TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Whenuapai Assessment of Ecological Effects

December 2022

Version 1.0

WAKA KOTAHI
NZ TRANSPORT AGENCY

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Document Status

Responsibility	Name
Author	Dayna Zidich-Murrell (AEE specialist – Ecology), Michiel Jonker (AEE specialist – Ecology)
Reviewer	Fiona Davies (AEE specialist – Ecology)
Approver	John Daly

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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).

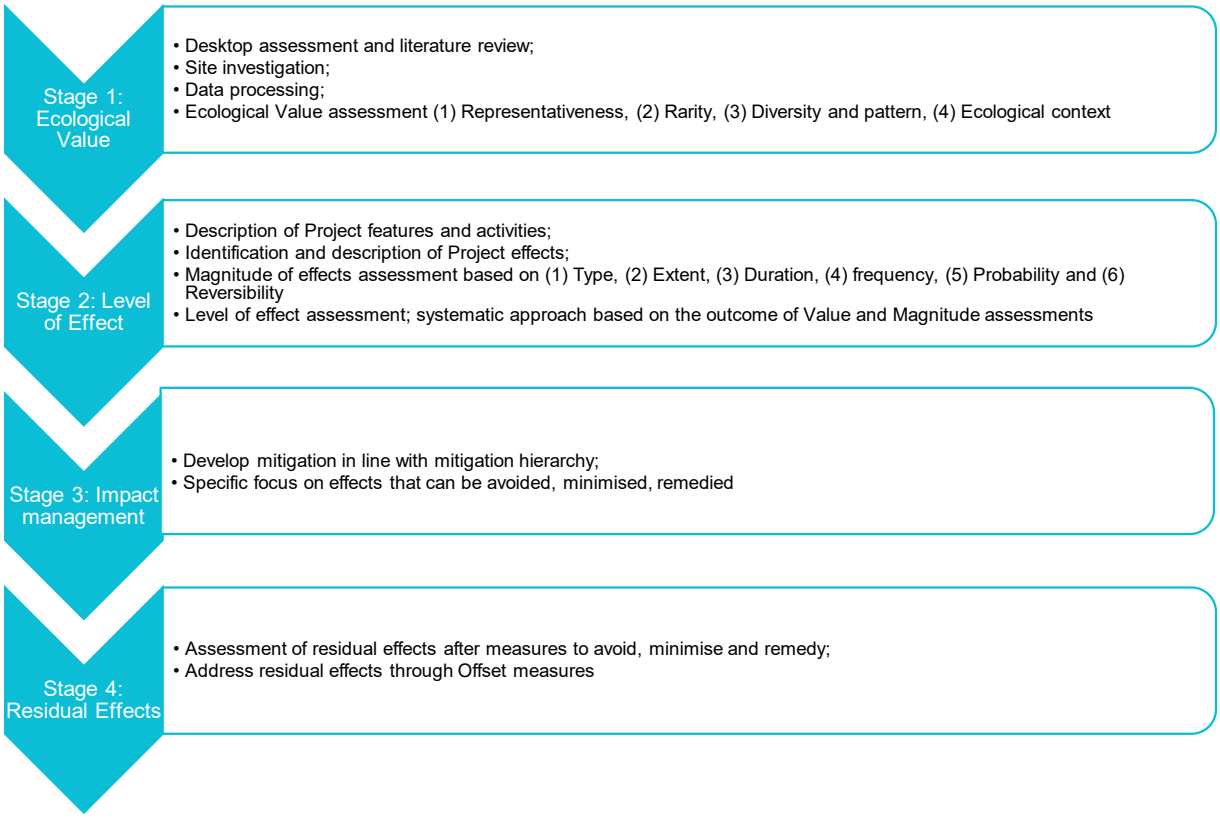

Figure 3-1 EcIA process followed for this assessment

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.

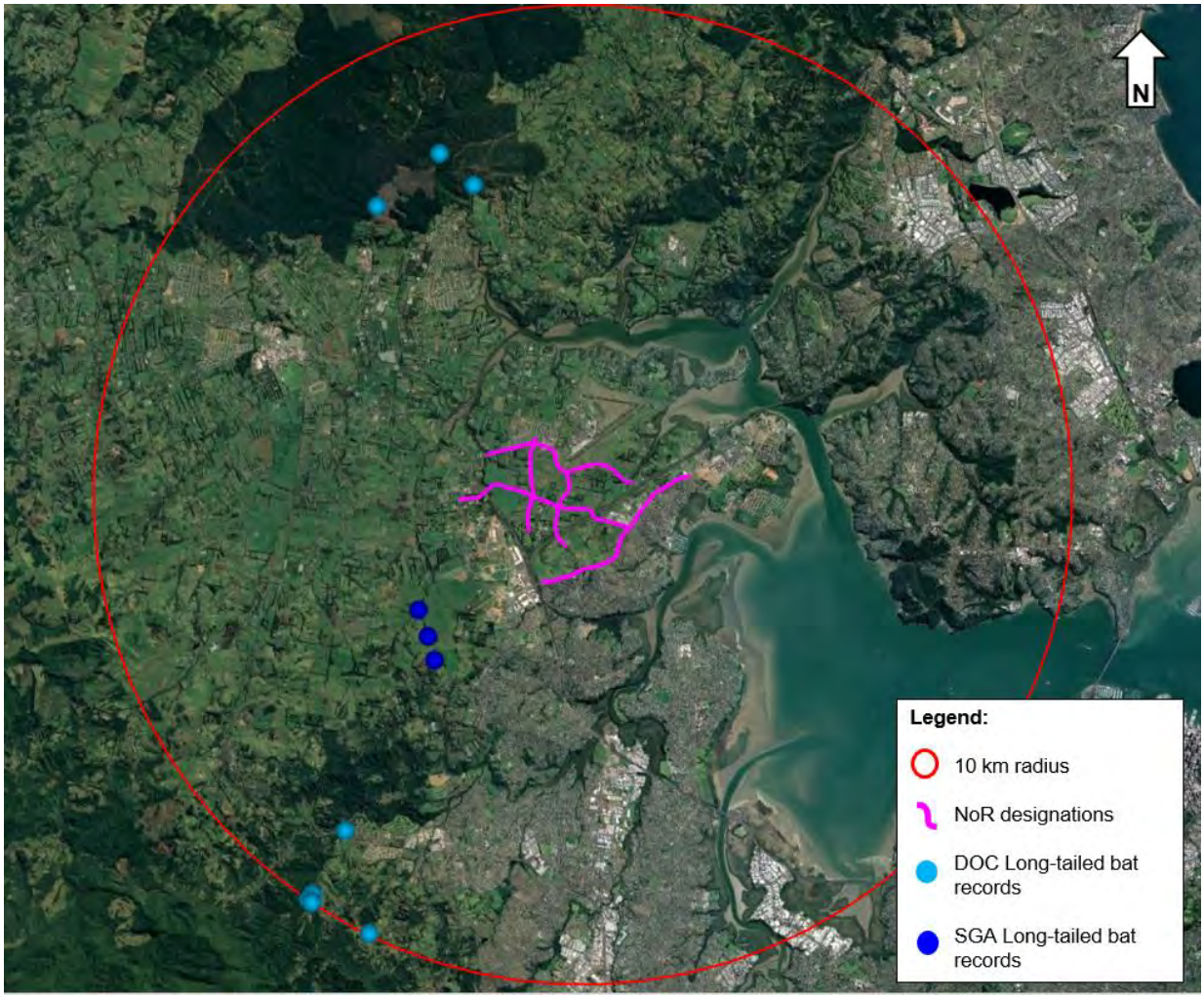

Figure 6-1 DOC and SGA historical long-tailed bat records within 10 km radius of the Project Area.

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	**TL.3 (total area of 3019 m²)** **Pohutukawa row - PL.1 (total area of 1085.9 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 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 (m²)	Designation (m²)
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.

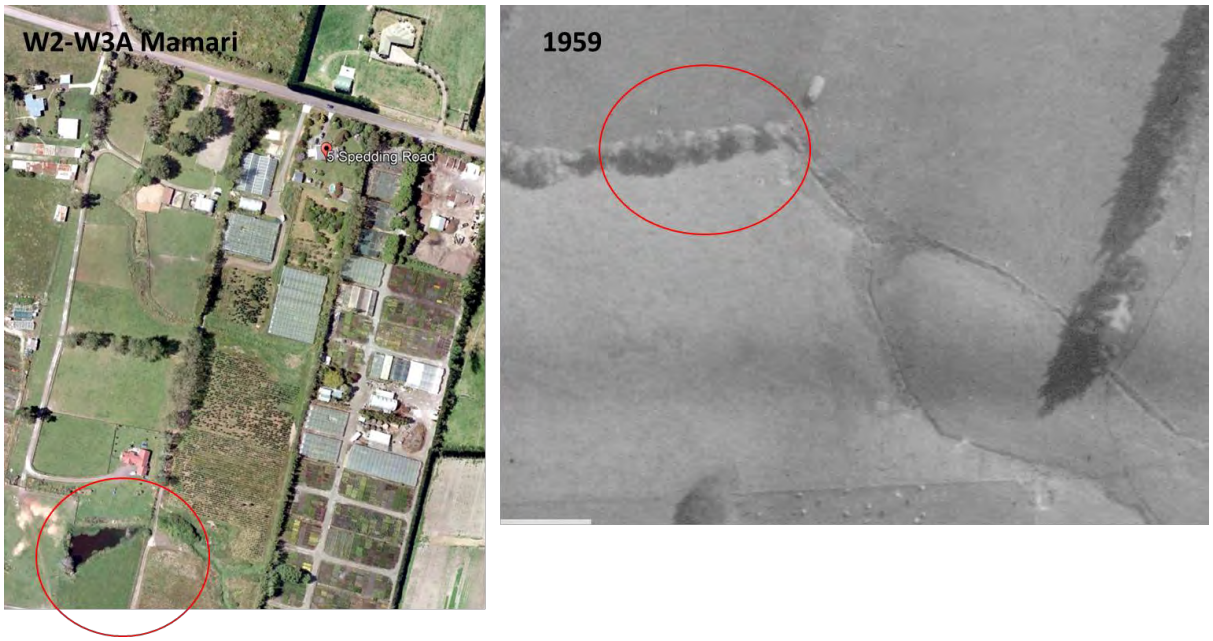

Figure 9-1 Comparison of W2-W3A during 2017 and 1959.

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.

10.2.3.5Freshwater 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.

10.2.3.6Freshwater 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.

10.2.3.7Wetland 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.

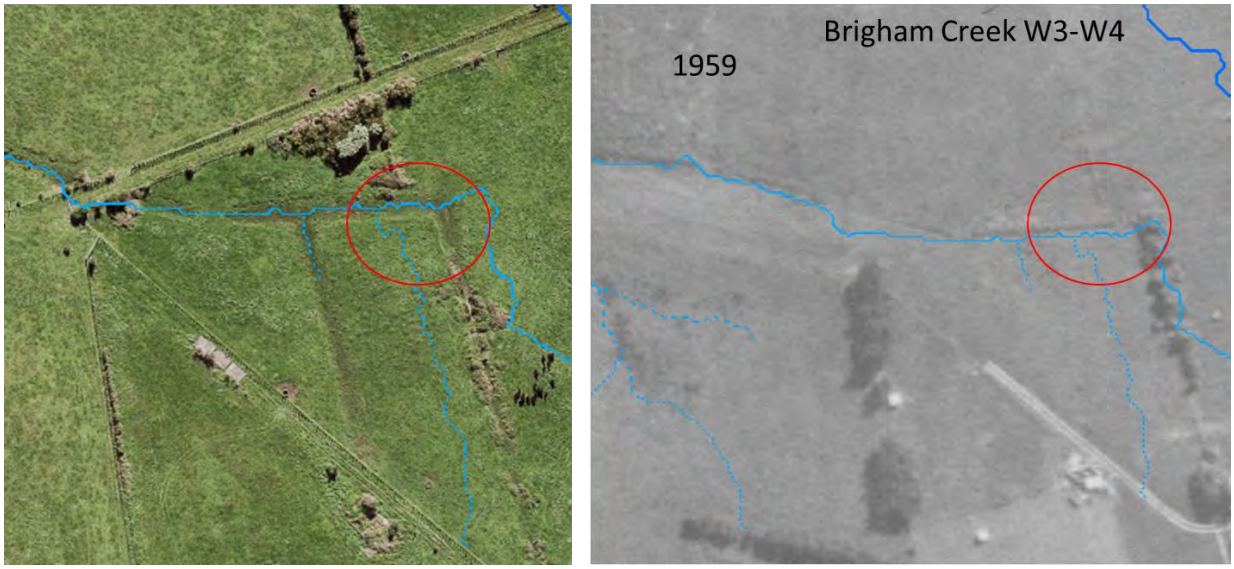

Figure 10-1 Comparison of W3-W4 during 2017 and 1959.

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

10.4.1.6Wetland 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.

11.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however two 'At Risk – Declining' species, īnanga and longfin eel have been recorded 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).

11.2.3.6 Freshwater 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.

11.2.3.7 Wetland 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 m^2)** 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.

11.4.1.6Wetland 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.

12.2.3.2Terrestrial 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 m²)** 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 (m²)	Designation (m²)
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).	✓		✓
	Reclamation/culvertin g/other structures e.g., bank armouring.	Permanent loss/modification of habitat/ecosystem.		✓	
Freshwater habitat – wetland or stream (including riparian margins)	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)

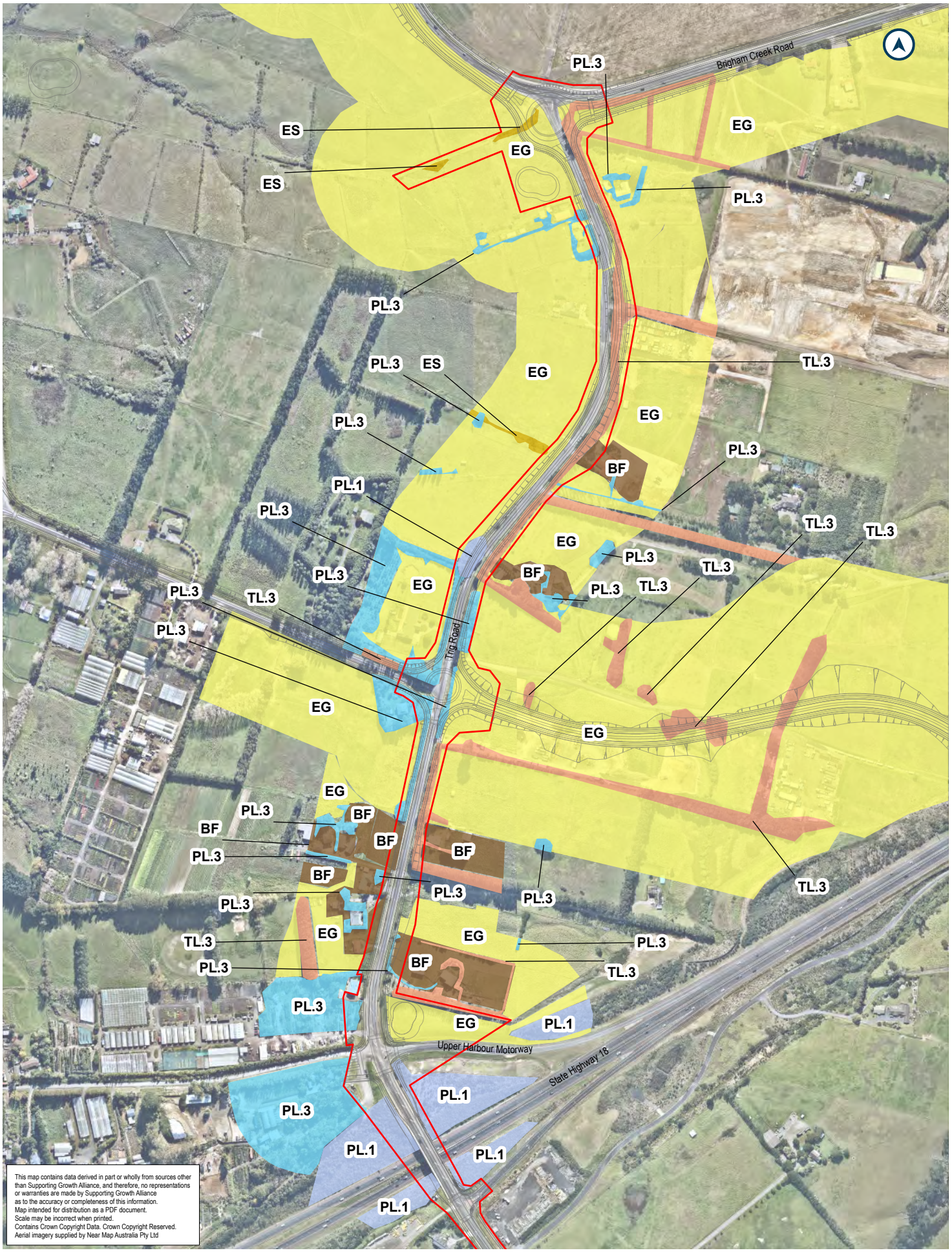
Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Pied shag	Kāruhiruhi	*Phalacrocorax varius*	At Risk - Recovering	eBird (Bird Atlas)
Pied stilt	Poaka	*Himantopus himantopus leucocephalus*	Not Threatened	eBird (Bird Atlas)
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened	eBird (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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Scale may be incorrect when printed.

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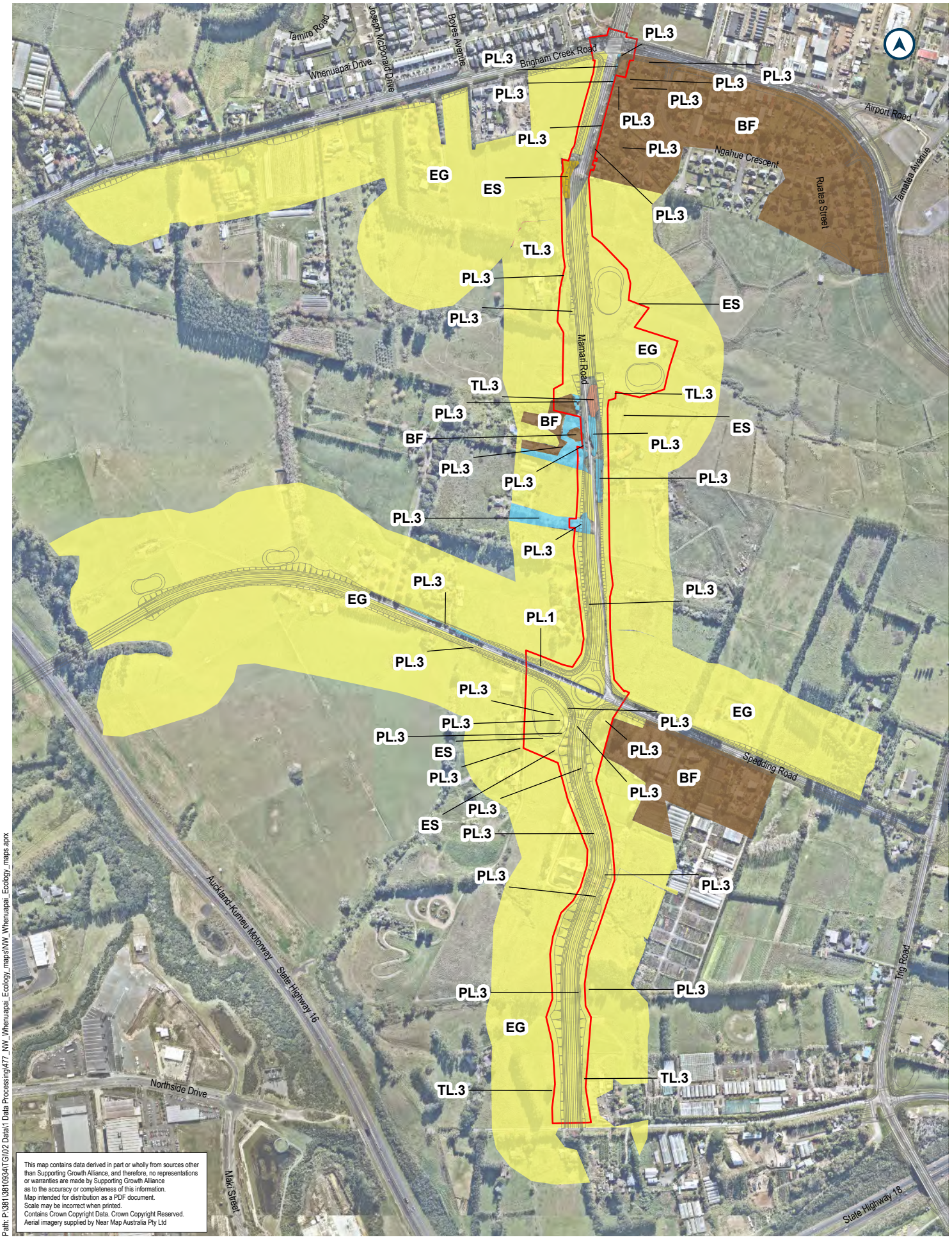
LEGEND

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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LEGEND

Route Options
Designations
Habitat Mapping
EG
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ES
PL.1
PL.3
TL.3

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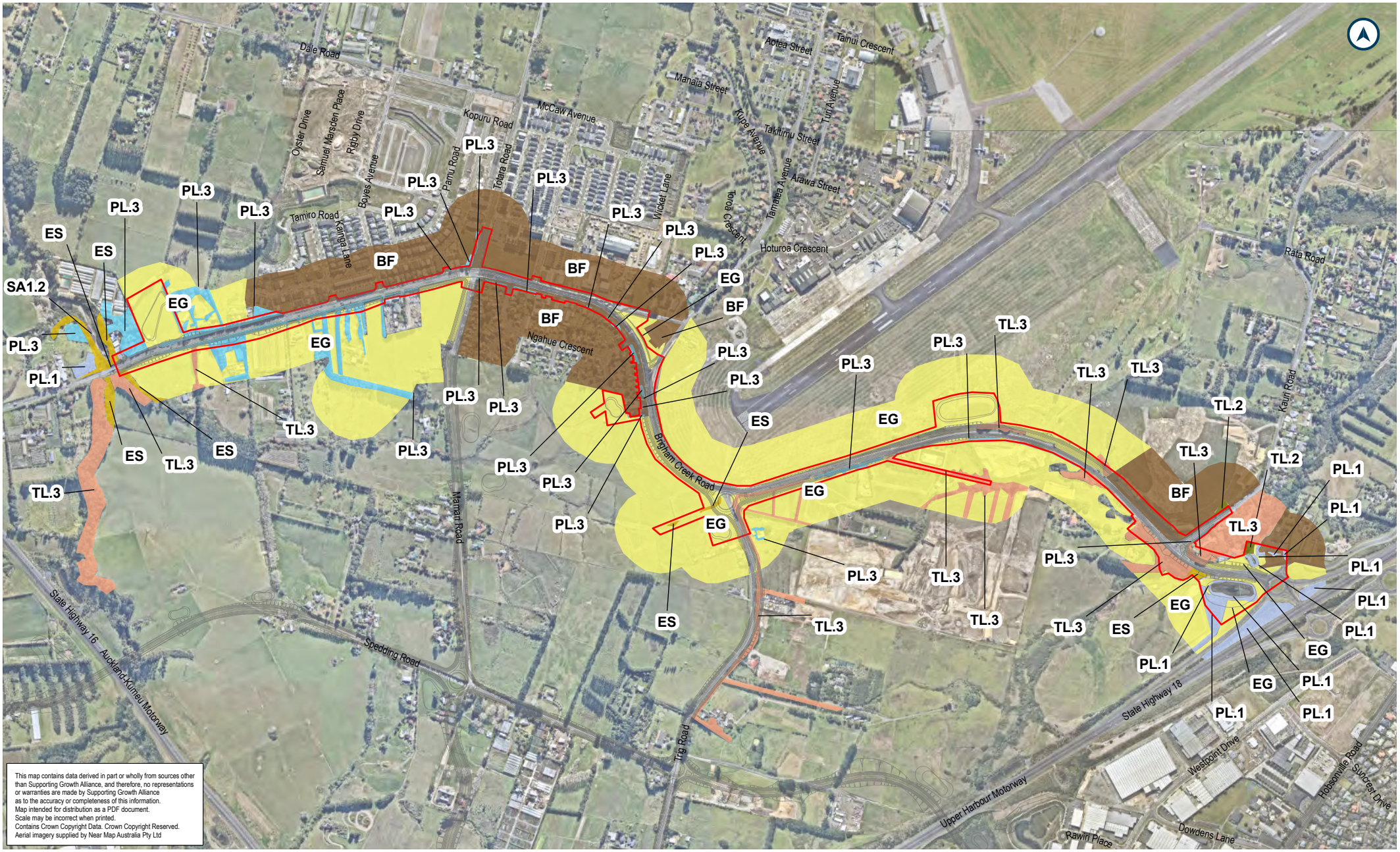
Metres

5.1.3 Brigham Creek Road



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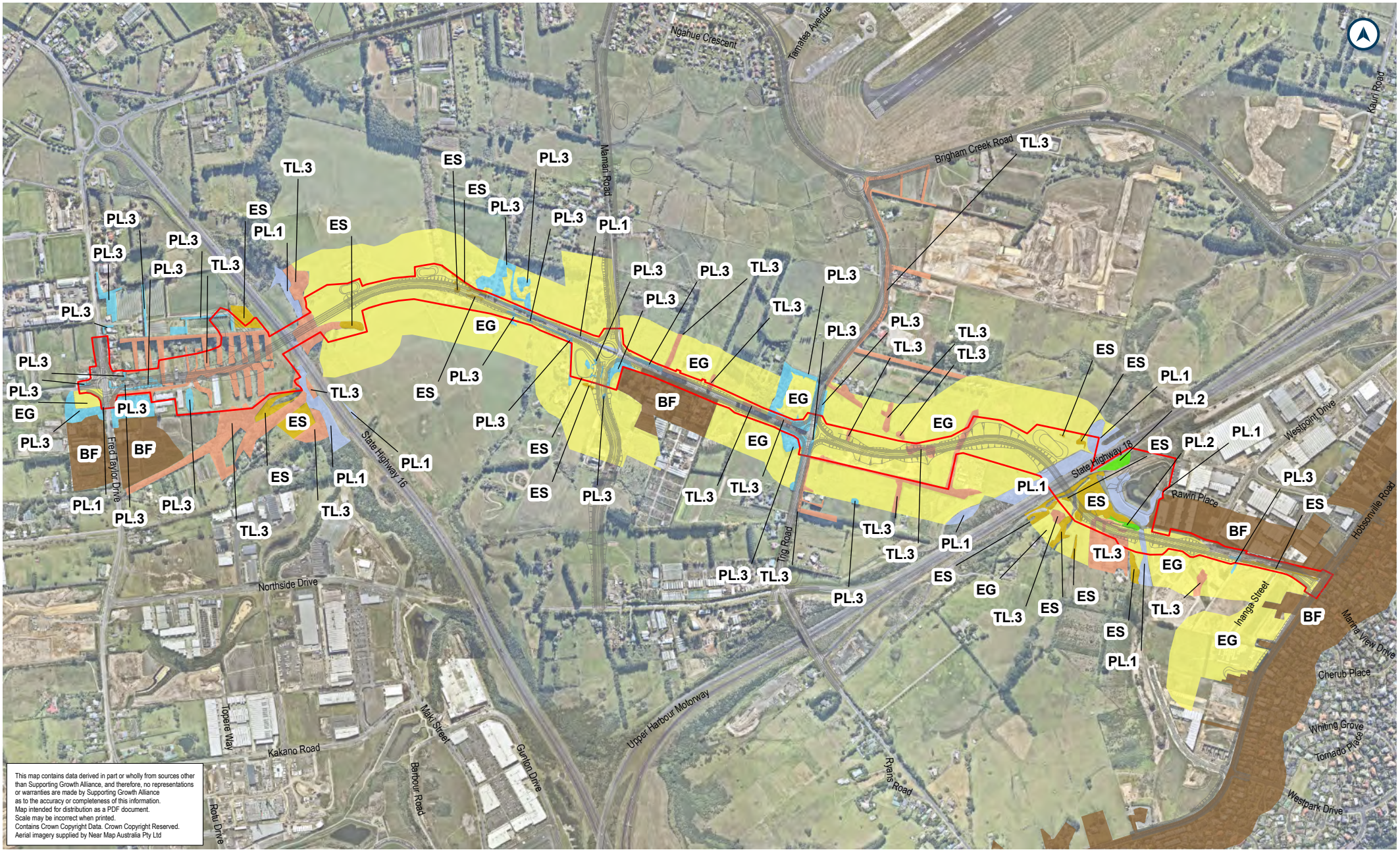
Metres

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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Tamatea Avenue
Kauri Road
Brigham Creek Road
Mamari Road
State Highway 16
Fred Taylor Drive
Northside Drive
Trig Road
Upper Harbour Motorway
Kakano Road
Topere Way
Maki Street
Barbour Road
Gunton Drive
Ryans Road
Rotu Drive
Rawiri Place
Inanga Street
Westpoint Drive
Hobsonville Road
Marina View Drive
Cherub Place
Whiting Grove
Tornado Place
Westpark Drive
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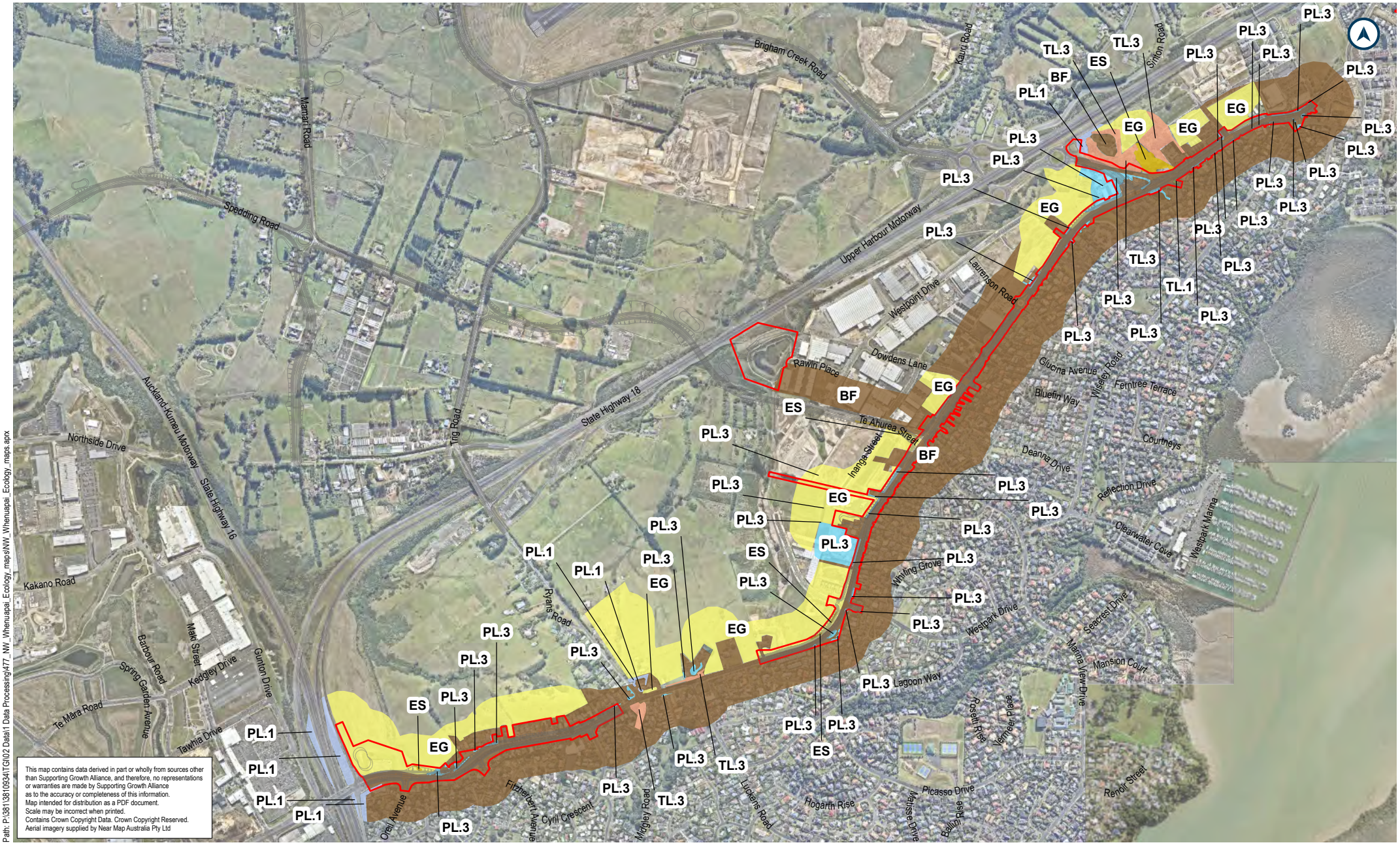
Path: P:\3811\38109341TGN\02 Data\1 Data Processing\477_NW_Whenuapai_Ecology_mapsNW_Whenuapai_Ecology_maps.aprx
LEGEND
Route Options
Designations
Habitat Mapping
BF
EG
ES
PL.1
PL.2
PL.3
TL.3
0
250
500
Metres

5.1.5 Hobsonville Road



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LEGEND

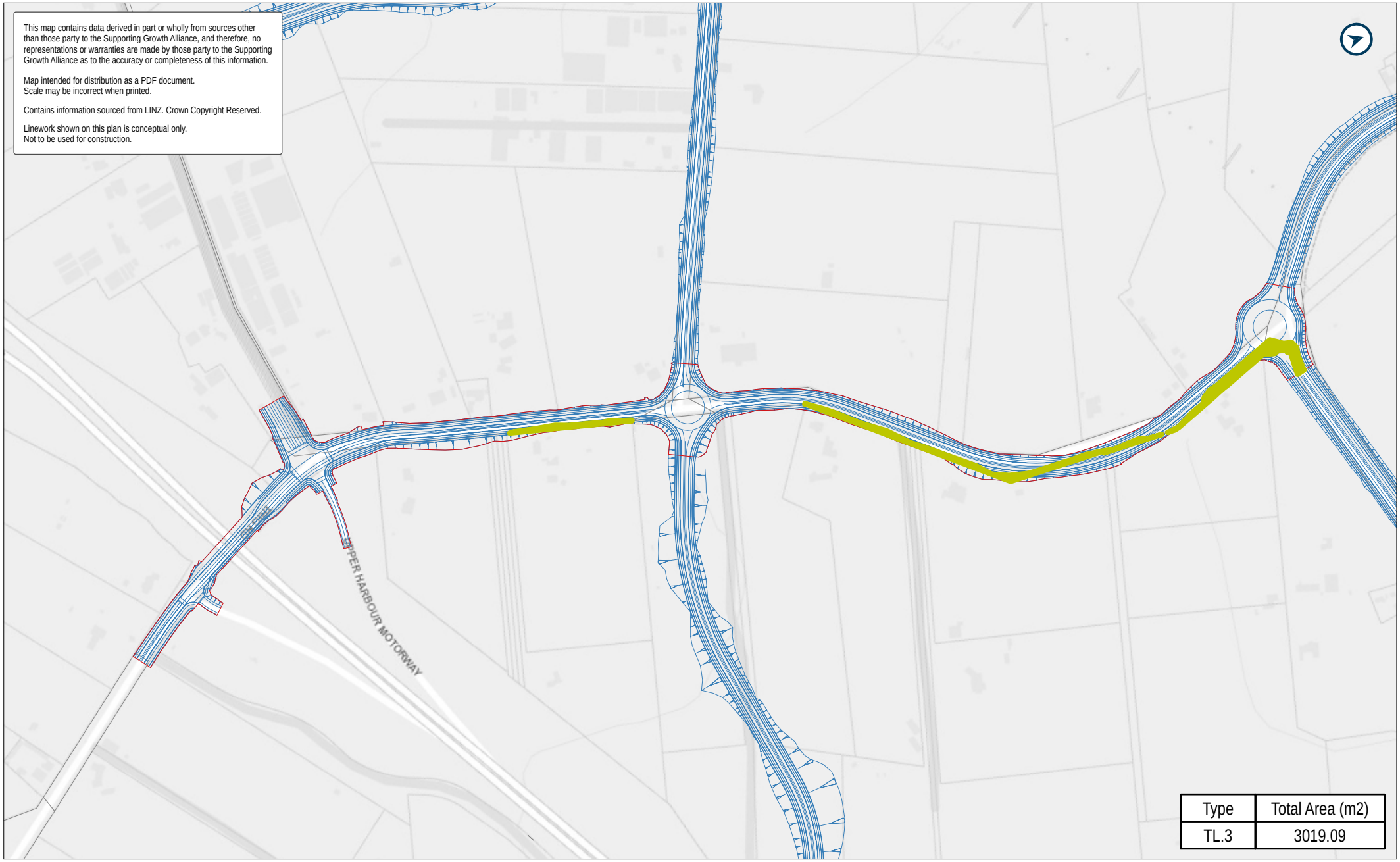
Route Options
Designations

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



Type	Total Area (m2)
TL.3	3019.09

LEGEND

- TL.3_DPT
- Route Option
- Design Boundary
- Road

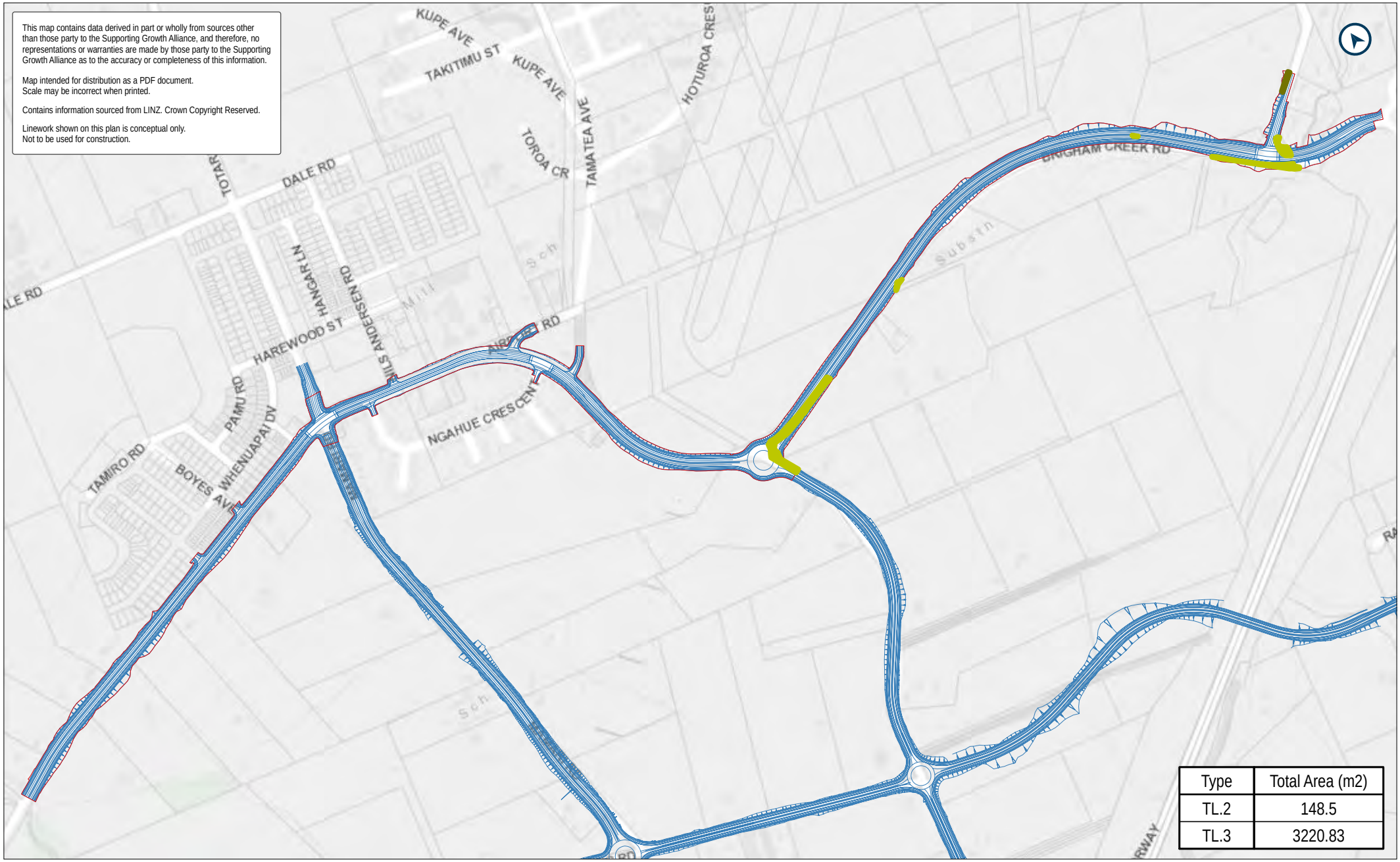
0 0.1 0.1
Kilometres

5.2.2 Māmari Road

LEGEND

- TL.3_DPT
- Route Option
- Design Boundary
- Road

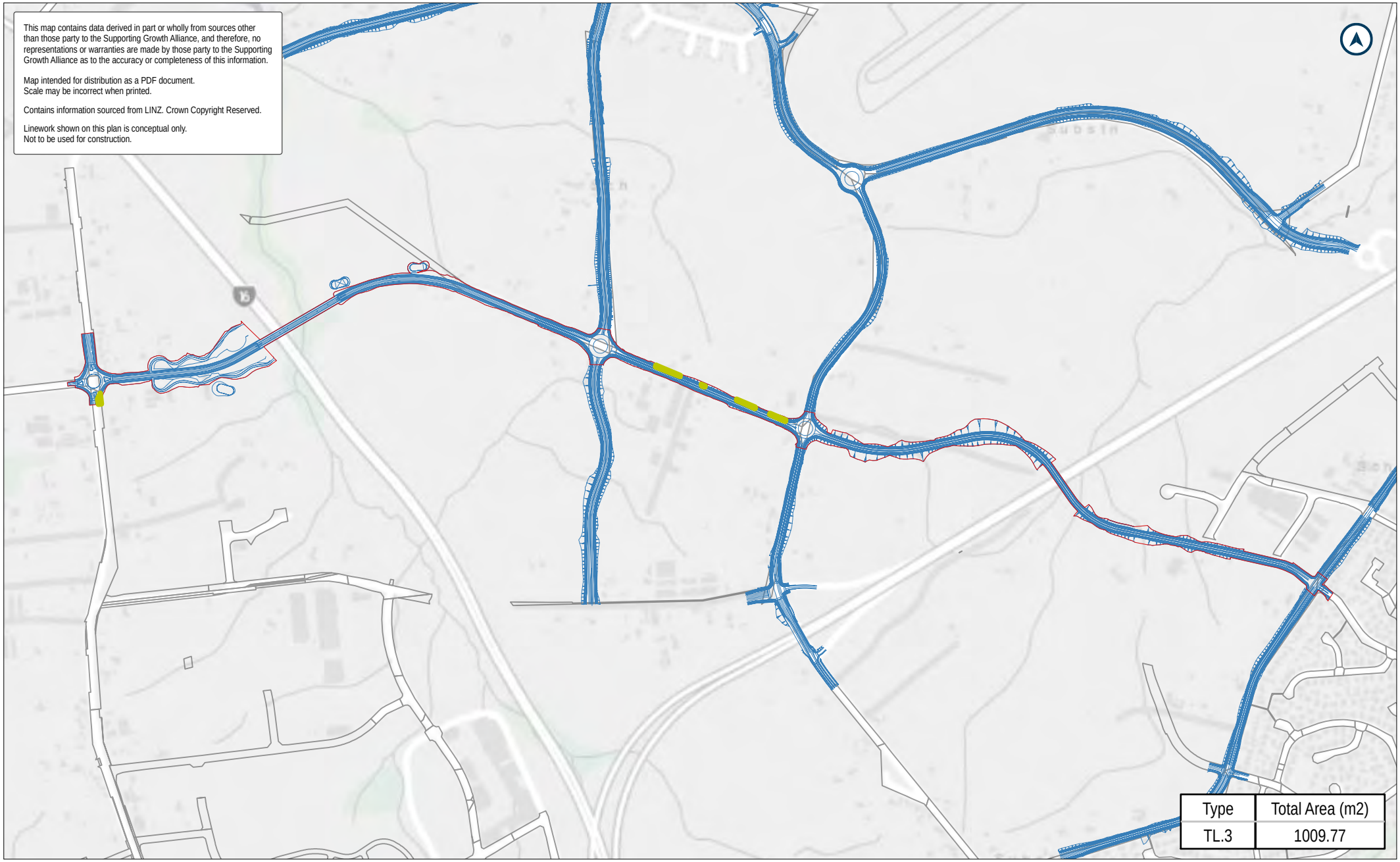
5.2.3 Brigham Creek Road



Name of Map: Brigham Creek Road

Path: P:\381\38109\94TG\02 Data\1 Data Processing\527_North West (Strategic) - District Plan trees\NW_District Plan Trees.aprx

5.2.4 Spedding Road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Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
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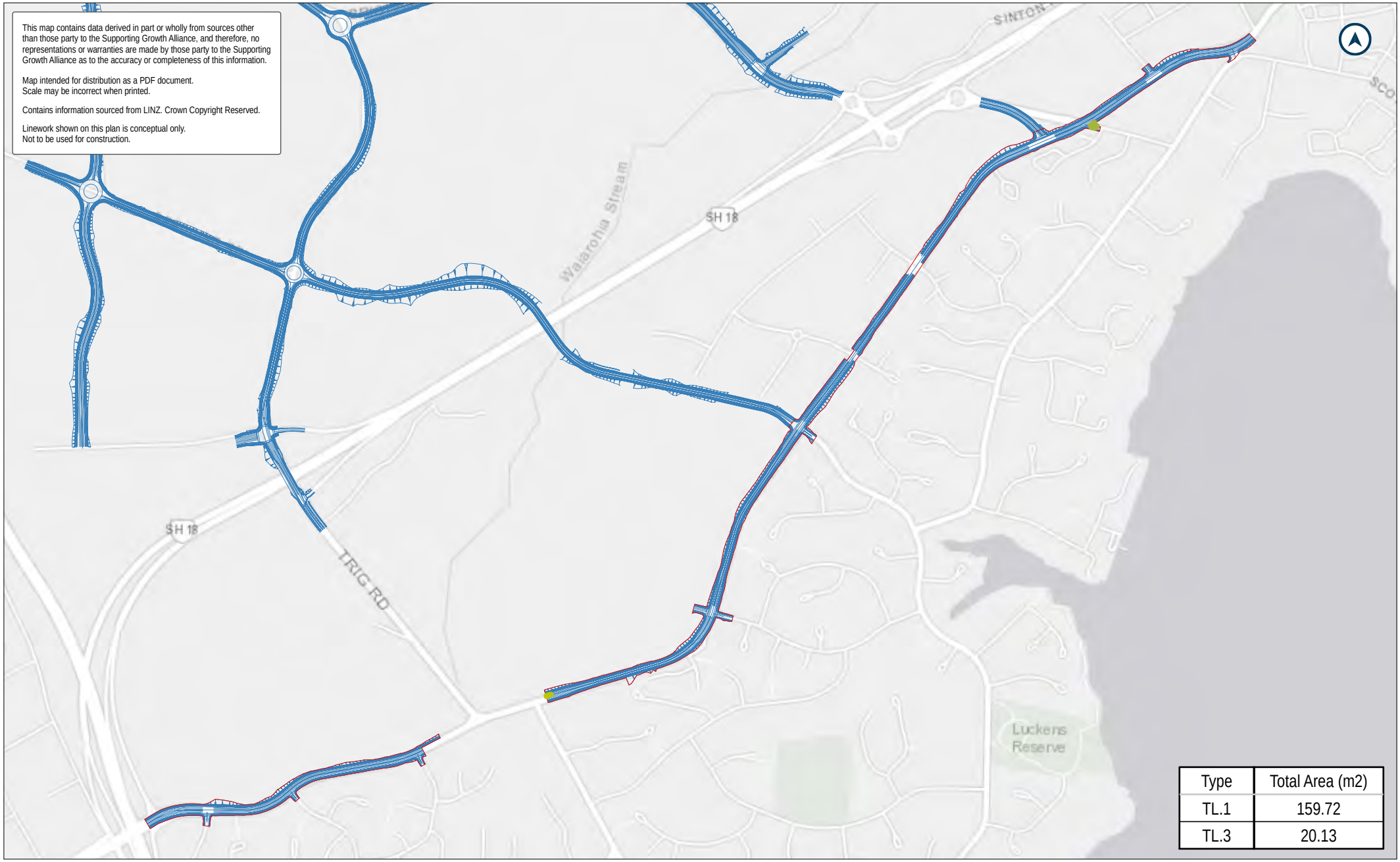
Not to be used for construction.
Name of Map: Spedding Road
Path: P:\381\381093\4TG\02 Data\1 Data Processing\527_North West (Strategic) - District Plan trees\NW_District Plan Trees.aprx
Type
Total Area (m2)
TL.3
1009.77
LEGEND
TL.3_DPT
Route Option
Design Boundary
Road
0
0.1
0.3
Kilometres

5.2.5 Hobsonville Road


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
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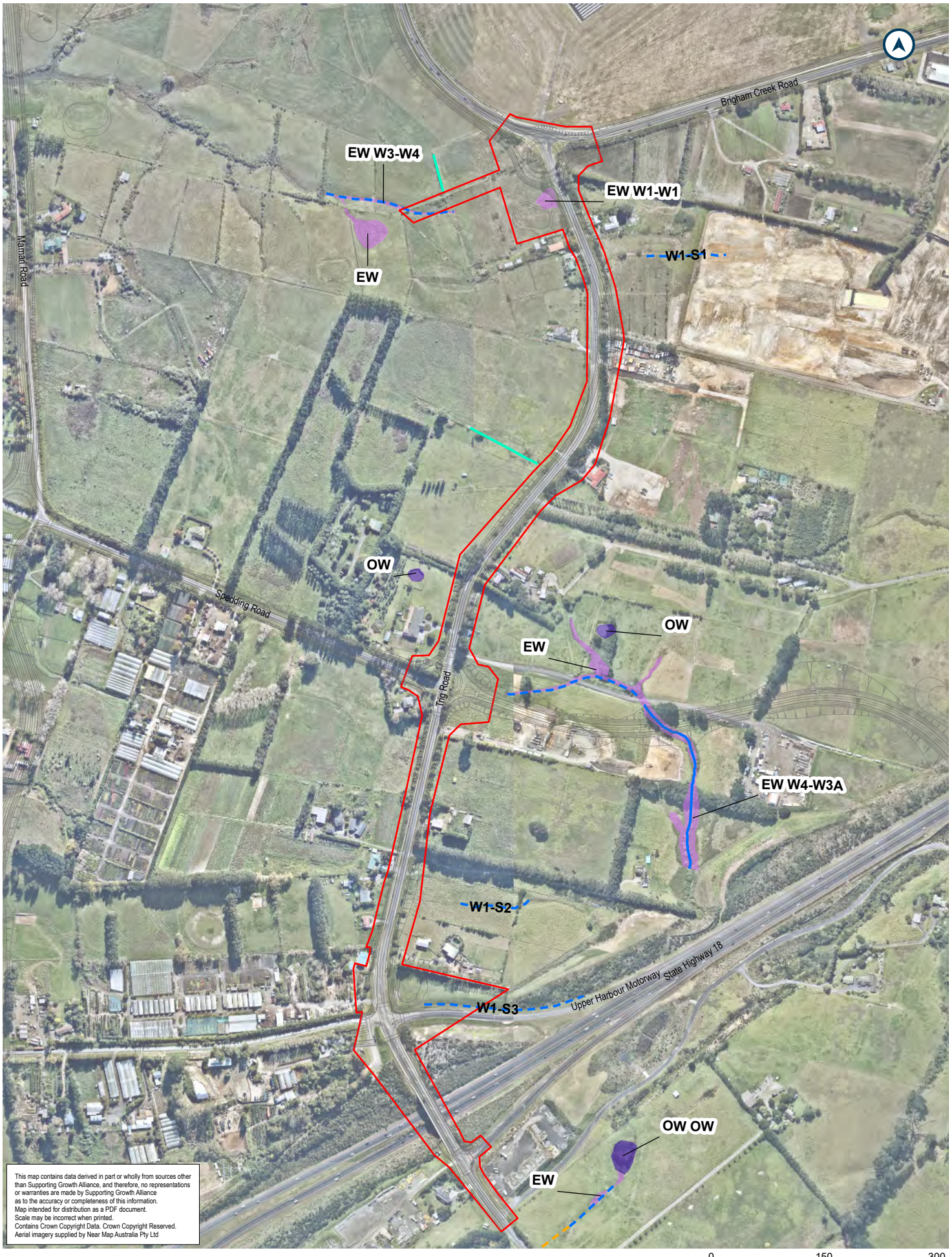
Linework shown on this plan is conceptual only.
Not to be used for construction.
Name of Map: Hobsonville Road
Path: P:\3811\381093\4TGI\02 Data\1 Data Processing\527_North West (Strategic) - District Plan trees\NW_District Plan Trees.aprx
SINTON
SCO
Waiarohia Stream
SH 18
SH 18
TRIG RD
Luckens Reserve
Type
Total Area (m2)
TL.1
159.72
TL.3
20.13
LEGEND
TL.1_DPT
TL.3_DPT
Route Option
Design Boundary
Road
0
0.1
0.3
Kilometres

5.3 Freshwater and Wetland Habitat

5.3.1 Trig Road North



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LEGEND

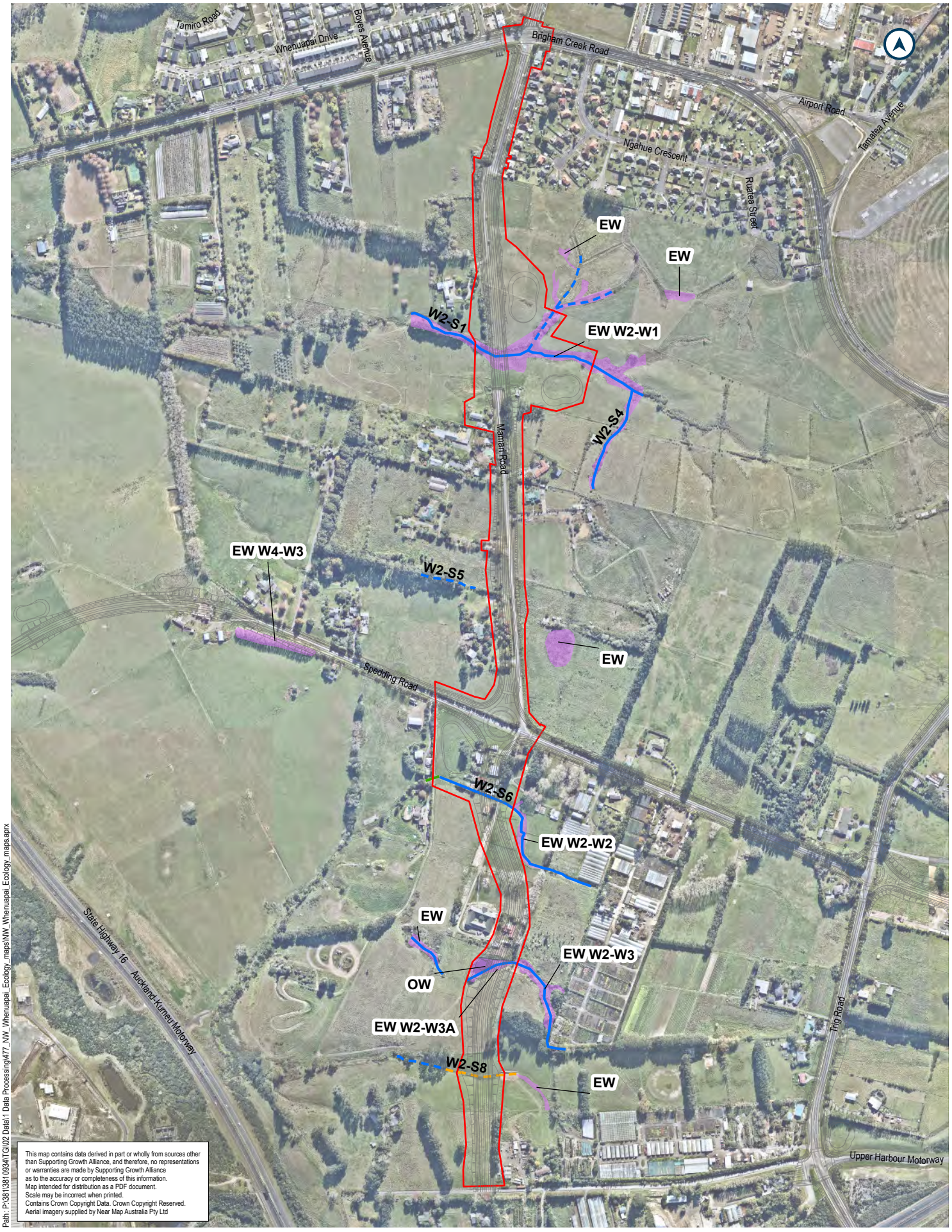
- Route Options
- Designations

Stream Classification
- Artificial swale/drainage ditch
- Ephemeral
- Intermittent
- Permanent

Habitat Mapping
- EW
- OW

0 150 300
Metres

5.3.2 Māmari Road



Path: P:\381\381093\4TGI\02 Data\1 Data Processing\477_NW_Whenuapai_Ecology_maps\NW_Whenuapai_Ecology_maps.aprx

LEGEND

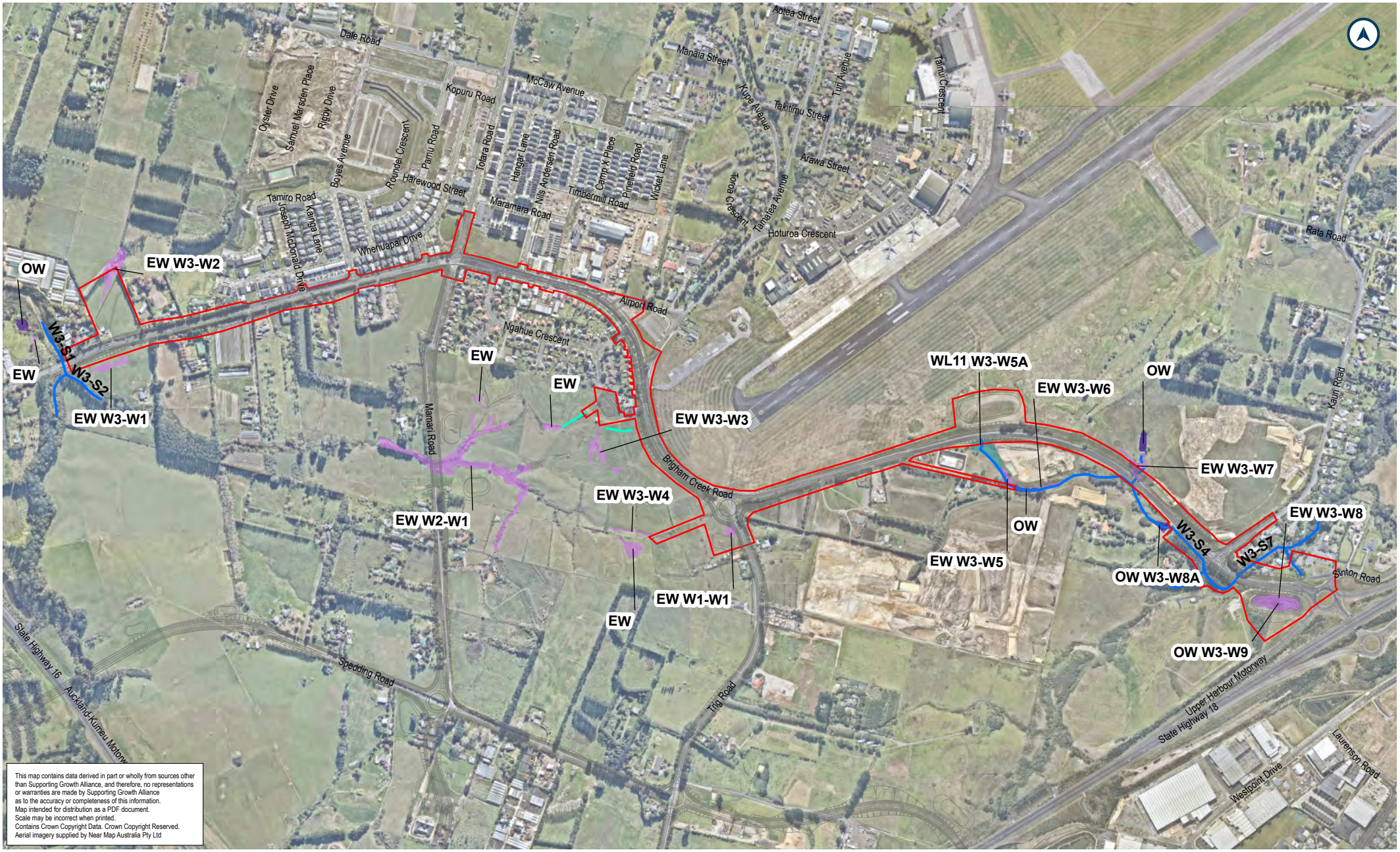
Route Options
Designations

Stream Classification
Artificial/Piped/Culvert
Ephemeral
Intermittent
Permanent

Habitat Mapping
EW
OW

0 200 400
Metres

5.3.3 Brigham Creek Road



Path: P:\381\38109341TGN\02 Data\1 Data Processing\477_NW_Whenuapai_Ecology_maps\NW_Whenuapai_Ecology_maps.aprx

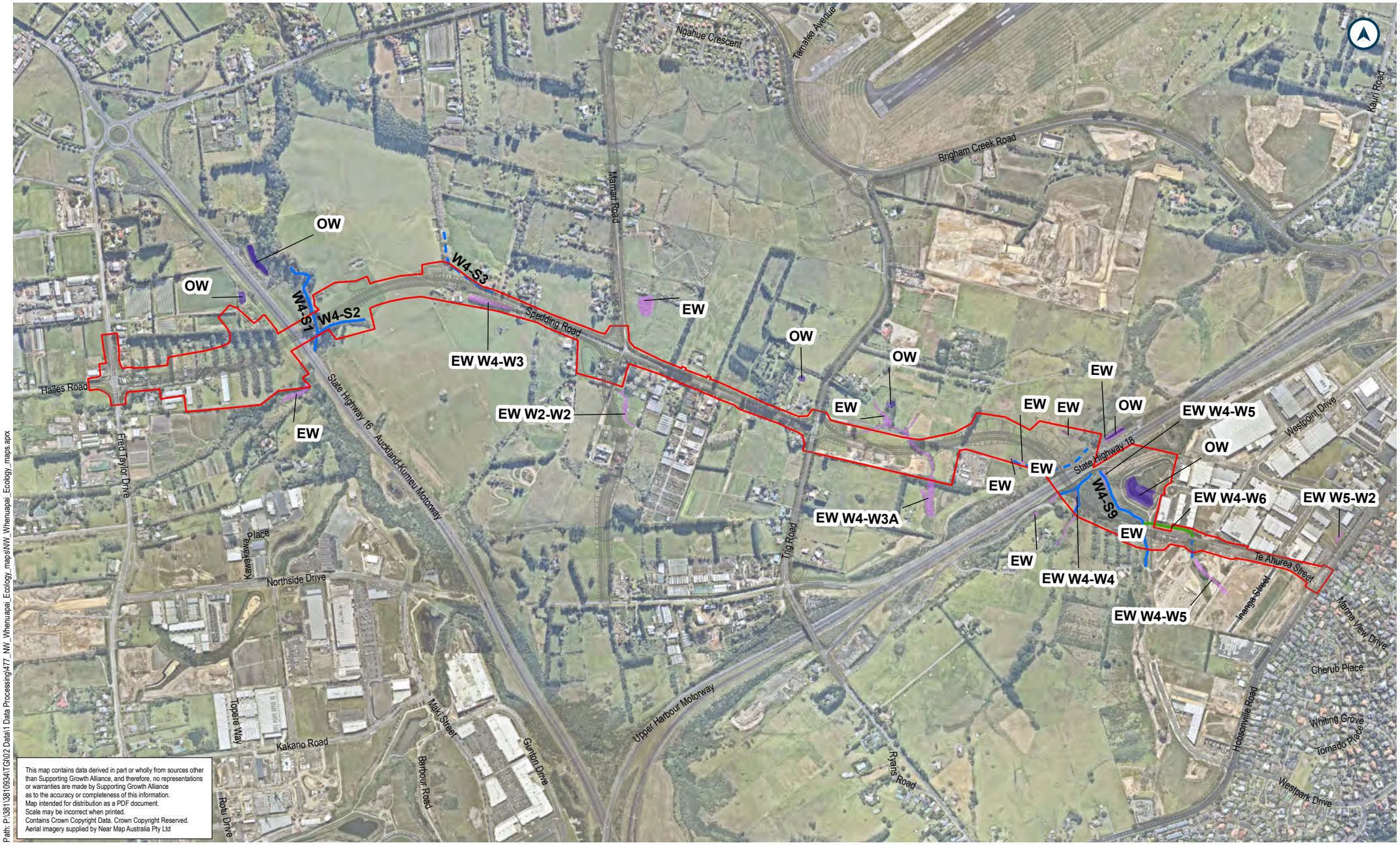
LEGEND

- 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



Path: P:\381\381093\4\TGI\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
  - OW
  - EW

5.3.5 Hobsonville Road

Path: P:\381\38109341TGN\02 Data\1 Data Processing\477_NW_Whenuapai_Ecology_mapsNW_Whenuapai_Ecology_maps.aprx

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

New Zealand Government

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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).

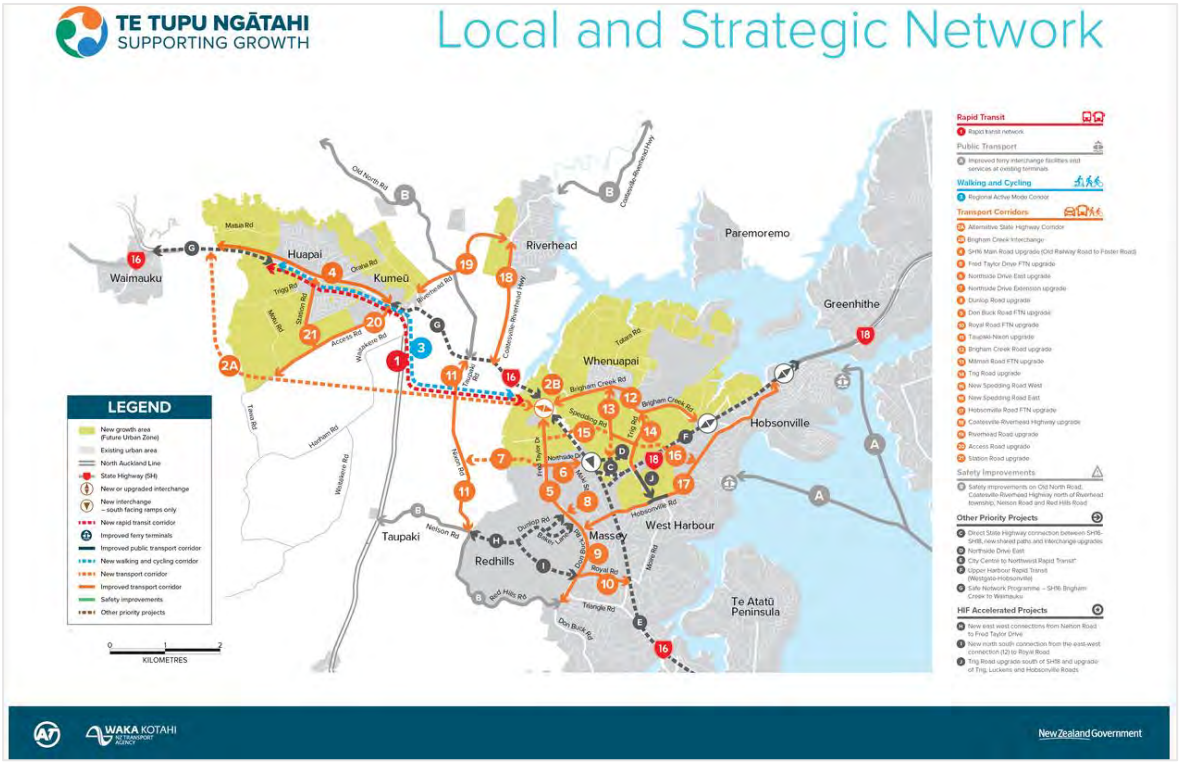

Figure 2-1 North West Growth Area Local and Strategic Network

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

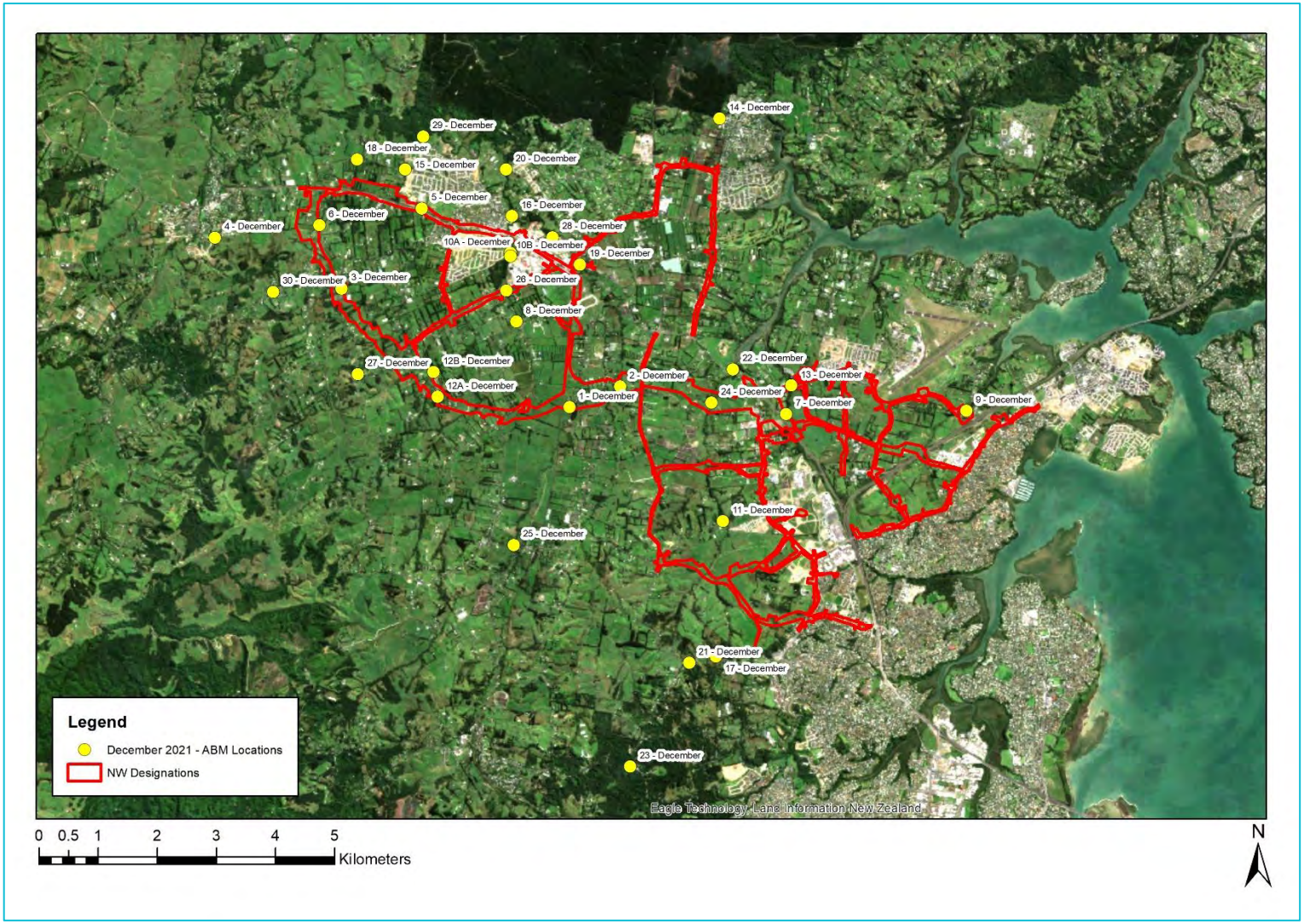

Figure 3-1 ABM locations (December 2021 survey).

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

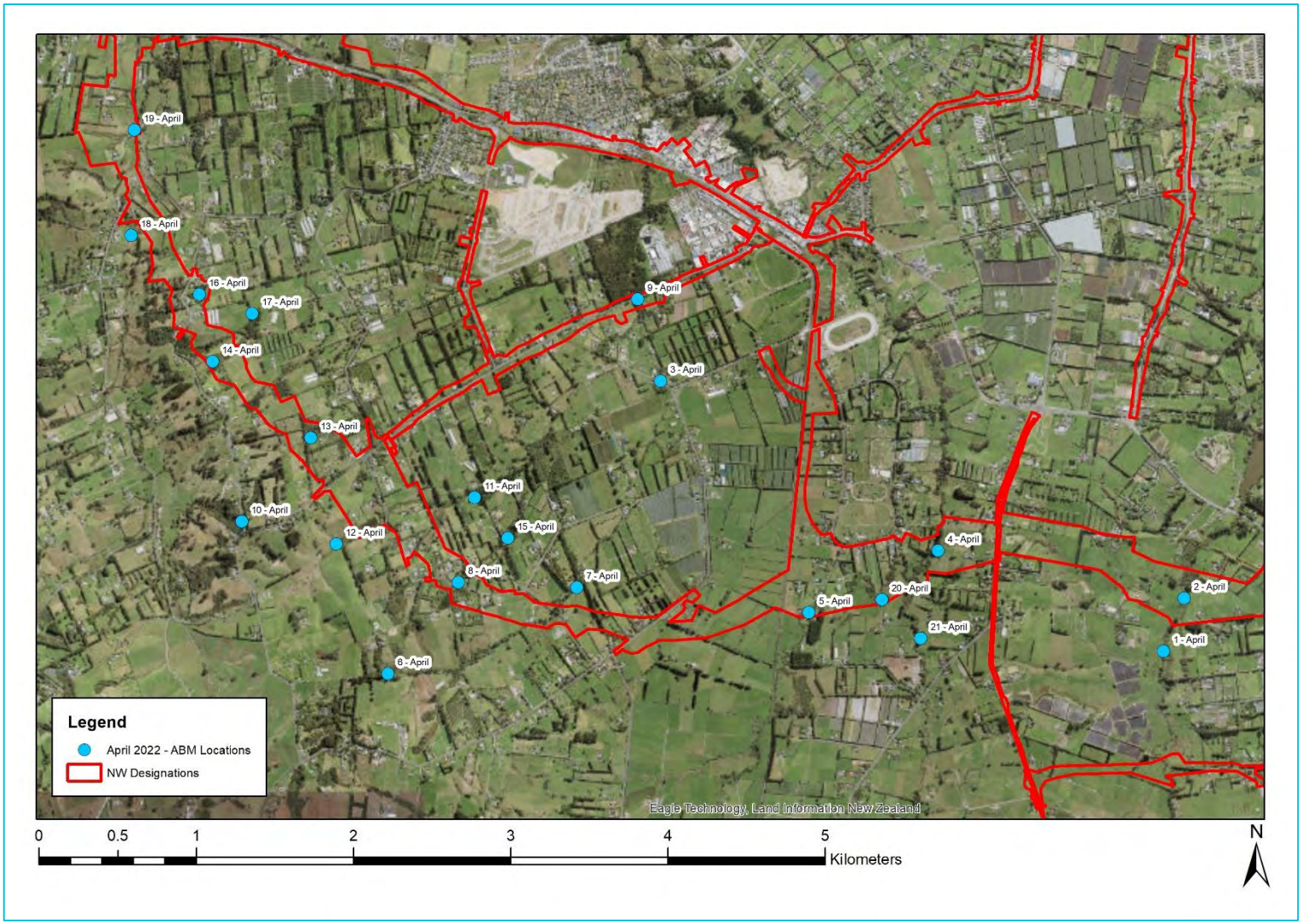

Figure 3-2 ABM locations (April 2022 survey)

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

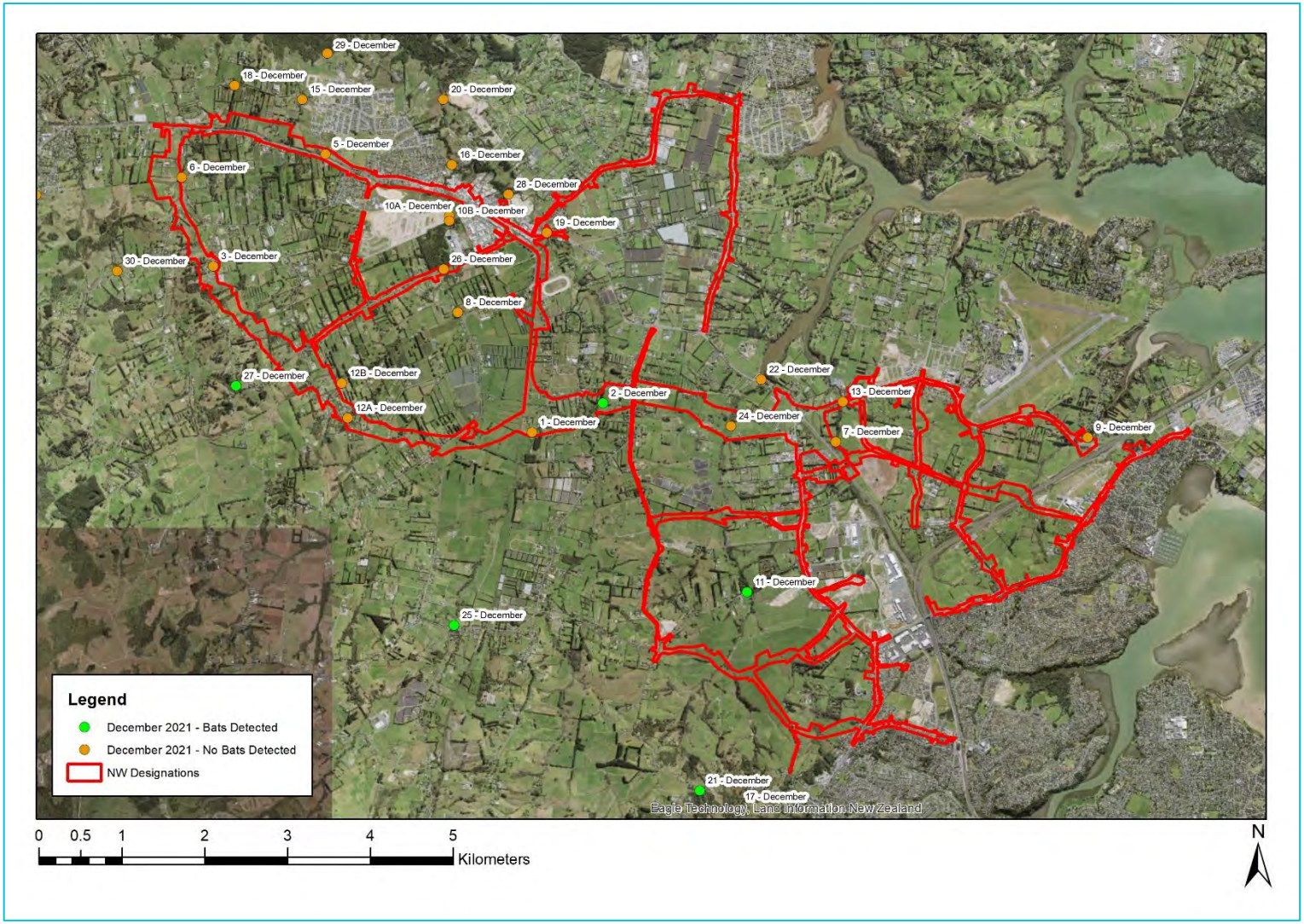

Figure 4-1 Long-tailed bat presence/absence (December 2021 survey)

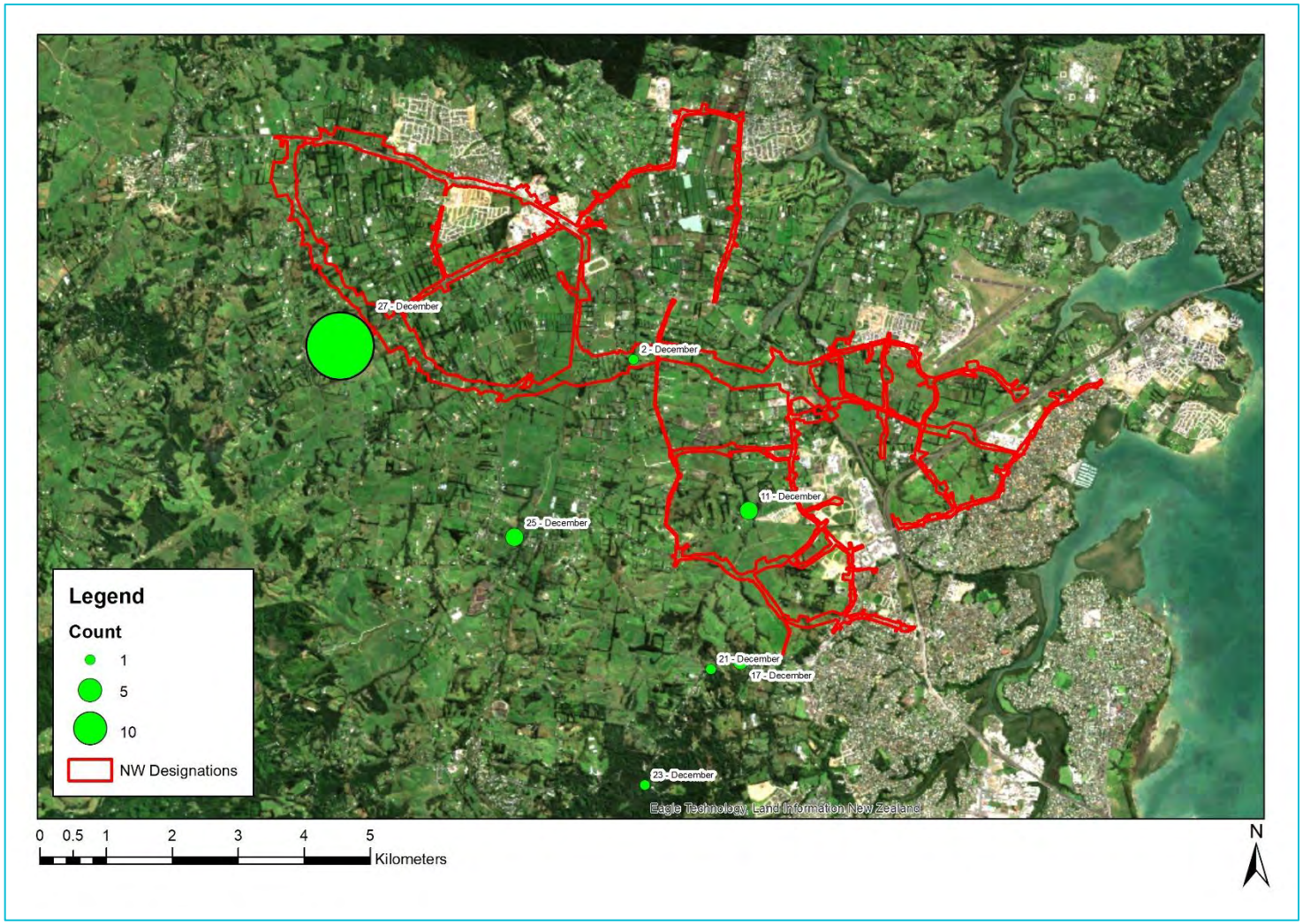

Figure 4-2 Sites with confirmed long-tailed bat presence (December 2021 survey). Proportional symbology indicates the relative proportion of bat passes in relation to the site with the highest number of bat passes (#27-December).

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

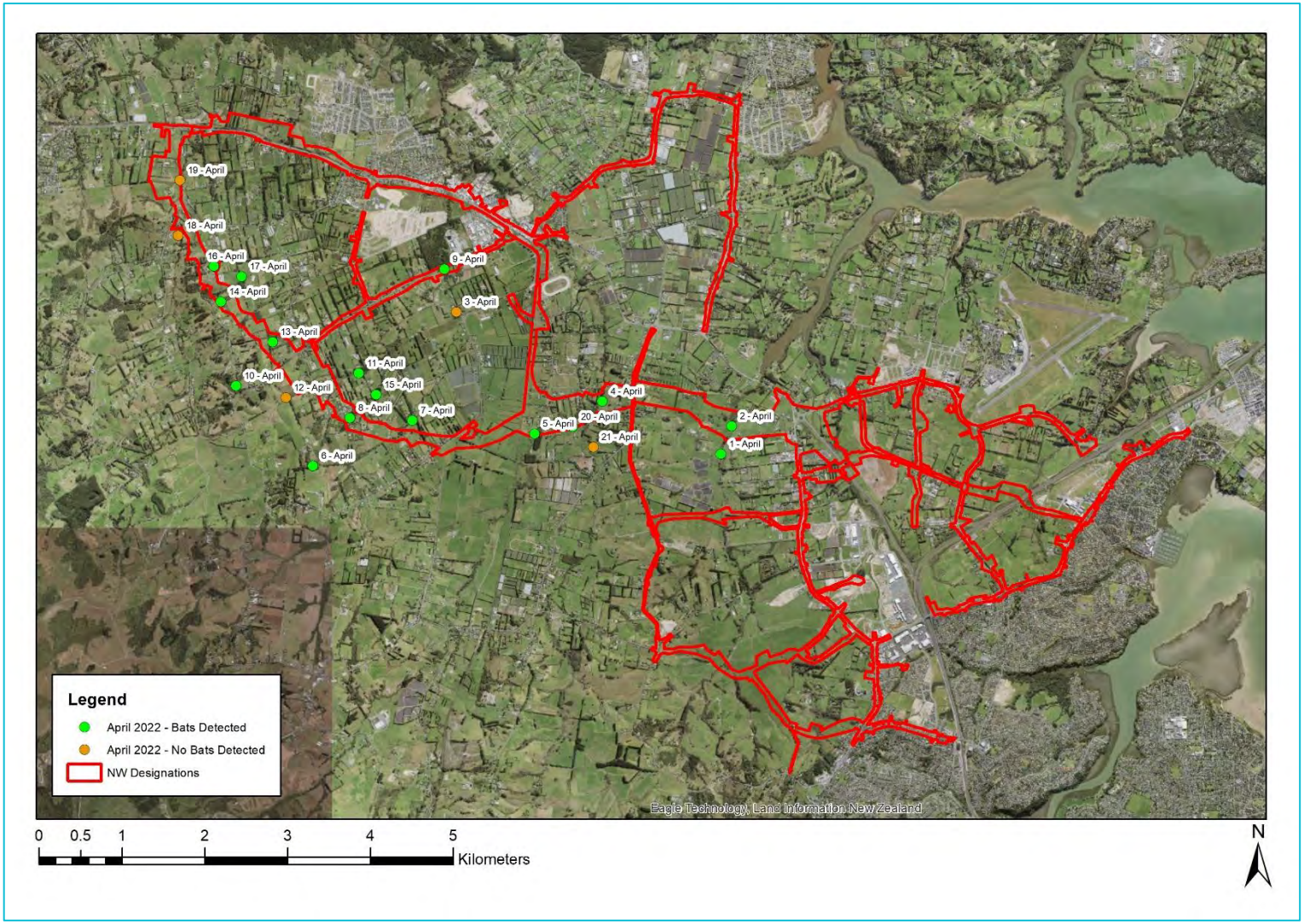

Figure 4-3 Long-tailed bat presence/absence (April 2022 survey)

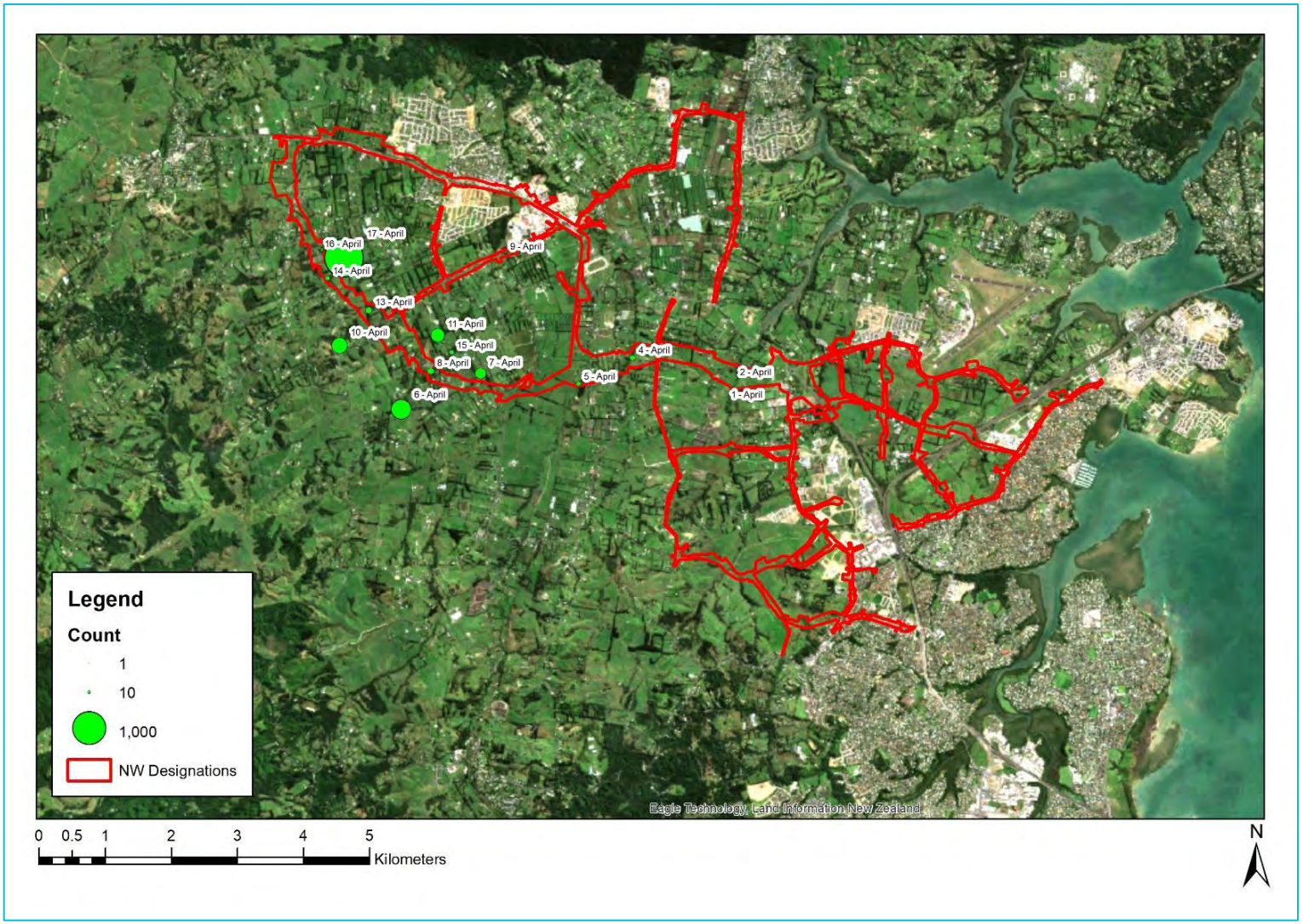

Figure 4-4 Sites with confirmed long-tailed bat presence (April 2022 survey). Proportional symbology indicates the relative proportion of bat passes in relation to the site with the highest number of bat passes (#17-April).

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.

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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