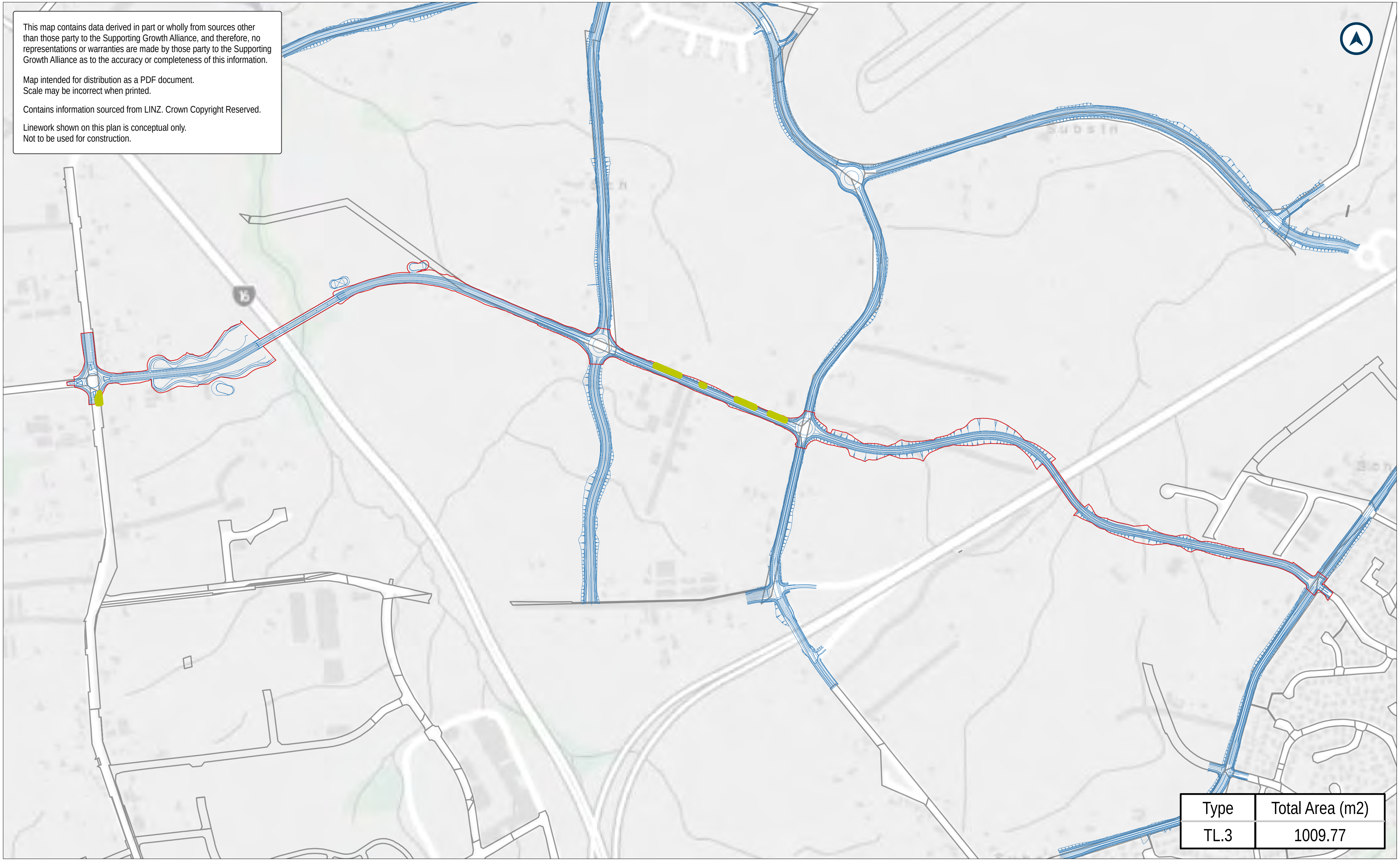

Type	Total Area (m2)
TL.3	1009.77

LEGEND

- TL.3_DPT
- Route Option
- Design Boundary
- Road

5.2.5 Hobsonville Road

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

Type	Total Area (m2)
TL.1	159.72
TL.3	20.13

0 0.1 0.3
Kilometres

Name of Map: Hobsonville Road

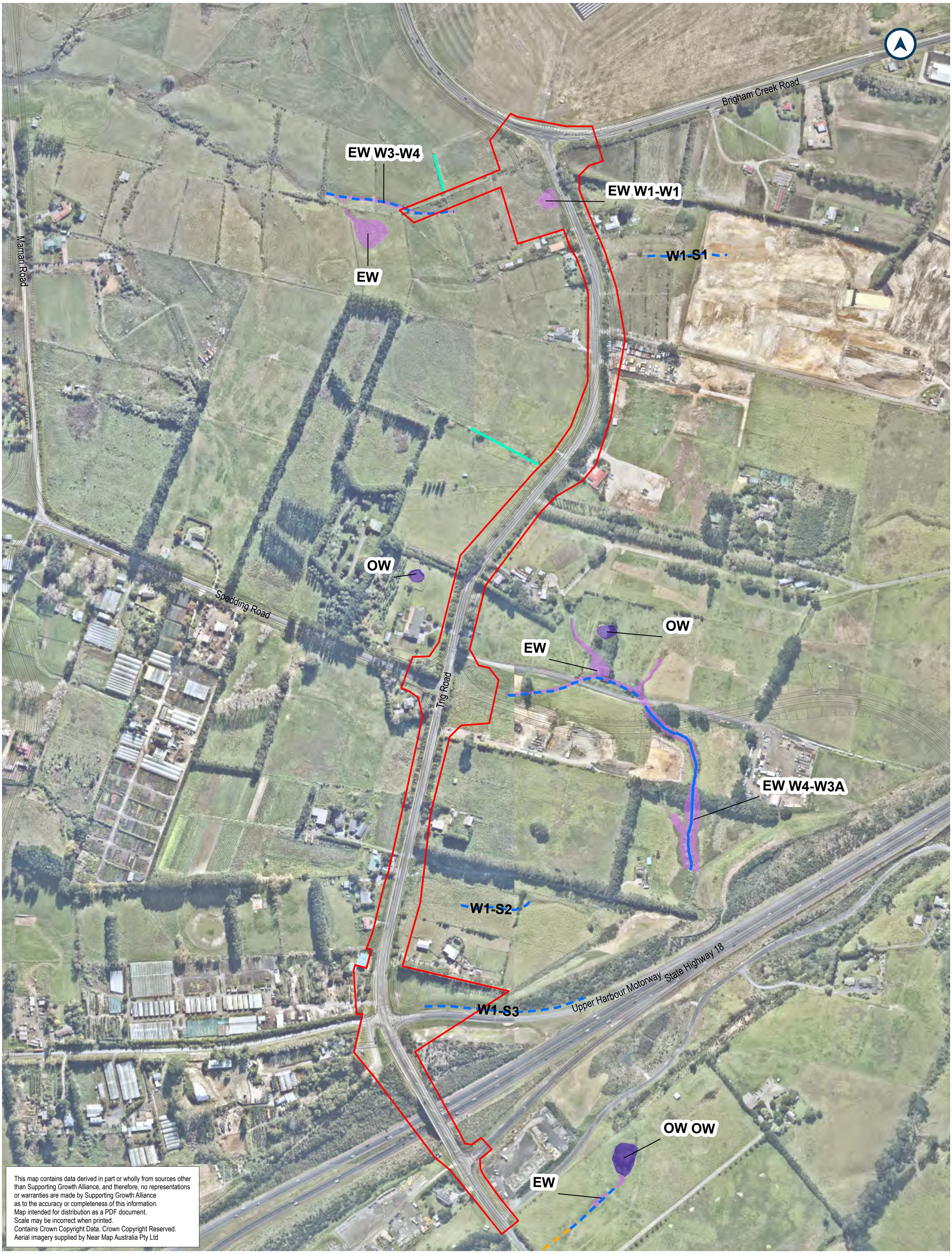
Path: P:\38113810934\TG\02 Data\1 Data Processing\527_North West (Strategic) - District Plan trees\NW_District Plan Trees.aprx

LEGEND

- TL.1_DPT
- TL.3_DPT
- Route Option
- Design Boundary
- Road

5.3 Freshwater and Wetland Habitat

5.3.1 Trig Road North



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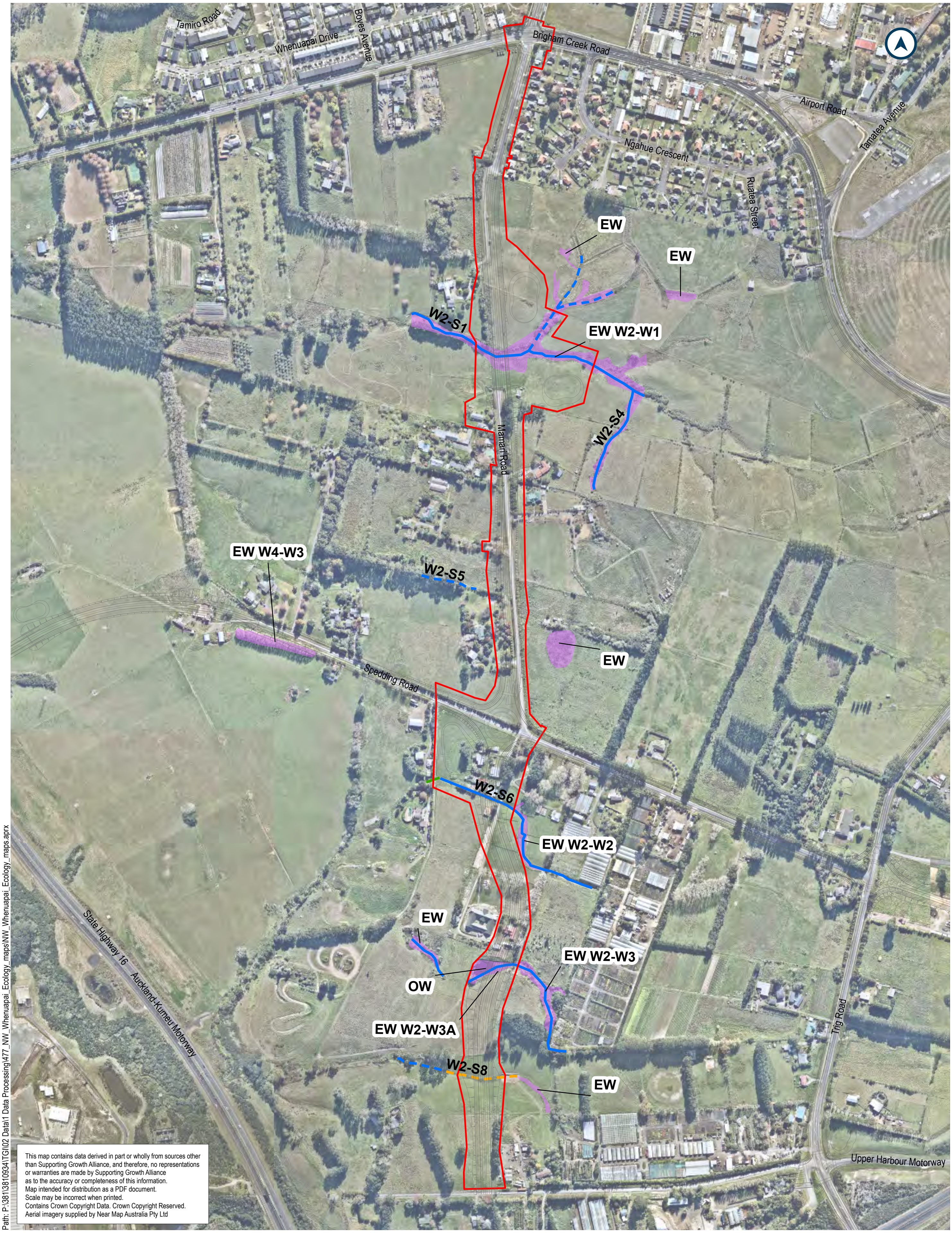
LEGEND

Route Options
Designations

Stream Classification
Artificial swale/drainage ditch
Ephemeral
Intermittent
Permanent

Habitat Mapping
EW
OW

5.3.2 Māmari Road



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0 200 400
Metres

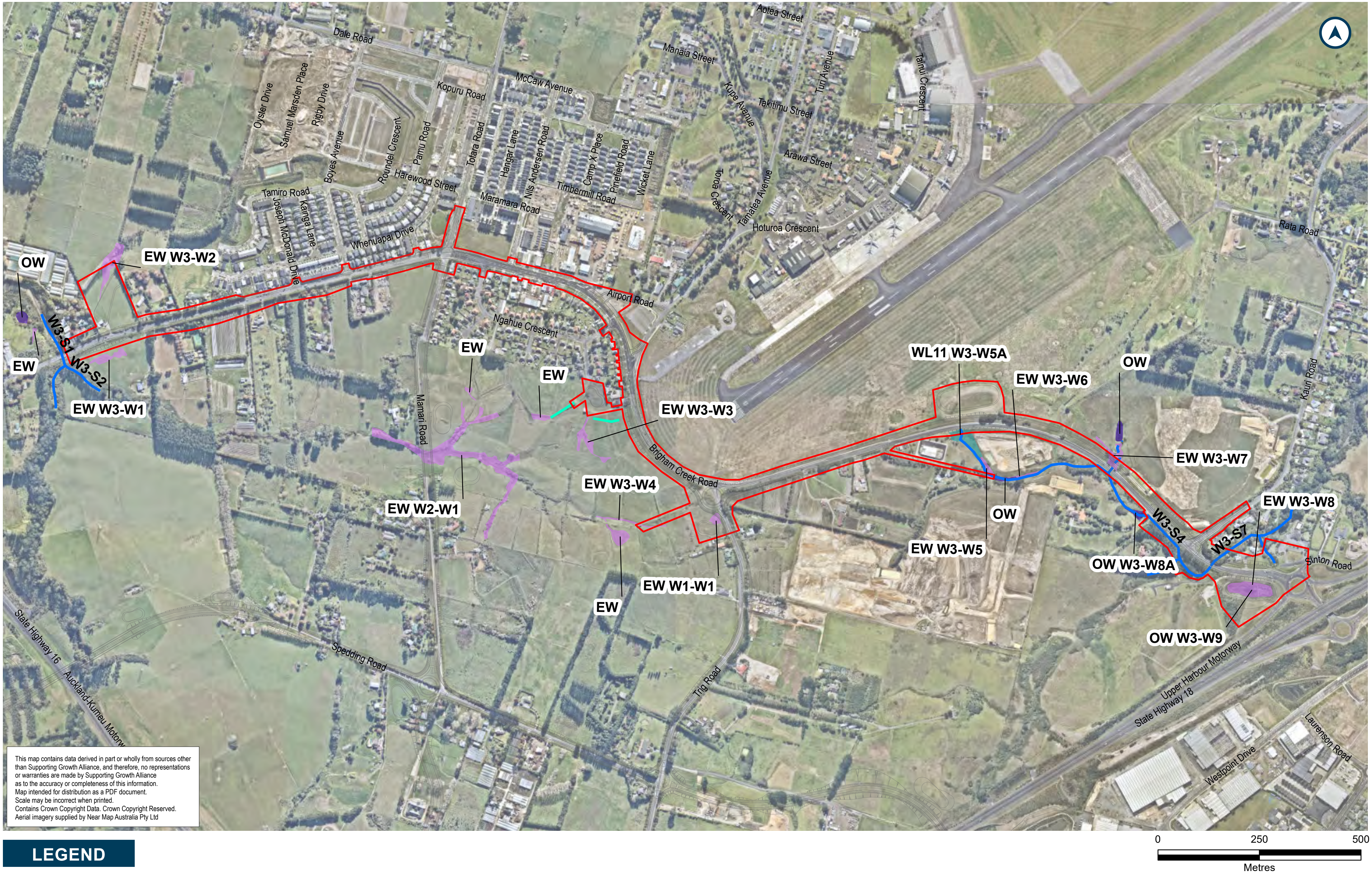
LEGEND

Route Options
Designations

Stream Classification
Artificial/Piped/Culvert
Ephemeral
Intermittent
Permanent

Habitat Mapping
EW
OW

5.3.3 Brigham Creek Road



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LEGEND

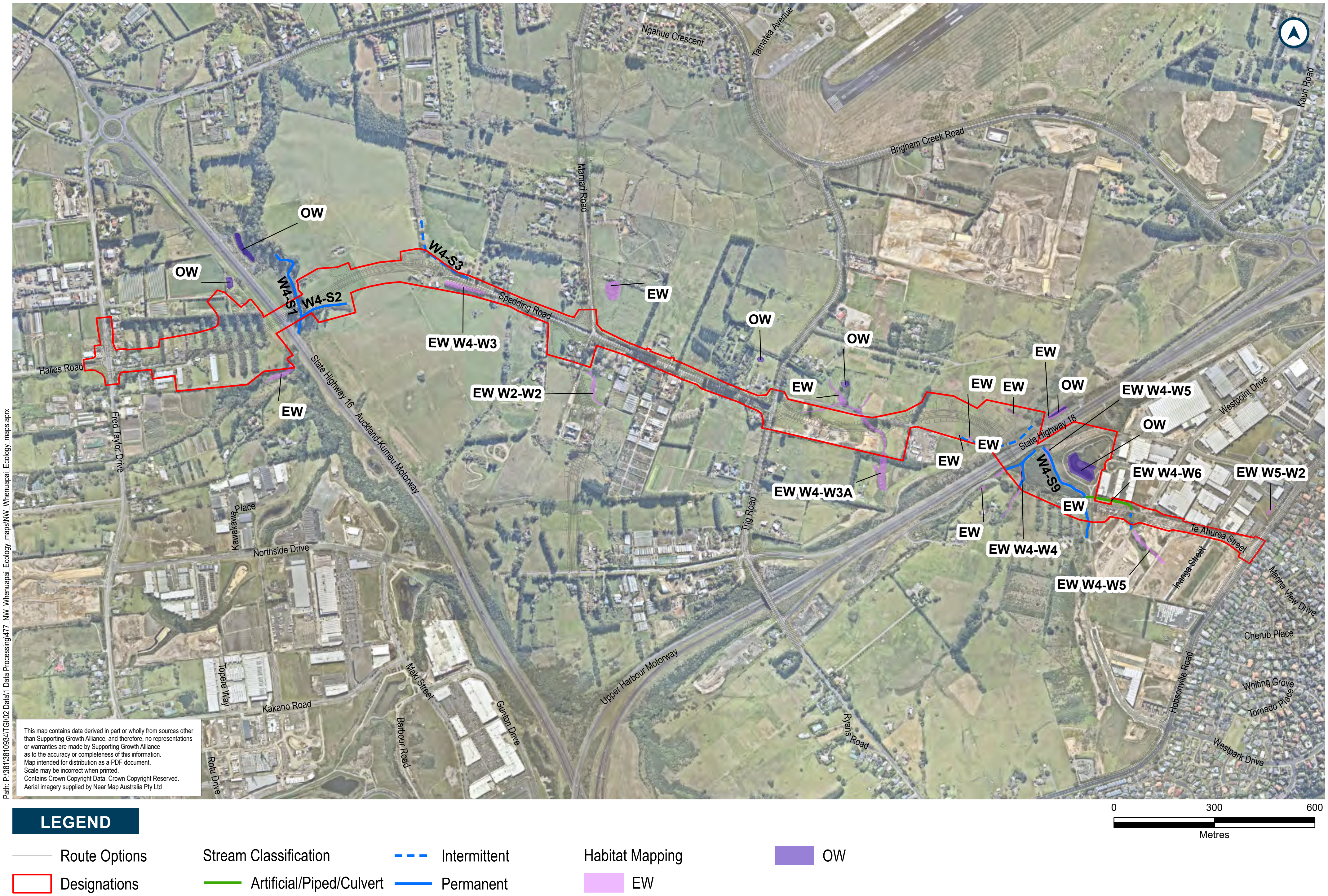
- Route Options
- Designations

Stream Classification
- Artificial swale/drainage ditch
- Artificial/Piped/Culvert
- Ephemeral
- Intermittent
- Permanent

Habitat Mapping
- EW
- OW

- WL11

5.3.4 Spedding Road



OW
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W4-S1
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EW W5-W2
EW
EW W4-W5
W4-S9
Ngahue Crescent
Tamatea Avenue
Kauri Road
Brigham Creek Road
Mamari Road
Spedding Road
Hailes Road
Fred Taylor Drive
State Highway 16
Auckland-Kumeu Motorway
State Highway 18
Westpoint Drive
Te Ahurea Street
Inanga Street
Marina View Drive
Cherub Place
Whiting Grove
Tornado Place
Westpark Drive
Hobsonville Road
Ryans Road
Upper Harbour Motorway
Trig Road
Kawakawa Place
Northside Drive
Kakano Road
Tapere Way
Rotu Drive
Barbour Road
Maki Street
Gunton Drive
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Path: P:\381\38109347TGI\02 Data\1 Data Processing\477_NW_Whenuapai_Ecology_maps\NW_Whenuapai_Ecology_maps.aprx
0
300
600
Metres
LEGEND
Route Options
Designations
Stream Classification
Artificial/Piped/Culvert
Intermittent
Permanent
Habitat Mapping
EW
OW

5.3.5 Hobsonville Road

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0 250 500
Metres

LEGEND

Route Options
Designations

Stream Classification
Artificial swale/drainage ditch
Intermittent
Permanent

Habitat Mapping
EW
OW

6 Appendix 6 - Terrestrial Value Assessment Tables

Table 14-9 Ecological values of the vegetation types present within the Trig Road North Upgrade study area

Attributes to be considered	W1-EG	W1-ES	W1-PL.3	W1-PL.1	W1-TL.3	W1-TL.3 (DP)	W1-PL.1 (DP)	W1-Bats	W1-Birds	W1-Lizard	Justification
Representativeness	**1**	**2**	**2**	**4**	**2**	**2**	**4**	**0**	**2**	**0**	
Typical structure and composition	1	1	2	3	2	-	-	-	-	-	Generally poor for exotic dominated vegetation units. However, PL.3 and TL.3 will provide more vertical structure and may reflect an increase in native animals. PL.1 represents a higher native representation.
Indigenous representation	1	2	2	4	2	2	4	-	2	-	Higher scores are associated with an increase proportion of native plants and animals.
Rarity/distinctiveness	**3**	**3**	**3**	**3**	**4**	**4**	**3**	**4**	**2**	**3**	
Species of conservation significance (fauna only)	-	-	-	-	-	-	-	4	2	3	(W1-Bats) Long-tailed bat (Threatened - Nationally Critical) present and potentially using features associated with the Project Area. (W1-Birds) No TAR bird species expected to be reliant on habitat features associated with the Project Area. Project Area not considered an important corridor for movement of TAR bird species. Project Area not associated with coastal, forest or wetland habitat of significant value to native birds. (W1-Lizards) Copper skink (At Risk – Declining) likely to use the features identified within the Project Area.
Species of conservation significance	3	3	3	3	4	4	3	-	-	-	Likely presence of copper skink (At Risk – Declining) associated with all vegetation units and the potential value of exotic treeland in supporting long-tailed bat

Attributes to be considered	W1-EG	W1-ES	W1-PL.3	W1-PL.1	W1-TL.3	W1-TL.3 (DP)	W1-PL.1 (DP)	W1-Bats	W1-Birds	W1-Lizard	Justification
											(Threatened - Nationally Critical) activity in the broader landscape for TL.3.
Distinctive ecological values	1	1	1	2	3	-	-	-	-	-	Scores reflect increase value for native animals (excluding TAR species).
Diversity and pattern	**1**	**2**	**2**	**2**	**3**	**3**	**2**	**0**	**2**	**0**	
Habitat diversity	1	1	1	2	3	3	2	-	2	-	Score reflects the value in the patchy distribution of TL habitat within a fragmented landscape and the increase diversity associated with areas of indigenous planting (PL.1).
Species diversity	1	2	2	2	2	-	-	-	-	-	Lowest for EG.
Patterns in habitat use	1	1	1	1	1	-	-	-	-	-	Habitat not important for lifecycle completion or periodic habitat utilisation at any scale.
Ecological context	**1**	**1**	**2**	**3**	**3**	**3**	**3**	**0**	**0**	**0**	
Size, shape and buffering	1	1	1	3	1	1	3	-	-	-	Score reflects the increase buffering value of PL.1 next to Upper Harbour Highway.
Sensitivity to change	1	1	1	1	1	-	-	-	-	-	Habitat generally modified with no residual receptors sensitive to change.
Ecological networks (linkages, pathways, migration)	1	1	2	2	3	3	1	-	-	-	Woody structure (PL.1 and PL.3) and aged woody structure (TL.3) increase steppingstone value (connecting other areas of ecological value).
Combined value	**L**	**L**	**M**	**M**	**M**	**M**	**M**	**VH**	**L**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-10 Ecological values of the vegetation types present within the Māmari Road corridor study area

Attributes to be considered	W2-EG	W2-ES	W2-PL.3	W2-TL.3	W2-TL.3 (DP)	W2-Bat	W2-Bird (Forest)	W2-Lizard	W2-Bird (TAR)	Justification
Representativeness	**1**	**2**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	
Typical structure and composition	1	1	2	2	-	-	-	-	-	Generally poor for exotic dominated vegetation units. However, PL.3 and TL.3 will provide more vertical structure and may reflect an increase in native animals.
Indigenous representation	1	2	2	2	2	-	-	-	-	Scores reflect an increase in native fauna associated with habitat structure.
Rarity/distinctiveness	**3**	**3**	**3**	**4**	**2**	**4**	**2**	**3**	**3**	
Species of conservation significance (fauna only)	-	-	-	-	-	4	2	3	3	(W2-Bats) Nationally Threatened Longtail bat present and potentially using features associated with the Project Area. Note Māmari is mostly green fields. (W2-Birds) No TAR bird species expected to be reliant on habitat features associated with the Project Area. Project Area not considered an important corridor for movement of TAR bird species. Project Area not associated with coastal, forest or wetland habitat of significant value to native birds. (W2-Lizards) Copper skink (At Risk – Declining) likely to use the features identified within the Project Area. Most notably exotic scrub and exotic wetland habitat.
Species of conservation significance	3	3	3	4	2	-	2	-	-	Likely presence of copper skink (At Risk – Declining) associated with all vegetation units and the potential value of exotic treeland in supporting long-tailed bat (Threatened - Nationally Critical) activity in the broader landscape for TL.3.

Attributes to be considered	W2-EG	W2-ES	W2-PL.3	W2-TL.3	W2-TL.3 (DP)	W2-Bat	W2-Bird (Forest)	W2-Lizard	W2-Bird (TAR)	Justification
Distinctive ecological values	1	1	1	3		-	-	-	-	Scores reflect increase value for native animals (excluding TAR species).
Diversity and pattern	**1**	**2**	**2**	**3**	**2**	**0**	**2**	**0**	**0**	
Habitat diversity	1	1	2	3	2	-	2	-	-	Scores reflected the relatively restricted extent of woody vegetation in the broader area and associated role in providing habitat for native species (bats, birds and lizards).
Species diversity	1	2	2	2	2	-	-	-	-	Expected to be lowest for exotic grassland.
Patterns in habitat use	-	-	-	-	-	-	-		-	-
Ecological context	**1**	**1**	**2**	**2**	**2**	**0**	**2**	**0**	**0**	
Size, shape and buffering	1	1	1	1	1	-	2	-	-	Habitat features generally fragmented and not directly connected to higher value habitat (for example SEAs).
Sensitivity to change	1	1	1	2	-	-	-		-	Largely modified habitat with low or negligible residual sensitivities.
Ecological networks (linkages, pathways, migration)	1	1	2	2	2	-	-	-	-	More mature woody structure associated with exotic treeland mature planting likely to play a role in ecological connectivity.
Protected status	-	-	-	-	-	-	-	-	-	-
Combined value	**L**	**L**	**M**	**M**	**L**	**VH**	**L**	**H**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-11 Ecological values of the vegetation types present within the Brigham Creek corridor study area

Attributes to be considered	W3-EG	W3-ES	W3-PL.1	W3-PL.3	W3-TL.2	W3-TL.3	W3-TL.3 (DP)	W3-TL.2 (DP)	W3- Bird (TAR)	W3-Bat	Justification
Representativeness	**1**	**2**	**4**	**2**	**2**	**2**	**2**	**2**	**0**	**0**	
Typical structure and composition	1	1	3	2	2	2	-	-	-	-	Species structure and composition likely to be more representative of reference conditions for PL.1 and lowest for EG and ES.
Indigenous representation	1	2	4	2	2	2	2	2	-	-	Highest for PL.1 which is dominated by native planting. The presence of native animals may increase with structural complexity of other exotic vegetation types including ES, PL.3 and TL.3.
Rarity/distinctiveness	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**1**	**3**	**4**	
Species of conservation significance (fauna only)	-	-	-	-	-	-	-	-	3	4	(W3-Bats) Long-tailed bat (Threatened - Nationally Critical) present and potentially using features associated with the Project Area. (W3-Birds) No TAR bird species expected to be reliant on habitat features associated with the Project Area. Project Area not considered an important corridor for movement of TAR bird species. Project Area not associated with coastal, forest or wetland habitat of significant value to native birds. (W3-Lizards) Copper skink (At Risk – Declining) likely to use the features identified within the Project Area.
Species of conservation significance	3	3	3	3	4	4	4	1	-	-	Likely presence of copper skink (At Risk – Declining) associated with all vegetation units and the potential value of TL.3 in supporting

Attributes to be considered	W3-EG	W3-ES	W3-PL.1	W3-PL.3	W3-TL.2	W3-TL.3	W3-TL.3 (DP)	W3-TL.2 (DP)	W3- Bird (TAR)	W3-Bat	Justification
											long-tailed bat (Threatened - Nationally Critical) activity in the broader landscape.
Distinctive ecological values	1	1	3	2	3	3	-	-	-	-	Scores reflect increase value for native animals (excluding TAR species).
Diversity and pattern	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**1**	**0**	**0**	
Habitat and species diversity	1	1	3	2	3	3	3	1	-	-	Scores reflect the increased value associated with native (PL.1), woody (PL.3) and mature woody elements (TL.3) in providing diversity in structure and support native species diversity.
Patterns in habitat use	1	1	1	1	3	3	3	-	-	-	TL.3 associated with Waiarohia Stream may play an important role seasonal influenced bat behaviour. Both these features may also be important in controlling instream and stream margin habitat for seasonal spawners.
Ecological context	**3**	**1**	**1**	**2**	**3**	**3**	**4**	**1**	**0**	**0**	
Size, shape and buffering	3	1	1	1	3	3	3	1	-	-	EG is the most abundant habitat template associated with the study area, while TL.3 likely to provide some buffering from the existing Brigham Creek road and SNA associated with the Waiarohia Stream inlet.
Sensitivity to change	1	1	1	1	1	1	1	-	-	-	Largely modified habitat associated with pre-existing fragmentation with low or negligible residual sensitivities.
Ecological networks (linkages, pathways, migration)	1	1	1	2	4	4	4	1	-	-	More mature woody structure associated with TL.3 likely to play a role in ecological connectivity between the Waiarohia harbour and the upper area of the Waiarohia Stream catchment.
Combined value	**L**	**L**	**M**	**M**	**H**	**H**	**H**	**L**	**H**	**VH**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-12 Ecological values of the vegetation types present within the Spedding corridor study area

Attributes to be considered	W4-EG	W4-ES	W4-PL.1	W4-PL.2	W4-PL.3	W4-TL.3	W4-TL.3 (DP)	W4-Bat	W4-Bird	W4-Lizard	Justification
Representativeness	**1**	**2**	**4**	**3**	**2**	**2**	2	**0**	**0**	**0**	
Typical structure and composition	1	1	3	2	2	2	2	-	-	-	Species structure and composition likely to be more representative of reference conditions for PL.1 and lowest for EG and ES.
Indigenous representation	1	2	4	3	2	2	2	-	-	-	Highest for PL.1 which is dominated by native planting, followed by PL.2 (mixed native and exotic). The presence of native animals may increase with structural complexity of other exotic vegetation types including ES, PL.3 and TL.3.
Rarity/distinctiveness	**3**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**2**	**3**	
Species of conservation significance	-	-	-	-	-	-	-	4	2	3	(W4-Bats) Long-tailed bat (Threatened - Nationally Critical) confirmed/likely and likely to occur in both Totara Creek and Waiarohia catchments. (W4-Birds) Most of the study area of value to native but not threatened species common to rural and urban environment. (W4-Lizards) Copper skink likely to be associated with most habitat features identified within the Project Area.
Species of conservation significance	3	3	3	3	3	4	4	-	-	-	Likely Presence of copper skink (At Risk – Declining) associated with all vegetation units and the potential value of TL.3 in supporting Nationally Critical bat activity in the broader landscape.
Distinctive ecological values	1	1	3	2	2	3	3	-	-	-	Scores reflect increase value for native animals (excluding TAR species).

Attributes to be considered	W4-EG	W4-ES	W4-PL.1	W4-PL.2	W4-PL.3	W4-TL.3	W4-TL.3 (DP)	W4-Bat	W4-Bird	W4-Lizard	Justification
Diversity and pattern	**1**	**1**	**3**	**2**	**2**	**3**	3	**0**	**2**	**0**	
Habitat diversity	1	1	3	2	2	3	3	-	2	-	Scores reflect the increased value associated with native (PL.1), woody (PL.3) and mature woody elements (TL.3) in providing diversity in structure and support native species diversity.
Patterns in habitat use	1	1	1	1	1	3	3	-	-	-	TL.3 associated with Totara Creek, Trig and Rawiri Streams may play an important role in seasonal influenced bat behaviour. For Totara Creek, TL.3 may also be important for controlling instream and stream margin habitat for seasonal spawners.
Ecological context	**3**	**3**	**3**	**1**	**1**	**4**	**4**	**0**	**2**	**0**	
Size, shape and buffering	3	3	3	1	1	4	4	-	2	-	Size and distribution of EG and ES are relatively large. PL.1 mostly associated with roadside planting for SH16 (Totara Creek crossing) and SH18 (Trig Stream crossing). Native plantings once established will play an important buffering function for existing roads. The allocation of a relatively high score is therefore more to accommodate the future value of PL.1. Buffering function of TL.3 of downslope SEA (Totara Creek) against existing SH crossing considered relatively higher.
Ecological networks (linkages, pathways, migration)	1	1	1	1	1	4	4	-	-	-	Larger trees of PL.3 and mature trees of TL.3 are important for ecological connectivity, specifically TL.3 around Totara Creek. Stream corridors and associated vegetation likely to be maintained in the FUZ and will therefore become more important for sustaining ecological connectivity within a post developed landscape.
Combined value	**L**	**M**	**H**	**M**	**L**	**H**	**H**	**VH**	**L**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-13 Ecological values of the vegetation types present within the Hobsonville corridor study area

Attributes to be considered	W5-EG	W5-ES	W5-PL.1	W5-PL.3	W5-TL.3	W5-Bat	W5-Bird	W5-Lizard	W5-TL.3 (DP)	W5-TL.1 (DP)	Justification
Representativeness	**1**	**2**	**4**	**2**	**2**	**0**	**0**	**0**	**2**	**1**	
Typical structure and composition	1	1	3	2	2	-	-	-	-	-	Exotic dominated for EG, ES, PL.3 and TL.3. However, PL.3 and TL.3 may support more native species. Highest for native PL.1.
Indigenous representation	1	2	4	2	2	-	-	-	2	1	Lowest for EG. Native representation expected to be higher for woody habitat and very high for PL.1.
Rarity/distinctiveness	**3**	**3**	**1**	**1**	**2**	**0**	**3**	**3**	**2**	**3**	
Species of conservation significance	3	3	1	1	1	-	-	-	-	3	Potential copper skink presence associated with EG and ES. In the context of NoR W5 other habitat units are unlikely to be of value for copper skink.
Distinctive ecological values	1	1	1	1	2	-	-	-	2	-	Scores reflect increase value for native animals (excluding TAR species). Score considers the size and location and distribution of each feature.
Diversity and pattern	**1**	**1**	**2**	**1**	**2**	**0**	**0**	**0**	**2**	**1**	
Habitat diversity	1	1	2	1	2	-	-	-	2	1	Structural diversity lowest for EG and ES and higher for PL.1 and TL.3 (although the latter is relatively limited in extent).
Patterns in habitat use	1	1	1	1	2	-	-	-	2	-	No migratory or seasonal species relaying on any of the habitat features.
Ecological context	**1**	**1**	**1**	**2**	**2**	**0**	**0**	**0**	**2**	**1**	
Size, shape and buffering	1	1	1	1	1	-	-	-	1	1	Score considers the size and location of habitat unit in relation to existing and future stressors (infrastructure etc.) and other adjacent ecological features of value. Generally assessed as Low for all habitat units of NoR W5.

Attributes to be considered	W5-EG	W5-ES	W5-PL.1	W5-PL.3	W5-TL.3	W5-Bat	W5-Bird	W5-Lizard	W5-TL.3 (DP)	W5-TL.1 (DP)	Justification
Ecological networks (linkages, pathways, migration)	1	1	1	2	2	-	-	-	2	-	Similar considerations as for size, shape and buffering, but with a focus on the features capacity to support ecological connectivity the broader landscape (typically assessed the catchment scale, or between important ecological nodes). NoR W5 on watershed between Waiarohia Stream and Manutewhau Creek ecological features. Terrestrial features associated with NoR W5, generally reflect Low connectivity function. PL.3 and TL.3 scores slightly higher as these units may enable local connectivity within a fragmented baseline environment.
Combined value	**L**	**L**	**L**	**L**	**L**	**N**	**H**	**H**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7 Appendix 7 - Freshwater Value Assessment Tables

Table 14-14 Assessment of ecological value for freshwater ecology features for Trig Road North

Attributes to be considered	W1-S3*	Justification
Representativeness	**1**	
Instream habitat modification	-	-
Riparian habitat modification	1	The riparian features of all streams have been significantly altered by human activities.
Rarity/distinctiveness	**1**	
Species of conservation significance	1	No 'At Risk' species were identified in streams, but common indigenous species were identified.
Diversity and pattern	**1**	
Level of natural diversity	1	Zero order streams have low natural diversity.
Ecological context	**3**	
Stream order	1	All streams are zero order.
Hydroperiod	3	All streams are intermittent (>6 months).
Combined value	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-15 Assessment of ecological value for freshwater ecology features for Māmari Road

Attributes to be considered	W2-S1*	W2-S2*	W2-S3*	W2-S4*	W2-S5*	W2-S6*	W2-S7*	W2-S8*	Justification
Representativeness	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	
Instream habitat modification	-	-	-	-	-	-	-	-	-
Riparian habitat modification	2	2	2	2	2	2	2	2	Riparian features of all streams have been affected by human activities.
Rarity/distinctiveness	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	
Species of conservation significance	3	1	1	1	1	1	1	1	'At Risk – Declining' species identified at S1. No 'Threatened' species identified at any other streams, but native species present.
Diversity and pattern	**2**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	
Level of natural diversity	2	1	1	2	1	2	2	1	Zero order and first order streams have low natural diversity.
Ecological context	**4**	**3**	**3**	**4**	**3**	**4**	**4**	**3**	
Stream order	2	1	1	2	1	2	2	1	Streams S1, S4, S6 and S7 are order 1 streams. S2, S3, S5 and S8 are zero order streams.
Hydroperiod	4	3	3	4	3	4	4	3	Streams S1, S4, S6 and S7 are permanent streams. S2, S3, S5 and S8 are intermittent streams.
Combined value	**M**	**L**	**L**	**M**	**L**	**M**	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-16 Assessment of ecological value for freshwater ecology features for Brigham Creek Road

Attributes to be considered	W3-S1*	W3-S2	W3-S3*	W3-S5	W3-S6	W3-S7	W3-S8	Justification
Representativeness	**3**	**3**	**1**	**2**	**2**	**2**	**1**	
Riparian habitat modification	3	3	1	2	2	2	1	Streams S1 riparian features are insignificantly affected by human activities. Riparian features of streams S5 and S7 are affected by human activities. Streams S3 and S8 are significantly altered by human activities.
RHA score relative to potential score	-	2	-	1	2	2	1	RHA scores of stream S7 is 40-70% of the maximum score possible. Streams S5 and S8 RHA scores are <40% of the maximum score possible.
Rarity/distinctiveness	**3**	**3**	**1**	**1**	**3**	**3**	**3**	
Species of conservation significance	3	3	1	1	3	3	3	'At Risk – Declining' species were identified through the desktop study at streams S1, S7 and S8. Native species were identified at streams S3, S4 and S5.
Diversity and pattern	**2**	**3**	**1**	**2**	**1**	**3**	**1**	
Level of natural diversity	2	3	1	2	1	3	1	Instream RHA scores of stream S7 is 6. Streams S4 and S5 recorded instream RHA scores of 3-5. S8 had an instream RHA score of 2. Order 3 streams have moderate natural diversity, order 1 streams have low natural diversity.
Ecological context	**4**	**4**	**3**	**3**	**4**	**4**	**4**	
Stream order	3	3	1	1	2	3	1	Streams S1 and S7 are order 2 or 3, and the remaining streams are zero order.

Attributes to be considered	W3-S1*	W3-S2	W3-S3*	W3-S5	W3-S6	W3-S7	W3-S8	Justification
Hydroperiod	4	4	3	3	4	4	4	Streams S3 and S5 are intermittent streams, and the remaining streams are permanent.
Combined value	**M**	**H**	**L**	**L**	**M**	**M**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-17 Assessment of ecological value for freshwater ecology features for Spedding Road

Attributes to be considered	W4-S1*	W4-S2*	W4-S3*	W4-S4	W4-S5	W4-S6*	W4-S7	W4-S8	W4-S9	Justification
Representativeness	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	
Riparian habitat modification	3	3	2	2	3	2	3	3	3	Riparian features of streams S1, S2, S5, S7, S8 and S9 have been insignificantly affected by human activities. The riparian features of streams S3, S4 and S6 have been affected by human activities. S10 riparian features have been significantly altered by human activities.
RHA score relative to potential score	-	-	-	1	2	-	1	1	2	Streams S5 and S9 have RHA scores of 40-70% relative to the maximum score possible. Streams S4, S7 and S8 have RHA scores of <40% relative to the maximum score possible.
Rarity/distinctiveness	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	
Species of conservation significance	3	3	3	3	3	3	3	3	3	Desktop study indicates presence of 'At Risk – Declining' species at all streams.
Diversity and pattern	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**4**	

Attributes to be considered	W4-S1*	W4-S2*	W4-S3*	W4-S4	W4-S5	W4-S6*	W4-S7	W4-S8	W4-S9	Justification
Level of natural diversity	2	2	1	1	2	1	1	2	4	Stream S9 has an instream RHA score of 8 (Very high). Streams S5 and S8 have instream RHA scores of 3 to 5 (Moderate). Streams S4, S7 and S10 have instream RHA scores of <3 (Low). Order 3 streams have moderate natural diversity (S1 & S2), order 1 streams have low natural diversity (S3 & S6).
Ecological context	**4**	**4**	**3**	**3**	**4**	**3**	**4**	**4**	**4**	
Stream order	3	3	1	1	2	1	2	2	2	Streams S1 and S2 are order 2 or 3 streams. Streams S5, S7, S8 and S9 are stream order 1. The remaining streams are all zero order.
Hydroperiod	4	4	3	3	4	3	4	4	4	Streams S1, S2, S5, S7, S8 and S9 are permanent streams. Streams S3, S4, S6 and S10 are intermittent streams.
Combined value	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-18 Assessment of ecological value for frehwater ecology features for Hobsonville Road

Attributes to be considered	W5-S1*	W5-S2*	W5-S3*	W5-S4	W5-S5	Justification
Representativeness	**3**	**1**	**2**	**3**	**2**	

Attributes to be considered	W5-S1*	W5-S2*	W5-S3*	W5-S4	W5-S5	Justification
Riparian habitat modification	3	1	2	3	2	Stream S4 riparian features insignificantly affected by human activities. Stream S5 riparian features have been affected by human activities.
RHA score relative to potential score	-	-	-	3	1	Stream S4 has RHA score of 70-90% relative to the maximum score possible. S5 has an RHA score of <40% relative to maximum score possible.
Rarity/distinctiveness	**1**	**1**	**1**	**1**	**1**	
Species of conservation significance	1	1	1	1	1	No 'At Risk' species were identified, but native species present from desktop study.
Diversity and pattern	**1**	**1**	**1**	**4**	**1**	
Level of natural diversity	1	1	1	4	1	Stream S4 has an instream RHA score of 8 (Very high). Stream S5 has an instream RHA score of 2 (Low). Zero order streams have low natural diversity.
Ecological context	**3**	**3**	**3**	**4**	**3**	
Stream order	1	1	1	1	1	All streams are zero order streams.
Hydroperiod	3	3	3	4	3	Stream S4 is a permanent stream. Stream S5 is an intermittent stream.
Combined value	**L**	**L**	**L**	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

8 Appendix 8 - Wetland Value Assessment Tables

Table 14-19 Assessment of ecological value for wetland ecology features for Trig Road North

Attributes to be considered	W1-W1	Justification
Representativeness	**3**	
Hydrological modification	3	Wetland mostly retains hydrological functioning (i.e., seasonal saturation not notably impacted by existing road or farm drains).
Biota	1	Dominated by exotic and invasive species.
Rarity/distinctiveness	**2**	
Wetland type (rare or distinctive)	2	Seasonally saturated depression wetland requires relatively flat topography high up in catchment.
Distinctive ecological values (ecosystem services)	1	Wetlands is isolated and not connected (concentrated or channelled surface flow) to the downslope receiving environment.
Diversity and pattern	**2**	
Diversity of habitat types	2	Expression of wetness generally contribute to increase habitat diversity within the landscape.
Ecological context	**3**	
Flood attenuation	2	Small depression, shallow perched water.
Sediment trapping	2	Likely limited due to position in landscape and sediment yield capacity of the direct catchment.
Phosphate, nitrate and toxicant assimilation	3	Existing catchment likely source of nutrients and toxicants.
Connectivity and migration	1	

Attributes to be considered	W1-W1	Justification
Combined value	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-20 Assessment of ecological value for wetland ecology features for Māmari Road

Attributes to be considered	W2-W1	W2-W2	W2-W3A	W2-W3	Justification
Representativeness	**3**	**2**	**1**	**3**	Scores reflect differences between wetlands for hydrological modification and representation of native species.
Hydrological modification	3	2	-	3	(W2-W1) Local landscape hydrology remains mostly intact (i.e., catchment runoff characteristics retained). (W2-W2) Catchment hydrology and runoff characteristics moderately modified by upslope and lateral farm drains. (W2-W3A) Largely modified hydrology due to construction of pond not present in historical image (see historical comparison). (W2-W3) Similar to W2-W2 but less effected by drains.
Biota	1	1	1	1	All wetland associated with NoR W2 dominated by exotic species.
Rarity/distinctiveness	**3**	**2**	**3**	**2**	Differences in scores are attributed to wetland type, (seep, depression, valley bottom etc) size and distinctive ecological values (ecosystem services) within a larger catchment context. W2-W3 provide potential habitat for 'At Risk' birds.
Species of conservation significance	-	-	3	-	-
Wetland type (rare or distinctive)	3	2	1	2	(W2-W1) Relatively large, channelled valley bottom with well-defined hillslope seeps. (W2-W2) Majority of wetland due to hillslope seepage into a valley bottom landform, although relatively small. The wetland is also associated with a stream, but mainly maintained by hillslope

Attributes to be considered	W2-W1	W2-W2	W2-W3A	W2-W3	Justification
					hydrology. (W2-W3A) Wetland assessed as artificial. (W2-W3) Requires field verification, but wetland characterised by lateral hillslope seeps (potentially permanent in some places but mainly seasonal (inferred from slope) and well-defined riparian features.
Distinctive ecological values (ecosystem services) Larger context	3	1	-	1	(W2-W1) Type and size considered relatively important at the scale of the Sinton stream catchment. (W2-W2) Functional value mostly constrain to local sub catchment due to size, modification and seasonality of the wetland. (W2-W3A) Wetland feature part of the upper Pikau Stream catchment. This catchment and stream are largely modified, and the wetland contributes negatively to the hydrological modification of the stream. (W2-W3) Similar to W2-W2.
Diversity and pattern	**3**	**2**	**3**	**2**	Score indicates differences in hydroperiod (saturation or inundation -permanent, seasonal or temporary) and vegetation diversity of soil saturation or inundation (permanent, seasonal or temporary) resulting in habitat diversity.
Diversity of habitat types	3	2	3	2	(W2-W1) Presence of diverse hydroperiods (permanent, seasonal and temporary saturated areas) well represented and contiguous with Sinton Stream habitat. (W2-W2) Field survey required to confirm, but desktop indicates likely dominance of seasonal saturation. However, the gradient in soil wetness from adjacent terrestrial soils (agriculture) to seasonal wetland does result in changes in vegetation and therefore locally increase habitat diversity. (W2-W3A) Higher score allocated due to the permanent presence of inundated habitat and habitat associated with the littoral (area of emergent wetland vegetation surrounding the edge of the pond). (W2-W3) Same as for W2-W2.
Ecological context	**4**	**3**	**2**	**3**	Scores mainly represent the values of wetlands to attenuate floods, regulate stream flows, trap sediment, purify water and facilitate ecological connectivity.

Attributes to be considered	W2-W1	W2-W2	W2-W3A	W2-W3	Justification
Flood attenuation	2	1	2	1	(W2-W1) Attenuates flow from >six small sub-catchments. (W2-W2) Attenuation capacity value constrained by small catchment and wetland type. (W2-W3A) Ponds/dams may have inherent attenuation capacity. However, the feature drains a relatively small catchment.
Streamflow regulation	3	1	1	1	(W2-W1) Flow augmentation expected to be important at the scale of the Sinton Stream catchment. (W2-W2) Importance of the wetland to contribute notably to downstream flow is low due to catchment size, lack of permanent wetland hydrology, ad modification through drains. (W2-W3A) Negatively impact on stream flows. (W2-W3) Wetland less affected by to drains but similar to W2-W2.
Sediment trapping	3	2	2	2	(W2-W1) Drain upper catchment of Sinton Stream which in turn drains into Totara Creek associated with an SEA. Catchment condition likely to provide a source of nutrients and toxicants associated with agrochemicals. System therefore buffers an important downstream receptor. (W2-W2) Local catchment condition likely to result in moderate sediment and agrochemical yields. No obvious indication of erosional features. Upslope and lateral drains further reduce the capacity of the wetland to trap sediment, while the while the downslope farm pond is likely to substitute sediment trapping functions. (W2-W3A) The artificial pond is likely to play a role in local sediment control. The sediment yield from the catchment is expected to be low to moderate due to existing catchment uses (W2-W3) Same as for W2-W2.
Phosphate, nitrate and toxicant assimilation	4	3	1	3	(W2-W1) Same as above. (W2-W2) Same as above. (W2-W3A) Nutrient treatment in open water likely to be less effective than in palustrine wetlands (although still present and therefore allocated a low score) but negated by other negative water quality effects including oxygen depletion, pH and temperature impacts on the downstream environment. (W2-W3) same as for W2-W2.

Attributes to be considered	W2-W1	W2-W2	W2-W3A	W2-W3	Justification
Connectivity and migration	4	2	-	2	(W2-W1) Main drainage feature within the Sinton Stream catchment and presently unfragmented by linear infrastructure. The Sinton Stream corridor and associated wetlands likely to retain ecological corridor function with FUZ. (W2-W2) Wetland relatively high up in sub catchment. Upper catchment of wetland substantially modified with little residual habitat and therefore a lower requirement for connectivity. Connectivity to downstream areas affected by farm dam, piped section and SH16 crossing. (W2-W3A) Pikau Stream fragmented by several farm ponds, piped sections and SH16. The artificial pond contributes to the loss in connectivity. (W2-W3) Same as for W2-W2.
Sum	13	9	9	10	-
Combined value	**H**	**M**	**M**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-21 Assessment of ecological value for wetland ecology features for Brigham Creek Road

Attributes to be considered	W3-W2	W3-W4	W3-W5	W3-W7	W3-W8	Justification
Representativeness	**3**	**1**	**2**	**2**	**3**	Scores reflect differences between wetlands for hydrological modification and representation of native species.
Hydrological modification	3	1	2	1	-	(W3-W2) Local landscape hydrology remains mostly intact (i.e., catchment runoff characteristics retained). However, historical attempt to drain wetland. (W3-W4) Moderate to large hydrological modification through historical drains (longitudinal and lateral). Historical presence could not be confirmed. (W3-W5) Upslope catchment modified by dry detention pond north

Attributes to be considered	W3-W2	W3-W4	W3-W5	W3-W7	W3-W8	Justification
						of Brigham Creek Road. (W3-W5A) Similar or W3-W5. (W3-W7) Large hydrological modification due to upslope pond.
Biota	1	1	2	2	3	All wetland associated with NoR W3 dominated by exotic species W3-W5 does have some native species present for a small portion of the wetland but remains mostly dominated by exotic species. (W3-W5A) >50% native species dominated. (W3-W8) large proportion of native sedges planted around stormwater pond.
Rarity/distinctiveness	**2**	**1**	**3**	**2**	**3**	Differences in scores are attributed to wetland type (seep, depression, valley bottom etc) size and distinctive ecological values (ecosystem services) within a larger catchment context.
Species of conservation significance	-	-	-	-	3	Suitable habitat for potentially occurring spotless crake (At Risk - Declining), although not observed during the site visits.
Wetland type (rare or distinctive)	2	1	3	2	1	(W3-W2) Hillslope seep wetland with exotic vegetation connected to a valley bottom system. (W3-W4) Valley system. (W3-W5) Relatively large valley bottom with well-defined hillslope seeps. (W3-W5A) Singers (2017) Endangered/Critically Endangered vegetation type (WL11). (W3-W7) Channelled valley bottom system with hillslope seeps. (W3-W8) Stormwater pond.
Distinctive ecological values (ecosystem services) Larger context	2	1	3	2	-	(W3-W2) Drains a relatively small sub catchment of the Slaughter House Stream. (W3-W4). (W3-W5 + W3-W5A) Drains most of the upper catchment of the Waiarohia Stream tributary. (W3-W7) Drains first order catchment.
Diversity and pattern	**2**	**1**	**3**	**2**	**3**	Score indicates differences in hydroperiod (saturation or inundation -permanent, seasonal or temporary) and vegetation diversity of soil

Attributes to be considered	W3-W2	W3-W4	W3-W5	W3-W7	W3-W8	Justification
						saturation or inundation (permanent, seasonal or temporary) resulting in habitat diversity.
Diversity of habitat types	2	1	3	2	3	(W3-W2) Catchment position and vegetation indicative of only seasonal saturation. (W3-W4) Catchment position and vegetation indicative of only temporarily saturated. (W3-W5 +W3-W5A) Presence of diverse hydroperiods (permanent, seasonal and temporary saturated areas) well represented and contiguous with Waiarohia Stream tributary. (W3-W7) Similar to W3-W2. (W3-W8) Structural differences in vegetation from lake like to shallow emergent wetland vegetation and the well-defined gradient of terrestrial to wetland associated with the stormwater result in diverse habitat present.
Ecological context	**2**	**2**	**3**	**3**	**4**	Scores mainly represent the values of wetlands to attenuate floods, regulate stream flows, trap sediment, purify water and facilitate ecological connectivity.
Flood attenuation	1	1	1	1	4	(W3-W2) Some seasonal attenuation but for a relatively small sub portion of the Slaughter House catchment. (W3-W4) Small catchment. (W3-W5 +W3-W5A) Flood attenuation function negated by the upslope presence of the dry detention pond north of Brigham Creek. (W3-W7) Negated by large upslope pond. (W3-W8) Stormwater pond designed to attenuate local floods.
Streamflow regulation	1	1	3	3	1	(W3-W2) Flow augmentation localised due to relatively small catchment and seasonal nature of the wetland. (W3-W4) Similar as above. (W3-W5) Wetland reflects permutant saturation and is therefore likely to provide important downstream flow augmentation. (W3-W5A) Less than W3-W5 as is represents a much smaller portion of the larger W3-W5. (W3-W7) Areas of permanent saturated indicate value for downstream flow augmentation.

Attributes to be considered	W3-W2	W3-W4	W3-W5	W3-W7	W3-W8	Justification
						(W3-W8) Pond like to be relative impermeable with little or no downslope augmentation.
Sediment trapping	2	2	2	2	4	(W3-W2) Direct catchment expected to have moderate sediment yield. (W3-W4) Considered to be relatively restricted to wetland size. (W3-W5 & W3-W5A) Sediment trapping functions somewhat negated by upslope pond, however, likely to assist in sediment trapping and water treatment from runoff from the road. (W3-W7) Negated by pond, although a small portion of the wetland catchment does not drain into the pond directly. (W3-W8) Pond designed with a sediment trapping function.
Phosphate, nitrate and toxicant assimilation	2	2	2	2	4	(W3-W2) Direct catchment potential source of agrichemicals and herbicide, although the sub catchment of the wetland is relatively small. (W3-W4) Same as above. (W3-W5 & W3-W5A) Same as above. (W3-W7) Same as above. (W3-W8) Pond designed with water treatment capacity.
Connectivity and migration	1	1	1	1	2	(W3-W2) Wetland located on hillslope draining into the lower part of the Slaughter House Stream prior to its confluence with Totara Creek therefore facilitating localised connectivity. (W3-W5 +W3-W5A) Downslope sections fragmented by several ponds. System located high up in sub catchment. Upslope habitat of low ecological value. (W3-W7) Same as for W3-W7. (W3-W8) Connectivity affected by existing Brigham Creek infrastructure. However, may of some value for bird movement between the Waiarohia inlet and the upper portions of the Waiarohia catchment.
Sum	9	5	11	9	13	
Combined value	**M**	**L**	**M**	**M**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-22 Assessment of ecological value for wetland ecology features for Brigham Spedding Road

Attributes to be considered	W4-W1	W4-W2	W4-W3	W4-W3A	W4-W4	W4-W5	Justification
Representativeness	**1**	**1**	**3**	**3**	**2**	**2**	Scores reflect differences between wetlands for hydrological modification and representation of native species. W4-W6 was not allocated a score as the system is considered artificial.
Hydrological modification	1	1	3	3	2	2	(W4-W1) Historically drained. (W4-W2) Historically drained and affected by commercial agriculture. (W4-W3) Runoff characteristics partially changes due to existing Spedding Rd, but likely to be maintained by spring water. (Farmer unscheduled attempted to drain the wetland in the past. The Willows were planted in an attempt to dry up the wetland). (W4-W3A) Catchment hydrology mostly intact, some historical evidence suggest that the associated stream channel was less defined historically, therefore potentially straightened or deepened potentially affecting wetland hydrology. (W4-W4) Historical indication of a wider wetland. Hydrology affected by the existing SH18 (part of the wetland have been realigned for the road. Excavation on the right bank of the wetland associated with Trig Stream has exacerbated wetland conditions. Several small upslope ponds on Trig Stream further impact on wetland hydrology. (W4-W5) Rawiri wetland induced by upslope ponding due to SH18 crossing based on historical evidence which shows likely stream characteristics. (W4-W6) Induced wetland resulting from realignment through piping of Rawiri Tributary due to infill and construction to the north of the system.
Biota	1	1	1	1	1	1	All wetland associated with NoR W4 dominated by exotic species.
Rarity/distinctiveness	**1**	**1**	**3**	**1**	**3**	**3**	Differences in scores are attributed to wetland type (seep, depression, valley bottom etc) size and distinctive ecological values (ecosystem services) within a larger catchment context.

Attributes to be considered	W4-W1	W4-W2	W4-W3	W4-W3A	W4-W4	W4-W5	Justification
Species of conservation significance	-	-	-	-	1	1	Parts of W4-W4 and W4-W5 provide potential habitat for spotless crake (At Risk – Declining).
Range restricted or endemic species	-	-	-	-	-	-	-
Wetland type (rare or distinctive)	1	1	3	1	3	3	W4-W3 represents of depression wetland which is potentially spring fed (inferred from soil indicators of permanent saturation against relatively small catchment). (W4-W4 & W4-W5) Wetlands with relatively large well-defined zones of permanent inundation (indicated by dominance of *Glyceria* sp.) relatively uncommon at catchment scale.
Distinctive ecological values (ecosystem services) Larger context	-	-	-	-	-	-	-
Diversity and pattern	**1**	**1**	**3**	**3**	**3**	**3**	Scores reflect the diversity of different hydroperiods (permanent, seasonal, temporary) associated with each wetland.
Diversity of habitat types	1	1	3	3	3	3	Scores reflect the diversity of different hydroperiods (permanent, seasonal, temporary) associated with each wetland.
Species diversity	-	-	-	-	-	-	-
Ecological context	**3**	**3**	**3**	**2**	**3**	**3**	Scores mainly represent the values of wetlands to attenuate floods, regulate stream flows, trap sediment, purify water and facilitate ecological connectivity.
Flood attenuation	1	1	1	1	1	1	All NoR W4 wetlands drain relatively small headwater catchments.
Streamflow regulation	1	1	-	1	2	2	(W4-W1) Seasonal and small catchment. (W4-W2) Seasonal and small catchment. (W4-W3) Permanent and seasonal but not connected downslope watercourse through surface flow.

Attributes to be considered	W4-W1	W4-W2	W4-W3	W4-W3A	W4-W4	W4-W5	Justification
							(W4-W3A) Permanent and seasonal. (W4-W4) Permanent and seasonal. Similar to W4-W3A but draining bigger catchment and is associated with permanent stream. (W4-W5) Same as W4-W5. (W4-W6) Temporary saturation from local catchment. Water from upslope catchment piped to flow into W4-W5).
Sediment trapping	3	3	3	2	2	2	Scores reflect differences in local catchment sediment yield and the wetland capacity to control sediment. Local catchments with the highest sediment yield are associated with wetlands (W4-W1, W2 and W3). The sensitivity of the downstream environment is also considered (for example W3-W1 and W2 buffering the receiving Totara Creek and downslope SEA). Wetland W4-W1 drains the smallest local catchment.
Water purification function	2	2	3	2	3	3	Scores reflect catchment contamination potential (Existing and Future Environment) and the capacity of wetlands to provide a treatment function. Wetlands with degraded catchments and larger permanently saturated zones (W4-W3, W4, W5) were allocated higher scores.
Connectivity and migration	1	1	1	1	2	2	W4-W1, W2, W3 part of small Totara Creek sub-catchments with localised connectivity value. W4-W4 and W4-W5 connects approximately 50% of Waiarohia catchment. However, two notable points of fragmentation within this catchment includeSH18 and Brigham Creek Rd crossing.
Combined value	**L**	**L**	**M**	**M**	**M**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 14-23 Assessment of ecological value for wetland ecology features for Hobsonville Road

Attributes to be considered	W5-W1	W5-W2	W5-W3	Justification
Representativeness	**3**	**1**	**1**	
Hydrological modification	3	1	-	Valley head seep, historically drained but extent appears consistent with historical extent.
Biota	1	1	1	Dominated by exotic species.
Rarity/distinctiveness	**1**	**2**	**3**	
Species of conservation significance	1	1	3	N/A
Wetland type (rare or distinctive)	1	2	-	Valley head seep wetlands relatively common in the local landscape.
Diversity and pattern	**1**	**1**	**2**	
Diversity of habitat types	1	1	2	Seasonal temporary wetlands with low structural diversity.
Ecological context	**2**	**2**	**3**	
Flood attenuation	1	1	3	W5-W1 attenuates small catchments on a seasonal basis. W5-W3 designed for stormwater management.
Streamflow regulation	1	-	1	(W5-W1) Likely to contribute seasonally to downstream flows.
Sediment trapping	1	2	2	Scores reflect wetland capacity and likely sediment yield form immediate catchments.
Water purification	2	2	2	Same as above.
Connectivity and migration	2	1	2	NoR W5 on watershed between Waiarohia and Manutewhau catchments. Catchment connectivity heavily fragmented by SH18, existing HB Rd. and urban development south of HB Rd. In the context of existing Baseline and Future Environment the stormwater wetland provides a 'steppingstone' function and

Attributes to be considered	W5-W1	W5-W2	W5-W3	Justification
				wetlands directly connected to the stream network are considered to be of relatively higher value for ecological connectivity.
Combined value	**L**	**L**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

9 Appendix 9 - Impact Assessment Tables

9.1 Trig Road North

NoR W1 - Trig Road North Upgrade													
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Main Effect Description	Detailed Effect Description	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Magnitude (pre-mitigation)	Level of Effect (pre-mitigation)
Construction	Noise/vibration/dust	W1-Bats	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	National	Short-term (<5 years)	Frequently	Unlikely	Low	Moderate
Construction	Noise/vibration/dust	W1-Birds	Low	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Definite	Moderate	Low
Operation	Lighting and noise	W1-Bats	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Regional	Permanent (>25 years)		Unlikely	Low	Moderate
Operation	Presence of the road	W1-Bats	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Low
Operation	Lighting and noise	W1-Birds	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Very Low
Operation	Lighting and noise	W1-Lizards	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Low
Operation	Lighting and noise	W1-Lizards	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Low
Construction	Noise/vibration/dust	W1-Lizards	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Unlikely	Negligible	Very Low
Operation	Presence of the road	W1-Birds	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)		Likely	Low	Very Low
Construction	Vegetation removal	W1-TL.3 (District Plan)	Moderate	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Likely	Low	Low
Construction	Vegetation removal	W1-Bats	Very High	Construction- Bats	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Low
Construction	Vegetation removal	W1-Bats	Very High	Construction- Bats	Kill or injure individual bats due to vegetation removal	Direct	Local	Permanent (>25 years)		Likely	Low	Moderate
Construction	Vegetation removal	W1-Birds	Low	Construction- Birds	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W1-Birds	Low	Construction- Birds	Nest loss due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W1-Birds	Low	Construction- Birds	Kill or injure individual due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W1-PL.1 (District Plan)	Moderate	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Likely	Low	Low

9.2 Māmari Road

NoR W2 - Māmari Road Upgrade												
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed (Dropdown)	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Magnitude (pre-mitigation)	
Construction	Noise/vibration/dust	W2-Bats	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Likely	Low	Moderate
Construction	Noise/vibration/dust	W2-Non-TAR Birds	Low	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Definite	Moderate	Low
Construction	Noise/vibration/dust	W2-Lizards	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Unlikely	Negligible	Very Low
Operation	Lighting and noise	W2-Bats	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)		Likely	Low	Moderate
Operation	Presence of the road	W2-Bats	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Regional	Permanent (>25 years)		Likely	Moderate	High
Operation	Presence of the road	W2-Non-TAR Birds	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)	Continuously	Highly Likely	Moderate	Low
Operation	Lighting and noise	W2-Non-TAR Birds	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)	Continuously	Highly Likely	Moderate	Low
Operation	Presence of the road	W2-Lizards	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Low
Operation	Presence of the road	W2-Lizards	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use	Direct	Local	Permanent (>25 years)	Continuously	Unlikely	Low	Low
Construction	Lighting and noise	W2-TAR Bird	High	Construction- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration		Local	Short-term (<5 years)	Frequently	Likely	Low	Low
Construction	Vegetation removal	W2-TL.3 (District Plan)	Low	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Likely	Low	Very Low
Construction	Vegetation removal	W2-Bats	Very High	Construction- Bats	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Low
Construction	Vegetation removal	W2-Bats	Very High	Construction- Bats	Kill or injure individual bats due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Low
Construction	Vegetation removal	W2-Non-TAR Birds	Low	Construction- Birds	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	W2-Non-TAR Birds	Low	Construction- Birds	Nest loss due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	W2-Non-TAR Birds	Low	Construction- Birds	Kill or injure individual due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low

9.3 Brigham Creek Road

NoR W3 - Brigham Creek Road Upgrade

Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed (Dropdown)	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Magnitude (pre-mitigation)	
Construction	Noise/vibration/dust	W3-Bats	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Likely	Low	Moderate
Construction	Noise/vibration/dust	W3-TAR Birds	High	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Continuously	Highly Likely	Moderate	High
Construction	Noise/vibration/dust	W3-Lizards	High	Construction- Herpetofauna (native)	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Unlikely	Negligible	Very Low
Operation	Lighting and noise	W3-Bats	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)	Continuously	Unlikely	Low	Moderate
Operation	Presence of the road	W3-Bats	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Regional	Permanent (>25 years)	Continuously	Likely	Moderate	High
Operation	Lighting and noise	W3-Non TAR Birds	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Very Low
Operation	Presence of the road	W3-Non TAR Birds	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Very Low
Operation	Presence of the road	W3-Lizards	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Low
Construction	Notice/vibration/Dust	W3-Non TAR Birds	Low	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)		Local	Short-term (<5 years)	Frequently	Definite	Moderate	Low
Operation	Presence of the road	W3-Lizards	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Low
Construction	Vegetation removal	W3-TL.3 (District Plan)	High	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Likely	Low	Low
Construction	Vegetation removal	W3-Bats	Very High	Construction- Bats	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Low
Construction	Vegetation removal	W3-Bats	Very High	Construction- Bats	Kill or injure individual bats due to vegetation removal	Direct	Local	Permanent (>25 years)		Likely	Low	Moderate
Construction	Vegetation removal	W3-Non TAR Birds	Low	Construction- Birds	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W3-Non TAR Birds	Low	Construction- Birds	Nest loss due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W3-Non TAR Birds	Low	Construction- Birds	Kill or injure individual due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W3-TL.2 (District Plan)	Low	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low

9.4 Spedding Road

NoR W4 - Spedding Road Upgrade												
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed (Dropdown)	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Magnitude (pre-mitigation)	
Construction	Noise/vibration/dust	W4-Bats	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Highly Likely	Low	Moderate
Construction	Noise/vibration/dust	W4-Birds	Low	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Definite	Moderate	Low
Construction	Noise/vibration/dust	W4-Lizards	High	Construction- Herpetofauna (native)	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)	Frequently	Highly Likely	Low	Low
Operation	Lighting and noise	W4-Bats	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)	Continuously	Highly Likely	Moderate	High
Operation	Presence of the road	W4-Bats	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Regional	Permanent (>25 years)	Continuously	Highly Likely	High	Very High
Operation	Lighting and noise	W4-Birds	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Very Low
Operation	Presence of the road	W4-Birds	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)	Continuously	Unlikely	Low	Very Low
Operation	Presence of the road	W4-Lizards	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Low
Operation	Presence of the road	W4-Lizards	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Direct	Local	Permanent (>25 years)	Continuously	Likely	Low	Low
Construction	Vegetation removal	W4-TL.3 (District Plan)	High	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Likely	Low	Low
Construction	Vegetation removal	W4-Bats	Very High	Construction- Bats	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Low
Construction	Vegetation removal	W4-Bats	Very High	Construction- Bats	Kill or injure individual bats due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	High
Construction	Vegetation removal	W4-Birds	Low	Construction- Birds	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W4-Birds	Low	Construction- Birds	Nest loss due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low
Construction	Vegetation removal	W4-Birds	Low	Construction- Birds	Kill or injure individual due to vegetation removal	Direct	Local	Permanent (>25 years)		Highly Likely	Moderate	Low

9.5 Hobsonville Road

NoR W5 - Hobsonville Road FTN Upgrade													
Phase	Project Activity	Resource Unit (Habitat/Species)	Ecological Value	Effect Description Main	Effect Description Detailed (Dropdown)	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Magnitude (pre-mitigation)	
Construction	Noise/vibration/dust	W5-Birds	Low	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)		Unlikely	Negligible	Very Low
Construction	Noise/vibration/dust	W5-Lizards	High	Construction- Herpetofauna (native)	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Direct	Local	Short-term (<5 years)		Likely	Negligible	Very Low
Operation	Lighting and noise	W5-Birds	Low	Operation- Birds (native)	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Operation	Presence of the road	W5-Birds	Low	Operation- Birds (native)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Indirect	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Operation	Lighting and noise	W5-Lizards	High	Operation- Herpetofauna (native)	Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use	Indirect	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	Notable Tree	Negligible	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Operation	Presence of the road	W5-Lizards	High	Operation- Herpetofauna (native)	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	Indirect	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	W5-TL.3 (District Plan)	Low	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	W5-Birds	Low	Construction- Birds	Loss of foraging habitat due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	W5-Birds	Low	Construction- Birds	Nest loss due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	W5-Birds	Low	Construction- Birds	Kill or injure individual due to vegetation removal	Direct	Local	Permanent (>25 years)		Unlikely	Negligible	Very Low
Construction	Vegetation removal	W5-TL.1 (District Plan)	Low	Construction- Terrestrial habitat	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal	Direct	Local	Permanent (>25 years)		Definite	High	Low

10 Appendix 10 - Rapid Habitat Assessment Tables

Table 14-24 Summary of Brigham Creek Road stream classification and RHA values

Stream	Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
W3-S2	5	6	5	6	6	6	5	7	7	7	**60**	**M**
W3-S4	5	3	2	3	2	2	6	5	6	6	**40**	**P**
W3-S5	1	4	1	4	2	4	4	3	6	5	**34**	**P**
W3-S6	5	2	2	2	3	2	6	4	7	9	**42**	**M**
W3-S7	4	6	5	6	6	5	6	6	7	9	**60**	**M**
W3-S8	2	2	2	3	3	2	5	5	6	5	**35**	**P**

Table 14-25 Summary of Spedding Road stream classification and RHA values

Stream	Deposited sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
W4-S4	1	1	1	1	1	1	2	2	3	3	**16**	**P**
W4-S5	3	5	5	5	6	5	5	5	3	8	**50**	**M**
W4-S7	3	2	3	3	4	1	5	4	5	9	**39**	**P**

Stream	Deposited sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
W4-S8	5	3	2	3	4	3	4	5	5	6	**40**	**P**
W4-S9	7	8	8	8	6	8	7	6	4	5	**67**	**G**
W4-S10	2	1	1	1	1	1	4	3	3	2	**19**	**P**

Table 14-26 Summary of Hobsonville Road stream classification and RHA values

Stream	Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
W5-S4	6	8	7	8	7	9	5	8	6	9	**73**	**G**
W5-S5	3	2	1	2	2	1	5	4	5	5	**30**	**P**

Note:

* = Corresponding habitat values for each habitat quality score

P = Poor

M = Moderate

G = Good

E = Excellent

Light blue shading = Permanent Stream

No shading = Intermittent Stream

11 Appendix 11 - Wetland Observations

NoR	Wetland ID	Desktop/Field Observation	Species	Cover (%)	Rating	Soil Type	Concretions	Colour
Trig Road North	W1-W1	Field	*Ranunculus repens*	100	FAC	Mineral	Iron	Mottled
			Persicaria maculosa	1	FACW			
			Juncus effusus	20	FACW			
	W1-W2	Desktop	-	-	-	-	-	-
	W1-W3	Field	*Pennisetum clandestinum*	-	-	-	-	-
			Holcus lanatus	-	FAC	-	-	-
			Trifolium pratense	-	FACU	-	-	-
			Juncus effusus	-	FACW	-	-	-
			Ranunculus repens	-	FAC	-	-	-
Māmari Road	W2-W1	Field	*Juncus effusus*	-	FACW	-	-	-
			Eleocharis acuta	-	OBL	-	-	-
			Paspalum distichum	-	FACW	-	-	-
			Phormium tenax	-	-	-	-	-
			Juncus articulatus	-	FACW	-	-	-
	W2-W2	Desktop	-	-	-	-	-	-
	W2-W3	Desktop	-	-	-	-	-	-

NoR	Wetland ID	Desktop/Field Observation	Species	Cover (%)	Rating	Soil Type	Concretions	Colour
	W2-W3a	Desktop	-	-	-	-	-	-
Brigham Creek Road	W3-W1	Field	*Paspalum urvillei*	60	FAC	-	-	-
			Persicaria maculosa	5	FACW	-	-	-
			Rumex obtusifoius	20	-	-	-	-
			Juncus effusus	20	FACW	-	-	-
			Cyperus eragrostis	5	FACW	-	-	-
			Juncus articulatus	5	FACW	-	-	-
	W3-W2	Desktop	-	-	-	-	-	-
	W3-W3	Desktop	-	-	-	-	-	-
	W3-W4	Desktop	-	-	-	-	-	-
	W3-W5	Field	*Cordyline australis*	20	FAC	Mineral	Iron	Black/Dark Brown
			Paraserianthes lophantha	10	UPL			
			Phormium tenax	30	-			
			Blechnum novae zelandiae	20	-			
			Hedychium gardnerianum	20	-			
			Juncus effusus	40	FACW			
	W3-W6	Desktop	-	-	-	-	-	-
	W3-W7	Field	*Juncus effusus*	20	FACW	Mineral	-	

NoR	Wetland ID	Desktop/Field Observation	Species	Cover (%)	Rating	Soil Type	Concretions	Colour
			Ranunculus repens	50	FAC			Black/Dark Brown Mottled
			Holcus lanatus	30	FAC			
			Persicaria maculosa	20	FACW			
			Lolium perenne	2	FACU			
			Antroxanthum odoratum	2	-			
			Salix alba	50	-			
			Ulex europaeus	5	FACU			
			Paspalum urvillei	5	FAC			
			Blechnum novae zelandiae	5	-			
			Ipomoea purpurea	-	-			
			Trifolium pratense	-	FACU			
			Cyperus eragrostis	20	FACW			
	W3-W8	Desktop	-	-	-	-	-	-
	W3-W9	Field	Confirmed not wetland – stormwater pond					
Spedding Road	W4-W1	Field	Confirmed not wetland – ephemeral stream					
	W4-W2	Field	Confirmed not wetland – intermittent stream					
	W4-W3	Field	*Ranunculus repens*	50	FAC	Mineral	Iron	Gley
			Juncus effusus	40	FACW			

NoR	Wetland ID	Desktop/Field Observation	Species	Cover (%)	Rating	Soil Type	Concretions	Colour
			Dactylis glomerata	2	FACU			
			Pennisetum clandestinum	80	-			
	W4-W3A	Refer W1-W3						
	W4-W4	Field	*Glyceria maxima*	100	OBL	Mineral	Manganese	Gley
	W4-W5	Field	*Glyceria maxima*	100	OBL	-	-	-
	W4-W6	Field	*Juncus effusus*	80	FACW	-	-	-
			Holcus lanatus	400	FAC	-	-	-
			Ranunculus repens	20	FAC	-	-	-
			Trifolium pratense	5	FACU	-	-	-
Hobsonville Road	W5-W1	Desktop	-	-	-	-	-	-

Notes: OBL = obligate wetland, FACW = facultative wetland, FAC = facultative, FACU = facultative upland, UPL = obligate upland.

12 Appendix 12 - Long-Tailed Bat Acoustic Monitoring Report (2021-2022)

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Long-Tailed Bat Acoustic Monitoring Report 2021-2022

July 2022

Version 1

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Table of Contents

Appendices

Table of Figures

Table of Tables

1 Executive Summary

As part of the Supporting Growth Programme, Te Tupu Ngātahi Supporting Growth (SG) is preparing Notices of Requirement (NoRs), on behalf of Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT), to designate land, under the Resource Management Act 1991 (RMA), for the purpose of constructing, operating and maintaining a proposed strategic and local arterial transport network in the North West (NW) of Auckland, hereinafter referred to as the 'Project'.

Long-tailed bats (pekapeka) (*Chalinolobus tuberculatus*) are considered 'Threatened – Nationally Critical' (O'Donnell et al., 2018) and are known to be present within the Northwest of Auckland. Although desktop records confirm their presence within a 10 km radius of the Project area, the understanding of how bats use the wider landscape is limited. To gain an understanding of the habitat features that are of value to long-tailed bats it is necessary to monitor the landscape in a manner that reflects how they use it. Therefore, to establish an ecological baseline and identify if there are vegetated corridors that bats are using frequently to move through the landscape, acoustic monitoring for bats was undertaken at an areawide level.

Automatic Bat Monitors (ABM)s were deployed across the Project area in two separate survey sessions. The first (December 2021) was completed within the bat maternity period (December - February) and the second (April 2022) within the bat mating season (March - May). ABMs were placed in a network within habitats that would be affected by the Project and would provide suitable habitat for bat roosting, foraging, and commuting. Specifically, pre-determined survey locations were selected based on the current understanding of habitats that are favoured by bats.

During the December 2021 survey, seven of the 32 ABM sites (December sites #2, #11, #17, #21, #23, #25, and #27) detected bat activity. The site with the greatest number of bat passes was December site #27. No foraging calls or social calls were recorded, and no bat passes were recorded within 30 minutes of sunset or sunrise.

During the April 2022 survey, 16 of the 21 ABM sites (April sites #1, #2, #4, #5, #6, #7, #8, #9, #10, #11, #13, #14, #15, #16, #17, and #20) detected bat activity. The site with the greatest number of bat passes was April site #17 with 1370 bat passes recorded during the survey. Foraging calls were recorded at 10 of the ABM sites, with the greatest number recorded at April site #17. No social calls were recorded, and no bat passes were recorded within 30 minutes of sunset or sunrise.

The results suggest that bats are active in the North West Project area. Specifically, the results suggests that bats are active in both the Local Arterials Package area (Whenuapai Arterials, Redhills Arterials, and Riverhead Arterials), and the Strategic Projects and Kumeū Huapai Local Arterials Package area, with the highest bat activity recorded in the Alternative State Highway (ASH) NoR.

2 Introduction

2.1 Background

As part of the Supporting Growth Programme, Te Tupu Ngātahi Supporting Growth (SG) is preparing Notices of Requirement (NoRs), on behalf of Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT), to designate land, under the Resource Management Act 1991 (RMA), for the purpose of constructing, operating and maintaining a proposed strategic and local arterial transport network in the North West (NW) of Auckland, hereinafter referred to as the 'Project'.

SG is preparing the NoRs for the individual projects within the NW and the projects have been split into two lodgement packages:

- **Lodgement Package 1** is the **Local Arterial Package** and consists of three area-based assessment volumes (Whenuapai, Redhills and Riverhead) (Table 2-1).
- **Lodgement Package 2** is the **Strategic and Kumeū-Huapai Package**. The assessments have been grouped based upon their strategic role, or in the case of Access and Station Road the relationship with the strategic projects (Table 2-2).

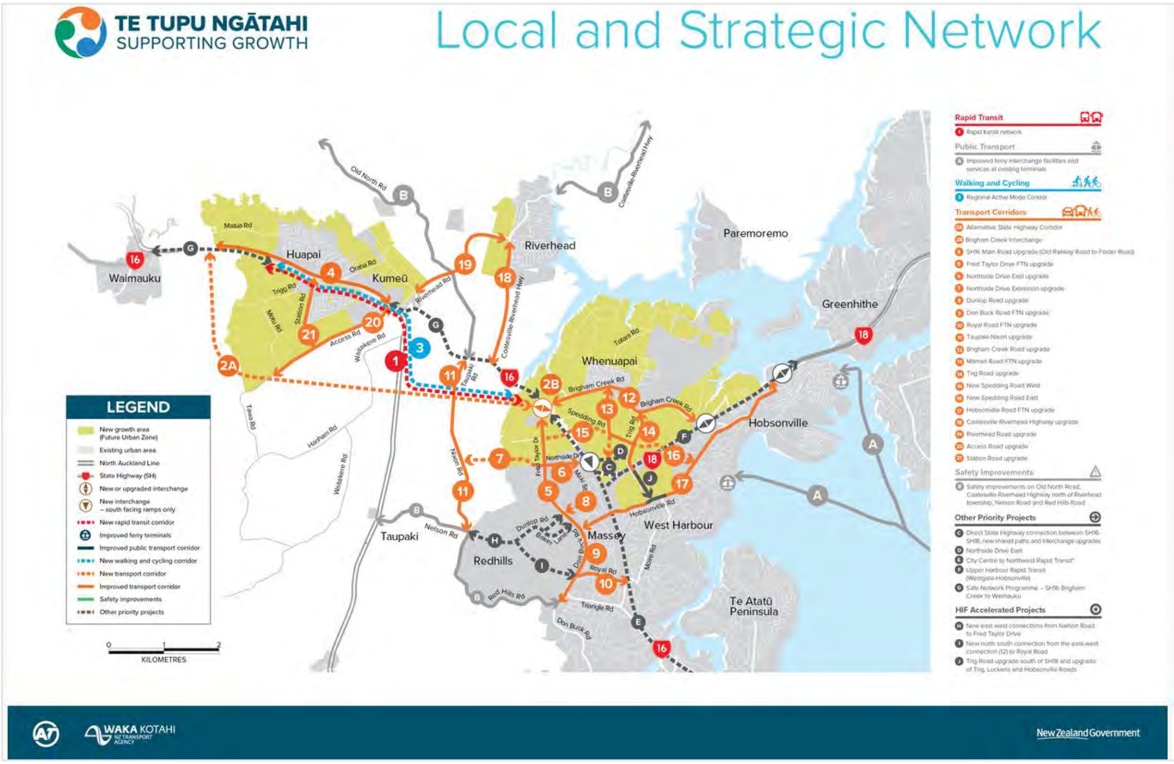

Figure 2-1 North West Growth Area Local and Strategic Network

Table 2-1 Local Arterial Package

Package	Assessment Volume	Proposed NoRs
Local Arterial Package	**Whenuapai Arterials**	Proposed NoRs: • Brigham Creek Road upgrade • Māmari Road FTN upgrade

Package	Assessment Volume	Proposed NoRs
		• Trig Road North upgrade • Spedding Road East and West
		Proposed alternations to existing designations: • Hobsonville Road FTN upgrade
	Redhills Arterials	Proposed NoRs: • Northside Drive East extension • Don Buck Road FTN upgrade • Royal Road FTN upgrade
		Proposed alternations to existing designations: • Fred Taylor Drive Frequent Transport Network (FTN) upgrade
	Riverhead Arterials	• Coatesville – Riverhead Highway Upgrade • Riverhead Road Upgrade

Table 2-2 Strategic Package

Package	Proposed NoRs
Strategic Projects and Kumeū Huapai Local Arterials	Proposed NoRs: • Rapid Transit Corridor (RTC), including Regional Active Mode Corridor (RAMC) • Alternative State Highway (ASH), including Brigham Creek Interchange • Access Road upgrade • Station Road upgrade
	Proposed alternations to existing designations: • SH16 Main Road upgrade

2.2 Acoustic Monitoring

Long-tailed bats (pekapeka) (*Chalinolobus tuberculatus*) are considered ‘Threatened – Nationally Critical’ (O’Donnell *et al.,* 2018) and are known to be present within the Northwest of Auckland (Waitakere Ranges, Riverhead Forest etc) (DOC, 2022). Although desktop records confirm their presence within a 10 km radius of the NoRs, the understanding of how bats use the wider landscape is limited.

To gain an understanding of the habitat features that are of value to long-tailed bats it is necessary to monitor the landscape in a manner that reflects how they use it. Therefore, to establish an ecological baseline and identify if there are vegetated corridors that bats are using frequently to move through the landscape, acoustic monitoring for bats was undertaken at an areawide level.

3 Methodology

3.1 Acoustic Monitoring

Automatic Bat Monitors (ABM)s (Song Meter SM4BAT-FS Ultrasonic Bat Detectors with SMM-U2 microphones) were deployed across the Project area. ABMs were deployed in two separate survey sessions. The first (December 2021) was completed within the bat maternity period (December - February) and the second (April 2022) within the bat mating season (March - May). The intent of surveying in two sessions was to cover any potential changes in bat activity patterns between the maternity and mating seasons.

Once deployed, ABMs were pre-set to start recording 60 minutes before sunset, and cease recording 60 minutes after sunrise (a 'night'). Each ABM was left *in-situ* for at-least 14 nights with suitable weather conditions (O'Donnell & Sedgeley, 2001). For the purposes of this report suitable weather conditions have been defined as:

- Air temperatures dropped below 10°C in the first four hours after sunset.
- Mean overnight wind speed was considered 'strong breeze' on the Beaufort Scale (39-49 km/h) (Royal Meteorological Society, 2021).
- Maximum overnight wind gust exceeded 60 km/h; and/or
- Persistent heavy rain in the first two hours after sunset (heavy rain is described as >4 mm/h) (United States Geological Survey, 2016).

3.1.1 December 2021 Survey

ABMs were placed in a network within habitats that would be affected by the Project and would provide suitable habitat for bat roosting, foraging, and commuting. Specifically, pre-determined survey locations were selected based on the current understanding of habitats that are favoured by bats, drawing information from recent radio tracking that AECOM has completed on the urban fringe of the Waitakere Ranges, existing bat records (Department of Conservation and Auckland Council), and a heat map produced by Auckland Council (Crewther, 2016).

32 ABMs were left in-situ at various times during the period 17 November 2021 until 23 December 2021. The locations of the December 2021 survey sites are detailed in Table 3-1 and presented in Figure 3-1.

Table 3-1 December 2021 ABM survey locations

Site	NZTM Easting (X)	NZTM Northing (Y)
#1-Dec	1739214	5926273
#2-Dec	1740072	5926623
#3-Dec	1735355	5928284
#4-Dec	1733209	5929146
#5-Dec	1736714	5929643
#6-Dec	1734977	5929358

Site	NZTM Easting (X)	NZTM Northing (Y)
#7-Dec	1742885	5926156
#8-Dec	1738312	5927722
#9-Dec	1745935	5926209
#10A-Dec	1738213	5928889
#10B-Dec	1738211	5928832
#11-Dec	1741815	5924338
#12A-Dec	1736983	5926448
#12B-Dec	1736912	5926867
#13-Dec	1742972	5926641
#14-Dec	1741756	5931165
#15-Dec	1736431	5930302
#16-Dec	1738242	5929512
#17-Dec	1741693	5922045
#18-Dec	1735617	5930473
#19-Dec	1739393	5928689
#20-Dec	1738140	5930302
#21-Dec	1741241	5921934
#22-Dec	1741983	5926912
#23-Dec	1740244	5920178
#24-Dec	1741618	5926346
#25-Dec	1738270	5923934
#26-Dec	1738146	5928249
#27-Dec	1735631	5926833
#28-Dec	1738928	5929152
#29-Dec	1736737	5930863
#30-Dec	1734194	5928226

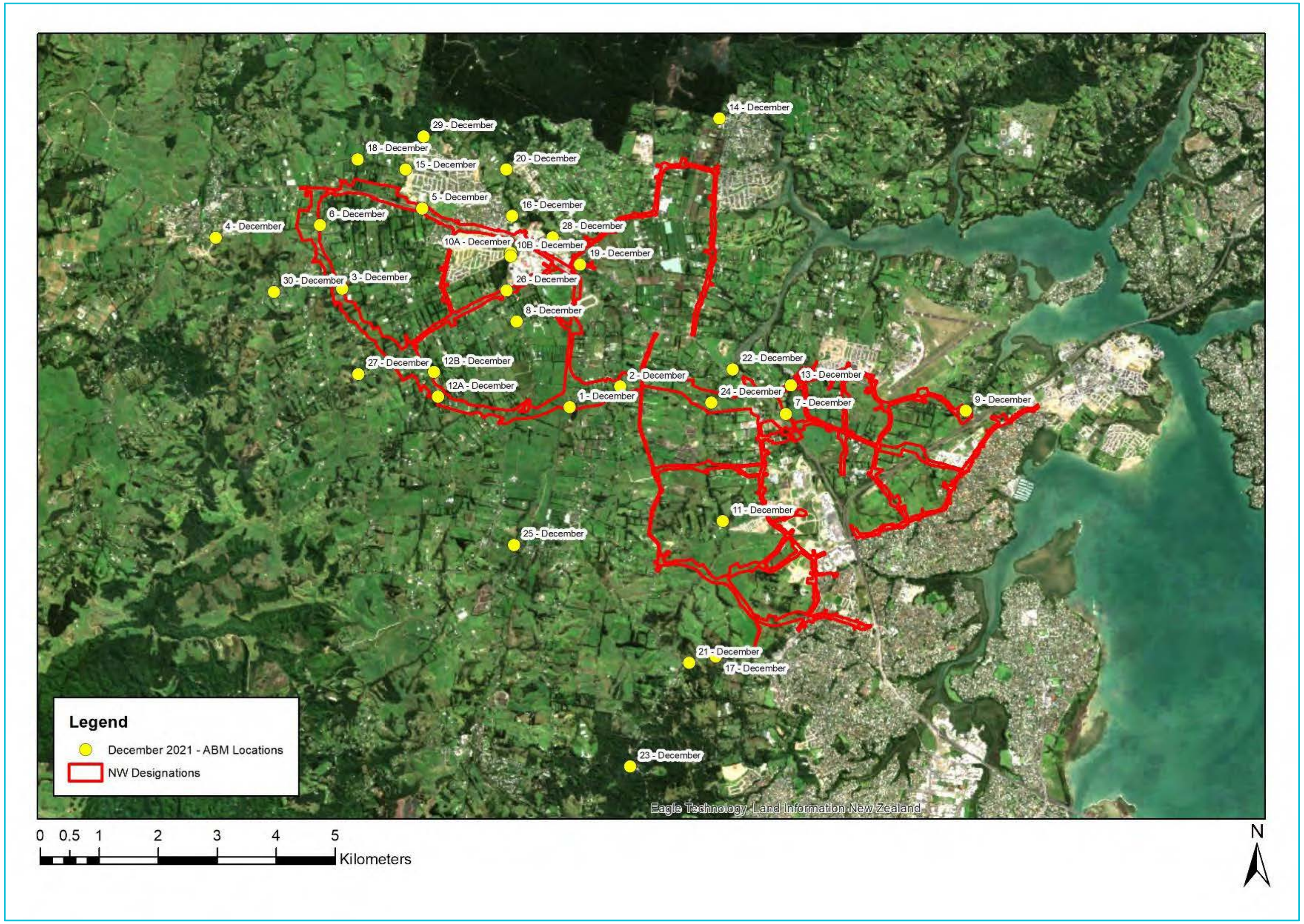

Figure 3-1 ABM locations (December 2021 survey).

3.1.2 April 2022 Survey

Based on the results of the first survey, ABMs locations were specific to the stream and river corridors associated with the proposed Strategic alignment and specifically the Alternative State Highway (ASH).

A total of 21 ABMs were left *in-situ* from 6-7 April 2022 until 3 May 2022. The locations of the April 2022 survey sites are detailed in Table 3-2 and presented in Figure 3-2.

Table 3-2 April 2022 ABM survey locations

Site	NZTM Easting (X)	NZTM Northing (Y)
#1-Apr	1741497	5926010
#2-Apr	1741627	5926348
#3-Apr	1738298	5927729
#4-Apr	1740062	5926649
#5-Apr	1739242	5926255
#6-Apr	1736563	5925866
#7-Apr	1737764	5926415
#8-Apr	1737011	5926448
#9-Apr	1738151	5928249
#10-Apr	1735633	5926835
#11-Apr	1737116	5926987
#12-Apr	1736235	5926691
#13-Apr	1736074	5927368
#14-Apr	1735449	5927854
#15-Apr	1737326	5926729
#16-Apr	1735364	5928281
#17-Apr	1735701	5928158
#18-Apr	1734931	5928655
#19-Apr	1734952	5929326
#20-Apr	1739706	5926337
#21-Apr	1739953	5926092

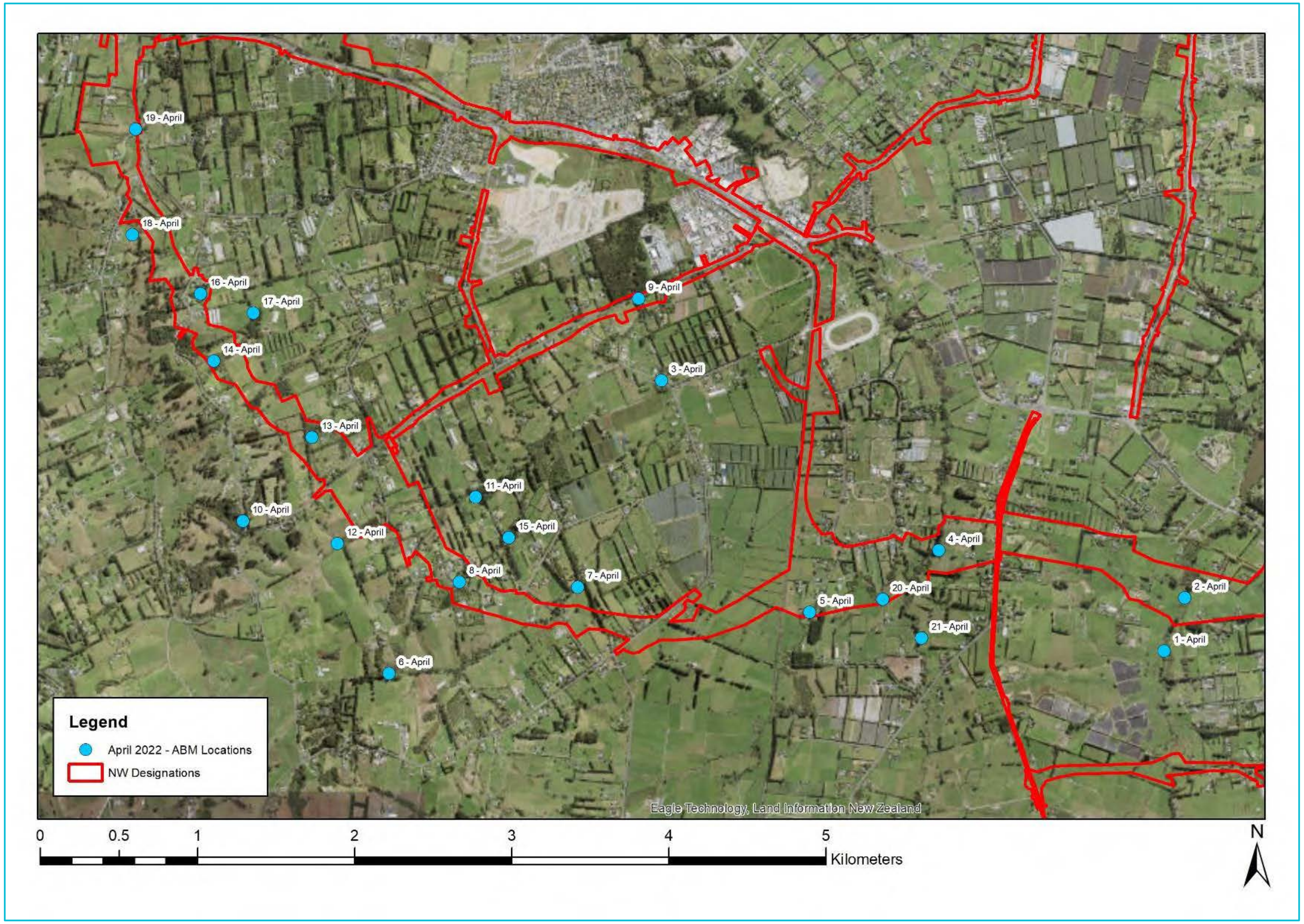

Figure 3-2 ABM locations (April 2022 survey)

3.2 Data Analysis

3.2.1 Long-tailed bat detection and behaviour

The ABM recordings were analysed by an experienced ecologist using Kaleidoscope Pro Analysis[1] software. Confirmed bat recordings (several bat echolocation calls recorded in a sound file) were further classified into:

- Echolocation calls i.e. regularly-spaced calls;
- Echolocation calls with foraging calls (feeding buzzes); and
- Echolocation calls with social calls.

The ABM data was removed from the analysis of trends if there was instrument error or weather conditions overnight were suboptimal for bat activity. Weather data for the survey period was provided by the nearest NIWA CliFlo weather station with relevant data available (North Shore Albany Ews, Agent 37852)[2] and the weather conditions during this period are included in Appendix 1.

3.2.2 First and Last Bat Pass

A review of the ABM data was undertaken to determine when the first and last bat pass was detected in comparison with sunset or sunrise time (data collected from the Time and Date website[3]). The purpose of this analysis was to gain an understanding as to whether bats could potentially be roosting in close proximity to an ABM site. Griffiths (2007) found that long-tailed bats emerged on average 30.1 ± 1.5 minutes after sunset and between January – February bats returned to their roost just before sunrise. However, by March bats were observed to be returning earlier to their roosts and by the end of May they returned as early as 40 minutes after emerging.

The following information was reviewed:

- Percentage of nights at each site where first/last bat pass is recorded within 30 minutes of sunset/sunrise;
- First and last bat pass recorded at each site during the survey period; and
- Minimum time difference between sunset/sunrise and the first/last bat pass.

[1] https://www.wildlifeacoustics.com/download/kaleidoscope-software.
[2] https://cliflo.niwa.co.nz/
[3] https://www.timeanddate.com

4 Results

4.1 December 2021

Table 4-1 and Figure 2-1 present the overall results of the bat surveys completed for the North West during the December 2021 survey. Raw survey data is included in Appendix 2.

Seven of the 32 ABM sites (December sites #2, #11, #17, #21, #23, #25, and #27) detected bat activity during the survey period. The site with the greatest number of bat passes was December site #27, all other sites had similarly low numbers of bat passes (Figure 4-2). No foraging calls or social calls were recorded during the survey.

No bat passes were recorded within 30 minutes of sunset or sunrise (Appendix 3). The site with the lowest minimum time difference between sunset and first bat pass was at December site #17, with a time of one hour 37 minutes. The site with the lowest minimum time difference between sunrise and last bat pass was at December site #25, with a time of 3 hours 9 minutes.

Table 4-1 December 2021 survey results of sites with bat activity

Site	Total Number of Echolocation Calls	Total Number of Foraging Calls	Total Number of Social Calls
#2-Dec	1	0	0
#11-Dec	3	0	0
#17-Dec	2	0	0
#21-Dec	1	0	0
#23-Dec	1	0	0
#25-Dec	3	0	0
#27-Dec	42	0	0

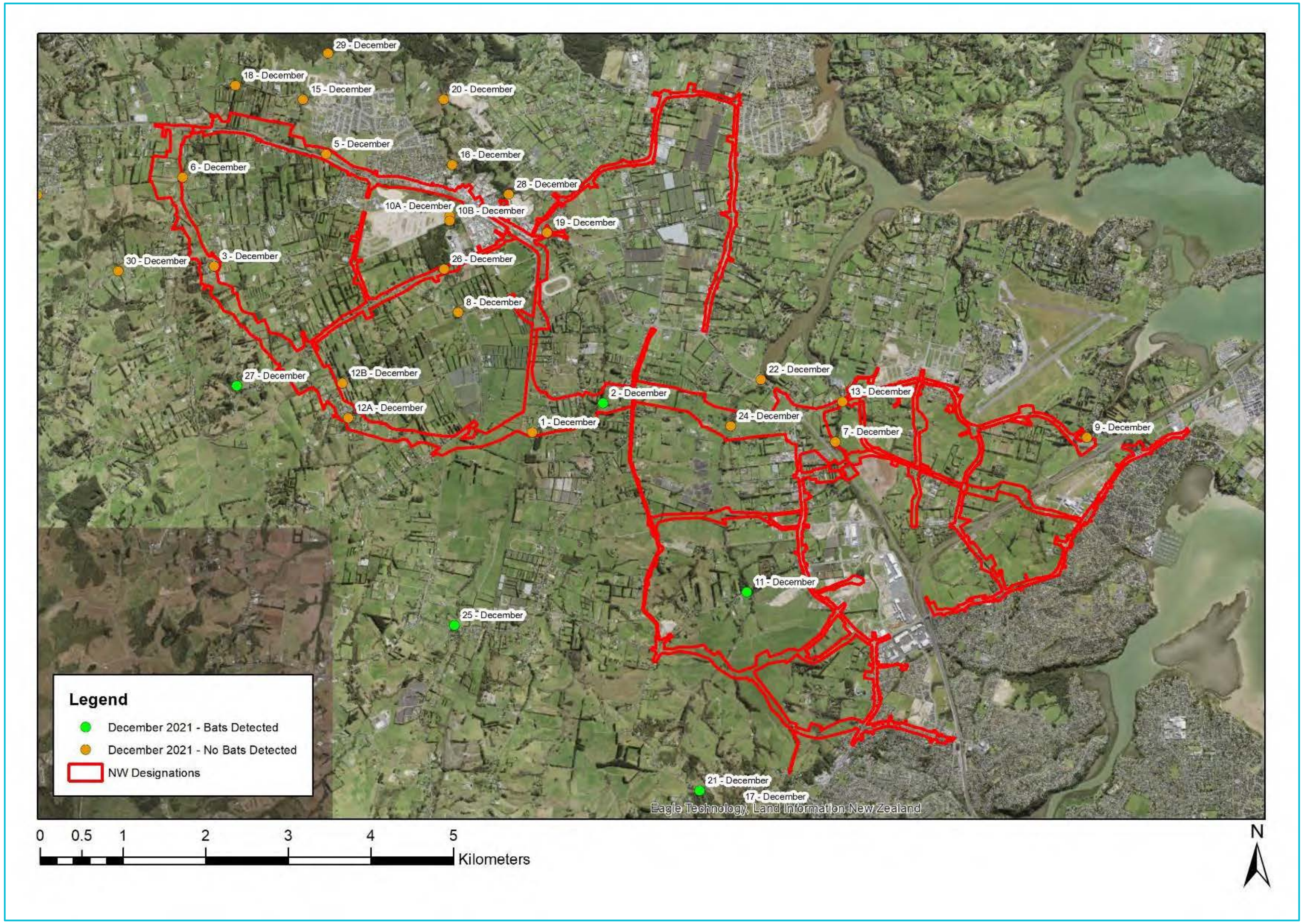

Figure 4-1 Long-tailed bat presence/absence (December 2021 survey)

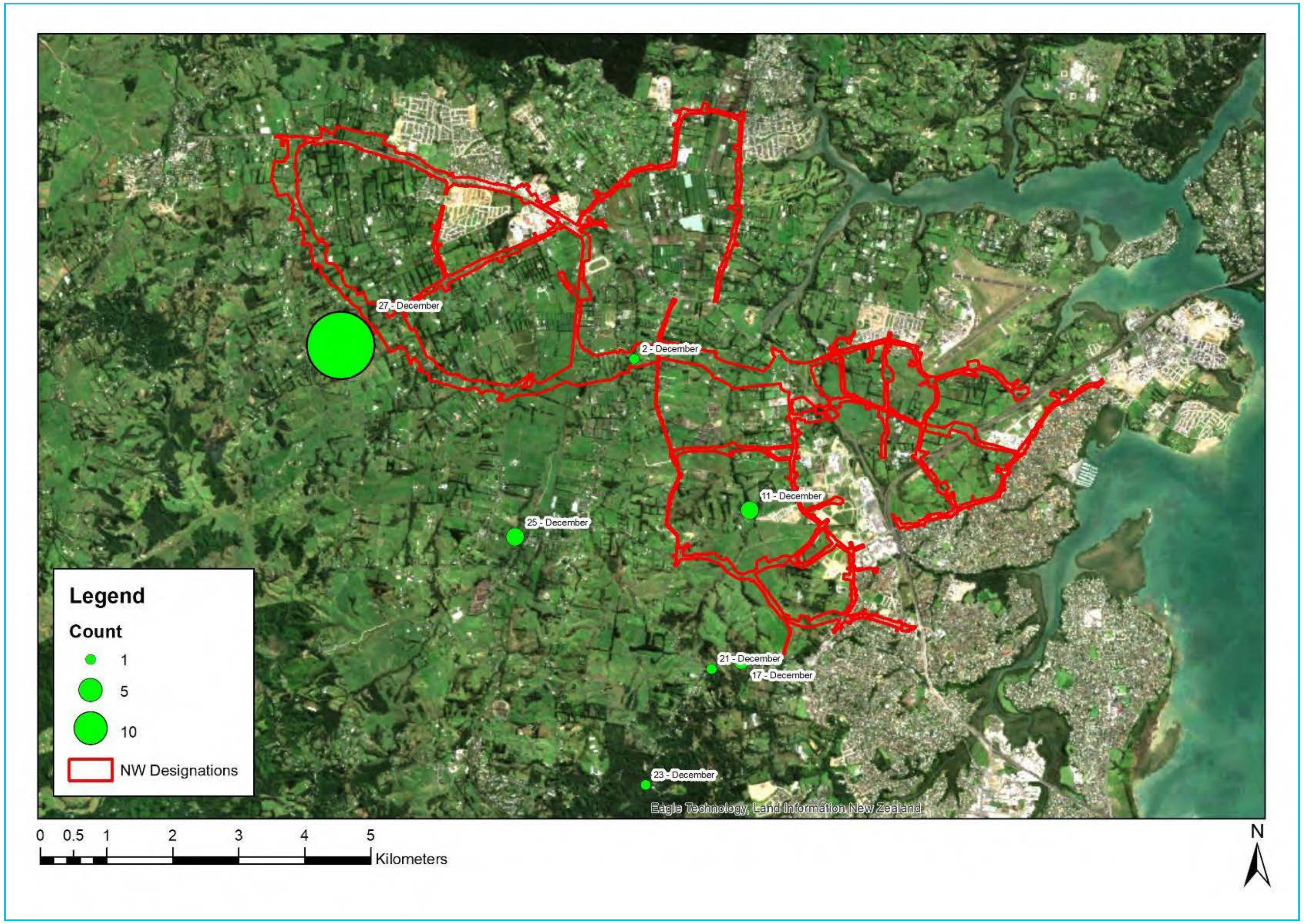

Figure 4-2 Sites with confirmed long-tailed bat presence (December 2021 survey). Proportional symbology indicates the relative proportion of bat passes in relation to the site with the highest number of bat passes (#27-December).

4.2 April 2022

Table 4-2 and Figure 4-3 present the overall results of the bat surveys completed for the North West during the April 2022 survey. Raw survey data is included in Appendix 2.

A total of 16 of the 21 ABM sites detected bat activity during the survey period (April sites #1, #2, #4, #5, #6, #7, #8, #9, #10, #11, #13, #14, #15, #16, #17, and #20). The site with the greatest number of bat passes was April site #17 with 1370 bat passes recorded during the survey (Figure 4-4). Foraging calls were recorded at 10 of the ABM sites, with the greatest number recorded at April site #17, and no social calls were recorded during the survey.

No bat passes were recorded within 30 minutes of sunset or sunrise (Appendix 3). The site with the lowest minimum time difference between sunset and first bat pass was at April site #11, with a time of 46 minutes. The site with the lowest minimum time difference between sunrise and last bat pass was at April site #17, with a time of 1 hour 2 minutes.

Table 4-2 April 2022 survey results of sites with bat activity

Site	Total Number of Echolocation Calls	Total Number of Foraging Calls	Total Number of Social Calls
#1-Apr	1	0	0
#2-Apr	2	0	0
#4-Apr	29	4	0
#5-Apr	21	2	0
#6-Apr	346	15	0
#7-Apr	103	14	0
#8-Apr	35	3	0
#9-Apr	2	0	0
#10-Apr	231	5	0
#11-Apr	162	15	0
#13-Apr	37	1	0
#14-Apr	21	1	0
#15-Apri	18	0	0
#16-Apr	5	0	0
#17-Apr	1370	265	0
#20-Apr	1	0	0

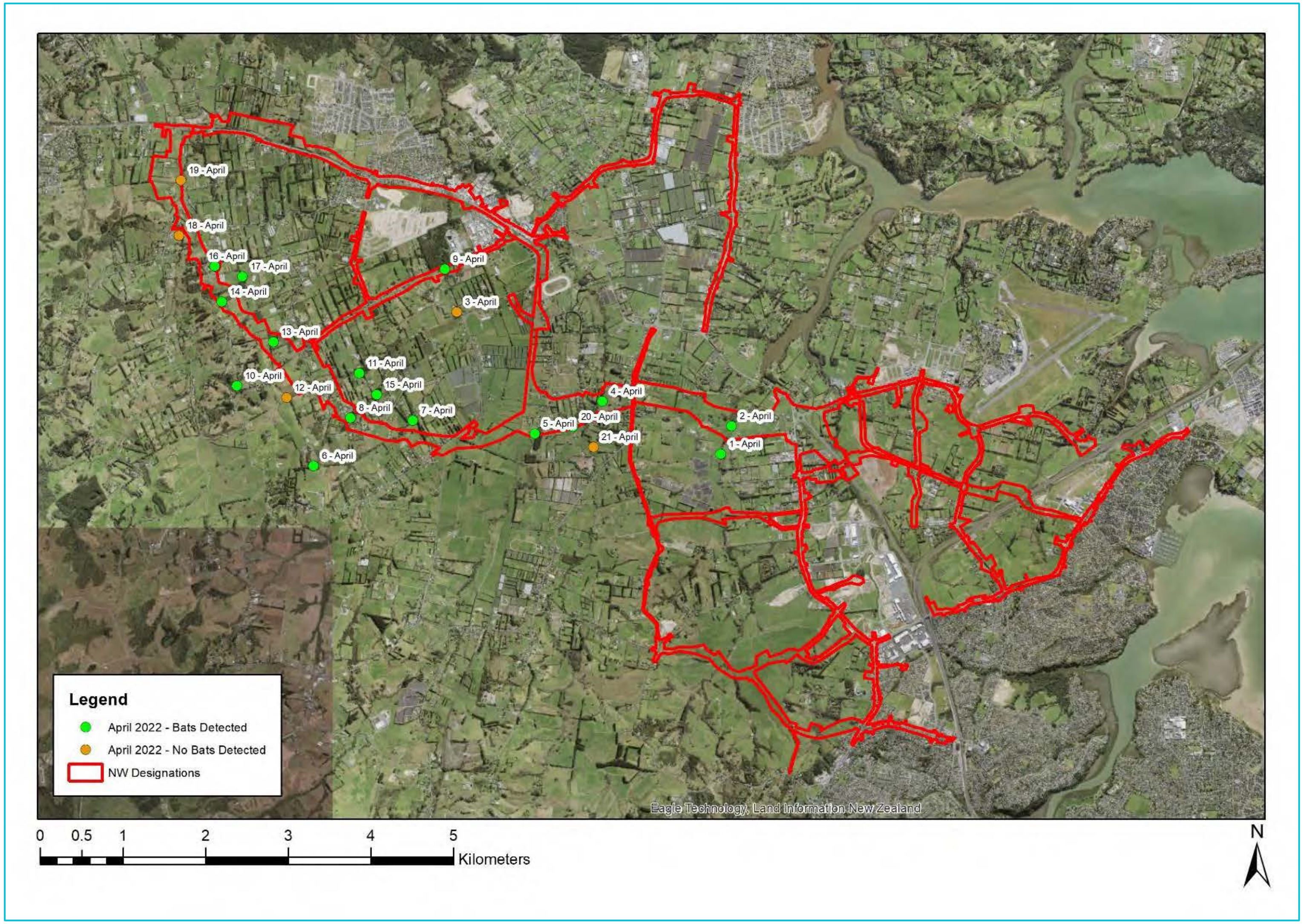

Figure 4-3 Long-tailed bat presence/absence (April 2022 survey)

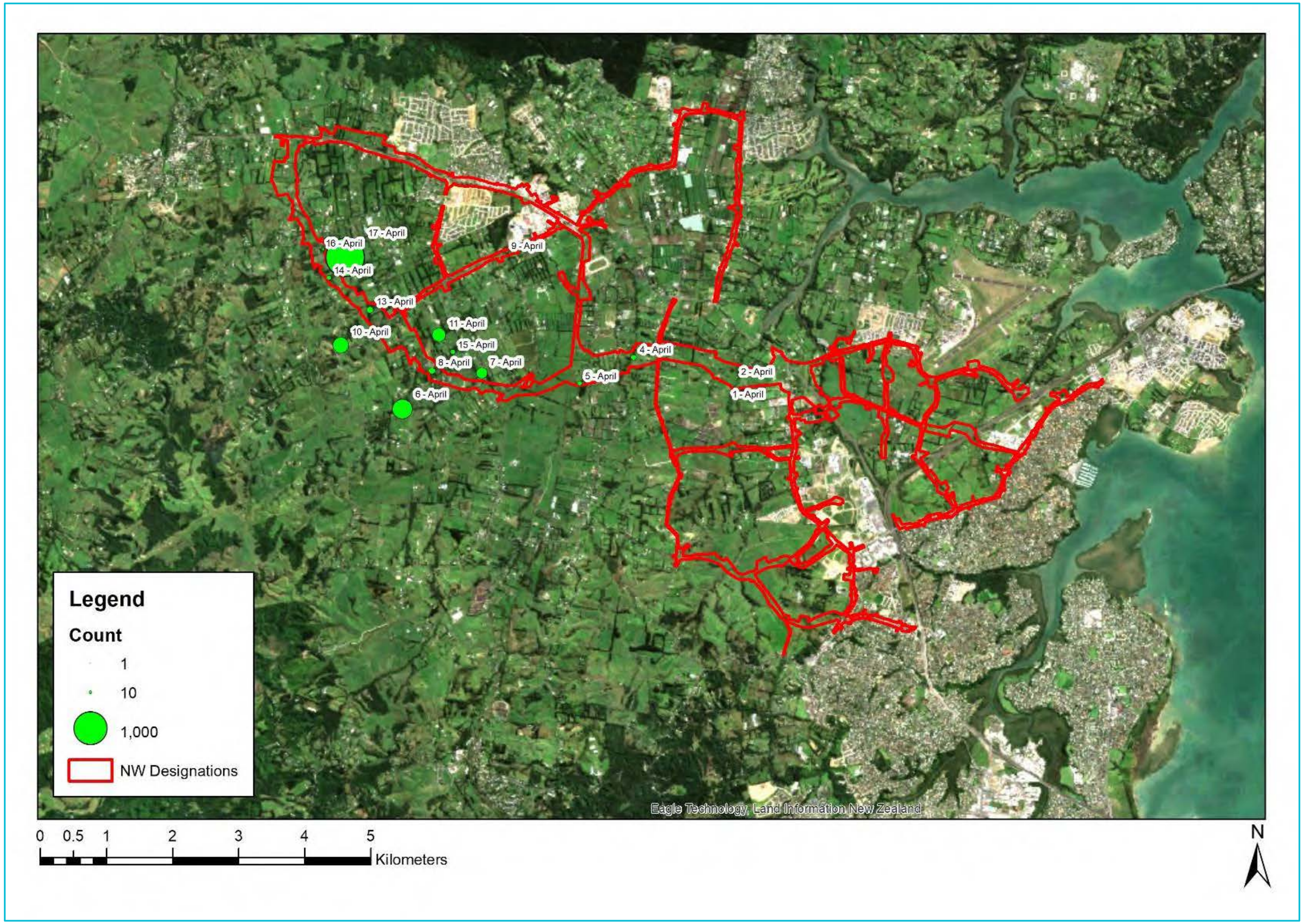

Figure 4-4 Sites with confirmed long-tailed bat presence (April 2022 survey). Proportional symbology indicates the relative proportion of bat passes in relation to the site with the highest number of bat passes (#17-April).

4.3 Survey Limitations

Some survey locations were limited by access to private property. If access was not available for a pre-determined survey location, then an alternative survey location as close as possible to the original survey site was used.

Instrument error was recorded during both the December 2021 and April 2022 surveys. An overview of when and where instrument error occurred is included in Appendix 2.

5 Conclusion

Both the December 2021 and April 2022 surveys found evidence of long-tailed bat activity in the Project area. Bats were observed to be most active during the April 2022 survey (bat mating season) with the highest mean number of 53 nightly bat passes recorded at April site #17. During the December 2021 survey, the highest mean number of bat passes was 1 nightly bat pass at December site #27.

Foraging calls were recorded during the April 2022 survey, with the highest number of foraging calls recorded at April site #17, with a total of 265 calls (19% of the total calls recorded at this site). Foraging calls were not recorded during the December 2021 survey, and social calls were not recorded during either survey.

Analysis of the first and last bat pass suggests that there are no bat roosts within the immediate vicinity of each ABM location. It is possible that bats may be roosting in the vicinity of April sites #6, #8, #11, #15, and #17 with first bat passes recorded within an hour of sunset.

Using the information obtained from the surveys, the results suggest that bats are active in the North West Project area. Specifically, the results suggests that bats are active in both the Local Arterials Package area (Whenuapai Arterials, Redhills Arterials, and Riverhead Arterials), and the Strategic Projects and Kumeū Huapai Local Arterials Package area, with the highest bat activity recorded in the Alternative State Highway (ASH) NoR.

6 References

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1 Appendix 1 - Weather Conditions

Analysis of the nightly weather against the criteria described in Section 3 led to the exclusion of data whilst the ABMs were in situ during the 2021-2022 surveys. The dates that met weather criteria and were selected for data analysis are presented in Table 1 and Table 2.

Table 1 Weather conditions during the December 2021 survey

Date	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable Weather Conditions?
17 Nov 2021	13.7	2.62	13.0	0.0	✓
18 Nov 2021	15.8	2.57	11.1	0.0	✓
19 Nov 2021	15.5	3.08	13.2	0.0	✓
20 Nov 2021	26.3	10.3	17.4	0.0	✓
21 Nov 2021	23.4	5.92	18.9	0.0	✓
22 Nov 2021	21.6	7.01	16.6	0.0	✓
23 Nov 2021	28.4	7.76	17.0	0.0	✓
24 Nov 2021	11.9	2.88	15.0	0.0	✓
25 Nov 2021	13.0	2.58	14.4	0.0	✓
26 Nov 2021	9.4	1.66	13.2	0.0	✓
27 Nov 2021	17.3	2.77	17.0	0.0	✓
28 Nov 2021	10.8	2.03	17.3	0.0	✓
29 Nov 2021	16.6	2.23	15.4	0.0	✓
30 Nov 2021	11.2	1.80	16.4	0.0	✓
1 Dec 2021	20.2	4.09	18.7	0.3	✓
2 Dec 2021	32.8	14.56	18.9	0.0	✓
3 Dec 2021	40.0	16.56	19.6	0.0	✓
4 Dec 2021	33.1	14.81	19.2	0.3	✓
5 Dec 2021	36.4	15.45	19.7	0.0	✓
6 Dec 2021	31.7	12.96	20.3	0.0	✓
7 Dec 2021	20.2	5.37	19.8	0.0	✓
8 Dec 2021	16.2	2.53	18.6	0.0	✓

Date	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable Weather Conditions?
9 Dec 2021	12.2	2.42	19.1	0.0	✓
10 Dec 2021	19.8	5.22	18.8	0.0	✓
11 Dec 2021	17.3	4.82	19.8	0.4	✓
12 Dec 2021	20.9	5.67	19.3	0.4	✓
13 Dec 2021	38.9	16.14	19.2	2	✓
14 Dec 2021	65.5	21.11	18.8	4.5 (did not exceed >4mm/hr)	X
15 Dec 2021	26.3	7.37	17.7	0.0	✓
16 Dec 2021	33.8	6.08	17.3	0.2	✓
17 Dec 2021	32.0	4.22	14.6	0.0	✓
18 Dec 2021	26.3	3.71	15.2	0.0	✓
19 Dec 2021	19.4	2.85	13.8	0.0	✓
20 Dec 2021	14.8	2.62	17.0	0.0	✓
21 Dec 2021	17.3	4.30	19.0	0.0	✓
22 Dec 2021	28.1	7.89	18.2	0.0	✓
23 Dec 2021	28.1	8.74	19.5	0.0	✓

Table 2 Weather conditions during the April 2022 survey

Date	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable Weather Conditions?
6 Apr 2022	28.4	6.56	19.0	0.0	✓
7 Apr 2022	28.1	6.20	15.8	0.0	✓
8 Apr 2022	18.4	3.56	13.9	0.0	✓
9 Apr 2022	22.0	7.02	18.7	0.0	✓
10 Apr 2022	14.8	2.26	15.0	0.0	✓

Date	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable Weather Conditions?
11 Apr 2022	31.7	12.99	19.1	0.0	✓
12 Apr 2022	32.4	11.85	18.4	0.0	✓
13 Apr 2022	31.7	8.29	17.9	0.0	✓
14 Apr 2022	28.8	4.02	12.7	0.0	✓
15 Apr 2022	14.0	2.48	14.2	0.0	✓
16 Apr 2022	16.6	4.69	16.6	0.0	✓
17 Apr 2022	54.7	24.78	19.1	0.0	✓
18 Apr 2022	55.1	26.12	17.5	0.8	✓
19 Apr 2022	41.8	15.4	19.4	4 (did not exceed >4mm/hr)	✓
20 Apr 2022	36.4	13.86	19.6	0.0	✓
21 Apr 2022	31.7	9.81	19.9	0.0	✓
22 Apr 2022	43.9	12.42	15.8	0.0	✓
23 Apr 2022	27.7	3.71	12.1	0.0	✓
24 Apr 2022	39.6	4.94	14.5	1.5	✓
25 Apr 2022	23.0	2.54	12.5	0.0	✓
26 Apr 2022	22.7	3.11	15.7	0.0	✓
27 Apr 2022	32.8	6.06	14.5	0.0	✓
28 Apr 2022	19.1	8.16	17.5	0.0	✓
29 Apr 2022	27.4	8.14	16.3	0.0	✓
30 Apr 2022	29.2	10.32	15.8	0.0	✓
1 May 2022	22.3	4.01	15.7	0.0	✓
2 May 2022	19.8	2.36	14.7	0.0	✓
3 May 2022	12.6	1.91	15.0	0.0	✓

2 Appendix 2 - Survey Results

2.1 December 2021

Date	Site																														
	#1-Dec	#2-Dec	#3-Dec	#4-Dec	#5-Dec	#6-Dec	#7-Dec	#8-Dec	#9-Dec	#10A - Dec	#10B - Dec	#11-Dec	#12A - Dec	#12B - Dec	#13-Dec	#14-Dec	#15-Dec	#16-Dec	#17-Dec	#18-Dec	#19-Dec	#20-Dec	#21-Dec	#22-Dec	#23-Dec	#24-Dec	#25-Dec	#26-Dec	#27-Dec	#28-Dec	#29-Dec	#30-Dec
17-Nov-21	N/A	N/A	N/A	0	0	0	0	N/A	N/A	N/A	N/A	0	0	0	N/A	N/A	N/A	0	N/A	N/A	0	0	N/A	N/A	N/A	E	1	0	0	N/A	0	0
18-Nov-21	N/A	N/A	N/A	0	0	0	0	N/A	N/A	N/A	N/A	0	0	0	N/A	N/A	N/A	0	N/A	N/A	0	0	N/A	N/A	N/A	E	0	0	0	N/A	0	0
19-Nov-21	N/A	N/A	N/A	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
20-Nov-21	N/A	N/A	N/A	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
21-Nov-21	N/A	N/A	N/A	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
22-Nov-21	N/A	N/A	N/A	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
23-Nov-21	0	N/A	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
24-Nov-21	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
25-Nov-21	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
26-Nov-21	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	E	0	0
27-Nov-21	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	1	0	3	E	0	0
28-Nov-21	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	7	E	0	0
29-Nov-21	0	1	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	13	E	0	0
30-Nov-21	0	0	0	0	0	0	0	0	0	0	N/A	1	0	0	0	0	0	0	0	0	0	0	1	0	0	E	0	0	10	E	0	0
1-Dec-21	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	E	0	0
2-Dec-21	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0
3-Dec-21	0	0	0	0	0	0	0	0	0	0	N/A	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
4-Dec-21	0	0	0	0	0	0	0	E	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
5-Dec-21	0	0	0	0	0	0	0	E	E	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Dec-21	0	0	0	0	0	0	0	E	E	0	N/A	0	0	0	E	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	0	0
7-Dec-21	0	0	0	0	0	0	0	0	E	N/A	0	0	0	0	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Date	Site																															
	#1-Dec	#2-Dec	#3-Dec	#4-Dec	#5-Dec	#6-Dec	#7-Dec	#8-Dec	#9-Dec	#10A - Dec	#10B - Dec	#11-Dec	#12A - Dec	#12B - Dec	#13-Dec	#14-Dec	#15-Dec	#16-Dec	#17-Dec	#18-Dec	#19-Dec	#20-Dec	#21-Dec	#22-Dec	#23-Dec	#24-Dec	#25-Dec	#26-Dec	#27-Dec	#28-Dec	#29-Dec	#30-Dec
13-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	0	0	0
14-Dec-21	Weather conditions unsuitable.																															
15-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	0	0	0
16-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	0	0	0
17-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	E	1	0	0	0	0	0
18-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	0	0	0
19-Dec-21	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	0	0	0
20-Dec-21	0	0	0	0	0	0	0	E	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	E	0	0	0	0	0	0
21-Dec-21	0	0	0	0	0	0	0	E	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	0	0	0	0	N/A	0
22-Dec-21	0	0	0	N/A	N/A	N/A	N/A	E	N/A	N/A	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	E	N/A	N/A	0	N/A	N/A	N/A
Total Count of Bat Passes	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**3**	**0**	**42**	**0**	**0**	**0**
# Suitable Nights Recorded	**29**	**28**	**29**	**34**	**34**	**34**	**34**	**27**	**29**	**18**	**15**	**34**	**35**	**35**	**30**	**32**	**32**	**34**	**32**	**32**	**34**	**34**	**32**	**32**	**33**	**12**	**33**	**34**	**35**	**18**	**33**	**34**
Mean # Nightly Bat Passes	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**

Notes: N/A = ABM not deployed. E = Instrument error. Highlighted blue cells = Number of bat calls.

2.2 April 2022

Date	Site																				
	#1-Apr	#2-Apr	#3-Apr	#4-Apr	#5-Apr	#6-Apr	#7-Apr	#8-Apr	#9-Apr	#10-Apr	#11-Apr	#12-Apr	#13-Apr	#14-Apr	#15-Apr	#16-Apr	#17-Apr	#18-Apr	#19-Apr	#20-Apr	#21-Apr
6-Apr-22	N/A	0	0	N/A	0	N/A	N/A	1	0	1	N/A	Error	2	0	9	1	N/A	0	0	0	Error
7-Apr-22	1	1	0	0	0	27	15	1	0	21	0	Error	2	0	0	0	44	0	0	0	Error
8-Apr-22	0	0	0	3	1	46	58	1	0	4	4	Error	7	1	0	0	56	0	0	0	Error
9-Apr-22	0	0	0	3	3	62	3	3	0	7	1	Error	1	0	0	0	44	0	0	0	Error
10-Apr-22	0	0	0	8	0	17	3	4	2	5	7	Error	0	0	0	0	41	0	0	0	Error
11-Apr-22	0	0	0	0	0	14	0	0	0	23	26	Error	1	7	3	0	190	0	0	0	Error

Date	Site																				
	#1-Apr	#2-Apr	#3-Apr	#4-Apr	#5-Apr	#6-Apr	#7-Apr	#8-Apr	#9-Apr	#10-Apr	#11-Apr	#12-Apr	#13-Apr	#14-Apr	#15-Apr	#16-Apr	#17-Apr	#18-Apr	#19-Apr	#20-Apr	#21-Apr
12-Apr-22	0	0	0	0	0	9	0	1	0	17	4	Error	3	4	3	1	113	0	0	0	Error
13-Apr-22	0	0	0	5	0	2	0	2	0	2	7	Error	2	0	0	1	16	0	0	0	Error
14-Apr-22	0	0	0	0	0	14	0	3	0	11	3	Error	0	0	0	0	68	0	0	0	Error
15-Apr-22	0	0	0	1	0	7	0	0	0	2	3	Error	2	0	0	0	45	0	0	0	Error
16-Apr-22	0	0	0	1	5	22	0	0	0	22	43	Error	2	0	0	0	71	0	0	0	Error
17-Apr-22	0	0	0	0	0	1	0	3	0	2	0	Error	0	0	0	0	181	0	0	0	Error
18-Apr-22	0	0	0	0	0	0	0	0	0	0	0	Error	0	0	0	0	7	0	0	0	Error
19-Apr-22	0	0	0	0	0	0	0	0	0	0	0	Error	0	0	0	0	66	0	0	0	Error
20-Apr-22	0	0	0	0	0	3	0	0	0	7	2	Error	0	3	0	0	17	0	0	0	Error
21-Apr-22	0	0	0	0	0	0	0	0	0	0	0	Error	0	1	0	0	72	0	0	0	Error
22-Apr-22	0	0	0	0	0	1	0	1	0	0	0	Error	1	0	0	0	1	0	0	0	Error
23-Apr-22	0	0	0	0	3	9	0	1	0	1	1	Error	4	0	2	0	35	0	0	0	Error
24-Apr-22	0	0	0	1	0	4	0	0	0	0	1	Error	0	0	1	0	21	0	0	0	Error
25-Apr-22	0	0	0	0	0	10	3	1	0	8	3	Error	0	0	0	0	29	0	0	0	Error
26-Apr-22	0	0	0	0	2	2	0	2	0	4	5	Error	0	1	0	0	113	0	0	0	Error
27-Apr-22	0	0	0	5	7	3	0	2	0	14	15	Error	0	1	0	1	37	0	0	0	Error
28-Apr-22	0	1	0	1	0	12	0	0	0	12	18	Error	3	0	0	0	19	0	0	0	Error
29-Apr-22	0	0	0	0	0	9	0	0	0	6	0	Error	0	1	0	1	29	0	0	1	Error
30-Apr-22	0	0	0	1	0	27	10	0	0	18	10	Error	1	1	0	0	15	0	0	0	Error
1-May-22	0	0	0	0	0	25	11	2	0	34	6	Error	1	1	0	0	8	0	0	0	Error
2-May-22	0	0	0	0	0	20	0	7	0	10	3	0	5	0	0	0	32	0	0	0	Error
Total Count of Bat Passes	**1**	**2**	**0**	**29**	**21**	**346**	**103**	**35**	**2**	**231**	**162**	**0**	**37**	**21**	**18**	**5**	**1370**	**0**	**0**	**1**	**N/A**
# Suitable Nights Recorded	**26**	**27**	**27**	**26**	**27**	**26**	**26**	**27**	**27**	**27**	**26**	**1**	**27**	**27**	**27**	**27**	**26**	**27**	**27**	**27**	**N/A**
Mean # Nightly Bat Passes	**0**	**0**	**0**	**1**	**1**	**13**	**4**	**1**	**0**	**9**	**6**	**0**	**1**	**1**	**1**	**0**	**53**	**0**	**0**	**0**	**N/A**

Notes: N/A = ABM not deployed. E = Instrument error. Highlighted blue cells = Number of bat calls.

3 Appendix 3 - First and Last Bat Pass Results

Table 3 Times in which the first and last bat call was recorded each night, in relation to sunset and sunrise times (December 2021 survey)

Site	Sunset			Sunrise		
	First bat pass recorded during the survey period (hh:mm)	Minimum time difference between sunset and first bat pass (h:mm)	Percentage of nights where first bat pass is within 30 minutes of sunset (%)	Last bat pass recorded during the survey period (hh:mm)	Minimum time difference between last bat pass and sunrise (h:mm)	Percentage of nights where last bat pass is within 30 minutes of sunrise (%)
#2-Dec	02:14	5:50	0.00	02:14	3:40	0.00
#11-Dec	01:07	4:44	0.00	02:00	3:53	0.00
#17-Dec	01:42	1:37	0.00	01:42	4:13	0.00
#21-Dec	02:01	5:38	0.00	02:01	3:53	0.00
#23-Dec	22:26	2:13	0.00	22:26	7:32	0.00
#25-Dec	01:19	4:42	0.00	02:51	3:09	0.00
#27-Dec	23:55	3:33	0.00	02:10	3:44	0.00

Table 4 Times in which the first and last bat call was recorded each night, in relation to sunset and sunrise times (April 2022 survey)

Site	Sunset			Sunrise		
	First bat pass recorded during the survey period (hh:mm)	Minimum time difference between sunset and first bat pass (h:mm)	Percentage of nights where first bat pass is within 30 minutes of sunset (%)	Last bat pass recorded during the survey period (hh:mm)	Minimum time difference between last bat pass and sunrise (h:mm)	Percentage of nights where last bat pass is within 30 minutes of sunrise (%)
#1-April	19:26	1:20	0.00	19:26	11:11	0.00
#2-April	19:27	1:21	0.00	00:39	6:18	0.00
#4-April	18:55	1:15	0.00	23:27	7:15	0.00
#5-April	19:06	1:16	0.00	00:46	5:53	0.00
#6-April	18:35	0:53	0.00	03:43	3:00	0.00
#7-April	19:02	1:01	0.00	21:24	9:17	0.00

Site	Sunset			Sunrise		
	First bat pass recorded during the survey period (hh:mm)	Minimum time difference between sunset and first bat pass (h:mm)	Percentage of nights where first bat pass is within 30 minutes of sunset (%)	Last bat pass recorded during the survey period (hh:mm)	Minimum time difference between last bat pass and sunrise (h:mm)	Percentage of nights where last bat pass is within 30 minutes of sunrise (%)
#8-April	19:01	0:58	0.00	02:07	4:32	0.00
#9-April	19:46	1:44	0.00	19:52	10:50	0.00
#10-April	19:06	1:10	0.00	03:43	2:56	0.00
#11-April	18:26	0:46	0.00	01:38	5:03	0.00
#13-April	18:53	1:17	0.00	03:27	3:11	0.00
#14-April	19:52	2:16	0.00	02:34	4:16	0.00
#15-April	18:42	0:57	0.00	01:33	5:05	0.00
#16-April	20:18	2:19	0.00	02:51	3:53	0.00
#17-April	18:31	0:52	0.00	05:44	1:02	0.00
#20-April	19:16	1:38	0.00	19:16	11:42	0.00

ATTACHMENT 54

NORTH-WEST WHENUAPAI
LANDSCAPE EFFECTS ASSESSMENT

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Whenuapai Landscape Effects Assessment

December 2022

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

Responsibility	Name
Author	Oliver May (AEE Specialist Landscape and Visual)
Reviewer	John Goodwin (AEE Specialist Landscape and Visual)
Approver	John Daly

Revision Status

Version	Date	Reason for Issue
1.0	16/12/2022	Notice of Requirement Lodgement

Table of Contents

Appendices

No table of contents entries found.

Table of Figures

Table of Tables

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
AC	Auckland Council
AT	Auckland Transport
AUP:OP PO7	Auckland Unitary Plan Operative in Part
BLI	Business – Light Industry Zone
BMU	Business – Mixed Use
FTN	Frequent Transit Network
FUZ	Future Urban Zone
HNC	High Natural Character area
LCDB	Land Cover Data Base
LEA	Landscape Effects Assessment
NoR	Notice of Requirement (under the Resource ManagementAct 1991)
NPS-UD	National Policy Statement-Urban Development
NPS-FM	National Policy Statement for Freshwater 2020
NZCPS	New Zealand Coastal Policy Statement 2010
NZDF	New Zealand Defence Force
ONC	Outstanding Natural Character
ONF	Outstanding Natural Feature
ONL	Outstanding Natural Landscape
PPC5	Proposed Plan Change 5
RMA	Resource Management Act 1991
RNZAF	Royal New Zealand Air Force
SEA	Significant Ecological Areas
SH16	State Highway 16
SH18	State Highway 18
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Programme
ULDMP	Urban and Landscape Design Management Plan
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Whenuapai Assessment Package	Four Notices of Requirement and one alteration to an existing designation for the Whenuapai Arterial Transport Network for Auckland Transport.
Baseline Landscape	The landscape and visual character as it exists at the commencement of the assessment process – i.e. prior to the construction of the proposed development.
Change Management	Identification of ways to enhance the landscape and actions to avoid, remedy or mitigate adverse landscape effects.
Designation Boundary	The extent of the proposed NoRs
Landscape	Is the cumulative expression of natural and cultural features, patterns and processes in a geographical area, including human perceptions and associations.[1]
Landscape Character	Is derived from the distinct and recognisable pattern of elements that occur consistently in a particular landscape. It reflects particular combinations of geology, landform, soils, vegetation, land use and features of human settlement. These elements create a unique sense of place defining different areas of the landscape.
Likely Future Environment	The landscape and visual character as a result of the future development proposed in the AUP:OP, including specific precinct plans, structure plans and proposed plan changes relating to the Project area. The likely future environment includes any existing baseline landscape elements (i.e. ONL's, protected vegetation, water ways, landform, sites and/or elements of cultural significance, and existing land-use scenarios) that are likely to endure following anticipated future development resulting from future urban zoning, AUP:OP overlays and land development projects (planned and/or under construction).
Landscape Effects	Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced. This may in turn affect the perceived value ascribed to the landscape.
Natural Character	The level of natural character (or naturalness) varies within each landscape/seascape and is the result of the combined levels of indigenous nature and perceived nature. These are typically defined by the extent to which natural elements, patterns and processes occur and are legible, and the nature and extent of human modification to the landscape and ecosystems.
Natural Character Effects	Natural character effects arise from landform modification and subsequent vegetation clearance within water bodies including wetlands, lakes and rivers and their margins.[2]

[1] NZILA Landscape Assessment and Sustainable Management Practice Note 10.1
[2] Resource Management Act 1991 and New Zealand Coastal Policy Statement 10.1

Acronym/Term	Description
Permanent Effects (Operational Effects)	Describes the effects on the landscape of completed works (including integrated landscape mitigation measures), the significance of physical landscape change and ultimately the resulting effects of the Projects on landscape character, natural character and visual amenity for both public and private viewing audiences.
Project area	Refers to the land being developed within the boundary of the NoRs.
Temporary Effects (Construction Effects)	Describes the anticipated impacts on the bio-physical elements and features of the landscape resource (landform, vegetation and hydrology) resulting from the construction of the Project. It also includes visual amenity effects for both public and private viewing audiences from construction works.
Visual Effects	Visual effects relate to the changes to amenity values of a landscape including the "natural and physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes".[3]

[3] Resource Management Act 1991.

1 Executive Summary

Assessment undertaken

This Landscape Effects Assessment (LEA) has been undertaken with reference to Te Tangi a te Manu, Aotearoa New Zealand Landscape Assessment Guidelines[4]. It assesses the effects resulting from the proposed North West Local Arterial Network on the landscape which comprises physical and landscape character, natural character and visual amenity. Landscape effects result from natural or induced changes in the quality or character of landscape. Natural character effects relate to the changes to the condition of waterbodies and their margins..

Effects arise from change in the values associated with the landscape, not as simply as a result of the change itself. Visual effects are the result of change to the landscape and are a consequence of that change.

Changes during the construction process and/or activities associated with the implementation of development are considered separately to those generated by a completed development.

Project context summaries

NoR W1 Trig Road North

This project is set within an existing rural road corridor surrounded on either side by rural residential properties, agricultural production land and associated buildings. The surrounding land is zoned as FUZ and is expected to be urbanised in the future. The Whenuapai Structure Plan indicates that the future land use will be predominantly for business, commercial and industrial activities.

NoR W2 Māmari Road

The project is located along an existing north south rural road corridor which terminates either side of the Sinton Stream. At the northern end the road meets existing residential development, whereas the remainder of the route is surrounded by rural production land, rural residences and a local school. The entirety of the route is within FUZ land and will be urbanised in the future. The Whenuapai Structure Plan indicates that north of the Sinton Stream will be used for residential and south of the stream will be predominantly for business, commercial and industrial use.

NoR W3 Brigham Creek Road

Brigham Creek Road is an existing arterial road that connects SH16 (in the east) to SH18 (to the west) through the Whenuapai settlement. The existing road corridor includes a segregated active mode pathway and some street tree planting. The road is surrounded by rural properties to the east, the Whenuapai RNZAF base towards the centre and residential development to the west. Land to the south of the road corridor and at the eastern and western extents are largely zoned as FUZ. The Whenuapai Structure Plan indicates that south of Brigham Creek Road will developed primarily for business, commercial and industrial use, whereas to the north it is to be developed as residential.

NoR W4 Spedding Road

Spedding Road is an existing rural road which runs to the west of Trigg Road and is surrounded by rural production land and rural residences. The surrounding land is zoned as FUZ and is expected to

[4] 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', [Final Draft subject to final editing, graphic design, illustrations, approved by Tuia Pito Ora/NZILA 5 May 2021]

be urbanised in the future. The Whenuapai Structure Plan indicates that this will be predominantly for business, commercial and industrial use.

NoR W5 Hobsonville Road (alteration to existing designation 1437)

Hobsonville Road is an existing arterial road which traverses north-east from SH18 to Westgate junction. The existing road is bordered to the east and south by existing urban residential development. To the north and west the road borders a mix of rural residential, undeveloped fields and large lot commercial and business lots. The north-west of the route is primarily zoned as FUZ and BLI. The BLI is expected to continue to be developed for business and commercial use and the Whenuapai Structure Plan indicates that the FUZ will be developed for high and medium density residential development.

Potential Positive Effects

A number of positive landscape and visual effects are anticipated as a result of the Projects on completion of proposed mitigation.

Positive effects are likely to include:

- A landscaped streetscape to support emerging urban form within adjacent land;
- A net increase in green infrastructure within existing urban Project areas associated with street trees, berm and stormwater plantings, and planted stormwater wetlands. This will result in improved visual amenity for road users and adjacent viewing audiences within the context of the streetscape and expected future environment.
- Slower speed limits adjacent to existing dwellings and commercial activities improving the experiential qualities of the corridor for users and well as private properties adjacent to the road corridor.
- Assisting the delivering of the indicative esplanade reserves proposed within the Whenuapai Structure Plan.

Construction Effects

Adverse construction effects are expected to be primarily related to the presence of construction plant within existing and new road corridors, lighting of night works, construction sites and the construction of wetlands. The phasing of the Projects will increase the intensity of construction traffic moving along the Project routes throughout the construction period. The phasing of the works along the corridor reduces the length of time audiences are expected to experience adverse effects. Mitigation measures are proposed to reduce the impacts of these construction effects. The anticipated landscape and visual effects are considered with and without implementing mitigation measures.

Operational Effects

Adverse operational effects are expected to be as a result of a widened or introduced road corridor; changes in landform and alteration of watercourses. It is proposed that during the detailed design processes these adverse effects are addressed in the ULDMP. The anticipated landscape and visual effects are considered with and without implementing mitigation measures.

Proposed mitigation measures

Mitigation measures are recommended to reduce adverse effects of a low-moderate and above rating to a lower level.

Construction effects

Mitigation during construction is generally temporary (2-5 years) in nature and will address specific visual effects and impacts on the landscape as a result of the construction activity. ULDMP is recommended as a condition on the designation which should include the following matters:

- Provide hoarding around the boundaries of site compounds that face on to adjacent residential properties.
- Wherever possible, limit the removal of Scheduled notable trees and indigenous vegetation.
- Where topsoil is to be stored on site it is recommended that these areas are grassed to better integrate with the surrounding landscape.
- Wherever practicable consideration should be given to locating stockpiles at the edge of site compounds and grassing these to provide visual screening.
- Mitigate effects related to lighting during night time works by using directional lighting to prevent sky glow and glare/spill light falling on residential properties.

Operational effects

These are effects on the landscape of completed works (including integrated landscape mitigation measures). These effects are expected to endure, however may reduce over time as proposed planting matures. The measures to remedy and mitigate the adverse construction effects of the Project on the natural and urban landscape will be addressed within an ULDMP, these include the following matters:

- **Cut and Fill Batters (General areas)** - All cut and fill slopes to be shaped to a natural profile to integrate into the surrounding natural landform; benching and geometric angles should be avoided where practicable. These areas may be grassed or planted with trees and shrubs to integrate into the adjacent land use.
- **Site Compounds and Construction Yards** - Reinstate construction and site compound areas by removing any left-over fill and shaping ground to integrate with surrounding landform.
- **Impacts on private property** – the Project could potentially impact on existing property features in the following ways and mitigation may be required as a result of:
  - Encroachment into some private yards, impacting on residential amenity and existing entrance way design;
  - Surface level changes between private property and the upgraded road corridor and subsequent regrading of some driveways and private accessways;
  - Greater proximity of the carriageway and footpath/cycleway to property boundaries and increased traffic volumes.
  - Removal of existing boundary treatments

Conclusions

Across all NoRs the adverse landscape and visual effects without the implementation of mitigation proposals will range from **moderate-high** adverse to **very low** adverse during the construction phase. Landscape and visual effects during the operational phase, without mitigation are anticipated to range from **moderate** adverse to **low** adverse

It is anticipated that across all of the NoRs, where mitigation measures are undertaken landscape and visual effects will range from **very low** adverse to **low-moderate** adverse during the construction phase of works. With the project information currently available during the operational phase of works it is anticipated that landscape and visual effects will range from **low-moderate** adverse to **very low** adverse. Across all NoRs the proposed operational effects are assessed approximately 3-5 years after implementation when proposed planting has become established. After implementation it is expected that landscape effects will diminish over time until planting is established;

The highest level of anticipated adverse landscape effects with or without mitigation are related to the potential removal of the large mature trees at the south east of the Whenuapai Settlement Open Space (NoR W3) or the scheduled notable trees adjacent to the Hobsonville School (NoR W4). Wetlands, watercourses and riparian vegetation are also sensitive to the changes proposed in the construction and operation of the Projects. In particular where there are new proposed crossing points, structures and culverts including the Sinton Stream, Totara Creek, Waiarohia Stream, Trig Stream and Rawiri Stream watercourses. The highest level of anticipated adverse visual landscape effects across all NoRs are related to retained residential properties where existing screening and filtering vegetation is removed and/or the road corridor moves closer to the audience. For all of the NoRs it is anticipated that adverse effects can mitigated and will become amalgamated into the emerging urban development.

2 Introduction

This landscape assessment has been prepared for the North West Local Arterial Network Notices of Requirement (**NoRs**) for Auckland Transport (**AT**) (the "Whenuapai Assessment Package"). The NoRs are to designate land for future local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West Whenuapai area of Auckland.

The North West growth area is approximatively 30 kilometres north west of Auckland's central city. It will make a significant contribution to the future growth of Auckland's population by providing for approximately 42,355 new dwellings and employment activities that will contribute 13,000 new jobs across the North West. Whenuapai is one of these growth areas, located between State Highway 16 (**SH16**) and State Highway 18 (**SH18**) and at present is largely rural (but Future Urban Zoned) with an existing community consisting of new and more established residential, business and local centre land uses. This growth area is expected to be development ready by 2018-2022 with 401 hectares to accommodate 6,000 dwellings. Furthermore, a Whenuapai Structure Plan was adopted by the Council in 2016 and sets out the framework for transforming Whenuapai from a semi-rural environment to an urbanised community over the next 10 to 20 years.

The Whenuapai Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport (including the Frequent Transit Network (**FTN**)), needed to support the expected growth in Whenuapai.

This report assesses the landscape, natural character and visual effects of the North West Whenuapai Assessment Package identified in Figure 4-1 and Table 2-1 below.

The Whenuapai Assessment Package comprises five separate projects which together form the North West Whenuapai Arterial Network. The network includes provision for general traffic, walking and cycling, and frequent public transport

Refer to the AEE for a more detailed project description.

Table 2-1: North West Whenuapai Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR W1	Trig Road North
NoR W2	Māmari Road
NoR W3	Brigham Creek Road
NoR W4	Spedding Road
NoR W5	Hobsonville Road (alteration to existing designation 1437)

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Whenuapai Assessment Package. Its purpose is to inform the AEE that accompanies the four NoRs and one alteration to an existing designation for the North West Whenuapai Assessment Package sought by AT.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Whenuapai Assessment Package on the existing and likely future environment as it relates to effects on the landscape 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 North West Whenuapai Assessment Package area;
b) Identify and describe the actual and potential landscape effects of each Project corridor within the North West Whenuapai Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential adverse effects on the landscape (including any conditions/management plan required) for each Project corridor within the North West Whenuapai Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects on the landscape for each Project corridor within the North West Whenuapai Assessment Package after recommended measures are implemented.

2.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Whenuapai Assessment Package as it relates to the landscape;
c) Identification and description of the existing and likely future landscape;
d) Description of the actual and potential positive effects of the Project;
e) Description of the actual and potential adverse landscape effects of construction of the Project;
f) Description of the actual and potential adverse landscape effects of operation of the Project;
g) Recommended measures to avoid, remedy or mitigate potential adverse landscape effects; and
h) Overall conclusion of the level of potential adverse landscape effects of the Project after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Project, likely staging 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 effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

2.3 Preparation for this Report

The assessment is derived from the following data collection and field work:

- Online data collection of aerial maps and AUP:OP / GIS overlays, primarily:
    - Significant Ecological Areas (SEAs)
    - Outstanding Natural Features (ONF) and Outstanding Natural Landscapes (ONL)
    - Outstanding Natural Character (ONC)

  - High Natural Character (HNC)
  - Land Cover Data Base (LCDB)
  - AUP:OP zones; and
  - Catchments and hydrology
- Desktop analysis of the roads, urban areas / future urban areas with Google Maps and Google Streetview.
- Site Visits to each of the Project areas, was undertaken in July 2020, November and December 2021 .
  - The purpose of these site visits was to understand and evaluate the existing baseline as part of determining the physical and sensory impacts the Projects would have on the site and broader landscape; and to identify the Projects' viewing audiences.
- A study of aerial photography including land use, landform and vegetation patterns was undertakento determine the visual catchment and viewing audience of the proposal.
- Private properties which are likely to be affected have been visually surveyed from nearby publicly accessible locations where possible, with further reference to aerial imagery to understand the nature of these potential viewing audiences.
- Review of related specialist reports including Ecology, Arboriculture and Urban Design.
- Environmental and planning information relied upon in this assessment is located in the AEE and Assessment of Ecological Effects.

3 Assessment Methodology

3.1 Overview

This Landscape Effects Assessment (LEA) has been undertaken with reference to Te Tangi a te Manu, Aotearoa New Zealand Landscape Assessment Guidelines[5]. The same methodology applies to the construction and operational stages of the works and for NoRs (W1, W2, W3, W4 and W5).

While natural character, landscape and visual amenity effects assessments are closely related, they form separate procedures. An assessment of the effects on natural character of an activity involves consideration of the proposed changes to the current condition compared to the existing. The assessment of the potential effects on landscape considers effects on physical attributes, landscape character and values. The assessment of visual effects considers how changes to the physical landscape affect the viewing audience.

A detailed description of the methodology is available in Appendix 3 of this assessment.

3.2 Scale of Effects

In determining the magnitude of potential and actual landscape and visual effects of the Project, a consistent 7-point rating scale has been used that is based on the recommendations in the Te Tangi a te Manu, Aotearoa New Zealand Landscape Assessment Guidelines. The effects ratings referred to in this assessment are based upon a seven-point scale which ranges from ‘very low’ to ‘very high’ (a detailed description of these scales is available in Appendix 3 of this assessment).

3.3 Landscape Values, Landscape Sensitivity

Landscape values consider any scheduled high value landscape areas (ONLs, ONFs. HNCs or ONCs) at a national, regional or district level within or directly adjacent to the Project areas.

The sensitivity of landscape is influenced by the existing land use, future landscape direction (AUP:OP and also the Whenuapai Structure Plan). The interfaces between lands and water (riparian margins) are particularly sensitive to landscape change. Other landscape attributes may also be sensitive to the effects of landscape change such as topographical and landform features, vegetation, landmarks and landscape features in the contextual landscape.

3.4 Landscape and Natural Character Effects

Landscape effects are a result of physical change in the landscape, which may change the character of the landscape over time. Landscape effects relate to biophysical: abiotic (geophysical processes (landform) and drainage patterns), biophysical: biotic (vegetation cover, quality and pattern) and human attributes (land uses, active and passive recreation, amenity and built form).

Effects will be assessed in terms of:

- Temporary/construction effects, which relate to the construction activities required to implement the Project.

[5] ‘Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines’, [Final Draft subject to final editing, graphic design, illustrations, approved by Tuia Pito Ora/NZILA 5 May 2021]

- Permanent/operational effects, the effects on the landscape of completed works (including integrated landscape mitigation measures).

Natural character effects pertains to changes to the coastal environment (including the coastal marine area), wetlands, and lakes and rivers[6] and their margins. Effects are primarily concerned with the degree to which natural processes, natural patterns and natural elements have undergone human modification

The natural character assessment for this Project applies to the existing water bodies and wetlands associated with the Sinton Stream, Pikau Stream, Totara Creek, Waiarohia Stream, Rawiri Stream and Trig Stream.

3.5 Visual Effects

Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape. Visual effects are considered for both temporary (construction effects) and permanent (operational effects) of the Projects.

Assessment photography was obtained during the project site visit in November and December 2021. The outlook from viewpoints that were captured onsite were photographed and assessed in variable weather conditions and at standing eye level.

3.6 Limitations and Project Assumptions

This landscape assessment does not specifically address and respond to Mana whenua values from a landscape planning perspective. This report references the latest data available in respect of these matters at the time of issue.

All site assessments have been undertaken from public land and supported through detailed desktop GIS mapping and aerial photograph information.

A range of assumptions have been made in order to establish a consistent approach across the projects and to clearly define the parameters of the context of the construction and operational phases. Detailed list of the Project Assumptions is available in Appendix 3 of this assessment.

The findings of this landscape effects assessment are underpinned by the following assumptions:

3.7 Statutory Guidance

3.7.1 Notice of Requirement

This assessment has been prepared to support the NoRs for the projects. The process for consideration of a NOR is set out in section 168 of the RMA. This includes consideration of the actual or potential effects (including positive effects) on the environment of allowing the requirement under the Resource Management Act (RMA).

[6] A 'river' is defined in the RMA as a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse.

3.8 Non-Statutory Guidance

The Whenuapai Structure Plan indicates how the future urban environment may develop over time, subject to future plan change processes.

3.8.1 Whenuapai Structure Plan September 2016

The stated Whenuapai Structure Plan sets out the framework for transforming Whenuapai from a semi-rural environment to an urbanised community. The structure plan will be implemented through a statutory plan change process to rezone land in Whenuapai.

Detailed analysis of the Whenuapai Structure Plan is available in Appendix 3 of this assessment.

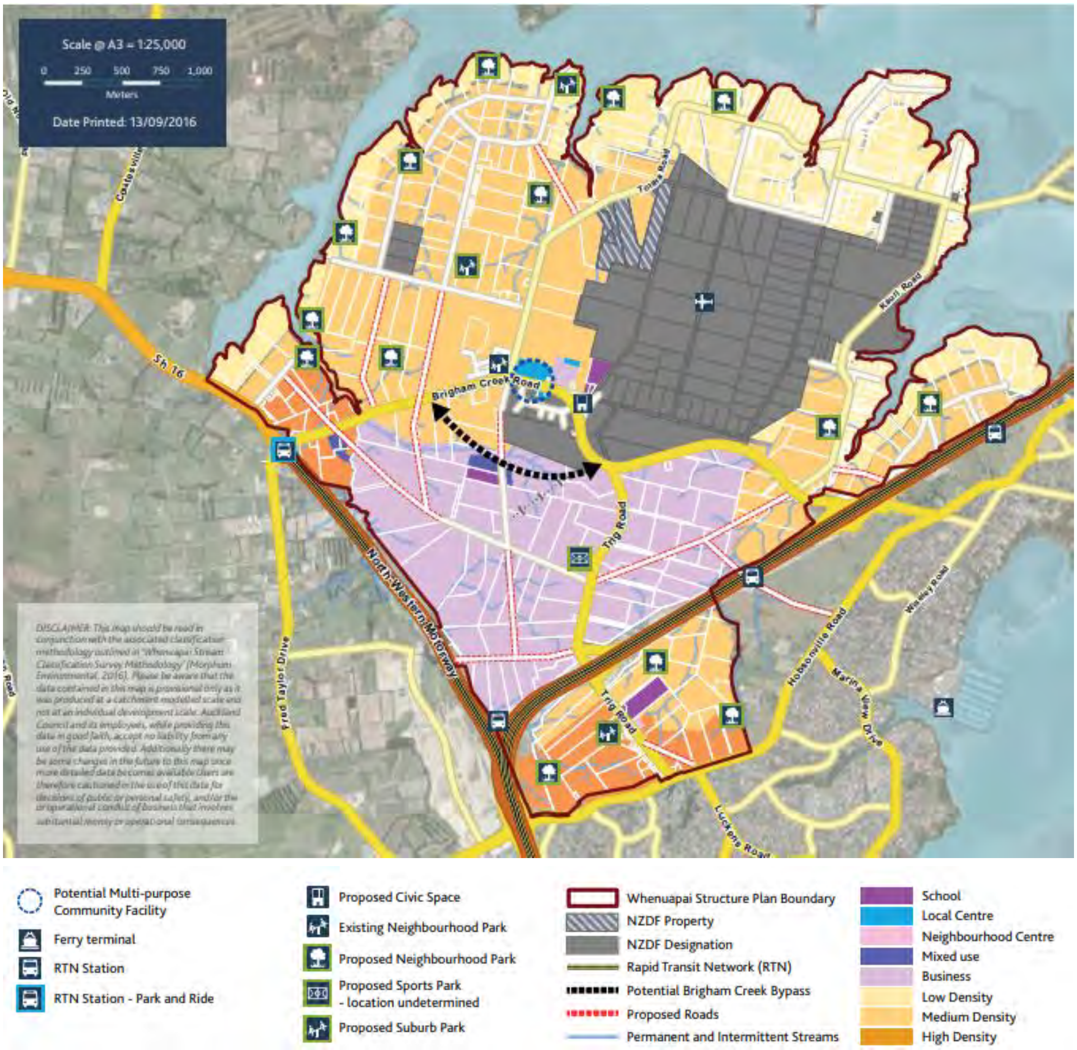


Figure 3-1: Whenuapai Structure Plan Map

3.8.2 National Policy Statement on Urban Development – NPS UD

The National Policy Statement-Urban Development (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 policy statement.

Detailed analysis of the NPS UD is available in Appendix 3 of this assessment.

4 Whenuapai Assessment Package Overview

An overview of the Whenuapai Package is provided in Figure **4-1: North West Whenuapai Assessment Package – Overview of NoRs for Assessment**

Table 4-1 below, with a brief summary of the Whenuapai Assessment Package projects provided in Figure 4-1.

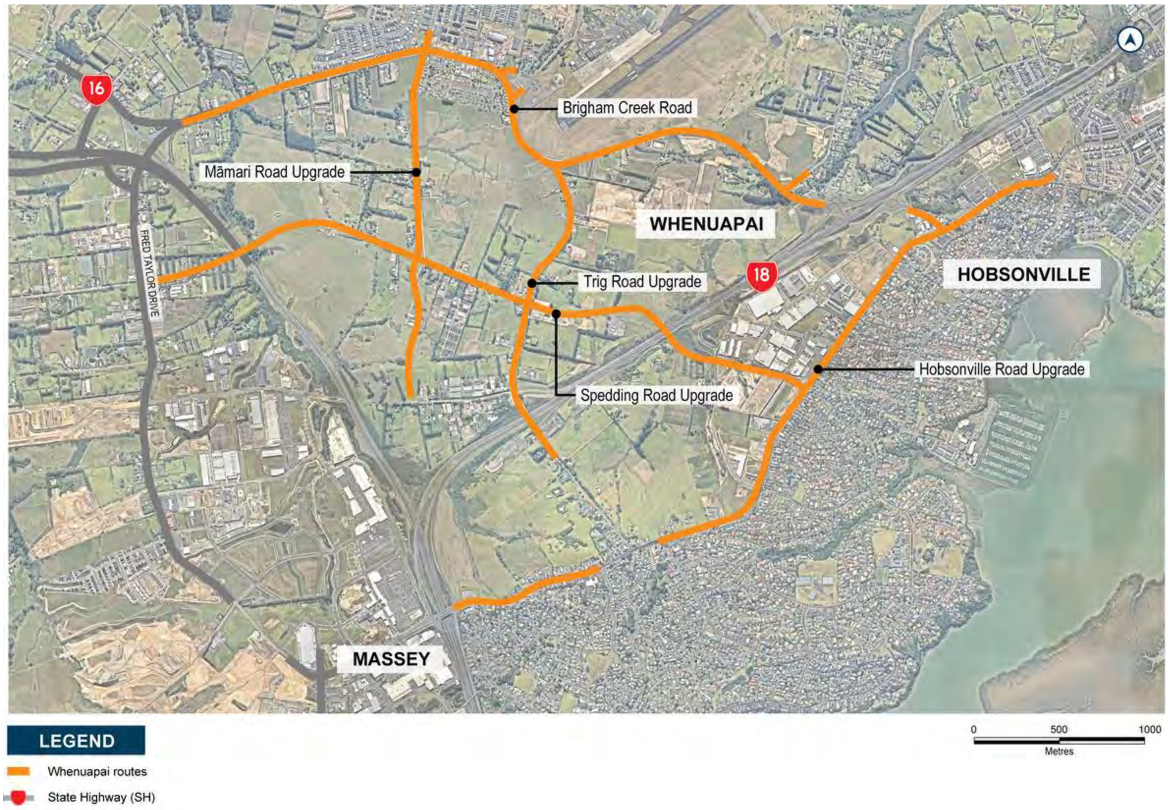


Figure 4-1: North West Whenuapai Assessment Package – Overview of NoRs for Assessment

Table 4-1: Whenuapai Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Trig Road North	NoR W1	Upgrade of Trig Road corridor to a 24m wide two-lane urban arterial cross-section with separated active mode facilities on both sides of the corridor.	Auckland Transport
Māmari Road	NoR W2	Extension and upgrade of Māmari Road corridor to a 30m wide four-lane urban arterial cross-section providing bus priority lanes and separated active mode facilities on both sides of the corridor.	Auckland Transport
Brigham Creek Road	NoR W3	Upgrade of Brigham Creek Road corridor to a 30m wide four-lane arterial cross-section with separated active mode facilities on both sides of the corridor.	Auckland Transport
Spedding Road	NoR W4	Upgrade of the existing Spedding Road corridor and new east and west extensions to form a 24m wide	Auckland Transport

Corridor	NOR	Description	Requiring Authority
		two-lane arterial with separated active mode facilities on both sides of the corridor.	
Hobsonville Road (alteration to existing designation 1437)	NoR W5	Alteration of the existing Hobsonville Road designation 1437 to provide for the widening of the Hobsonville Road corridor between Oriel Avenue and Memorial Park Lane. Upgrade of sections of Hobsonville Road corridor to a 30m wide four-lane cross section with separated active mode facilities on both sides of the corridor Upgrade of sections of Hobsonville Road corridor to a 24m wide two-lane cross section with separated active mode facilities on both sides of the corridor.	Auckland Transport

Please refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

5 Whenuapai Positive Effects

Positive effects in relation to landscape and visual elements are primarily associated with the provision or improvement of urban design and landscape amenity. Although infrastructure projects often introduce or expand a transportation corridor, there are opportunities to improve the visual amenity, landscape legibility and improve landscape character features. Positive landscape effects may result from general landscape improvements associated with the project and / or specific mitigation measures designed to improve anticipated landscape and / or visual effects.

A number of positive landscape and visual effects are anticipated as a result of the operation of the Projects (including proposed mitigation). Positive effects are likely to include:

- A streetscape to support emerging the urban form on corridors with adjacent land FUZ areas and to integrate with and enhance existing urban corridors (Don Buck Road, Hobsonville Road and the existing urban sections on Brigham Creek Road and Riverhead Road));
- A net increase in green infrastructure within existing urban Project areas associated with street trees, berm and stormwater plantings and planted stormwater wetlands, resulting in improved visual amenity for road users and adjacent audiences within the context of the streetscape and the expected future environment.
- Slower speed limits adjacent to existing dwellings and commercial activities improving the experiential qualities of the corridor for users as well as private properties adjacent to the road corridor.

6 Whenuapai Construction and Operational Effects and Proposed Mitigation

6.1.1 Site Enabling Works

Construction Areas

Construction compounds, laydowns, construction machinery, earthworks, material storage will be present across all Projects in this Package. Night works, where required, in places will introduce light into an existing unlit environment. Landscape effects related to activities across this package of work will be; the construction of a new carriage way through undeveloped land (NoR W2, NoR W4, NoR); the widening of an existing road corridor (All NoRs); bridge construction (NoR W1, NoR W2, NoR W4) wetland/dry pond construction (All NoRs), and removal of existing buildings and development (NoR W2, NoR W3, NoR W4, NoR W5). A more detailed indicative construction methodology is available in the AEE, this details the sequencing, typical construction impacts and approximate construction timings.

Vegetation Clearance

Broad areas of street-side vegetation are proposed to be removed to accommodate the wider road corridors and batter slopes for all NoRs. This consists of trees and shrubs located within the road-side boundaries of private properties, within the Project area. Exotic pasture, trees, shelterbelt plantings, private gardens, exotic forest patches and cropland make up the majority of vegetation to be removed.

6.1.2 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

The mitigation measures for all activities and built elements during construction for all NoR Project Areas in this package are outlined below. An Urban and Landscape Design Management Plan (ULDMP) is recommended as a condition on the designation which should include the following matters:

- Provide hoarding around the boundaries of site compounds that face on to adjacent residential properties.
- Interpretation - Where practicable, during construction, install construction hoardings with interpretive panels in selected areas which are in close proximity and visible to the public, to provide information about the Project and its progress.
- Reinstate earth worked areas at the completion of works.
- Vegetation clearance: wherever possible, limit the removal of scheduled notable trees under the AUP and indigenous vegetation.
- Where topsoil is to be stored on site it is recommended that these are grassed to better integrate with the surrounding landscape.
- Wherever practicable consideration should be given to locating stockpiles at the edge of site compounds to provide visual screening.
- Wherever practicable retain stockpile and re-use top soil from existing pastoral land (within the Project area) to reduce the amount of truck movements, and associated visual effect.
- Mitigate effects related to lighting during night time works by using directional lighting to prevent sky glow and glare/spill light falling on residential properties.

6.1.3 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The mitigation measures for all activities and built elements during operation for all NoR Project Areas in this package are outlined below. The measures to remedy and mitigate the adverse operational effects of the Project on the natural and urban landscape will be addressed under a ULDMP, which will lay out the main design themes, principles and outcomes of the Project.

- **Cut and Fill Batters (General areas)** - All cut and fill slopes to be shaped to a natural profile to integrate into the surrounding natural landform, benching and geometric angles should be avoided where practicable. These areas may be grassed or landscaped, to integrate into the adjacent land use.
- **Site Compounds and Construction Yards** - Reinstate construction and site compound areas by removing any left-over fill and shaping ground to integrate with surrounding landform.
- **Impacts on private property** – the Project could potentially impact on existing property features in the following ways:
  - Encroachment into some private yards, impacting on residential amenity and existing entrance way design;
  - Surface level changes between private property and the upgraded road corridor and subsequent regarding of some driveways and private accessways;
  - Greater proximity of the carriageway and footpath/cycleway to property boundaries and increased traffic volumes.
- For partially affected properties, where existing dwellings are assumed to remain, it is recommended that boundary fences and garden plantings (removed through the Project works) are reinstated on completion of the works affecting the property, unless other arrangements are requested by land owners.
- Noise mitigation measures and/or retaining walls (if proposed) are recommended to integrate with private boundary fencing reinstatement and any reinstatement planting required to replace vegetation lost through the Project works (i.e. to avoid double layering of noise walls and boundary fences). These features should be designed to minimise adverse visual amenity effects on residents, integrate with the layout and design of outdoor living spaces and in consideration of streetscape character.

7 NoR W1: Trig Road North Upgrade

7.1 Project Corridor Features

Trig Road is an existing rural arterial road extending from Brigham Creek Road in the north and Hobsonville Road in the south, providing an important connection between Whenuapai and West Harbour as well as the connection to SH18 and Hobsonville Road though east facing ramps.

The key landscape matters addressed for the Trig Road North Upgrade include:

- The nature and extent of impacts on the landscape as a physical resource during the construction period of the Project. A specific focus on the location of construction compounds, extent of vegetation clearance, the scale and location of proposed cut and fill slopes and the likely impacts of bridge construction.
- Consideration of landscape character effects and urban amenity issues in relation to the permanent landscape change, including specific assessment of how this corridor will integrate into the future urban environment;
- Potential removal of valued trees consideration of future opportunities to integrate existing trees.
- Consideration of landscape mitigation measures to be included within an Urban and Landscape Design Management Plan (ULDMP) as a condition on the proposed designation to address the potential landscape, natural character and visual effects arising from the operation the Project.

7.2 Existing and Likely Future Environment

7.2.1 Planning context

The Trig Road corridor runs through an existing rural environment, with the land either side of the Trig Road corridor currently zoned FUZ under the AUP:OP.

Table 7-1 below provides a summary of the North West existing and likely future environment

Table 7-1: Trig Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[7]	Likely Future Environment[8]
Undeveloped greenfield areas	Future Urban Zone	High	Urban
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Urban

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

[7] Based on AUP:OP zoning/policy direction
[8] Based on AUP:OP zoning/policy direction

7.2.2 Baseline / Existing Landscape

7.2.2.1 Baseline Landscape

The Project is situated within the existing Trig Road corridor and extends into adjacent land that is characterised by flat to gently rolling pastoral fields and agricultural production.

The local landscape character of Trig Road is summarised below;

- Vegetation cover comprising stand-alone elements of indigenous vegetation, hedgerows, shelterbelts, trees and shrubs along field boundaries; exotic pastoral grassland and non-native stand-alone trees.
- The landscape is characterised by land modification associated with the surrounding rural agricultural productive land use.
- The landscape character value is low within the context of the existing road reserve. There is the potential to enhance this aspect of the landscape.

Landform and Hydrology

Trig Road traverses a gently sloping topography that is slightly elevated to the south, with a high point located at the approach to the SH18 overbridge. The northern extent of Trig Road close to the intersection with Brigham Creek Road is adjacent to a 100 year flood plain.

Landcover

The landscape east and west of Trig Road is characterised by irregular shaped geometric fields bound in parts by isolated elements of native vegetation, exotic grassland, hedgerows and amenity planting in proximity to dwellings. Exotic specimen trees are the predominant landcover on both sides of the road corridor and within the surrounding rural properties. Areas of open pasture are located directly adjacent to the road corridor along the length of the designation on both sides.

Stands of mature native trees located within the road reserve and within the roadside boundaries of private properties contribute to the landscape character of the surrounding landscape. These include a linear belt of mature Pohutukawa (Figure 7-1 below) along the south east field boundary of 92 Trig Road and a line of macrocarpa along the western boundary of 53-55 Trig Road. Land at Lyndale Nurseries and Touch of the Tropics Nursery features dense mature shelter belt planting and a range of mature exotic trees within the properties and towards the road frontage.

No scheduled notable trees are present within proximity of the Project.

Figure 7-1. View north along the road corridor from outside of 92 Trig Road.

Land Use

The existing Trig Road corridor is approximately 20m wide and zoned as ‘Road under the AUP:OP.

Land use either side of the existing road reserve is rural and is predominantly pastoral with associated dwellings (Figure 7-2). Commercial activities are concentrated to the southern portion of the corridor near to SH18 and Northside Drive.

Figure 7-2. View south east across pastoral fields, from outside of 43 Trig Road.

Scheduled Landscape and Ecological Features

There are no scheduled landscape or ecological features within or proximate to the Project area.

Historical and Cultural Associations

An unscheduled World War Two gun emplacement site is situated in 92 Trig Road, this is proposed for scheduling in Plan Change 5. While this is positioned outside of the proposed works the entrance to the lot will be affected, by the road widening and the intersection with Spedding Road.

7.2.2.2 Likely Future Environment

Overview

The land surrounding the Project will witness a significant change from rural to urban land use character over the next 10 years. It is anticipated that the abiotic features of the landscape will be altered over time as the surrounding landscape is urbanised.

It is anticipated that some of the defining biotic (land cover) features of the landscape will undergo substantial change alongside future development, with the removal of large areas of vegetation to accommodate the proposed development. This will likely involve the implementation of street tree plantings, public open space areas and general landscaping within the private yards of future housing development for public amenity.

It is anticipated that the existing vegetation, including the mature vegetation that define the road corridor and field patterns will be removed as part of the urbanisation process.

7.2.2.3 Whenuapai Structure Plan

The Whenuapai Structure Plan provides general guidance for how the FUZ land adjacent to the Project area should be developed over time. The structure plan is illustrated in Appendix 1.

Land Use

The Whenuapai Structure Plan indicates that either side of the Project Area is intended to be urbanised with a “Business” land use. The plan envisages this Business use to comprise Industrial, Retail and Services. Extensive industrial activities such as manufacturing, transport and storage, logistics, construction and wholesale trade are expected. Retail and services are expected to be required to support the increased amount of housing within the Structure Plan.

7.3 Extent of Visibility and Viewing Audience

The visual catchment is the area of land from which part or all of the Project area is visible. This is largely determined by landform, land cover and built elements, which in combination may obscure or filter views. The extent of visibility of the proposed road corridor is contained by the surrounding vegetation, in addition to some subtle changes in topography. Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects. In summary the viewing audience for the Project includes:

- *Public Views:* Transient public audience (vehicle users). Key roads where views can be obtained from include Northside Drive, Spedding Road and Brigham Creek Road. Views include:
  - Travelers (cars, pedestrians and cyclists) along Spedding Road which bisects the site (Refer Appendix 2 Site Photo 1);
  - Travelers (cars, pedestrians, and cyclists) to the north of the site along Brigham Creek Road (Refer Appendix 2 Site Photo 2); and
- *Private Views:* The viewing context also includes a relatively small private viewing audience, comprising views from rural residential and lifestyle dwellings as well as from the commercial and agricultural businesses located to the west of the rail corridor. Specifically:
  - Views from the residential properties with short driveways that immediately front on to Trig Road (19, 33, 43, 52, 47, 67, 82A, 84, 90, 92, 96, 96A Trig Road (Refer Figure 7-3 below), refer Appendix 2 Site Photo 3, 4 and 5); and;
  - Occupants of nearby commercial buildings along Trig Road adjacent the proposed corridor.

Views are well contained within the immediate area surrounding the road corridor due to the relatively flat landscape and intervening vegetation.

Over time, the audience is likely to grow to include residents of future urban developments within the FUZ area.

Figure 7-3. View south towards the residential property at 96 Trig Road.

7.4 Landscape Values

There are no regionally or nationally significant landscapes (ONLs, ONFs or ONCs) within or proximate to the proposed designation boundary. The nearest ONL is Area 1 – Paremoremo Escarpment, located in the Paremoremo Creek approximately 3.8km to the north of the site.

The gently sloping topography and the mature stands of vegetation contribute to the visual amenity of the landscape. The highly modified landscape has limited natural features, which are restricted to individual stands of native vegetation. There is no identified open space within close proximity to the proposed corridor and there are no views from any open spaces or sports fields towards the proposed corridor from the wider landscape.

7.5 Landscape Sensitivity

This corridor is situated within a broader landscape that has been assessed within the AUP:OP as being suitable for urbanisation. The proposed urbanisation of the surrounding landscape as indicated by the Whenuapai Structure Plan will be primarily industrial, retail and service buildings. The Project area is assessed as having a low sensitivity to landscape change.

7.6 Assessment of Landscape Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

7.6.1 Positive Effects

Generalised positive effects related to the Project are covered in Section 5 of this report. Additional positive effects related specifically to this Project include:

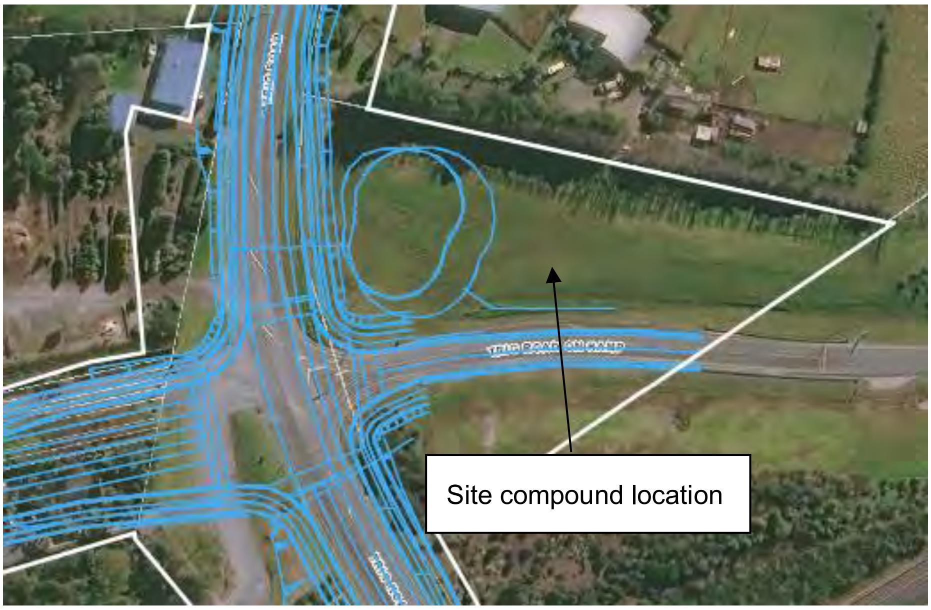
- Improved and/or new opportunities for active modes of transport and the ability to provide improved connectivity to Hobsonville that are projected in the Whenuapai Structure Plan. There is also the potential to create an active mode connection to a proposed Sports Park indicated in the Whenuapai Structure Plan.

7.6.2 Assessment of Construction Effects

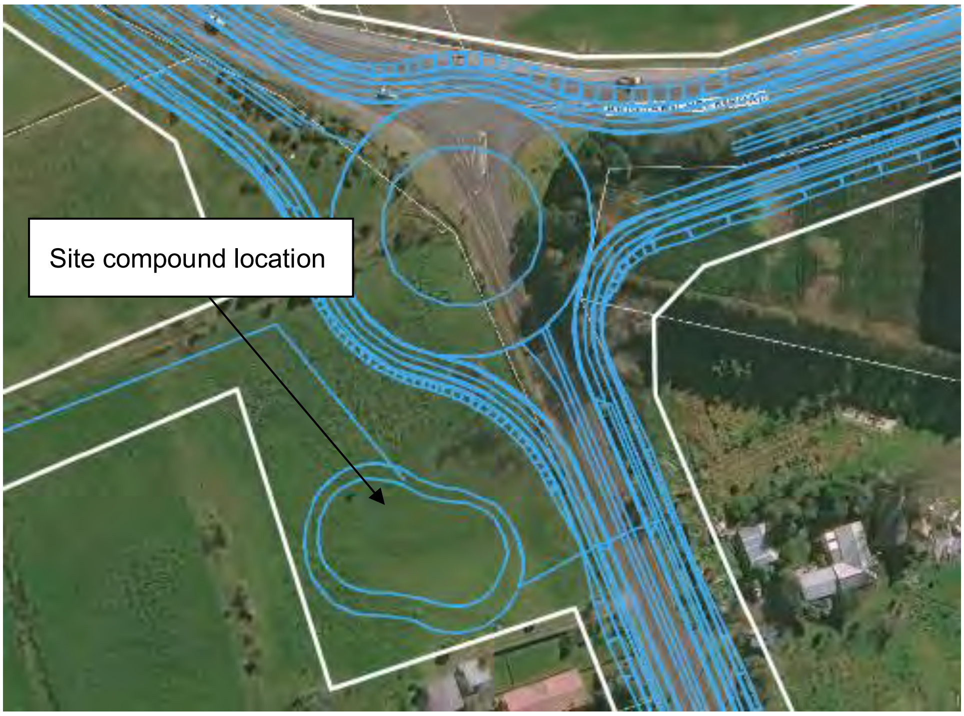
Construction Areas

Site compound and construction areas are to be established at two locations within the Project area. Construction traffic will be heightened at these locations through the construction period of the Project.

- Site compound, stockpile, sediment retention pond and lay-down area for bridge construction is adjacent to the SH18 northbound on ramp (location below).



- Site compound, stockpile, sediment retention pond is located adjacent to the Brigham Creek Road interchange at 96 Trig Road (location below).



The proposed site compounds and construction areas are located within pastoral land that is already somewhat modified by existing rural land use. It is recommended that all areas be grassed (reinstated) at the completion of the construction period.

Without any mitigation it is anticipated that the effects on the landscape would be **low-moderate** adverse to **low** adverse. Assuming that mitigation procedures are provided the adverse physical landscape effects resulting from establishment and use of the construction work areas within the Project area are anticipated to be **low**.

Vegetation Clearance

Broad areas of road side vegetation are proposed to be removed to accommodate the wider road corridors and batter slopes. This consists entirely of trees and shrubs (including some mature native specimen trees) located within the road-side boundaries of private properties, within the Project area. Exotic pasture, trees, shelterbelt plantings, private gardens, exotic stands of trees patches and cropland make up the majority of vegetation to be removed.

With the information available and assuming that the proposed mitigation is undertaken the physical landscape effects likely to arise from vegetation clearance within the Project area is assessed as **low** adverse. Although **low-moderate** adverse effects are expected where a small number of mature specimen trees will be removed. These are not covered by any protections and are detached from a larger contiguous habitat and their removal will be in the context of wider vegetation removal.

Structures and Earthworks

An active mode bridge will be added to the south of the existing bridge over SH18 to accommodate expected additional pedestrian and non-motorised users. This will require additional earthworks within the existing SH18 embankments. This new structure will be seen in the context of the existing road bridge.

It is anticipated that a greater amount of cut than fill earthworks to be undertaken across the project area. Some of these earthworks will occur on land with slopes greater than 10 degrees, overall, the proposed design has relatively even proportions of cut and fill.

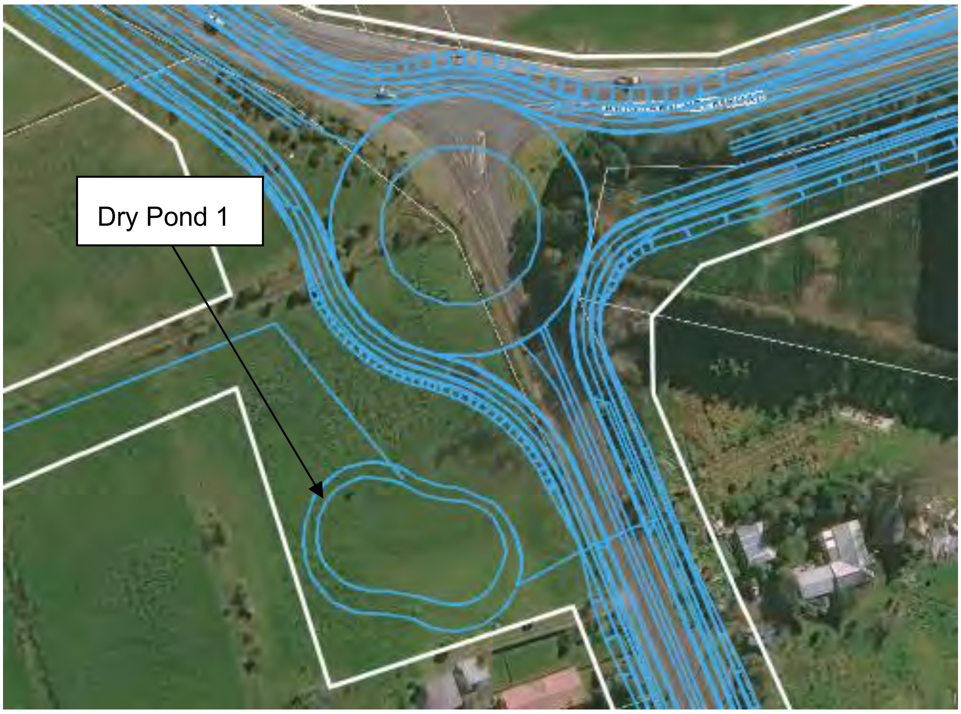
The impacts and potential landscape effects of the proposed earthworks include the modification of and permanent changes to the underlying landform, surface level changes in close proximity to private properties. The proposed cut and fill slopes range in scale from 1m to 28m wide approximately and will alter the form of the existing marginal pastoral land form.

It is recommended that a condition on the designation is included that promotes the re-use of topsoil from pastoral land impacted by the proposed earthworks[9]

Overall, the earthworks are considered to be of a quantity that is reasonably anticipated with a project of this scope and scale and all cut and fill slopes are expected to be integrated within the existing modified environment. Without mitigation it is anticipated that adverse effects would be **low**. With the information at hand with mitigation these are expected to result in a **very low** adverse level of effects.

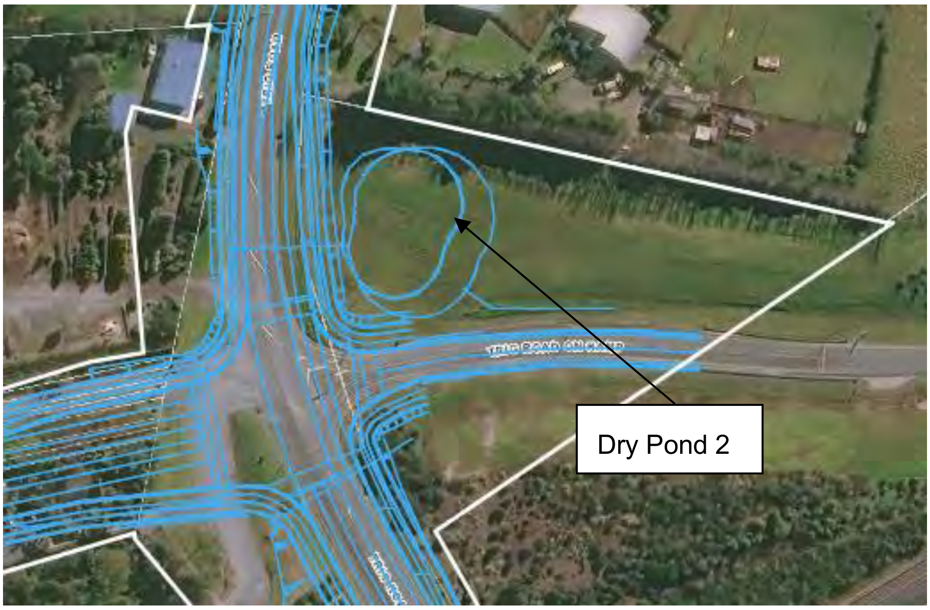
Dry Ponds and features

Two dry ponds are proposed within this Project area. Dry Pond 1 is proposed to the west of the road at the northern extent of the works close to the intersection with Brigham Creek Road at 139 Brigham Creek Road. Dry Pond 1 is set within an open pastoral area outside of existing waterways, within land that is already modified by rural land use.



Dry Pond 2 is proposed near the southern extent of the works on the eastern side of the works. Dry Pond 2 is proposed within the existing road boundary between Trig Road and the north on ramp on to SH18, this land is heavily modified and cleared of vegetation.

[9] Refer to NZTA Landscape Guidelines (September 2014), Section 4.12 Topsoil for additional information regarding best practice guidelines for topsoil management and soil stripping.



The dry ponds will require earthworks to re-shape the land and achieve optimal depths and edge profiles, which will be determined as part of the resource consent phase.

It is anticipated that mitigation will reduce adverse effects. However, due to the expected modification of the landscape and relative scale of the water features we consider adverse effects on the physical landscape to implement the proposed dry ponds to be **low** to **very low** with or without mitigation.

Private Properties

Residential properties within and adjacent to the Project area (including those which are partially designated) will be impacted by the Project in the following ways:

- Surface level changes between private property boundaries and the upgraded road corridor, requiring existing driveways and private accessways to be regraded;
- Encroachment into private yard areas and the removal of private garden plantings and trees, ancillary buildings and boundary fences;
- Potential construction of noise mitigation measures and retaining walls;
- Demolition of existing dwellings and ancillary buildings (required properties)

Approximately 12 existing dwellings are proposed to be impacted by the project works. Landscape mitigation measures are proposed under 6.1.2 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects.

Overall, without mitigation effects for some properties are anticipated be **moderate** adverse. With the implementation of mitigation it is assessed that the adverse effects on the physical landscape on private properties are anticipated to be **low-moderate.**

7.6.2.1 Site Finishing Works

Finishing works are expected to include grassing of exposed earth, lighting, signage, line markings, footpath/cycleway details and reinstatement of private property fences and gardens. Streetscape elements and landscaping, including that required as mitigation will also be implemented. These activities are to be determined by detailed design and will occur within the already modified areas of the Project. Without the implementation of mitigation measures it is anticipated that landscape effects have the potential to be **low** or **low-moderate** adverse. With consideration of the information available and providing that mitigation measures are implemented, landscape effects are anticipated to be **very low** through this final phase of the construction process.

7.6.2.2 Temporary Visual Effects

The construction of the Project is anticipated to be in two stages along the proposed corridor over a period of approximately 2.5 years. Visual effects are anticipated to occur progressively through the Project area and transient viewing audiences may concurrently experience adverse visual effects from both stages through the construction period.

The consideration of visual effects through the construction phase acknowledges the full range of activities (and their resultant visual impact), required to implement the upgraded road corridor.

It is anticipated that construction activities required to implement the Project will be generally consistent in nature and scale to road works and infrastructure activities commonly anticipated by transient viewing audiences within a main arterial corridor. Another important consideration is that landscape change by way of vegetation removal and land modification (on private rural property), albeit at a lesser scale, forms part of the expected backdrop of the existing environment.

Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects through the construction phase due to the magnitude of vegetation removal and/or earthworks proposed. These areas are outlined below:

- Private properties where physical landscape effects will occur along roadside boundaries.
- Private properties in proximity to the northern site compound at 139 Brigham Creek Road. This is also the location of proposed Dry Pond 1.
- Private properties in proximity to the southern site compound this is also the location of the proposed Dry Pond 2 and the proposed active modes bridge.

The nature and significance of the potential adverse visual effects is considered to be moderated through the Project area by the following:

- Road works and construction activities can generally be expected to occur within arterial roads;
- Trig Road is already a central element within the visual composition of the Project area;
- The existing road corridor landscape has already been modified by previous works required to shape the existing road corridor.
- The construction phase is expected to last approximately 2.5 years and is proposed to be implemented in phases to allow efficient access to the construction zones while maintaining continued access for the intersecting roads and existing private and commercial driveways.

With consideration of the information available and the expected surrounding context. Without mitigation it is anticipated that visual effects for the transient public viewing audience would be low adverse to low-moderate adverse. Provided that mitigation measures are implemented, adverse visual effects for the transient public viewing audience are anticipated to be **low** through the construction phase, taking into account those vantage points listed above where adverse effects are likely to be heightened during the temporary construction period.

Adverse visual effects during the construction phase are likely to be heightened on the basis that private audiences having more direct and prolonged engagement with the construction activities of the Project. This will include the presence of heavy machinery and the visible disturbance of both the road corridor and also individual private interfaces with the road.

With the information at hand and the expected wider context of landscape change and urbanisation and development. It is anticipated that without mitigation it is expected that visual effects for some private audiences have the potential to be **moderate** adverse. Visual effects on private audiences with the implementation of mitigation are anticipated to be **low-moderate** adverse at worst during the construction phase for private viewing audiences, depending on their location, proximity to the works and outlook.

7.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Recommendations are in line with the general recommendations in Section 6.1.2.

7.6.4 Assessment of Operational Effects

7.6.4.1 Natural Character Effects

Within the footprint of the road corridor and the proximate surrounding landscape, there are no existing watercourses or water bodies. As a result there will be no effects on natural character forming elements, features and processes within the Project area.

7.6.4.2 Visual Amenity Effects

Overall, there are likely to be a range of visual amenity effects on public and private viewing audiences relative to their proximity to the corridor. For existing properties set back from the Project area up to approximately 60m, the adverse visual amenity effects will be **very low** adverse without mitigation. However, with mitigation planting that has established some audiences may have no view of the works.

Very low residual adverse visual effects are anticipated for private residents in proximity to dry ponds and site compounds, despite the mitigation works. Residents may experience some level of material change to the visual composition and residential amenity of the road corridor as perceived from their private property.

From some properties directly adjacent to the Project area from which land is required (33, 42, 57, 67, 73, 82, 84, 86, 90, 92 and 139 Trig Road), visual amenity and residential character effects will be heightened as a result of the construction impacts including driveway regrading, potential loss of yard space and by the greater proximity of the carriageway and footpaths/cycleways to private dwellings. It is recommended that boundary fences and garden plantings (removed through the Project works) are reinstated on completion of the works affecting the property. These mitigation measures should be considered within the ULDMP under the lens of neighbourhood character and as such are discussed further in the following section.

Public viewing audiences will continue to engage with a similar transport environment, within the context of an increasingly urban neighbourhood character resulting in very low adverse effects. Over time, visual effects are anticipated to be positive for the public viewing audience, based on improved visual amenity for users associated with streetscape improvements, maturing street trees, berm planting and accessibility to active modes of transport.

Overall, visual effects are anticipated to be partially or fully mitigated by measures implemented during the finishing phase of the construction period (within the road corridor and private property boundaries), that will mature through the operational phase of the Project to adequately reduce any potential long-term residual visual effects of the Project. Specific mitigation measures for individual audiences are not anticipated, however this may be required following the detailed design phase.

Based on available information adverse visual effects within the Project area are likely to be **low** to **very low** without the inclusion of mitigation. With mitigation it is anticipated that effects will be **very low** adverse for transient viewers through the operational phase of the Project. For the private viewing audiences, the adverse visual effects following completion of all construction is anticipated to range from **low** to **very low**, reducing over an extended period of time as the landscape planting matures.

7.6.4.3 Landscape Character Effects

The principal elements of the Project will permanently alter the character of the existing Trig Road corridor and adjacent landscape. The existing corridor is currently distinctively rural in character as a result of the limited streetscape features, intermittent vegetation, shelterbelt and hedgerows along field boundaries and existing rural land uses adjacent to the corridor. At the completion of the Project, the upgraded corridor will resemble that of an urban collector road on account of the pedestrianisation, active modes of transport, reduced speed limit, structured street tree planting, integrated stormwater management and engineered roading elements that are inherently urban aesthetic.

Clearance of indigenous vegetation is expected as part of the required works, however these clearance areas will be limited and will not comprise any large areas of protected habitat. The stand of mature Pohutukawa trees within 92 Trig Road are not afforded any protections, however the removal of these trees will diminish the rural landscape character of the existing road. This has the potential to alter the character of these areas by heightening the impression of human modification.

A planting plan is recommended to be included in the ULDMP which will be developed as part of the detailed design of the Project. It is recommended that any planting proposed as mitigation through the regional consents process is integrated with the planting plan as recommended through this assessment under the ULDMP. This will ensure that natural character values are preserved as an outcome of the Project.

The Project is anticipated to enter the operational phase within the context of increased urbanisation as adjacent FUZ land is progressively live-zoned and developed. Although it is not possible to anticipate the exact future urban land use pattern, the Whenuapai Structure Plan suggests that industrial, retail and service buildings will be adjacent to Trig Road and the surrounding area. The Whenuapai Structure Plan indicates that a Proposed Sports Park may be situated close to Trig Road. On that basis we consider that the magnitude and nature of landscape change proposed by the Project is in accordance with that which will occur throughout the localised landscape over time.

Figure 4. Trig Road indicative 24m cross section

The cross section above illustrates the proposed upgrade to the road and the expected future use. Although indicative, there is available space within the road corridor for green infrastructure elements such as street trees and berms where low impact stormwater devices and associated planting can be accommodated These features are expected to improve landscape and urban amenity within the corridor.

As outlined earlier broad areas of vegetation along the existing corridor may not be able to be retained within the new corridor. New street tree planting along the length of the corridor will be an appropriate replacement (from a landscape character perspective) for the vegetation removed, within the context of the anticipated surrounding urban environment.

New street tree plantings, in conjunction with stormwater management and berm plantings, will provide landscape amenity and positively contribute to the landscape character of the Project area within the context of an urban environment. The full impact of the proposed new soft landscape will not by immediate, it is anticipated that adequate establishment will be achieved between 3-5 years.

On the basis of the above without mitigation effects may be as high as **low-moderate** adverse , allowing for future landscape mitigation, adverse landscape character effects are anticipated to be **low**.

7.6.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Recommendations are in line with the general recommendations in Section 6.1.3.

7.7 Conclusions

Overall, it is anticipated that landscape and visual effects, without the implementation of mitigation range from **moderate** adverse to **low** adverse for the construction phase and **low-moderate adverse** to **low** adverse for the operational phase. Adverse landscape and visual effects (with mitigation) range from **very low** to **low-moderate** for the construction phase and **very low** to **low** for the operational phase. Overall, the adverse effects can be mitigated and there are a number of positive landscape and visual effects that can ensue.

8 NoR W2: Māmari Road Upgrade

8.1 Project Corridor Features

Māmari Road is an existing semi-rural road (noting that a section of the corridor is a paper road[10]) that extends from the intersection of Brigham Creek Road and Totara Road in the north to the intersection with Spedding Road in the south. The proposed Māmari Road FTN upgrade will extend the existing corridor south to connect with Northside Drive. This will provide a north-south connection between the northern parts of Whenuapai and the proposed employment/industrial zoned land to the south.

The key landscape matters addressed for the Māmari Road Upgrade include:

- The nature and extent of impacts on the landscape as a physical resource during the construction period of the Project. A specific focus on the location of construction compounds, extent of vegetation clearance, the scale and location of proposed cut and fill slopes and the likely impacts of bridge construction.
- Consideration of landscape character effects and urban amenity issues in relation to the permanent landscape change, including specific assessment of how this corridor will integrate into the future urban environment;
- Consideration of the potential natural character effects of bridge re-construction within the Sinton and Pikau stream environments. In doing so, acknowledgement of the likely impacts on existing wetland and riparian vegetation (subject to regional consents) and future mitigation thereof.
- Potential natural character effects of the corridor construction and consideration of future opportunities to integrate the proposed wetland areas and associated existing mature vegetation.
- Landscape effects on the RNZAF housing int the SHZ accessed from the northern extents of Māmari Road.
- Consideration of landscape mitigation measures to be included within an Urban and Landscape Design Management Plan (ULDMP) as a condition on the proposed designation to address the potential landscape, natural character and visual effects arising from the operation the Project.

8.2 Existing and Likely Future Environment

8.2.1 Planning context

The northern section of Māmari Road to Spedding Road is an existing road corridor (although a section of the road is a ‘paper road’). The eastern side of this section is predominantly zoned under the AUP:OP as FUZ, with a portion of Residential – Single House Zone. The western side of this section is also predominantly FUZ (see Figure 8-1 below). The Whenuapai Structure Plan indicates that the FUZ land will be re-zoned medium residential to the north (west side of Māmari only) and business to the south.

[10] An unformed legal road (or ‘paper road’) is a legally recognised road that is undeveloped or partly formed, but provides public access to a particular area or feature. Auckland Transport, 2021.

Figure 8-1. View west across Māmari Road towards existing pastoral fields.

Table 8-1 below provides a summary of the North West existing and likely future environment.

Table 8-1: Māmari Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[11]	Likely Future Environment[12]
Residential	Residential	Low	Residential
Undeveloped greenfield areas	Future Urban	High	Urban
Timatanga Community School	Special Purpose - School Zone	Low	Urban

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

8.2.2 Landscape Environment

8.2.2.1 Baseline Landscape

The Project is situated within the existing northern and southern extents of Māmari Road corridor with a central section of paper road approximately 200m in length. The landform is gently sloping with depressions around the stream corridors and wetland features. Rolling pastoral fields and agricultural

[11] Based on AUP:OP zoning/policy direction
[12] Based on AUP:OP zoning/policy direction

production for the majority of the route. The northern end of the route at the intersection with Brigham Creek Road is boarded to the east by existing residential properties.

The local landscape character of Māmari Road are summarised below;

- Vegetation cover comprising stand alone elements of indigenous vegetation, hedgerows, shelterbelts, trees and shrubs along field boundaries; native riparian vegetation along rivers and wetland areas, exotic pastoral grassland and non-native stand alone trees.
- The Sinton and Pikau streams that cross the route through the middle of the Project
- The landscape is characterised by land modification associated with the surrounding rural agricultural productive land use.
- The landscape character value is low within the context of the existing road reserve. There is the potential to enhance this aspect of the landscape.

Landform and Hydrology

The existing Māmari Road and the central paper road section traverses a gently sloping topography that is slightly elevated to the south, with shallow stream valleys resulting in depressions laterally across the landform. Across the entire Project the proposed route is crossed by wetlands or streams in five locations, most prominently the Sinton Stream and Pikau Stream (refer images below).

Landcover

The landscape east and west of Māmari Road is characterised by elongated geometric fields bound in parts by isolated elements of native vegetation, exotic grassland, hedgerows and amenity planting in proximity to properties. Exotic specimen trees are the predominant landcover on both sides of the road corridor and within the surrounding rural properties. Areas of open pasture are located directly adjacent to the road corridor along the length of the designation on both sides. Indigenous wetland ecosystems within the stream corridors and wetland areas are an important habitat for bird and plant species. Specifically the Sinton Stream has a wide riparian area (see Figure 8-2 below) and identified for enhancement in the Whenuapai Structure Plan.

Stands of mature native trees located within the road reserve and along the roadside boundaries of private properties contribute to the landscape character of the surrounding landscape. The land at Timatanga Community School is surrounded by a mixture of dense mature native and exotic mature vegetation. Rural residential properties along the road tend to have a belt of native and non-native planting the road frontage.

No scheduled notable trees are present within proximity of the Project.

Figure 8-2. View north across the Sinton Stream towards the existing northern portion of Māmari Road.

Land Use

The existing Māmari Road corridor is approximately 20m wide and zoned as ‘Road under the AUP:OP.

Land use either side of the existing road reserve is rural and is predominantly pastoral (see Figure 8-3 below) with residential features and a rural school towards the centre of the Project. A small pocket of existing residential properties are concentrated to the north eastern portion of the corridor adjacent to Brigham Creek Road.

Figure 8-3. View north west across overgrown pastoral fields which contains landing signal lights for the RNZAF base.

Scheduled Landscape and Ecological Features

There are no scheduled landscape or ecological features within or proximate to the Project area.

Historical and Cultural Associations

There are no scheduled historical or cultural features within or proximate to the Project area.

8.2.2.2 Likely Future Environment

Overview

The land surrounding the Project will witness a significant change from rural to urban land use character over the next 10 years. It is anticipated that the abiotic features of the landscape will endure, these include the riparian and wetland environments associated with Sinton and Pikau streams and the existing landform.

It is anticipated that some of the defining biotic (land cover) features of the landscape will undergo significant change alongside future development, with the removal of large areas of vegetation to accommodate the proposed development. This will likely involve the implementation of street tree planting, public open space areas and general landscaping within the private yards of future housing development for public amenity.

The quality and natural character values of riparian and wetland environments are generally anticipated to be retained and, in some instances, enhanced as urban development progresses, in accordance with the policy direction of the AUP:OP and Whenuapai Structure Plan which generally seek to protect and enhance these landscape features.

8.2.2.3 Whenuapai Structure Plan

The Whenuapai Structure Plan provides general guidance for how the FUZ land adjacent to the Project area should be developed over time. The structure plan is illustrated in Appendix 1.

Land Use

The Whenuapai Structure Plan indicates that the route to the north of the Sinton Stream will be surrounded by residential development on either side. The east of the route will remain a SHZ for RNZAF housing. To the west the route will abut Medium Density residential development.

To the immediate south of the Sinton Stream is a small area of Mixed Use development adjacent to Timatanga Community School which will remain as a School zoned. Either side of the route further south is intended to be urbanised with a “Business” land use. The plan envisages this Business use to comprise Industrial and Retail and Services. Extensive industrial activities such as manufacturing, transport and storage, logistics, construction and wholesale trade are expected. Retail and services are expected to be required to support the increased amount of housing within the Structure Plan.

8.3 Extent of Visibility and Viewing Audience

The visual catchment is the area of land from which part or all of the Project area is visible. This is largely determined by landform, land cover and built elements, which in combination may obscure or filter views. The extent of visibility of the proposed road corridor is contained by the surrounding built form, in addition to some subtle changes in topography and intervening vegetation. Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects. In summary the viewing audience for the Project includes:

- *Public Views:* Transient public audience (vehicle users). Key roads where views can be obtained from include Spedding Road and Brigham Creek Road. Views include:
  - Travelers (cars, pedestrians and cyclists) along Spedding Road which bisects the corridor (Refer Appendix Site Photo 6);
  - Travelers (cars, pedestrians, and cyclists) to the south of the site along Northside Drive
  - Travelers (cars, pedestrians, and cyclists) to the north of the site along Brigham Creek Road (Refer Appendix Site Photo 7); and
- *Private Views:* The viewing context also includes a relatively small private viewing audience, comprising views from rural residential and lifestyle dwellings as well as from the commercial and agricultural businesses located to the west of the rail corridor. Specifically:
  - Views from the residential properties in an existing urban setting to the north of the corridor with short driveways that immediately front on to the east of Māmari Road (Even numbered properties 2-24) (Refer Appendix Site Photo 8);
  - Views from the residential properties within a rural context along Māmari Road , (5, 7, 11, 15, 28 and 80 (Refer Figure 8-4 below)) (Refer Appendix Site Photo 9);
  - Views from the residential properties accessed from Spedding Road (7 and 9);
  - Views from the residential properties accessed from Northside Drive (70, 72 and 80) and;
  - Occupants of Timatanga Community School at 9 Māmari Road;

Views are well contained within the immediate area surrounding the road corridor due to the relatively flat landscape and intervening vegetation. Over time, the audience is likely to grow to include residents of future urban developments within the FUZ area.

Figure 8-4. Residential property at 7 Māmari road that currently overlooks the Sinton Stream.

8.4 Landscape Values

There are no regionally or nationally significant landscapes (ONLs, ONFs or ONCs) within or proximate to the proposed designation boundary. The nearest ONL is Area 1 – Paremoremo Escarpment, located in the Paremoremo Creek approximately 3.5km to the north of the site.

The gently sloping topography and the mature stands of vegetation contribute to the visual amenity of the landscape. The highly modified landscape has limited natural features, which are restricted to stands of native vegetation, stream and wetland environments and indigenous planting within these stream and wetland habitats.

There is no existing identified open space within the proposed corridor, however there is an existing Neighbourhood Park to the north of the corridor at the corner of Brigham Creek Road and Totara Road.

The Whenuapai Structure Plan indicatively shows an esplanade reserve along the Sinton Stream could be provided as a future open space. It is proposed that this will comprise at least 20 metres in width where the opportunity arises for subdivisions along the coast and waterways.

8.5 Landscape Sensitivity

This corridor is situated within a broader landscape that has been assessed within the AUP:OP as being suitable for urbanisation. The proposed urbanisation of the surrounding landscape as indicated by the Whenuapai Structure Plan will be primarily industrial, retail and service buildings with medium density residential areas at the northern extent of the corridor. Although there are pockets of indigenous vegetation, stream and wetland environments with a moderate level of sensitivity, on balance the Project area is assessed as having a low sensitivity to landscape change.

8.6 Assessment of Landscape Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

8.6.1 Positive Effects

Generalised positive effects related to the Project are covered in Section 5 of this report. Additional positive effects related specifically to this Project include:

- Improved and/or new opportunities for active modes of transport and the ability to provide improved connectivity to Whenuapai town centre that are projected in the Whenuapai Structure Plan.
- Improvement or enhancement of riparian habitat within the Indicative Esplanades indicated in the Whenuapai Structure Plan.

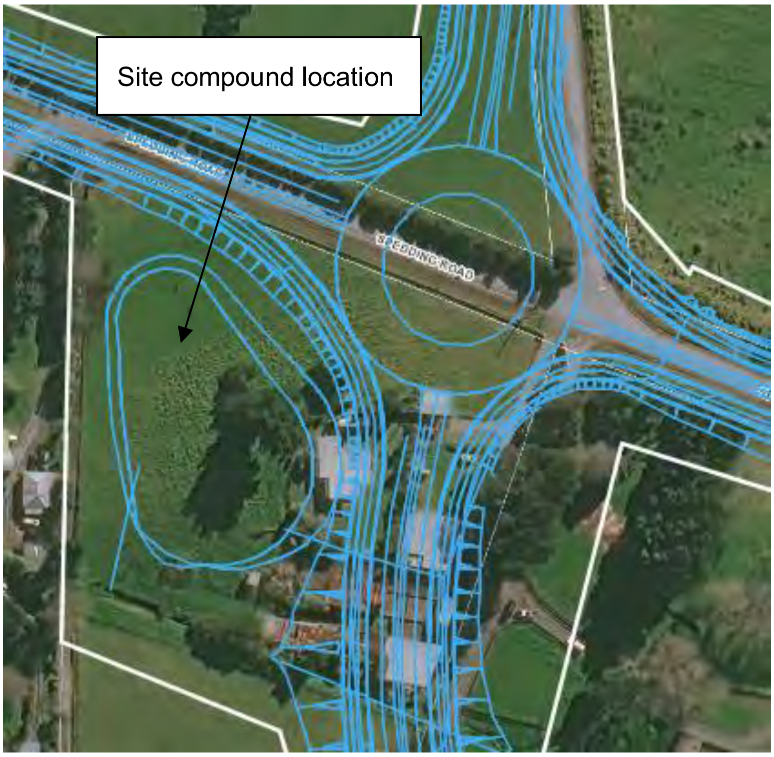
8.6.2 Assessment of Construction Effects

Construction Areas

Site compound and construction areas are to be established at two or three locations within the Project area. Construction traffic will be heightened at these locations through the construction period of the Project.

- Site compound, stockpile, sediment retention pond and lay-down area for bridge construction is located at adjacent to the Sinton Stream at 28A Māmari Road (refer to the image below).

- Site compound, stockpile, sediment retention pond is located in the lot at 10 Spedding Road, adjacent to the north western side of the Spedding Road interchange (refer to the image below).



The proposed site compounds and construction areas are both located within pastoral land that is already somewhat modified by existing rural land use. It is recommended that all areas be grassed (reinstated) at the completion of the construction period.

Without mitigation it is anticipated that physical effects on the landscape will be between **low-moderate** adverse and **low** adverse. With the inclusion of mitigation proposals, the physical landscape effects resulting from establishment and use of the construction work areas within the Project area is assessed to be **low** adverse.

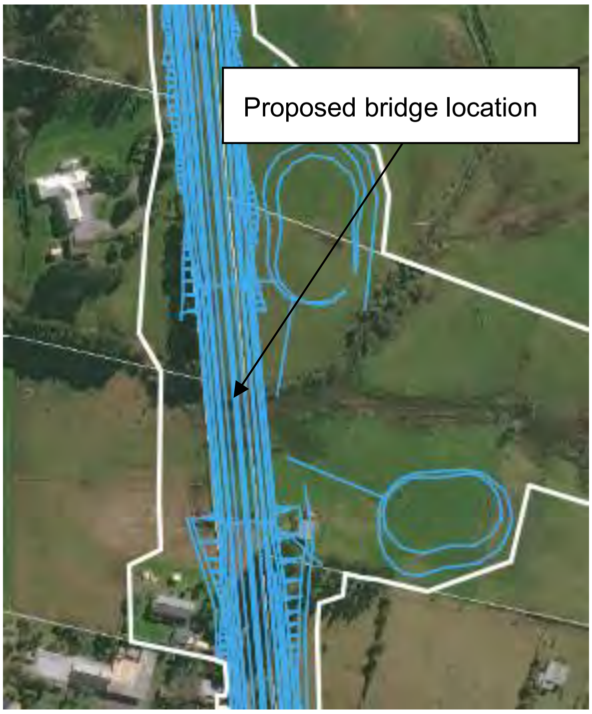
Vegetation Clearance

Broad areas of roadside vegetation are proposed to be removed to accommodate the wider road corridors and batter slopes. This consists entirely of trees and shrubs located within the road-side boundaries of private properties, within the Project area. Exotic pasture, trees, shelterbelt plantings, indigenous riparian vegetation, private gardens and exotic stands of trees patches make up the majority of vegetation to be removed.

With the information available regarding the scale of vegetation removal it is expected that adverse visual effects without implementing mitigation will be predominantly **low** adverse with **low-moderate** adverse effects. With the existing information available and provided that the proposed mitigation measure are implemented, the physical landscape effects likely to arise from vegetation clearance within the Project area is assessed as **low** adverse. Although some mature specimen trees will be removed these will be in the context of a landscape that will be urbanised over time.

Structures and Earthworks

A 90m long four lane bridge with footpath / cycle ways on either side is proposed to cross Sinton Stream (refer image below). This bridge is preferred to preserve the stream, wetland and riparian vegetation along the stream. This will require additional fill earthworks one the north and south Sinton Stream approaches.



The earthworks balance is anticipated to be to be undertaken over the site at a minimum. The majority of the proposed additional fill will comprise brown rock for engineering purposes.

The impacts and potential landscape effects of the proposed earthworks include the modification of and permanent changes to the underlying landform particularly in the wetland areas, surface level changes in close proximity to private properties. The proposed cut and fill slopes range in scale from 1m to 18m wide and will alter the form of the existing marginal pastoral land form, stream banks and wetlands.

It is recommended that a condition of the designation is included to promote the stockpile and re-use of topsoil from pastoral land impacted by the proposed earthworks[13]

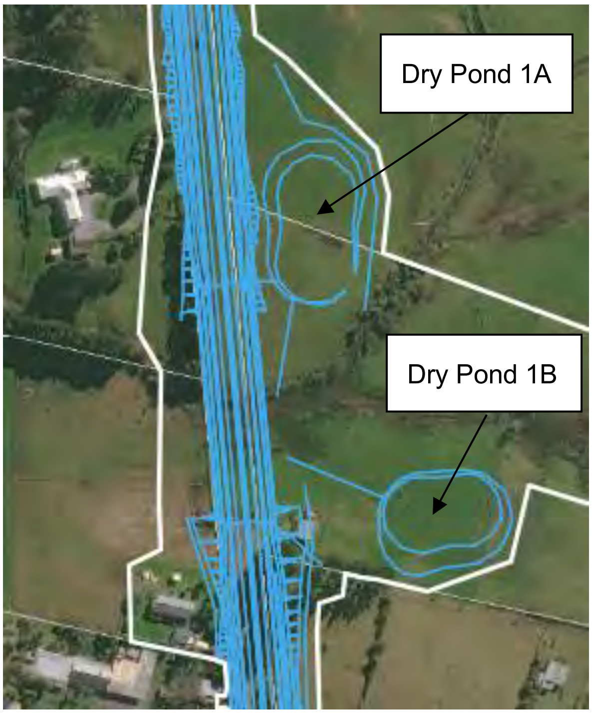
Overall, we consider the earthworks to be of a quantity that is reasonably anticipated with a project of this scope and scale and all cut and fill slopes are expected to be integrated with the existing modified environment. The proposed bridge structure will introduce a new element into the landscape, however this will preserve the connectivity of the stream and indigenous riparian vegetation. Provided that the proposed mitigation measures are undertaken we expect that the adverse effects of the earthworks and bridge structure will be **low**.

Dry Ponds and features

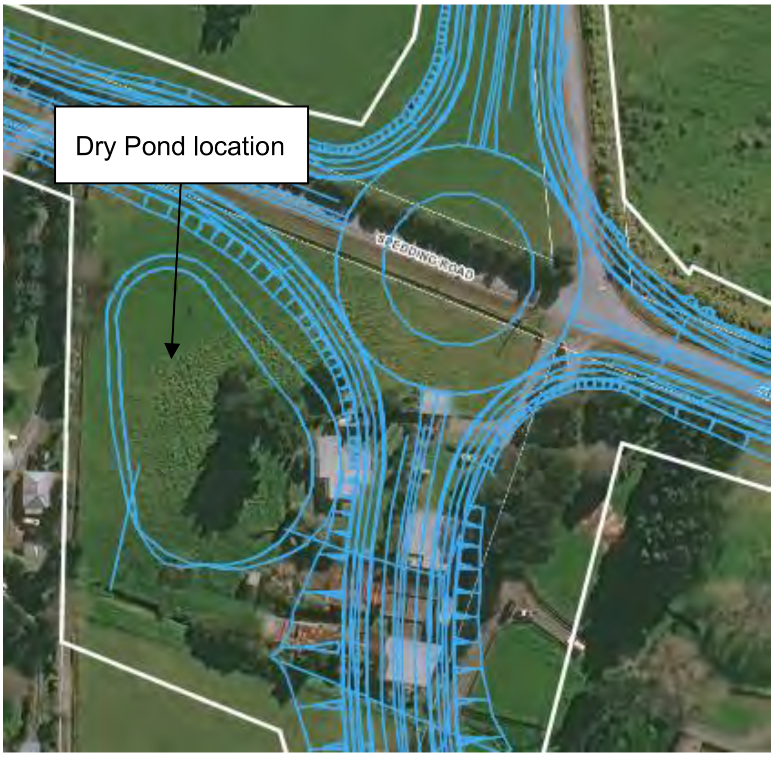
Three dry ponds are proposed within this Project area, one of which is shared with the Spedding Road corridors (refer image below). Dry Pond 1A is proposed to the north of the Sinton stream to the east of the road corridor. Dry Pond 1B, the larger of the two, is positioned to the south of the Sinton

[13] Refer to NZTA Landscape Guidelines (September 2014), Section 4.12 Topsoil for additional information regarding best practice guidelines for topsoil management and soil stripping.

Stream to the east of the road corridor. Both of these ponds will be located within existing pastoral fields.



The third dry pond is located to the south west of the Spedding Road interchange to the north of the Pikau Stream (refer image below).



The dry ponds will require earthworks to re-shape the land and achieve optimal depths and edge profiles, which will be determined as part of the resource consent phase.

It is anticipated that the proposed mitigation will reduce adverse effects as a result of the implementation of the above works. However, due to the existing modified landscape and relative scale of the water features we consider adverse effects on the physical landscape to implement the proposed dry ponds to be **very low** with or without mitigation.

Four branches of the Pikau Stream are required to be culverted (subject to resource consent), to the south of the Spedding Road interchange. Indigenous riparian vegetation within these stream branches is limited to small patches, which reduces their sensitivity to change.

With the information available, it is anticipated that without mitigation it effects on the physical landscape will be **low** adverse. We consider adverse effects on the physical landscape to implement the proposed culverts to be **very low**, provided that proposed mitigation is implemented.

Private Properties

Residential properties within and adjacent to the Project area (including those which are partially designated) will be impacted by the Project in the following ways:

- Surface level changes between private property boundaries and the upgraded road corridor, requiring existing driveways and private accessways to be regraded;
- Encroachment into private yard areas and the removal of private garden plantings and trees, ancillary buildings and boundary fences;
- Potential construction of noise mitigation measures and retaining walls;
- Demolition of existing dwellings and ancillary buildings (required properties).

Approximately 19 existing dwellings will be impacted by the proposed project works. Landscape mitigation measures are proposed under 8.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects below. Without the implementation of these mitigation measures it is anticipated the effects on private properties will range from **moderate** adverse to **low-moderate** adverse. Overall, with the information currently available and the implementation of proposed mitigation measures it is anticipated that the adverse effects of physical landscape effects on private properties is **low-moderate** adverse.

8.6.2.1 Site Finishing Works

Finishing works are expected to include grassing of exposed earth, lighting, signage, line markings, footpath/cycleway details and reinstatement of private property fences and gardens. Streetscape elements and landscaping, including that required as mitigation will also be implemented. These activities are to be determined by detailed design and will occur within the already modified areas of the Project.

Without the implementation of mitigation works physical landscape effects are anticipated to range between **low** adverse and **very low** adverse. With the implementation of mitigation proposals physical landscape effects are expected to be **very low** adverse through this final phase of the construction process.

8.6.2.2 Temporary Visual Effects

The construction of the Project is anticipated to be in three stages along the proposed corridor over a period of approximately 2-3 years. Visual effects are anticipated to occur progressively through the Project area and transient viewing audiences may concurrently experience adverse visual effects from several stages through the construction period.

The consideration of visual effects through the construction phase acknowledges the full range of activities (and their resultant visual impact), required to implement the upgraded road corridor.

It is anticipated that construction activities required to implement the Project will be generally consistent in nature and scale to road works and infrastructure activities commonly anticipated by transient viewing audiences within a main arterial corridor. Another important consideration is that landscape change by way of vegetation removal and land modification (on private rural property), albeit at a lesser scale, forms part of the expected backdrop of the existing environment.

Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects through the construction phase due to the magnitude of vegetation removal, proximity to construction compounds and/or earthworks proposed. These areas are outlined below.

- Private properties where physical landscape effects will occur along roadside boundaries.
- Private properties in proximity to the northern site compound at 5, 7 and 28 Māmari Road, Timatanga Community School and the rear of properties at 7, 8, 9 and 10 Tama Quadrant. This is also the location of proposed Dry Pond 1A and 1B and the proposed active modes bridge.
- Private properties in proximity to the southern site compound at 10 Spedding Road, 15 Māmari Road, 9 and 10 Spedding Road, this is also the location of the proposed Dry Pond 2.

We consider that the nature and significance of the potential adverse visual effects to be moderated through the Project area by the following aspects:

- The northern extent of Māmari Road is already a central element within the visual composition of the Project area;
- The existing road corridor landscape has already been partially modified by previous works required to shape the existing road corridor.
- The construction phase is expected to last approximately 2-3years and is proposed to be implemented in phases. This is expected to allow efficient access to the construction zones while maintaining continued access for the intersecting roads and existing private and commercial driveways.
- A limited number of transient and private viewing audiences will have views over the works.

Overall, without mitigation adverse visual effects for the transient public viewing audience are likely to be **low** adverse. With the anticipation of mitigation proposals being implement visual effects are expected to be **very low** adverse through the construction phase, taking into account those areas listed above where adverse effects are likely to be heightened during the temporary construction period.

Adverse visual effects during the construction phase are likely to be heightened for private viewing audiences directly adjacent to the Project area on the basis of more direct and prolonged engagement with the construction activities of the Project. This will include the presence of heavy machinery and the visible disturbance of both the road corridor and also individual private interfaces with the road.

Without mitigation it is expected that these effects will be **moderate** adverse for the majority of audiences, with audiences with short distance open views of the works as high as **moderate-high** adverse. Therefore, adverse visual effects are likely to range between **low-moderate** to **low** during the construction phase for private viewing audiences.

8.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Recommendations are in line with the general recommendations in Section 6.1.2.

In addition to these measures the following project specific interventions are suggested:

- Wherever possible maintain riparian vegetation within the stream and wetland environment and;
- It is recommended that a vegetation plan is prepared within the UDLMP, to indicate locations to be protected during construction.

8.6.4 Assessment of Operational Effects

8.6.4.1 Natural Character Effects

Natural character forming elements, features and processes within the Project area are limited. Indigenous riparian vegetation is more pronounced in the Sinton Stream than the branches of the Pikau Stream. Therefore, the natural character value in the landscape is comparatively low.

Clearance of indigenous vegetation within the road corridor is expected as part of the required works, however these clearance areas will be limited and will not comprise any large areas of protected habitat. This does have the potential to alter the character of these areas by heightening the impression of human modification. Clearance of indigenous riparian vegetation and habitat will be necessary to facilitate the construction of the Sinton Stream bridge, this will be limited to the areas required for construction.

A planting plan and vegetation protection plan is recommended as part of the ULDMP which will be developed as part of the detailed design of the Project. It is recommended that any planting proposed as mitigation through the regional consents process is integrated with the planting plan as recommended through this assessment under the ULDMP. This will ensure that natural character values are preserved as an outcome of the Project and facilitate the potential future use of the stream corridor as part of an esplanade, as indicated in the Whenuapai Structure Plan.

On the basis of the above without mitigation effects may be as high as **low-moderate** or **moderate**. Allowing for future landscape mitigation adverse natural character effects are anticipated to be **low** adverse.

8.6.4.2 Visual Amenity Effects

Overall, there are likely to be a range of visual amenity effects on public and private viewing audiences relative to proximity to the corridor. For existing properties set back from the Project area, the visual amenity effects will be a reduced incremental increase in existing effects from the introduction of an arterial road.

Private properties which have filtered, screened or distant views towards the works are expected to experience a reduced level of change as a result of the works. Where as residential viewing audiences closer to the proposed corridor will experience more direct material changes to the visual composition and residential amenity of the road corridor as perceived from private property.

For some properties directly adjacent to the Project area (from which land is required), visual amenity and residential character effects will be heightened as a result of the construction impacts including driveway regrading, potential loss of yard space and by the introduction of an urban style carriageway and footpaths/cycleways to private dwellings. It is recommended that boundary fences and garden plantings (removed through the Project works) are reinstated on completion of the works affecting the property, unless other arrangements are requested by land owners. These mitigation measures should be considered within the ULDMP under the lens of neighbourhood character and as such are discussed further in the following section.

Very few public viewing audiences have a direct view of the works due to the lack of connectivity and low number Māmari Road users. Over time as the surrounding FUZ land is developed visual effects are anticipated to be reduced for the public viewing audience, based on improved visual amenity for users associated with streetscape improvements, maturing street trees, berm planting and accessibility to active modes of transport.

Overall, some visual effects are anticipated to be partially or fully mitigated by measures implemented during the finishing phase of the construction period (within the road corridor and private property boundaries), that will mature through the operational phase of the Project. These will reduce some of the long-term residual visual effects of the Project, however the 30m wide road will be a noticeable new feature within the landscape, when the project is completed. The road corridor will appear less prominent as the surrounding area is urbanised over time.

Without the implementation of proposed mitigation it is anticipated that visual effects on transient viewers will be **low** adverse to **very low** adverse, effects on private viewing audiences are anticipated to be **moderate** adverse.

With all available information and the implementation of mitigation measures, visual effects within the Project area are likely to be **very low** adverse for transient viewers through the operational phase of the Project. For the private viewing audience, the visual effects are likely to be **low-moderate** adverse to **very low** adverse, reducing over an extended period of time. It is anticipated that mitigation planting is expected to take 3-5 years to become established and most effective.

8.6.4.3 Landscape Character Effects

The principal elements of the Project will permanently alter the character of the existing rural Māmari Road and adjacent landscape. The existing road is currently distinctively rural in character as a primarily unsealed and incomplete road way, characterised by the lack of streetscape features, informal intermittent vegetation, shelterbelt and hedgerows along field boundaries and existing rural land uses adjacent to the corridor. At the completion of the Project, the upgraded corridor will resemble that of an urban arterial road on account of the pedestrianisation, active modes of transport, reduced speed limit, structured street tree planting, integrated stormwater management and engineered roading elements that are inherently an urban aesthetic.

The Project is anticipated to enter the operational phase within the context of increased urbanisation as adjacent FUZ land is progressively live-zoned and urbanised. Although it is not possible to anticipate the exact future urban land use pattern, the Whenuapai Structure Plan suggests that industrial, retail and service buildings will be surrounding the southern portion of Māmari Road and medium density residential development to the north. The Whenuapai Structure Plan also indicates that is desirable to develop the riparian corridor along Sinton Stream into an esplanade reserve.

Based on the above the magnitude and nature of landscape change proposed by the Project are considered to match with the changes that will likely occur throughout the localised landscape over time.

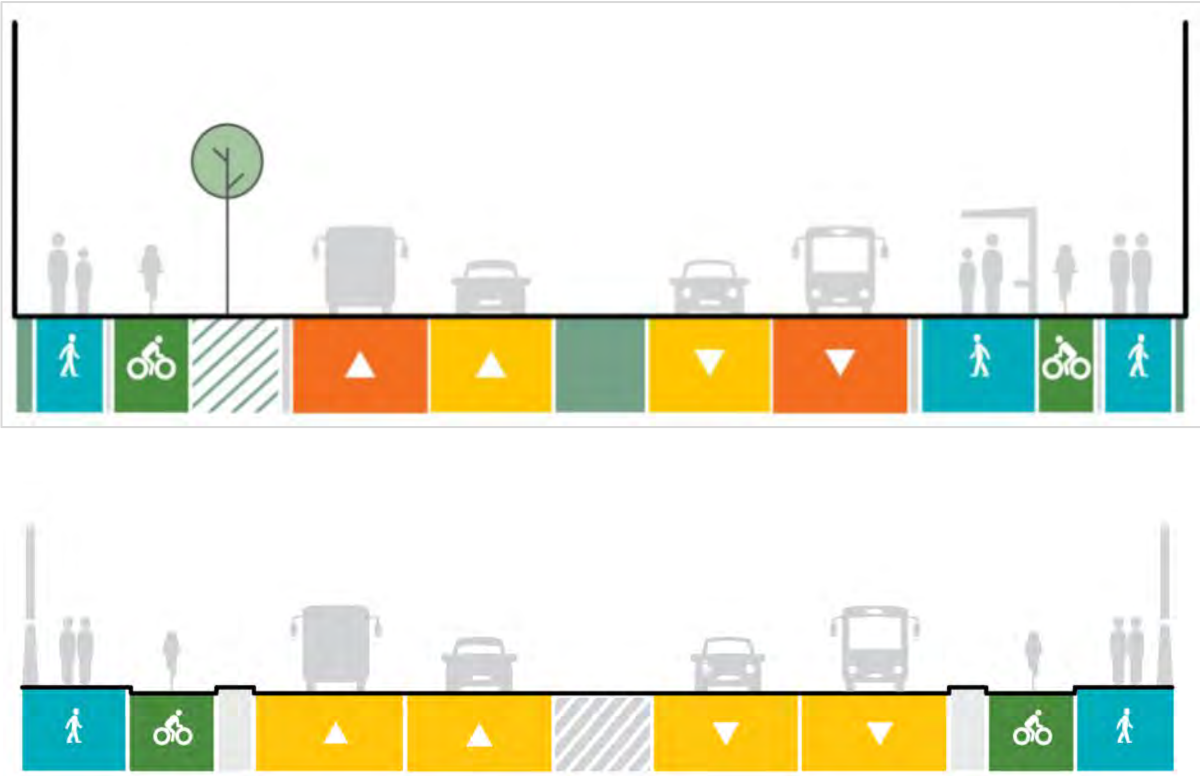


Figure 8-5: Māmari Road Upgrade Typical Cross Section – Corridor and Bridge

The typical cross section above illustrates the proposed upgrade to the road and the expected future use. Although indicative the available space within the road corridor for green infrastructure elements such as street trees and berms where low impact stormwater devices and associated planting can be accommodated These features are expected to improve landscape and urban amenity within the corridor.

As outlined earlier broad areas of vegetation along the existing corridor may not be able to be retained within the new corridor. New street tree planting along the length of the corridor will be an appropriate replacement for the vegetation removed (from a landscape character perspective), within the context of the anticipated surrounding urban environment. It is assessed that the new street tree planting, in conjunction with stormwater management and berm plantings, will provide landscape amenity and positively contribute to the landscape character of the Project area within the context of an urban environment.

On the basis of the above without mitigation effects may be as high as **low-moderate** adverse , allowing for future landscape mitigation, adverse landscape character effects are anticipated to be **low**.

8.6.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

Recommendations are in line with the general recommendations in Section 6.1.3. In addition to this the following recommendation is suggested:

- Produce a vegetation protection plan as part of the UDLMP to ensure that valued indigenous and riparian vegetation are protected.

8.7 Conclusions

Overall landscape and visual effects without mitigation range from **moderate-high** adverse to **low** adverse for the construction phase and **moderate** adverse to **very low** adverse for the operational phase. With the anticipation of mitigation measures being implement effects are expected to range from **low** to **low-moderate** for the construction phase and **low** to **low-moderate** for the operational phase. Overall, the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. There are a number of positive landscape and visual effects that will result from the project, not least the opportunity to create a linkage to the indicative esplanade proposed in the Whenuapai Structure Plan.

9 NoR W3: Brigham Creek Road Upgrade

9.1 Project Corridor Features

Brigham Creek Road is an existing arterial road that extends from the intersection with SH16 in the west to the intersection with Hobsonville Road to the east. The proposed upgrade extends from the eastern side of the existing Totara Creek bridge in the west, to Kauri Road near the existing SH18 Brigham Creek Interchange in the east. This proposed upgrade runs through an existing rural environment at each end, with the middle section being a mix of town centre, industrial and residential environments. The proposed corridor upgrade will provide an east-west connection for all modes within Whenuapai and access SH16, SH18 and local destinations such as Hobsonville and Kumeū-Huapai.

The key landscape matters addressed for the Brigham Creek Road Upgrade include:

- The nature and extent of impacts on the landscape as a physical resource during the construction period of the Project. A specific focus on the location of construction compounds, extent of vegetation clearance, the scale and location of proposed cut and fill slopes and the likely impacts of bridge construction.
- Consideration of landscape character effects and urban amenity issues in relation to the permanent landscape change, including specific assessment of how this corridor will integrate into the future urban environment;
- Consideration of the potential natural character effects of bridge re-construction within the Totara Creek and Waiarohia Stream environments. In doing so, acknowledgement of the likely impacts on existing wetland and riparian vegetation (subject to regional consents) and future mitigation thereof.
- Potential natural character effects of the corridor construction and consideration of future opportunities to integrate the proposed wetland areas and existing mature vegetation.
- Consideration of landscape mitigation measures to be included within an Urban and Landscape Design Management Plan (ULDMP) as a condition on the proposed designation to address the potential landscape, natural character and visual effects arising from the operation the Project.
- Landscape effects on the RNZAF housing int the SHZ accessed to the south of Brigham Creek Road.
- Integration with and potential landscape effects on the Whenuapai 1 and Whenuapai 2 precincts.
- Potential Landscape Effects on the SEAs around the stream environments.
- Integration of the four proposed dry ponds and the expansion of the existing wetland pond.
- Integrating the road corridor within proximity to the RNZAF base.

9.2 Existing and Likely Future Environment

9.2.1 Planning context

The land adjacent to the majority of Brigham Creek Road is zoned under the AUP:OP as FUZ, except within the Whenuapai urban area (which is zoned under the AUP:OP for a range of residential and business zones) and the Whenuapai New Zealand Defence Force (NZDF) airbase.

Table 9-1 below provides a summary of the North West existing and likely future environment.

Table 9-1: Brigham Creek Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[14]	Likely Future Environment[15]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
	Business (Local centre)	Low	Business (Local centre)
Residential	Residential	Low	Residential
Open Space	Open Space –Informal Recreation Zone	Low	Open Space
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Special Purpose – Airports and Airfields Zone

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

9.2.2 Landscape Environment

9.2.2.1 Baseline Landscape

The Project is situated within the existing Brigham Creek Road arterial road with rural landscape at both the eastern and western extents of the route and urban development at the centre of the corridor. The corridor has a central high point towards the centre of the route and the landform descends gently towards the Waiarohia Stream to the east and the Totara Creek to the west. Rolling pastoral fields surround the western and eastern extents of the site. The RNZAF base to the north west of the corridor is a substantial feature within the landscape with restrictions which effect the design and management of the landscape. Towards and surrounding the centre of the route are a range of residential and commercial development within the Whenuapai town centre.

The local landscape character of Brigham Creek Road are summarised below;

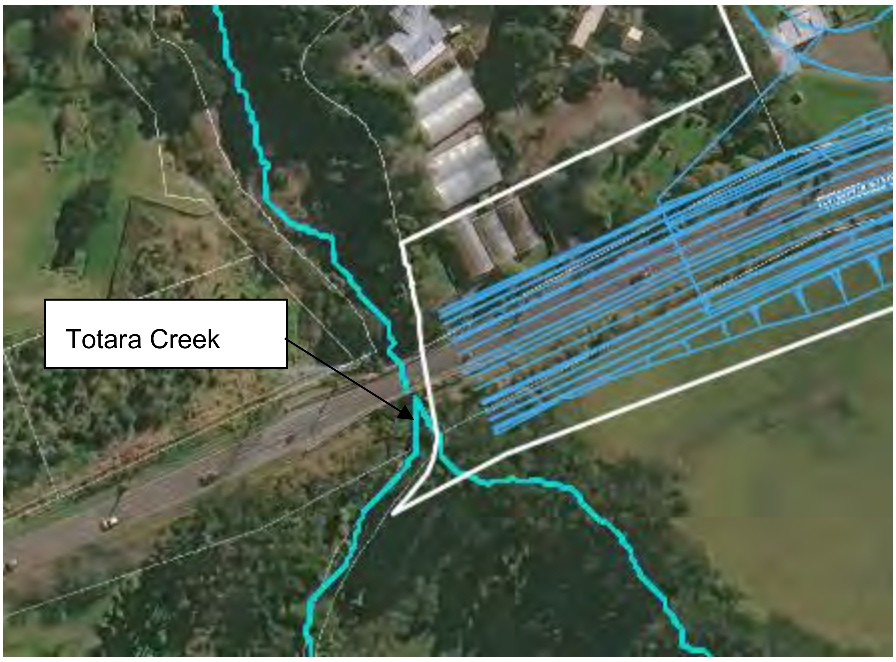
- Vegetation cover comprising stand alone elements of indigenous vegetation, hedgerows, shelterbelts, trees and shrubs along field boundaries; native riparian vegetation along rivers and wetland areas, exotic pastoral grassland and non-native stand-alone trees within the streetscape of the existing urban areas. The RNZAF base and its approaches are devoid of tall vegetation and trees due to air safety standards.
- The Totara Creek and Waiarohia Stream that cross the corridor at the eastern and western ends of the Project
- The landscape is characterised by land modification associated with the surrounding rural agricultural productive land use, urban core within Whenuapai Town and the RNZAF base.

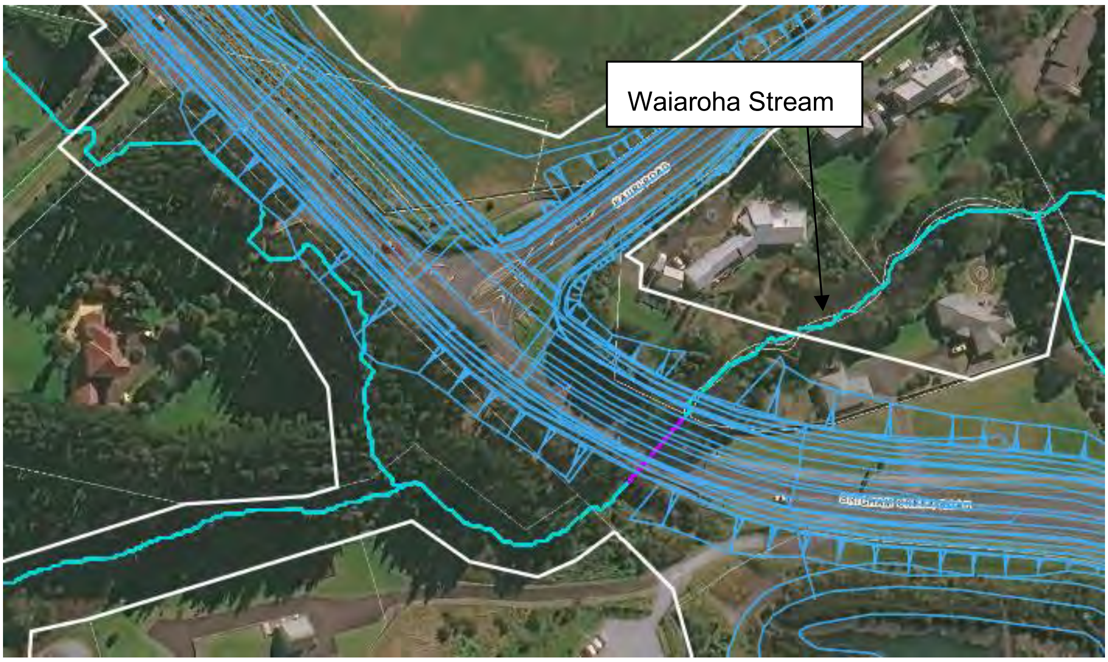
[14] Based on AUP:OP zoning/policy direction
[15] Based on AUP:OP zoning/policy direction

- The landscape character value is low within the context of the existing road reserve and has a moderate value within and in proximity to the SEA. There is the potential to enhance the landscape character of the landscape.

Landform and Hydrology

Brigham Creek Road and the existing arterial road traverses a gently sloping topography that reaches a high point towards the centre of the route. The lowest points of the site are at either end of the site where the land descends towards the Totara Creek to the west and Waiaroha Stream (refer images below). To the south of the corridor between for a stretch of 1.5km there are intermittent wetlands with indigenous riparian vegetation and grassland areas prone to flooding.





Landcover

The landscape to the eastern and western extents of Brigham Creek Road is characterised by elongated geometric fields bound in parts by isolated elements of native vegetation, exotic grassland, hedgerows and small areas of amenity planting in proximity to properties. Stands of mature native trees located within the road reserve and along the roadside boundaries of private properties contribute to the landscape character of the surrounding rural landscape. Rural residential properties along the road tend to have a belt of native and non-native planting the road frontage.

Areas of open pasture are located directly adjacent to the road corridor along the length of the designation on both sides. Indigenous wetland ecosystems within the stream corridors and wetland areas are an important habitat for bird and plant species.

To the north of the corridor near the centre of the scheme is the RNZAF base containing large area of exotic managed grassland. The central portion of the route sits within the rapidly developing Whenuapai Town Centre, with mixed density residential development and mixed commercial and industrial development. Trees within the streetscape are limited, however large mature trees are a focal point within the southern boundary of the Whenuapai Settlement Park (see Figure 9-1 below).

There are no scheduled notable trees are present within proximity of the Project.

Figure 9-1: View north west across the Totara Road, Brigham Creek Road and Māmari Road intersection, towards Whenuapai Settlement Open Space.

Land Use

The existing Brigham Creek Road corridor is approximately 20m wide and zoned as ‘Road’ under the AUP:OP.

Land use either side of the existing road reserve to the eastern and western extent of the corridor is rural and predominantly pastoral with typical residential elements around residential properties. Residential and commercial properties are present towards the centre of the route within Whenuapai Town Centre. To the north of the project, mixed urban housing development within the proximity of the scheme are in Whenuapai 1 precinct and commercial and industrial development are primarily within the Whenuapai 2 precinct. To the south of the corridor lower density SHZ housing within the RNZAF surrounds a small area of commercial development.

The RNZAF base to the north of the corridor is an influential land use on the character within the surrounding landscape (see Figure 9-2 below).

Figure 9-2: View north west across the Totara Road, Brigham Creek Road and Māmari Road intersection, towards Whenuapai Settlement Open Space.

Scheduled Landscape and Ecological Features

Within approximately 10m of the western extent of the corridor are an open space conservation zone, marine SEA (SEA-M2-57b) and terrestrial SEA (SEA_T_2034) within the Totara Creek and its margins. Within 70m of the eastern extent of the Project corridor an open space conservation zone and terrestrial SEA (SEA_T_4733) lies within the Totara Creek and its margins. These features have a high level of sensitivity to physical changes in the landscape.

Historical and Cultural Associations

There are no scheduled historical or cultural features within or proximate to the Project area.

9.2.2.2 Likely Future Environment

Overview

The land surrounding the Project will witness a significant change from rural to urban land use character over the next 10 years. It is anticipated that the abiotic features of the landscape will endure, these include the riparian and wetland environments associated with Totara Creek and Waiarohia Stream watercourses and the existing landform which will undergo some modification associated with ongoing urban development.

It is anticipated that some of the defining biotic (land cover) features of the landscape will undergo significant change alongside future development, with the removal of large areas of vegetation to accommodate the proposed development. This will likely involve the implementation of street tree plantings, public open space areas and general landscaping within the private yards of future housing development for public amenity.

The quality and natural character values of riparian and wetland environments are generally to be retained and, in some instances, enhanced as urban development progresses, in accordance with the policy direction of the AUP:OP and Whenuapai Structure Plan which seek to protect and enhance these landscape features.

9.2.2.3 Whenuapai Structure Plan

The Whenuapai Structure Plan provides general guidance for how the FUZ land adjacent to the Project area should be developed over time. The structure plan is illustrated in Appendix 1.

Land Use

The Whenuapai Structure Plan indicates that Totara Creek and Waiarohia Stream at either end of the proposed route link to indicative linear esplanade open space proposed by the Whenuapai Structure Plan. Towards the centre of the site the structure plan proposes a local centre with the potential for a Multi-purpose Community Facility.

The proposed western and eastern ends of the corridor will be developed into Medium Density residential areas. The south central section of the route is intended to be urbanised for a “Business” land use. The plan envisages this Business use to comprise Industrial, and Retail and Services. Extensive industrial activities such as manufacturing, transport and storage, logistics, construction and wholesale trade are expected. Retail and services are expected to be required to support the increased amount of housing within the Structure Plan.

The existing RZNAF base and RZNAF property and housing within the centre of the corridor will remain unchanged.

9.3 Extent of Visibility and Viewing Audience

The visual catchment is the area of land from which part or all of the Project area is visible. This is largely determined by landform, land cover and built elements, which in combination may obscure or filter views. The extent of visibility of the proposed road corridor is contained by the surrounding vegetation and built form, in addition to some subtle changes in topography. Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects. In summary the viewing audience for the Project includes:

- *Public Views:* Transient public audience (vehicle users). Key roads where views can be obtained from include Totara Road, Māmari Road, Trig Road, Kauri Road and Tamatea Road. Views include:
  - Travelers (cars, pedestrians and cyclists) along Totara Road to the north and Trig Road to the south of the site (Refer Appendix 2 Site Photo 10);
  - People within the Whenuapai Settlement Open Space (see Figure 9-3 below) to the north of the site (Refer Appendix 2 Site Photo 11); and
- *Private Views:* The viewing context also includes a concentrated urban residential viewing audiences and a relatively small number of rural properties with private viewing audiences, comprising views from rural residential and lifestyle dwellings as well as from the commercial and agricultural businesses. Specifically:

- Views from the rural residential properties with short driveways that immediately front on to Brigham Creek Road (18, 20, 26, 26A, 28, 31, 39, 145, 159, 162) (Refer Appendix 2 Site Photo 12);
- Views from the urban residential properties that immediately front on to Brigham Creek Road within the SHZ, RZNAF housing, Whenuapai 1 and Whenuapai 2 housing precincts and;
- Occupants of nearby commercial buildings along Brigham Creek Road adjacent the proposed corridor.

Views are well contained within the immediate area surrounding the road corridor and urban built form due to the relatively flat landscape, intervening vegetation and built form.

Over time, the audience is likely to grow to include residents of future urban developments within the FUZ area.

Figure 9-3: View north west into the Whenuapai Settlement Open Space from Brigham Creek Road.

9.4 Landscape Values

There are no regionally or nationally significant landscapes (ONLs, ONFs or ONCs) within or proximate to the proposed designation boundary. The nearest ONL is Area 1 – Paremoremo Escarpment, located in the Paremoremo Creek approximately 3.8km to the north of the site.

The gently sloping topography and the mature stands of vegetation contribute to the visual amenity of the landscape. The highly modified landscape has limited natural features, which are restricted to individual stands of native vegetation, riparian stream vegetation and the Totara Creek (see Figure 9-4 below) and Waiarohia Stream at either end to the corridor. The existing Whenuapai Settlement Park already sits within the context of an existing arterial road corridor there are no views from any open spaces or sports fields towards the proposed corridor from the wider landscape.

Figure 9-4: View west across the Totara Creek Bridge along Brigham Creek Road.

9.5 Landscape Sensitivity

This project corridor is situated within a broader landscape that has been assessed within the AUP:OP as being suitable for urbanisation. The proposed urbanisation of the surrounding landscape as indicated by the Whenuapai Structure Plan will be developed as medium density residential, local centre, industrial, retail and service buildings across the corridor. Although there are pockets of indigenous vegetation, stream and wetland environments with a moderate level of sensitivity and highly sensitive SEA's in proximity to the western and eastern inlets, on balance the Project area is assessed as having a low sensitivity to landscape change.

9.6 Assessment of Landscape Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

9.6.1 Positive Effects

Generalised positive effects related to the Project are covered in Section 5 of this report. Additional positive effects related specifically to this Project include:

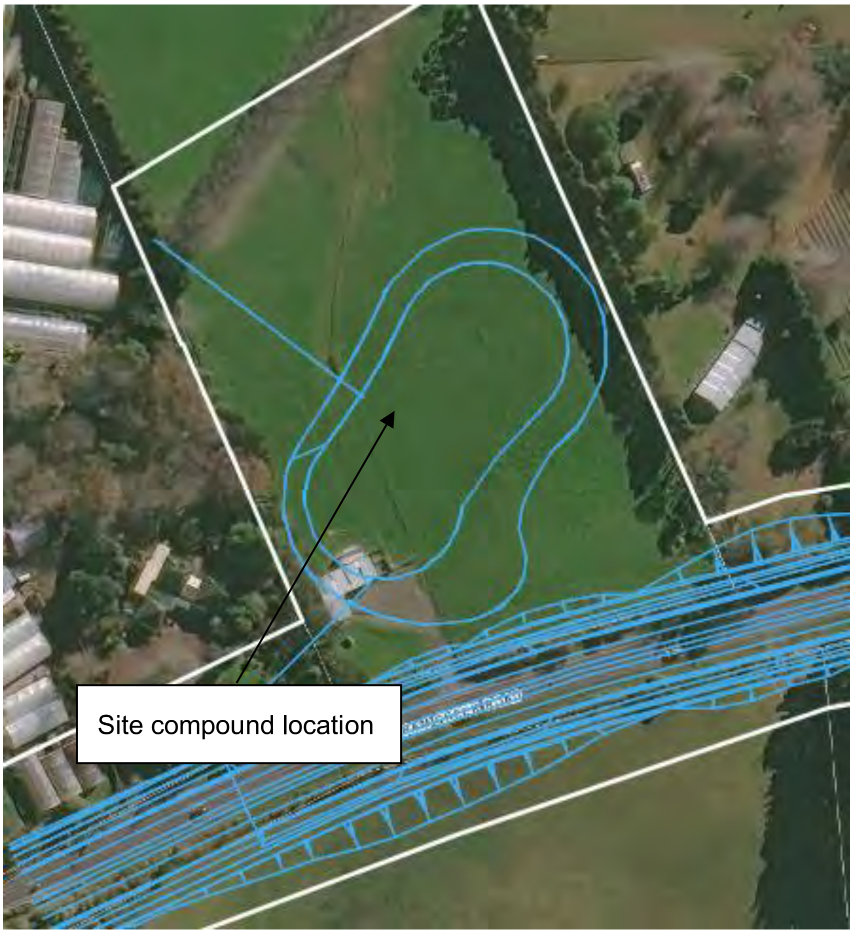
- Improved and/or new opportunities for active modes of transport and the ability to provide improved connectivity to Whenuapai town centre that are projected in the Whenuapai Structure Plan.
- Improvement or enhancement of riparian habitat within the Indicative Esplanades at either end of the project indicated in the Whenuapai Structure Plan;

9.6.2 Assessment of Construction Effects

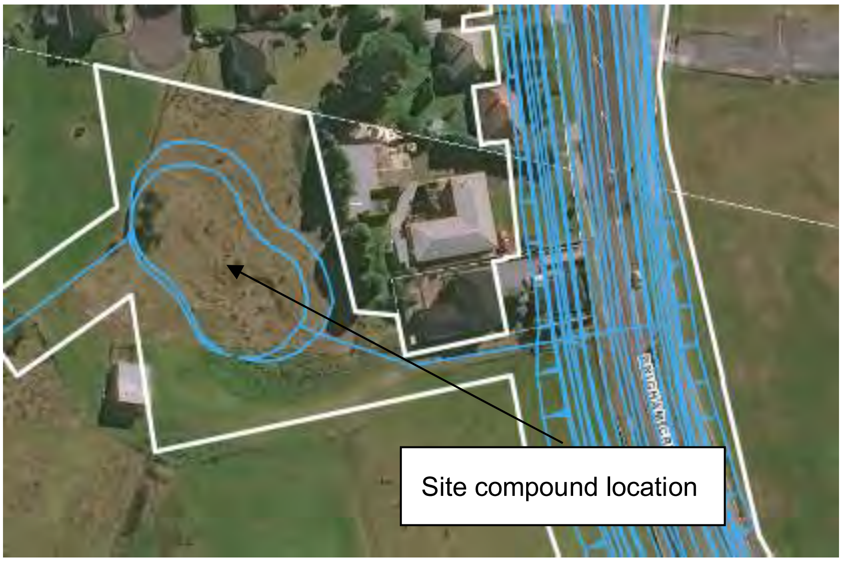
Construction Areas

Site compound and construction areas are to be established at four locations within the Project area. Construction traffic will be heightened at these locations through the construction period of the Project.

- A proposed site compound, stockpile, sediment retention pond and lay-down area for bridge construction is located at 20/22 Brigham Creek Road to the north side of the road corridor. This is located adjacent to the Totara Creek/Inlet and Dry Pond 1 at 20/22 Brigham Creek Road the area.



- A proposed site compound, stockpile, sediment retention pond is located on the south side of the road corridor. The site compound is located adjacent to the residential property at 129 Brigham Creek Road and near the proposed Dry Pond 2.



- The site compound adjacent to the Trig Road interchange is covered in the Trig Road Assessment.

- A proposed site compound, stockpile, sediment retention pond located on the north side of the road corridor. The site compound is located adjacent to the residential development at 1 Sinton Road and Waiarohia Stream, opposite the existing Brigham Creek Road Wetland Pond which will be expanded.

The proposed site compounds and construction areas are all located within pastoral land that is already somewhat modified by existing rural land use or road related works. It is recommended that measures to provide separation between the site compounds and surrounding wetlands / watercourses and that all areas be grassed (reinstated) at the completion of the construction period.

Effects on the landscape without the inclusion of the proposed mitigation measures are anticipated to be **low-moderate** adverse due to the proximity watercourses. With the information available it is anticipated that with the implementation of proposed mitigation, the physical landscape effects resulting from establishment and use of the construction work areas within the Project area is assessed to be **low** adverse.

Vegetation Clearance

Broad areas of road side vegetation are proposed to be removed to accommodate the wider road corridors and batter slopes. This consists entirely of trees and shrubs located within the road-side boundaries of private properties, within the Project area. Exotic pasture, trees, shelterbelt plantings, indigenous riparian vegetation, private gardens and exotic stands of trees patches make up the majority of vegetation to be removed.

Without mitigation, including the protection of existing large mature trees and it is anticipated that effects on the physical landscape will be **low-moderate** adverse. The removal of the large mature trees to the south of the Whenuapai Settlement Open Space are expected to result in **moderate-high** adverse to **moderate** adverse effects. Provided that the removal of indigenous vegetation is minimised where practicable, to reduce the level of adverse physical landscape, vegetation clearance as a result of the Project area expected to be **low** adverse.

Structures and Earthworks

Earthworks are anticipated to be imbalanced and require fill material to be brought into the project. The majority of the proposed additional fill will comprise brown rock for engineering purposes.

The impacts and potential landscape effects of the proposed earthworks include the modification of and permanent changes to the underlying landform particularly in the wetland areas, surface level changes in close proximity to private properties. The proposed cut and fill slopes range in scale from 1m to 13m wide and will alter the form of the existing marginal pastoral landform, stream banks and wetlands.

It is recommended that a condition on the designation is included that promotes the re-use of topsoil from pastoral land impacted by the proposed earthworks[16].

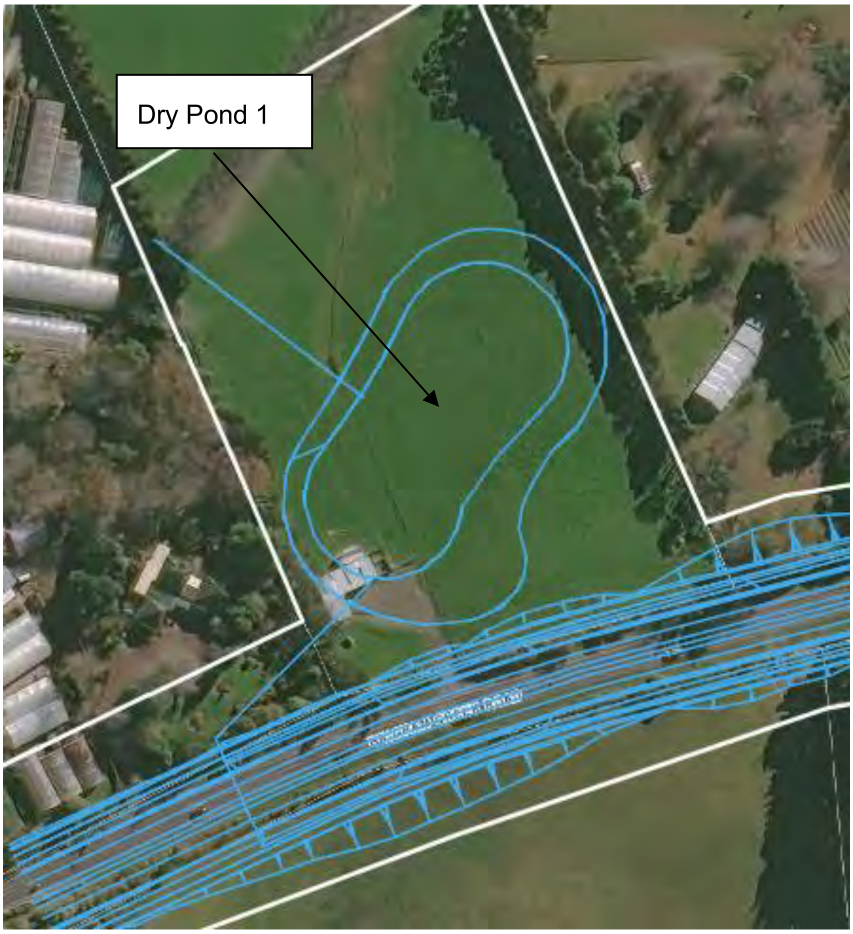
Overall, we consider that the earthworks are of a quantity that is reasonably anticipated with a project of this scope and scale and all cut and fill slopes are expected to be integrated with the existing modified environment. Without the inclusion of proposed mitigation it is anticipated that landscape effects will be **low-moderate** adverse to **low** adverse. Provided that the proposed mitigation measures are undertaken we expect that the adverse effects of the earthworks and bridge structure will be **low**.

Dry Ponds and features

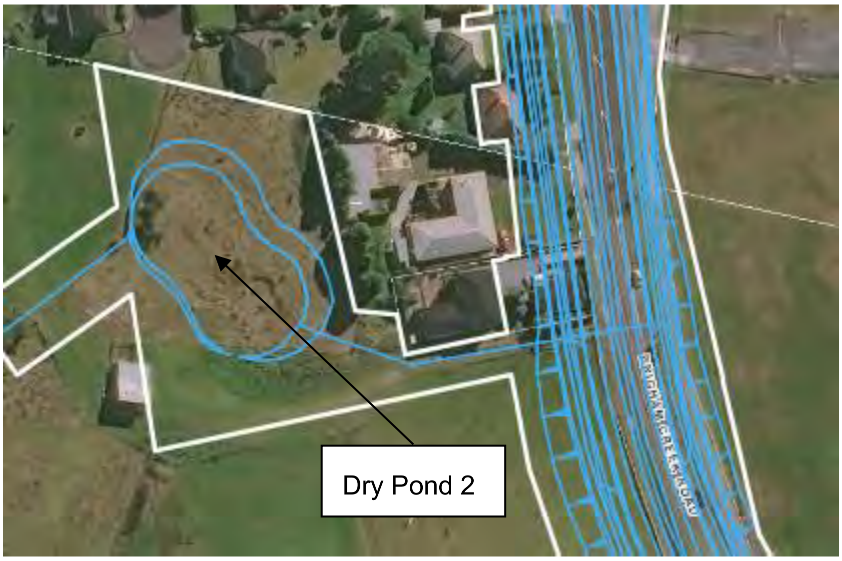
Three dry ponds are proposed within this Project area, one of which is shared with the Spedding Road corridors.

[16] Refer to NZTA Landscape Guidelines (September 2014), Section 4.12 Topsoil for additional information regarding best practice guidelines for topsoil management and soil stripping.

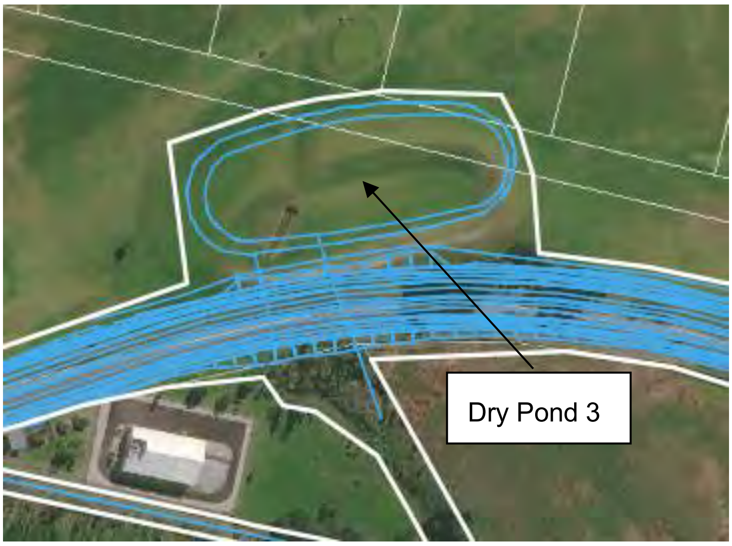
- Dry Pond 1 is proposed to the east of Totara Creek to the north of the corridor at 20/22 Brigham Creek Road.



- Dry Pond 2 is located within the boundary of the RNZAF Whenuapai base to the north of the road;



- Dry Pond 3 located on the south side of the road corridor in a pastoral field between 41 and 45 Brigham Creek Road.



All of these ponds will be located within existing pastoral or amenity grass fields.

The dry ponds will require earthworks to re-shape the land and achieve optimal depths and edge profiles, which will be determined as part of the resource consent phase.

It is anticipated that the proposed mitigation will reduce adverse effects as a result of the implementation of the above works. However, due to the existing modified landscape and relative scale of the water features we consider adverse effects on the physical landscape to implement the proposed dry ponds to be **low** adverse to **very low adverse** with or without mitigation.

Waiarohia Stream and its branches are required to be culverted (subject to resource consent) in four places along Brigham Creek Road between Spark's Southern Cross Network building and Sinton Road. An additional culvert is proposed to be tied into an existing culvert of the Slaughterhouse Stream. Indigenous riparian vegetation within these stream branches is limited to small patches, which reduces their sensitivity to change.

On that basis, we anticipate that without the implementation of mitigation proposals the landscape effects would range from **moderate** adverse to **low-moderate** adverse. Provided that the proposed mitigation measures are implemented, we consider the effects on the physical landscape to implement the proposed culverts to be **low** adverse**.**

Private Properties

Residential properties within and adjacent to the Project area (including those which are partially designated) will be impacted by the Project in the following ways:

- Surface level changes between private property boundaries and the upgraded road corridor, requiring existing driveways and private accessways to be regraded;
- Encroachment into private yard areas and the removal of private garden plantings and trees, ancillary buildings and boundary fences;
- Potential construction of noise mitigation measures and retaining walls;
- Demolition of existing dwellings and ancillary buildings (required properties).

Approximately 70 existing dwellings are proposed to be impacted by the project works, eight of these properties are in a rural setting and 62 are within the existing urban environment. Landscape mitigation measures are proposed under 9.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects below.

Without the implementation of the proposed mitigation measures it is anticipated that landscape effects will range from **moderate-high** adverse to **moderate** adverse. Overall, provided that mitigation proposals are undertaken we consider that landscape effects on private properties will range between **low** adverse and **low-moderate** adverse.

9.6.2.1 Site Finishing Works

Finishing works are expected to include grassing of exposed earth, lighting, signage, line markings, footpath/cycleway details and reinstatement of private property fences and gardens, unless other arrangements are requested by landowners. Streetscape elements and landscaping, including that required as mitigation will also be implemented. These activities are to be determined by detailed design and will occur within the already modified areas of the Project.

It is anticipated that the proposed mitigation will reduce adverse effects as a result of the implementation of the above works. However, due to the existing road environment and scale of the works we consider landscape effects on the physical landscape to implement final phase of the construction process to be **very low** adverse with or without mitigation.

9.6.2.2 Temporary Visual Effects

The construction of the Project is anticipated to be in three stages along the proposed corridor over a period of approximately 3.5 years. Visual effects are anticipated to occur progressively through the Project area and transient viewing audiences may concurrently experience adverse visual effects from several stages through the construction period.

The consideration of visual effects through the construction phase acknowledges the full range of activities (and their resultant visual impact), required to implement the upgraded road corridor.

It is anticipated that construction activities required to implement the Project will be generally consistent in nature and scale to road works and infrastructure activities commonly anticipated by transient viewing audiences within a main arterial corridor. Another important consideration is that landscape change by way of vegetation removal and land modification (on private rural property), albeit at a lesser scale, forms part of the expected backdrop of the existing environment.

Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects through the construction phase due to the magnitude of vegetation removal, proximity to construction compounds and/or earthworks proposed. These areas are outlined below:

- Private properties where physical landscape effects will occur along roadside boundaries.
- Private properties in proximity to the site compounds at 18, 36-38, 41, 45, 129 and 145 Brigham Creek Road and 1 Sinton Street.

We consider that the nature and significance of the potential adverse visual effects to be moderated through the Project area by the following aspects:

- The northern extent of Brigham Creek Road is already a central element within the visual composition of the Project area;
- The existing road corridor landscape has already been partially modified by previous works required to shape the existing road corridor.

- The construction phase is expected to be approximately 3.5 years. The construction period is proposed to be implemented in phases to allow efficient access to the construction zones while maintaining continued access for the intersecting roads and existing private and commercial driveways.

Adverse visual effects during the construction phase are likely to be heightened for private viewing audiences directly adjacent to the Project area on the basis of more direct and prolonged engagement with the construction activities of the Project. This will include the presence of heavy machinery and the visible disturbance of both the road corridor and also individual private interfaces with the road. On that basis, without the implementation of mitigation proposals it is anticipate that visual effects on private audiences will be between **moderate-high** adverse and **moderate** adverse. With the implementation of proposed mitigation measures it is considered that effects on these private viewing audiences will be **low-moderate** adverse.

Taking into account those areas listed above where adverse effects are likely to be heightened during the construction period. Without mitigation visual effects it is considered that visual effects on transient public audiences to be **low-moderate** adverse. With the implementation of mitigation proposals, we consider that adverse visual effects for the transient public viewing audience will be **low** through the construction phase.

Therefore, visual effects are anticipated to range between **moderate-high** adverse and **low-moderate** adverse without mitigation. With the implementation of mitigation visual effects are anticipated to be from **low-moderate** adverse to **low** adverse during the construction phase for audiences.

9.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Recommendations are in line with the general recommendations in Section 6.1.2.

In addition to these measures the following project specific interventions are suggested:

- Wherever possible maintain riparian vegetation within the stream and wetland environment;
- Ensure that measures are taken to prevent contamination and pollution of watercourses and wetlands within proximity to site compounds; and;
- The production of a vegetation plan is recommended to be provided within the UDLMP, to indicate protection measures and locations to be protected during construction.

9.6.4 Assessment of Operational Effects

9.6.4.1 Natural Character Effects

Natural character forming elements, features and processes within the Project area are limited. Indigenous vegetation is scarce throughout the heavily modified pastoral landscape. Indigenous riparian vegetation is more pronounced at the Totara Creek than the branches of the Waiarohia Stream. Therefore, the natural character value in the streams, wetlands, their margins and adjacent landscape context landscape is comparatively low.

Clearance of indigenous riparian vegetation and habitat will be necessary to facilitate the construction compound adjacent to the Totara Creek, this will be limited to the areas around the edge of the compound.

A planting plan and vegetation protection plan is recommended as part of the ULDMP which will be developed as part of the detailed design of the Project. It is recommended that any planting proposed as mitigation through the regional consents process is integrated with the planting plan as recommended through this assessment under the ULDMP. This will ensure that natural character values are preserved as an outcome of the Project.

On the basis, without mitigation natural character effects may be up to **moderate** adverse. Allowing for future landscape mitigation, natural character effects on the streams and riparian areas are anticipated to be **low** adverse**.**

9.6.4.2 Visual Amenity Effects

Overall, there are likely to be a range of visual amenity effects on public and private viewing audiences relative to proximity to the corridor. For existing properties set back from the Project area, the visual amenity effects will be a reduced incremental increase in existing effects from the introduction of an arterial road.

Private properties which have filtered, screened or distant views towards the works will experience a reduced level of change as a result of the works. Whereas a rural private viewing audiences with open short distance views of the Project will experience a more obvious change to the visual composition and residential amenity of the road corridor. Urban private viewing audiences with existing short distance views over the Brigham Creek Road corridor will experience very little difference between baseline views and views during operation.

For some properties directly adjacent to the Project area (from which land is required), visual amenity and residential character effects will be heightened as a result of the construction impacts including driveway regrading, potential loss of yard space and by the introduction of an urban style carriageway and footpaths/cycleways to private rural dwellings. It is recommended that boundary fences and garden plantings (removed through the Project works) are reinstated on completion of the works affecting the property. These mitigation measures should be considered within the ULDMP under the lens of neighbourhood character and as such are discussed further in the following section.

Very few rural public viewing audiences in the existing environment have a direct view of the works due to the lack of connectivity to rural roads and publicly accessible land. Over time as the surrounding FUZ land is developed adverse visual effects are anticipated to reduce for the public viewing audience, based on improved visual amenity for users associated with streetscape works, maturing street trees, berm planting and accessibility to active modes of transport. Public viewing audiences within the urban environment are primarily active mode users along the Brigham Creek Road and within the Whenuapai Settlement open space. In the operational stage views for these audiences will be largely the same as the existing views, with the potential for improved views where tree planting is introduced to the road corridor.

Overall, some visual effects are anticipated to be partially or fully mitigated by measures implemented during the finishing phase of the construction period (within the road corridor and private property boundaries), that will mature through the operational phase of the Project. These will reduce some of the long-term residual visual effects of the Project, however the 30m wide road will be a noticeable new feature within the landscape. The road corridor will be less apparent as the surrounding area is urbanised over time.

On that basis, the proposed project without the implementation of proposed mitigation the anticipated effects on transient audiences within the Project Area are **low** adverse. On the assumption that mitigation proposals are implemented as part of the Project works visual effects within the Project area are likely to be **very low** adverse for transient viewers through the operational phase of the Project.

The anticipated effects on private viewing audiences without mitigation measures are considered to be **moderate** adverse for the majority of audiences. Visual effects anticipated with the inclusion of mitigation measures are considered to range from **low-moderate** adverse to **very low** adverse, depending on proximity and existing screening elements, reducing over an extended period of time. It is anticipated that adequate establishment will be achieved between 3-5 years.

9.6.4.3 Landscape Character Effects

The principal elements of the Project will permanently alter the character of the existing rural sections of Brigham Creek Road and adjacent landscape. The rural sections of the road are characterised by the lack of streetscape features, informal intermittent vegetation, shelterbelt and hedgerows along field boundaries and existing rural land uses adjacent to the corridor. At the completion of the Project, the upgraded corridor will resemble that of an urban arterial road on account of the pedestrianisation, active modes of transport, reduced speed limit, structured street tree planting, integrated stormwater management and engineered roading elements that are inherently an urban aesthetic.

The Project is anticipated to enter the operational phase within the context of increased urbanisation within rural sections as adjacent FUZ land is progressively live-zoned and developed. Although it is not possible to anticipate the exact future urban land use pattern, Whenuapai Structure Plan industrial, retail and service buildings to the south of the route and medium density residential development to the east and west. The Whenuapai Structure Plan also indicates that it would be desirable to develop a new Local Centre and multi-purpose community facility at the centre of Whenuapai.

Based on the above the magnitude and nature of landscape change proposed by the Project we consider will match with the changes that will likely occur throughout the localised landscape over time.

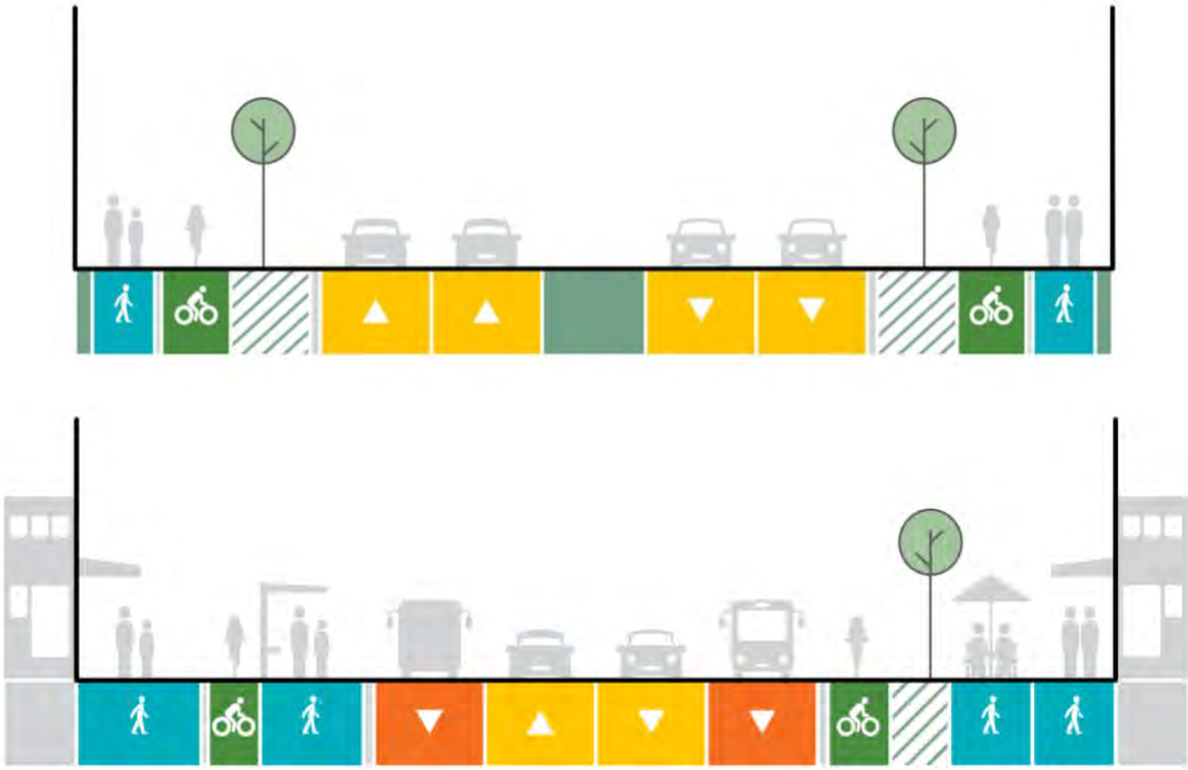


Figure 9-5: Brigham Creek Road Upgrade Typical Cross Section – Urban and Town Centre

The typical cross section above illustrates the proposed upgrade to the road and the expected future use. Although indicative the available space within the road corridor for green infrastructure elements such as street trees and berms where low impact stormwater devices and associated planting can be accommodated These features are expected to improve landscape and urban amenity within the corridor.

As outlined earlier broad areas of vegetation along the existing corridor may not be able to be retained within the new corridor. New street tree planting along the length of the corridor will be an appropriate replacement for the vegetation removed, within the context of the anticipated surrounding urban environment (from a landscape character perspective).

It is assessed that the new street tree plantings, in conjunction with stormwater management and berm plantings, will provide landscape amenity and positively contribute to the landscape character of the Project area within the context of an urban environment.

With the information available, without the implementation of mitigation landscape character effects are anticipated to be **low-moderate** adverse. Allowing for future landscape mitigation, which is expected to take 3-5 years to establish, adverse landscape character effects are anticipated to be **low** adverse.

9.6.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The measures to remedy and mitigate the adverse construction effects of the Project on the natural and urban landscape will be addressed under an Urban and Landscape Design Management Plan (ULDMP), which will lay out the main design themes, principles and outcomes of the Project.

Recommendations are in line with the general recommendations in Section 6.1.3. In addition to this the following recommendation is suggested:

- Produce a vegetation protection plan as part of the UDLMP to ensure that valued indigenous and riparian vegetation are protected.

9.7 Conclusions

Landscape and visual effects as a result of the project, without the implementation of mitigation measures are anticipated to range from **moderate-high** adverse to **low** adverse for the construction phase and **low-moderate** adverse to **low** adverse for the operational phase. Overall, landscape and visual effects with the implementation of mitigation are anticipated to range from **very low** adverse to **low-moderate** adverse for the construction phase and **very low** to **low-moderate** for the operational phase. Overall, the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. Existing urban areas have a lower level of sensitivity to change due to the existing context of the arterial road. There are a number of positive landscape and visual effects that will result from the project, not least the opportunity to create a linkage to the indicative esplanade proposed in the Whenuapai Structure Plan.

10 NoR W4: Spedding Road

10.1 Project Corridor Features

Spedding Road is an existing arterial road that extends from the intersection with the SH16 in the west to the intersection with Hobsonville Road to the east. The proposed upgrade extends from the eastern side of the existing Totara Creek bridge in the west, to Kauri Road near the existing SH18 Brigham Creek Interchange in the east. This proposed upgrade runs through an existing rural environment at each end, with the middle section being a mix of town centre, industrial and residential environments. The proposed corridor upgrade will provide an east-west connection for all modes within Whenuapai and access SH16, SH18 and local destinations such as Hobsonville and Kumeū-Huapai.

The Spedding Road Project comprises two corridors:

- Spedding Road West: the upgrade of the existing Spedding Road and new extension of Spedding Road to a two-lane arterial with separated active modes.
- Spedding Road East: A new extension of Spedding Road to a two-lane arterial with separated active modes.

The key landscape matters addressed for both corridor upgrades include:

- The nature and extent of impacts on the landscape as a physical resource during the construction period of the Project. A specific focus on the location of the construction compound, extent of vegetation clearance, the scale and location of proposed cut and fill slopes and the likely impacts of bridge construction.
- Consideration of landscape character effects and urban amenity issues in relation to the permanent landscape change, including specific assessment of how this corridor will integrate into the future urban environment;
- Potential natural character effects of the corridor construction and consideration of future opportunities to integrate the proposed wetland areas and existing riparian vegetation.
- Consideration of landscape mitigation measures to be included within an Urban and Landscape Design Management Plan (ULDMP) as a condition on the proposed designation to address the potential landscape, natural character and visual effects arising from the operation the Project.
- Potential Landscape Effects on the SEAs around the stream environments.
- Integration of the four proposed dry ponds and the expansion of the existing wetland pond.
- Introduction of a new arterial road into an undeveloped rural green field site.

Key Landscape matters for Spedding Road (West):

- Consideration of the potential natural character effects of bridge re-construction within the Totara Creek environment and the Pikau Stream near the Māmari Road intersection. In doing so, acknowledgement of the likely impacts on existing wetland and riparian vegetation (subject to regional consents) and future mitigation thereof.
- Introduction of a new bridge crossing over the North Western Motorway SH16.

Key Landscape matters for Spedding Road (East):

- Consideration of the potential natural character effects of bridge re-construction within the Trig Stream and Waiarohia Stream environments. In doing so, acknowledgement of the likely impacts on existing wetland and riparian vegetation (subject to regional consents) and future mitigation thereof.
- Introduction of a new bridge crossing over the Upper Harbour Motorway SH18.

10.2 Existing and Likely Future Environment

10.2.1 Planning context

The land on either side of Spedding Road is zoned under the AUP:OP as FUZ, with Business – Light Industry Zone land at the eastern end of the proposed Spedding Road corridor. Proposed Plan Change 5 (PPC5) proposes to rezone the surrounding FUZ land to Business – Light Industry Zone in the north and Residential - Mixed Housing Urban Zone and Open Space – Informal Recreation zone in the south.

Table 10-1 below provides a summary of the North West existing and likely future environment.

Table 10-1: Spedding Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[17]	Likely Future Environment[18]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
Residential	Residential	Low	Residential
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

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

10.2.2 Landscape Environment

Spedding Road is currently a primary rural collector connecting two low volume access roads with no exit roads that service several rural lots as well as Timitanga Community School along Māmari Road. The New Spedding Road West extends the existing Spedding Road west from its intersection with Māmari Road to the Redhills North area over SH16 to connect with Hailes Road and Fred Taylor Drive. The New Spedding Road West will upgrade the existing 14m width corridor to a 24m wide two-lane arterial cross section with separated cycle lanes and footpaths on both sides.

This new east-west connection will support active mode and public transport connectivity between residential land use in Redhills, employment land use in Whenuapai and the proposed CC2W rapid transit station (a non-SGA project). Furthermore, given the high degree of urbanisation expected in

[17] Based on AUP:OP zoning/policy direction
[18] Based on AUP:OP zoning/policy direction

this FUZ area, this connection will reduce severance already created by the State Highway network and will provide a non-interchange SH16 crossing location to support local movements for all modes.

The extension of Spedding Road (East) corridor consists of an upgrade of Spedding Road extending from the intersection with Māmari Road to Trig Road in the east, and a green field portion through an existing rural environment from Trig Road over SH18 to tie into Hobsonville Road in the west.

The proposed extension of Spedding Road (East) will consist of a 24m wide two-lane arterial cross section with separated cycle lanes and footpaths on both sides of the corridor. The intersections of Spedding Road with Trig Road and Māmari Road are proposed to be roundabouts. Similar to the proposed extension of Spedding Road (West), the proposed extension of Spedding Road (East) will provide an east-west connection that supports active mode and public transport connectivity between the areas of Whenuapai and Hobsonville.

The local landscape character of the combined Spedding Road area is summarised below;

- Vegetation cover comprising stand alone elements of indigenous vegetation, hedgerows, shelterbelts, trees and shrubs along field boundaries; native riparian vegetation along rivers and wetland areas, exotic pastoral grassland and non-native stand-alone trees.
- The landscape is characterised by land modification associated with the surrounding rural agricultural productive land use.
- The landscape character value is low within the context of the existing road reserve, due to the pastoral fields in the location of the road extension.

The local landscape character features specific to Spedding Road (West) are summarised below

- Totara Creek adjacent to the proposed SH16 bridge, Sinton Stream and the Pikau Stream adjacent to the Māmari Road interchange.

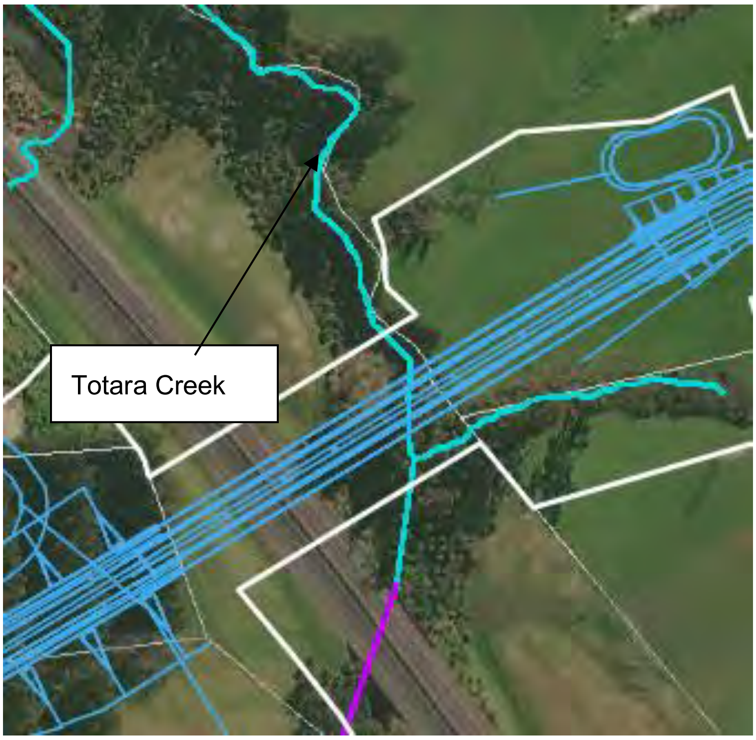
The local landscape character features specific to Spedding Road (East) are summarised below

- Trig Stream and Waiarohia Stream that cross the corridor at the eastern and western ends of the Project

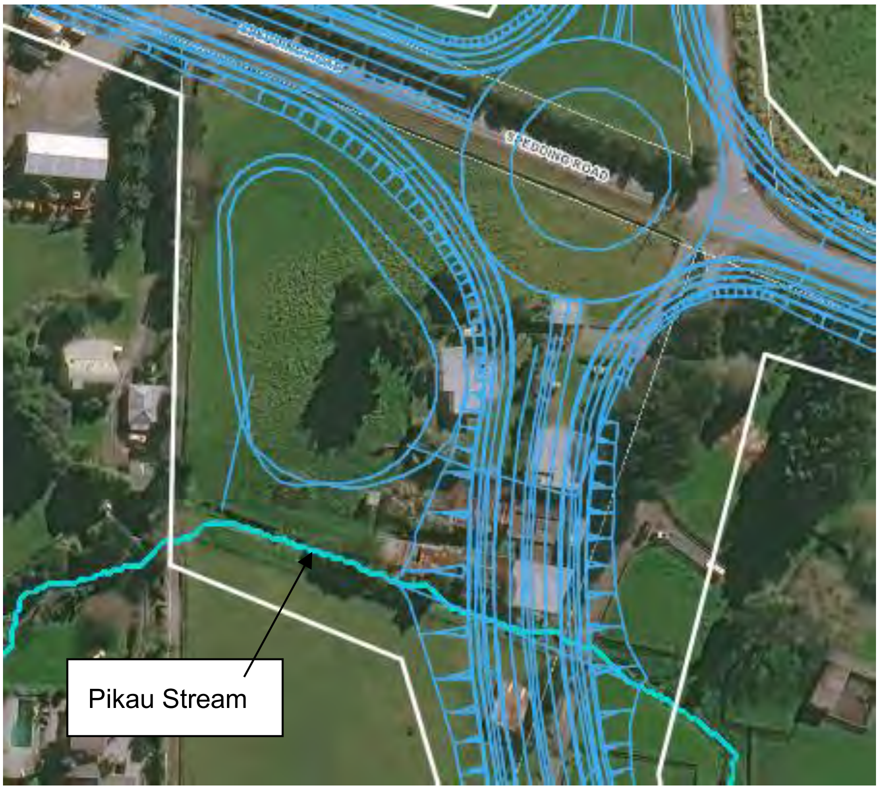
Landform and Hydrology

Spedding Road and the existing rural road traverses a gently sloping topography that reaches a high point towards the centre of the route near the intersection with Māmari Road. The topographically low points of the site are on the approaches and crossing points at SH16 and SH18.

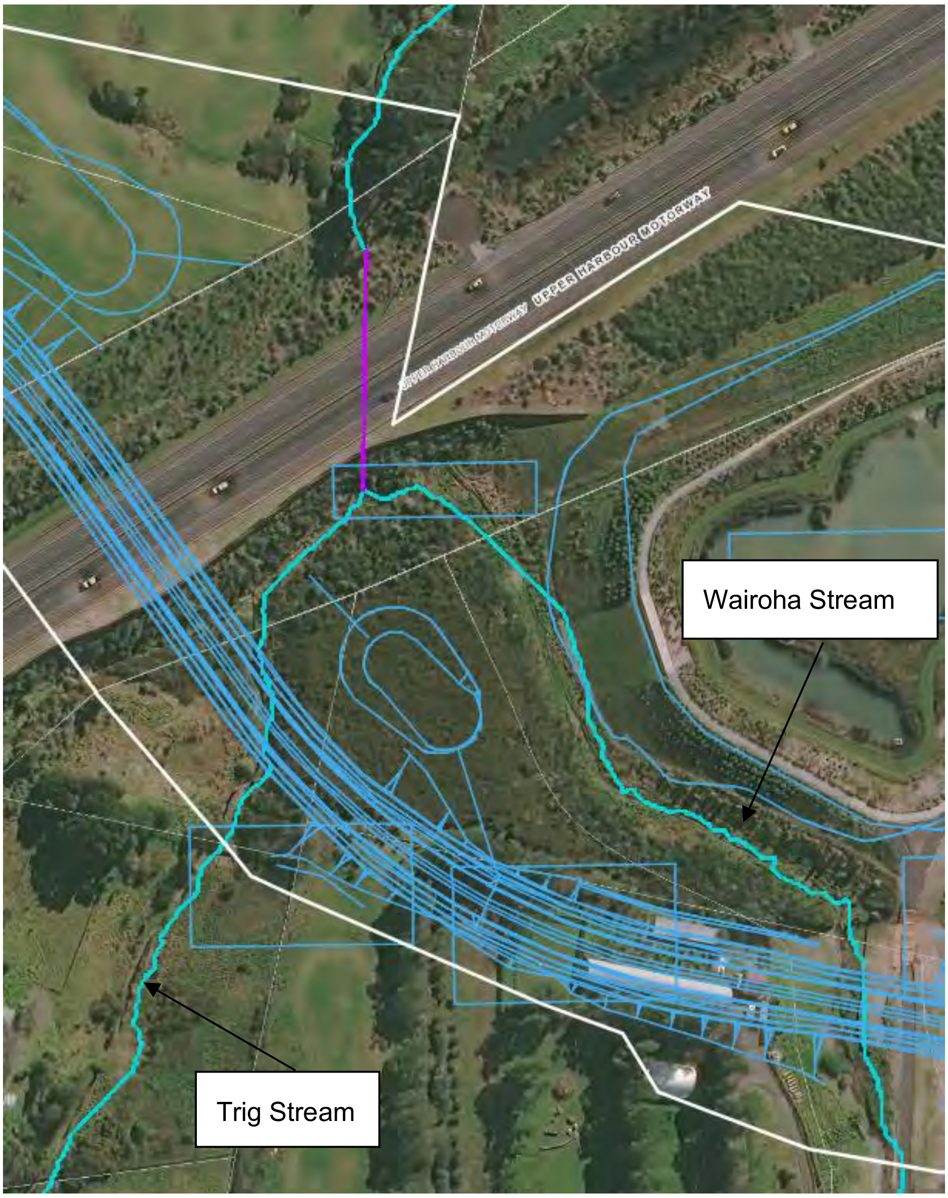
The Spedding Road (West) section has several stream/wetland crossings, Totara Creek, a branch of the Sinton Stream is close to the Wetland 3 and the Pukea Stream in proximity to the Māmari Road intersection (refer images below).


Totara Creek


Sinton Stream



The Spedding Road (East) section has stream/wetland crossings, Trig Stream to the east of the Trig Road intersection, Waiarohia; Trig Stream crosses the road corridor close to the SH18 bridge crossing (refer images below).



Landcover

The landscape across the majority of Spedding Road is characterised by elongated geometric fields bound in parts by isolated elements of native vegetation, exotic grassland, hedgerows and small areas of amenity planting in proximity to properties. Stands of mature native trees located within the road reserve and along the roadside boundaries of private properties contribute to the landscape character of the surrounding rural area. Rural residential properties along the road tend to have a belt of native and non-native planting along the road frontage.

Areas of open pasture are located directly adjacent to the road corridor along the length of the designation on both sides (see Figure 10-1 below). Indigenous wetland ecosystems within the stream corridors and wetland areas are an important habitat for bird and plant species.

There are no scheduled notable trees present within proximity of the Project.

Figure 10-1: View south from Spedding Road across the property located at 13 Spedding Road.

Land Use

The existing Spedding Road corridor is approximately 14m wide and zoned as ‘Road under the AUP:OP from the Totara Creek to Trig Road.

Land use either side of the existing road reserve to from the western extents of the route to the SH18 crossing is rural and is predominantly pastoral with some commercial industry, residential elements features around residential properties - this land is zoned under the AUP:OP as FUZ.

Medium and large rural industrial development at 3 and 5A Spedding Road are characteristic of the rural industries within the wider landscape. The western end of the corridor intersects with Fred Taylor Drive where there is a concentration of rural residential properties and rural commercial, pastoral and industrial development (see Figure 10-2 below). The eastern extent of the road towards the proposed intersection with Hobsonville Road is bordered to the north by large commercial and light industrial development.

To the east of SH18 the corridor is primarily surrounded by Business – Light Industry zoned land with a smaller section of undeveloped FUZ land adjacent to the SH18 corridor. Land to the north of the corridor is a mix of industrial and commercial development, in line with the underlying zoning. The southern light industrial area is currently under construction for industrial and commercial development.

The proposed corridor contains a bridge to cross the northern extent of a 43m wide small parcel of Open Space Conservation zoned land along a 255m stretch of the Rawiri Stream. Over the last few years the Rawiri Stream Restoration and Walkway project has sought to maximise the ecological value of the stream and provide landscape amenity along a new recreational trail. This project has received support from Ngāti Whātua o Kaipara, Te Kawerau A Maki and Auckland Council (Healthy Waters and City Transformations)

Figure 10-2: View south from Spedding Road across the pastoral field located at 90 Trig Road.

Scheduled Landscape and Ecological Features

The proposed road corridor on the approach to SH16 passes 95m to the south of the terrestrial SEA (SEA_T_2034) along the eastern banks of Totara Creek, (the designation boundary is 33m to the south). There are no scheduled landscape features within or proximate to the Project area.

Historical and Cultural Associations

There are no scheduled historical or cultural features within or proximate to the Project area. However, due to the investment in the rehabilitation and improvement of the Rawiri Stream by Ngāti Whātua o Kaipara and Te Kawerau A Maki iwi's, there is a cultural association with this landscape feature.

10.2.2.1 Likely Future Environment

Overview

The land surrounding the Project will witness a substantial change from a rural to urban land use character over the next 10 years. It is anticipated that the abiotic features of the landscape will largely endure, these include the riparian and wetland environments associated with Totara Creek and Waiarohia, Trig and Rawiri streams and the existing landform which will undergo some modification.

It is anticipated that some of the defining biotic (land cover) features of the landscape will also undergo substantial change alongside future development, with the removal of large areas of vegetation to accommodate the proposed widened corridor. This will likely involve the implementation of street tree plantings, public open space areas and general landscaping around commercial and industrial development and within private yards of future housing development to the west of SH16.

The quality and natural character values of riparian and wetland environments are generally anticipated to be retained and, in some instances, enhanced as urban development progresses, in accordance with the policy direction of the AUP:OP and Whenuapai Structure Plan which generally seeks to protect and enhance these landscape features.

The future development of the surrounding area is expected to be an extension of the Hobsonsville and Whenuapai urban areas. To the east of SH16 the Hobsonville BLI zone will intersect with the Whenuapai Structure Plan (2016) area, which indicates that medium density housing will be introduced. To the west of SH16 the route will be set within the Whenuapai Stage 3 development. This section of the route is designated to be developed for business uses in the Whenuapai Structure Plan (2016).

10.2.2.2 Whenuapai Structure Plan

The Whenuapai Structure Plan provides general guidance for how the FUZ land adjacent to the Project area should be developed over time. The structure plan is illustrated in Appendix 1.

Land Use

The Whenuapai Structure Plan indicates that the Totara Creek, Waiarohia Stream, Trig Stream and Rawiri Stream at either end of the proposed route link to an indicative linear esplanade open space proposed by the Whenuapai Structure Plan.

The proposed western and eastern ends of the corridor are outside of the Whenuapai Structure Plan area. The central section of the Project, between SH16 and SH18 is intended to be urbanised for a “Business” land use. The plan envisages this Business use to comprise Industrial, and Retail and Services. Extensive industrial activities such as manufacturing, transport and storage, logistics, construction and wholesale trade are expected. Retail and services are expected to be required to support the increased amount of housing within the Structure Plan.

10.3 Extent of Visibility and Viewing Audience

The visual catchment is the area of land from which part or all of the Project area is visible. This is largely determined by landform, land cover and built elements, which in combination may obscure or filter views. The extent of visibility of the proposed road corridor is contained by the surrounding vegetation, in addition to some subtle changes in topography. Notwithstanding the above, audiences from some vantage points within the Project area are likely to witness heightened adverse visual effects. In summary the viewing audience for the Project includes:

- *Public Views:* Transient public audience (vehicle users). Key roads where views can be obtained from include Spedding Road, Māmari Road, Trig Road, Hobsonville Road, State Highway 16 and State Highway 18. Views include:
  - Travelers (cars, pedestrians and cyclists) along Māmari Road, Trig Road, SH16, SH18, to the north of the site (Refer Appendix Site Photo 13);
- *Private Views:* The viewing context includes a concentrated urban residential viewing audience and a relatively small number of rural properties with private viewing audiences, comprising views from rural residential and lifestyle dwellings as well as from the commercial and agricultural businesses. Specifically:
  - Views from the rural residential properties with short driveways that immediately front on to Fred Taylor Drive (121, 123 and 125A); Spedding Road (2, 5A, 6, 9, 10, 13, 14, 15, 16,); and; Trig Road (90 and 92) (Refer Appendix Site Photo 14);
  - Views from the urban residential properties that immediately front on to Hobsonville Road (231, 233, 235, 237, 239, 241 and 243); and;
  - Occupants of nearby commercial buildings along Westpoint Drive, Workspace Drive and Rawiri Place adjacent the proposed corridor (Refer Appendix Site Photo 15 and 16).

Views are well contained within the immediate area surrounding the road corridor due to the relatively flat landscape and intervening vegetation and built form.

Over time, the audience is likely to grow to include residents of future urban developments within the FUZ area.

10.4 Landscape Values

There are no regionally or nationally significant landscapes (ONLs, ONFs or ONCs) within or proximate to the proposed designation boundary.

The gently sloping topography and the mature stands of vegetation contribute to the visual amenity of the landscape. The highly modified landscape has limited natural features, which are restricted to individual stands of native vegetation, riparian stream vegetation and the Totara Creek and Waiarohia, Trig and Rawiri streams at either end to the corridor. An Open Space Conservation zone along the Rawiri Stream has been partially restored but is currently inaccessible to the public.

10.5 Landscape Sensitivity

This project corridor is situated within a broader landscape that has been assessed within the AUP:OP as being suitable for urbanisation. The proposed urbanisation of the surrounding landscape as indicated by the Whenuapai Structure Plan will be developed primarily for industrial, retail and service buildings. The Project area is assessed as having a low sensitivity to landscape change, although there are pockets of indigenous vegetation, stream and wetland environments with a moderate level of sensitivity and highly sensitive SEA's in proximity to Totara Creek to the west.

10.6 Assessment of Landscape Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

10.6.1 Positive Effects

Generalised positive effects related to the Project are covered in Section 5 of this report. Additional positive effects related specifically to this Project include:

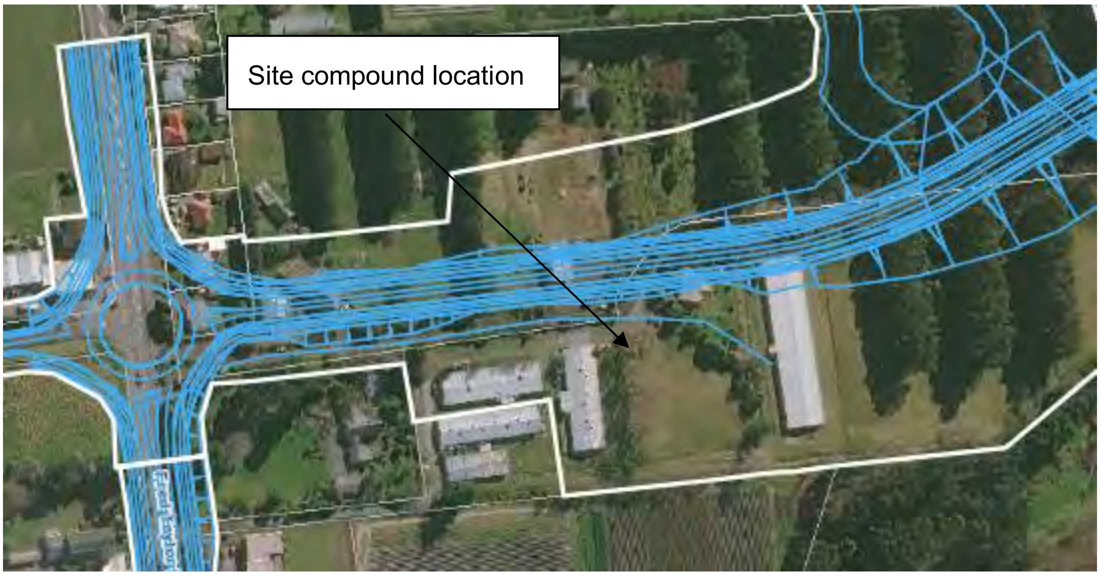
- Improved and/or new opportunities for active modes of transport and the ability to provide improved connectivity between Whenuapai and Hobsonville.
- Improvement or enhancement of riparian habitat within the Indicative Esplanades along Totara Creek and Waiarohia, Trig and Rawiri streams at either end of the project indicated in the Whenuapai Structure Plan;
- The improvement of the existing road which in parts are unsealed.

10.6.2 Assessment of Construction Effects

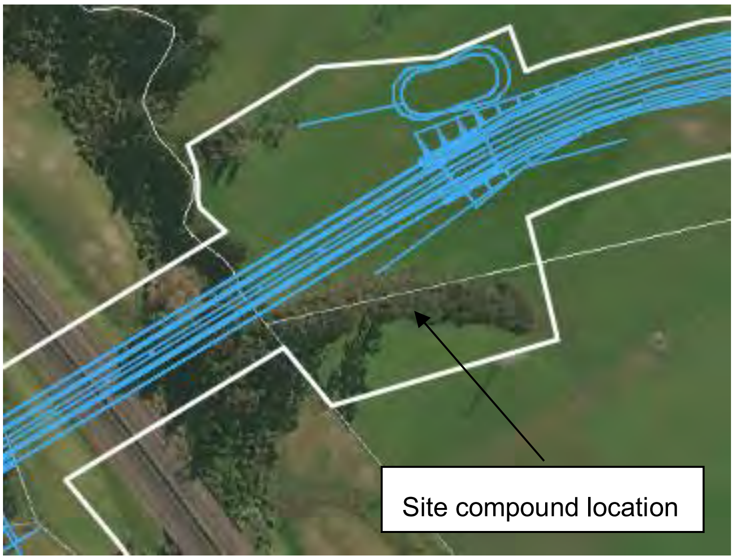
Construction Areas

Site compound and construction areas are to be established at four locations within the Project area with. Construction traffic will be heightened at these locations through the construction period of the Project.

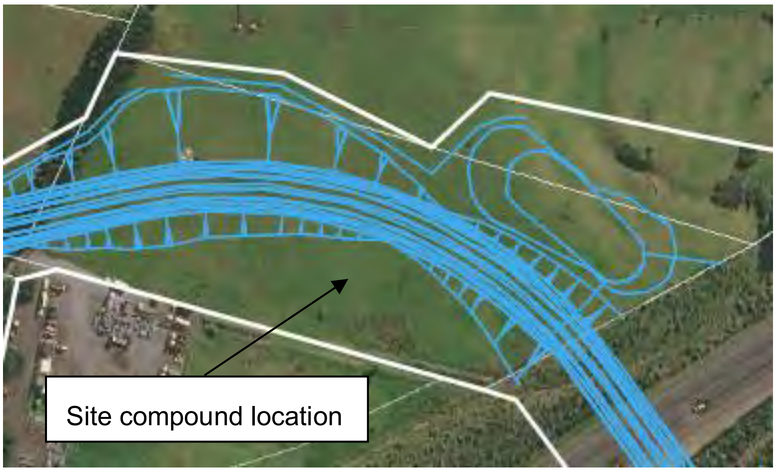
- A proposed site compound, stockpile, sediment retention pond and lay-down area for bridge construction is located to the south side of Spedding Road West section of the corridor adjacent to the Pine Poultry Farm at 119 Fred Taylor Drive. This is set back approximately 176m from Fred Taylor Drive and residential properties that front on to that road.



- A proposed site compound, stockpile, sediment retention pond and lay-down area for bridge construction is located to the south side of the Spedding Road West corridor. This compound is located to the south west of a rural farm property at 16 Spedding Road.



- The site compound adjacent to the Māmari Road interchange is covered in the Māmari Road assessment.
- A proposed site compound, stockpile, sediment retention pond and lay-down area for bridge construction is located to the south side of the Spedding Road East section of the road corridor adjacent to the property at 100 Hobsonville Road. This is set back approximately 435m from Trig Road and residential properties that front on to the road.



- A proposed site compound, stockpile, sediment retention pond and lay-down area for bridge construction is located to the south side of the Spedding Road East outside of the designation to the north west of the highway.

The proposed site compounds and construction areas located within pastoral land or rural production land that is already somewhat modified by existing rural land use or road related works. It is recommended that measures to provide separation between the site compounds and surrounding wetlands / watercourses and that all areas be grassed (reinstated) at the completion of the construction period.

Overall, without the implementation of mitigation measures it is anticipated that the physical landscape effects would be **low-moderate** adverse. The anticipated physical landscape effects resulting from establishment and use of the construction work areas within the Project area, with the application of mitigation measures, are assessed to be **low** adverse.

Vegetation Clearance

Broad areas of roadside vegetation are proposed to be removed to accommodate the wider road corridors and batter slopes. This consists of trees and shrubs located within the road-side boundaries of private properties, within the Project area. Exotic pasture, trees, shelterbelt plantings, indigenous riparian vegetation, private gardens and exotic stands of trees make up the majority of vegetation to be removed.

Riparian vegetation within Totara Creek, Trig Stream, Rawiri Stream and Waiarohia Stream will be bridged as part of the proposed scheme. It is proposed that the removal of indigenous riparian vegetation in these locations will be avoided where possible. Bridge piers should be placed to avoid the disturbance of the watercourses, which may result in the removal of some vegetation.

Without the inclusion of proposed mitigation measures it is anticipated that effects will be primarily **low-moderate** adverse. However, there is the potential for **moderate-high** adverse effects if large areas of indigenous vegetation is removed from within the SEA close to Totara Creek.

Landscape effects likely to arise from vegetation clearance within the Project area are assessed as **low** adverse, provided that mitigation is undertaken for the removal of as little indigenous vegetation as possible.

Structures and Earthworks

Spedding Road West

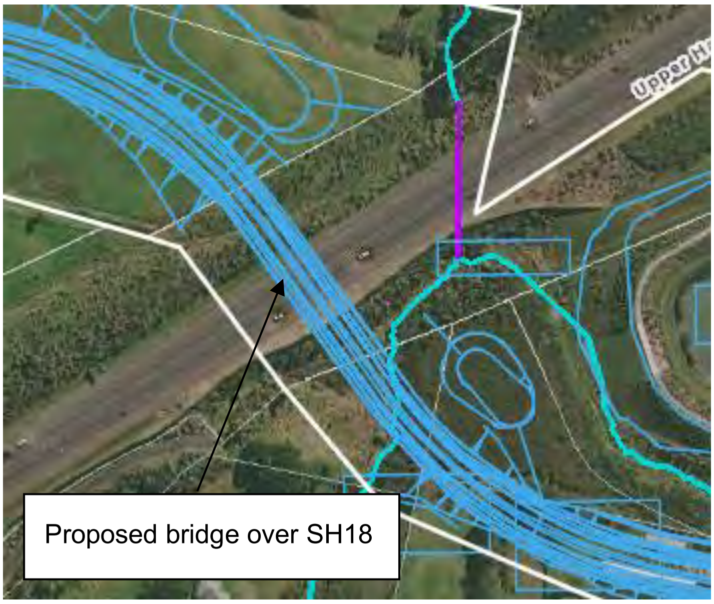
It is estimated that the earthworks of fill earthworks are anticipated to be undertaken over the site at a minimum. The majority of the proposed additional fill will comprise brown rock for engineering purposes.

The impacts and potential landscape effects of the proposed earthworks include the modification of and permanent changes to the underlying landform particularly at the SH16 bridge approaches, watercourse crossings, surface level changes in close proximity to private properties. The proposed cut and fill slopes range in scale from 1m to 28m wide and will alter the form of the existing marginal pastoral land form, stream banks and wetlands.

Spedding Road East

Approximately 72,000m^3 cut and 108,200m^3 of fill earthworks are anticipated to be undertaken over the site at a minimum. The majority of the proposed additional fill will comprise brown rock for engineering purposes.

The impacts and potential landscape effects of the proposed earthworks include the modification of and permanent changes to the underlying landform particularly at the SH18 bridge approaches, watercourse crossings, surface level changes in close proximity to private properties. The proposed cut and fill slopes range in scale from 1m to 35m wide and will alter the form of the existing marginal pastoral land form, stream banks and wetlands.



It is recommended that a condition on the designation is included that promotes the re-use of topsoil from pastoral land impacted by the proposed earthworks for both western and eastern sections of the road corridor.[19]

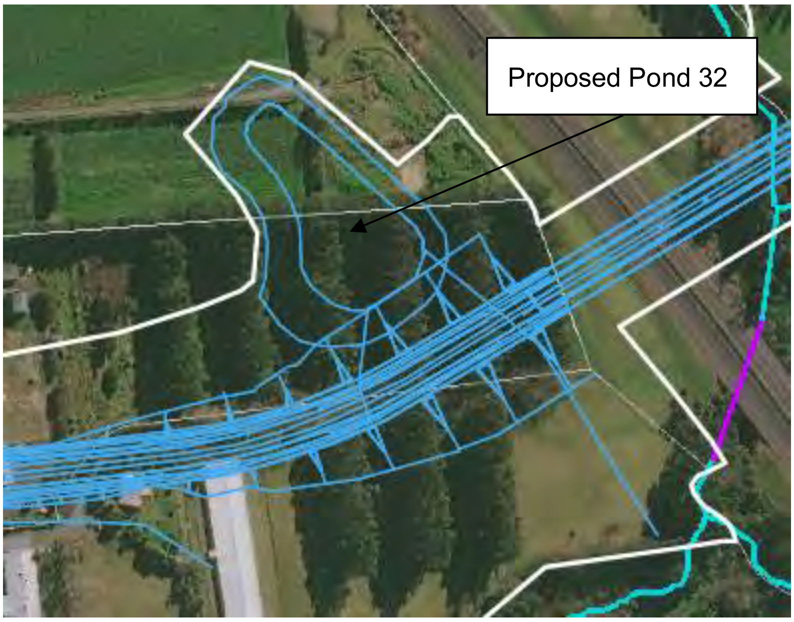
Overall, we consider the earthworks for both sections are to be of a quantity that is reasonably anticipated with a project of this scope and scale and all cut and fill slopes are expected to be integrated with the existing modified environment. Effects experienced without the implementation of proposed mitigation measures are anticipated to be **low-moderate** adverse for the majority of the route, works in proximity to watercourses have the potential to result in **moderate** adverse effects. Provided that the proposed mitigation measures are undertaken we expect that the adverse effects of the earthworks and bridge structure will be **low** adverse.

Dry Ponds and features

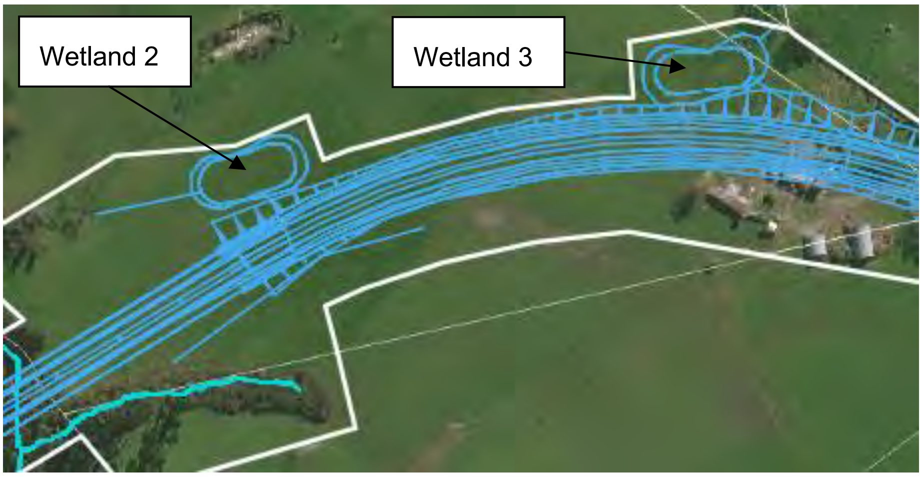
Four dry ponds are proposed within this Project area, one of which is shared with the Spedding Road corridors.

- Pond #32 is proposed to the north of the SH16 and Totara Creek bridge approach of the corridor in 123 Fred Taylor Drive at Spedding Road West ;

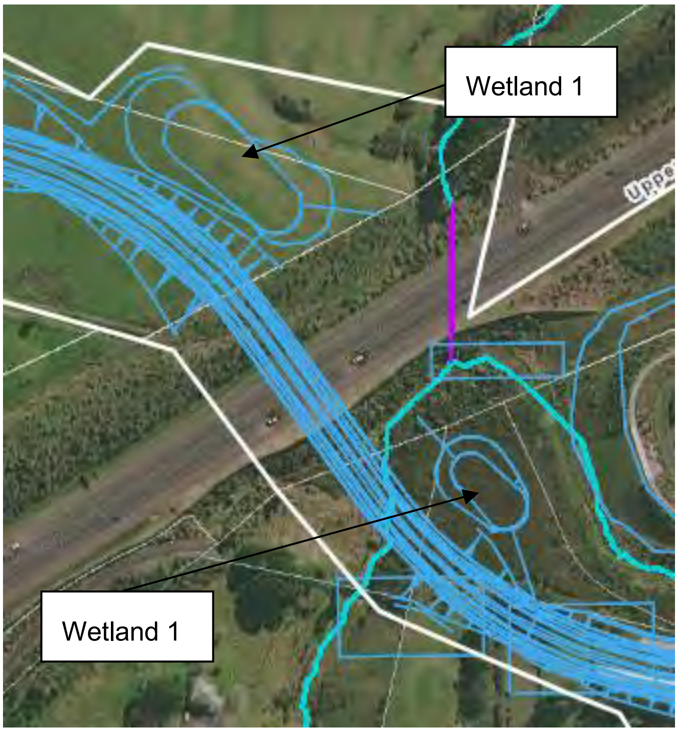
[19] Refer to NZTA Landscape Guidelines (September 2014), Section 4.12 Topsoil for additional information regarding best practice guidelines for topsoil management and soil stripping.



- Wetland 2 and Wetland 3 are proposed to the north of the SH16 and Totara Creek bridge approach of the corridor in 15-19 Spedding Road;



- The pond at the Māmari Road intersection is covered in the Māmari Road assessment;
- Wetland 1 is proposed to the north of the SH18 and Waiarohia Stream bridge approach of the corridor at Spedding Road East;
- Wetland 1 is proposed to the south of the SH18 and Waiarohia Stream bridge approach of the corridor at Spedding Road East;

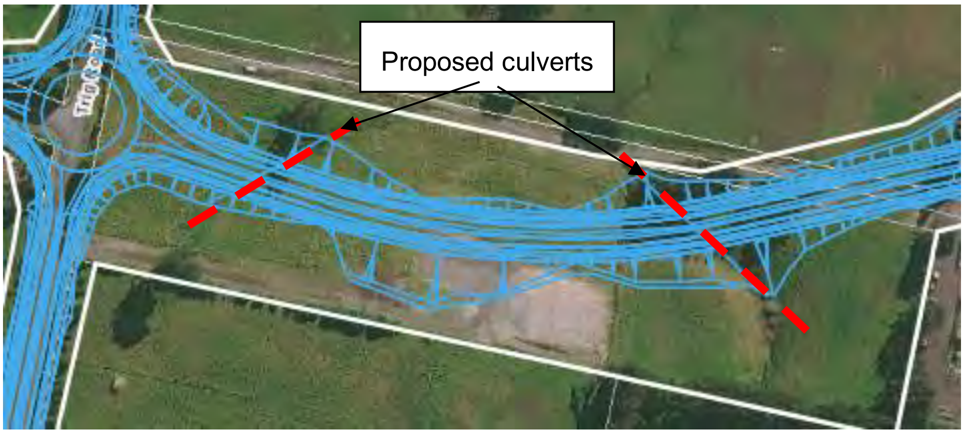


All of these ponds will be located within existing pastoral fields or modified greenfield locations.

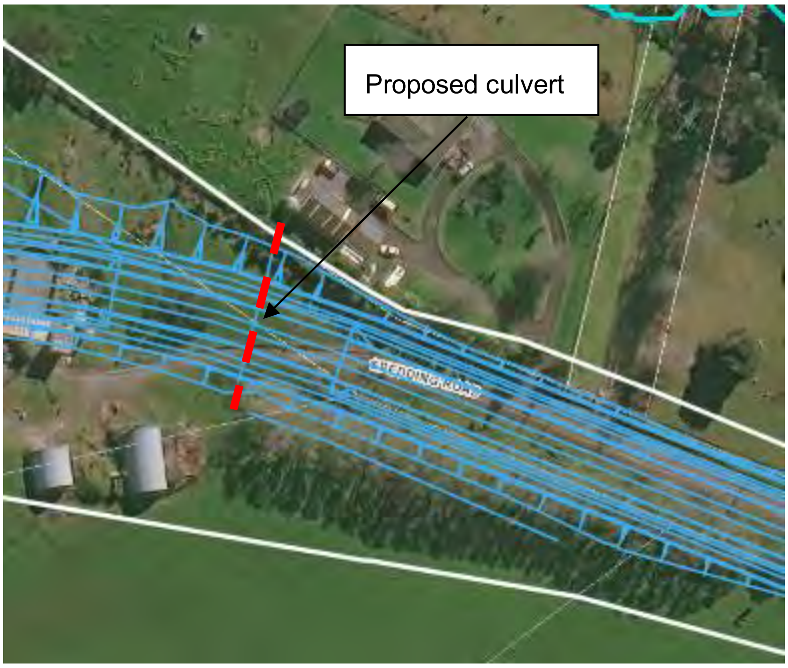
The wetlands will require earthworks to re-shape the land and achieve optimal depths and edge profiles, which will be determined as part of the resource consent phase. Wetland 1 to the south of SH1 is in proximity of the Trig and Rawiri streams which have a heightened sensitivity to change but will not be physically impacted by the works.

Without the implementation of the proposed mitigation measures it is anticipated that physical landscape effects will range from **moderate** adverse to **low-moderate** adverse. Effects on the physical landscape to implement the proposed dry ponds, with the implementation of mitigation measures we consider to be **low** adverse**.**

A Waiarohia Stream branch is required to be culverted (subject to resource consent) in two places within the Spedding Road East section of the corridor.



A culvert is proposed at a branch of the Sinton Stream within the Spedding Road West. Indigenous riparian vegetation within these stream branches is limited to small patches, which reduces their sensitivity to change.



It is anticipated that without the implementation of mitigation measures effects on the physical landscape would be **low** adverse. With mitigation measures implemented as part of the project, effects on the physical landscape to implement the proposed culverts we consider to be **very low** adverse**.**

Private Properties

Residential properties within and adjacent to the Project area (including those which are partially designated) will be impacted by the Project in the following ways:

- Surface level changes between private property boundaries and the upgraded road corridor, requiring existing driveways and private accessways to be regraded;
- Encroachment into private yard areas and the removal of private garden plantings and trees, ancillary buildings and boundary fences;
- Potential construction of noise mitigation measures and retaining walls;
- Demolition of existing dwellings and ancillary buildings (required properties)

Approximately 20 existing retained dwellings are proposed to be impacted by the project works, all of these are within a rural context. Landscape mitigation measures are proposed under 10.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects below.

It is anticipated that without the implementation of mitigation measures, physical landscape effects on private properties to be **moderate** adverse to **low-moderate** adverse. Overall, it is assessed that the magnitude of physical landscape effects on private properties with the implementation of mitigation measures are anticipated to range between **low** adverse and **low-moderate** adverse.

10.6.2.1 Site Finishing Works

Finishing works are expected to include grassing of exposed earth, lighting, signage, line markings, footpath/cycleway details, reinstatement planting and reinstatement of private property fences and gardens. Streetscape elements and landscaping, including that required as mitigation will also be implemented. These activities are to be determined by detailed design and will occur within the already modified areas of the Project. Without the implementation of mitigation measures effects are anticipated to be **low** adverse. Physical landscape effects are expected to be **very low** through this final phase of the construction process.

10.6.2.2 Temporary Visual Effects

The construction of the Project is anticipated to be in three stages along the proposed corridor over a period of approximately 2-3 years. The construction of the SH16 and SH18 over-bridges are expected to take up a large portion of the construction time. There are only a few audiences in proximity to the bridge works that are expected to be affected.

Visual effects are anticipated to occur progressively through the Project area and transient viewing audiences may concurrently experience adverse visual effects from several stages through the construction period.

The consideration of visual effects through the construction phase acknowledges the full range of activities (and their resultant visual impact), required to implement the upgraded road corridor.

It is anticipated that construction activities required to implement the Project will be generally consistent in nature and scale to road works and infrastructure activities commonly anticipated by transient viewing audiences within a main arterial corridor. Another important consideration is that landscape change by way of vegetation removal and land modification (on private rural property), albeit at a lesser scale, forms part of the expected backdrop of the existing environment.

Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects through the construction phase due to the magnitude of vegetation removal, proximity to construction compounds and/or earthworks proposed. These areas are outlined below:

- Private properties where physical landscape effects will occur along roadside boundaries.
- Private properties in proximity to the site compounds at; 121, 123 and 125A Fred Taylor Drive; 2, 5A, 6, 9, 10, 13, 14, 15, 16, Spedding Road; 90, 92 Trig Road; and; 231, 233, 235, 237, 239, 241 and 243 Hobsonville Road.

The nature and significance of the potential adverse visual effects we consider to be moderated through the Project area by the following:

- The existing road corridor landscape has already been partially modified by previous works required to shape the existing road corridor.
- The construction phase is expected to have a substantial amount of main works being concentrated at the over-bridge construction away from residential audiences.
- The construction period is proposed to be implemented in three stages which is expected to allow efficient access to the construction zones while maintaining continued access for the intersecting roads and existing private and commercial driveways.
- The eastern extent of the works will be overlooked by residential viewing audiences within the context of the busy arterial Hobsonville Road and business and industrial development in the foreground.

Without the implementation of proposed mitigation it is anticipated that visual effects on transient public audience will be **low-moderate** adverse. Overall, adverse visual effects for the transient public viewing audience are likely to be **low** adverse through the construction phase.

Adverse visual effects during the construction phase are likely to be heightened for private viewing audiences directly adjacent to the Project area on the basis of more direct and prolonged engagement with the construction activities of the Project. This will include the presence of heavy machinery and the visible disturbance of both the road corridor and also individual private interfaces with the road.

Without the implementation of mitigation measures, private viewing audiences are anticipated to experience moderate adverse effects. Visual effects are likely to range between **low-moderate** adverse to **low** adverse during the construction phase for private viewing audiences, where mitigation measures have been implemented.

10.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Recommendations are in line with the general recommendations in Section 6.1.2.

In addition to these measures the following project specific interventions are suggested:

- Wherever possible maintain riparian vegetation within the stream and wetland environment;
- Proposed bridge structures should avoid where practicable placing piers within watercourses;
- Ensure that measures are taken to prevent contamination and pollution of watercourses and wetlands within proximity to site compounds; and;
- The production of a vegetation plan is suggested to be provided within the UDLMP, to indicate protection measures and locations to be protected during construction.

10.6.4 Assessment of Operational Effects

10.6.4.1 Visual Amenity Effects

Natural character forming elements, features and processes within the Project area are limited. Indigenous vegetation is limited throughout the heavily modified pastoral landscape. Indigenous riparian vegetation is more pronounced in Totara Creek, Trig Stream, Rawiri Stream and Waiarohia Stream. The proposal will not have an impact on the terrestrial SEA adjacent to the Totara Creek. Overall, the natural character value in the landscape is comparatively low across the entirety of the corridor.

Clearance of indigenous vegetation within the road corridor is expected as part of the required works, however these clearance areas will be limited and will not comprise any large areas of protected habitat. This does have the potential to alter the character of these areas by heightening the impression of human modification. Clearance of indigenous riparian vegetation and habitat will be necessary to facilitate the construction of the SH16, SH18 and Rawiri Stream over-bridges, this will be limited to the areas required for construction.

A planting plan and vegetation protection plan is recommended as part of the ULDMP which will be developed as part of the detailed design of the Project. It is recommended that any planting proposed as mitigation through the regional consents process is integrated with the planting plan as recommended through this assessment under the ULDMP. This will ensure that natural character values are preserved as an outcome of the Project.

Without mitigation natural character effects may vary from **low-moderate** adverse to **moderate** adverse. On the basis of the above (allowing for future landscape mitigation), natural character effects are likely to be **low** adverse**.**

10.6.4.2 Visual Amenity Effects

Overall, there are likely to be a range of visual amenity effects on public and private viewing audiences relative to proximity to the corridor. For existing properties set back from the Project area, the visual amenity effects will be a reduced incremental increase in existing effects from the introduction of an arterial road.

Private properties which have filtered, screened or distant views towards the works are expected to experience a reduced level of change as a result of the works. Whereas residential viewing audiences closer to the proposed corridor people will experience a more direct level of material change to the visual composition and residential amenity of the road corridor as perceived from private property.

For some properties directly adjacent to the Project area (from which land is required), visual amenity and residential character effects will be heightened as a result of the construction impacts including driveway regrading, potential loss of yard space and by the introduction of an urban style carriageway and footpaths/cycleways to private dwellings. It is recommended that boundary fences and garden plantings (removed through the Project works) are reinstated on completion of the works affecting the property, unless other arrangements are requested by land owners. These mitigation measures should be considered within the ULDMP under the lens of neighbourhood character and as such are discussed further in the following section.

Very few public viewing audiences have a direct view of the works due to the lack of connectivity and low number Māmari Road users. Over time as the surrounding FUZ land is developed visual effects are anticipated to be reduced for the public viewing audience, based on improved visual amenity for users associated with streetscape improvements, maturing street trees, berm planting and accessibility to active modes of transport.

Some visual effects are anticipated to be partially or fully mitigated by measures implemented during the finishing phase of the construction period (within the road corridor and private property boundaries), that will mature through the operational phase of the Project. These will reduce some of the long-term residual visual effects of the Project, however the 30m wide road will be a noticeable new feature within the landscape. The road corridor will be less apparent as the surrounding area is urbanised over time.

Without the implementation of mitigation, it is expected that these effects would range from **moderate** adverse to **low** adverse. On that basis, visual effects within the Project area are likely to be **very low** for transient viewers through the operational phase of the Project. For the private viewing audience, the visual effects are likely to be **low-moderate** to **very low**, reducing over approximately 3-5 years as proposed planting establishes.

10.6.4.3 Landscape Character Effects

The principal elements of the Project will permanently alter the character of the existing rural Spedding Road, the green field site of the extended corridor and the adjacent landscape. The existing road is currently distinctively rural in character as a primarily unsealed and incomplete road way, characterised by the lack of streetscape features, informal intermittent vegetation, shelterbelt and hedgerows along field boundaries and existing rural land uses adjacent to the corridor. At the completion of the Project, the upgraded corridor will resemble that of an urban arterial road on account of the pedestrianisation, active modes of transport, reduced speed limit, structured street tree planting, integrated stormwater management and engineered roading elements that are inherently an urban aesthetic.

The Project is anticipated to enter the operational phase within the context of increased urbanisation as adjacent FUZ land is progressively live-zoned and urbanised. Although it is not possible to anticipate the exact future urban land use pattern, Whenuapai Structure Plan suggests that industrial, retail and service buildings will be surrounding Spedding Road and the AUP zoning to the east.

Based on the above the magnitude and nature of landscape change proposed by the Project, we consider that the proposed changes will match with those which will likely occur throughout the localised landscape over time.

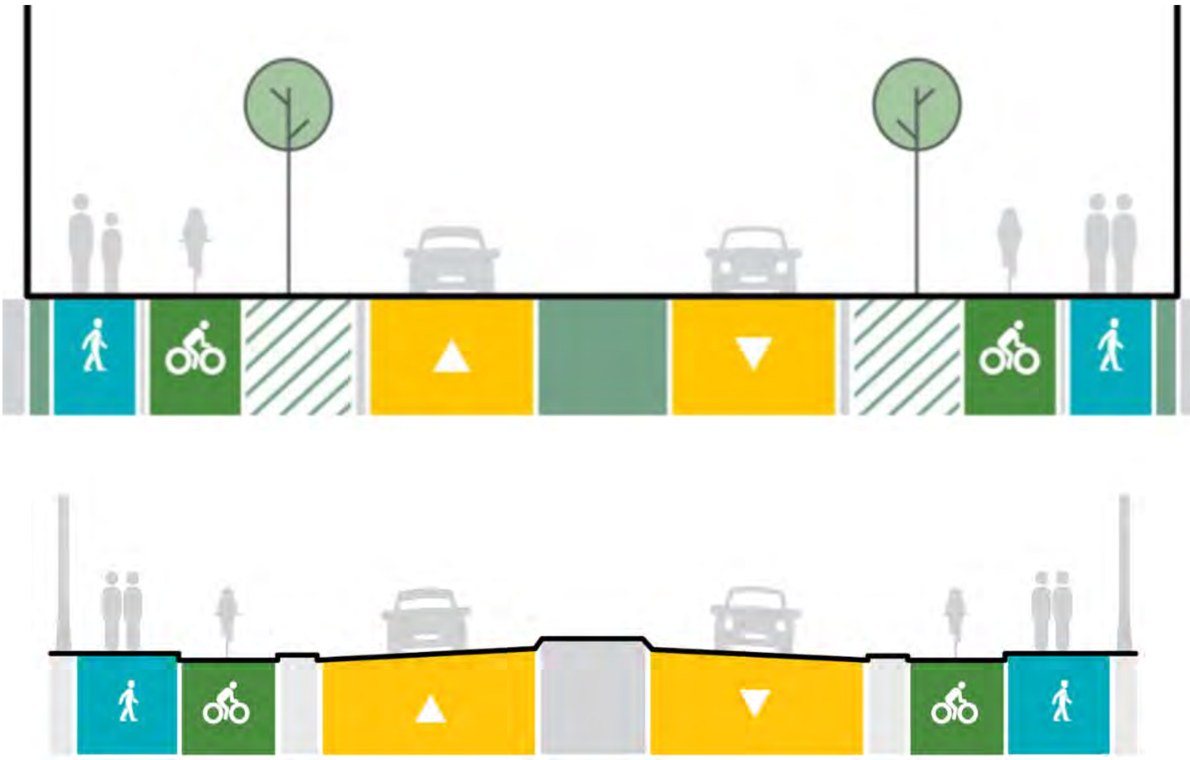


Figure 10-3: Spedding Road Upgrade Typical Cross Section – Corridor and Bridge

The typical cross section above illustrates the proposed upgrade to the road and the expected future use. Although indicative the available space within the road corridor for green infrastructure elements such as street trees and berms where low impact stormwater devices and associated planting can be accommodated These features are expected to improve landscape and urban amenity within the corridor.

As outlined earlier broad areas of vegetation along the existing corridor may not be able to be retained within the new corridor. New street tree planting along the length of the corridor will be an appropriate replacement for the vegetation removed, within the context of the anticipated surrounding urban environment (from a landscape character perspective).

It is assessed that the new street tree plantings, in conjunction with stormwater management and berm plantings, will provide landscape amenity and positively contribute to the landscape character of the Project area within the context of an urban environment.

On the basis of the above without mitigation effects are anticipated to be **low-moderate** adverse**.** Allowing for future landscape mitigation, natural character effects are anticipated to be **low** adverse.

10.6.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The measures to remedy and mitigate the adverse construction effects of the Project on the natural and urban landscape will be addressed under an Urban and Landscape Design Management Plan (ULDMP), which will lay out the main design themes, principles, and outcomes of the Project. It is recommended that the ULDMP also considers additional enhancement and future opportunities.

Recommendations are in line with the general recommendations in Section 6.1.3. In addition to this the following recommendation is suggested:

Specific mitigation measures for individual audiences are not anticipated, however this may be required following the during the detailed design phase. The following mitigation measures are recommended to remedy and mitigate the adverse construction effects of the Spedding Road Project:

- Produce a vegetation protection plan as part of the UDLMP to ensure that valued indigenous and riparian vegetation are protected.

10.7 Conclusions

Overall, it is anticipated that without the implementation of mitigation measures landscape and visual effects range from **moderate-high** adverse to **low** adverse during the construction phase and **moderate adverse** to **low** adverse during the construction phase. Landscape and visual effects with the implementation of mitigation are anticipated to range from **very low** adverse to **low-moderate** adverse for the construction phase and **low** adverse to **low-moderate** adverse for the operational phase. It is considered that the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. Existing urban areas have a lower level of sensitivity to change due to the existing context of the arterial road. There are a number of positive landscape and visual effects that will result from the project, not least the opportunity to create a linkage to the indicative esplanade proposed in the Whenuapai Structure Plan.

11 NoR W5: Hobsonville Road FTN Upgrade

11.1 Project Corridor Features

Hobsonville Road is an existing arterial corridor over 4km in length, extending from SH16 in the west to Hobsonville Point Road and Buckley Avenue / Squadron Drive in the east. The project extends from the intersection with Oriel Avenue in the west to the intersection Memorial Park Drive in the east and provides an important east-west connection from Westgate to Hobsonville.

The existing Hobsonville Road traverses land zoned for a range of activities under the AUP:OP (FUZ, Residential, Open Space and Business (including industrial), therefore the recommended form and function of the corridor reflects the adjacent future land use.

The key landscape matters addressed for the Hobsonville Road Upgrade include:

- The nature and extent of impacts on the landscape as a physical resource during the construction period of the Project. A specific focus on the location of construction compounds, extent of vegetation clearance, the scale and location of proposed cut and fill slopes and the likely impacts of bridge construction.
- Consideration of landscape character effects and urban amenity issues in relation to the permanent landscape change, including specific assessment of how this corridor will integrate into the future urban environment.
- Potential natural character effects of the corridor construction and consideration of future opportunities to integrate streams and wetlands.
- Consideration of landscape mitigation measures to be included within an Urban and Landscape Design Management Plan (ULDMP) as a condition on the proposed designation to address the potential landscape, natural character and visual effects arising from the operation the Project.
- Expansion of the existing wetland from a Waiarohia inlet.
- Working around scheduled notable trees within the Hobsonville School grounds.
- Integration of the five wetlands into the surrounding urban landscape.

11.2 Existing and Likely Future Environment

11.2.1 Planning context

The Hobsonville Road corridor runs through an existing rural environment, with the land either side of the Trig Road corridor currently zoned FUZ under the AUP:OP.

Table 11-1 below provides a summary of the North West existing and likely future environment.

Table 11-1: Hobsonville Road FTN Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[20]	Likely Future Environment[21]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
	Business (Local centre)	Low	Business (Local centre)
Residential	Residential	Low	Residential
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

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

11.2.2 Landscape Environment

11.2.2.1 Baseline Landscape

The Project is situated within the existing Hobsonville Road arterial road which is developed along its length on the eastern side and developed in part on the western side. The eastern side of the Project comprises predominantly residential properties that front on to the road. Development on the western side is residential between Trig Road and Fitzherbert Road, the remaining comprises undeveloped rural fields and mixed commercial and industrial development with the longstanding Hobsonsville school near the centre or the corridor.

The local landscape character of Hobsonville Road are summarised below;

- Vegetation cover comprising stand alone elements of indigenous vegetation; hedgerows and shelterbelts along remnant field boundaries; exotic rank grassland; and non-native stand-alone trees within front gardens and streetscape of the existing urban areas.
- The landscape is characterised by established urban residential development to the east and large for commercial and retail development and remnant rural fields to the west..
- The landscape character value is low within the context of the existing arterial road and emerging commercial and retail development. There is the potential to enhance this aspect of the landscape through the implementation of this Project.

Landform and Hydrology

Hobsonville and the existing arterial road is positioned along a central ridgeline with a moderate slope ascending towards a high point at the Trig Road intersection that then gradually descends towards Hobsonville Point. The lowest point of the Project is at the northern extent of the corridor at the intersection with Memorial Park Lane.

Landcover

The landscape to the west of Hobsonville Road is characterised by mixed size geometric fields bound in parts by isolated native vegetation, hedgerows and exotic grassland (see Figure 11-1 below). Large

[20] Based on AUP:OP zoning/policy direction
[21] Based on AUP:OP zoning/policy direction

lot light industrial and commercial properties are present and under development on the site of remnant fields. Mature trees within the road reserve and front yards of private development contribute to the character of the urban streetscape. Wetland ecosystems are limited to managed areas within the urban landscape, the stream corridors and wetland areas are an important habitat for bird and plant species.

Figure 11-1: View across Hobsonville Road towards open pastoral fields of 4-6 Hobsonville Road.

The landscape to the east of Hobsonville Road the landscape is defined by the one and two storey residential development. Mature trees within the road reserve and front yards of private development contribute to the character of the urban streetscape.

Three scheduled notable trees [1980, Pohutukawa (2), Kauri] are within or proximate to the project boundary, three in or outside of Hobsonville School and one at the intersection of Hobsonville Road and Williams Road (see Figure 11-2 below).

Figure 11-2: View south west across the Hobsonville towards the scheduled notable Pohutukawa trees in proximity to Hobsonville School.

Land Use

The existing Brigham Creek Road corridor is approximately 18m wide and zoned as ‘Road under the AUP:OP.

Land use to the west of Hobsonville Road is residential with small open space opposite Ryans Road. West of Hobsonville Road is predominantly zoned as Business – Light Industry Zone between Westpoint Drive and Brigham Creek Road (see Figure 11-3 below). To the south the route is shown as Mixed Housing Urban zoned land and FUZ, the Whenuapai Structure Plan indicates that this will be developed for High Density Residential development in the future. At the northern extent of the western side of the route are a mix of Business Mixed Used and Local Centre zones.

Figure 11-3: Existing and emerging large lot commercial and industrial development to the north of Hobsonville Road.

Scheduled Landscape and Ecological Features

There are tree scheduled notable trees located at 104A/B Hobsonville Road, Hobsonville School. These comprises two Pohutukawa adjacent to the school entrance and a Kauri tree set back further within the school grounds.

Historical and Cultural Associations

There are no scheduled historical or cultural features within or proximate to the Project area.

11.2.2.2 Likely Future Environment

Overview

The land to the west of the Project will witness a significant change from rural to urban land use character over the next 10 years. It is anticipated that the abiotic features of the landscape will endure, these are limited to the existing landform and modified wetland features which will undergo some modification. The land on the eastern side of the Project will stay relatively the same into the future.

It is anticipated that some of the defining biotic (land cover) features of the landscape will undergo significant change alongside future development, with the removal of vegetation to accommodate proposed commercial and residential development. This will likely involve the implementation of street tree plantings, public open space areas and general landscaping within the private yards of future housing development for public amenity.

The quality and natural character values of riparian and wetland environments are generally anticipated to be retained and, in some instances, enhanced as urban development progresses, in accordance with the policy direction of the AUP:OP and Whenuapai Structure Plan and Whenuapai Structure Plan which generally seek to protect and enhance these landscape features.

11.2.2.3 Whenuapai Structure Plan

The Whenuapai Structure Plan only covers the south western corner of the proposed project and provides general guidance for how the FUZ land adjacent to the Project area should be developed over time. The structure plan is illustrated in Appendix 1.

Land Use

The south western section of the corridor will be developed into Medium and High Density residential areas. The high density residential development is indicated to be introduced adjacent to Hobsonville Road.

11.3 Extent of Visibility and Viewing Audience

The visual catchment is the area of land from which part or all of the Project area is visible. This is largely determined by landform, land cover and built elements, which in combination may obscure or filter views. The extent of visibility of the proposed road corridor is contained by built form and existing vegetation. Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects. In summary the viewing audience for the Project includes:

- *Public Views:* Transient public audience (vehicle users). Key roads where views can be obtained from include; Hobsonville War Memorial Park, Hobsonville School, commercial and light industrial development that front onto Hobsonville Road, Brigham Creek Road, Fitzherbert Road, Westpack Drive and Marina View Drive. Views include:
  - Travelers (cars, pedestrians and cyclists) along Brigham Creek Road, Fitzherbert Road, Westpack Drive and Marina View Drive;
  - People in Hobsonville War Memorial Park (SP22)
- *Private Views:* The viewing context also includes a concentrated urban residential viewing audiences and people within commercial and industrial businesses. A small number of rural properties with private viewing audiences, comprising views from rural residential and lifestyle dwellings. Specifically:
  - Views from the rural residential properties with short driveways that front on to Hobsonville Road (78, 80, 82, 94, 26A, 28, 31, 39, 145, 159, 162) (Refer Appendix 2 Site Photo 16);
  - Views from the urban residential properties that immediately front on to Hobsonville Road (Refer Appendix 2 Site Photo 17, SP18);
  - View from the urban residential properties that have boundaries on to Hobsonville Road (SP19, SP20)
  - Staff and Students of Hobsonville School (104/104A Hobsonville Road) (Refer Appendix 2 Site Photo 21); and;
  - Occupants of nearby commercial buildings along Hobsonville adjacent the proposed corridor.

Views are well contained within the immediate area surrounding the road corridor and urban built form due to the relatively flat landscape and intervening vegetation and built form.

Over time, the audience is likely to grow to include residents of future urban developments within the FUZ area.

11.4 Landscape Values

There are no regionally or nationally significant landscapes (ONLs, ONFs or ONCs) within or proximate to the proposed designation boundary.

The gently sloping topography and small areas of remnant rural mature vegetation contribute to the visual amenity of the landscape. The highly modified landscape has limited natural features, which are restricted to individual isolated stands of mature vegetation, scheduled notable trees and existing managed wetlands. Hobsonville War Memorial Park is within the context of an existing arterial road corridor and urban development, there are no views from any open spaces or sports fields in the wider landscape towards the proposed corridor.

11.5 Landscape Sensitivity

This project corridor is situated between the existing urban residential area and a developing urban landscape. The developing landscape has been assessed within the AUP:OP as being suitable for urbanisation. The proposed urbanisation of the surrounding landscape to the south west as indicated by the Whenuapai Structure Plan will be developed as high and medium density residential. Although there are pockets of indigenous vegetation and wetland environments with a moderate level of sensitivity, on balance the Project area is assessed as having a low sensitivity to landscape change.

11.6 Assessment of Landscape Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

11.6.1 Positive Effects

Generalised positive effects related to the Project are covered in Section 5 of this report. Additional (non-landscape related) positive effects include:

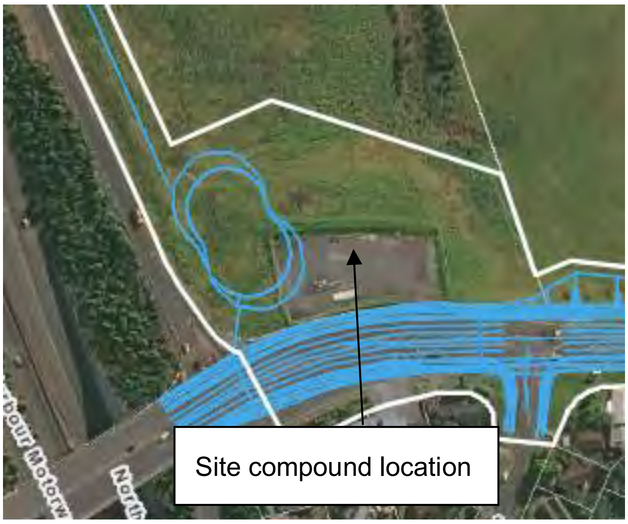
- Improved and/or new opportunities for active modes of transport and the ability to provide improved connectivity along Hobsonville Road.

11.6.2 Assessment of Construction Effects

Construction Areas

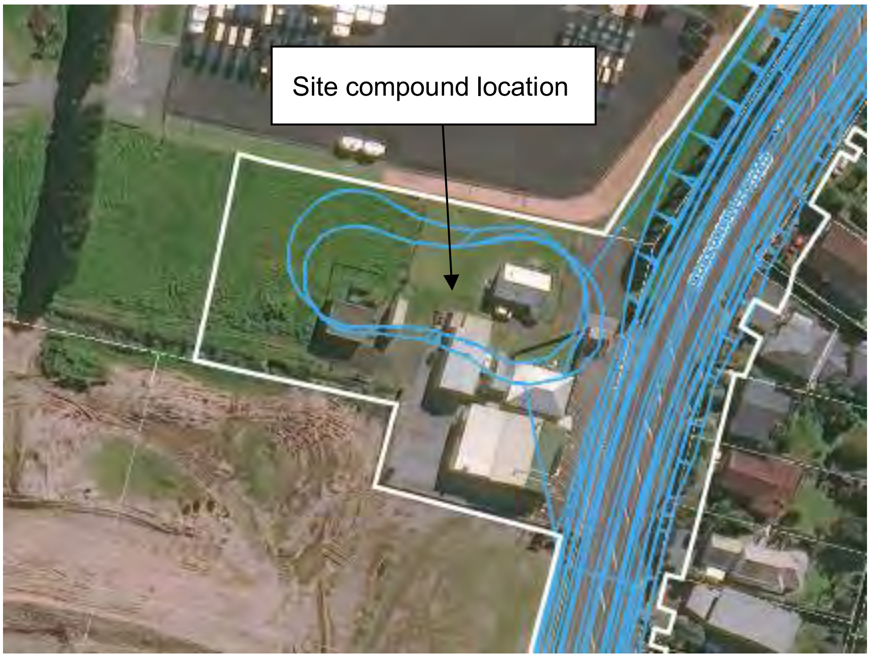
Site compound and construction areas are to be established at four locations within the Project area with one outside of the designation. Construction traffic will be heightened at these locations through the construction period of the Project.

- A proposed site compound, stockpile and sediment retention pond is located on the west of Hobsonville Road corridor in land adjacent to the SH18 off-ramp zoned as Road in the AUP:OP. This compound is adjacent to the proposed Wetland 1 and Opposite the West Harbour Fire Station.

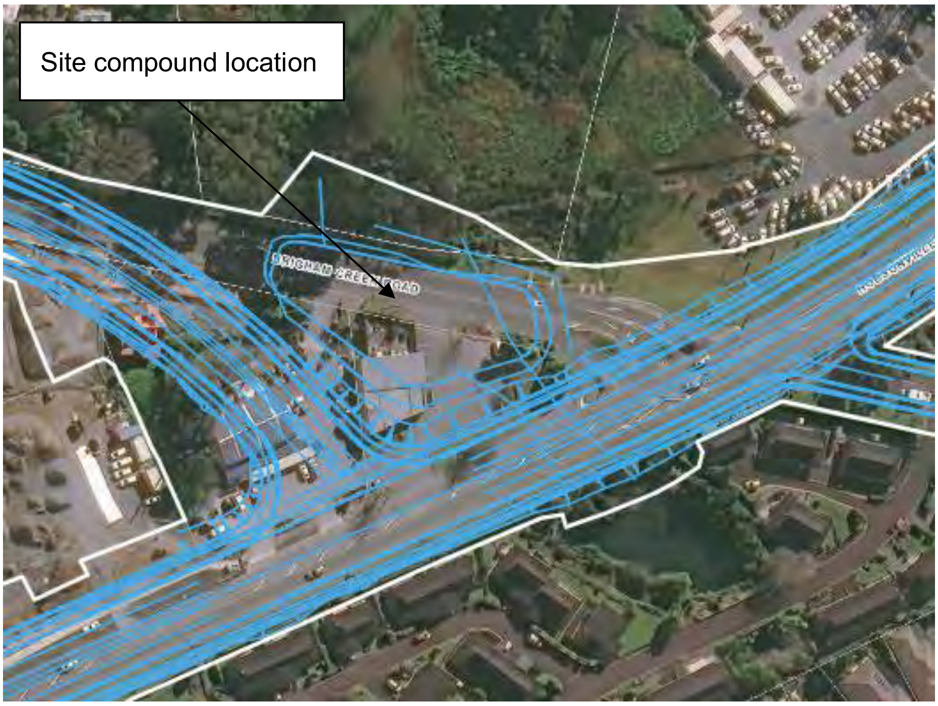


- A proposed site compound, stockpile and sediment retention pond is proposed to the west side of the corridor outside of the designation area - residential properties opposite this compound do not front on to Hobsonville Road.

- A proposed site compound, stockpile, sediment retention pond is located on the west side of the corridor at 92 Hobsonville Road between lots with commercial/retail development currently under construction. The site is opposite residential properties the front on to 195, 197, 199A, 203 Hobsonville Road. The site compound will include proposed Wetland 2.



- A proposed site compound, stockpile, sediment retention pond is located on the west side of the corridor. The site compound is located behind the commercial car lot at 188A Hobsonville Road. The site compound is adjacent to Wetland 4.



- A proposed storm water pond area is proposed away from the main road alignment to the west of Hobsonville School as an upgrade to an established wetland and new proposed wetland.

It is anticipated that without the implementation of mitigation measures the physical landscape effects would be **low-moderate** adverse. The physical landscape effects resulting from establishment and use of the construction work areas within the Project area with the implementation of mitigation measures is anticipated to be **low** adverse.

Vegetation Clearance

Small areas of road side vegetation are proposed to be removed to accommodate the wider road corridors and batter slopes. This consists of trees and shrubs located within the road-side boundaries of private properties, within the Project area. Exotic pasture, trees, shelterbelt plantings, private gardens and exotic stands of trees patches make up the majority of vegetation to be removed. It is assumed that all scheduled notable trees proximate to the Project will be retained.

Without the implementation of mitigation measures it is anticipated that physical landscape effects on average will be **low-moderate** adverse. There is additional sensitivity regarding the scheduled notable trees adjacent to Hobsonville School, the loss of these trees would result in **moderate-high** adverse effects. Provided that an appropriate amount of revegetation mitigation is undertaken for the removal of indigenous vegetation, the physical landscape effects likely to arise from vegetation clearance within the Project area are assessed as **low** adverse.

Structures and Earthworks

Approximately 40,200m^3 cut and 33,000m^3 of fill earthworks are anticipated to be undertaken over the site. The majority of the proposed additional fill will comprise brown rock for engineering purposes.

The impacts and potential landscape effects of the proposed earthworks include the modification of and permanent changes to the underlying landform particularly in the wetland areas, surface level changes in close proximity to private properties. The proposed cut and fill slopes range in scale from 1m to 21m wide and will alter the form of the existing marginal pastoral land form, stream banks, wetlands and private gardens. Cut and fill slopes within the road corridor are up to 13m wide and predominantly to the west side of the road corridor into the undeveloped pastoral fields. Slopes wider than 13m are located exclusively at the Brigham Creek Road interchange.

It is recommended that a condition on the designation is included that promotes the re-use of topsoil from pastoral land impacted by the proposed earthworks[22] for mitigation planting and landscaping.

Overall, we consider the proposed earthworks to be of a quantity that is reasonably anticipated with a project of this scope and scale and all cut and fill slopes are expected to be integrated with the existing modified environment. The progression from a rural to urban land use within adjacent areas will integrate with the proposed road upgrade.

Without the implementation of mitigation measures it is anticipated that physical landscape effects would be **low-moderate** adverse. Provided that the proposed mitigation measures are undertaken we expect that the effects of the earthworks and bridge structure will be **low** adverse.

Wetlands and features

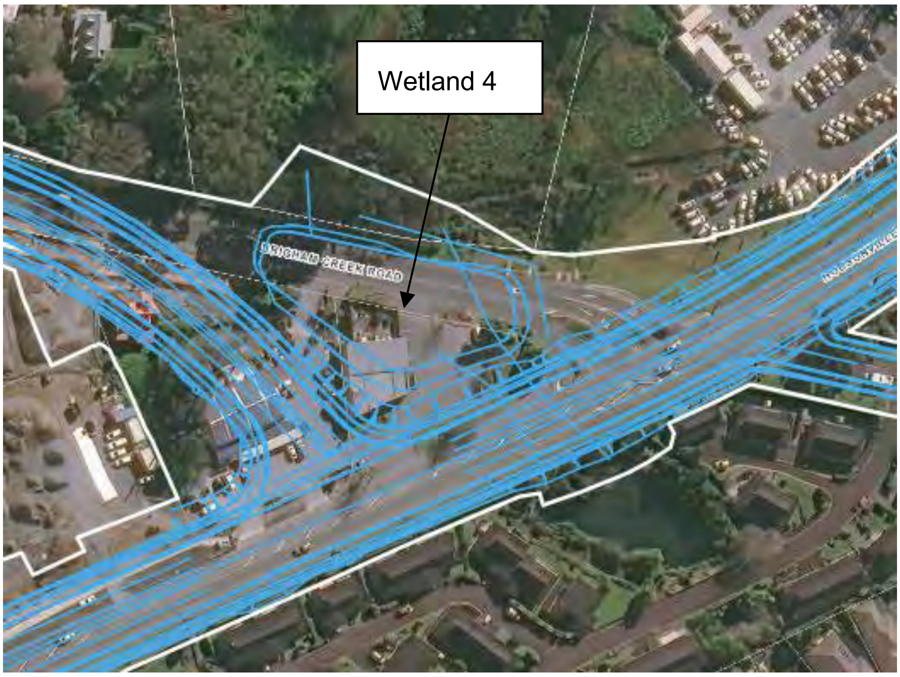
Four wetlands are proposed within this Project area and one existing wetland will be upgraded as part of the Project.

- Wetland 1 is located to the west of the project corridor at in SH18 land adjacent to the off ramp;

- Wetland 2 is located to the west of the project corridor at 92 Hobsonville Road;

[22] Refer to NZTA Landscape Guidelines (September 2014), Section 4.12 Topsoil for additional information regarding best practice guidelines for topsoil management and soil stripping.

- Wetland 4 is located to the west of the project corridor at 188A Hobsonville Road; and;



- The Wetland 5 upgrade is located to the north of the project corridor to the west of Hobsonville Point Secondary School.

All of these proposed wetlands will be located within green field sites with the exception of Wetland 3 which will require the removal of eight properties, an additional three properties will be required to be removed to facilitate the project. The Wetland 5 upgrade will require the removal of existing riparian vegetation within the existing wetland to expand.

The wetland ponds will require earthworks to re-shape the land and achieve optimal depths and edge profiles, which will be determined as part of the resource consent phase.

On that basis, without the implementation of mitigation measures, it is anticipated that physical landscape effects would be **low-moderate** adverse. We consider the adverse effects on the physical landscape with implementation of mitigation measures will be **low** adverse.

Private Properties

Residential properties within and adjacent to the Project area (including those which are partially designated) will be impacted by the Project in the following ways:

- Surface level changes between private property boundaries and the upgraded road corridor, requiring existing driveways and private accessways to be regraded;
- Encroachment into private yard areas and the removal of private garden plantings and trees, ancillary buildings and boundary fences;
- Potential construction of noise mitigation measures and retaining walls;
- Demolition of existing dwellings and ancillary buildings (required properties)

Approximately 140 existing dwellings are proposed to be impacted by the project works, ten of these properties are set within rural surrounds but face on to an urban area with the remaining within the urban environment. Approximately 40 dwellings will be removed / acquired to accommodate the Project. Landscape mitigation measures are proposed under 9.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects below.

Without the implementation of mitigation measures it is anticipated that physical landscape effects on private properties would range from **moderate** adverse to **low-moderate** adverse. Overall, it is assessed that the magnitude of physical landscape effects on private properties with the implementation of mitigation measures will range between **low** adverse and **low-moderate** adverse.

11.6.2.1 Site Finishing Works

Finishing works are expected to include grassing of exposed earth, lighting, signage, line markings, footpath/cycleway details and reinstatement of private property fences and gardens. Streetscape elements and landscaping, including that required as mitigation will also be implemented. These activities are to be determined by detailed design and will occur within the already modified areas of the Project. Without the implementation of the proposed mitigation measures it is anticipated that the site finishing works will result in **low** adverse to **low-moderate** adverse physical landscape effects. Physical landscape effects are expected to be **very low** adverse through this final phase of the construction process, with the implementation of mitigation measures.

11.6.2.2 Temporary Visual Effects

The construction of the Project is anticipated to be in three stages along the proposed corridor over a period of approximately 3.5 years. Visual effects are anticipated to occur progressively through the Project area and transient viewing audiences may concurrently experience adverse visual effects from several stages through the construction period.

The consideration of visual effects through the construction phase acknowledges the full range of activities (and their resultant visual impact), required to implement the upgraded road corridor.

It is anticipated that construction activities required to implement the Project will be generally consistent in nature and scale to road works and infrastructure activities commonly anticipated by transient viewing audiences within a main arterial corridor. Another important consideration is that landscape change by way of vegetation removal and land modification (on private rural property), albeit at a lesser scale, forms part of the expected backdrop of the existing environment.

Notwithstanding the above, some vantage points within the Project area are likely to witness heightened adverse visual effects through the construction phase due to the magnitude of vegetation removal, proximity to construction compounds and/or earthworks proposed. These areas are outlined below:

- Private properties where physical landscape effects will occur along roadside boundaries to Hobsonville Road.
- Private properties at 149A-F, 147A-E.195, 197 and 203A Hobsonville Road in proximity to site compounds.
- Outdoor space, classrooms and buildings within Hobsonville School which directly overlook the Project.

The nature and significance of the potential adverse visual effects we consider to be moderated through the Project area by the following aspects:

- The Hobsonvillle Road is already a central element within the visual composition of the Project area;
- The existing road corridor landscape has already been partially modified by previous works required to shape the existing road corridor.

- The construction phase is expected to be approximately 3.5 years. The construction period is proposed to be implemented allow efficient access to the construction zones while maintaining continued access for the intersecting roads and existing private and commercial driveways.

Overall, it is anticipated that without the implementation of mitigation measures visual effects for transient audiences are anticipated to be **low-moderate** adverse. Visual effects for the transient public viewing audience are likely to be **low** adverse through the construction phase where mitigation measures are implemented. This takes into account those areas listed above where adverse effects are likely to be heightened during the construction period.

Adverse visual effects during the construction phase are likely to be heightened for private viewing audiences directly adjacent to the Project area on the basis of more direct and prolonged engagement with the construction activities of the Project. This will include the presence of heavy machinery and the visible disturbance of both the road corridor and also individual private interfaces with the road.

It is anticipated that without the inclusion of mitigation measures the visual effects for private viewing audiences are expected to range between **moderate-high** adverse to **moderate** adverse. We consider visual effects are expected to range between **moderate** adverse and **low** adverse during the construction phase for private viewing audiences.

Adverse visual effects on Hobsonville School are likely to be heightened due to the proximity of the school to the project, approximately 1m to the closest building and 10m from the closest outdoor space. Although the schools primary outlook is not towards Hobsonville Road as the main access and egress for the school the works will be a focal point for this viewing audience.

The schools north east outdoor open space used by students during break times will have short distance open views of the works. Without mitigation the effects on the school and residential audiences within proximity to the scheme have the potential to be **moderate-high**. It is considered that adverse visual effects on the school with mitigation will be **moderate** overall.

11.6.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Recommendations are in line with the general recommendations in Section 6.1.2.

In addition to these measures the following project specific interventions are suggested:

- Provide hoarding or other screening along the frontage to Hobsonville School to reduce visual effects on user of the outdoor space that look on to Hobsonville Road;
- Ensure that measures are taken to prevent contamination and pollution of groundwater and wetlands within proximity to site compounds; and;
- The production of a tree protection plan is suggested to be provided within the UDLMP, to indicate protection measures and locations to be protected during construction in particular around the scheduled notable trees identified in the AUP:OP.

11.6.4 Assessment of Operational Effects

11.6.4.1 Natural Character Effects

Natural character forming elements, features and processes within the Project area are limited to areas of wetland surrounded by the existing heavily modified landscape. Indigenous riparian vegetation is only present in the existing man-made wetland that will be upgraded as the works at Wetland 5. Therefore, we consider that, the natural character value in the landscape is **very low**.

Clearance of indigenous riparian vegetation and habitat will be necessary to facilitate the expansion of the existing Wetland 5, this vegetation will be replaced as part to of the Project.

A planting plan and vegetation protection plan is recommended as part of the ULDMP which will be developed as part of the detailed design of the Project. It is recommended that any planting proposed as mitigation through the regional consents process is integrated with the planting plan as recommended through this assessment under the ULDMP. This will ensure that natural character values of the and wetlands are preserved as an outcome of the Project.

On the basis of the above without mitigation there is the potential for landscape effects to be **low** adverse. Allowing for mitigation measures during construction adverse natural character effects are anticipated to be **very low.**

11.6.4.2Visual Amenity Effects

Overall, there are likely to be a range of visual amenity effects on public and private viewing audiences relative to proximity to the corridor. For existing properties set back from the Project area, the visual amenity effects will be a reduced incremental increase in existing effects from the introduction of an arterial road.

Private properties which have filtered, screened or distant views towards the works are expected to experience a reduced level of change as a result of the works. Whereas residential viewing audiences closer to the proposed corridor will experience more direct levels of material change to the visual composition and residential amenity of the road corridor as perceived from private property. Urban private properties with an existing short distance views over Hobsonville Road particularly those that front on to the corridor will experience very little difference between baseline views and views during operation.

For some properties directly adjacent to the Project area (from which land is required), visual amenity and residential character effects will be heightened as a result of the construction impacts including driveway regrading, potential loss of yard space and by the introduction of an urban style carriageway and footpaths/cycleways to private dwellings. It is recommended that boundary fences and garden plantings (removed through the Project works) are reinstated on completion of the works affecting the property, unless other arrangements are requested by landowners. These mitigation measures should be considered within the ULDMP under the lens of neighbourhood character and as such are discussed further in the following section.

Very few rural public viewing audiences in the existing environment have a direct view of the works due to the lack of connectivity to rural land. Over time as the surrounding FUZ land is developed visual effects are anticipated to be reduced for the public viewing audience, based on improved visual amenity for users associated with streetscape improvements, maturing street trees, berm planting and accessibility to active modes of transport. Public viewing audiences within the urban environment are primarily active mode users along the Hobsonville Road and within the Hobsonville War Memorial Park open space. During operation viewing audiences associated with Hobsonville School will experience views that are largely the same as existing views. In the operational stage views for these audiences will be largely the same as the existing views, with the potential for improved views where tree planting is introduced to the road corridor. Overall, some visual effects are anticipated to be mitigated by measures implemented during the finishing phase of the construction period (within the road corridor and private property boundaries), that will mature through the operational phase of the

Project. These will reduce some of the long-term residual visual effects of the Project, however the 24-30m wide road will be a noticeable feature within the landscape. The road corridor will be less apparent as the surrounding area is urbanised over time.

On that basis, without the inclusion of mitigation measures it is anticipated that visual effects for transient viewers will be **low** adverse. With the inclusion of mitigation measures, visual effects within the Project area are likely to be **very low** adverse for transient viewers through the operational phase of the Project.

For the private viewing audience, without the implementation of mitigation measures visual effects are anticipated to range from **moderate** adverse to **low** adverse. With the implementation of mitigation measures, visual effects on private audiences are anticipated to range from **low-moderate** adverse to **very low** adverse, reducing over an extended period of time. It is expected that landscape mitigation will take 3-5 years to establish, adverse landscape character effects are anticipated to be low adverse.

11.6.4.3 Landscape Character Effects

The principal elements of the Project will permanently alter the character of the existing remnant rural features to the west of the west of Hobsonville Road. The sections of the road to the west are characterised by the lack of streetscape features, informal intermittent vegetation, shelterbelt and hedgerows along field boundaries and existing rural land uses adjacent to the corridor. The existing road corridor does feature urban elements including a segregated cycleway, footpaths and a kerb and channel roadway more prominently to the east. At the completion of the Project, the upgraded corridor will resemble that of an urban arterial road on account of the pedestrianisation, active modes of transport, reduced speed limit, structured street tree planting, integrated stormwater management and engineered roading elements that are inherently urban aesthetic.

The Project is anticipated to enter the operational phase within the context of increased urbanisation within rural sections as adjacent business zoned land, local centre and developed FUZ land is progressively live-zoned and urbanised. Although it is not possible to anticipate the exact future urban land use pattern, Whenuapai Structure Plan suggests that High and Medium density residential development will be introduced into the south western section of the route. The AUP:OP indicates that is desirable to develop the majority of the western portion of the corridor as for business, commercial and industrial uses. A local centre is indicated at the northern extent of the road corridor.

Based on the above the magnitude and nature of landscape change proposed by the Project we consider that the proposed changes will match with those that will likely occur throughout the localised landscape over time.

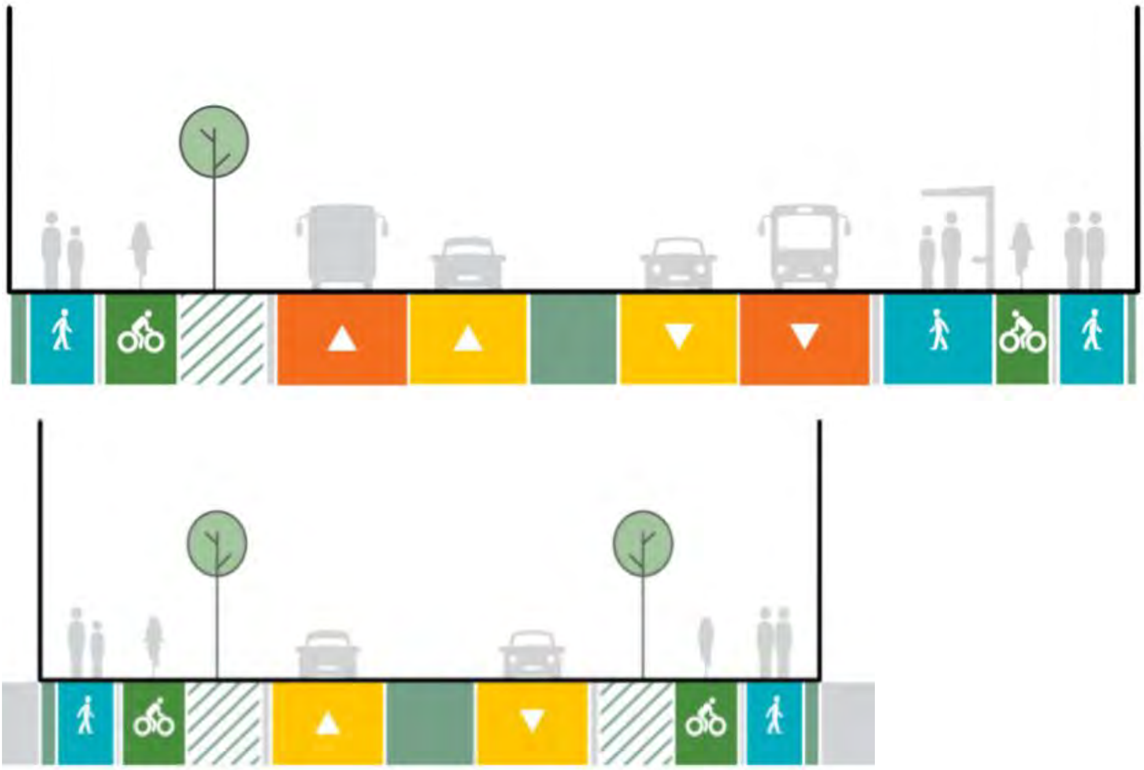


Figure 11-4: Hobsonville Road FTN Upgrade Typical Cross Sections (typical 30m and typical 24m)

The typical cross section above illustrates the proposed upgrade to the road and the expected future use. Although indicative the available space within the road corridor for green infrastructure elements such as street trees and berms where low impact stormwater devices and associated planting can be accommodated These features are expected to improve landscape and urban amenity within the road corridor.

As outlined earlier broad areas of vegetation along the existing corridor may not be able to be retained within the new corridor. New street tree planting along the length of the corridor will be an appropriate replacement for the vegetation removed, within the context of the anticipated surrounding urban environment (from a landscape character perspective).

It is assessed that the new street tree plantings, in conjunction with stormwater management and berm plantings, will provide landscape amenity and positively contribute to the landscape character of the Project area within the context of an urban environment.

On the basis of the above without the implementation of mitigation measures it is anticipated that landscape character effects are anticipated to be **low-moderate** adverse to **low** adverse. Allowing for future landscape mitigation, landscape character effects are anticipated to be **very-low** adverse.

11.6.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The measures to remedy and mitigate the adverse construction effects of the Project on the natural and urban landscape will be addressed under an Urban and Landscape Design Management Plan (ULDMP), which will lay out the main design themes, principles and outcomes of the Project. It is recommended that the ULDMP also considers additional enhancement and future opportunities.

Recommendations are in line with the general recommendations in Section 6.1.3. In addition to this the following recommendation is suggested:

Specific mitigation measures for individual audiences are not anticipated, however this may be required following the during the detailed design phase. The following mitigation measures are recommended to remedy and mitigate the adverse construction effects of the Hobsonville Road Project:

- Produce a vegetation protection plan as part of the UDLMP to ensure that valued indigenous and riparian vegetation are protected; and
- Produce a landscape planting plan for the reinstatement and enhancement of Wetland 5.

11.7 Conclusions

It is anticipated that landscape and visual effects, without implemented mitigation, range from **moderate high** adverse to **low-moderate** adverse for the construction phase and **moderate** adverse to **low** adverse for the operational phase. The highest level of potential effects is related to the potential removal of the scheduled notable Pohutukawa trees located adjacent to Hobsonville School.

Overall landscape and visual effects (with mitigation) range from **low** adverse to **moderate** adverse for the construction phase and **very low** adverse to **low-moderate** adverse for the operational phase. The highest level of effects for the construction phase are in regard to short distance views towards construction works from Hobsonville.

Overall, the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. The surrounding landscape context has a lower level of sensitivity to change due to the existing context of the arterial road. There are a number of positive landscape and visual effects that will result from the project including the opportunity to formalise the streetscape and amenity provide consistent amenity along the Project.

12 Conclusions

NoR W1 Trig Road North

Overall, it is anticipated that landscape and visual effects, without the implementation of mitigation range from **moderate** adverse to **low** adverse for the construction phase and **low-moderate adverse** to **low** adverse for the operational phase. Adverse landscape and visual effects (with mitigation) range from **very low** to **low-moderate** for the construction phase and **very low** to **low** for the operational phase. Overall, the adverse effects can be mitigated and there are a number of positive landscape and visual effects that can ensue.

NoR W2 Māmari Road

Overall landscape and visual effects without mitigation range from **moderate-high** adverse to **low** adverse for the construction phase and **moderate** adverse to **very low** adverse for the operational phase. With the anticipation of mitigation measures being implement effects are expected to range from **low** to **low-moderate** for the construction phase and **low** to **low-moderate** for the operational phase. Overall, the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. There are a number of positive landscape and visual effects that will result from the project, not least the opportunity to create a linkage to the indicative esplanade proposed in the Whenuapai Structure Plan.

NoR W3 Brigham Creek Road

Landscape and visual effects as a result of the project, without the implementation of mitigation measures are anticipated to range from **moderate-high** adverse to **low** adverse for the construction phase and **low-moderate** adverse to **low** adverse for the operational phase. Overall, landscape and visual effects with the implementation of mitigation are anticipated to range from **very low** adverse to **low-moderate** adverse for the construction phase and **very low** to **low-moderate** for the operational phase. Overall, the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. Existing urban areas have a lower level of sensitivity to change due to the existing context of the arterial road. There are a number of positive landscape and visual effects that will result from the project, not least the opportunity to create a linkage to the indicative esplanade proposed in the Whenuapai Structure Plan.

NoR W4 Spedding Road

Overall, it is anticipated that without the implementation of mitigation measures landscape and visual effects range from **moderate-high** adverse to **low** adverse during the construction phase and **moderate adverse** to **low** adverse during the construction phase. Landscape and visual effects with the implementation of mitigation are anticipated to range from **very low** adverse to **low-moderate** adverse for the construction phase and **low** adverse to **low-moderate** adverse for the operational phase. It is considered that the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. Existing urban areas have a lower level of sensitivity to change due to the existing context of the arterial road. There are a number of positive landscape and visual effects that will result from the project, not least the opportunity to create a linkage to the indicative esplanade proposed in the Whenuapai Structure Plan.

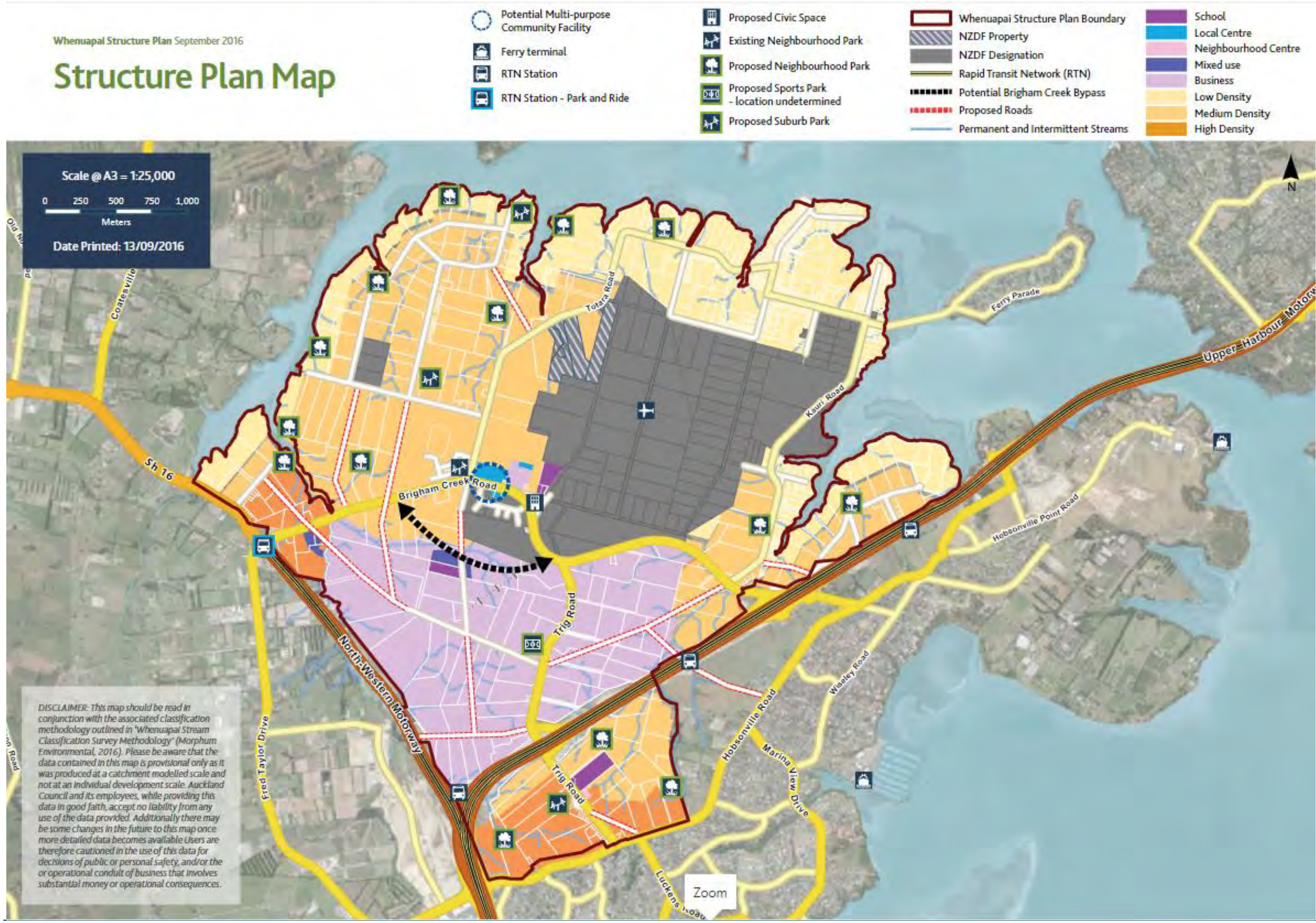
NoR W5 Hobsonville Road (alteration to existing designation 1437)

It is anticipated that landscape and visual effects, without implemented mitigation, range from **moderate high** adverse to **low-moderate** adverse for the construction phase and **moderate** adverse to **low** adverse for the operational phase. The highest level of potential effects are related to the potential removal of the scheduled notable Pohutukawa trees located adjacent to Hobsonville School.

Overall landscape and visual effects (with mitigation) range from **low** adverse to **moderate** adverse for the construction phase and **very low** adverse to **low-moderate** adverse for the operational phase. The highest level of effects for the construction phase are in regard to short distance views towards construction works from Hobsonville.

Overall, the adverse effects can be mitigated and reduced over time in relation to the urbanisation of the surrounding landscape. The surrounding landscape context has a lower level of sensitivity to change due to the existing context of the arterial road. There are a number of positive landscape and visual effects that will result from the project including the opportunity to formalise the streetscape and amenity provide consistent amenity along the Project.

1 Appendix 1: Whenuapai Structure Plan


Whenuapai Structure Plan September 2016
Structure Plan Map
Potential Multi-purpose Community Facility
Ferry terminal
RTN Station
RTN Station - Park and Ride
Proposed Civic Space
Existing Neighbourhood Park
Proposed Neighbourhood Park
Proposed Sports Park - location undetermined
Proposed Suburb Park
Whenuapai Structure Plan Boundary
NZDF Property
NZDF Designation
Rapid Transit Network (RTN)
Potential Brigham Creek Bypass
Proposed Roads
Permanent and Intermittent Streams
School
Local Centre
Neighbourhood Centre
Mixed use
Business
Low Density
Medium Density
High Density
Scale @ A3 = 1:25,000
0 250 500 750 1,000
Meters
Date Printed: 13/09/2016
N
Coatesville
Sh 16
Brigham Creek Road
Totara Road
Kauri Road
Ferry Parade
Upper Harbour Motorway
Hobsonville Point Road
Trig Road
North-Western Motorway
Fred Taylor Drive
Hobsonville Road
Whenuapai Road
Marina View Drive
Luckens Road
Zoom
DISCLAIMER: This map should be read in conjunction with the associated classification methodology outlined in 'Whenuapai Stream Classification Survey Methodology' (Morphum Environmental, 2016). Please be aware that the data contained in this map is provisional only as it was produced at a catchment modelled scale and not at an individual development scale. Auckland Council and its employees, while providing this data in good faith, accept no liability from any use of the data provided. Additionally there may be some changes in the future to this map once more detailed data becomes available Users are therefore cautioned in the use of this data for decisions of public or personal safety, and/or the or operational conduit of business that involves substantial money or operational consequences.

2 Appendix 2: Graphic Supplement

Boffa Miskell

SUPPORTING GROWTH ALLIANCE

NORTH WEST WHENUAPAI - NOTICE OF REQUIREMENTS

LANDSCAPE AND VISUAL EFFECTS ASSESSMENT APPENDIX 2 GRAPHIC SUPPLEMENT

AUGUST 2022

North West Whenuapai - Notice of Requirements

Contents

Boffa Miskell

www

Viewpoint Details

Date of Photography: 12:55 pm 9 December 2021 NZST

Horizontal Field of View	: 74°
Vertical Field of View	: 46°
Projection	: NA

Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W1 TRIG ROAD NORTH

View south east along Spedding Road

Date: 9 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 1

Boffa Miskell

www

Viewpoint Details

Date of Photography: 1:21 pm 9 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W1 TRIG ROAD NORTH

View south from Brigham Creek Road towards Trig Road

Date: 9 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 2

Boffa Miskell

www

Viewpoint Details

Date of Photography: 3:55 pm 9 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W1 TRIG ROAD NORTH

View south down outside residential property at 92 Trig Road

Date: 9 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 3

Existing View

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www

Viewpoint Details

Date of Photography: 3:58 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W1 TRIG ROAD NORTH

Residential properties at 84 and 82A Trig Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 4

Boffa Miskell

www

Viewpoint Details

Date of Photography: 3:58 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W1 TRIG ROAD NORTH

Residential property at 33 Trig Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 5

Boffa Miskell

www

Viewpoint Details

Date of Photography: 12:57 pm 9 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W2 MĀMARI ROAD

View west towards Mamari Road from Spedding Road

Date: 9 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 6

Boffa Miskell

www

Viewpoint Details

Date of Photography: 1:21 pm 9 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W2 MĀMARI ROAD

View south west towards Mamari from Brigham Creek Road

Date: 9 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 7

Boffa Miskell

www

Viewpoint Details

Date of Photography: 3:21 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W2 MĀMARI ROAD

View south along Mamari Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 8

Viewpoint Details

Date of Photography: 1:11 pm 9 December 2021 NZST

Horizontal Field of View	: 74°
Vertical Field of View	: 46°
Projection	: NA
Image Reading Distance @ A3 is 50 cm	

Data Sources: Photography - BML

NOR W2 MĀMARI ROAD

View north from Mamari Road

Date: 9 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 9

Boffa Miskell

www

Viewpoint Details

Date of Photography: 3:52 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W3 BRIGHAM CREEK ROAD

View north west towards Brigham Creek Road from Trig Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 10

Boffa Miskell

www

Viewpoint Details

Date of Photography: 3:31 pm 8 December 2021 NZST

Horizontal Field of View	: 74°
Vertical Field of View	: 46°
Projection	: NA
Image Reading Distance @ A3 is 50 cm	

Data Sources: Photography - BML

NOR W3 BRIGHAM CREEK ROAD

View east along Brigham Creek Road from the south east corner of the Whenuapai Settlement Open Space

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 11

Boffa Miskell

www

Viewpoint Details

Date of Photography: 3:29 pm 8 December 2021 NZST

Horizontal Field of View	: 74°
Vertical Field of View	: 46°
Projection	: NA
Image Reading Distance @ A3 is 50 cm	

Data Sources: Photography - BML

NOR W3 BRIGHAM CREEK ROAD

View east along Brigham Creek Road from the south east corner of the Whenuapai Settlement Open Space

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 12

Boffa Miskell

www

Viewpoint Details

Date of Photography: 1:00 pm 9 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W4 SPEDDING ROAD

View south east from Mamari Road towards Spedding Road

Date: 9 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 13

Existing View

Boffa Miskell

www

Viewpoint Details

Date of Photography: 3:49 pm 8 December 2021 NZST

Horizontal Field of View	: 74°
Vertical Field of View	: 46°
Projection	: NA
Image Reading Distance @ A3 is 50 cm	

Data Sources: Photography - BML

NOR W4 SPEDDING ROAD

View east from Trig Road towards the Spedding Road eastern extension

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 14

Boffa Miskell

www

Viewpoint Details

Date of Photography: 2:15 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W4 SPEDDING ROAD

View south west from Westpoint Drive towards the Spedding Road eastern extension

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 15

Boffa Miskell

www

Viewpoint Details

Date of Photography: 2:17 pm 8 December 2021 NZST

Horizontal Field of View : 40°
Vertical Field of View : 25°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W4 SPEDDING ROAD

View west from Rawiri Place towards the Spedding Road eastern extension

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 16

Boffa Miskell

www

Viewpoint Details

Date of Photography: 1:53 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W5 HOBSONVILLE ROAD (ALTERATION TO EXISTING DESIGNATION 1437)

View east along Hobsonville Road from outside 78 Hobsonville Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 16

Existing View

Boffa Miskell

www

Viewpoint Details

Date of Photography: 2:09 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W5 HOBSONVILLE ROAD (ALTERATION TO EXISTING DESIGNATION 1437)
View south along Hobsonville Road from outside 185A Hobsonville Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 17

Boffa Miskell

www

Viewpoint Details

Date of Photography: 1:19 pm 8 December 2021 NZST

Horizontal Field of View	: 74°
Vertical Field of View	: 46°
Projection	: NA
Image Reading Distance @ A3 is 50 cm	

Data Sources: Photography - BML

NOR W5 HOBSONVILLE ROAD (ALTERATION TO EXISTING DESIGNATION 1437)

View east from Hobsonville Road towards the SH16 Overbridge

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 18

Boffa Miskell

www

Viewpoint Details

Date of Photography: 1:31 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W5 HOBSONVILLE ROAD (ALTERATION TO EXISTING DESIGNATION 1437)

View east along Hobsonville Road from outside 75 Hobsonville Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 19

Existing View

Boffa Miskell

www

Viewpoint Details

Date of Photography: 2:35 pm 8 December 2021 NZST

Horizontal Field of View	: 74°
Vertical Field of View	: 46°
Projection	: NA
Image Reading Distance @ A3 is 50 cm	

Data Sources: Photography - BML

NOR W5 HOBSONVILLE ROAD (ALTERATION TO EXISTING DESIGNATION 1437)

View south along Hobsonville Road from opposite 311 Hobsonville Road

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 20

Boffa Miskell

www

Viewpoint Details

Date of Photography : 2:25 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W5 HOBSONVILLE ROAD (ALTERATION TO EXISTING DESIGNATION 1437)

View south along Hobsonville Road from outside Hobsonville School

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 21

Existing View

Boffa Miskell

www

Viewpoint Details

Date of Photography : 2:55 pm 8 December 2021 NZST

Horizontal Field of View : 74°
Vertical Field of View : 46°
Projection : NA
Image Reading Distance @ A3 is 50 cm

Data Sources: Photography - BML

NOR W5 HOBSONVILLE ROAD (ALTERATION TO EXISTING DESIGNATION 1437)

View south from the corner of Hobsonville War Memorial Park

Date: 8 December 2021 Revision: 0

Plan prepared for Supporting Growth

SP 22

3 Appendix 3: Landscape Effects Methodology

3.1 Overview

This Landscape Effects Assessment (LEA) has been undertaken with reference to Te Tangi a te Manu, Aotearoa New Zealand Landscape Assessment Guidelines[23]. The same methodology applies to the construction and operational stages of the works and for NoRs (W1, W2, W3, W4 and W5).

While natural character, landscape and visual amenity effects assessments are closely related, they form separate procedures. An assessment of the effects on natural character of an activity involves consideration of the proposed changes to the current condition compared to the existing. The assessment of the potential effects on landscape considers effects on physical attributes, landscape character and values. The assessment of visual effects considers how changes to the physical landscape affect the viewing audience.

Visual effects relate to the amenity values of a landscape including the natural and physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.

Landscape effects result from natural or induced change in the components, character or quality of the landscape. Usually these are the result of landform or vegetation modification or the introduction of new structures, facilities or activities into the landscape.

Natural character effects are in relation to natural or induced change to any streams, wetlands and their margins as outlined in the NZCPS guidance note[24]. These are usually the result of landform, vegetation or hydrological modification or the introduction of structures into the waterbody or its margin.

The process of change itself, that is the construction process and/or activities associated with the development, also carry with them their own visual effects, however, these are distinct from those generated by a completed development.

The landscape and visual effects generated by any particular proposal can, therefore, be perceived as:

- positive (beneficial), contributing to the visual character and quality of the environment.
- negative (adverse), detracting from existing character and quality of environment; or
- neutral (benign), with essentially no effect on existing character or quality of environment.

The degree to which landscape and visual effects are generated by a development depends on a number of factors, these include:

- The degree to which the proposal contrasts, or is consistent, with the qualities of the surrounding landscape.
- The proportion of the proposal that is visible, determined by the observer's position relative to the objects viewed.
- The distance and foreground context within which the proposal is viewed.
- The area or extent of visual catchment from which the proposal is visible.

[23] 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', [Final Draft subject to final editing, graphic design, illustrations, approved by Tuia Pito Ora/NZILA 5 May 2021]

[24] 'New Zealand Coastal Policy Statement' [issued 4 November 2010]. Accessed online 24.11.2021 *NZCPS 2010 Guidance note Policy 13: Preservation of natural character* (DOC, September 2013). (https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/coastal-management/nz-coastal-policy-statement-2010.pdf)

- The number of viewers, their location and situation (static, or moving) in relation to the view.
- The backdrop and context within which the proposal is viewed.
- The predictable and likely known future character of the locality.
- The quality of the resultant landscape, its aesthetic values and contribution to the wider landscape character to the area.

Change in a landscape and 'visibility' of a proposal does not of itself, constitute an adverse landscape or visual effect. It is the effect on the values of the landscape, positive, adverse or benign that need to be understood and evaluated.

3.2 Scale of Effects

In determining the magnitude of potential and actual landscape and visual effects of the Project, a consistent 7-point rating scale has been used that is based on the recommendations in the Te Tangi a te Manu, Aotearoa New Zealand Landscape Assessment Guidelines. The effects ratings referred to in this assessment are based upon a seven-point scale which ranges from 'very low' to 'very high' and are described in the table below.

7-point rating scale

Effect Rating	*Use and Definition*
Very High:	Total loss of key elements / features / characteristics, i.e. amounts to a complete change of landscape character and in views.
High:	Major modification or loss of most key elements / features / characteristics, i.e. little of the pre-development landscape character remains and a major change in views. <u>Concise Oxford English Dictionary Definition</u> High: adjective- Great in amount, value, size, or intensity.
Moderate-High:	Modifications of several key elements / features / characteristics of the baseline, i.e. the pre-development landscape character remains evident but materially changed and prominent in views.
Moderate:	Partial loss of or modification to key elements / features / characteristics of the baseline, i.e. new elements may be prominent in views but not necessarily uncharacteristic within the receiving landscape. <u>Concise Oxford English Dictionary Definition</u> Moderate: adjective- average in amount, intensity, quality or degree
Low-Moderate:	Minor loss of or modification to one or more key elements / features / characteristics, i.e. new elements are not prominent within views or uncharacteristic within the receiving landscape.

Effect Rating	*Use and Definition*
Low:	Little material loss of or modification to key elements / features / characteristics. i.e. modification or change is not uncharacteristic or prominent in views and absorbed within the receiving landscape. Concise Oxford English Dictionary Definition Low: adjective- 1. Below average in amount, extent, or intensity.
Very Low:	Negligible loss of or modification to key elements/ features/ characteristics of the baseline, i.e. approximating a 'no change' situation and a negligible change in views.

Mitigation

For effects that are very low or low, mitigation is generally not required. Additional landscape mitigation may be required for landscape effects of a low-moderate to high rating to reduce effects to a lower degree. For effects that are very high, mitigation is unlikely to reduce the level of effect to any discernible degree. Operational effects are assessed after mitigation planting has been established, typically this is between 3-5 years after implementation. While planting establishes it is anticipated that adverse effects will reduce over time.

3.3 Methodology Breakdown

The methodology that forms the basis for the assessment is set out below:

- Identification of relevant statutory provisions and non-statutory guidance relating to landscape;
- Analysis and description of existing landscape elements, features and character of the existing 'Baseline Landscape' within the NoRs and surrounding areas;
- Analysis and description of landscape elements, features and character of the likely future environment within the NoRs and surrounding areas;
- Analysis and description of perceptual, sensory and associative qualities within the Project areas, and the identification of the viewing audience and visual catchment;
- Summary of landscape values within the Project areas, including inputs from other specialists such as ecology, stormwater and historic heritage;
- Evaluation of the sensitivity of the landscape within the Project areas to landscape change arising from transport infrastructure upgrades;
- Analysis and description of the development proposal including construction methodology, timeline and discussion of avoidance and mitigation measures already integrated through the design;
- Identification of the principal elements of the Project (effects generators) likely to result in landscape, natural character and visual effects;
- Identification of temporary (construction) vs permanent (operational) effects of the Projects;
- Identification of general and targeted mitigation measures to reduce the magnitude of likely effects;
- Assessment of effects (adverse, neutral and/or positive) on the bio-physical aspects of the landscape resource, landscape character, natural character and visual amenity, taking account of the proposed mitigation measures; and
- Summary of the overall landscape and visual effects of the Projects and an overall determination of the significance of landscape and visual effects.

3.4 Landscape Values

Considering the absence of any scheduled high value landscape areas (ONLs, ONFs. HNCs or ONCs) at a national, regional or district level within or directly adjacent to the Project areas, a summary is provided of local landscape values within each Project Group. Local values generally considered three broad categories including: biophysical, perceptual and associative values.[25]

3.5 Landscape Sensitivity

The level of sensitivity of the sites and wider rural areas to land use change is influenced by the latest planning direction (AUP:OP and also the Whenuapai Structure Plan) that has placed the sites, local landscape and NoRs into the Future Urban Zone (FUZ) and some live mixed housing urban zoning around Whenuapai Local Centre.

Notwithstanding the above, the interface between the land and water (riparian margins) is particularly sensitive to landscape change and under Part 2 of the RMA (section 6(a)) and relevant policies of the National Policy Statement for Freshwater 2020 (NPS-FM), the values within these areas of the landscape should generally be protected from inappropriate subdivision, use and development.

Other landscape attributes may also be sensitive to the effects of landscape change such as topographical and landform features, vegetation (notable trees or patterns of contiguous land cover), existing sensitivity associated with the built environment and views afforded to landmarks and/or landscape features within the contextual landscape. A notable tree is a tree or group of trees that a community or nation regards as being of special importance. These are listed in the Schedule 10: notable trees schedule in the AUP:OP[26].

3.6 Landscape Effects

Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced over time. This may in turn affect the perceived value ascribed to the landscape.

Potential landscape effects in this assessment relate to the following landscape attributes:

- Biophysical - Abiotic: Geophysical processes (landform) and drainage patterns.
- Biophysical – Biotic: Vegetation cover, quality and pattern (native and exotic).
- Human attributes: Land uses, active and passive recreation, amenity and built form.

Landscape and visual effects are assessed in two parts as outlined below; firstly, through the construction period of the Projects where the bio-physical and human attributes within the Project area are required to be modified to implement the Project. Landscape and visual effects during the construction phase are generally considered to be temporary and dynamic in nature and may temporarily be heightened by the intervention of heavy machinery, areas of exposed ground and the use of construction service areas. In the second part (the operational phase of the Projects), the overall significance and value of landscape and visual change is explored and ultimately the Project's impact on landscape character, natural character and visual amenity is assessed.

[25] Landscape Guideline: Appendix 1: NZTA Landscape and Visual Assessment Guidelines

[26] AUP:OP Schedule 10: Notable Trees, https://unitaryplan.aucklandcouncil.govt.nz/Images/Auckland%20Unitary%20Plan%20Operative/Chapter%20L%20Schedules/Schedule%201 0%20Notable%20Trees%20Schedule.pdf [accessed 5 July 2022]

The two categories of effects are outlined as follows:

- **Temporary Effects** (Construction Effects): Describes the anticipated impacts on the bio-physical elements and features of the landscape resource (landform, vegetation and hydrology) resulting from the construction of the Project. It also includes visual amenity effects for both public and private viewing audiences from construction works. The construction activities required to implement the Project are categorised under the following broad headings:
    - **Site enabling works** - site establishment, demolition and vegetation clearance;
    - **Project formation works** - bulk earthworks, retaining walls, park and ride formation, platform and overhead structures, culvert upgrades, stormwater wetlands construction.

- **Permanent Effects** (Operational Effects): Describes the effects on the landscape of completed works (including integrated landscape mitigation measures), the significance of physical landscape change and ultimately the resulting effects of the Projects on landscape character, natural character and visual amenity for both public and private viewing audiences.
    - **Finishing works** – include lighting, signage, road, footpath/cycleway details and line markings, streetscape elements and landscaping (including trees, mitigation planting and riparian/stormwater device/wetland planting).

3.7 Natural Character Effects

Section 6(a) of the RMA identifies as a matter of national importance to recognise / provide for the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers[27] and their margins, and the protection of them from inappropriate subdivision, use, and development.

Assessing existing natural character is primarily concerned with the degree to which natural processes, natural patterns and natural elements have undergone human modification. Hydrological and ecological survey and assessment for the Project area generally underpin the landscape evaluation of existing natural character values.

The natural character assessment for this Project applies to the existing water bodies and wetlands associated with the Sinton Stream, Pikau Stream, Totara Creek, Waiarohia Stream, Rawiri Stream and Trig Stream.

3.8 Visual Effects

Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual effects are considered for both temporary (construction effects) and permanent (operational effects) of the Projects.

Potential effects considered in this assessment relate to the following visual amenity attributes:

- Visual quality and composition (legibility, coherence, setting, scenic quality)
- Visibility (extent of visibility to the Project area)

[27] A 'river' is defined in the RMA as a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse.

- Views (viewing audience and views afforded to, from and within the Project area).

The nature and magnitude of the visual effect can be influenced by a number of factors such as:

- The extent to which the Project areas are visible;
- Legibility and whether there are intervening elements in the landscape that restrict views towards the Project area;
- Whether or not aspects of the Project appear 'at odds or integrated' with existing (or anticipated future) landscape character and composition;
- Distance between the viewer and the Project area;
- The nature of the viewing audience, numbers and extent of the visual catchment.

The proposed road corridor NoRs are located within an evolving future urban landscape, which in itself will bring about substantial landscape and visual change. Therefore, the visual composition that exists today is likely to change considerably over the course of the next decade.

Based on the above, the visual assessment for the Projects focuses on the potential visual effects arising (through the construction and operation of the Projects) within the proposed NoR areas, and localised landscape. The focus of the assessment is on the nature and significance of effects within the Project areas and how that translates to effects for immediately adjacent land uses (existing and future, but acknowledging that the existing land uses will change in the future).

Assessment photography was obtained during the project site visit in November 2021 and December 2022. The outlook from viewpoints that were captured onsite were photographed and assessed in variable weather conditions and at standing eye level. The photographs were taken with a digital SLR camera.

3.9 Limitations

This landscape assessment does not specifically address and respond to Mana whenua values from a landscape planning perspective. However, Mana whenua knowledge and associative values of the project landscape has been shared through the separate and parallel engagement between the Project team and Mana whenua who have expressed interest in the Projects. There are several crossovers with related specialties including urban design, hydrology, ecology, arboriculture and historic heritage. This report references the latest data available in respect of these matters at the time of issue.

All site assessments have been undertaken from public land and supported through detailed desktop GIS mapping and aerial photograph information.

3.10 Project Assumptions

The findings of this landscape effects assessment are underpinned by the following assumptions:

- For the FUZ areas, it is likely that construction of the road corridors will occur ahead of, or in parallel to, the urbanisation of these areas. Therefore, the starting assumption is that the roads will be constructed in the existing village and semi-rural environment and operate in an urban environment.
- Enabling work is expected to begin on stage 1 of the roads in 2023. The overall duration for the works is estimated to be approximately five years i.e. completed by 2028. Construction timings are

indicative and further details will be confirmed closer to the time of construction and at the OPW stage.
- Areas that are already urbanised, or are planned to be (as per precinct plans in the AUP:OP), construction and operation of the transport corridors will be within an urban environment.
- The Whenuapai Structure Plan can be relied upon to reasonably anticipate the likely future context of the proposed corridors.
- The proposed designation footprint has sufficient space to enable design changes to occur through the detailed design phase of the Project, in order to integrate the road corridor from a visual and urban design perspective with adjoining land uses.

3.11 Statutory Guidance

3.11.1 Notice of Requirement

This assessment has been prepared to support the NoRs for the projects. The process for consideration of a NOR is set out in section 168 of the RMA. This includes consideration of the actual or potential effects (including positive effects) on the environment of allowing the requirement under the Resource Management Act (RMA).

Part 2, Schedule 6, Clause 33(7)(b) in Part 8 of the RMA, in particular ss 168, 171 and 176 of the RMA. The designation once confirmed authorises the activities relating to the Project or work enabled by the designation that would otherwise require a resource consent for land use activities pursuant to section 9(3) of the RMA. This assessment therefore focuses on the landscape and visual effects of the land use activities that will be authorised by the proposed designations for the Project. Landscape and visual effects arising from activities that require future regional consents will be assessed as part of a future consent process.

3.12 Non-Statutory Guidance

The Whenuapai Structure Plan indicates how the future urban environment may develop over time, subject to future plan change processes. As such, it is possible to describe, in general terms, the likely future urban framework for land within and adjacent to the proposed Trig Road North, Māmari Road, Brigham Creek Road, Hobsonville Road and Spedding Road East corridors.

3.12.1 Whenuapai Structure Plan September 2016

The stated vision for Whenuapai

> *“Whenuapai is a liveable, compact and accessible place with a mix of high quality residential and employment opportunities. It makes the most of its extensive coastline, is well connected to the wider Auckland Region, and respects the cultural and heritage values integral to its distinctive character.”*

Seven key objectives are identified, the sixth and seventh relate broadly to landscape as follows:

#6. Enhance the natural environment and protect natural heritage

- freshwater quality throughout the catchment is enhanced over time
- scheduled natural heritage is protected
- the overall biodiversity of the area is improved over time

- environmental constraints, such as coastal erosion and contaminated land, are adequately managed
- sedimentation of the Upper Waitematā Harbour is carefully managed through subdivision and development processes.

#7. The provision of quality open spaces

- a network of high-quality open spaces and recreation areas meet the needs of the growing Whenuapai community
- there are ample opportunities for cycling, sport, passive recreation and social interaction
- stream networks are utilised as recreational routes and connections between open spaces and the coast where practicable
- public access to, and along, the coast is enhanced where practicable.

And two further key outcome that broadly relate to landscape:

- "*2. Quality- built environment*" - the street network enhances Whenuapai's sense of place by favouring pedestrians, cyclists and public transport modes.
- "*3. A well connected Whenuapai*" - dedicated cycle and pedestrian footpaths provide safe, connected and high amenity linkages between areas of activity at a local scale.

Landscape does not feature strongly in the vision and /or the key outcomes for the Whenuapai Structure Plan with 8.2.4 Open Space and Recreation, providing the greatest specific direction. The "indicative esplanade" connections and provisions of Neighbourhood Parks, Sports Parks and Suburb Parks throughout the structure plan area are however referenced.

Land Use

Future development of land within the structure plan area will have a significant shift from rural land use to urban land use. These future land uses include; low / medium / high density residential; Business; Mixed Use (BMU); Local Centre (LCZ); and; Neighbourhood Centre zone (NCZ). The southern portion of the structure plan area is primarily designated for business use with the balance areas for residential uses at a variety of densities. In all cases, there is expected to be a significant shift from rural to urban land use which means that the existing landscape character and visual amenity surrounding the proposed designations is likely to experience substantial change over the next 10-30 years.

The staging proposal of the structure plan outlines two stages. Stage 1 is predominantly to the east of the structure plan area adjacent to the Upper Harbour Motorway and two outlying areas; one to the west of the structure plan and one at the existing Whenuapai town centre. Stage 1 includes areas of residential and business land that will be developed up to 2026. The balance of the Structure plan area in Stage 2 further required investment in new infrastructure between 2017 – 2027.

Whenuapai Structure Plan Natural Character, Landscape and Visual Assessment

A Natural Character, Landscape and Visual Assessment[28] was undertaken during the production of the structure plan to identify any potential landscape effects that may result from future land use activities. The landscape assessment identifies that while there are no areas of high natural character or landscape, the structure plan area retains relatively high levels of amenity because of its largely open rural nature, mature trees, and proximity to the Upper Waitematā Harbour.

[28] 7.9 Natural character, landscape and visual of the Whenuapai Structure Plan.

The assessment acknowledges that there will be a level of adverse effects on the landscape as a result of changing land uses, but that this also presents opportunities to enhance some landscape outcomes. The assessment makes the following recommendations to mitigate likely adverse effects:

- Maintain and enhance areas of high visual amenity, especially around the northern part of the structure plan area with appropriate built form, open space and plantings
- Restore and enhance biodiversity through planting, and weed and pest control
- Connect habitats along coastal and stream networks
- Improve the quality of stormwater entering the upper Waitematā harbour
- Create integrated networks of public open space
- Introduce appropriate plantings in new development
- Provide landscape variety to build on existing characteristics of different parts of the structure plan area.

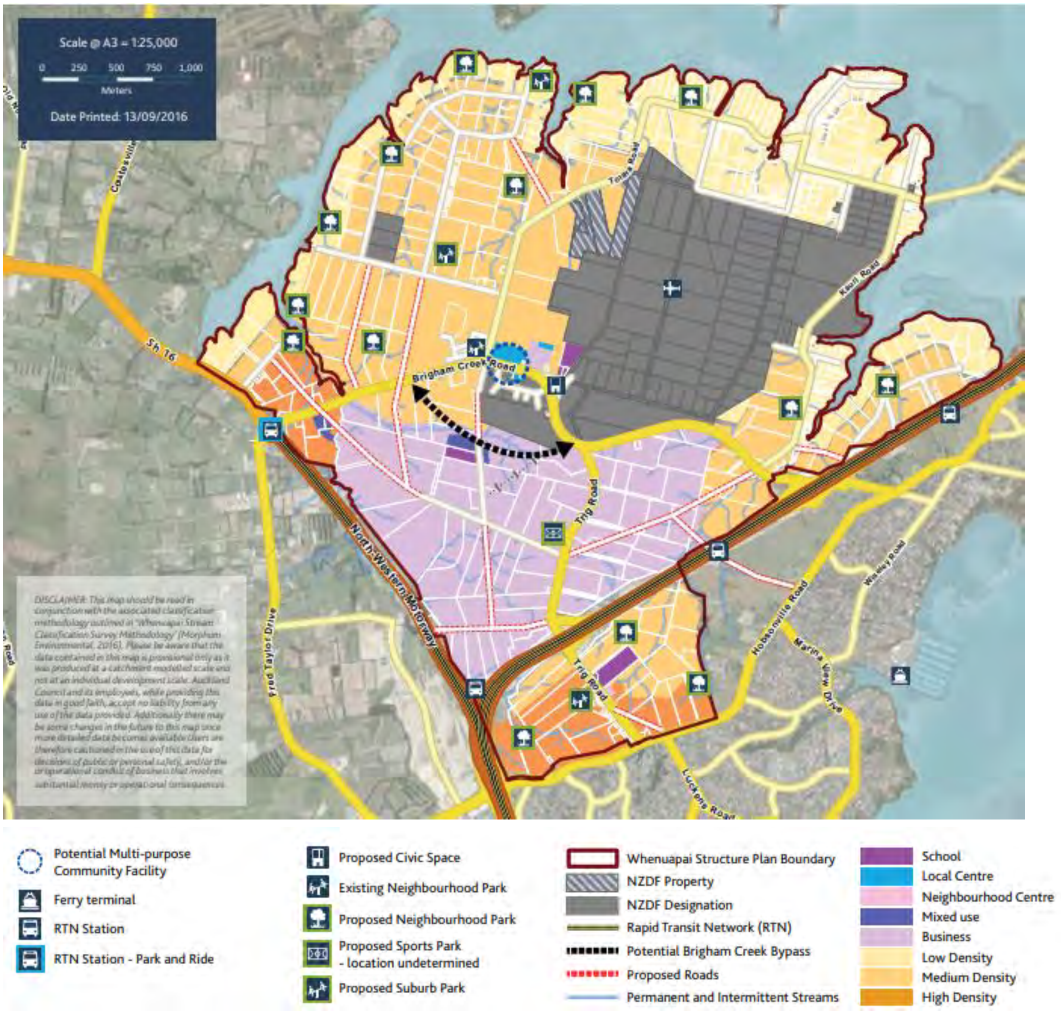

Figure 12-1: Whenuapai Structure Plan Map

3.12.2 National Policy Statement on Urban Development – NPS UD

The National Policy Statement-Urban Development (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 policy statement. 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 density and development capacity through "up-zoning" and more enabling planning provisions:

- Around centre zones
- In areas with employment opportunities
- In areas that are well serviced by existing or planned public transport or where there is high demand for housing or business
- Along rapid transit stops

In the context of this Project, the NPS-UD Policy 1 defines what constitutes a well-functioning urban environment as one that provides "good accessibility for all people between housing, jobs, community services, natural spaces, and open spaces, including by way of public or active transport". The implications of NPS-UD Policy 3 are that development of six storeys or more building heights are more likely within the context of an expanded road corridor.

ATTACHMENT 55

NORTH-WEST WHENUAPAI
ASSESSMENT OF
HERITAGE / ARCHAEOLOGY EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Whenuapai Assessment of Heritage / Archaeology Effects

December 2022

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

Responsibility	Name
Author	Dr. Hans-Dieter Bader (AEE Specialist – Archaeology)
Reviewer	Dr. Janice Adamson (AEE Specialist – Archaeology)
Approver	John Daly

Revision Status

Version	Date	Reason for Issue
1.0	16/12/2022	Notice of Requirement Lodgement

Table of Contents

Table of Figures

Table of Tables

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
CHI	Cultural Heritage Inventory
FTN	Frequent Transit Network
FUZ	Future Urban Zone
HNZPT	Heritage New Zealand Pouhere Taonga
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014
NoR	Notice of Requirement (under the Resource Management Act 1991)
NZAA	NZ Archaeological Association
PPC5	Proposed Plan Change 5
RMA	Resource Management Act 1991
SH16	State Highway 16
SH18	State Highway 18
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Programme
Waka Kotahi	Waka Kotahi NZ Transport Agency
WW2	World War 2

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
koiwi	Human remains
tikanga	Customs: “the way things are done”
wāhi tapu	Sacred place
Whenuapai Assessment Package	Four Notices of Requirement and one alteration to an existing designation for the Whenuapai Arterial Transport Network for Auckland Transport.

1 Executive Summary

Assessment undertaken

The assessment is based on:

- A review of the heritage databases at Auckland Council, New Zealand Archaeological Association Site Recording Scheme and Heritage New Zealand Pouhere Taonga (**HNZPT**)
- a review of historic maps
- published and unpublished publications on the history of the study area
- previously undertaken archaeological investigations and research
- landscape and environment
- oral traditions where available

Assessment criteria used are from:

- Heritage New Zealand Pouhere Taonga Act (HNZPTA)
- Resource Management Act (RMA)
- Auckland Unitary Plan Operative in Part (**AUP:OP**)

All cultural heritage sites, archaeological sites and risk areas where unrecorded, sub surface archaeological features could be encountered within 200 metres of the extent of each notice of requirement (**NoR**) are considered as part of this assessment.

NoR W1 Trig Road (North)

Results of assessment and recommended measures

There are no recorded historic heritage or archaeological sites within the extent of NoR W1. One historic anti-aircraft gun emplacement is within 200m of the extent. This site will be discussed further as part of NoR W4 as it is not impacted by the works on NoR W1. As a result, there are no adverse effects on recorded historic heritage or archaeological sites by NoR W1.

Construction around wetlands and streams will allow environmental archaeological research to be undertaken that could clarify the dates, sequence and details of the anthropogenic vegetation change from forest to open fern lands as it was in 1853.

The potential for unrecorded archaeological deposits and features to be encountered needs to be taken into account for all earthworks that include topsoil stripping, not just within the extent of NoR W1, but also other areas such as haul roads and laydown areas. Once the earthworks are finished there will be no effects on archaeological or heritage sites during operation of NoR W1.

There is a small risk of potential adverse effects due to unrecorded archaeological sites being encountered. However as there are no navigable stream crossings within NoR W1, the risk of encountering unrecorded archaeological sites is small This small risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority from HNZPT under the HNZPTA.

Any processes regarding tikanga, especially around koiwi, should be discussed with mana whenua before the start of the project.

Conclusion

In conclusion there are no significant adverse effects on historic heritage or archaeological sites from NoR W1.

NoR W2 Māmari Road

Results of assessment and recommended measures

There are no heritage sites or archaeological sites recorded within the extent of NoR W2.

Construction around wetlands and streams will allow environmental archaeological research to be undertaken that could clarify the dates, sequence and details of the anthropogenic vegetation change from forest to open fern lands as it was in 1853.

The potential for unrecorded archaeological deposits and features to be encountered needs to be taken into account for all earthworks that include topsoil stripping not just within the extent of NoR W2, but also other areas such as haul roads and laydown areas. Once the earthworks are finished there will be no effects on archaeological or heritage sites during operation of NoR W2.

The crossing of the Sinton Stream which leads into the Totara Creek has the potential to have unrecorded archaeological features. The risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority from HNZPT under the HNZPTA.

Any processes regarding tikanga, especially around koiwi, should be discussed with mana whenua before the start of the project.

Conclusion

In conclusion there are no significant adverse effects on historic heritage as a result of NoR W2, and there are no residual adverse effects on historic heritage with the recommended mitigation in place.

NoR W3 Brigham Creek Road

Results of assessment and recommended measures

There are no recorded archaeological sites or historic heritage sites within the extent of NoR W3. However a shell midden site is close by and indicates that the stream crossings (Totara Creek and Waiarohia Stream) are high risk areas for the discovery of sub surface and unrecorded archaeological features. A group of 4 native trees along Airport Road are on the AUP:OP list of notable trees. However, they are outside the proposed designation boundary.

Construction around wetlands and streams will allow environmental archaeological research to be undertaken that could clarify the dates, sequence and details of the anthropogenic vegetation change from forest to open fern lands as it was in 1853.

The potential for unrecorded archaeological deposits and features to be encountered needs to be taken into account for all earthworks that include topsoil stripping, not just within the extent of NoR W3, but also within other areas such as haul roads and laydown areas. Once the earthworks are finished there will be no adverse effects on archaeological or heritage sites during operation of NoR W3.

As set out above, two navigable stream crossings close to a recorded archaeological site present a reasonable risk of unrecorded archaeological features being encountered. The risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority from HNZPT under the HNZPTA.

Any processes regarding tikanga, especially around koiwi, should be discussed with mana whenua before the start of the project.

Conclusion

In conclusion there are no residual adverse effects on historic heritage with the recommended mitigation in place.

<u>NoR W4 Spedding Road</u>

Results of assessment and recommended measures

There are no historic heritage sites or archaeological sites recorded within the extent of NoR W4. However a World War 2 (**WW2**) anti-aircraft gun emplacement consisting of several gun pits and ancillary buildings of various functions is recorded in the Cultural Heritage Inventory (**CHI**) and is adjacent to NoR W4. There is a risk that some subsurface features could be found during construction of NoR W4. However the current condition of the site is not recorded as recently a house has been built close to the structures. A plan change has also been proposed (**PPC5**) for a heritage overlay for this site.

There is also a risk that archaeological features may be uncovered at the stream crossing of the Totara Creek. The stream crossings of the Waiarohia and Rāwiri streams present a low risk of unidentified archaeological features being uncovered as both streams have been recently modified.

Construction around wetlands and streams will allow environmental archaeological research to be undertaken that could clarify the dates, sequence and details of the anthropogenic vegetation change from forest to open fern lands as it was in 1853.

The potential for unrecorded archaeological deposits and features to be encountered needs to be taken into account for all earthworks that include topsoil stripping not just within the extent of NoR W4, but also within other areas such as haul roads and laydown areas. Once the earthworks are finished there will be no effects on archaeological or heritage sites during operation of NoR W4.

As set out above, there is a low risk of encountering subsurface ancillary structures belonging to the WW2 gun emplacements. As they are not archaeological sites but can be considered having heritage value under the AUP:OP criteria of historical, technological and contextual values, discussions with the Auckland Council Heritage Unit are encouraged.

The small risk of encountering unrecorded archaeological features can also be mitigated by a precautionary archaeological authority being obtained from HNZPT under the HNZPTA.

Any processes regarding tikanga, especially around koiwi, should be discussed with mana whenua before the start of the project.

Conclusion

In conclusion there are no residual adverse effects with the recommended mitigation in place.

NoR W5 Hobsonville Road

Results of assessment and recommended measures

Within the 200m buffer of NoR W5, several historic heritage structures and notable trees are recorded. Apart from one notable tree located within NoR W5 there is little risk of encountering archaeological sites during construction of NoR W5.

Construction around wetlands and streams will allow environmental archaeological research to be undertaken that could clarify the dates, sequence and details of the anthropogenic vegetation change from forest to open fern lands as it was in 1853.

The potential for unrecorded archaeological deposits and features to be encountered needs to be taken into account for all earthworks that include topsoil stripping not just within the extent of NoR W5, but also within other areas such as haul roads and laydown areas. Once the earthworks are finished there will be no effects on archaeological or heritage sites during operation of NoR W5.

The small risk of encountering archaeological features during construction could be mitigated by applying for an archaeological authority for pre and post Contact archaeological features from HNZPT under the HNZPTA.

Any processes regarding tikanga, especially around koiwi, should be discussed with mana whenua before commencing the project.

Conclusion

In conclusion there are no significant adverse effects on historic heritage due to NoR W5 and there are no residual adverse effects with the recommended mitigation in place.

2 Introduction

This historic heritage / archaeology assessment has been prepared for the North West Local Arterial Network Notices of Requirement (**NoRs**) for Auckland Transport (**AT**) (the "Whenuapai Assessment Package"). The NoRs are to designate land for future local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West Whenuapai area of Auckland.

The North West growth area is approximatively 30 kilometres north west of Auckland's central city. It makes a significant contribution to the future growth of Auckland's population by providing for approximately 42,355 new dwellings and employment activities that will contribute 13,000 new jobs across the North West. Whenuapai is one of these growth areas, located between State Highway 16 (**SH16**) and State Highway 18 (**SH18**) and at present is largely rural (but Future Urban Zoned) with an existing community consisting of new and more established residential, business and local centre land uses. This growth area is expected to be development ready by 2018-2022 with 401 hectares to accommodate 6,000 dwellings. Furthermore, a Whenuapai Structure Plan was adopted by the Council in 2016 and sets out the framework for transforming Whenuapai from a semi-rural environment to an urbanised community over the next 10 to 20 years.

The Whenuapai Assessment Package will provide route protection for the local arterials, which include walking, cycling and public transport (including the Frequent Transit Network (**FTN**)), needed to support the expected growth in Whenuapai.

This report assesses the effects on historic heritage / archaeology of the North West Whenuapai Assessment Package identified in Figure 5-1 and Table 2-1 below.

The Whenuapai Assessment Package comprises five separate projects which together form the North West Whenuapai Arterial Network. The network includes provision for general traffic, walking and cycling, and frequent public transport

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

Table 2-1: North West Whenuapai Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR W1	Trig Road North
NoR W2	Māmari Road
NoR W3	Brigham Creek Road
NoR W4	Spedding Road
NoR W5	Hobsonville Road (alteration to existing designation 1437)

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Whenuapai Assessment Package. Its purpose is to inform the AEE that accompanies the four NoRs and one alteration to an existing designation for the Whenuapai Assessment Package sought by AT.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Whenuapai Assessment Package on the existing and likely future environment as it relates to effects on historic heritage and archaeology and recommends measures that may be implemented to avoid and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the known historic heritage, archaeological sites, areas of risk to encounter unrecorded sites and context of the Whenuapai Assessment Package area;
b) Identify and describe the actual and potential effects on historic heritage and archaeological sites of each project corridor within the Whenuapai Assessment Package;
c) Recommend measures as appropriate to avoid or mitigate actual and potential effects on historic heritage and archaeological sites (including any conditions/management plan required) for each project corridor within the Whenuapai Assessment Package; and
d) Present an overall conclusion of the level of actual and potential effects on historic heritage and archaeological sites for each project corridor within the Whenuapai Assessment Package after recommended measures are implemented.

This report is not considering Māori cultural values and / or wāhi tapu. Mana whenua will have to be consulted for those values and places.

2.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines.
b) Description of each project corridor and project features within the Whenuapai Assessment Package as it relates to historic heritage and archaeology.
c) Identification and description of the existing and likely future heritage landscape, separated into physical environment, Māori settlement history, European settlement history and previous archaeological projects as far as it is relevant to describe positive and adverse effects.
d) Description of the actual and potential positive effects on heritage and archaeology of each project corridor.
e) Description of the actual and potential adverse effects on heritage and archaeology of construction of each project corridor.
f) Description of the actual and potential adverse effects on heritage and archaeology of operation of each project corridor.
g) Recommended measures to avoid or mitigate potential adverse effects on heritage and archaeology; and
h) Overall conclusion of the level of potential adverse effects on heritage and archaeology of each project corridor after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the background and context of the project. The AEE also contains a detailed description of works to be authorised for the project, likely staging 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 effects on historic heritage and archaeology. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

2.3 Preparation for this Report

Preparation for this report included desktop investigations and drive by visits from public land.

Sources for desktop research include:

- NZ Archaeological Association (NZAA) online site recording database Archsite
- LINZ database of historic maps and survey plans via Quickmaps
- Heritage New Zealand Heritage List/ Rārangi Kōrero
- Heritage New Zealand online reports database
- Auckland Council Geomaps GIS viewer
- Auckland Council CHI
- Auckland Council Archives (online resources)
- Archives New Zealand (online resources)
- Local histories – published and unpublished
- Archaeological reports
- Aerial photographs
- National Library cartographic collection
- Alexander Turnbull Tiaki online collection
- Auckland Museum pictorial collections

The following archaeological reports were of particular interest:

Foster, R., Felgate, M., 2011, *Archaeological Investigation of Field Cottage and Ocklestone House,* Unpublished report to NZ Transport Agency, Auckland.

Hawkins, S., Campbell, M.,2020*, 120 Hobsonville Road, R11/2965 (HNZPTA authority 2019/697): final report,* Unpublished report to Savill and Foodstuffs Ltd, Auckland.

MacReady, S., 2019, *SH16 IMPROVEMENTS, BRIGHAM CREEK TO WAIMAUKU: PRELIMINARY ARCHAEOLOGICAL ASSESSMENT*, Unpublished report to NZ Transport Agency Safe Roads Alliance, Auckland.

Shackles, R. et.al., 2019, *COASTAL WALKWAY SUNDERLAND-HUDSON PRECINCT, HOBSONVILLE POINT: ARCHAEOLOGICAL MONITORING AND INVESTIGATION REPORT*, Unpublished report to Hobsonville Land Company, Auckland.

The drive by visits used only public roads and public land to get close to areas of interest pinpointed by the desktop research. It was decided that a detailed site visit with landowner notification is not necessary for the NoR surveys. The risk to historic heritage and the archaeological resource could be sufficiently assessed without going onto private land.

As a result of the site visits both Auckland Council and HNZPT officers were contacted for latest, up to date information for specific sites.

Photos were taken during the site visits and the locational information updated as required.

3 Assessment Methodology

3.1 Statutory Requirements

There are two main pieces of legislation in New Zealand that control work affecting archaeological sites. These are the HNZPTA)and the RMA.

This assessment considers heritage places and archaeological sites as defined in the HNZPTA, scheduled sites in the AUP:OP and also heritage sites that are recognised in the Auckland Council CHI.

3.1.1 Heritage New Zealand Pouhere Taonga Act 2014

HNZPT administers the HNZPTA. The HNZPTA contains a consent (authority) process for any work affecting archaeological sites, where an archaeological site is defined as:

> *"6(a) any place in New Zealand, including any building or structure (or part of a building or structure), that—*
>
> *(i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and*
>
> *(ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and*
>
> *6(b) includes a site for which a declaration is made under section 43(1)"*

Any person, who intends carrying out work that may damage, modify or destroy an archaeological site, or to investigate a site using invasive archaeological techniques, must first obtain an authority from HNZPT. The process applies to sites on land of all tenure including public, private and designated land. The HNZPTA contains penalties for unauthorized site damage or destruction.

The archaeological authority process applies to all sites that fit the HNZPTA definition, regardless of whether:

- The site is recorded in the NZAA Site Recording Scheme or registered by HNZPT;
- The site only becomes known about as a result of ground disturbance; and/ or
- The activity is permitted under a district or regional plan, or a resource or building consent has been granted.

HNZPT also maintains The New Zealand Heritage List Rārangi Kōrero of Historic Places, Historic Areas, Wāhi Tupuna/Tipuna, Wāhi Tapu and Wāhi Tapu Areas. The New Zealand Heritage List Rārangi Kōrero includes some significant archaeological sites. The purpose of The New Zealand Heritage List Rārangi Kōrero is to inform members of the public about such places and to assist with their protection under the RMA.

3.1.2 Resource Management Act 1991

The RMA promotes the sustainable management of natural and physical resources (RMA Section 2, 5(1)).

RMA Section 2, 5(2) states that:

*In this Act, **sustainable management** means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—*

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations

The protection of historic heritage from inappropriate subdivision, use, and development is identified as a matter of national importance (section 6(f)).

Historic heritage is defined in the RMA as those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, derived from archaeological, architectural, cultural, historic, scientific, or technological qualities.

Historic heritage includes (RMA, section 2):

- historic sites, structures, places, and areas;
- archaeological sites;
- sites of significance to Maori, including wāhi tapu; and
- surroundings associated with the natural and physical resources

These categories are not mutually exclusive and some archaeological sites may include above ground structures or may also be places that are of significance to Māori. In Auckland the AUP:OP has specific provisions for historic heritage and places of significance to mana whenua. Those places of significance to mana whenua also have the potential to contain archaeological value. It is noted that scheduled historic heritage places have a stronger protection than archaeological sites that are not scheduled in the AUP:OP.

3.1.3 Assessment Criteria

> *"Archaeological values relate to the potential of a place to provide evidence of the history of New Zealand. This potential is framed within the existing body of archaeological knowledge, and current research questions and hypotheses about New Zealand's past. An understanding of the overall archaeological resource is therefore required"* (Heritage New Zealand Pouhere Taonga 2019:9).

The assessment criteria are split into two sections: Main Archaeological values and Additional values:

The first archaeological values look at an ***intra*** *(within the)* ***site*** *context.*

- **Condition**:
  How complete is the site? Are parts of it already damaged or destroyed?
  Condition varies from undisturbed to destroyed and every variation in between. It is also possible that the condition of different parts of the site varies.

- **Rarity/Uniqueness:**
  Rarity can be described in a local, regional and national context. Rarity can be rare as a site, or rarely examined or today a rare occurrence in the records.

- **Information Potential:**
  How diverse are the features to be expected during an archaeological excavation on the site?
  How complete is the set of features for the type of site?
  Can the site inform about a specific period or specific function?

The second set of archaeological values are ***inter site*** *(between sites) context* criteria:

- **Archaeological landscape / contextual value:**
  What is the context of the site within the surrounding archaeological sites?
  The question here relates to the part the site plays within the surrounding known archaeological sites. A site might sit amongst similar surrounding sites without any specific features. Or a site might occupy a central position within the surrounding sites. Though a site can be part of a complete or near complete landscape, whereby the value of each individual site is governed by the value of the completeness of the archaeological landscape.

- **Amenity value**:
  What is the context of the site within the physical landscape?
  This question is linked to the one above but focuses onto the position of the site in the landscape. Is it a dominant site with many features still visible or is the position in the landscape ephemeral with little or no features visible? This question is also concerned with the amenity value of a site today and its potential for onsite education.

- **Cultural Association:**
  What is the context of the site within known historic events or to people?
  This is the question of known cultural association either by tangata whenua or other descendant groups. This question is also concerned with possible commemorative values of the site.

Other values could include (Heritage New Zealand Pouhere Taonga 2019:9):

- Architectural
- Historic
- Scientific
- Technological
- Cultural

The last value, cultural, acknowledges if there is an impact on Māori cultural values. This assessment will not evaluate these, but rather state their relevance in relation to the other values. The HNZPTA requires an assessment of Maori values as part of archaeological authority applications. Generally, HNZPT prefers that such an assessment be provided by tangata whenua (Heritage New Zealand Pouhere Taonga 2019:10).

In addition, the AUP:OP (Part 1, Chapter B: 5.2.2) outlines a place as having historic heritage value if it has one or more of the following values:

Identify and evaluate a place with historic heritage value considering the following factors:

(a) historical: the place reflects important or representative aspects of national, regional or local history, or is associated with an important event, person, group of people, or with an idea or early period of settlement within New Zealand, the region or locality;
(b) social: the place has a strong or special association with, or is held in high esteem by, a particular community or cultural group for its symbolic, spiritual, commemorative, traditional or other cultural value;
(c) (c) Mana Whenua: the place has a strong or special association with, or is held in high esteem by, Mana Whenua for its symbolic, spiritual, commemorative, traditional or other cultural value;

(d) knowledge: the place has potential to provide knowledge through archaeological or other scientific or scholarly study, or to contribute to an understanding of the cultural or natural history of New Zealand, the region, or locality;
(e) technology: the place demonstrates technical accomplishment, innovation or achievement in its structure, construction, components or use of materials;
(f) physical attributes: the place is a notable or representative example of:
    (i) a type, design or style;
    (ii) a method of construction, craftsmanship or use of materials; or
    (iii) the work of a notable architect, designer, engineer or builder;
(g) aesthetic: the place is notable or distinctive for its aesthetic, visual, or landmark qualities;
(h) context: the place contributes to or is associated with a wider historical or cultural context, streetscape, townscape, landscape or setting.

The methodology applies to all NoRs (NoRs W1, W2, W3, W4 and W5) and to both construction and operation stages.

4 Background

4.1 Physical Environment

The physical environment is low lying and undulating. The study area (for all NoRs) is framed by the Ngongetepara Stream (off Brigham Creek) with the Totara Creek as a side stream and the Waiarohia Creek and Stream. The latter forms a natural boundary to the Hobsonville peninsula, called Onekiritea in pre-Contact times.

The soils of the area are allophanic soils impeded (LI) (https://soils-maps.landcareresearch.co.nz/). These soils are made from volcanic materials and this is reflected by the area made from East Coast Bays formation (Mwe: sand and mudstone with mixed volcanic content – see code in Figure 1), Puketoka formation (Pup: pumiceous mud, sand and gravel including alluvial deposits – see code in Figure 1) and Taupo Pumice alluvium (Q1a: estuarine and swamp deposits – see code in Figure 1) (Figure 1).

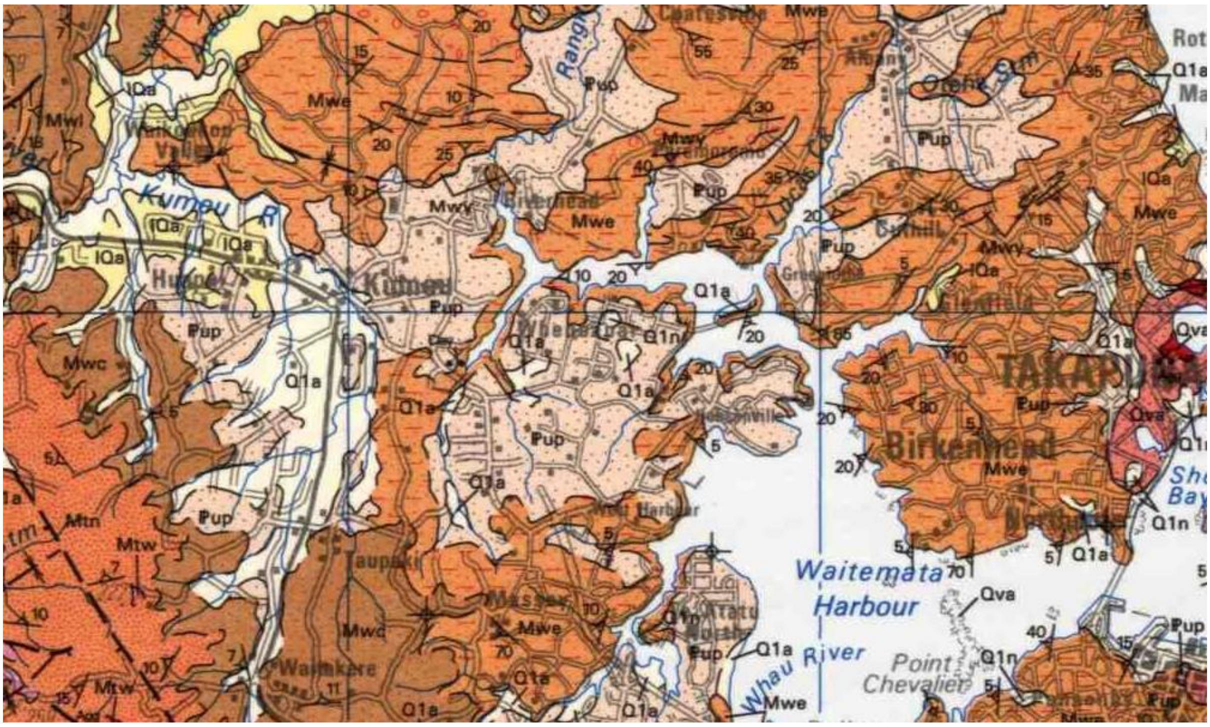

Figure 1: Detail of geological map, Auckland (Copyright Crown).

Historically the area was covered in Kauri forest like the rest of West Auckland, but with contact since European settlement this forest has given way to 'undulating fern lands' (Figure 2).

The modern use of the land for farming and grazing shows that the volcanic content of the soils adds fertility to the general silty clay soils. The Māori name of the Hobsonville area 'Onekiritea' relates to the whiteness of the clay soils in the area. The question is therefore how the area was used in pre-Contact times. The fertility of the soil would have supported growing of taro and other crops and swamps were seen as 'food baskets' for birds, eels and other resources like raupo. Is the observed deforestation during pre-Contact times simply a matter of burning the forest or is it a sign of horticulture that left little archaeological signatures?

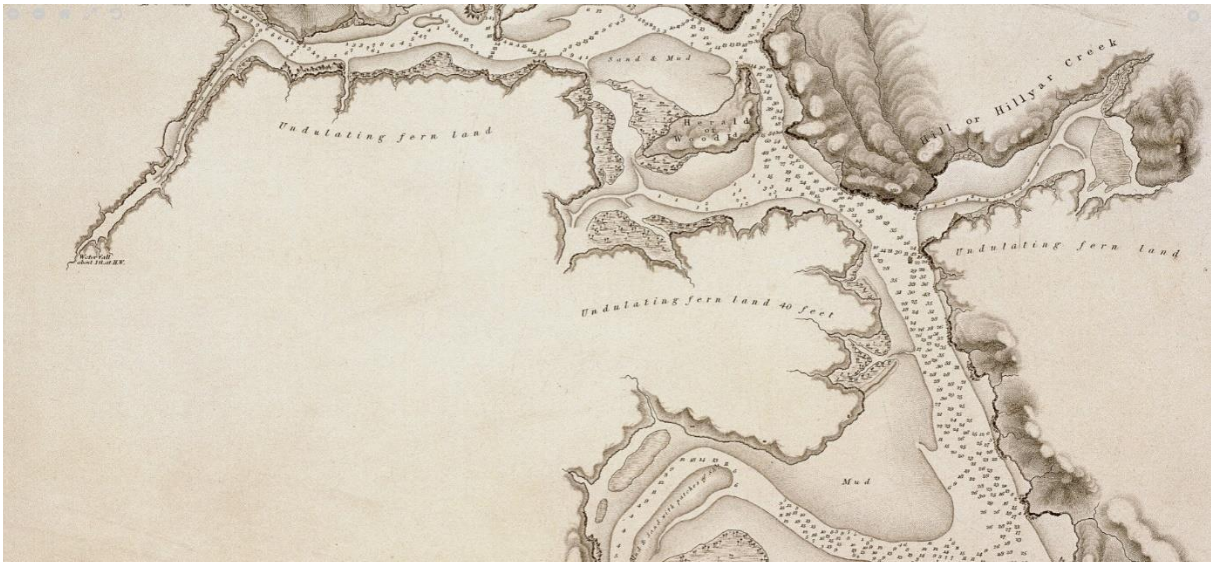

Figure 2: Detail of: 'Waitemata River from Kauri Point Auckland Harbour to its sources, surveyed by Comr. B. Drury and the officers of H.M.S. Pandora 1854'-(Auckland Libraries Heritage Collections Map 3909).

4.2 Pre-Contact Settlement

Whenuapai is on the cross roads for several portages between Kaipara and Waitemata Harbour and close to one of the portages between Waitemata and Manukau harbours, Ngongitepata and Te Whau (Hooker 1997). The meaning of the 'Whenua pai' might be 'fertile' or 'good' land (Simmons 1980) which contradicts the view of the early European settlers of the land being of poor quality as it is low lying, often flooded and clay soils (Rutherford 1940). An alternative, possibly older Māori name of the area is Waimarie which could be translated as 'calm water' (Simmons 1980). Most recorded archaeological sites are along the harbour or creek edges indicating that exploitation of kai moana was an important food source.

Like most places in Tāmaki Makaurau many different iwi have a relationship with the place. Te Kawerau, Wai o Hua and Ngāti Whātua and their many hāpu had a particular influence in the study area. The most recent of these inter tribals conflicts was attacks by Ngāpuhi under Hongi Heke. Armed with muskets they inflicted a defeat on Ngāti Whātua as utu for being defeated in the previous century. For some years few people lived in the district as Ngāpuhi did not establish settlements (https://www.kaiparamoana.com/k-rero-o-mua-our-history).

One of the first visits by a European to the area was by Samuel Marsden in 1820 who reported that plenty of food was around the Kaipara. Ngāti Whātua settlements near Kumeū are reported for this period (Dunsford 2002; Stone 2001).

4.3 Post Contact Settlement

For a short moment in time Governor Hobson considered Hobsonville as an area to start the Auckland settlement (Foster and Felgate 2011).

Between 1844 and 1865 pre-emptive waiver transactions, Crown purchases and Native Land Court sales reduced Māori customary land occupation in the Kaipara area to about a third of its pre-Contact size[1].

The Waiparera Block is part of the study area. It was sold to the Crown in 1853 (Turton 1877). It is one example how the land changed hands. Brigham's land claim and later Crown Grant in 1857 is another example. Brigham's Creek is named after this land speculator.

Dense Kauri forest within the Kumeū area and throughout the Waitakere Ranges drew European commerce into the area. Within a few decades all timber able to be milled was cut down (Morris 1996). Gum diggers followed the timber mills, but little is known of this activity through historic sources.

Towards the end of the 19th century the clay on the Hobsonville peninsula and surrounding areas was used for brick and pipe works which supplied the growing Auckland with this valuable building resource.

4.4 Archaeological Background

The NZAA Site Record Scheme has several site records close to the study area. It is mainly coastal shell midden and a few early historic structures. Historic structures including WW2 structures are recorded in Auckland Council's CHI. Several sites from both these databases are scheduled in the AUP:OP.

Each NoR, including the transport corridors, wetlands and construction areas, has been buffered by 200 metres and all recorded historic sites as well as archaeological site potential are discussed individually in relation to these individual buffer zones. Accurate locations are not available for the older recorded archaeological sites and the sub surface extent of historic heritage sites and archaeological sites can be much larger than the surface features indicate. A 200 m buffer zone mitigates those limitations of the existing records.

[1] https://www.kaiparamoana.com/wai312-claim-to-settlement

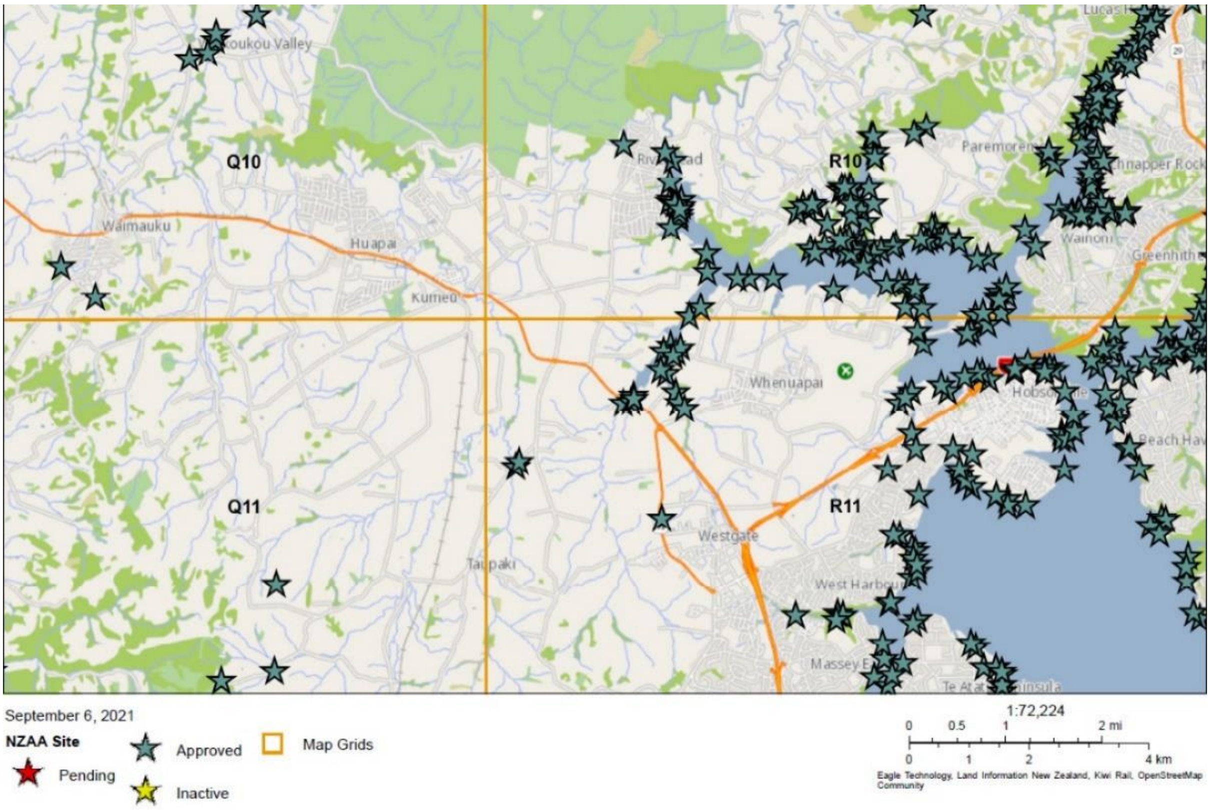

Figure 3: Archsite site distribution in the vicinity of the study area.

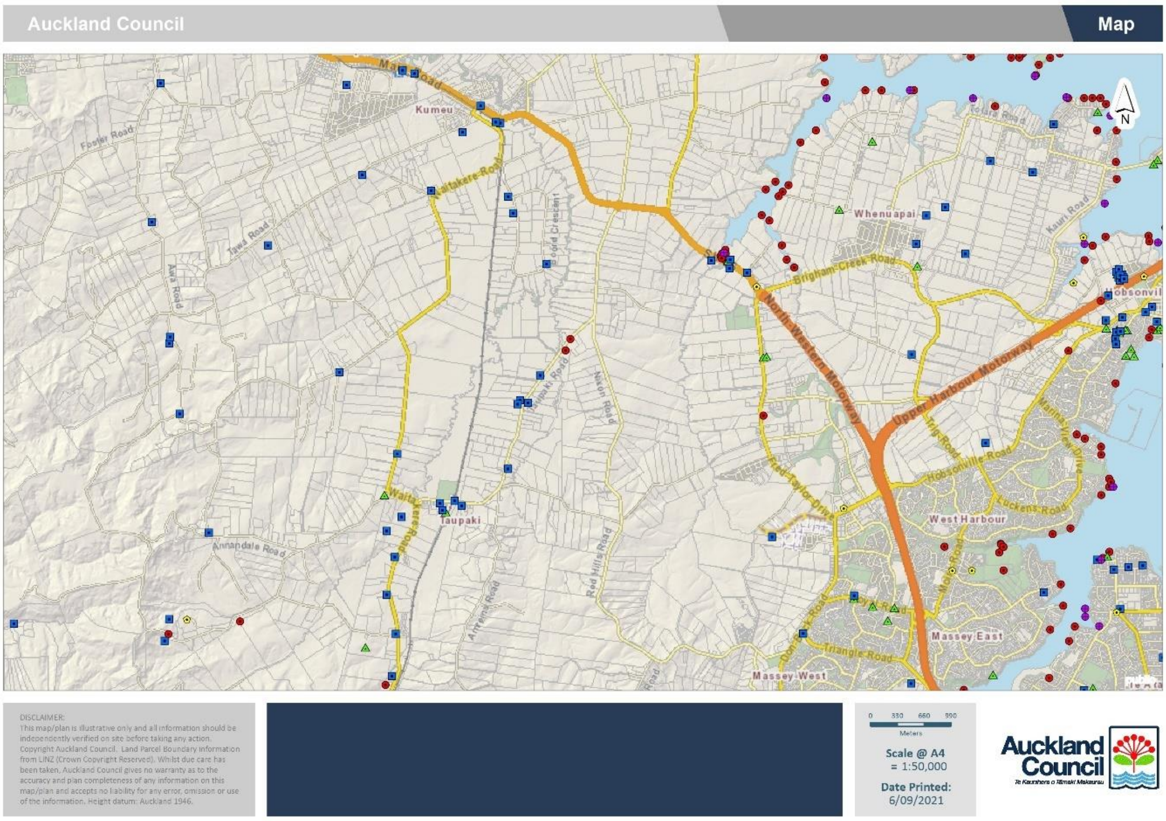

Figure 4: CHI sites in the vicinity of the study area.

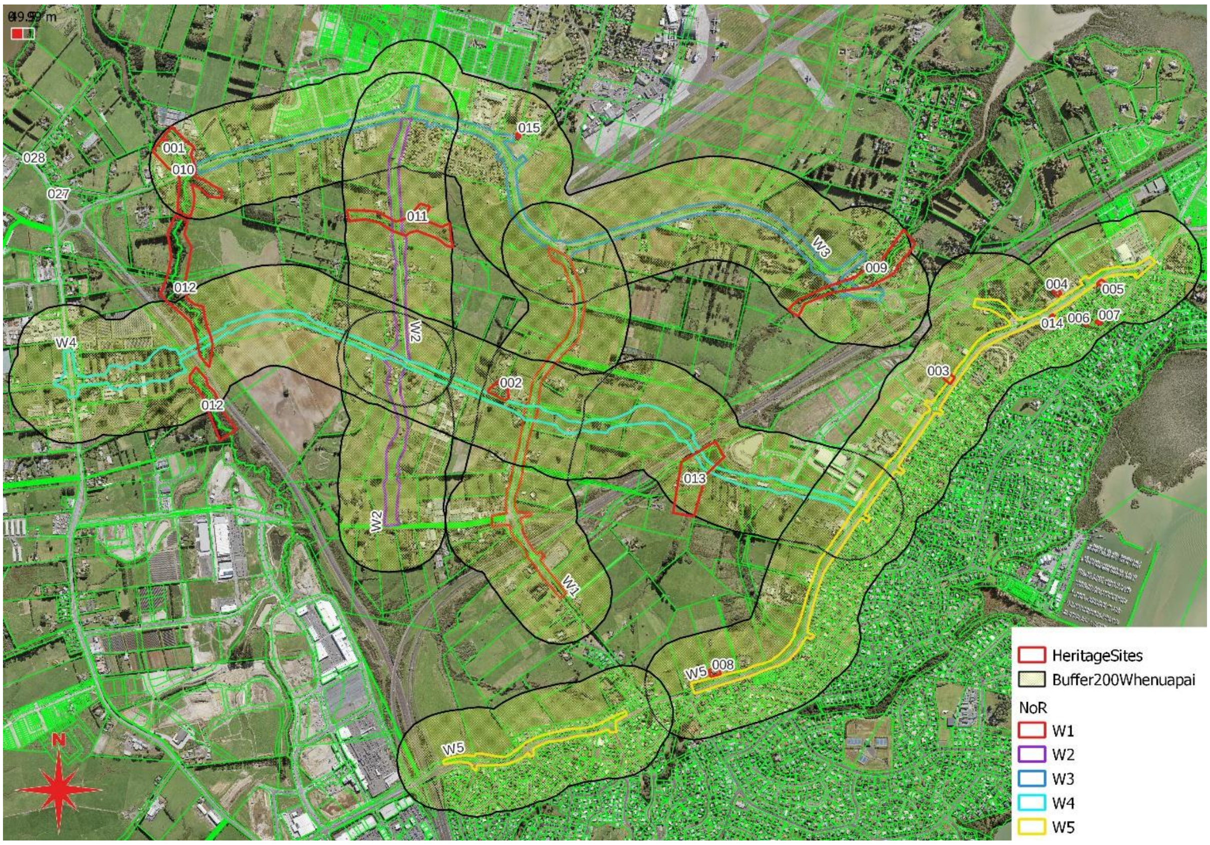

Figure 5: NoRs corridors (W1 - W5 in various colours) with 200m bufferzones (hatched areas surrounding NoR corridors), all heritage sites (numbered 001 - 008) and high risk areas (numbered 009 - 013) within these buffer zones.

Details of the sites and the risk areas are discussed within each NoR (Section 8 to 11 below).

4.5 Previous Archaeological Investigations

A number of assessments and monitoring exercises have taken place in the area between Hobsonville and Kumeū (see bibliography (Macready 2019)). Only a handful of these projects added anything significant to our knowledge of the area (Foster and Felgate 2011; Hawkins and Campbell 2020; Shackles 2019).

Investigations of site damages to a few shell midden along the northern coastline along Hobsonville showed a long occupation history using continuous kai moana exploitation (Shackles 2019).

Another investigation focused on the homestead and its development of one of the early settlers in the area, the Ocklestones (Foster and Felgate 2011). It paints a vivid picture of the changes and continuations of the rural life on the edge of Auckland, which is today replaced by suburbia. The 1940 aerial shows the study area dominated by orchards and grazing (Figure 6).

A similar case study was undertaken during moving a heritage house from its original position (Hawkins and Campbell 2020).

Figure 6: Rural character of the study area in 1940. Work on the airfield at Whenuapai has just started.

5 Whenuapai Assessment Package Overview

An overview of the Whenuapai Assessment Package is provided in Figure 5-1 below, with a brief summary of the Whenuapai Assessment Package projects provided in Table 5-1 below.

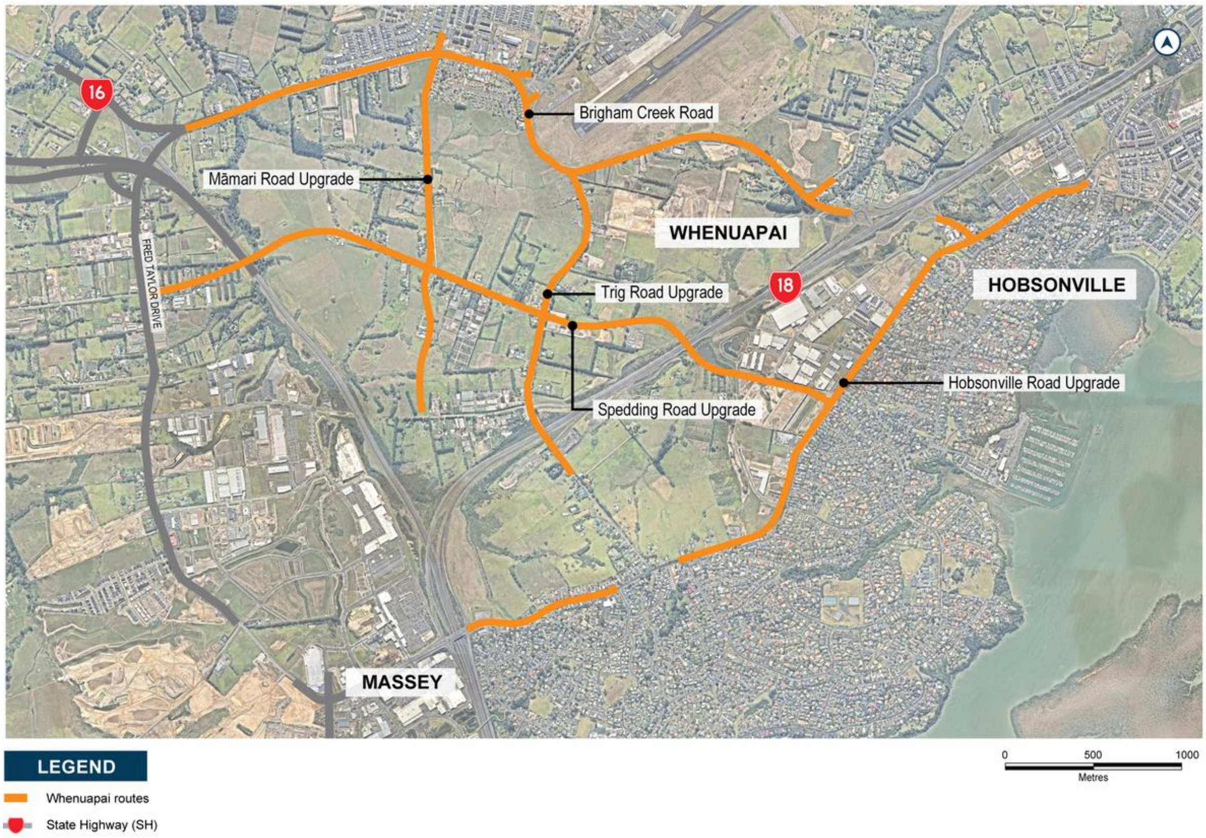

Figure 5-1: North West Whenuapai Assessment Package – Overview of NoRs for Assessment

Table 5-1: Whenuapai Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Trig Road North	NoR W1	Upgrade of Trig Road corridor to a 24m wide two-lane urban arterial cross-section with separated active mode facilities on both sides of the corridor.	Auckland Transport
Māmari Road	NoR W2	Extension and upgrade of Māmari Road corridor to a 30m wide four-lane urban arterial cross-section providing bus priority lanes and separated active mode facilities on both sides of the corridor.	Auckland Transport
Brigham Creek Road	NoR W3	Upgrade of Brigham Creek Road corridor to a 30m wide four-lane arterial cross-section with separated active mode facilities on both sides of the corridor.	Auckland Transport
Spedding Road	NoR W4	Upgrade of the existing Spedding Road corridor and new east and west extensions to form a 24m wide two-lane arterial with separated active mode facilities on both sides of the corridor.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Hobsonville Road (alteration to existing designation 1437)	NoR W5	Alteration of the existing Hobsonville Road designation 1437 to provide for the widening of the Hobsonville Road corridor between Oriel Avenue and Memorial Park Lane. Upgrade of sections of Hobsonville Road corridor to a 30m wide four-lane cross section with separated active mode facilities on both sides of the corridor Upgrade of sections of Hobsonville Road corridor to a 24m wide two-lane cross section with separated active mode facilities on both sides of the corridor.	Auckland Transport

Please refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

6 Whenuapai Positive Effects

The nature of historic heritage, especially archaeological features, recorded and unrecorded, is that all disturbances including construction has a negative effect that cannot be remediated only mitigated.

Nonetheless construction around wetlands and streams will allow environmental archaeological research to be undertaken that could clarify the dates, sequence and details of the anthropogenic vegetation change from forest to open fern lands.

Any pre-Contact horticulture like frequent harvesting of fern root rhizomes or taro fields has not been observed in the study area. Large linear developments like the proposed transport corridors are a rare opportunity to close this gap in our knowledge.

7 Whenuapai Construction Effects

The following construction effects apply to each of the NoRs within the Whenuapai Assessment Package:

- Any topsoil removal for ancillary developments like laydown areas, haul roads and the like has the potential to uncover archaeological features, both pre-Contact and post Contact. Therefore, there is no difference in the risk and effects assessment between the proposed transport corridors and the construction areas, such as laydown areas.

Potential effects to heritage and archaeological sites are considered within a 200 m buffer zone of the construction areas and the assessment of each NoR is based on the results of this consideration. Mitigation is therefore set out in Section 8 to 12 for each NoR.

Any processes regarding tikanga, especially around koiwi, should be discussed with mana whenua before the start of the project. This is a recommended measure for each NoR.

8 NoR W1: Trig Road North Upgrade

8.1 Project Corridor Features

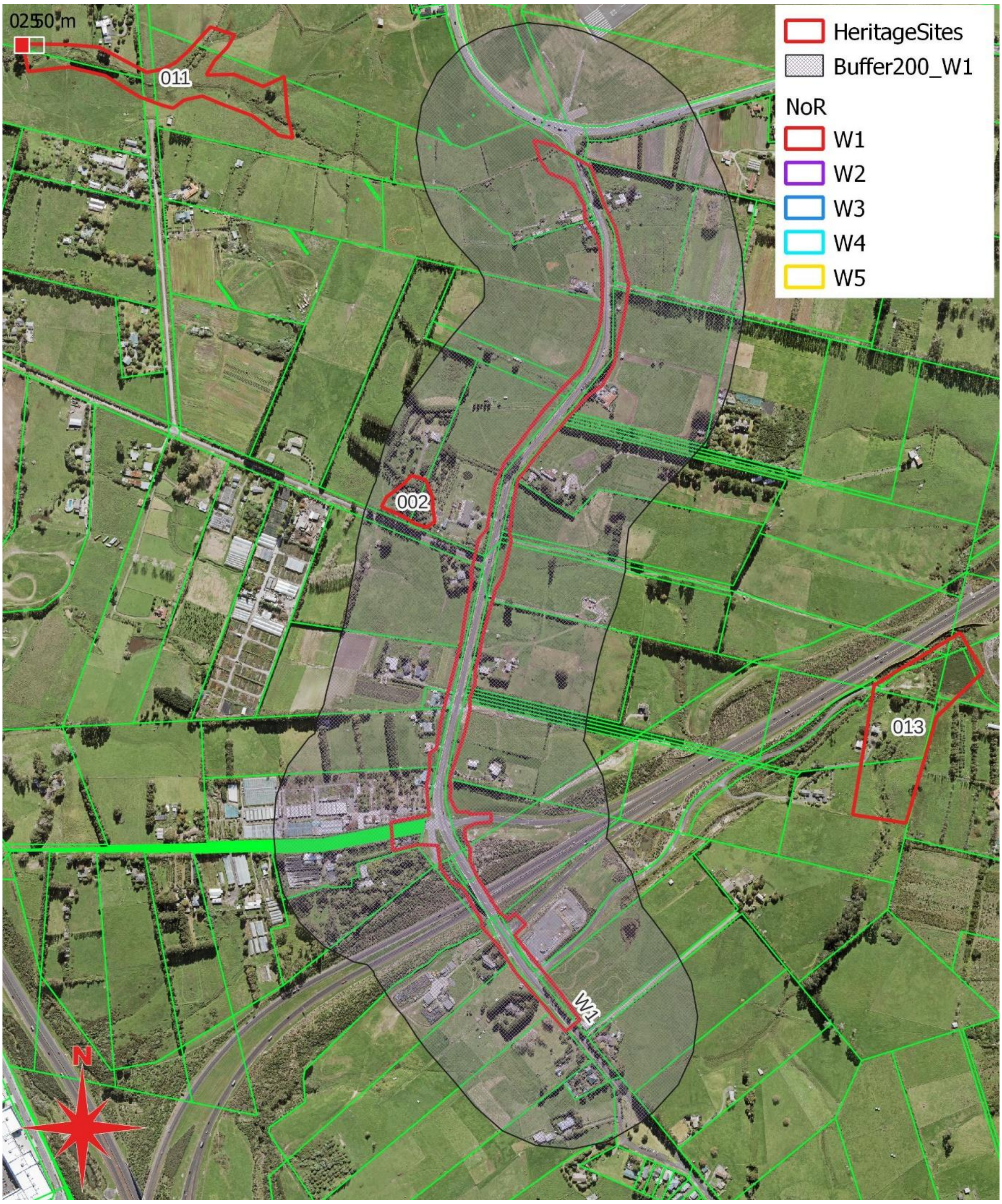

Figure 8: NoR W1 in relation to any heritage sites.

The feature 002 is a WW2 gun emplacement protecting Whenuapai airfield. It is recorded in the CHI as number 20469 and a heritage overlay is proposed through PPC5 to the AUP:OP. Further information about this site is discussed in relation to NoR W4 below. This is because this feature is outside the construction corridor for NoR W1 and will not be impacted by NoR W1.

8.2 Existing and Likely Future Environment

8.2.1 Planning context

The Trig Road corridor runs through an existing rural environment, with the land either side of the Trig Road corridor currently zoned Future Urban Zone (**FUZ**) under the AUP:OP. PPC5 proposes to rezone the eastern side of Trig Road north of SH18 and the western side of Trig Road between Brigham Creek Road and Spedding Road as Business – Light Industry Zone. A heritage overlay is proposed at 92 Trig Road and 4 Spedding Road.

PPC5 does not extend to the west side of the corridor south of Spedding Road, however the Whenuapai Structure Plan identifies this area for business zoning. The Whenuapai Structure Plan identifies a potential Sports Park at the corner of Trig Road and Spedding Road.

The NZDF Air Base (Special Purpose - Airports and Airfields Zone) is located to the north of Trig Road on Brigham Creek Road. The airbase is designated (Designation 4310) for defence purposes by the Minister of Defence. Table 8-1 below provides a summary of the Trig Road North existing and likely future environment

Table 8-1 below provides a summary of the North West existing and likely future environment

Table 8-1: Trig Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[2]	Likely Future Environment[3]
Undeveloped greenfield areas	Future Urban Zone	High	Urban
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Urban

8.2.2 Heritage Environment

There are no recorded archaeological or historic heritage sites within the footprint of NoR W1.

As NoR W1 does not cross any major streams or creeks there is only a small risk of unrecorded archaeological sites being encountered. None of the historic maps show any historic heritage features within the footprint of NoR W1.

8.3 Assessment of Effects on historic heritage and archaeological sites and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

8.3.1 Positive Effects

Potential positive effects are detailed in section 5.

[2] Based on AUP:OP zoning/policy direction
[3] Based on AUP:OP zoning/policy direction

8.3.2 Assessment of Construction Effects

Based upon the heritage environment for NoR W1 there are no adverse effects on historic heritage from NoR W1.

The small risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority from HNZPT under the HNZPTA and complying with the conditions of the authority.

8.3.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Any potential previously unrecorded archaeological deposits that are exposed during the works can be mitigated under the provisions of a precautionary HNZPTA authority, and the means of mitigation detailed in an Archaeological Management Plan prepared for the HNZPTA authority application.

It is recommended that all areas of earthworks or topsoil stripping during construction are included in the precautionary archaeological authority.

8.3.4 Assessment of Operational Effects

There are no other adverse effects on historic heritage during operation of NoR W1.

8.3.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

There are no recommended measures to avoid operational effects as there are no adverse effects to be mitigated.

8.4 Conclusions

There are no known archaeological sites within NoR W1 however there remains a small risk that unrecorded archaeological features may be encountered.

The associated effects of encountering unrecorded archaeological features can be mitigated through the conditions by requiring a precautionary HNZPTA archaeological authority to be obtained.

With the recommended mitigation in place, there are no residual adverse effects on historic heritage.

9 NoR W2: Māmari Road Upgrade

9.1 Project Corridor Features

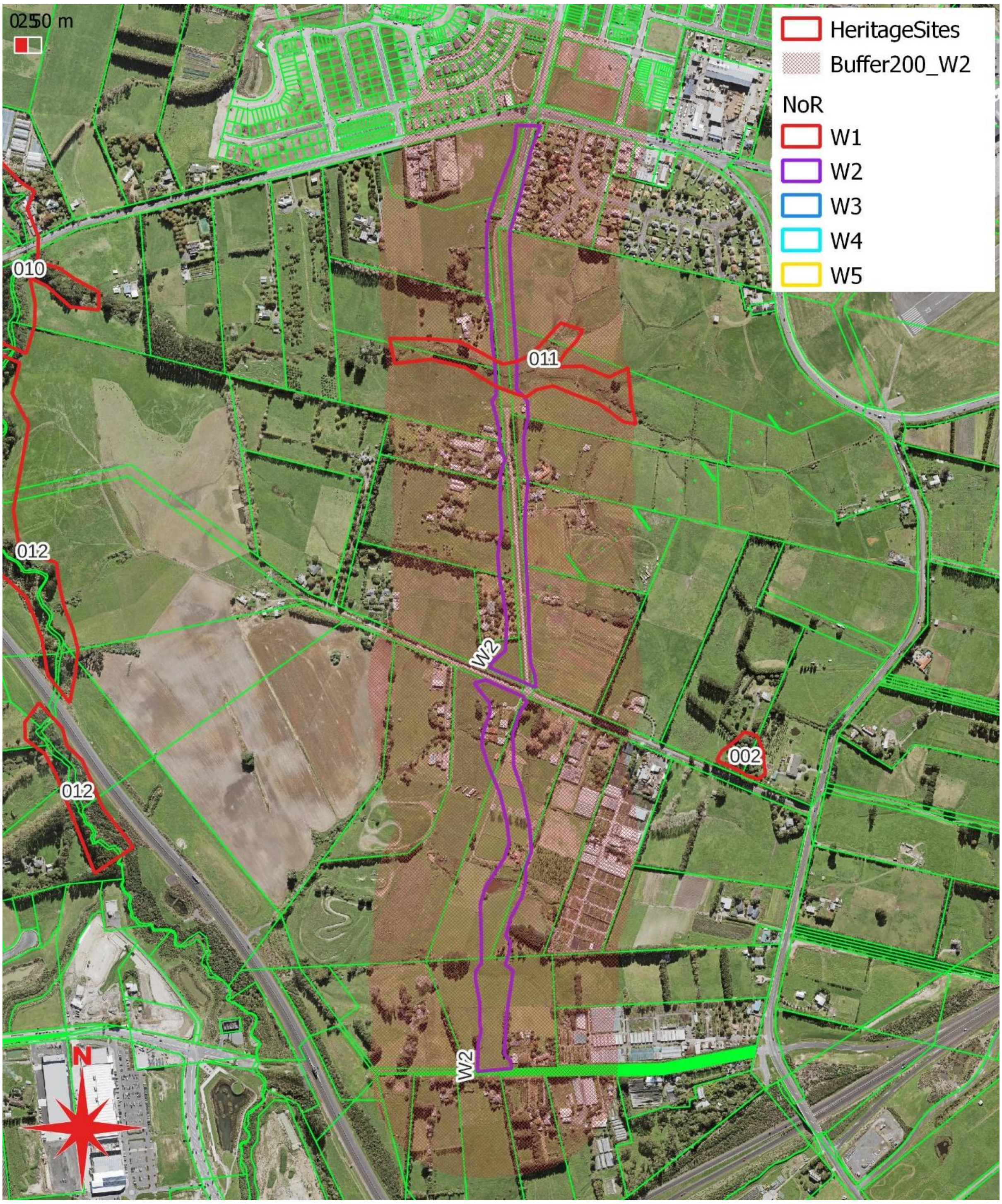

Figure 9: NoR W2 alignment in relation to any risk areas with potential for unrecorded archaeological features.

There are no heritage sites or archaeological sites recorded within the extent of NoR W2. However, unrecorded archaeological features could potentially be encountered at the crossing of the Sinton Stream which leads into the Totara Creek (marked as 011 in the graphics).

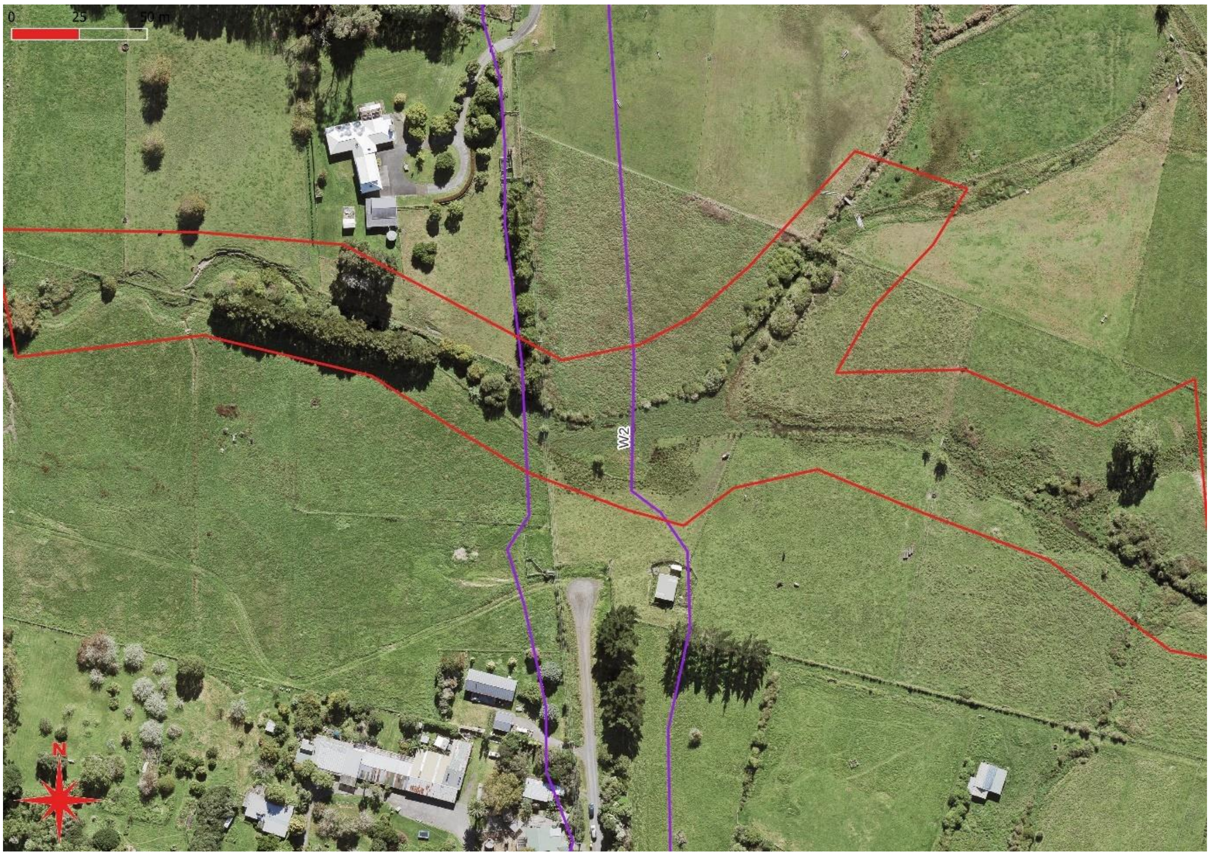

Figure 10: Sinton stream crossing within the 200m buffer (011).

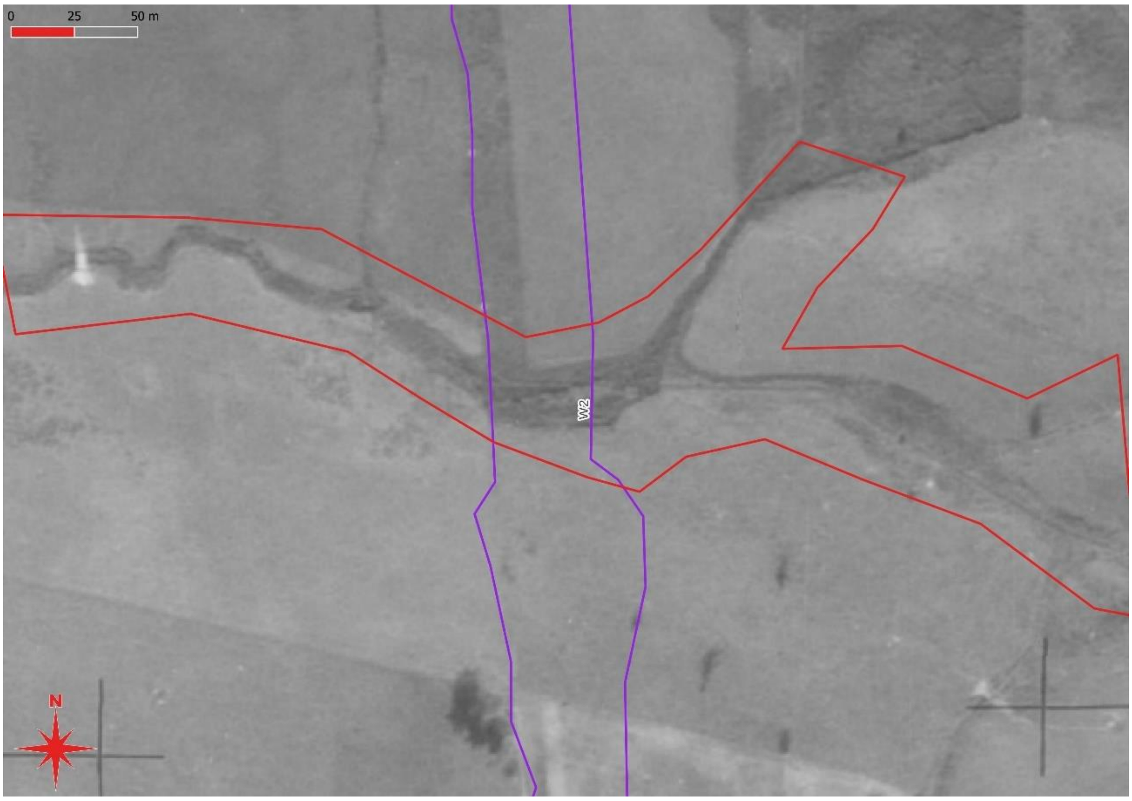

Figure 11: Sinton stream crossing in 1940. No major earthworks have taken place between 1940 and today.

Figure 12: View over stream crossing from a distance. Crossing is on private land.

Figure 13: View over stream crossing from a distance.

Figure 14: View over Sinton stream and grazing land adjacent to it.

9.2 Existing and Likely Future Environment

9.2.1 Planning context

The Trig Road corridor runs through an existing rural environment, with the land either side of the corridor currently zoned FUZ under the AUP:OP. PPC5 proposes to rezone the eastern side of Trig Road north of SH18 and the western side of Trig Road between Brigham Creek Road and Spedding Road as Business – Light Industry Zone. A heritage overlay is proposed at 92 Trig Road and 4 Spedding Road.

PPC5 does not extend to the west side of the corridor south of Spedding Road, however the Whenuapai Structure Plan identifies this area for business zoning. The Whenuapai Structure Plan identifies a potential Sports Park at the corner of Trig Road and Spedding Road.

The NZDF Air Base (Special Purpose - Airports and Airfields Zone) is located to the north of Trig Road on Brigham Creek Road. The airbase is designated (Designation 4310) for defence purposes by the Minister of Defence.

Table 9-1 below provides a summary of the North West existing and likely future environment.

Table 9-1: Māmari Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[4]	Likely Future Environment[5]
Residential	Residential	Low	Residential
Undeveloped greenfield areas	Future Urban	High	Urban
Timatanga Community School	Special Purpose - School Zone	Low	Urban

9.2.2 Heritage Environment

There are no recorded archaeological or historic heritage sites within the footprint of NoR W2.

NoR W2 crosses the Sinton stream which seems to be unchanged since the 1940s. However there is a risk that unrecorded archaeological sites could be encountered.

None of the historic maps show any historic heritage features within the footprint of NoR W2.

9.3 Assessment of Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

9.3.1 Positive Effects

Potential positive effects are detailed in Section 6.

9.3.2 Assessment of Construction Effects

There are potential adverse effects in relation to unrecorded archaeological features being encountered close to the Sinton Stream crossing. Any archaeological features are likely to be from seasonal camps which were used to exploit local resources. They would not have been rare but are rarely recorded and their information potential is high considering that few inland pre-Contact sites have been recorded or documented. As any sites would be sub surface, they have no amenity value and their cultural association would be related to the known relationship of iwi and hapū to the area. No additional assessment criteria are applicable.

Based upon the heritage environment for NoR W2 there are no adverse effects on historic heritage from NoR W2. The risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority from HNZPT under the HNZPTA and complying with the conditions of the authority.

[4] Based on AUP:OP zoning/policy direction

[5] Based on AUP:OP zoning/policy direction

9.3.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Any potential previously unrecorded archaeological deposits that are exposed during the works can be mitigated under the provisions of a precautionary HNZPTA authority, and the means of mitigation detailed in an Archaeological Management Plan prepared for the HNZPTA authority application.

It is recommended that all areas of earthworks or topsoil stripping during construction are included in the precautionary archaeological authority.

9.3.4 Assessment of Operational Effects

There are no other adverse effects on historic heritage during operation of NoR W2.

9.3.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

There are no recommended measures to avoid operational effects as there are no adverse effects to be mitigated.

9.4 Conclusions

There are no known archaeological sites within NoR W2 however there remains a reasonable risk that unrecorded archaeological features could be encountered. The associated effects can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

With the recommended mitigation in place, there are no residual adverse effects on historic heritage.

10 NoR W3: Brigham Creek Road Upgrade

10.1 Project Corridor Features

Figure 15: NoR W3 corridor in relation to the 200 m buffer and heritage features: shell midden 001, notable tree 015, high risk area 010 (Totara Creek crossing) and 009 (Waiarohia Stream crossing).

Within the 200m buffer of NoR W3, one archaeological site 001 is recorded at the edge of the Totara Creek (R11/2084, CHI#13579) and a notable group of trees 015 is noted at 10–12 Airport Road, Whenuapai (AUP:OP #1813, CHI#2318). None of these features are impacted by NoR W3.

Two high risk areas are indicated within the 200 m buffer: the Waiarohia Stream crossing (009) and the Totara Creek crossing (010). Both stream crossings seem to have little earthworks done since 1940 and if there are any subsurface archaeological features in the vicinity there is a high risk that they are still in situ. Both are major streams with a deep channel and would have been most likely used in pre-Contact times for waka travel.

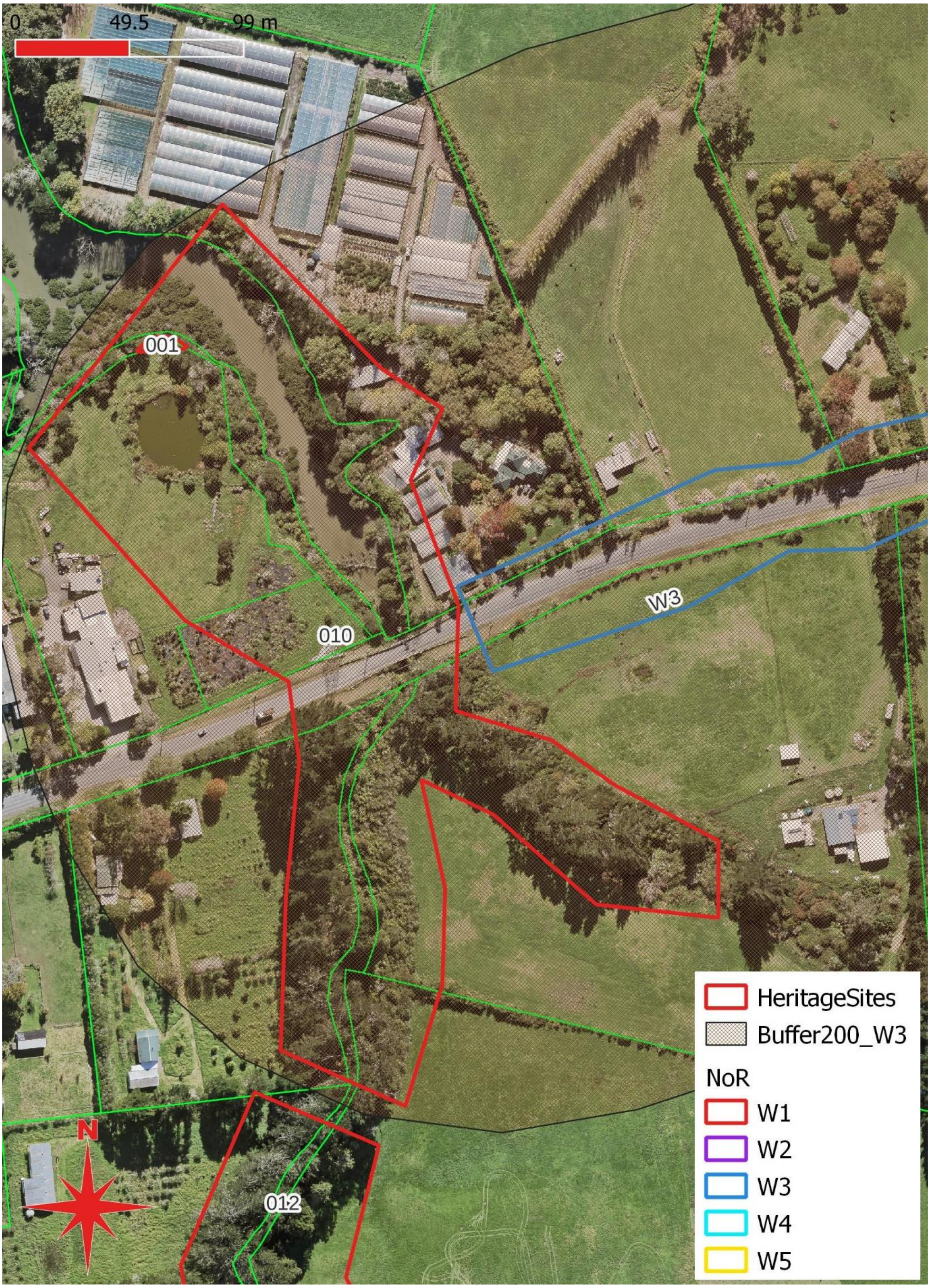

Figure 16: Shell midden site 001 and Totara Creek crossing (010) in relation to the end of NoR W3.

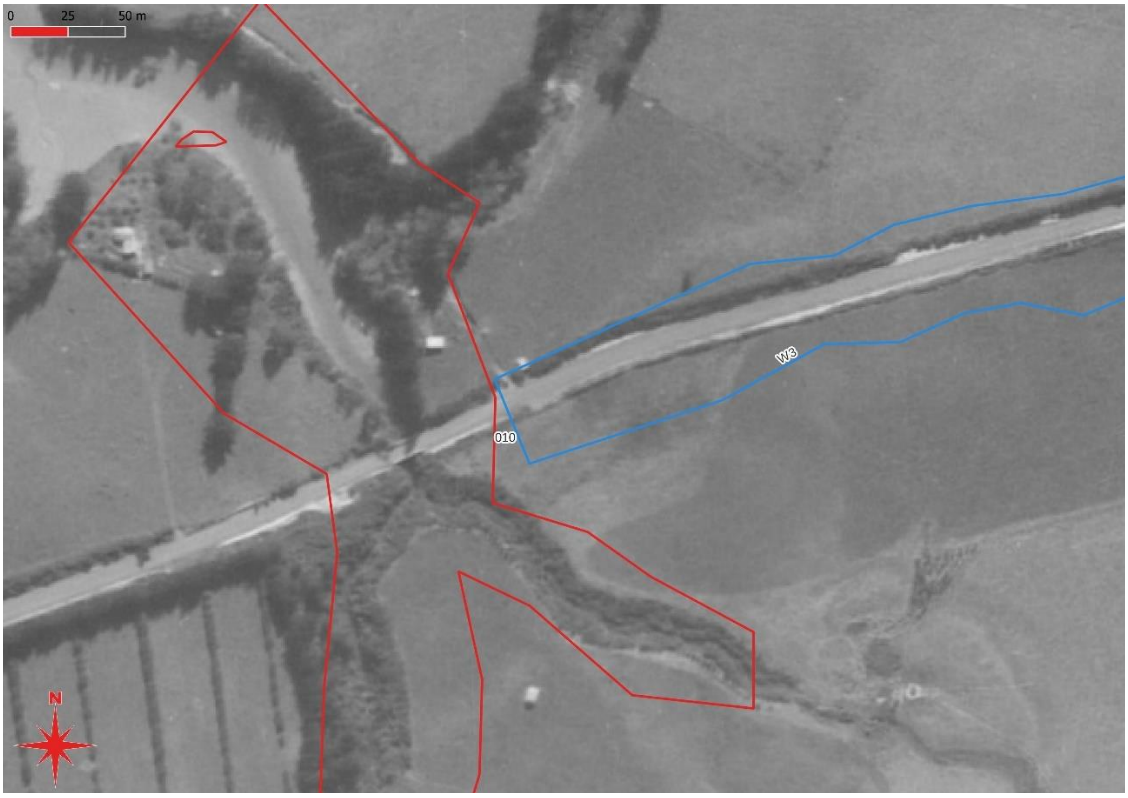

Figure 17: Shell midden site and Totara Creek crossing in 1940.

Figure 18: Totara Creek crossing, view upstream.

Figure 19: Totara Creek crossing, view downstream.

Figure 20: Narrow bridge over the Totara Creek.

Figure 21: Totara and Kauri at Airport Road - group of notable trees (AUP:OP).

Figure 22: Location of notable trees in relation to extent of W3.

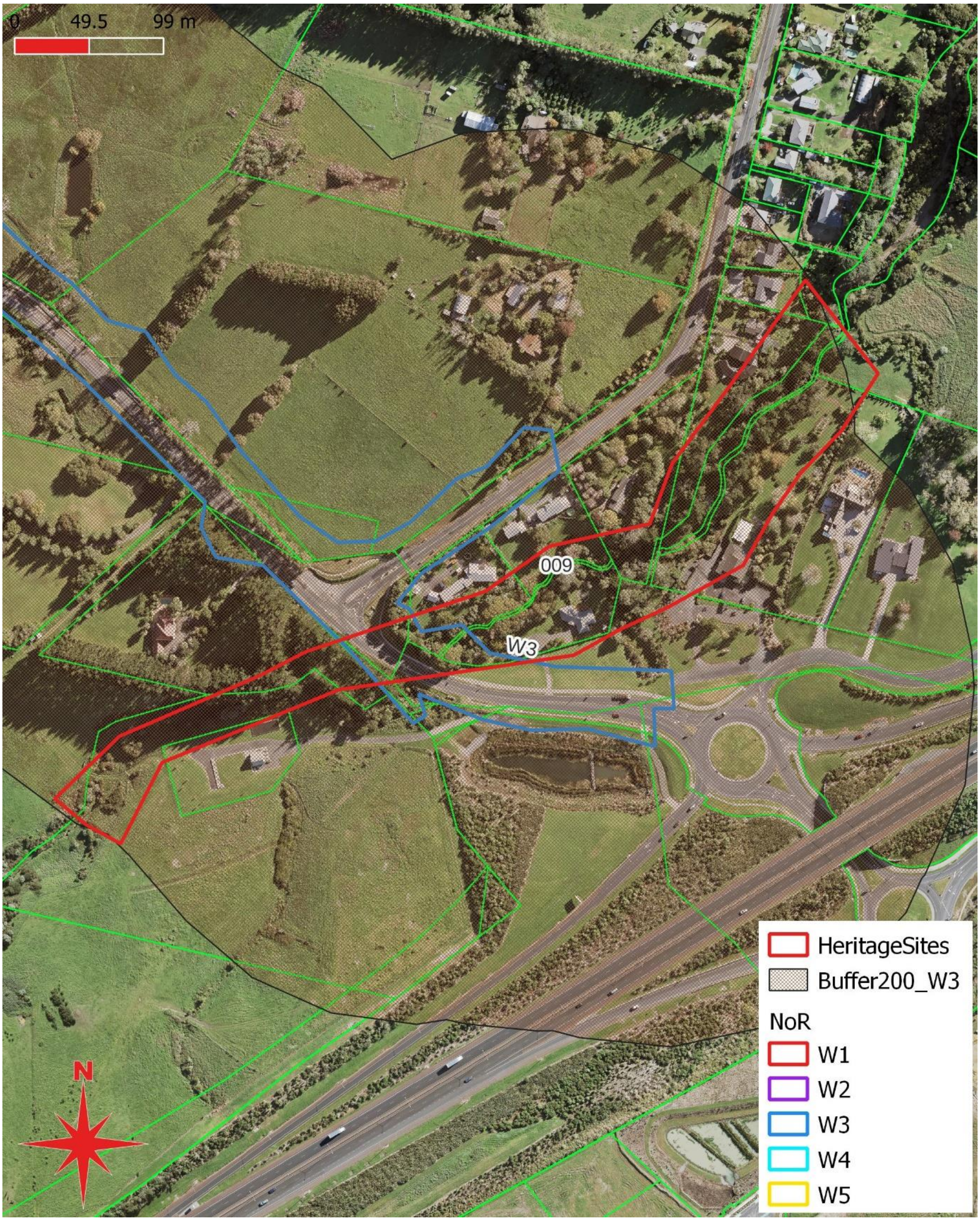

Figure 23: 200 m buffer at the Waiarohia Stream crossing.

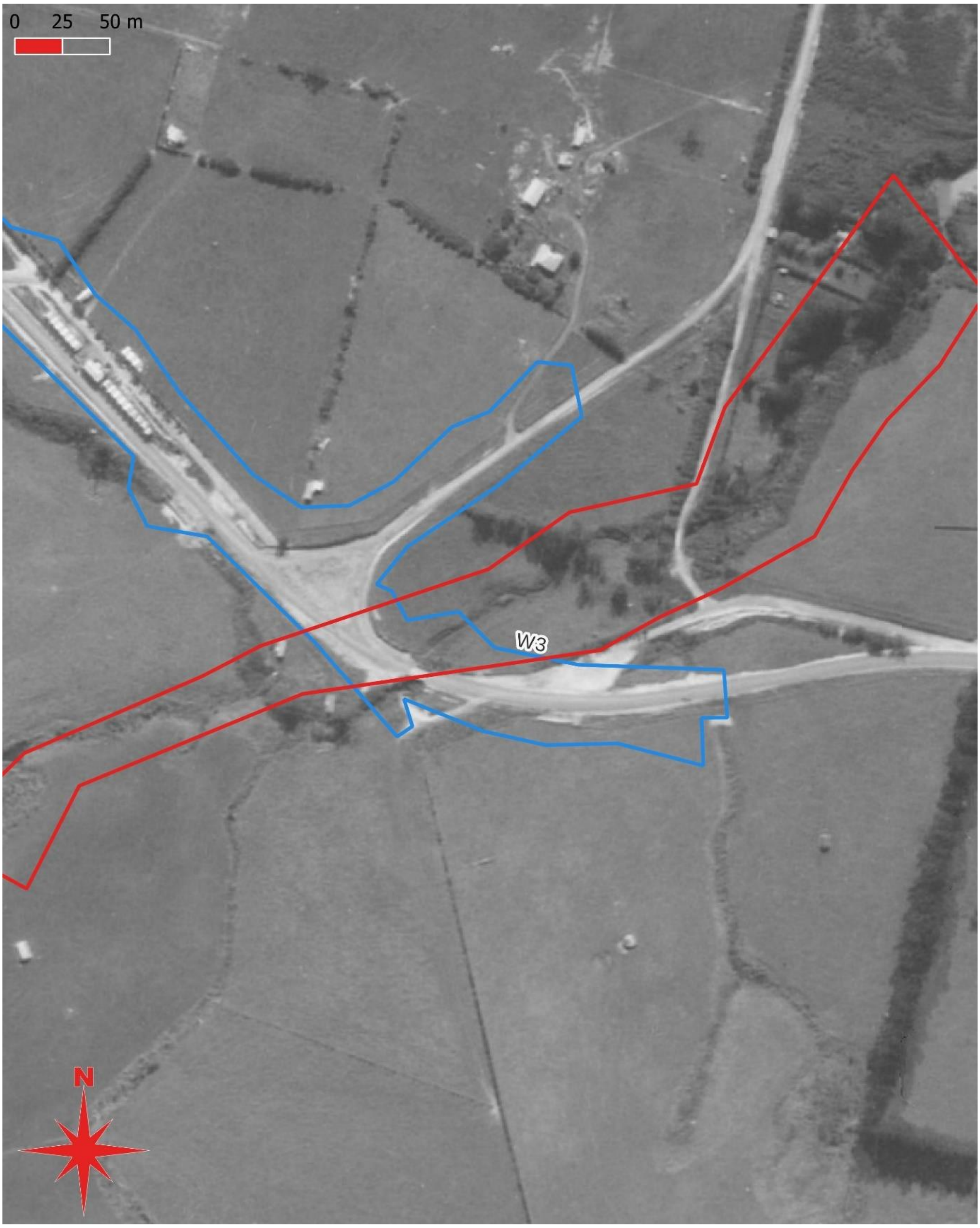

Figure 24: The Waiarohia stream crossing in 1940 showing little earthworks have been done since 1940.

Figure 25: View over stream crossing looking downstream.

Figure 26: View over bridge and stream crossing looking upstream.

Figure 27: Deep channel of the Waiarohia stream with a blue stone footing - possibly for an old crossing.

10.2 Existing and Likely Future Environment

10.2.1 Planning context

The land adjacent to Brigham Creek Road is zoned under the AUP:OP as FUZ, except within the existing Whenuapai Centre (which is zoned under the AUP:OP for a range of residential and business zones) and the Whenuapai NZDF airbase. The airbase is designated (Designation 4310) for defence purposes by the Minister of Defence. The designation also includes the Residential – Single House Zone within the Whenuapai Centre.

PPC5 proposes to rezone the eastern portion of Brigham Creek Road on the south of the corridor to Business – Light Industrial zoning. The Whenuapai Structure Plan identifies medium density residential and business land uses to the south of Brigham Creek Road, with medium density residential land uses identified to the north.

Table 10-1 below provides a summary of the Brigham Creek Road existing and likely future environment.

Table 10-1: Brigham Creek Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[6]	Likely Future Environment[7]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
	Business (Local centre)	Low	Business (Local centre)
Residential	Residential	Low	Residential
Open Space	Open Space –Informal Recreation Zone	Low	Open Space
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban
New Zealand Defence Force Air Base	Special Purpose - Airports and Airfields Zone	Low	Special Purpose – Airports and Airfields Zone

10.2.2 Heritage Environment

No archaeological sites or historic heritage sites are recorded within the boundaries of NoR W3. A shell midden site is close by and indicates that the stream crossings (Totara Creek and Waiarohia Stream) are high risk areas for the discovery of sub surface and unrecorded archaeological features.

A group of 4 native trees along Airport Road are on the AUP:OP list of notable trees. They are outside the boundary of the proposed development.

10.3 Assessment of Effects on Historic Heritage and Archaeology and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

10.3.1 Positive Effects

Potential positive effects are detailed in Section 6.

10.3.2 Assessment of Construction Effects

There are potential adverse effects as a result of unrecorded archaeological features being encountered close to the Waiarohia Stream and Totara Creek crossings. Any archaeological features are likely to be from seasonal camps which were used to exploit local resources like the shell midden close to NoR W3 along the Totara Creek. They would not have been rare but are rarely investigated comprehensively and their information potential is high considering that no inland pre-Contact sites have been recorded or documented. As any sites would be sub surface they have no amenity value and their cultural association would be the known relationship of iwi and hapū to the area. No additional assessment criteria are applicable.

[6] Based on AUP:OP zoning/policy direction
[7] Based on AUP:OP zoning/policy direction

The reasonable high risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority applied for with HNZPT under the HNZPTA and complying with the conditions of the authority.

10.3.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Any potential previously unrecorded archaeological deposits that are exposed during the works can be mitigated under the provisions of a precautionary HNZPTA authority, and the means of mitigation detailed in an Archaeological Management Plan prepared for the HNZPTA authority application.

It is recommended that all areas of earthworks or topsoil stripping during construction are included in the precautionary archaeological authority.

10.3.4 Assessment of Operational Effects

There are no other adverse effects on historic heritage during operation of NoR W3.

10.3.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

There are no recommended measures to avoid operational effects as there are no adverse effects to be mitigated.

10.4 Conclusions

There are no known heritage or archaeological sites within the proposed corridor of NoR W3 however there remains a reasonably high risk of encountering unrecorded archaeological features. The associated effects can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

With the recommended mitigation in place, there are no residual adverse effects on historic heritage.

11 NoR W4: Spedding Road

11.1 Project Corridor Features

Figure 28: NoR W4 corridor in relation to the 200 m buffer. A heritage site (CHI#20469), a WW2 gun emplacement (002), has been recorded and two risk areas at stream crossings have been identified (012 and 013).

A gun emplacement of WW2 has been identified right next to the road corridor (002 on the graphics and CHI#20469). It is not an archaeological site under the definition of the HNZPTA and it is not yet scheduled in the AUP:OP, although, a heritage overlay is proposed as part of PPC5. The extent of the proposed heritage overlay on 92 Trig Road and 4 Spedding Road is slightly different to the extent of the battery (see Figure 29 to 31). The crew building is not incorporated in the overlay, but the overlay extends further north than the battery structures (Macready 2017). There is a risk that some ancillary works of this multi structure heritage site extends into the proposed construction corridor.

The stream crossing at Totara Creek is within possibly undisturbed paddocks and there is a high risk that unrecorded archaeological sub surface features could be encountered (012).

Crossings at the Waiarohuia and the Rāwiri stream are low risk areas for encountering previously unrecorded sites as they both have already been modified recently at the point where NoR W4 crosses them (013).

Figure 29: The gun emplacement under vegetation cover.

Figure 30: The gun emplacement including ancillary buildings in 1950 (not yet build in the 1940 aerial).

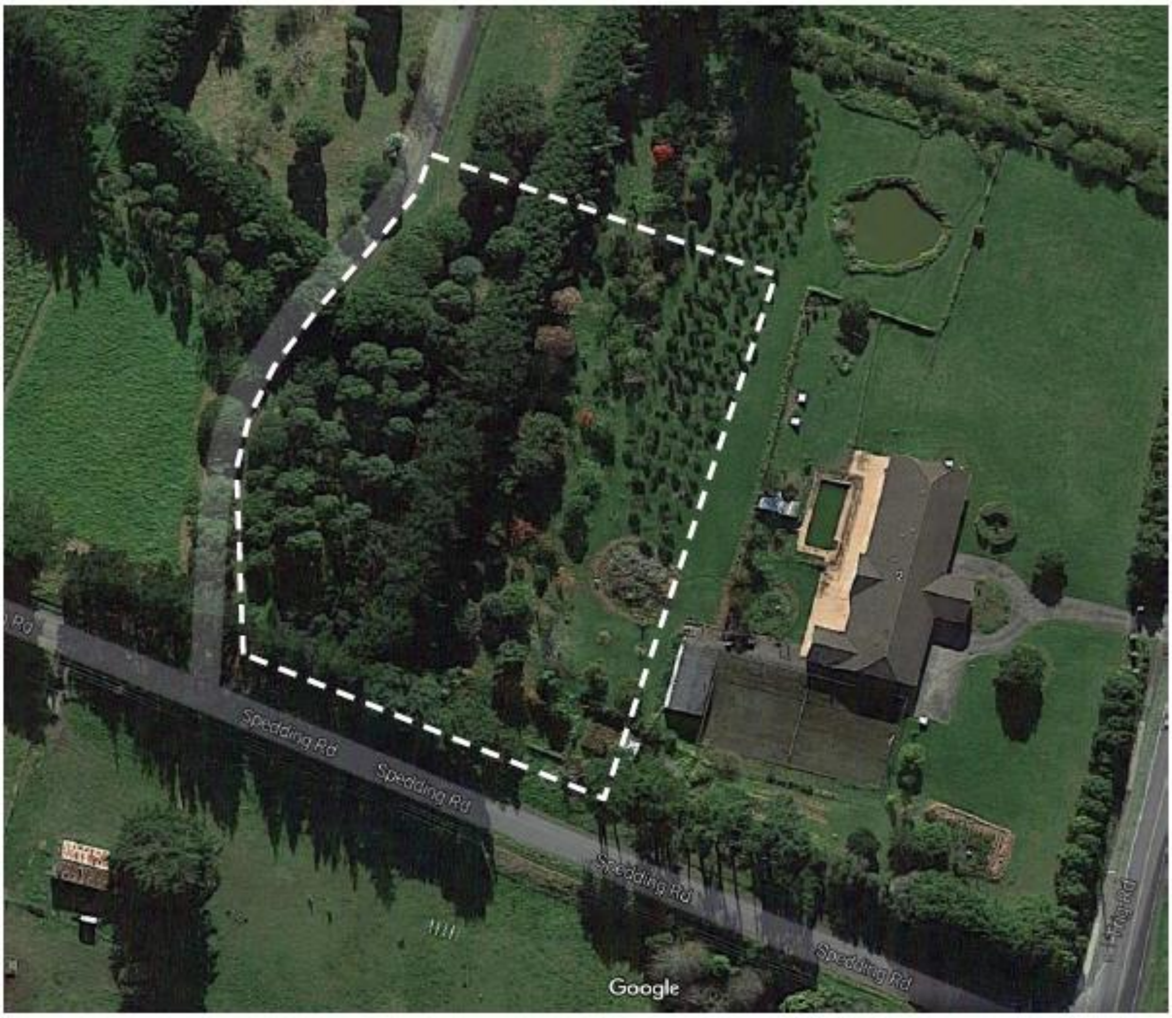

Figure 2. Extent of Whenuapai Heavy AA Battery recommended for scheduling

Figure 31: Proposed heritage overlay after Macready 2017:Figure2. Note the discrepancies between this extent and the extent based on the 1950 aerial (Figure 29 and 30). The likely crew buildings are outside this proposed extent and the proposed extent reaches further north than the battery buildings.

Figure 32: The gun emplacement in 1959 with some of the buildings already demolished but all gun pits still clearly visible.

Figure 33: Gun pits view from the road.

Figure 34: Gun pits view from the road.

Figure 35: Road reserve next to the gun pits.

Figure 36: Embankment which is possibly part of the gun emplacement.

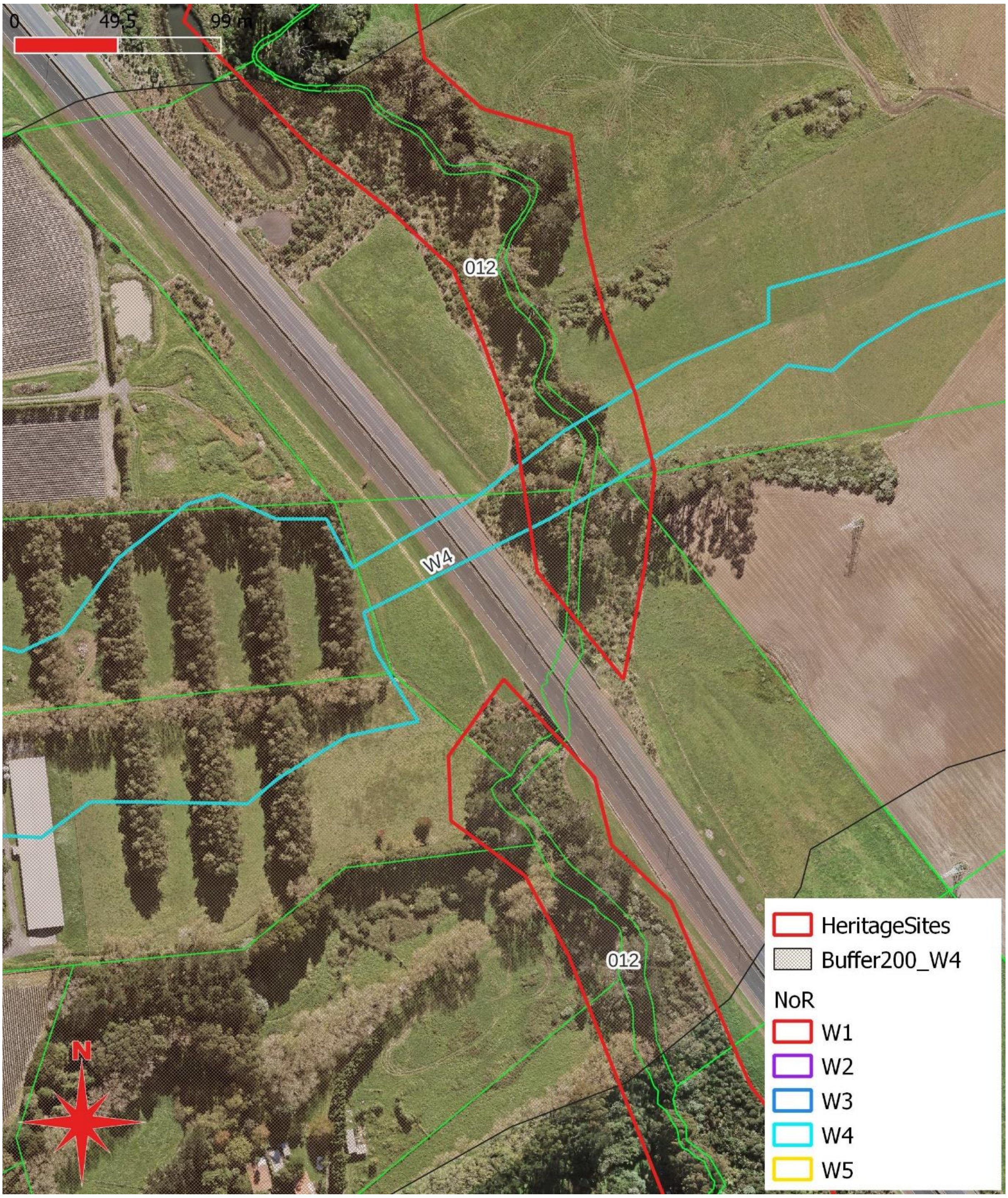

Figure 37: Crossing of Totara Creek within the 200 m buffer (012).

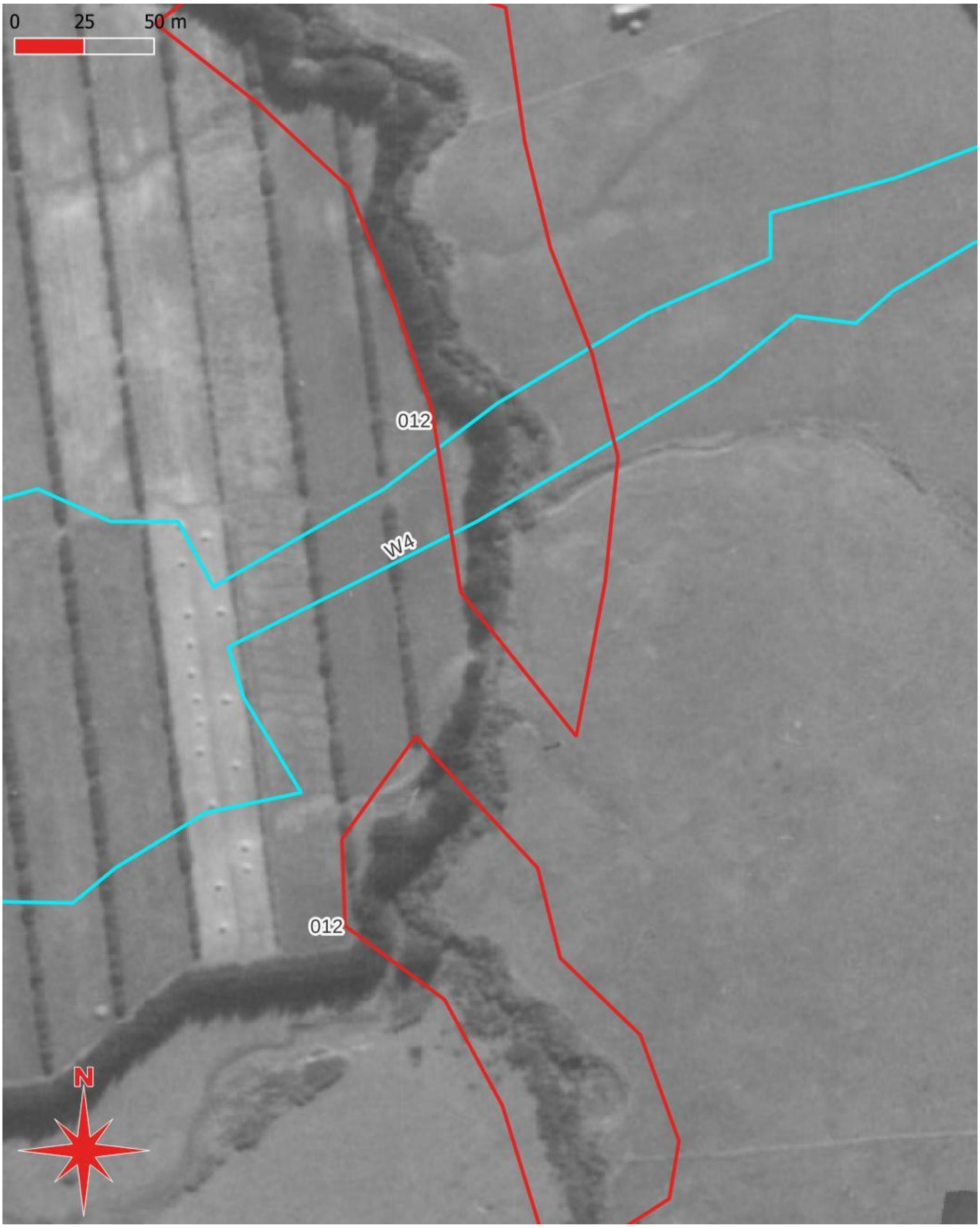

Figure 38: Totara Creek in 1940.

Figure 39: Modern modification close to the crossing of Waiarohia Stream.

11.2 Existing and Likely Future Environment

11.2.1 Planning context

The land on either side of Spedding Road is zoned under the AUP:OP as FUZ, with the exception being the Business – Light Industry Zone within the Hobsonville Corridor Precinct.

On the eastern end of the corridor PPC5 proposes to rezone the surrounding FUZ land to Business – Light Industry Zone in the north and Residential - Mixed Housing Urban Zone and Open Space – Informal Recreation zone in the south. The remainder of the land to the south falls within the Hobsonville Corridor Precinct.

The Whenuapai Structure Plan identifies the land surrounding the existing central section and proposed western end of the corridor for business.

The western section of the proposed corridor extends across SH16 and the eastern section across SH18, both SH16 and SH18 are designated by Waka Kotahi for State Highway purposes (Designation 6741).

Table 11-1 below provides a summary of the North West existing and likely future environment.

Table 11-1: Spedding Road Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[8]	Likely Future Environment[9]
Business	Business (Light Industrial)	Low	Business (Light Industrial)
Residential	Residential	Low	Residential
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

11.2.2 Heritage Environment

There are no historic heritage sites or archaeological sites recorded within the footprint of NoR W4.

A WW2 heavy anti-aircraft gun emplacement consisting of several gun pits and ancillary buildings of various functions is recorded in the CHI and is adjacent to the proposed corridor of NoR W4. There is a risk that some subsurface features could be found within NoR W4. A heritage overlay is proposed as part of PPC5 and is very close to the proposed corridor of NoR W4 (Macready 2017).

The stream crossing of the Totara Creek is a high risk area for sub surface archaeological features to be uncovered.

The stream crossings of the Waiarohia and Rāwiri streams have low potential for sub surface archaeological features to be uncovered as both have been recently modified.

11.3 Assessment of Effects on Historic Heritage and Archaeological sites and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

11.3.1 Positive Effects

Potential positive effects are detailed in section 5.

11.3.2 Assessment of Construction Effects

Potential adverse effects include that unrecorded archaeological features may be encountered close to the Waiarohia Stream, Rāwiri Stream and Totara Creek crossings. Any archaeological features are likely to be from seasonal camps used to exploit local resources. They would not have been rare but are rarely investigated comprehensively and their information potential is high considering that no inland pre-Contact sites have been recorded or documented. As any sites would be sub surface they have no amenity value and their cultural association would be the known relationship of iwi and hapū to the area. No additional assessment criteria are applicable.

[8] Based on AUP:OP zoning/policy direction

[9] Based on AUP:OP zoning/policy direction

A precautionary archaeological authority would mitigate the risk of encountering unrecorded archaeological features.

There is also a low risk that subsurface ancillary structures belonging to the WW2 heavy anti-aircraft gun emplacements may be encountered. As they are not archaeological sites but can be considered to have heritage value under the AUP:OP criteria of historical, technological and contextual values, discussions with the Auckland Council Heritage Unit are encouraged. The outlined site extent (Figure 29) should be considered as having high historic heritage value.

In conclusion there are no significant adverse effects on historic heritage by the proposed NoR corridor of W4. The reasonably high risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority applied for with HNZPT under the HNZPTA and complying with the conditions of the authority.

11.3.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Any potential previously unrecorded archaeological deposits that are exposed during the works can be mitigated under the provisions of a precautionary HNZPTA authority, and the means of mitigation detailed in an Archaeological Management Plan prepared for the HNZPTA authority application.

It is recommended that all areas of earthworks or topsoil stripping during construction are included in the precautionary archaeological authority.

11.3.4 Assessment of Operational Effects

There are no other adverse effects on historic heritage during operation of NoR W4.

11.3.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

There are no recommended measures to avoid operational effects as there are no adverse effects to be mitigated.

11.4 Conclusions

There are no known heritage or archaeological sites within the proposed corridor of NoR W4 however there remains a reasonably high risk of encountering unrecorded archaeological features. The associated effects can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

With the recommended mitigation in place, there are no residual adverse effects on historic heritage of NoR W4.

12 NoR W5: Hobsonville Road FTN Upgrade

12.1 Project Corridor Features

Figure 40: NoR W5 in relation to the 200 m buffer and recorded historic heritage structures and notable trees.

Figure 41: The buildings at 005 (Hobsonville Hall) and 007 (residential property) in 1940. Two notable trees (006 and 014) are shown too. The heritage building at 004 has recently been investigated and moved to a different location.

Within the 200 m buffer of NoR W5 several historic heritage structures and notable trees are recorded.

The Hobsonville Hall (005 in the graphics) is recorded in the CHI (3496) but has not been scheduled in the AUP:OP and is not considered an archaeological site as it was built after 1900. It is outside the footprint of the proposed development, but ancillary sub surface features related to the hall might be uncovered.

A residential property at 1 Williams Road (007) is recorded in the CHI (3385) and scheduled as 00071 in the Historic Heritage list of the AUP:OP. It is outside the footprint of the proposed corridor. The same is correct for a notable tree with a bronze plaque next to it (CHI# 2299 and 3629, Notable trees of the AUP:OP #1811). This is a gum tree which is described in a plaque at the base of the tree to have been possibly planted by Governor Hobson in the middle of the 19th century. Hobsonville was considered for a short period as a contender for the European capital in New Zealand.

A building across the road (004) is recorded on the CHI (3702) and as archaeological site R11/2965. As part of developing the New World supermarket this building was moved to a new location and the footprint investigated (Hawkins and Campbell 2020). The proposed development will have no impact on this site.

A notable tree is recorded in the road reserve on the corner of Hobsonville Road and Williams Road (AUP:OP notable trees #1812 and CHI #2281, “014” on Figure 40, 41 and 50). NoR W5 will not impact this tree as the design of NoR W5 has been amended so as to avoid the removal of the tree.

A midden and possible gum digger camp have been recorded on the basis of local European oral traditions at area “003” on the maps (CHI# 12363, R11/2026). Current earthworks in this area (carried out under an archaeological authority) have not yet discovered any archaeological features (S. Phear, HNZPT, Auckland, pers. comm.). However we consider there is still a possibility that this site may be present on the RSA property next door and the widening of the road as part of NoR W5 could impact on it.

A large house built or moved to the site after 1940 (008 in the graphics) further along Hobsonville Road is recorded as heritage item 3699 in the CHI. The footprint of the building is outside the development area of NoR W5.

There is little risk of encountering archaeological features during widening of the road. The small risk that unidentified archaeological features could be encountered could be mitigated by applying for an archaeological authority for pre and post Contact archaeological features from HNZPT under the HNZPTA.

Figure 42: Hobsonville Hall (005) viewed from the road.

Figure 43: Hobsonville Hall in relation to the road.

Figure 44: Carpark of the Hobsonville Hall.

Figure 45: View over Hobsonville Hall from the carpark.

Figure 46: Location of destroyed archaeological site R11/2965 (moved building 004).

Figure 47: Historic house at 1 Williams Road (AUP:OP 00071) "007".

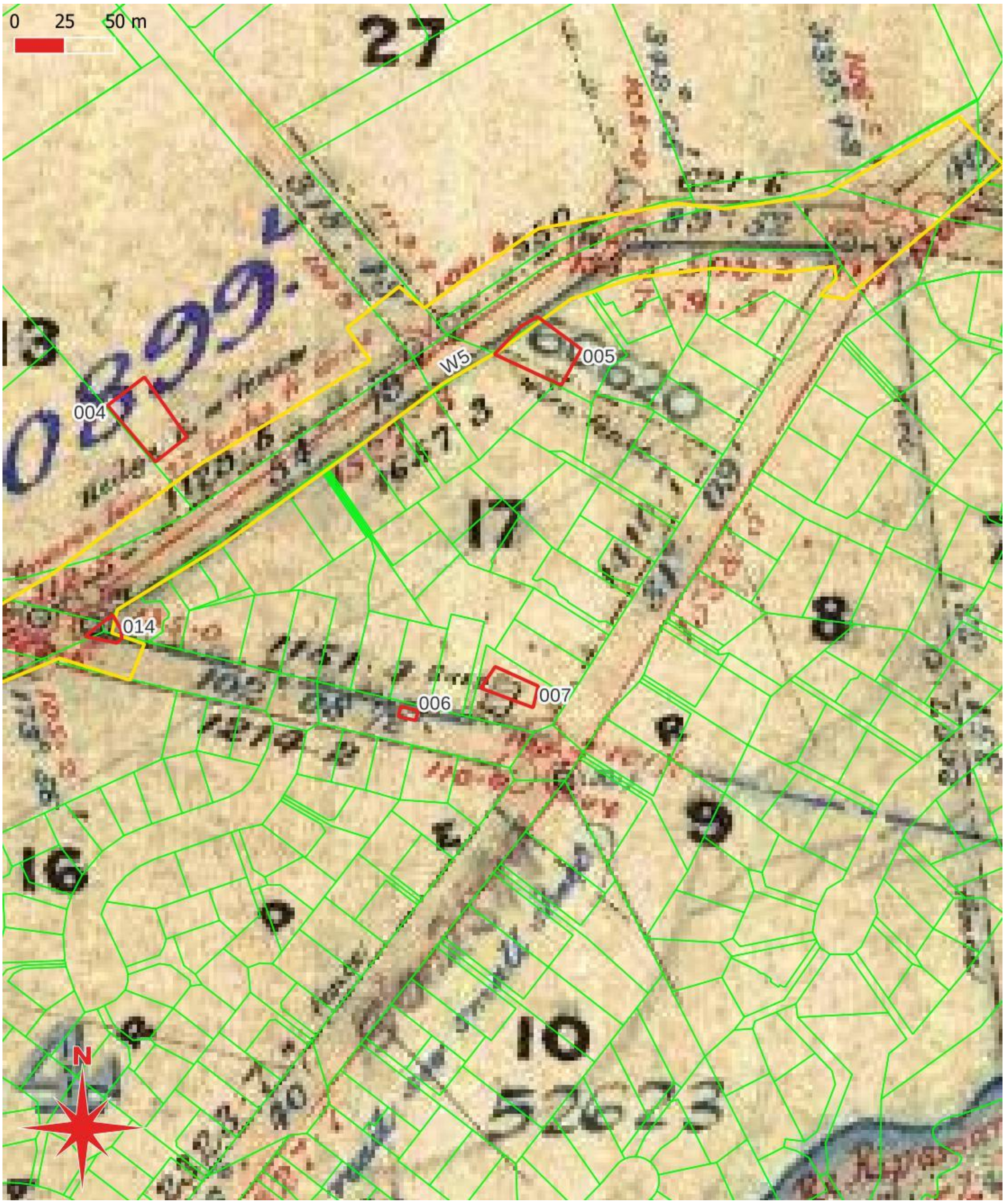

Figure 48: Historic map from 1881 (SO2598) showing location of historic house '007"

Figure 49: Notable gum tree at '006'.

Figure 50: Bronze plaque below gum tree.

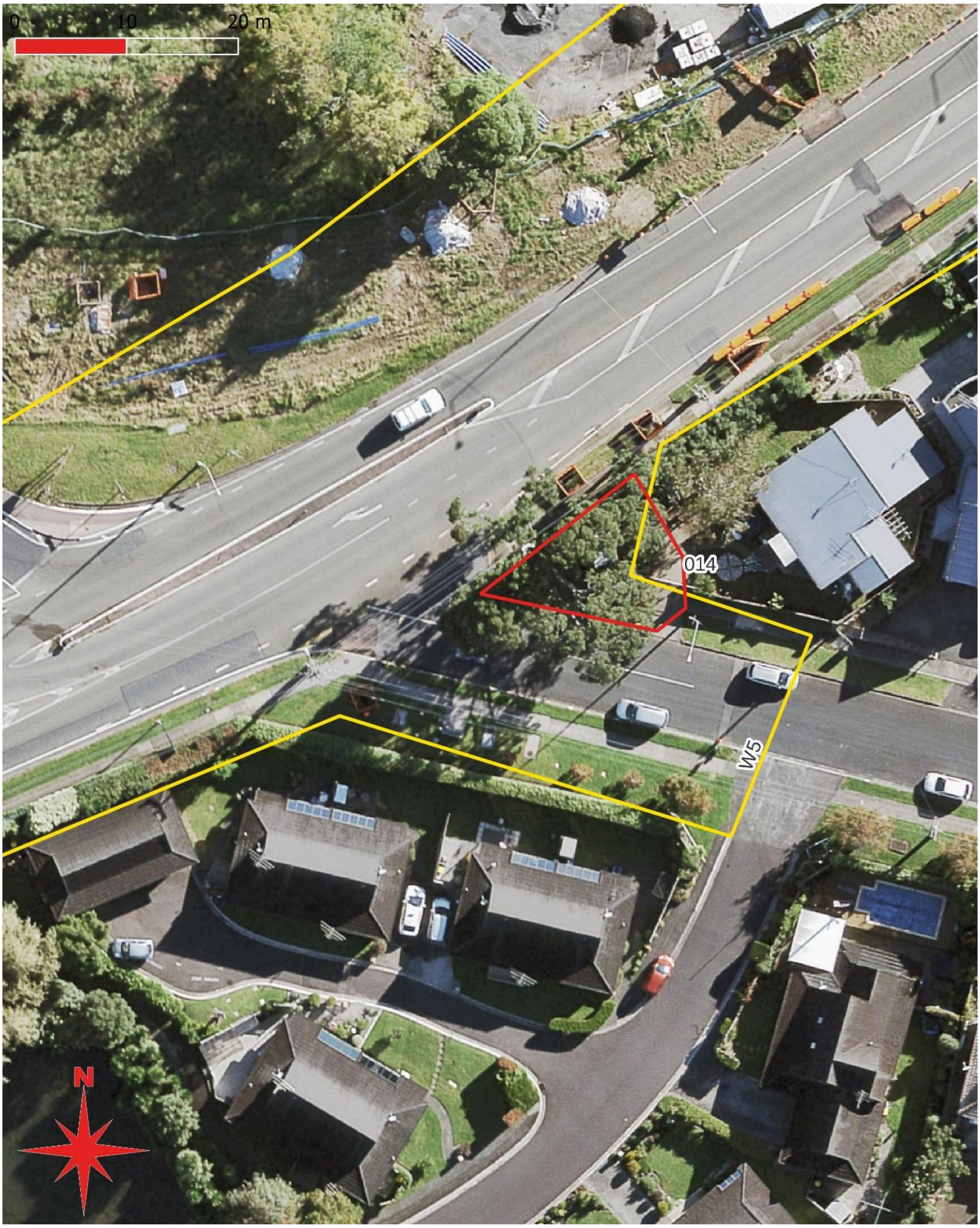

Figure 51: Notable tree (014) within the road reserve at the road corner Hobsonville Road and Williams Road.

Figure 52: Recent earthworks on recorded 'gum digger camp' (003).

Figure 53: Historic house post 1940 ('008') in relation to the proposed development.

Figure 54: House at '008'.

Figure 55: Current road reserve at '008'.

12.2 Existing and Likely Future Environment

12.2.1 Planning context

Hobsonville Road is an existing urban corridor with land zoned under the AUP:OP as follows:

- The southern side of Hobsonville Road is largely zoned Residential – Mixed Housing Urban Zone, with a Business – Local Centre Zone located adjacent to the intersection of Hobsonville Road, Wiseley Road and Clark Road at the eastern end of the corridor; and
- The northern side of Hobsonville Road contains a variety of land uses. Adjacent land on the western end of the corridor is currently zoned Residential – Mixed Housing Zone between SH16 and Trig Road (proposed for up zoning as part of PPC5), with FUZ land behind. Land to the east of Trig Road to Westpark Drive is currently zoned FUZ, with land then zoned Business – Light Industrial Zone to the east of Westpark Drive.

PPC5 proposes to re-zone the existing FUZ area to Residential – Mixed Housing Zone and Residential – Terrace and Apartment Building Zone.

The Hobsonville Road corridor is currently designated by AT for Transport Purposes (Designation 1437). Designation 1437 has been given effect to and it is proposed to alter this designation.

Table 12-1 below provides a summary of the North West existing and likely future environment.

Table 12-1: Hobsonville Road FTN Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likely Future Environment[10]	Likelihood of Change for the environment[11]
Business	Business (Light Industrial)	Business (Light Industrial)	Low
	Business (Local centre)	Business (Local centre)	Low
Residential	Residential	Residential	Low
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	Urban	High

12.2.2 Heritage Environment

No historic heritage or archaeological sites are recorded within NoR W5.

A notable tree is within NoR W5 but the design of NoR W5 has been amended to avoid removal of this tree.

There is a small risk that features from the reported gum digger site could be encountered during earthworks.

[10] Based on AUP:OP zoning/policy direction
[11] Based on AUP:OP zoning/policy direction

12.3 Assessment of Effects on Historic Heritage and Archaeological Sites and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

12.3.1 Positive Effects

Potential positive effects are detailed in Section 6.

12.3.2 Assessment of Construction Effects

The notable tree on the corner of Hobsonville and Williams Road is within the extent of NoR W5. It is scheduled within the AUP:OP. However the design of NoR W5 has been amended to avoid removal of this tree.

There could be a potential adverse effect on the reported gum digger site during earthworks.

If remains were encountered, they are not rare, but are rarely recorded due to their ephemeral nature. There is only limited information potential from it and as they would be sub surface they don't have any amenity value. No specific link to a social group is likely to be established from the remains only and no other criteria are applicable.

In conclusion there are no significant adverse effects on historic heritage resulting from NoR W5.

12.3.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

The small risk of encountering unrecorded archaeological features can be mitigated by obtaining a precautionary archaeological authority from HNZPT under the HNZPTA and complying with the conditions of the authority.

It is recommended that all areas of earthworks or topsoil stripping during construction are included in the precautionary archaeological authority.

12.3.4 Assessment of Operational Effects

There are no other adverse effects on historic heritage during operation of NoR W5.

12.3.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

There are no recommended measures to avoid operational effects as there are no adverse effects to be mitigated.

12.4 Conclusions

There are no known heritage or archaeological sites within the proposed corridor of NoR W5 however there remains a small risk of unrecorded archaeological features being encountered. The associated effects can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

A notable tree is within the proposed corridor of NoR W5. However the design of NoR W5 has been amended so that removal of the notable tree is avoided.

Therefore, with the recommended mitigation in place, there are no residual negative effects on historic heritage due to NoR W5.

13 Conclusion

The nature of historic heritage, especially archaeological features, recorded and unrecorded, is that all disturbances including construction has a negative effect that cannot be remediated only mitigated.

Nonetheless construction around wetlands and streams will allow environmental archaeological research to be undertaken. The positive effect of investigating the various silt layers is that it could clarify the dates, sequence and details of the anthropogenic vegetation change from forest to open fern lands. This can be done independent or in conjunction with investigation archaeological features.

Any pre-Contact horticulture such as frequent harvesting of fern root rhizomes or taro fields have not been observed in the study area to date. Large linear developments like the ones proposed here are a perfect opportunity to close this gap in our knowledge independent from finding archaeological features.

NoR W1 Trig Road North There are no adverse effects on historic heritage by NoR W1.

There is a small risk of potential adverse effects due to unrecorded archaeological sites being encountered.

However overall, there is no significant adverse effect on historic heritage by NoR W1 as the associated effects of encountering unrecorded archaeological features can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

NoR W2 Māmari Road

Potential adverse effects would result if unrecorded archaeological features are discovered close to the Sinton Stream crossing. Any archaeological features if discovered are likely to be from seasonal camps used as bases to exploit local resources. They would not have been rare but are rarely recorded and their information potential is high considering that no inland pre-Contact sites have been recorded or documented. As any sites would be sub surface they have no amenity value and their cultural association would be the known relationship of iwi and hapū to the area. No additional assessment criteria are applicable.

A precautionary archaeological authority would manage the risk of encountering unrecorded archaeological features.

Overall there is no significant adverse effect on historic heritage by the NoR of W2 because the small risk of encountering unrecorded archaeological features can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

NoR W3 Brigham Creek Road

Potential adverse effects would result if unrecorded archaeological features are discovered close to the Waiarohia Stream and Totara Creek crossings. Both streams might have been navigable by waka beyond the proposed NoR W3 crossing. Any archaeological features are likely to be from seasonal camps used to exploit local resources like the shell midden close to NoR W3 along the Totara Creek. They would not have been rare but are rarely investigated comprehensively and their information potential is high considering that no inland pre-Contact sites have been recorded or documented. As any sites would be sub surface they have no amenity value and their cultural association would be the known relationship of iwi and hapū to the area. No additional assessment criteria are applicable.

A precautionary archaeological authority would mitigate the risk of encountering unrecorded archaeological features.

Overall there is no significant adverse effect on historic heritage by the NoR of W3, because the reasonably high risk of encountering unrecorded archaeological features can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

NoR W4 Spedding Road

Potential adverse effects would result if unrecorded archaeological features are discovered close to the Waiarohia Stream, Rāwiri Stream and Totara Creek crossings. Any archaeological features are likely to be from seasonal camps used to exploit local resources. They would not have been rare but are rarely investigated comprehensively and their information potential is high considering that no inland pre-Contact sites have been recorded or documented. As any sites would be sub surface they have no amenity value and their cultural association would be the known relationship of iwi and hapū to the area. No additional assessment criteria are applicable.

A precautionary archaeological authority would mitigate the risk of encountering unrecorded archaeological features.

There is also a low risk that subsurface ancillary structures belonging to the WW2 heavy anti-aircraft gun emplacements could be encountered. As they are not archaeological sites but can be considered having heritage value under the AUP:OP criteria of historical, technological and contextual values, discussions with the Auckland Council Heritage Unit are encouraged. It is noted that a heritage overlay is also proposed under PPC5 for this site.

Overall there are no significant adverse effects on historic heritage due to NoR W4, as while there remains a reasonably high risk of encountering unrecorded archaeological features, at least at the Totara Creek crossing, the associated effects can be mitigated through the conditions requiring a precautionary HNZPTA archaeological authority to be obtained.

NoR W5 Hobsonville Road

The notable tree on the corner of Hobsonville and Williams Road is within the extent of the development. It is scheduled with the AUP:OP. However, the design for NoR W5 has been amended to ensure the notable tree is avoided.

There are potentially adverse effects on the reported gum digger site should this site be encountered during earthworks.

If features of a gum digger site are encountered, they are not rare within west Auckland or the North Island, but are rarely recorded due to their ephemeral nature. There is only limited information potential from it and as they would be sub surface they don’t have any amenity value. No specific link to a social group is likely to be established from the remains only and no other criteria under the HNZPTA or AUP:OP are applicable.

Overall there are no significant adverse effects on historic heritage from NoR W5 as the small risk of encountering unrecorded archaeological features can be managed by a precautionary archaeological authority being applied for from HNZPT under the HNZPTA.

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