TE TUPU NGĀTAHI
SUPPORTING GROWTH

North Assessment of Ecological Effects

August 2023

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

Document Status

Responsibility	Name
Author	Michiel Jonker and Sandy Huang
Reviewer	Fiona Davies, Kathleen Bunting
Approver	Kathleen Bunting

Revision Status

Version	Date	Reason for Issue
1.0	31/08/2023	Final for Lodgement

Table of Contents

Appendices

Table of Figures

Table of Tables

Glossary of Defined Terms and Acronyms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
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 i.e. Future Urban Zoned land
Hydroperiod	Flow and/or soil saturation period of streams or wetlands.
Project Area	Area of land that is within the proposed 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).

Table 1-1: Glossary

Acronym/Term	Description
ABM	Automatic Bat Monitors
AEE	Assessment of Effects on the Environment report
ASCV	Area of Significant Conservation Value
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan: Operative in Part
BMP	Bat Management Plan
District Plan Tree	Any notable tree, or tree that is greater than 4m in height and/or greater than 400mm in girth located in the Road and / or Open Space Zone (see Appendix 3 for more detail)
DOC	Department of Conservation
EcIA	Ecological Impact Assessment
ED	Ecological District
EIANZ	Ecological Impact Assessment New Zealand: terrestrial and freshwater ecosystems
FUZ	Future Urban Zone
HNC	High Natural Character Areas
LINZ	Land Information New Zealand
MCA	Multi-Criteria Assessment
MDRS	Medium Density Residential Standards
N/A	Not Applicable
NIWA	National Institute of Water and Atmospheric Research
NPS	National Policy Statement
NPS:FM	National Policy Statement on Freshwater Management 2022
NPS:UD	National Policy Statement on Urban Development 2020
NoR	Notice of Requirement
NoR 1	New Rapid Transit Corridor (RTC)
NoR 2	New Milldale Station and associated facilities
NoR 3	New Pine Valley East Station and associated facilities
NoR 4	SH1 improvements

Acronym/Term	Description
NoR 5	New SH1 crossing at Dairy Stream
NoR 6	New Connection between Milldale and Grand Drive
NoR 7	Upgrade to Pine Valley Road
NoR 8	Upgrade to Dairy Flat Highway (between Silverdale and Dairy Flat)
NoR 9	Upgrade to Dairy Flat Highway (between Dairy Flat and Albany)
NoR 10	Upgrade to Wainui Road
NoR 11	New connection between Dairy Flat Highway and Wilks Road
NoR 12	Upgrade and extension to Bawden Road
NoR 13	Upgrade to East Coast Road (between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange)
NZ	New Zealand
NZFFDMS	New Zealand Freshwater Fish Database
ONC	Outstanding Natural Character Areas
ONF	Outstanding Natural Features
ONL	Outstanding Natural Landscapes
North Projects	The collective projects and NoRs (i.e., all 13 NoRs)
RHA	Rapid Habitat Assessment
RMA	Resource Management Act 1991
RTC	Rapid Transit corridor
SEA	Significant Ecological Area
SEV	Stream Ecological Valuation
SH1	State Highway 1
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
TAR	Threatened and At-Risk Species
THAB	Terraced House and Apartment Building zone
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
ZoI	Zone of Influence

Executive Summary

This Ecological Impact Assessment (EcIA) has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, North Projects and Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices (Table 1-2) are to designate land for future strategic transport corridors and stations as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation and maintenance of transport infrastructure in the North area of Auckland.

Table 1-2 North – Notices of Requirement and Projects

Notice	Project
NoR 1	Rapid Transit Corridor (RTC) between Albany and Milldale
NoR 2	Milldale Station and associated facilities
NoR 3	Pine Valley East Station and associated facilities
NoR 4	SH1 Improvements
NoR 5	SH1 crossing at Dairy Stream
NoR 6	Connection between Milldale and Grand Drive
NoR 7	Pine Valley Road Upgrade
NoR 8	Dairy Flat Highway (between Silverdale and Dairy Flat) Upgrade
NoR 9	Dairy Flat Highway (between Dairy Flat and Albany) Upgrade
NoR 10	Wainui Road Upgrade
NoR 11	New connection between Dairy Flat Highway and Wilks Road
NoR 12	Bawden Road Upgrade and Extension
NoR 13	East Coast Road Upgrade (between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange)

As the North Projects relate 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.

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. Ecological features included:

- A total of 18 vegetation types ranging in value from Low to Very High;
- Long-tailed bats associated with all NoRs and assessed as Very High value;
- A total of 79 avifauna species may be present, of which, 58 are native, 30 have a Threatened or At-Risk status, and the remainder are exotic;

- A total of nine herpetofauna species were identified, of which, six are native and five have a Threatened or At-Risk status;
- Kauri snail (At-Risk – Declining) was the only native invertebrate species identified in the desktop review within 5 km of the Project Area;
- A total 15 intermittent streams and 70 permanent streams have been assessed and range in value from Low to High. Streams are associated with the following main catchments: Ōrewa, Wēiti, John Creek, Rangitopuni, Dairy Stream, Huruhuru, Ōkura, Lucas Creek and Waiokahukura;
- A total of 24 native fish of which six have a Threatened or At-Risk status have the potential to occur in the Project Area;
- A total of 145 wetlands have delineated, representing eight wetland types. Wetlands range in value from Low to High.

Construction Effects

The district matter ecological effects relevant to construction prior to any mitigation identified are disturbance and displacement to long-tailed bat (*Chalinolobus tuberculatus*) roosts and threatened bird nests (existing) due to construction activities (noise, light, dust, vibration etc.), and the effect of habitat removal on long-tailed bats and lizards, specifically relating to mortality/injury and roost loss/disturbance. Where the level of effect was assessed to be **Moderate** or higher, mitigation has been developed. Recommended construction effect mitigation measures include:

- A Bat Management Plan (BMP) for each NoR (except for NoR 11) should be developed to include:
  - Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed;
  - Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar);
  - Siting of compounds and laydown areas to avoid mature forest types;
  - Lighting design to reduce light levels and spill from construction areas;
  - Restriction of nightworks around mature forest types;
  - Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance;
  - Consideration to the provisions of the Wildlife Act including the implementation of a vegetation removal protocol (Bat Roost Protocol v2 DOC, 2021 or equivalent version at time of removal) (**NoR 1, 4 and 9 only**);
- An Avifauna Management Plan (AMP) for each NoR (except for NoR 2 and 5) should include:
  - Preconstruction surveys to confirm presence and guide further management;
  - Where practical, construction works near wetland habitat (Appendix 4) should commence prior to the bird breeding season (September to February) in order to discourage bird nesting;
  - Bird management should be consistent with any regional consent conditions that may be required for regional compliance;
  - Consideration to the provisions of the Wildlife Act including timing vegetation removal to avoid the key nesting period (September to February) or where this is not possible, pre-clearance inspections undertaken prior to vegetation removal (NoR 1, 4, and 9 only);

- A Lizard Management Plan (LMP) for each affected NoR 1, 4, and 9 should consider the following:

  - Preconstruction surveys and/or habitat potential surveys to confirm (potential) presence and guide further management;
  - Timing of the implementation of the LMP;
  - A description of methodology for survey, trapping and relocation of lizards rescued including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), nocturnal and diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols.

- A description of the relocation site(s); including discussion of:

  - provision for additional refugia, if required e.g. depositing salvaged logs, wood or debris for newly released native skinks that have been rescued;
  - any protection mechanisms (if required) to ensure the relocation site is maintained (e.g.) covenants, consent notices etc;
  - any weed and pest management to ensure the relocation site is maintained as appropriate habitat;
  - Monitoring methods, including but not limited to: baseline surveying within the site; baseline surveys outside the site to identify potential release sites for salvaged lizard populations and lizard monitoring sites; ongoing annual surveys to evaluate translocation success; pre and post – translocation surveys; and monitoring of effectiveness of pest control and/or any potential adverse effects on lizards associated with pest control;
  - A post-vegetation clearance search for remaining lizards;
  - A suitably qualified and experienced ecologist/herpetologist approved to oversee the implementation of the Lizard Management Plan (LMP) shall certify that the lizard related works have been carried out according to the certified LMP within two weeks of completion of the vegetation clearance works;
  - Lizard management should be consistent with any regional consent conditions (and the Wildlife Act 1953) that may be required for regional compliance.

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

Operational Effects

District matter ecological effects relevant to operation prior to any mitigation identified are disturbance and displacement to long-tailed bat roosts and threatened bird nests, and loss in connectivity due to the presence of the road (including light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat). Where the level of effect was assessed to be **Moderate** or higher, mitigation has been developed. Recommended operational effect mitigation measures include:

- A Bat Management Plan (BMP) for NoR 1, 4, 6, 7, 8, 9, 10, and 13 should be developed to include consideration for:
    - Buffer planting, hop-over/under planting, retention of existing mature trees between the transport corridor alignment and features with potential for bat roosts as outlined in the indicative bat mitigation in Appendix 14;
    - Light and noise management through design;
    - Future presence of roosts within the alignment (placement of flaps on features with high roost potential);
    - Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action;
- An Avifauna Management Plan (AMP) for NoR 1, 6, and 10 should be developed to include:
    - Retention of vegetation near wetland habitat, where practicable;
    - Buffer planting between the transport corridor alignment and suitable habitat adjacent to the corridor (Appendix 14).

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

The magnitude of effects of loss in connectivity and disturbance to native herpetofauna is considered **Negligible** across **All NoRs**, both within the current and future environment considerations.

1 Introduction

This Ecological Impact Assessment (EcIA) has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance, North Auckland Projects to support 13 Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (WK) as requiring authorities under the Resource Management Act 1991 (RMA). The notices are to designate land for future strategic transport corridors and two rapid transit corridor stations to enable the future construction, operation, and maintenance of transport infrastructure in the North area of Auckland. The North area extends from Albany to Ōrewa and via the growth areas of Dairy Flat, Silverdale West, Wainui East, and Redvale (refer Figure 2-1). The North Projects are summarised in Section 2.

This report addresses the ecological effects of the North Projects identified in Section 2.

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

1.1 Purpose and Scope of this Report

This EcIA forms part of the suite of technical reports prepared to support the AEE for the North Projects. Its purpose is to inform the AEE that accompanies the North NoRs for AT and WK.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Projects on the existing and likely future environment as it relates to ecological effects and the works authorised by each NoR and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

1. Identify and describe the ecological context / baseline of the Project Area;
2. Identify and describe the actual and potential ecological effects of each Project;
3. Recommend measures as appropriate to avoid, remedy or mitigate actual and potential ecological effects (including any conditions/management plan required) for each Project; and
4. Present an overall conclusion of the level of actual and potential ecological effects for each Project after recommended measures are implemented.

1.2 Report Structure

The report is structured as follows:

a) Project overview with a summary of the North Projects in Section 2;
b) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines in Section 3 and Section 4;
c) Identification and description of the existing and likely future ecological environment in Section 5;
d) Description of the actual and potential positive effects on the ecology in Section 6;
e) Description of the actual and potential adverse ecological effects of construction and operation, including recommended measures to avoid or mitigate potential adverse effects, in Section 7 and 8;
f) Overall conclusion of the level of potential adverse ecological effects after recommended measures are implemented in Section 9.

This report should be read alongside the AEE, which contains further details on the history and context of the North Projects. The AEE also contains an indicative description of works to be authorised for the North Projects as a whole and for each NoR, and the typical, indicative 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.

2 North Projects Overview

An overview of the North Projects is provided in Figure 2-1 below, with a brief summary of the North Projects provided in Table 2-1.

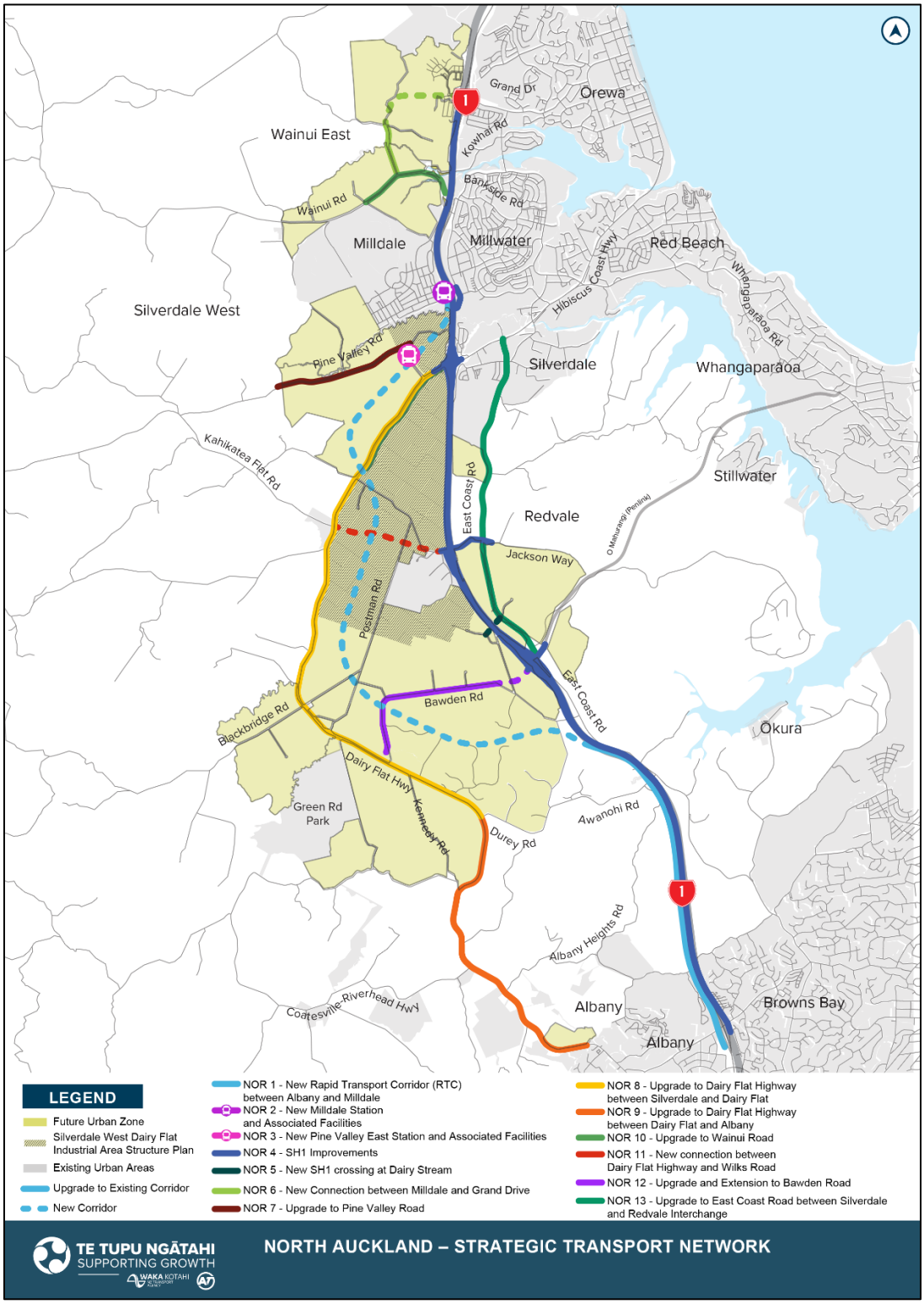

Figure 2-1 Map showing the location of each Project within the North growth area

Table 2-1 North Projects Summary

NoR	Project	Description	Requiring Authority
1	New Rapid Transit Corridor (RTC) between Albany and Milldale, including new walking and cycling path between Bawden Road and Dairy Flat Highway	• A 16km-long RTC corridor for public transport and active mode purposes • An 80km/hr operating speed (other than around stations) • Walking and cycling facilities along some of its length from Bawden Road to the point where the RTC crosses Dairy Flat Highway • Grade separated crossings at intersections with other key transport corridors. • The NoR will overlap with the existing motorway designation and SH1 improvements project over some of the length (between Albany and around Bawden Road)	WK
2	New Milldale Station and Associated Facilities	• A new rapid transit station and associated facilities, including: • Station building with associated station facilities • Cycle and shared mobility device parking provision • Local bus layover and stop provision • Taxi and ride share drop-off facilities.	WK
3	New Pine Valley East Station and Associated Facilities	• A new rapid transit station and associated facilities, including: • Station building with associated station facilities on structure over New Pine Valley Road with associated stairs and lift towers • Cycle and shared mobility device parking provision • Local bus layover and stop provision • Layover facilities for bus based RTC mode • Taxi and ride share drop-off facilities • Park and ride facility (up to 500 car parking spaces) • Upgrade to Old Pine Valley Road along station frontage	WK
4	SH1 Improvements (alteration to designations 6761, 6760, 6759, 6751)	• Widening the SH1 carriageway from two lanes to three lanes in each direction from the Lonely Track Road overbridge to the Silverdale interchange • Upgraded Ō Mahurangi Penlink (Redvale) Interchange (upgrading this interchange to add north facing ramps) • New Wilks Road interchange (south facing ramps only) • Silverdale interchange upgrade for east-west capacity • New walking and cycling path along SH1 - an approximately 16 km long active mode corridor along one side of SH1 from Albany to Grand Drive (starts on east of SH1 at Oteha Valley Road, crosses to west of SH1 around Bawden Road and then back to east around Silverdale interchange.) • Silverdale to Highgate Active mode connection - connection from the strategic active mode corridor at Silverdale to Highgate Parkway • Wainui interchange upgrade for active modes – new bridge for active modes across SH1	WK

NoR	Project	Description	Requiring Authority
5	New SH1 crossing at Dairy Stream	• A new two-lane urban arterial connection and SH1 motorway overbridge between Top Road and East Coast Road near Huruhuru (Dairy Stream) • Active mode facilities on both sides of the carriageway • The overbridge would cross six lanes of motorway, a two-lane link road to the motorway service centre and the new walking and cycling path on SH1 (refer to NoR 4 above)	AT
6	New Connection between Milldale and Grand Drive	• A new two-lane urban arterial with separated walking and cycling facilities on both sides between Wainui Road (Milldale) and the western edge of the Ara Hills development in Ōrewa. This will connect through to Grand Drive at SH1 via a new 30m road corridor to be vested by the Ara Hills developer	AT
7	Upgrade to Pine Valley Road	• An upgrade to Pine Valley Road (FUZ section) between Poynter Lane and Argent Lane to a two-lane urban arterial with separated walking and cycling facilities on both sides	AT
8	Upgrade to Dairy Flat Highway between Silverdale and Dairy Flat	• An upgrade to a 4-lane urban arterial on sections where FUZ land is located both sides of the road (between Silverdale interchange and Wilks Road and between Richards Road and Durey Road), with separated walking and cycling paths on both sides of the corridor • Upgrade to a 2-lane rural arterial between Wilks Road and Richards Road – with a swale on the west and separated walking and cycling on the east • Upgraded bridge over Huruhuru (Dairy Stream)	AT
9	Upgrade to Dairy Flat Highway between Dairy Flat and Albany	• An upgrade to Dairy Flat Highway between Dairy Flat and Albany for active mode and safety improvements including a central wire rope barrier and side barriers. • The widened Road corridor will retain two lanes (one in each direction) and will also retaincrawler lanes as currently located • Cycle path added on the western side of the carriageway between Durey Road and the Coatesville Riverhead Highway Roundabout and then on the eastern side between the Roundabout and Te Wharau (Albany Village)	AT
10	Upgrade to Wainui Road	• Upgrade to Wainui Road to a 2-lane urban arterial between Lysnar Road and the new Argent Lane • Separate, dedicated, walking and cycling facilities on both sides of the carriageway • Upgraded bridge over Waterloo Creek (tributary to Ōrewa River)	AT

NoR	Project	Description	Requiring Authority
11	New connection between Dairy Flat Highway and Wilks Road	• Segment 1 (Kahikatea Flat Road to Postman Road Segment) will feature a 2-lane urban arterial (24 m wide corridor) with separated walking and cycling facilities on both sides • Segment 2 (Postman Road to SH1) features a 4-lane urban arterial (30 m wide corridor) with separated cycling and walking facilities, two lanes of general traffic and two-lanes where priority may given to freight traffic	AT
12	Upgrade and Extension to Bawden Road	• Upgrade and extension to Bawden Road. This will include a 30m four-lane road corridor with walking and cycling facilities on both sides. Two lanes for general traffic and two lanes for a frequent transit network (likely bus lanes) • Road intersects with the RTC. The road is likely to go under the RTC (grade separated crossing)	AT
13	Upgrade to East Coast Road between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange	• Upgrade to the footpath on the west side and new footpath on east side between Hibiscus Coast Highway and Silverwater Drive • Segment 1 (from Silverwater Drive to Newman Road) features a two-lane urban arterial upgrade (24 m) with separated walking and cycling facilities on both sides Segment 2 (from Newman Road to Jackson Way, where one or both sides is rural) has a shared path to the west only, with no works to the existing carriageway and no swales • Segment 3 (from Jackson Way to the end of the FUZ) features a 24 m wide cross section with walking and cycling facilities on both sides	AT

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 (Roper-Lindsay et al., 2018) (referred to as the EIANZ Guidelines in this report). The overarching goal of the ecological assessment is to determine the ecological effects of specific Project features or activities and has been considered under two scenarios – 1) the existing ecological baseline and 2) the likely future ecological environment. The requirements for such an assessment are outlined with the EIANZ Guidelines and form the basis of this report. This process is summarised in Figure 3-1 below and further detailed in Appendix 1.

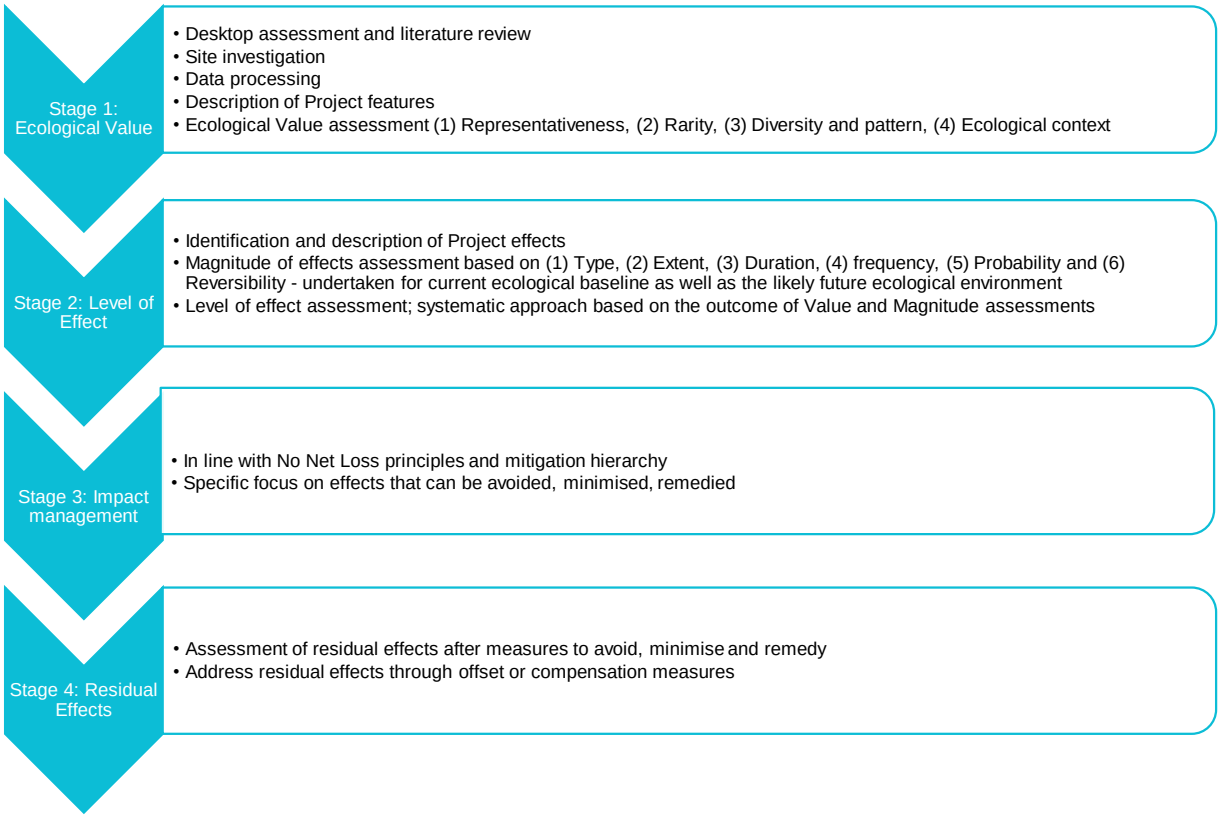

Figure 3-1 Approach process followed for this assessment.

3.2 EcIA and the Likely Future Ecological Environment

The EIANZ Guidelines provide 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 North Planning Team from Te Tupu Ngātahi has advised of the following to inform the assessment of the likely future ecological environment:

- The purpose of the NoRs within the North Projects is to protect the transport corridors that will support the future urbanisation of Silverdale, Dairy Flat, Wainui and Ōrewa. Construction and operation of the new and upgraded corridors will not occur until urbanisation has at least been confirmed by way of a plan change or is under development. Guidance on the future urbanisation can be taken from the AUP:OP, the Draft Spatial Land Use Strategy by Auckland Council and the Silverdale West Dairy Flat industrial Area Structure Plan;
- In addition, the AUP:OP permits activities for infrastructure and development, which will also change the likely future ecological environment. 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 urbanisation of Silverdale, Dairy Flat, Wainui and Ōrewa, assessing the effects on the environment solely as it exists today (i.e., at the time of ecological site investigation/the preparation of this ecology assessment) 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;
- A summary of the likely future ecological environment is provided in Section 5 and within the AEE.

3.3 Permitted Activities and the Likely Future Environment

The majority of the North Projects are within (or immediately adjacent to) undeveloped greenfield areas currently zoned as FUZ, and as such are planned for urbanisation. The remainder are within the existing urban or rural zones.

Vegetation clearance within the FUZ, excluding habitat identified as Significant Ecological Area, vegetation within 10 m of a riparian strip of wetlands, streams and lakes, and tree removal (excluding district plan 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 NoRs, will likely be removed by future development, and will not be present when the upgraded transport corridors are operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken the above into account.

3.4 Assessment of District Plan Matters and Approach to Regional Matters

The designation authorises Waka Kotahi or AT, as the relevant 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 North Projects relate to proposed designations, this EcIA assesses district plan matters only. Regional matters 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 alternatives assessment, proposed designation boundaries and potential implications for future regional resource consents and are presented in Section 8.

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

The assessment of district matter effects assumed that the value of ecological features, such as wetlands and riparian features, to native fauna will be the same in the future, as the transport corridor construction will occur prior to future urban development.

3.5 Wildlife Act Matters

The Wildlife Act (1953) includes specific provisions for activities that may disturb, injure, or kill native animals. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 3. The scope of this report pertains to district matters and although not required for NoRs, further consideration has been given to ecological effects under the Wildlife Act in Section 8. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 3.

3.6 National Policy Statement for Indigenous Biodiversity

The National Policy Statement for Indigenous Biodiversity (NPS-IB) seeks to maintain indigenous biodiversity across New Zealand so that there is at least no overall loss in indigenous biodiversity. The NPS-IB highlights the need for a cautionary approach to considering effects on indigenous biodiversity both within and beyond Significant Natural Areas (SNAs) and including areas supporting highly mobile fauna. Increased indigenous vegetation cover in urban and non-urban environments is promoted, as is information gathering and monitoring of indigenous biodiversity.

At the same time, the NPS-IB sets out a need to recognise and allow for activities which contribute to New Zealand's social, economic, cultural, and environmental wellbeing. The NPS-IB provides a consenting pathway for specified infrastructure which provides significant national or regional public benefit, and which has a functional or operational need to locate in a particular location, when there are no practicable alternatives.

At the date of preparing the report, the NPS-IB had not been given effect to in the AUP. However, many of the policy directions in the NPS-IB are already contained within the AUP and in relation to large scale infrastructure projects there is not a notable change in policy direction. The assessment of the project against the NPS-IB is therefore substantively similar to the assessment against the corresponding AUP provisions along with EIANZ 2018.

As well as district matters (which are the focus of this assessment), ecological effects associated with activities that require regional consents and consideration under the NPS-IB are discussed in this report (e.g., highly mobile fauna such as long-tailed bats) and were considered to inform design and alignment options for the North Projects.

4 Assessment Methodology

Desktop and site investigations were undertaken for ecological features within all 13 NoRs. Ecological features within the proposed designation boundary and a distance of approximately 100 m radius[1] of the designation have been mapped and included in this assessment. Terrestrial, stream, and wetland features were investigated and mapped to provide context for potential adjustments to the proposed designation boundary. In addition to the areas included in the ecological mapping, potential habitat for native fauna was considered within the Zone of Influence (ZOI) (see Section 4.1).

4.1 Zone of Influence

The zone of influence (ZOI)[2] relates to an area occupied by habitats and species that are adjacent to and may go beyond the proposed designation boundaries and their 100 m buffers for the North Projects. 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 North Projects can be different for different species and habitat types. The ZOI is used throughout this report to describe the impacts of each Project (construction and operational) on adjacent or connected terrestrial, freshwater, and wetland habitats and associated native species. For example, all Significant Ecological Areas (SEAs) within 2km of the Project Area have been included in the desktop review, along with their connectivity to each NoR. This was to ensure that these important habitats within the wider landscape were taken into consideration when determining the ZOI for the projects.

The ZOI of the North Projects on different species differs depending on how individual species 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 North 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 the Project Area, varying search distances were used depending on the species context.

4.2 Desktop Assessment

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 for each NoR.

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 included:

- Auckland Council Geomaps3;
- Department of Conservation (DOC) Bioweb records4;

[1] The proposed designation boundary has undergone several rounds of refinement. The ecological mapping was undertaken on the initial proposed 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).

[2] The ZoI 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*."

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

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

- Department of Conservation Threat Classification Series5;
- Ecological Regions and Districts of New Zealand (McEwen, 1987);
- iNaturalist records6, records within approximately 2-5 km buffer of the NoRs;
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al., 2017);
- National Institute of Water and Atmospheric Research (NIWA) freshwater fish database (NZFFDMS)7;
- New Zealand Bird Atlas eBird database8; recorded within 10km2 grid squares. Results from grid squares Y66, Y67, Z66, Z67 AA66, AA67;
- NZ River Name Lines (LINZ Data Service9); and
- Retrolens Historical Aerial Imagery10.

4.3 Site Investigations

Site investigations[11] were undertaken in order to:

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

Sites were selected and prioritised for onsite investigation based on:

- Locations that would be directly impacted by the proposed designation footprint of a NoR;
- Accessibility due to health and safety considerations and / or landowner approval;
- The level at which the site represents the terrestrial, freshwater / stream, and wetland ecosystem types present in the Project Area:
  - **Terrestrial Vegetation:** it was aimed to undertake site investigations at, at least one site containing each of the different ecosystem types, as classified by Singers et al., (2017), that make up the terrestrial vegetation within the Project Area;
  - **Freshwater / stream:** it was aimed to undertake site investigations at, at least one site containing a stream that represented each of the different hydroperiods and vegetation covers throughout the Project Area;
  - **Wetland:** it was aimed to undertake site investigations at, at least one site containing each of the wetland types that represented each the different hydro-systems and ecosystems as classified by Johnson & Gerbeaux, (2004), that make up the wetlands within the Project Area.

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

[6] https://www.inaturalist.org/

[7] https://nzffdms.niwa.co.nz/search

[8] https://ebird.org/atlasnz/home

[9] https://data.linz.govt.nz/layer/103632-nz-river-name-lines-pilot/

[10] https://retrolens.co.nz/

[11] Not all features where subject to a site investigation due to access constraints. Features assessed at desktop level are identified throughout the report.

4.3.1 Site Investigation Limitations

Site investigations were limited due to a lack of private property access i.e., site access to private land not being granted by current landowners. Of the 80 landowner requests for access, 19 were granted. Where possible, potential ecological features were assessed using roadside observation and / or from adjacent properties where access had been granted, and results were analysed further with an in-depth desktop review.

To address this limitation, a comparative analysis was undertaken between ecological features. This analysis looked for commonality and/or notable patterns between each terrestrial, freshwater/stream, and wetland ecosystems that had been assessed within the field, and then applied these commonalities and/or notable patterns to desktop identified terrestrial, freshwater/stream, and wetland ecosystems in an attempt to provide a high-level ecological value to all features.

4.3.2 Terrestrial Habitat

Site walkovers were undertaken between December 2022 and January 2023 by experienced ecologists; to map and describe the habitats present within the Project Area. Habitats were classified into ecosystem types 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.

Habitat assessment focused on areas of potentially significant value, such as habitat that was identified as an 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 used to focus search efforts on certain areas within the Project Area.

During the site walkovers 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 surveys also included searches for any rare or threatened plant species previously recorded within the Project Area.

Common plant names are predominantly used within this report. Maps showing the vegetation cover along the proposed designation of the NoRs are provided in Appendix 4. Terrestrial ecological value assessment methodology is discussed in Appendix 1.

4.3.3 Bat Surveys

A bat survey was undertaken for the Project Area (Appendix 16). The stream corridors associated with the catchments of the Ōrewa River, Wēiti Stream, Rangitopuni Stream, Huruhuru (Dairy Stream), Ōkura River, and Waiokahukura (Lucas Creek), are considered the most likely to indicate bat activity. The bat monitors were deployed for two rounds, with the first round undertaken December 2022-January 2023, and the second round undertaken April 2023. Monitoring data for at least 14 suitable days (weather conditions not constraining bat activity) were analysed and used for the report.

4.3.4 Freshwater Habitat

Where access allowed, streams within the Project Area identified on the Auckland Council Geomaps ('Named Streams') were ground-truthed and classified as permanent, intermittent, or ephemeral, according to the stream definitions described by Storey & Wadhwa (2009). Any additional streams observed during site walkovers were also classified. Streams are mapped in Appendix 4.

Freshwater assessments were undertaken by experienced ecologists on all streams identified on site and included stream classification, assessment of the riparian vegetation composition and the implementation of the Rapid Habitat Assessment (RHA) protocol. 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 included during the future regional resource consenting phase. As such, macroinvertebrate and fish surveys were not undertaken as part of this assessment. However, records from NZFFDMS (Stoffels, 2022) were used to inform the potential ecological value of streams. Access was restricted at several locations and as such some stream assessments were based solely on desktop information. Freshwater ecological value assessment methodology is discussed in Appendix 9 – Aquatic Value Assessment.

4.3.5 Wetland Habitat

Potential wetland habitat areas were identified by ecologists based on Auckland Council Geomaps contours and the presence of wetland vegetation on aerial maps including a review of historical images). Potential wetlands were mapped and where access permitted, verified through the use of the rapid technique outlined in the wetland delineation protocol (Ministry for the Environment, 2020). Because the wetland delineation predominantly relied on desktop assessment, a more conservative delineation was adopted. Ambiguous areas were assumed to be wetlands. Wetland areas along the proposed designation of the NoRs are mapped in Appendix 4.

Note that the scope of the specialist study for route protection did not provide for a detailed wetland delineation. The key focus was to confirm wetland presence and approximate extent. This approach is considered practical for the purposes of route protection involving only NoRs. It is expected that a detailed design will occur in the future which will confirm actual design and subsequent potential impacts, therefore a more detailed wetland assessment will be undertaken during the regional resource consenting phase.

Wetlands were assessed based on the RMA definition of a wetland[12] and classified into ecosystem types 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 National Policy Statement for Freshwater Management 2022 (NPS-FM) for natural wetlands (assessed for potential exclusions). Details regarding the wetland value assessment are outlined in Appendix 10 – Wetland Value Assessment.

4.4 Ecological Value Assessment

The ecological value of each visited ecological feature (terrestrial, freshwater and wetland) was assessed using a spreadsheet template by assigning a score of *0 (None), 1 (Low), 2 (Moderate), 3 (High), or 4 (Very High)* based on professional judgement (with justification) to attributes associated with each of the four ecological matters recommended within EIANZ (2018): *1) Representativeness; 2) Rarity/distinctiveness; 3) Diversity and pattern; and 4) Ecological context.*

Considerations in relation to the four matters and corresponding aspects for terrestrial, freshwater, and wetland features are detailed below:

[12] "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"

Terrestrial Ecology

1. **Representativeness:** Typical structure, species composition, and indigenous representation;
2. **Rarity/distinctiveness:** Species of conservation significance, and 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, and ecological networks (i.e., 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

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

The score for each matter was constrained to the highest score for each aspect (e.g., 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 EIANZ Guidelines.

Where ecological features were not visited during the site investigation, these were assessed using desktop information coupled with the analysis of commonalities and patterns noted of similar ecosystem type to determine a high level assumed ecological value. Detailed ecological value assessment of each ecological feature would be undertaken at the future regional resource consent stage.

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 EIANZ Guidelines, Table 5):

- 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 North Projects;
- Consideration and adjustment of ecological value may occur dependent on regional threat status and local knowledge (if available). The more conservative of the ecological values should be used.

5 Existing and Likely Future Ecological Environment

5.1 Planning and Land Use Context

The assessment of effects needs to consider both the existing environment and the likely future ecological environment at the time at which effects will likely occur. It is anticipated the North Projects will be constructed between 10 – 30+ years from now, meaning the ecological environment may differ significantly from what is present today.

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

The adopted Silverdale West - Dairy Flat Industrial Area Structure Plan anticipates the development of a large industrial area within an area of FUZ predominantly between Dairy Flat Highway and SH1.

The remaining areas of FUZ, including Upper Ōrewa, Pine Valley and Dairy Flat have not yet been structure planned by Auckland Council. Auckland Council has, however, released some high-level thinking on future land uses in a draft Spatial Land Use Strategy, which broadly suggests:

- A metropolitan/town centre in Dairy Flat, located adjacent to the Rapid Transit Corridor alignment;
- The potential for Terrace Housing and Apartment (THAB) zoning for 800m surrounding this metropolitan / town centre;
- Two potential local centres in the Pine Valley area.

All areas of FUZ have a high likelihood of change in planning and land use context. It is anticipated that the likelihood of change in the following areas / zones is generally low overall, although Plan Change 78 will enable greater densities within the existing urban areas in the North with the predominant change being a shift from residential single house zone and mixed housing suburban zone changing to the mixed housing urban zone:

- Current residential areas/zones, including Single House, Mixed Housing Suburban, Mixed Housing Urban, Terrace and Apartment Buildings, and Large Lot zones;
- Current business areas/zones, including Light Industry, Mixed Use, General Business, Neighbourhood Centre, Local Centre, Town Centre, Heavy Industrial zones;
- Current open space areas/zones, including Informal Recreation, Community, Sport and Active Recreation, Conservation zones;
- Current rural areas which are not FUZ zoned, including Countryside Living zone;
- Other areas currently within the Special Purpose zone including Special Purpose – Cemetery, Special Purpose – School, and Special Purpose – North Shore Airport.

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

5.2 Ecological Baseline

5.2.1 Historical Ecological Context

The North Projects are located predominately within the Rodney Ecological District (ED), except for the southern sections of NoR 4: SH1 improvements (i.e., Section between Lonely Track Road and Oteha Valley Road) and NoR 9: Upgrade to Dairy Flat Highway (between Dairy Flat and Albany) (i.e., section between Potter Road and Albany Village) which are located within the Tamaki Ecological District.

The landscape within the Project Area would have originally been covered in extensive forest. Currently, it is characterised by areas of low soil fertility due to leaching and podzolization with impeded drainage by kauri podocarp, broadleaved forests, and the presence of these forests on steep slopes and ridge lines (McEwen, 1987; Singers et al., 2017). Of the original native land cover, only 18% indigenous land cover (Rodney ED) and 11% (Tamaki ED) remain; and 3% (Rodney ED) and 1% (Tamaki ED) of freshwater wetlands and wetland forests remain (Lindsay et al., 2009). The extent of remaining indigenous vegetation cover in the Project Area are limited to the large areas of SEAs to the south, areas along the Wēiti River and the mouth of the Ōrewa River, or are reduced to small fragments of regenerating vegetation following historical clearance.

5.2.2 Terrestrial Habitat and Fauna

5.2.2.1 Terrestrial Vegetation

Where natural habitat remains, the AUP:OP has mapped and classified habitats as terrestrial or marine SEAs. The full list of SEAs which occur within 2 km of the Project Area are described in Appendix 5. A distance of 2 km was selected as potential ZOI for adverse effects depending on the potential receiving environment and the habitats and species present within an SEA. SEAs that fall within the proposed designation boundary of each NoR, and that will be potentially affected, are presented below in Table 5-1 and Figure 5-1.

Table 5-1 SEAs that fall within a proposed designation boundary of a NoR for the North Projects

SEA	Criteria met for SEA Classification	SEA Description	Relevant NoR
SEA_T_2169	1, 2, 3, 4	Representative of WF8, and contains threatened ecosystems of WF4 and WF8. Provides habitat for Threatened and / or At-Risk bird and fish species, and contains rare plants species. Consists of diverse habitat types, including SA1, WF4, WF8, and VS5. Buffers another SEA or protected area.	NoR 4
SEA_T_2180	1, 2, 4, 5	Representative of WF11. Provides habitat for Threatened and / or At-Risk bird and lizard species. Buffers another SEA or protected area. Supports type locality of fungi species.	NoR 4
SEA_T_2191	2, 3, 4	Provides habitat for Threatened and / or At-Risk fish species. Consists of diverse habitat types, including WF13 and VS3. Buffers another SEA or protected area.	NoR 1, 4
SEA_T_2192a	1, 2, 3, 4	Representative of WF4, and contains threatened ecosystems of WF4 and WF7. Consists of diverse habitat types, including WF7, MF4, and WF9. Buffers	NoR 1, 4

SEA	Criteria met for SEA Classification	SEA Description	Relevant NoR
		another SEA or protected area Acts as a migration pathway.	
SEA_T_2218	2	Supports Threatened and / or At-Risk fish species and acts as a migration pathway.	NoR 1, 4
SEA_T_3590	2, 3	Provides habitat for Threatened and / or At-Risk species. Consists of diverse habitat types include SA1 and WF7.	NoR 4,10
SEA_T_5446	4	Buffers another SEA or protected area	NoR 7
SEA_T_6669	1, 2, 3, 4	Representative of WF11. Provides habitat for Threatened and / or At-Risk fish species. Consists of diverse habitat types, including WF11 and VS3. Buffers another SEA or protected area.	NoR 9
SEA_T_8296	1, 3	Representative of WF9, WF11, and MF4, and contains the threatened ecosystem of MF4. Consists of diverse habitat types, including WF11, VS2, VS3 and WF9.	NoR 9
SEA_T_8297	1, 2, 3	Representative of WF9, WF11, and MF4, and contains the threatened ecosystem of MF4. Provides habitat for Threatened and / or At-Risk fish species. Consists of diverse habitat types, including WF9, MF4, VS2, and WF11.	NoR 1, 4
SEA_T_8300	1, 2, 3, 4	Representative of WF7 and WF11, and contains the threatened ecosystem of WF7. Provides habitat for Threatened and / or At-Risk fish species. Consists of diverse habitat types, including WF7 and WF11. Buffers another SEA or protected area	NoR 9
SEA_T_8301	4	Acts as a migration pathway.	NoR 9
SEA_T_8332	1, 2, 3	Representative of VS2, WF9, and WF11. Provides habitat for Threatened and / or At-Risk fish and bird species. Consists of diverse habitat types, including VS2, WF9, and WF11.	NoR 9

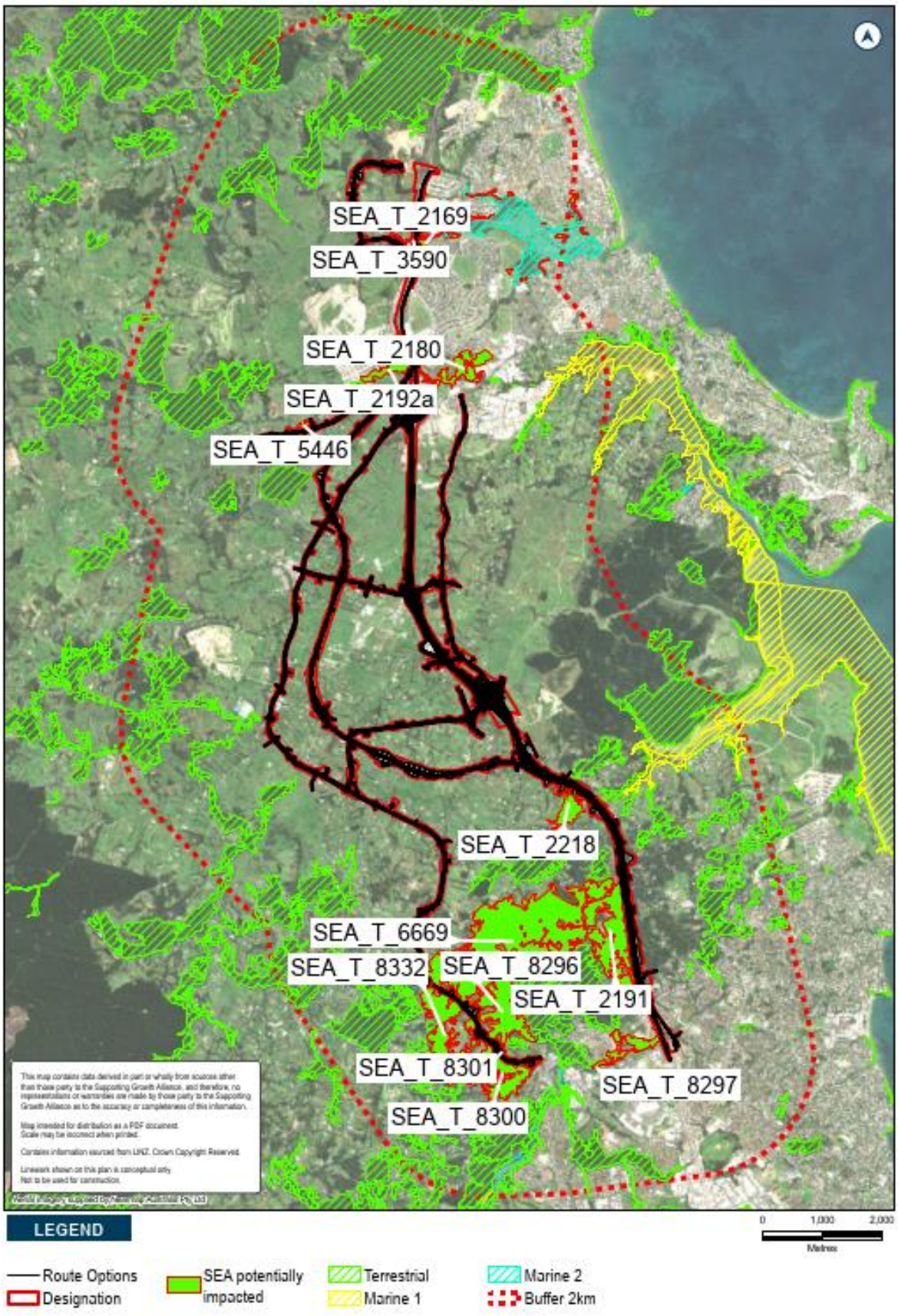

Figure 5-1 SEAs present within 2 km of the Project Area. Labelled SEAs are included in table above

All terrestrial vegetation has been described using a combination of desktop and site investigations. Table 5-2 summarises the terrestrial vegetation types associated with the Project Area and Table 5-3 summarises the type and ecological value of the terrestrial vegetation that fall within the proposed designation boundary of each NoR. Vegetation types are classified using Singers et al., (2017). Mapping of terrestrial vegetation is presented in Appendix 4, and the detailed ecological values for terrestrial vegetation are presented in Appendix 8.

District plan trees (e.g., road trees, open space trees, notable trees) have been considered in the Assessment of Arboricultural Effects Report and subsequently as part of this effects assessment. As detailed in Section 3 and Appendix 3, the remainder of terrestrial habitat (and associated fauna) identified will be subject to an ecological effects assessment in the future regional consenting phase (including Wildlife Act compliance).

Six groups of district plan trees are located in an Open Space or Road Reserve overlay (District Plan matter) that interacts (i.e., located within or adjacent to) with a SEA overlay (Regional Plan matter) in the AUP:OP. The ecological effects of the removal of these areas of SEA vegetation are a regional consenting matter and as such have been considered and discussed further as part of the wider SEA vegetation removal considerations in Section 8.1.1. Due to the overlap of these groups of district plan trees with SEAs (which are a regional plan matter) and the time lapse between this effects assessment and implementation of the Project (which is likely to result in changes in the extent and value of these district plan trees), it is considered appropriate to defer the assessment of ecological effects associated with the potential removal of these six groups of district plan trees to the regional consent stage. Ecological effects related to the removal of these trees, has therefore, not been considered any further.

The only other district plan trees of note are located in NoR 1, 2, 4, 9 and 13, and include groups of district plan trees that may provide (low quality) habitat to long-tailed bats, lizards, and Non-TAR birds. The vegetation is of **Moderate** ecological value and associated fauna values detailed in Section 5.2.2.2 – 5.2.2.4. Each group of trees are briefly described in the points below (refer to the Arboricultural Assessment for further details).

- NoR 1 (tree/group ID 101): A group of semi mature pioneer indigenous and mixed exotic plantings at 259 Oteha Valley Road, south of SEA_T_8297, in an Open Space overlay;
- NoR 1 and 2 (tree/group ID 106): A group of semi mature pioneer indigenous and mixed exotic plantings at 97 Ahutoetoe Road, Pine Valley, north of SEA_T_2192a, in Open Space overlay;
- NoR 4 (tree/group ID 102, 103, and 104 (also in NoR 1)): Two groups of semi-mature to mature indigenous and exotic trees near Redvale Rise and parallel to Awanohi Road (one next to SEA_T_2218, other next to SEA_T_2165) and one group of semi-mature indigenous planted trees by 21 Fairview Avenue (opposite SEA_T_8297); all in an Open Space overlay. None of the trees are located within a SEA;
- NoR 9 (tree/group ID 901 and 905): One group of semi-mature exotic and mixed pioneer native trees adjacent to R335 Dairy Flat Highway, next to SEA_T_8300 and one group of semi-mature to mature pine and manuka/kanuka by 1 Hobson Road, on the edge of SEA_T_8300 (but not within it);
- NoR 13 (1306): One group of four semi-mature manuka adjacent to 2200 East Coast Road.

Table 5-2. Description of the terrestrial vegetation types present within the Project Area. Vegetation type is classified according to Singers & Rogers (2014)

Terrestrial Vegetation Type	Abbrev.	Description
Exotic Forest	EF	Forest vegetation with >50% cover of exotic species in the canopy. Generally used to describe single species forestry plantations. This level of distinction was used for desktop habitat assessment where the understory vegetation could not be assessed.
Exotic Forest – Native understory	EF.1	EF vegetation with >50% native understory and/or groundcover biomass.
Exotic Grassland	EG	Grassland dominated by long grass and exotic species.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species.
Kahikatea Forest	MF4	Characterised by abundant kahikatea. In the Project Area, it is mostly old remnant forest associated with SEA_T_3590 and SEA_T_2169.
Planted Vegetation	PL	Native restoration plantings with <50% exotic biomass, or exotic and / or native amenity plantings. This level of distinction was used for desktop habitat assessment where the dominant vegetation and / or age of vegetation could not be assessed.
Planted Vegetation – Native (recent)	PL.1	Native restoration plantings with <50% exotic biomass. Recently planted native scrub and forest <20 years old.
Planted Vegetation - Native (mature)	PL.2	Native restoration plantings with <50% exotic biomass. Mature planted native scrub and forest >20 years old.
Planted Vegetation – Exotic and / Native (amenity)	PL.3	Amenity plantings. This includes planted exotic and / or mixed native and exotic vegetation within parks, roads, amenity areas and private gardens.
Treeland – Native-Dominated	TL.1	Tree canopy cover 20-80%: Native-dominated: >75% native tree cover. For the purposes of mapping this includes planted and wilding native vegetation and mature shelterbelts. This includes mature riparian vegetation, and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.
Treeland – Mixed Native/Exotic	TL.2	Tree canopy cover 20-80%. Mixed native/exotic: with 25-75% native tree cover. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation, and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation, and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.
Kānuka Scrub / Forest	VS2	Kānuka-dominated forest with insufficient emergent secondary species to determine trajectory to mature forest type. In the Project Area, much of this forest is contiguous with more mature native forest types, or form part of an SEA.
Mānuka, kānuka scrub	VS3	A mosaic of kānuka and kānuka dominated scrub or mānuka dominated scrub. It is considered early successional or regenerating native forest.
Taraire, tawa, podocarp forest	WF9	Characterised by large emergent rimu and northern rātā, with kahikatea in gullies emerging over a broadleaved canopy of abundant taraire and kohekohe, with tōwai and tawa becoming more common at higher

Terrestrial Vegetation Type	Abbrev.	Description
		altitudes. In the Project Area, it is mostly old remnant forest associated with SEA_T_8296 and SEA_T_8332.
Kauri, Podocarp, Broadleaved Forest	WF11	Kauri predominantly (but not exclusively) present on ridge-crests and hill-slopes, with broadleaved species more abundant in gullies. In the Project Area, it is mostly old remnant forest associated with SEA_T_2180, SEA_T_8296, SEA_T_8297, SEA_T_8300, SEA_T_8301, and SEA_T_8332.
Kauri, podocarp, broadleaved, beech forest	WF12	Characterised by hard beech, occasional tānekaha, thin-barked totara and kauri are generally confined to ridges. In the Project Area, it is mostly old remnant forest associated with SEA_T_8296.
Tawa, Kohekohe, Rewarewa, Hīnau, Podocarp Forest	WF13	Characterised by abundant tawa and kohekohe in the canopy. In the Project Area, it is mostly old remnant forest associated with SEA_T_2191.

Table 5-3 The terrestrial vegetation types that fall within the proposed designation boundary of each NoR and their ecological value (see Section 4.4 for assessment methodology)

Terrestrial Vegetation Type	Ecological Value												
	NoR 1	NoR 2	NoR 3	NoR 4	NoR 5	NoR 6	NoR 7	NoR 8	NoR 9	NoR 10	NoR 11	NoR 12	NoR 13
EF	–	–	–	M	–	–	–	–	M*	–	–	M	–
EF.1	–	–	–	–	–	–	–	–	M	–	–	–	–
EG	–	–	–	L	N	–	-	L	–	–	–	–	–
ES	L	–	–	L	–	L	–		L*	–	–	L	L
MF4	VH*	–	–	H*	–	–	VH*	–	–	–	–	–	–
PL.1	M	–	L	M	–	M	–	–	–	–	–	–	–
PL.2	M*	–	–	M *	–	–	–	–	–	–	–	–	–
PL.3	M	N	L	L	L	L	L	M	L	L	L	L	L
TL.1	–	–	–	M	–	–	–	–	–	–	–	–	–
TL.2	–	–	–	L	–	–	–	H	M	–	–	–	–
TL.3	M	–	L	M*	L	M	M	M	M	M*	L	L	L
VS2	VH*	–	–	H*		H	VH*	H	H*	–	–	–	–
VS3	H	–	–	H	–	–	–	H	–	M	–	–	–
WF9	–	–	–	–	–	–	–	–	VH*	–	–	–	–
WF11	VH*	–	–	VH*	–	–	–	–	VH*	–	–	–	–
WF12	–	–	–	–	–	–	–	–	VH*	–	–	–	–
WF13	VH*	–	–	VH*	–	–	–	–	–	–	–	–	–

Notes: *= associated with SEA; N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

5.2.2.2 Long-tailed Bats

Existing desktop records (DOC, 2022a) confirm the presence of long-tailed bats (*Chalinolobus tuberculatus*) within 10 km of the Project Area (Figure 5-2).

The desktop assessment also revealed several stream systems and areas of vegetation with large trees (e.g., areas of EF, EF.1, EF.2, TL.2, TL.3, VS2, and mature indigenous forest types) within the Project Area that long-tailed bats have the potential to utilise.

Area wide bat surveys have also been undertaken for the Project Area. The results of the bat survey are detailed in Appendix 16. The ABM survey confirmed bat activity at the following survey locations during the November-December 2022 assessment:

- 161 Ahutoetoe Road, Wainui (adjacent to Wēiti Stream);
- 228 Wilks Road (at intersection between Wilks Road and SH1);
- 1722 East Coast Road (immediate north of Ō Mahurangi (Penlink) interchange); and
- 422 Bawden Road (immediate west of SH1).

The ABM survey confirmed bat activity at the following survey locations during the March-April 2023 assessment:

- 228 Wilks Road (at intersection between Wilks Road and SH1)

Table 5-4 presents the ecological value for bats for each NoR based on the results of the desktop assessment, ABM and habitat potential surveys. The conservation status of this species is 'Threatened - Nationally Critical' (O'Donnell et al., 2013), therefore the ecological value of long-tailed bats is **Very High** if they are likely to be present (see Section 4.4 for assessment methodology of ecological value).

Table 5-4 Results of desktop, ABM, and habitat potential surveys for long-tailed bats within the proposed designation boundary of each NoR

NoR	Desktop Records within ZOI	Potential bat habitat present – bat roost potential, foraging	ABM Survey Results – Bat Present?	Bat Passes (if relevant)	Ecological Value
NoR 1	Yes - 7.3km	John Creek (named tributary of Wēiti Stream), Rangitopu Stream, Huruhuru (Dairy Stream), Ōkura River	Yes - Site at 161 Ahutoetoe Road and 422 Bawden Road.	2 bat calls (Dec)at 161 Ahutoetoe Road (native dominated old remnant forest with restoration plantings), 1 (Dec) at 422 Bawden Road (exotic dominated treeland)	Very High
NoR 2	Yes – 6 km	No suitable habitat within designation boundary, but large area of SEA to the immediate south	–	–	Very High
NoR 3	Yes – 6km	No suitable habitat within designation boundary, but John Creek within 100 m to the south	–	–	Very High

NoR	Desktop Records within ZOI	Potential bat habitat present – bat roost potential, foraging	ABM Survey Results – Bat Present?	Bat Passes (if relevant)	Ecological Value
NoR 4	Yes - 5.3km	Wēiti Stream, John Creek (named tributary of Wēiti Stream), Rangitopu Stream, Huruhuru (Dairy Stream), Ōkura River, Waiokahukura (Lucas Creek), large areas of SEA forest	Yes – Sites at 161 Ahutoetoe Road, 228 Wilks Road, 1722 East Coast Road, and 422 Bawden Road.	19 bat calls at 228 Wilks Road (1 in Dec, 18 in Mar) – exotic dominated treeland	Very High
NoR 5	Yes – 9.6km	Huruhuru (Dairy Stream)	–	–	Very High
NoR 6	Yes – 4km	Ōrewa River	–	–	Very High
NoR 7	Yes – 7.1km	Wēiti Stream, John Creek (named tributary of Wēiti Stream), Rangitopu Stream, Huruhuru (Dairy Stream), Ōkura River, Waiokahukura (Lucas Creek)	–	–	Very High
NoR 8	Yes - 6.2km	Rangitopu Stream, Huruhuru (Dairy Stream)	–	–	Very High
NoR 9	Yes - 7.6km	Waiokahukura (Lucas Creek), large areas of SEA forest	–	–	Very High
NoR 10	Yes - 7.5km	Ōrewa River	–	–	Very High
NoR 11	Yes - 8.8km	Rangitopu Stream	–	–	Very High
NoR 12	Yes - 7km	Huruhuru (Dairy Stream)	–	–	Very High
NoR 13	Yes - 7.2km	Huruhuru (Dairy Stream)	Yes - Site at 1722 East Coast Road	1 bat pass (Dec) at 1722 East Coast Road (exotic (poplar) dominated treeland)	Very High

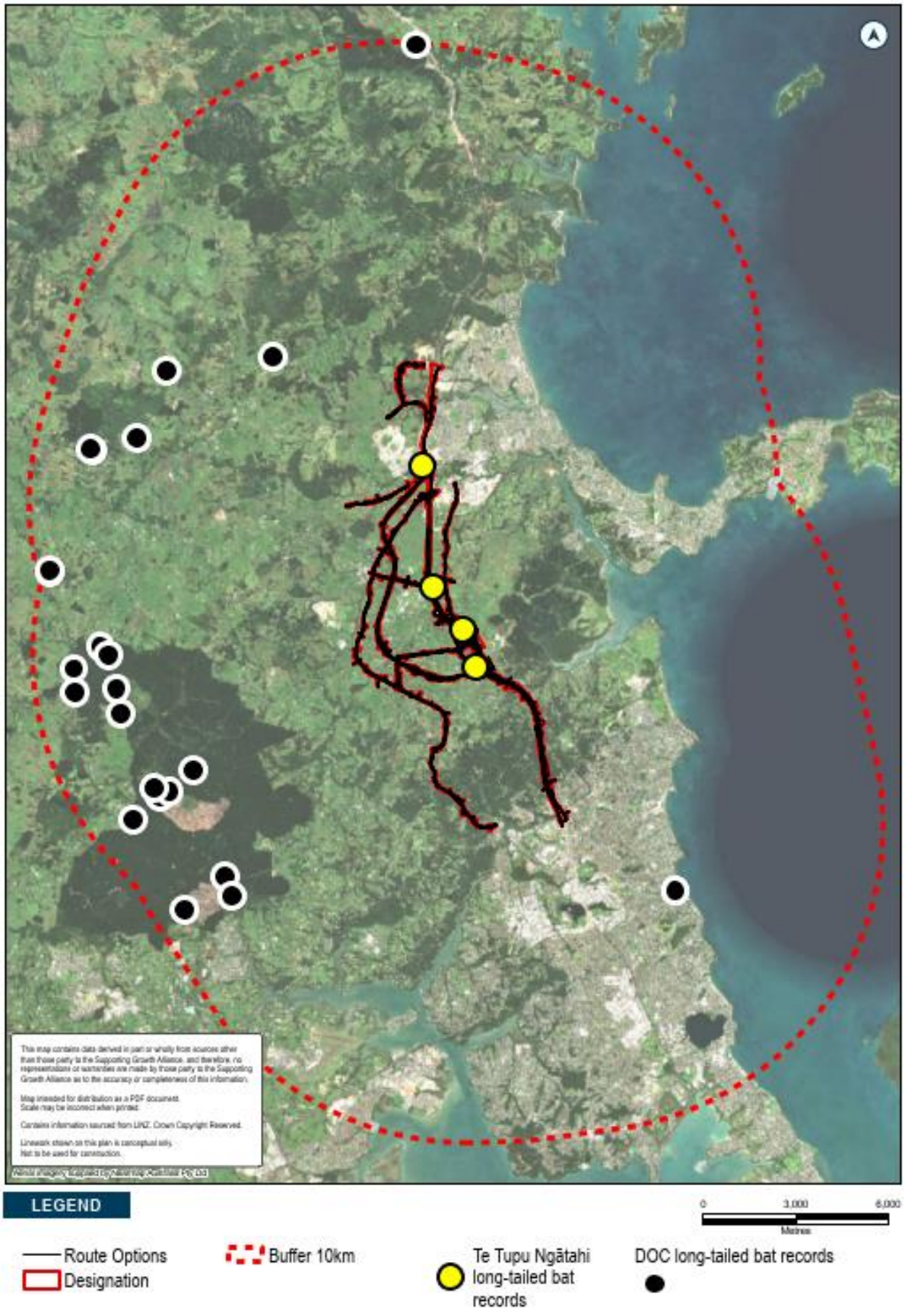

Figure 5-2 Long-tailed bat records within 10 km radius of the Project Area

5.2.2.3 Avifauna

An area wide desktop review identified the presence of native forest, freshwater, and coastal avifauna (bird) species within a 2 km buffer of the Project Area (eBird, 2022; GBIF.Org User, 2022). No dedicated bird surveys were undertaken for the Projects; however, incidental observations of birds were recorded during site visits. A full list of species identified from the desktop review and incidental observations is included in Appendix 6 (including introduced and naturalised species). A total of 79 species were identified, of which, 58 are native, 30 have a Threatened or At Risk status, and the remainder are exotic (Robertson et al., 2021).

A desktop assessment identified potential habitat for several TAR species. Table 5-5 details all the observed and potential TAR bird species for each NoR, including the ecological value for each species, based on the availability of potential habitat within the Project Area[13]. The NoR was considered relevant to the species if desktop records indicate presence in that area and if its potential habitat falls within or adjacent to the designation of the NoR.

Any TAR species that were identified during desktop review but are expected to be absent from the Project Area due to a lack of suitable habitat, were not assessed for ecological value and impact. This includes species that have a strong preference for oceanic or coastal habitats (e.g., gulls, petrels, shearwaters, terns, and spoonbills), sandy beaches (e.g., dotterels), rocky shores (e.g., herons), and large, open mudflat areas (e.g., godwits, oystercatchers).

[13] Non-threatened native bird species are considered to have a **Low** ecological value. The full list of bird species identified via desktop assessment and incidental observations are included in Appendix 6 – Full list of Fauna Records.

Table 5-5 TAR bird species observed or likely to occur within a proposed designation boundary for the North Projects based on suitable habitat, as well as their ecological values (see Section 4.4 for assessment methodology)

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Preferred Habitat	Suitable Habitat within Project Area	Ecological Value	Relevant NoR
Australasian bittern *(Botaurus poiciloptilus)*	Threatened – Nationally Critical	iNaturalist	Raupō-fringed lakes, spring-fed creeks with cover and areas of rank-grass along paddock/drain edges. Will mostly inhabit mineralised and semi-mineralised wetlands, although they also forage in drains and wetland / farmland edges (E. Williams, 2013). Found throughout New Zealand.	Has the potential to utilise any open water habitat for foraging. This can include stock water ponds, ornamental ponds, and stormwater ponds (e.g., OW) Also has the potential to utilise dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW), *Machaerina* sedgeland (WL11), and Raupō Reedland (WL19). May occur along Ōrewa River near the SH1 bridge, due to its proximity to suitable wetland habitat.	Very High	NoR 1, 3, 4, 5, 6, 7, 8, 9, 11, 12, and 13
Banded rail (*Gallirallus philippensis assimilis*)	At Risk – Declining	iNaturalist (incl. records in proximity to NoR 4)	Breeding and foraging within coastal wetland habitat (saltmarsh and mangroves), as well as densely planted wetlands. Roosting and breeding within wetlands above the high tide. Uncommon but widespread in the Auckland region (Bellingham, 2013).	May occur along Ōrewa River near the SH1 bridge, which consists of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank. Also, likely to occur at any densely vegetated wetlands adjacent to SH1 based on past observations from iNaturalist.	High	NoR 4, 6, and 10
Black Shag (*Phalacrocorax carbo*)	At Risk - Relict	iNaturalist (incl. records in proximity to NoR 4)	Strongly prefers coastal inlets, but can occur in open water wetland habitat such, as lakes, ponds, streams etc., if there are large, mature trees with overhanging	May occur along Ōrewa River near the SH1 bridge, which consists of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank.	High	NoR 4, 6, and 10

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Preferred Habitat	Suitable Habitat within Project Area	Ecological Value	Relevant NoR
			branches available for Roosting and breeding. It is widespread throughout New Zealand, although sparsely so (Powlesland, 2022).	Unlikely to occur further inland as the open water systems present do have not appropriate tree habitat around their margins.		
Brown teal *(Anas chlorotis)*	Threatened – Nationally Increasing	iNaturalist	Wetlands with open water, including stock ponds and small streams that retain overhanging vegetation along the margins (M. J. Williams, 2013). Rare but widespread in the Auckland region. Reliant on pest predator control.	Has the potential to utilise a wide range of open water and wetland locations (e.g., OW, PLW, WL.11). However, as this species is reliant on pest control, while it could be present within the NoR boundaries, it is unlikely to be resident or breeding within the NoR.	Very High	NoR 1, 3, 4, 5, 6, 7, 8, 9, 11, 12, and 13.
Dabchick *(Poliocephalus rufopectus)*	Threatened - Nationally Increasing	iNaturalist	Small shallow freshwater lakes and ponds, with dense vegetation around wetland margins. Uncommon but widespread in the Auckland region (Szabo, 2013).	Has the potential to utilise any freshwater open water habitat with a healthy pond system and densely vegetated margins. This can include stock water ponds, ornamental ponds, and stormwater ponds (e.g., OW, PLW, WL.11). Likely to breed in associated marginal wetland vegetation.	Very High	NoR 1, 3, 4, 8, 9, and 12
Grey duck *(Anas superciliosa)*	Threatened - Nationally Vulnerable	eBird	Wetlands with open water, including stock ponds and small streams that retain overhanging marginal vegetation. Pure grey ducks are rare and much diminished on mainland New Zealand (E. Williams, 2013).	Has the potential to utilise a wide range of open water and wetland locations (e.g., OW, PLW, WL.11).	Very High	NoR 1, 3, 4, 5, 6, 7, 8, 9, 11, 12, and 13.
Little Black Shag *(Phalacrocorax sulcirostris)*	At Risk - Naturally Uncommon	eBird	Occur in coastal inlets, lakes, and ponds, including stormwater	May occur along Ōrewa River near the SH1 bridge, which consist of coastal Mangrove Forest and scrub	High	NoR 4, 10

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Preferred Habitat	Suitable Habitat within Project Area	Ecological Value	Relevant NoR
			ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Armitage, 2013).	(SA1.2) along the water edge and grades into terrestrial vegetation further up the bank.		
Little Pied Shag *(Microcarbo melanoleucos)*	At Risk - Relict	eBird	Occur in coastal inlets, lakes, and ponds, including stormwater ponds. Roosting and breeding in overhanging trees (Adams, 2013).	May occur along Ōrewa River near the SH1 bridge, which consist of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank.	High	NoR 4, 10
Long-tailed Cuckoo *(Eudynamys taitensis)*	Threatened - Nationally Vulnerable	eBird	Summer migrant to New Zealand arriving spending winter in tropical Pacific islands. As a parasite nester, their range is restricted to host species whitehead, brown creeper, and yellowhead. Absent as a breeding species from Auckland region (except Te Hauturu-o-Toi, Little Barrier Island) but occur on migration passage throughout New Zealand (Gill, 2013).	Has the potential to briefly occur on migration passage across the Project Area. Can occur in native / exotic forest, scrub, farmland, or urban areas on passage to breeding / winter habitat (e.g., EF, PL.2, TL, VS2, VS3, mature indigenous forest types).	Very High	All NoRs
North Island Fernbird *(Poodytes punctatus vealeae)*	At Risk - Declining	eBird	Wetlands with dense vegetation. Rare but widespread in the Auckland region (Miskelly, 2013).	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW), *Machaerina* sedgeland (WL11), and Raupō Reedland (WL19).	High	NoR 6
North Island Kākā *(Nestor meridionalis)*	At Risk - Recovering	eBird, iNaturalist	Kākā are generally restricted to indigenous forest habitat and offshore islands in the Auckland region. However, they make seasonal migrations to the	Has the potential to utilise any mature treeland (TL), exotic forest (EF) or mature indigenous forest types.	High	NoR 1, 4, 5, 6, 7, 8, 9, 11, 12, 13

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Preferred Habitat	Suitable Habitat within Project Area	Ecological Value	Relevant NoR
			Auckland mainland, particularly in winter where they often utilize exotic pine and eucalyptus trees in rural and urban areas. Rare but widespread (seasonal migrant) in the Auckland region (Moorhouse, 2013).			
Pied Shag *(Phalacrocorax varius)*	At Risk - Recovering	eBird, iNaturalist	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Powlesland, 2013).	May occur along Ōrewa River near the SH1 bridge, which consist of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into kanuka scrub and forest (VS2) and coastal broadleaf forest (WF4) further up the bank.	High	NoR 4, 10
Spotless Crake *(Zapornia tabuensis)*	At Risk - Declining	eBird	Wetland vegetation and freshwater lakes and ponds, with dense marginal vegetation. Rare but widespread in the Auckland region (Fitzgerald, 2013).	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW), *Machaerina* sedgeland (WL11), and Raupō Reedland (WL19) and dense vegetation associated with the margins of stock water ponds, ornamental ponds, and stormwater ponds (e.g., OW, PLW, WL.11).	High	NoR 1, 3, 4, 5, 6, 7, 8, 9, 11, 12, and 13.

Species	Conservation Status (Robertson et al., 2021)	Record Source	Distribution and Preferred Habitat	Suitable Habitat within Project Area	Ecological Value	Relevant NoR
White heron *(Ardea alba)*	Threatened - Nationally Critical	eBird	Mostly inhabit harbours and estuaries, but also visit freshwater wetlands, including high country lakes (Adams, 2013)	May occur along Ōrewa River near the SH1 bridge, which consists of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank.	Very High	NoR 4, 10

5.2.2.4 Herpetofauna

Existing desktop records (DOC, 2022b; GBIF.Org User, 2022) have identified the presence of native herpetofauna species within 5 km of the Project Area. No dedicated herpetofauna surveys were undertaken for the Projects; however opportunistic searches were conducted where possible. A full list of species (including introduced and naturalised species) is included in Appendix 6. A total of nine species were identified, of which, six are native and five have a Threatened or At Risk status (Hitchmough et al., 2021).

Table 5-6 details all the observed and potential native herpetofauna species for each NoR, including the ecological value for each species, based on the availability of potential habitat within the Project Area [14]. The NoR was considered relevant to the species if desktop records indicate presence in that area and if its potential habitat falls within or adjacent to the designation of the NoR.

The potential occurrence of native frogs (specifically Hochstetters) was considered but excluded based on the absence of suitable habitat.

Shore skinks (*Oligosoma smithi*; At Risk – Declining) were identified during the desktop review but is expected to be absent from the Project Area due to a lack of suitable coastal habitat (e.g., dunelands, rocky coastal platforms, pebble / boulder beaches (NZ Herpetological Society, 2021)). Therefore, it will not be assessed for ecological value and impact.

[14] The full list of herpetofauna species identified via desktop assessment and incidental observations are included in Appendix 6 – Full list of Fauna Records.

Table 5-6 Native herpetofauna likely to occur within a proposed designation boundary for the North Projects, as well as their ecological values (see Section 4.4 for assessment methodology)

Species	Conservation Status (Hitchmough et al., 2021; Melzer et al., 2022)	Record Source	Distribution and Preferred Habitat	Suitable Habitat within Project Area	Ecological Value	Relevant NoR
Auckland Green / Elegant Gecko *(Naultinus elegans)*	Nationally and in Auckland: At Risk – Declining	DOC Bioweb, iNaturalist	Inhabits forests, including scrubby/regenerating habitat, swamps, scrubland, and mature forest (NZ Herpetological Society, 2021).	Areas with sufficient understorey relating to vegetation units EF, TL, PL1, PL2, VS2, VS3, and mature indigenous forest types.	High	All NoRs
Copper Skink *(Oligosoma aeneum)*	Nationally and in Auckland: At Risk – Declining	DOC Bioweb (includes records in proximity to NoR 13)	Inhabits areas with good groundcover in open and shaded areas of forests. Also found in urban areas, including thick-rank grass, compost heaps, or under rocks, logs and other debris (NZ Herpetological Society, 2021).	Areas with sufficient understorey relating to vegetation units EF, EF.1, EF.2, EG (unmanaged rank grass, not grazed or mown), ES, PL.1, PL.2, PL.3, TL.2, TL.3, VS2, VS3, and mature indigenous forest types.	High	All NoRs
Forest Gecko *(Mokopirirakau granulatus)*	Nationally and in Auckland: At Risk – Declining	DOC Bioweb, iNaturalist (includes records in proximity to NoR 9)	Inhabits a range of habitats, including swamps, scrubland, mature forests (beech, podocarp, and broadleaf), and rock fields (up to 1400m asl). In the North Island, they appear to favor scrubby/regenerating habitats (NZ Herpetological Society, 2021).	Areas with sufficient understorey relating to vegetation units EF, TL, PL1, PL2, VS2, VS3, and mature indigenous forest types.	High	All NoRs
Ornate Skink *(Oligosoma ornatum)*	Nationally and in Auckland: At Risk – Declining	DOC Bioweb (includes records in proximity to NoR 4 and 13)	Inhabits forested areas, shrubland and heavily vegetated coastlines (NZ Herpetological Society, 2021).	Shrubland and forest with sufficient understorey relating to vegetation units EF, TL, PL2, VS2, VS3, and mature indigenous forest types.	High	All NoRs
Pacific Gecko *(Dactylocnemis pacificus)*	Nationally: Not Threatened Auckland: At Risk – Declining	DOC Bioweb	Inhabits a range of different habitats, including swamps, scrubland, mature forests, rocky coastlines, back-dunes, rocky islets, and rock outcrops (NZ Herpetological Society, 2021).	Scrublands such as VS2, VS3, and mature indigenous forest types.	High *(based on the Auckland threat status)*	All NoRs

5.2.2.5 Invertebrates

Kauri snail (*Paryphanta* spp.) (At Risk – Declining) (Mahlfeld et al., 2012) was the only native invertebrate species identified in the desktop review within 5 km of the Project Area. One 'research grade' observation of Kauri snail from iNaturalist (GBIF.Org User, 2022) was recorded approximately 3.6km southeast of NoR 4: SH1 improvements .

Kauri snails inhabit moist areas of forest and native scrub. They live in areas of high soil fertility and abundant earthworms (DOC, 2023). Based on their habitat preferences, these invertebrate species are potentially present within the proposed designation boundaries of NoR 4: SH1 improvements and NoR 9: Upgrade to Dairy Flat Highway (between Dairy Flat and Albany) due to the large areas of mature, native forest and dense leaf litter.

It is considered that Project effects on kauri snails are less than **Negligible**, as it is not anticipated that these invertebrates are sensitive to district matter effects. Therefore, these invertebrate species have not been assessed further in this report. However, impact management will be required under the Wildlife Act to prevent killing or injuring these species. This is detailed further in Section 7.5.

5.2.3 Freshwater Habitat and Fauna

5.2.3.1 Streams

A review of the NZ River Name Lines dataset (LINZ, 2022) indicated that named rivers/streams and their tributaries will be crossed in the Project Area, and this is further detailed in Table 10-14.

All potential streams within the Project Area were mapped (Appendix 4), classified as either permanent or intermittent (ephemeral streams were mapped when possible). Permanent or intermitted streams that were within the NoR areas were numbered and assessed. Additionally, all streams that were accessed during site investigations were surveyed using the Rapid Habitat Assessment (RHA), with the detailed RHA results included in Appendix 12. Table 10-14 identifies what streams are crossed in each NoR, and Table 10-15 in Appendix 7 presents the detailed ecological value for streams identified in the Project Area.

5.2.3.2 Freshwater Fish

The New Zealand Freshwater Fish Database (NZFFD) (Stoffels, 2022) was reviewed for native freshwater fish and freshwater invertebrate records within stream catchments associated with the Project Area. Fish surveys were not carried out during site investigations, and no native fish species were incidentally observed onsite.

A full list of species (including introduced and naturalised species) is included in Appendix 6. Of the freshwater fish and invertebrates recorded, 24 are native and 6 have a Threatened or At Risk status (Dunn et al., 2018; Grainger et al., 2018). The results are presented in Table 10-10 in Appendix 6.

5.2.4 Wetland Habitat

A desktop review of existing ecological records was undertaken to gain an understanding of the wetland habitat that could be present within the Project Area.

A total of 145 wetlands within the Project Area were identified and assessed. The different wetland types and their classification are summarised in Table 5-7 (Singers et al., 2017; Singers & Rogers, 2014). Details regarding the vegetation cover, potential NPS-FM classification, potential for supporting

TAR species, and ecological value for each wetland is presented in Table 10-16 in Appendix 7. Refer to Appendix 4 for a map showing the spatial distribution of wetlands.

Table 5-7 Description of the wetland types present within the Project Area

Wetland Type	Abbrev.	Description
Exotic Wetland	EW	Wetland ecosystems with >50% exotic plant biomass.
Open Water	OW	Open Water (e.g., ornamental ponds, stormwater ponds, stock ponds).
Native rushland	N/A	In the Project Area this wetland is dominated by a mix of juncus species.
Mangrove forest and scrub	SA1.2	Mangrove forest and scrub occurring in areas of frequent tidal inundation with abundant silt deposition, particularly near stream and river mouths.
Planted Wetland – Native (recent)	PLW	Native restoration plantings with <50% exotic biomass and <10 years old.
Machaerina sedgeland	WL11	A species-poor scrub / restiad rushland. Typically, a mix of juncus spp., sedge species, and ferns.
Herbfield (ephemeral wetland)	WL14	Herbfield and/or low sedgeland dominated by a wide range of predominantly montane, short-statured herbs, grasses and sedges. In the Project Area, the WL14 wetland is dominated by swamp millet (*Isachne globose*).
Raupō reedland	WL19	Characterised by abundant raupō.

5.2.5 Likely Future Ecological Environment

The assessment of ecological effects should take account of the likely future environment, including the likelihood of change from the existing environment, based on the current AUP: OP zoning, permitted activities for infrastructure, and planned urbanisation and directions within any current National Policy Statements i.e., NPS FM. Based on these components, the following implications of the future environment on ecological features are assumed:

Future urban zones (FUZ)

- High likelihood of change for the environment;
- As land is developed, the majority of unprotected terrestrial vegetation (such as planted vegetation, forestry and shelterbelts outside riparian and wetland features, but adjacent to the NoR) is assumed to be cleared and developed. However, these features may be present during the construction phase of the transport corridors (depending on the time difference between corridor construction and urban development);
- Some SEAs may degrade over time due to pressures such as edge effects, pest animal browsing pressures and uncontrolled stock access. At the same time some SEAs may increase in value due to private/community pest control projects, re-colonisation of indigenous fauna and flora. Therefore, SEA vegetation is assumed to maintain its value as currently assessed to balance potential increase and decrease at a feature level;
- Land development will increase noise and light pollution effects on terrestrial fauna species;

- Likely increase in natural wetland habitat due to requirements to restore and enhance degraded systems. This is expected to occur at the same time as, or following urbanisation (but after the implementation of the Transport corridors);
- Streams and floodplains, wetlands, and riparian vegetation are expected to be retained and enhanced and protected within esplanade reserves and habitat enhancement;
- Fish passage is expected to improve with the removal of old culverts and pipes that historically blocked passage;
- It is expected that Urban Development will continue to progress with green infrastructure and carbon benefits incorporated as part of development. Therefore, the inclusion of street side vegetation is expected to occur, including the provision of street trees within large parts of the urban development.

All non-FUZ zones

- Low likelihood of change for the environment;
- All ecological features are likely to remain similar or the same. Therefore, vegetation cover, streams and wetland features are likely to be relatively unchanged.

6 Assessment of Positive Effects

The following section outlines the positive effects of the proposed alignment for each NoR in relation to specific ecological features (Table 6-1). The statement regarding positive effects assumes that some native planting will occur on the sides of the transport corridors as part of the landscape management.

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

- Improved blue/green infrastructure (stormwater wetlands, swales, raingardens) and associated landscaping (which will be indigenous species);
- Mass revegetation of sloping berms, batters, and embankments to connect with retained forest remnants/mature trees;
- Proposed bat and bird mitigation in association with the revegetation and stormwater wetlands mentioned above will have positive ecological outcomes for native fauna (Appendix 14).

Table 6-1 Summary of positive effects associated with each NoR

Positive Effect	Ecological Feature	Relevant NoR
The Project landscape planting will tie into stream and riparian corridors. Riparian vegetation will be retained (where practicable) and enhanced (weeds control and indigenous vegetation planted).	All streams and riparian corridors	All NoRs
Existing infrastructure upgrades will include new bridge structures replacing culverts. This improves habitat connectivity for freshwater and terrestrial species. This will include improved fish passage and improved riparian habitat connectivity.	Dairy Stream Tributary (N4-S16a)	NoR 4
	Wēiti Stream (N7-S1a)	NoR 7
	Dairy Stream Tributary (N4-S16b)	NoR 13
	Dairy Stream Tributary (N8-S10)	NoR 8
	Rangitopuni Tributary (N8-S3)	NoR 8
	Rangitopuni Tributary (N8-S2)	NoR 8

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

Section 7 assesses the ecological effects of activities (construction and operational) which relate to district plan matters under the AUP:OP, as these relate to the designations sought (noting regional consents will be sought later, closer to construction). For each key ecological effect, the assessment details the 'Magnitude of Effect' and subsequent 'Overall level of Effect' (see Appendix 1 for details on assessment methodology) as they relate to the ecological features identified. Impact management and residual effects are presented where the overall level of effect is assessed to be Moderate or higher.

The effects assessment has considered two scenarios – the current ecological baseline and the likely future ecological environment. Refer to Section 5.2.5 for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

7.1 Overview of Construction and Operational Effects

The Projects involve the construction of new transport corridors in mostly FUZ areas, and the upgrading and widening of existing roads in mostly FUZ areas, with some sections of NoR 1: New Rapid Transit Corridor (RTC), NoR 4: SH1 Improvements, NoR 9: Upgrade to Dairy Flat Highway (between Dairy Flat and Albany), and NoR 13: Upgrade to East Coast Road between Silverdale and Ō Mahurangi Penlink (Redvale) Interchange, located in urban or rural landscapes.

The potential construction effects (direct and indirect) on the terrestrial habitat and species (as they relate to district matters) are identified as:

- Habitat removal that is subject to district controls, including native fauna (bats, birds and lizards) effects (mortality injury, roost/nest loss/disturbance) (refer Section 5.2.2 and Appendix 3);
- Disturbance and displacement to roosts/nests, and bats, birds, and lizards due to construction activities (noise, light, dust etc.). It is assumed that this effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the Project footprints/designations or underneath structures such as bridges.

The potential operational effects from the Projects that relate to District plan matters are identified as:

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise, and vibration effects from the operation of the transport corridors/stations, leading to fragmentation of habitat;
- 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 transport corridors. It is assumed that the habitat features (such as wetlands and riparian margins) will retain the same value as for the ecological baseline for at least a portion of the initial operation.

7.2 Long-tailed Bats

7.2.1 Construction Effects

The following potential construction related effects to long-tailed bats have been identified within and adjacent to all the NoRs:

- Disturbance and displacement of long-tailed bats and/or their roosts due to construction activities (noise, light, vibration, dust etc.) leading to a change in population dynamics[15]. It is assumed that this effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the Project footprints/designations or underneath structures such as bridges.

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

- Roost loss;
- Mortality or injury to bats.

During construction of the Projects, night works may be required, and site compounds may be lit overnight. Lighting at night has the potential to modify the behaviour of bats if they are 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. For some NoRs, bats will utilise roost sites within and adjacent to the Project Area based on confirmed habitat suitability (large trees with roost features, connected to linear corridors; confirmed foraging presence; and frequent utilisation of numerous roosting sites throughout their home range (Smith et al., 2017). The construction duration is expected to take no longer than six years from commencement to completion for each NoR proposed.

Table 7-1 details the potential magnitude of effect and subsequent level of effect (with justification) on long-tailed bats (**Very high** ecological value) for NoRs where the level of effect is **Moderate** or higher. Associated impact management presented in Section 7.2.2

The effects assessment has considered two scenarios – the current ecological baseline and the 'likely future ecological environment' (i.e., allowing for permitted activities). The level of effect within the likely future ecological environment across all NoRs is expected to remain the **same as the baseline**, as the assessment undertaken above is still relevant to the future environment because riparian corridors are likely to persist in the future ecological environment.

Further detail regarding how magnitude was determined and detail on assumptions for the likely future ecological environment is provided in the tables in Appendix 11.

[15] Long-tailed bat population dynamics refers to fluctuations and changes in the population size and structure of long-tailed bats over time. This may include factors such as birth rates, death rates, migration patterns, habitat availability, and environmental conditions that influence the abundance and distribution of long-tailed bats

Table 7-1 Summary of ecological effects on long-tailed bats during construction (Moderate level of effect or higher)

Activity	Effect Description	Effects Justification	NoR	Ecological Value	Magnitude	Level of Effect (pre-mitigation)
Construction - Noise/lighting/ vibration	Disturbance and displacement to roosts (existing) due to construction activities (noise, light, dust etc.)	New road cutting through some wetlands and a few stream tributaries. Bat presence confirmed via ABMs at 161 Ahutoetoe Rd (North end of NoR) and 422 Bawden Rd (south end of NoR). Roosts likely to be present in associated native and exotic vegetation. Bats highly likely to be disturbed by construction activities due to proximity to bat corridor and potential roosts.	NoR 1	Very High	Low	**Moderate**
		New station next to Ahutoetoe Rd. Bat presence confirmed via ABMs at 161 Ahutoetoe Rd, and roosts likely present in association with the native vegetation. Bats highly likely to be disturbed by construction activities due to proximity to bat corridor and potential roosts.	NoR 2	Very High	Low	**Moderate**
		New station, over small Wēiti stream tributary, a small patch of native plantings and exotic forest. John creek tributary within 100 m south of NoR possibly acts as a bat corridor. Bats could be by disturbed by construction activities due to proximity to bat corridor.	NoR 3	Very High	Low	**Moderate**
		Upgrade to existing motorway. Aside from WF11 stretch towards southern end of NoR, no significant vegetation structure. ABMs at 161 Ahutoetoe Rd, 228 Wilks Rd, 1722 East Coast Rd, 422 Bawden Rd confirm bat presence all along the NoR. Some disturbance to bat is expected due to bat corridors.	NoR 4	Very High	Low	**Moderate**
		New road crossing Dairy Stream tributary. Possible bat roosts in exotic vegetation west of tributary. Bats could be disturbed due to construction activity.	NoR 5	Very High	Low	**Moderate**

Activity	Effect Description	Effects Justification	NoR	Ecological Value	Magnitude	Level of Effect (pre-mitigation)
		Partly greenfield road, partly upgrade of an existing road, including four stream crossings – once of Ōrewa river and three times its tributaries, of which one is likely used by bats for foraging and commuting. Bats likely to be disturbed by construction activities.	NoR 6	Very High	Low	**Moderate**
		Upgrade of existing road, running along Wēiti Stream and its tributaries. Bat roost potential in riparian vegetation within NoR designation. Fragmented exotic forest along mainly south of NoR.	NoR 7	Very High	Low	**Moderate**
		Upgrade of existing road, crossing several tributaries of Dairy Stream, most significantly at intersection with Green Rd where the tributary has a higher potential of acting as a bat corridor. For over 2 km, from approximately Richards Rd to Horseshoe Bush Rd intersection, a possible bat corridor runs along Highway within 100 m of NoR designation. Bats are likely to be disturbed by construction activity.	NoR 8	Very High	Low	**Moderate**
		Upgrade of existing road. Roosts may be present in associated native vegetation. Significant structures of TL.2, WF11, VS2, EF, WF9. Bats may be disturbed by construction activities due to proximity to bat corridor and potential roosts.	NoR 9	Very High	Low	**Moderate**
		Upgrade of existing road, crossing Ōrewa River which is likely to be utilised by bats for foraging and commuting. Some native scrub and exotic forest to the east end of NoR.	NoR 10	Very High	Low	**Moderate**

Activity	Effect Description	Effects Justification	NoR	Ecological Value	Magnitude	Level of Effect (pre-mitigation)
		Upgrade of existing road and new road at eastern end. Both ends of NoR surrounded by exotic forest/scrub and wetlands. Mature trees (mostly hedgerows) adjacent to construction areas provide potential bat habitat.	NoR 12	Very High	Low	**Moderate**
		Upgrade of existing road crosses two tributaries of Dairy Stream at the southern end of NoR. No significant vegetation structures. South of intersection with Worsnop Way the road crosses a possible bat corridor – ABM at site 1722 East Coast Rd confirms bat presence. Bats likely to be disturbed by construction activities.	NoR 13	Very High	Low	**Moderate**
	Roost loss through vegetation removal	Potential of bat roost loss due to removal of mature district plan trees (tree group no. 102 103, and 104) in VS2/VS3 habitat.	NoR 4 (and NoR 1 for tree group no.104)	Very High	Low	**Moderate**
		Potential for bats to roost within district plan tree groups no. 901 and 905 adjacent to SEA_T_8300 (WF11).	NoR 9	Very High	Low	**Moderate**
		Potential for bats to be present and thus killed/injured within tree groups no. 102, 103, 104 due to close relation to SEAs.	NoR 4 (and NoR 1 for tree group no.104)	Very High	Low	**Moderate**
		Potential for bats to be present and thus killed/injured within district plan tree groups no. 901 and 905 adjacent to SEA_T_8300 (WF11).	NoR 9	Very High	Low	**Moderate**

The effect of habitat removal on long-tailed bats (specifically relating to mortality/injury and roost loss/disturbance) has also been considered for the district plan trees located in NoR 1, 2, 4, 9 and 13 (refer Section 5.2.2). Only the tree groups in NoRs 1, 4 and 9 (tree group no. 102, 103, 104, 901 and 905) have the potential for bat habitat, based on the results of the bat surveys (refer Section 4.3.3) and the habitat type (including tree roost potential in the likely future ecological environment). Long-tailed bats have **Very high** ecological value and the magnitude of effect is considered to be **Low**, with the overall level of effect assessed as **Moderate** prior to mitigation. As such impact management is required and is described in Section 7.2.2 below.

7.2.2 Impact Management and Residual Effects During Construction

Table 7-1 identifies that NoR 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12 and 13 have construction related disturbance effects on long-tailed bats that are **Moderate** and as such impact management is required.

NoRs 1, 4 and 9 have construction related habitat removal effects (mortality/injury and roost loss/disturbance) on long-tailed bats that are **Moderate** and as such impact management is required.

To address effects, a Bat Management Plan (BMP) for each affected NoR should be developed to include consideration for:

- Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed;
- Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar);
- Siting of compounds and laydown areas to avoid mature forest types;
- Lighting design to reduce light levels and spill from construction areas;
- Restriction of nightworks around mature forest types;
- Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance;
- Consideration to the provisions of the Wildlife Act including the implementation of a vegetation removal protocol (Bat Roost Protocol v2 DOC, 2021 or equivalent version at time of removal) (NoRs 1, 4 and 9 only)

The residual impact is assessed as **Very Low** post mitigation.

7.2.3 Operational Effects

The following potential operational related effects have been identified in relation to long-tailed bats within and adjacent to all the NoRs:

- Loss in connectivity due to the presence of the transport corridors (including light and noise effects from the corridors, leading to fragmentation of terrestrial, wetland and riparian habitat and a change in population dynamics due to the presence of the infrastructure);
- Disturbance and displacement of bats leading to a change in population dynamics due to light, noise, and vibration from the transport corridors.

The loss of connectivity through the presence of new or upgraded transport corridors and associated disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat. It has the potential to impact on bat movement in the broader

landscape and can potentially disturb nearby bat roosts (including maternity roosts). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. Likely bat movement corridors have been mapped and are presented in Appendix 13.

Table 7-2 and Table 7-3 detail the potential magnitude of effect (connectivity and disturbance effects) and subsequent level of effect (with justification) on long-tailed bats (**Very High** ecological value) for each NoR. Only NoRs where the level of effect is **Moderate** or higher is presented, with associated impact management presented in Section 7.2.4.

The effects assessment has considered two scenarios – the current ecological baseline and the 'likely future ecological environment'. The level of effect within the likely future ecological environment across all NoRs is expected to remain the **same as the baseline**, as the assessment undertaken above is still relevant to the future environment because stream riparian corridors are likely to persist in the future ecological environment.

Further detail regarding how magnitude was determined and detail on assumptions for the likely future ecological environment is provided in the tables in Appendix 11.

Table 7-2 Summary of connectivity effects on long-tail bats (Moderate level of effect or higher) during operation

Activity	Effect Description	Effects Justification	NoR	Ecological value	Magnitude	Level of Effect (pre-mitigation)
Presence of the road	Loss in connectivity due to the presence of the transport corridor (including light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat) resulting in changes in population dynamics.	Crosses possible bat corridor around Awanohi Rd entrance from East Coast Rd, where Bawden Rd and Dairy Stream Rd intersect, and then goes along a corridor for approximately 2.5 km at the northern end of the NoR (within 150 m of NoR boundary). Additional fragmentation expected to occur.	NoR 1	Very High	Low	**Moderate**
		Several bat corridors pass across SH1. Although it is an upgrade to an existing motorway, additional fragmentation is still expected. However low base rate and poorly defined ecological nodes on either side of the infrastructure.	NoR 4	Very High	Low	**Moderate**
		Four stream crossings, of which two will be new. Significant TL.3 structure at northern end of NoR impacted. New Ōrewa River tributary to be crossed is likely bat corridor, fragmentation likely to occur.	NoR 6	Very High	Moderate	**High**
		Upgrade of an existing road, crosses a stream which is likely to be utilised by bats for foraging and commuting where a roundabout is planned for the intersection between Pine Valley Rd and Young Access. Likelihood adjusted to Unlikely due to existing fragmentation however ecological nodes are present and potential bat movement cannot be excluded.	NoR 7	Very High	Low	**Moderate**
		One stream crossing of important stream corridor (Dairy Stream tributary). Although it is an upgrade of an existing road, and these crossings are already bridged, additional fragmentation may occur.	NoR 8	Very High	Low	**Moderate**
		Upgrade of an existing road. Riparian corridor within 100 m. Mitigation requires light and noise management only.	NoR 9	Very High	Low	**Moderate**

Activity	Effect Description	Effects Justification	NoR	Ecological value	Magnitude	Level of Effect (pre-mitigation)
		One stream crossing of important stream corridor (Orewa River) for bat utilisation. Although it is an upgrade of an existing road, and these crossings are already bridged, additional fragmentation may occur.	NoR 10	Very High	Low	**Moderate**
		Upgrade of an existing road, crosses possible bat corridor (in Future Urban Zone), additional fragmentation may occur.	NoR 13	Very High	Low	**Moderate**

Table 7-3 Summary of disturbance to long tail bats due to the operation of road (light, noise vibration), for Moderate level of effects or higher during operation

Activity	Effect Description	Effects Justification	NoR	Ecological value	Magnitude	Level of Effect (pre-mitigation)
Presence of the road	Disturbance and displacement of (new and existing) roosts due to lighting and noise/vibration (**operational**)	New transport corridor. Proximity to bat corridors and possible roosts increase likelihood of disturbing bats.	NoR 1	Very High	Low	**Moderate**
		Upgrade of existing motorway. Likely disturbance in northern section associated with SEA_T_2192a	NoR 4	Very High	Low	**Moderate**
		Upgrade of existing road. Likely disturbance in proximity to SEA_T_5446	NoR 7	Very High	Low	**Moderate**
		Proximity to potential bat habitat in rural sections and possible roosts increase likelihood of disturbing bats. Mitigation will relate to noise and light management (no buffer planting required)	NoR 9	Very High	Low	**Moderate**
		Upgrade of existing road. Proximity to SEA_T_3590 and bat habitat associated with stream to the south of Wainui Rd crossing	NoR 10	Very High	Low	**Moderate**

7.2.4 Impact Management and Residual Effects During Operation

Table 7-2 identifies that NoR 1, 4, 6, 7, 8, 9, 10 and 13 have operational related connectivity effects on long-tailed bats that are **Moderate or High** and as such impact management is required. To address effects, a Bat Management Plan (BMP) for each NoR should be developed to include consideration for the indicative bat mitigation in Appendix 14.

The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained.

The BMP should also have additional consideration for:

- Lighting design to minimise light levels and light spill along the transport corridors;
- Noise management to minimise noise disturbance at indicative bat mitigation areas;
- Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action.

The residual impact is assessed as **Low** post mitigation.

Table 7-3 identifies that NoR 1, 4, 7, 9 and 10 have operational related disturbance effects on long-tailed bats that are **Moderate** and as such impact management is required. To address effects, a Bat Management Plan (BMP) for each NoR should be developed to include consideration for:

- Buffer planting and retention of existing mature trees between the road alignment and features with potential for bat roosts;
- Lighting design to minimise light levels and light spill along the transport corridors.
- Noise management through design;
- Future presence of roosts within the alignment (placement of flaps on features with high roost potential).

The residual impact is assessed as **Low** post mitigation.

7.3 Avifauna

The effect on birds has been considered against the typical behaviours, habitat preference, and the sensitivity of the various TAR species within the North Projects. Effects have been considered on an individual species level, or where suitable species with similar habitat preferences and sensitivities were grouped, to assess species population effects. This grouping was further supported due to the high-level assessment that has been carried out, whereby presence has been assumed due to historic positive detection within proximity to the North Projects. These groups are as follows:

Cryptic Wetland Birds:

Including bittern, banded rail, fernbird, and spotless crake. Typically, these species are associated with vegetated wetlands with sufficient cover. They are noted as being generally sensitive to disturbance. These species (with the exception of fernbird) are noted as traveling between suitable habitat with most exhibiting some form of territorial behaviour.

Open Water Wetland Birds:

Including brown teal, dabchick, and grey duck. Typically, these three species can be found utilising open water wetlands (ponds and shallow lakes) and large stream systems with plenty of slow moving or still water. They are noted as being generally sensitivity to disturbance, however there are ample records of dabchick and brown teal developing a level of tolerance to noise and light, with individuals and breeding pairs being noted on stormwater ponds. They are noted as being relatively mobile outside of the breeding season with frequent habitat relocations.

Coastal Birds:

Including white heron and the shag species. Typically, these are noted as occurring within the coastal environment, including harbours and estuaries. These species may occasionally be vagrant with freshwater systems including wetlands and river margins. With regards to the White heron, the only recorded breeding colony is on the Waitangiroto River, just north of Okarito Lagoon, Westland. Regarding shag species the nest behaviour is generally typified by breeding on mature trees with over hanging branches over water or in colonies on cliff sides in close proximity to water. For the sake of coastal birds, it has been assumed that no current habitat with the Project Area presents suitable breeding habitat, although adjacent habitat is present.

Forest Birds:

Including Long-tailed cuckoo and Kaka. Typically, these species are noted as occurring within established bush blocks. Both species are noted as having a wider home range with long-tailed cuckoo undertaking annual migrations but with poor recolonisation where new host species have been reintroduced. Both are affected by the presence of mammalian predators which affect reproductive success.

7.3.1 Construction Effects

The following potential construction related effects to native birds within and adjacent to all the NoRs have been identified:

- Disturbance and displacement of native birds and/or their nests due to construction activities (noise, vibration, dust etc.) leading to a change in population dynamics. It is assumed that this

effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the Project footprints/designations or underneath structures such as bridges.

Noise and vibration during construction may disturb birds that are roosting in the immediate vicinity of the construction works. It has been assumed that the disturbance may impact potential birds in suitable habitat up to 100m from the proposed designation boundary. Appendix 4 shows the location of potential habitat associated with each NoR.

Appendix 11 details the potential magnitude of effect and subsequent level of effects (with justification) for species and groups for each NoR. Table 7-4 summarises the NoRs where the level of effect is **Moderate** or higher. The effects assessment has considered two scenarios – the current ecological baseline and the 'likely future ecological environment'. The level of effect for the current baseline and the 'likely future ecological environment' were the same for both assessments.

Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Nest loss;
- Mortality or injury to birds.

Level of effect of vegetation removal is Very Low except for North Island kākā in the 'likely future ecological environment' for NoRs 1, 4 and 9 (tree group no. 102, 103, 104, 901, and 905). As the currently semi-mature trees mature in the future, kākā presence becomes more likely hence level of effect of nest loss and mortality/injury is assessed as **Moderate.**

Table 7-4 Summary of disturbance to native birds and nests, resulting in changes to population dynamics, (Moderate level of effect or higher) during construction

Effect Description	Risk of disturbance to native birds and nests (existing) adjacent to construction activities (noise, light, dust, vibration etc.) resulting in changes in population dynamics					
Bird Type	**Species**	**Ecological Value**	**NoR**	**Effect Justification**	**Magnitude**	**Level of Effect (pre-mitigation)**
Cryptic Wetland Birds	Australian bittern	Very High	NoR 1	New transport corridor mainly over grazed pasture. Potential for birds to utilise ponds within NoR and moderate to large sized wetlands (> 3000 m^2) adjacent to NoR (west to NoR at towards South end, to east of intersection with Awanohi road (SA1.2), east of intersection with NoR 8) for foraging. The designation goes over all named wetlands, thus disturbance by construction is highly likely.	Low	**Moderate**
			NoR 4	Potential for birds to be utilising suitably sized wetlands (>3000 m^2) within the NoR (N4-W1, N4-W3, N4-W9, N4-W14) and within 100 m of NoR boundary (west to NoR towards South end, to east of intersection with Awanohi Road (SA1.2), between NoR and Bawden Road). Disturbance by construction activities highly likely due to relation with road designation.	Low	**Moderate**
			NoR 6	Possibly utilising permanent open water in the NoR (N6-O1, N6-O2, N6-O3) for foraging, and the wetlands N6-W2, N6-W3 and N6-W5 for foraging. Construction activities likely to disturb Australasian bittern.	Low	**Moderate**
			NoR 7	Upgrade of the existing Pine Valley Road. Potential for birds to utilise moderate to large sized wetlands (> 3000 m^2) within 100 m of NoR designation, or ponds (N7-O1, N7-O2, N7-O3). Disturbance during construction likely.	Low	**Moderate**
			NoR 8	Upgrade of the existing Dairy Flat highway. Potential of Australasian bittern to utilise moderate to large sized wetlands (>3000 m^2) within NoR (N8-W4, N8-W5, N8-W6, N8-W7, N8-W8) and within 100m of NoR (where NoR8 and NoR1 intersect). Disturbance due to construction activity likely.	Low	**Moderate**
			NoR 13	Upgrade of the existing East Coast Road. Potential for birds to utilise large sized wetland, N13-W1 (>5000 m^2) and ponds in NoR boundary (N13-O1, and N13-O2 and N13-O4, which the road designation goes over both) and adjacent to NoR.	Low	**Moderate**
	Spotless crake	High	NoR 1	New transport corridor mainly over grazed pasture. Potential for birds to utilise moderate to large sized wetlands (> 3000 m^2) in the NoR (N1-W4, N1-W6, N1-W8, N1-W9, N1-W10, N1-W12), and adjacent to NoR (west to NoR at towards	Low	**Moderate**

Effect Description	Risk of disturbance to native birds and nests (existing) adjacent to construction activities (noise, light, dust, vibration etc.) resulting in changes in population dynamics					
				South end, to east of intersection with Awanohi Road (SA1.2), east of intersection with NoR 8) for foraging and nesting. The designation goes over all named wetlands, thus disturbance by construction is highly likely.		
			NoR 4	Potential for birds to be utilising suitably sized wetlands (>3000 m^2) within the NoR (N4-W9, N4-W3, N4-W4, N4-W1, N4-W14) and within 100 m of NoR boundary (west to NoR towards South end, to east of intersection with Awanohi Road (SA1.2), between NoR and Bawden Road). Disturbance by construction activities highly likely due to relation with road designation.	Low	**Moderate**
			NoR 6	New road passing through pasture as well as upgrade of existing road. Potential of spotless crake to utilise native rushland N6-W3 and large sized wetlands (> 3000 m2) (N6-W2, N6-W5) which road slope goes over. Disturbance by construction activities likely.	Low	**Moderate**
			NoR 7	Upgrade of the existing Pine Valley Road. Potential for birds to utilise large sized wetland (>5000 m^2) within 100 m of NoR designation (notably one adjacent to NoR east of Young Access intersection).	Low	**Moderate**
			NoR 8	Upgrade of the existing Dairy Flat Highway. Potential of spotless crake to utilise moderate to large sized wetlands (>3000 m^2) within NoR (N8-W4, N8-W5, N8-W6, N8-W7, N8-W8) and within 100m of NoR (where NoR8 and NoR1 intersect). Disturbance due to construction activity likely.	Low	**Moderate**
			NoR 9	Upgrade of the existing highway. Potential for birds to utilise moderate to large sized wetlands (> 3000 m^2) in the NoR (N9-W1, N9-W2) and an unnamed wetland adjacent to NoR opposite N9-W2 for foraging and nesting.	Low	**Moderate**
			NoR 12	Upgrade of the existing Bawden Road. Two wetlands within NoR boundary are small (<3000 m^2) so unlikely to be utilised by spotless crake. One large sized wetland (>5000 m^2) ~80 m away from NoR boundary to the west potentially utilised by spotless crake. Disturbance by construction activities likely.	Low	**Moderate**
			NoR 13	Upgrade of the existing East Coast Road. Potential for birds to utilise large sized wetland, N13-W1 (>5000 m^2) and dense vegetation associated with margins of ponds in NoR boundary (N13-O1, and N13-O2 and N13-O4, where the road designation goes over both) and adjacent to NoR.	Low	**Moderate**

Effect Description	Risk of disturbance to native birds and nests (existing) adjacent to construction activities (noise, light, dust, vibration etc.) resulting in changes in population dynamics					
	North Island fernbird		NoR 6	New road passing through pasture as well as upgrade of existing road. Potential of North Island fernbird to utilise native rushland N6-W3 (> 3000 m^2).	Low	**Moderate**
	Banded rail		NoR 4	Potential for birds to occur in wetlands N4-W1a and N4W1-b which consists of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank. Also, likely to occur at any densely vegetated wetlands adjacent to SH1 based on past observations from iNaturalist.	Low	**Moderate**
			NoR 6	New road passing through pasture as well as upgrade of existing road. Potential of banded rail to utilise native rushland N6-W3 (> 3000 m2).	Low	**Moderate**
			NoR 10	Upgrade of the existing Wainui Road. Potential for birds to utilise N4-W1a adjacent to NoR boundary at the eastern end, which consists of coastal Mangrove Forest and scrub (SA1.2). Construction will take place in associated vegetation; hence disturbance is likely.	Low	**Moderate**
Open Water Wetland Birds	Brown teal, dabchick, grey duck	Very High	NoR 1	Potential for birds to be found in any of the named ponds within NoR (N1-O1 to O21) or the several ponds within 100 m of NoR boundary along NoR. Designation goes over almost all the named ponds. Disturbance by construction activities highly likely.	Low	**Moderate**
			NoR 4	Potential for birds to utilise ponds within NoR (of notable size N4-O6, N4-O7, N4-O14, N4-21, N4-O23) and within 100 m boundary of NoR (notably between curve in Top Rd and NoR). Disturbance by construction activities highly likely due to relation with road designation.	Low	**Moderate**
			NoR 6 (excl. dabchick)	Potential for birds to utilise ponds within NoR. Construction activities will take place over N6-O1 and N6-O2, and the edge of N6-O3 (the only significantly sized pond: >3000 m^2). It is highly likely that birds will be disturbed.	Low	**Moderate**
			NoR 7 (excl. dabchick)	Potential for birds to utilise ponds within or adjacent to NoR (N7-O1, N7-O2, N7-O3). It is highly likely that construction activities will disturb any bird present.	Low	**Moderate**
			NoR 8	Potential of brown teal, dabchick, and grey ducks to be utilising ponds within and adjacent to NoR. Dabchick may also be in wetland N8-W8 due to its	Low	**Moderate**

Effect Description	Risk of disturbance to native birds and nests (existing) adjacent to construction activities (noise, light, dust, vibration etc.) resulting in changes in population dynamics					
				proximity to an open water wetland. Road designation over N8-O1, N8-O2, N8-O3 (edge), N8-O7, N8-O8. Disturbance by construction activities highly likely.		
			NoR 9	Potential for birds to utilise ponds within NoR (N9-O1, N9-O2, where the road designation goes over both) and other ponds within 100 m of boundary. Disturbance by construction activities likely.	Low	**Moderate**
			NoR 11 (excl. dabchick)	New road over grazed pasture. Potential for birds to utilise open water wetlands (N11-O1, N11-O2). As road boundary goes over N11-O1, disturbance due to construction activities highly likely.	Low	**Moderate**
			NoR 12	Potential for birds to utilise open water habitats within NoR (N12-O2 to O8) and within 100 m of designation boundary (N1-O10, and unnamed few on both ends of NoR). Due to abundance of possible habitats, disturbance by construction activity highly likely.	Low	**Moderate**
			NoR 13 (excl. dabchick)	Upgrade of the existing East Coast Road. Potential for birds to utilise open water habitats within the NoR (N13-O1, and N13-O2 and N13-O4, where the road designation goes over both), and other similarly sized ponds within 100 m of designation boundary (N5-O1, and other unnamed ponds mainly N13-O1 northwards). They are likely to be disturbed by construction activities due to abundance of habitat along NoR.	Low	**Moderate**
Coastal Birds	Black shag, little black shag, little pied shag, pied shag	High	NoR 4	Potential for birds to occur in wetlands N4-W1a and N4W1-b which consist of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank. Disturbance due to construction activities likely	Low	**Moderate**
			NoR 10	Upgrade of the existing Wainui Road. Potential for birds to utilise N4-W1a adjacent to NoR boundary at the eastern end, which consists of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank. Construction will take place in associated vegetation; hence disturbance is likely.	Low	**Moderate**
	White heron	Very High	NoR 4	Potential for birds to occur in wetlands N4-W1a and N4W1-b which consist of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank. Disturbance due to construction activities likely.	Low	**Moderate**

Effect Description	Risk of disturbance to native birds and nests (existing) adjacent to construction activities (noise, light, dust, vibration etc.) resulting in changes in population dynamics					
			NoR 10	Upgrade of the existing Wainui Road. Potential for birds to utilise N4-W1a adjacent to NoR boundary at the eastern end, which consists of coastal Mangrove Forest and scrub (SA1.2) along the water edge and grades into terrestrial vegetation further up the bank. Construction will take place in associated vegetation; hence disturbance is likely.	Low	**Moderate**
Forest Birds	Long-tailed cuckoo	Very High	NoR 3	Patch of native plantings and exotic forest within NoR will be built over. New station. Any long-tailed cuckoo present expected to be disturbed by construction activity.	Low	**Moderate**
			NoR 6	Significant riparian forest to the east end of NoR, within and adjacent to boundary. Long-tailed cuckoos likely to be disturbed by construction activities.	Low	**Moderate**
			NoR 7	Potential of long-tailed cuckoos in the kanuka scrub (SEA_T_5446) by intersection with Young Access, and exotic forest along western half of NoR. Disturbance by construction activities likely.	Low	**Moderate**
			NoR 10	Long-tailed cuckoo are considered a highly mobile species in this area, with high dispersal. Significant riparian forest to the east end of NoR, within and adjacent to boundary. Long-tailed cuckoos likely to be disturbed by construction activities.	Low	**Moderate**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

The effect of habitat removal on native birds (specifically relating to mortality/injury and nest loss/disturbance) has also been considered for the district plan trees located in NoR 1, 2, 4, 9 and 13 (refer Section 5.2.2). All of these groups of trees have the potential for non TAR native bird habitat. Non TAR native birds are **Low** ecological value and the magnitude of effect is considered to be **Low**, with the overall level of effect assessed as **Low** prior to mitigation. Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds and is described in Section 7.3.2 below.

7.3.2 Impact Management and Residual Effects During Construction

Table 7-4 identifies that NoR 1, 3, 4, 6, 7, 8, 9, 10, 11, 12 and 13 have construction related disturbance effects on TAR bird species that are **Moderate** and as such impact management is required.

NoRs 1, 4 and 9 have construction related habitat removal effects (mortality/injury and nest loss/disturbance) on North Island kākā that are **Moderate** and as such impact management is required.

To address effects, an Avifauna Management Plan (AMP) for each affected NoR should consider the following:

- Preconstruction surveys to confirm presence and guide further management;
- Where practical, construction works near wetland habitat (see Appendix 4) should commence prior to the bird breeding season (September to February) in order to discourage bird nesting;
- Bird management should be consistent with any regional consent conditions that may be required for regional compliance;
- Consideration of the provisions of the Wildlife Act including timing vegetation removal to avoid the key nesting period (September to February) or where this is not possible, pre-clearance inspections undertaken prior to vegetation removal (NoR 1, 4 and 9 only).

The residual impact is assessed as **Low** post mitigation.

7.3.3 Operational Effects

Potential operational effects on birds in all the NoRs from the construction of new transport corridors, stations and upgrading / widening of existing roads include:

- Loss in connectivity due to the presence of the transport corridors (including light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat and a change in population dynamics due to the presence of the infrastructure);
- Disturbance and displacement of birds due to light, noise, and vibration from the transport corridors resulting in changes in population dynamics.

The loss of connectivity through the presence of the transport corridors and associated disturbance, such as operational noise/vibration and light, can lead to an overall reduction in size and quality of bird foraging habitat, and has the potential to impact on bird movements in the broader landscape.

The level of effect on birds due to operational impacts associated with loss or decrease in connectivity has been assessed in the context of habitat suitability, the existing degree of fragmentation and the likely fragmentation in the future urban environment.

Appendix 11 details the level of effect on birds in relation to connectivity. Overall, the effect of loss in connectivity was assessed as **Negligible** to **Low** dependent on the ecological value of the species, and therefore impact management is not required.

Noise, vibration, and lighting disturbance caused by the presence of the transport corridors could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to the NoRs. Table 7-5 summarises the operational disturbance effects (**Moderate** and higher) for birds for all NoRs related to disturbance. Appendix 11 further details the level of effect on birds due to operation disturbance.

7.3.4 Impact Management and Residual Effects During Operation

Table 7-5 identifies that NoR 1, 6 and 10 have operational related connectivity effects on several TAR birds that are **Moderate** and as such impact management is required. To address effects, an Avifauna Management Plan (AMP) for each NoR should be developed to include consideration for the indicative bird mitigation in Appendix 14. The following mitigation measures should be implemented where practicable:

- Retention of vegetation near wetland habitat, where practicable;
- Buffer planting between the road alignment and suitable habitat adjacent to the road.

The residual impact is assessed as **Low** post mitigation for all affected NoRs.

Table 7-5 Summary of disturbance to native birds and nests, resulting in changes to population dynamics, (Moderate level of effect or higher) during operation

Effect Description	**Disturbance and displacement of birds (new and existing) and nests due to light, noise, vibration etc due to the presence of the infrastructure, resulting in changes to the population dynamics**					
Bird Type	Species	Ecological Value	NoR	Effect Justification	Magnitude	Level of Effect (pre-mitigation)
Cryptic Wetland Birds	Spotless crake	High	NoR 1	Potential for birds to utilise moderate to large sized wetlands (> 3000 m^2) adjacent to NoR (west to NoR at towards South end, to east of intersection with Awanohi road (SA1.2), east of intersection with NoR 8) for foraging and nesting. As it is a new transport corridor, disturbance to spotless crake due to road presence is likely.	Low	**Moderate**
			NoR 6	Spotless crake potentially to use N6-W2 and N6-W5. As it is a new road going through greenfields, disturbance to birds likely.	Low	**Moderate**
	Banded rail	High	NoR 10	Banded rail potentially to utilise N4-W1a adjacent to NoR boundary at the eastern end, which consists of coastal Mangrove Forest and scrub (SA1.2). Due to high quality of the habitat and connection to estuary/coast, there is a higher risk of disturbance and so a Moderate level of effect has been assigned.	Low	**Moderate**
	Australian bittern	Very High	NoR 6	Possibly utilising pond N6-O3, and wetlands N6-W2, N6-W5. As it is a new road going through greenfields, disturbance to birds in the wetlands likely.	Low	**Moderate**
Coastal Birds	Black shag, little black shag, little pied shag, pied shag	Very High	NoR 10	Shags potentially to utilise N4-W1a adjacent to NoR boundary at the eastern end, which consists of coastal Mangrove Forest and scrub (SA1.2). Due to high quality of the habitat and connection to estuary/coast, there is a higher risk of disturbance and so a Moderate level of effect has been assigned.	Low	**Moderate**
	White heron	Very High	NoR 10	White heron potentially to utilise N4-W1a adjacent to NoR boundary at the eastern end, which consists of coastal Mangrove Forest and scrub (SA1.2). Due to high quality of the habitat and connection to estuary/coast, there is a higher risk of disturbance and so a Moderate value has been assigned.	Low	**Moderate**

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effect. Table does not include species where there were less than **Moderate** level of effect.

7.4 Herpetofauna

The effects on herpetofauna have been considered against the typical behaviours, habitat preference and sensitivity of the various species. In general, the five species are likely to occur within the North Projects and can be grouped into two types – arboreal gecko species and ground skink species.

Arboreal geckos

Species included in this group are Auckland green gecko *(Naultinus elegans)*, forest gecko *(Mokopirirakau granulatus)*, and the Pacific gecko *(Dactylocnemis pacificus)*. Generally, these three species require native mature trees with a preference for mānuka and kānuka dominated forest types (VS2, VS3). The species are not considered mobile relative to other gecko species; however, anecdotal evidence from salvages within the wider Auckland region has noted that individual geckos have travelled greater than 400 m in one 24hr period. In general, gecko species are considered to be relatively resilient in regard to dust and noise disturbance with gecko hotspots being located less than 2m from a road margin.

Ground skink species

Species included in this group are copper skinks *(Oligosoma aeneum)* and ornate skinks *(Oligosoma ornatum)*. These two species are considered to be habitat generalists relative to other skink species, requiring either overgrown vegetation or organic refuge that maintains a moist environment. Populations typically occur in greater density within forested areas, but have still been noted occurring within roadside vegetation. In general, similar to the gecko species, they are considered to be relatively resilient to dust and noise disturbance.

7.4.1 Construction Effects

The following potential construction related effects to herpetofauna within and adjacent to all the NoRs have been identified:

- Disturbance and displacement of herpetofauna due to construction activities (noise, light, vibration, dust etc.) leading to a change in population dynamics. It is assumed that this effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the Project footprints/designations or underneath structures such as bridges.

Noise and vibration during construction are not considered to have any major impacts on native herpetofauna species. Indeed, it is not uncommon within salvage projects to relocate herpetofauna to the immediate habitat (where available) adjacent to any construction site. Should noise and vibration result in a disturbance and displacement then standard herpetofauna management would not support the reintroduction of the species within the immediate proximity of the proposed construction works.

Table 7-6 summarises the effects assessment related to disturbance for herpetofauna across the Project Area due to the construction activities. The magnitude of effects of disturbance and displacement due to noise and vibration for native herpetofauna is considered **Negligible** across **all NoRs**, both within the current and likely future ecological environment considerations. As the ecological value of all herpetofauna species is **High**, the overall level of effect is assessed as **Low** prior to mitigation, and impact management is not required. The level of effect within the likely future ecological environment is expected to remain the **same as the baseline**.

The effect of habitat removal causing mortality or injury to lizards has also been considered for the district plan trees located in NoR 1, 2, 4, 9 and 13 (refer Section 5.2.2). The groups of trees (101, 102, 103, 104, 901, and 905) in NoRs 1, 4 and 9 have the potential for lizard habitat which should be confirmed during pre-construction surveys. Lizards (all potential gecko and skink species identified) are **High** ecological value and the magnitude of effect is considered to be **Low**, with the overall level of effect assessed as **Moderate**[16] prior to mitigation. As such impact management is required and is described in Section 7.4.2 below.

[16] Overall level of effect was adjusted to Moderate based on expert judgement. A strict adherence to the EIANZ (2018) effects matrix results in a Low level of effect for a High value feature and a Low magnitude of effect, while a Moderate magnitude results in High level of effect. A High level of effect is considered an overstatement in the context of the relevant NoRs assessed.

Table 7-6 Assessment of ecological effects and impact management for lizards during construction

Effect Description	Ecological Value	Relevant NoR	Magnitude of Effect		Overall Level of Effect		Impact management and residual level of effect	
			Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Disturbance and displacement to existing individuals adjacent to construction activities (noise, light, dust etc.)	High: *Arboreal gecko spp.*	All NoRs	Negligible	Same as baseline (Negligible)	Very Low	Same as baseline (Very Low)	Not Required based on Effect	Not Required based on Effect
	High: *Ground skink spp.*	All NoRs	Negligible	Same as baseline (Negligible)	Very Low	Same as baseline (Very Low)	Not Required based on Effect	Not Required based on Effect
Habitat loss due to removal of district plan trees	High: *Arboreal gecko spp.*	NoR 1, 4, 9	Low	Same as baseline (Low)	Moderate	Same as baseline (Moderate)	LMP Required	LMP Required
		NoR 2, 13	Negligible	Same as baseline (Negligible)	Very Low	Same as baseline (Very Low)	Not Required based on Effect	Not Required based on Effect
Mortality and injury to individuals due to removal of district plan trees	High: *Arboreal gecko spp.*	NoR 1, 4, 9	Low	Same as baseline (Low)	Moderate	Same as baseline (Moderate)	LMP Required	LMP Required
	High: *Ground skink spp.*	NoR 2, 13	Negligible	Same as baseline (Negligible)	Very Low	Same as baseline (Very Low)	Not Required based on Effect	Not Required based on Effect

7.4.2 Impact Management and Residual Effects During Construction

The removal of district plan trees during construction within NoRs 1, 4 and 9 has the potential to cause mortality or injure lizards resulting in a **Moderate** level of effect and as such impact management is required. To address effects, a Lizard Management Plan (LMP) for each affected NoR should consider the following:

- Preconstruction surveys and/or habitat potential surveys to confirm (potential) presence and guide further management if required;
- Timing of the implementation of the LMP;
- A description of methodology for survey, trapping and relocation of lizards rescued including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), nocturnal and diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols;
- A description of the relocation site(s); including discussion of:
    - provision for additional refugia, if required e.g., depositing salvaged logs, wood or debris for newly released native skinks that have been rescued;
    - any protection mechanisms (if required) to ensure the relocation site is maintained (e.g.) covenants, consent notices etc;
    - any weed and pest management to ensure the relocation site is maintained as appropriate habitat.
- Monitoring methods, including but not limited to: baseline surveying within the site; baseline surveys outside the site to identify potential release sites for salvaged lizard populations and lizard monitoring sites; ongoing annual surveys to evaluate translocation success; pre and post – translocation surveys; and monitoring of effectiveness of pest control and/or any potential adverse effects on lizards associated with pest control;
- A post-vegetation clearance search for remaining lizards;
- A suitably qualified and experienced ecologist/herpetologist approved to oversee the implementation of the Lizard Management Plan (LMP) shall certify that the lizard related works have been carried out according to the certified LMP within two weeks of completion of the vegetation clearance works;
- Lizard management should be consistent with any regional consent conditions (and the Wildlife Act 1953) that may be required for regional compliance.

The residual impact is assessed as **Low** post mitigation.

7.4.3 Operational Effects

Potential operational effects on herpetofauna in all the NoRs from the construction of new transport corridors and upgrading / widening of existing roads include:

- Loss in connectivity due to the presence of the transport corridor (including light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat and a change in population dynamics due to the presence of the infrastructure);
- Disturbance and displacement of herpetofauna leading to a change in population dynamics due to light, noise, and vibration from the transport corridor.

Suitable habitat was identified within all NoRs which could potentially support both native geckos and, or skinks. Native geckos and skinks require vegetated corridors to facilitate natural dispersal, although they are relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding. Indeed, it is not uncommon to identify lizard populations within proximity to road corridors on both side of the road, indicating that there is potential for successful migration between the two fragmented habitats.

Table 7-7 summarises the effects assessment for herpetofauna across the Project Area due to operational activities related to connectivity and disturbance. The magnitude of effects of loss in connectivity and disturbance to native herpetofauna is considered **Negligible** across **All NoRs**, both within the current and future environment considerations. As the ecological value of all herpetofauna species is **High**, the overall level of effect is assessed as **Low** prior to mitigation, and such impact management is not required. The level of effect within the likely future ecological environment is expected to remain the **same as the baseline**.

Table 7-7 Assessment of ecological effects and impact management for lizards during operation

Effect Description	Ecological Value	Magnitude of Effect		Overall Level of Effect		Impact management and residual level of effect		Relevant NoR
		Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment	
Loss in connectivity due to permanent habitat loss, light, and noise effects from the transport corridors, leading to additional fragmentation of terrestrial habitat due to the presence of the infrastructure	High: *Arboreal gecko spp. And ground skink spp.*	Negligible	Same as baseline (Negligible)	Very Low	Same as baseline (Very Low)	Not Required based on Effect	Not Required based on Effect	All NoRs
Disturbance and displacement of herpetofauna due to light, noise, and vibration from the transport corridor	High: *Arboreal gecko spp. And ground skink spp.*	Negligible	Same as baseline (Negligible)	Very Low	Same as baseline (Very Low)	Not Required based on Effect	Not Required based on Effect	All NoRs

7.5 Cumulative Effects

As stated in the EIANZ Guidelines, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. Upgrading existing roads and building new transport corridors/stations within the Project Area combined with urban development (external projects) risk a cumulative effect that does not necessarily require mitigation from the perspective of a singular project.

7.5.1 District Cumulative Effects

Mobile native fauna species are expected to use the Project Area and wider landscape. The Project Area is predominantly rural as of present, and hence native fauna are expected to be more sensitive to disturbance. Although they may habituate to disturbance by noise, light, and vibration as a consequence of transport corridors, eventually, gradual incremental changes in habitat caused by surrounding urbanisation could discourage nesting/roosting and reduce viability of native fauna over time. Long-tailed bats are more sensitive to disturbance and will require strategic mitigation in tandem with the wider urban development as the future infrastructure develops.

The potential cumulative impacts of lighting from transport corridors and urban growth on coastal birds, such as the Cook's petrel, in the Auckland region is specifically considered within this section, as the Project does not pose a direct risk to coastal birds (other than the species included in the effects assessment) in isolation. However, the cumulative effect of artificial lighting at night (ALAN) can have various effects on coastal birds, including disorientation, attraction, and disruption of natural behaviours.

Transport corridors can act as barriers to the movement of animals, including migratory species, leading to fragmentation of habitats. This can result in reduced genetic diversity, population declines, and changes to community structure. Although an individual NoR or project may have been assessed to have a “Low” effect, considering urban development, the habitat fragmentation is likely to be cumulative and should be considered holistically.

All developments should be aware of the vulnerability and resilience of the receiving environment and the cumulative effects which may arise from multiple development activities within the Project Area.

As urban areas expand and transport infrastructure develops, it is important for collaboration between transport providers, consent authorities (i.e. Auckland Council) and developers to assess the combined effects of lighting and take measures to mitigate these impacts (at a landscape scale) such as the provision of vegetated (including dark) corridors, wildlife-friendly lighting designs, wildlife crossings and vegetated buffers to protect sensitive habitats and fauna.

7.5.2 Regional Cumulative Effects

The wider area of the Project Area is rural as of present and is designated to be Future Urban Zone in the future. Regardless of whether the transport corridors are developed, or urbanisation occurs first, construction often involves clearing of vegetation which can lead to the loss of habitat for native plant and animal species. The habitat degradation from ongoing cumulative removal of low value vegetation (which does not necessarily require impact management under EIANZ Guidelines) should be considered at a landscape scale by the consent authorities in the wider regional context to prevent a decline in biodiversity and changes to ecosystem function.

Transport corridors can increase the amount of impervious surface in an area, leading to increased runoff and decreased infiltration of rainwater. This can result in increased erosion and sedimentation in nearby streams and wetlands, and the transport of pollutants from roads into aquatic ecosystems. They can also alter the natural flow of water in an area by changing the amount and timing of runoff, and by blocking or diverting water. This can lead to changes in the structure and function of streams and wetlands, as well as changes to the groundwater recharge rate. To mitigate adverse effects on hydrology, minimise flooding risks and protect water quality, use of green infrastructure (at a landscape scale) including riparian planting and stormwater management in the context of external development is important.

Additionally, ongoing monitoring and adaptive management can help identify and address any unexpected impacts that may arise.

8 Design and Future Regional Resource Consent Considerations

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM are briefly discussed in the following sections to inform design and alignment options for each NoR. Wildlife Act Authority permits are also discussed in relation to the potential for killing or injuring of native fauna associated with the North Projects activities.

Ecological features relevant to regional matters (and their approximate values) were considered during the Multi Criteria Assessment (MCA) to inform the Alternatives Assessment and proposed designation boundaries for all the proposed alignment options. This was achieved through a desktop assessment and a proxy-based assessment of ecological value (catchment condition, vegetation type, relationship with other ecological features).

Note that during the future detailed design process (as an additional consideration under the future regional consent process) there is scope within the designation to address (including to avoid) some potential effects/concerns/regional matters through design considerations at the detailed design phase.

8.1 Terrestrial Ecology

Construction of the North Projects will result in temporary and permanent loss of vegetation within the Project Area and is comprised of both native and exotic vegetation which ranges from **Low** to **Very High** ecological value (Appendix 8). Terrestrial features of **High** and **Very High** value relate to SEAs and are detailed in Section 8.1.1

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 consents (for example, removal of vegetation in the riparian setback) and wildlife permit applications (if required).

The potential extents and types of all terrestrial vegetation that could be permanently lost from the North Projects is presented in Table 8-1. This includes vegetation that will be directly impacted by the footprint of the corridors/stations and batter slopes. It also includes vegetation that is subject to district and regional plan controls, as well as vegetation that can be removed as a permitted activity. Some of these areas are likely to provide habitat to native fauna, and this is discussed in Sections 8.1.1 – 8.1.5 below.

Table 8-1. Potential area of permanent terrestrial vegetation loss for the Project Area

Terrestrial Vegetation Type	Loss (m^2)												
	NoR 1	NoR 2	NoR 3	NoR 4	NoR 5	NoR 6	NoR 7	NoR 8	NoR 9	NoR 10	NoR 11	NoR 12	NoR 13
EF	–	–	–	16603	–	–	–	–	1714	–	–	4954	–
EF.1	–	–	–	–	–	–	–	–	154	–	–	–	–
EG	–	–	–	1566	1141	–	80	–	–	–	–	–	–
ES	315	–	–	34862	–	1936	–	1647	2090	–	–	3007	8
MF4	68	–	–	1317	–	–	32	–	–	–	–	–	–
PL	1388	–	–	1176	–	–		–	–	–	–	–	–
PL.1	2323	–	–	4137		7098		–	–	–	–	–	–
PL.2	13998	–	–	51470	–	–	–	–	–	–	–	–	–
PL.3	99060	1997	2343	87759	1593	11155	8574	86067	21473	15177	16117	26013	18224
TL.1	–	–	–	195	–	–	–	–	–	70	–	–	–
TL.2	–	–	–	3537	–	–	–	–	–		–	–	–
TL.3	–	–	2771	835	–	–	–	1181	4827	–	–	–	–
VS2	30467	–	–	54604	3248	28290	3440	13853	6600	–	1790	1222	7174
VS3	24957	–	–	37518	–	7308	1017	–	1158	–	–	–	–
WF9	5276	–	–	46555	–	–	–	204	–	1303	–	–	–
WF11	–	–	–	–	–	–	–	–	3873	–	–	–	–
WF12	395	–	–	41307	–	–	–	–	20046	–	–	–	–
WF13	–	–	–	–	–	–	–	–	5524	–	–	–	–

8.1.1 SEAs

This section includes detail of the terrestrial vegetation that is classified as SEA and occurs within the proposed designation boundary of each NoR (Table 8-3). It is noted that the detailed design of the road and construction footprint will aim to avoid SEAs as far as practicable.

With regards to the NPS-IB, indicative mapping of high value habitat areas was considered when assessing route options, selecting preferred alignments, and confirming designation boundaries (noting these areas are subject to confirmation as SNAs through future assessment and plan change processes by Auckland Council). Along with existing SEAs (which are considered the Auckland equivalent of SNAs in the NPS-IB), other high value habitat areas and areas supporting highly mobile fauna were considered in the development and assessment of options for the project, as well as design refinement of the preferred options. Identified / indicative biodiversity areas have therefore been avoided where practicable, in line with the effects management hierarchy. However, high value habitat that is not currently an SNA has not been considered as part of the offset calculations provided below. As such, these calculations would need to be reviewed in future.

The Project Team looked at specific locations where SEA areas were within the proposed designations to provide realistic requirements for SEA loss. While detailed design and investigation is yet to take place, an indicative range was provided as set out in Table 8-2.

Table 8-2: Range of SEA impacts

Scenario	SEA removal assumed	Approximate area
Maximum SEA impact	Full designation area	12.8 Ha
Realistic Upper bound	Operational corridor with 60% of remaining designation area assumed to be removed	8.9 Ha
Realistic Lower bound	Operational corridor with 30% of remaining designation area assumed to be removed	4.5 Ha
Minimum SEA impact	Operational corridor only	1 Ha

Table 8-3 provides a more detailed calculation on the Minimum (i.e., Operational corridor footprint excluding batter slopes) and Maximum (all SEAs within the new designation boundary) SEA loss by project.

Table 8-3. Potential maximum and minimum area of SEA loss within each relevant NoR for the North Project Area based on their respective proposed designation boundaries. Areas of SEA located within existing designation boundaries (i.e., for NoR 4: SH1 Improvements) are not included

SEA		Loss (m^2)									
Schedule	Vegetation Type	NoR 1		NoR 4		NoR 7		NoR 9		NoR 10	
		max	min	max	min	max	min	max	min	max	min
SEA_T_2169	TL.3			210	210						
SEA_T_2191	WF13	363									
SEA_T_2192a	MF4	76	53								
SEA_T_2218	VS2	50788	4546								
SEA_T_3590	TL.3									32	
SEA_T_5446	VS2					1214	250				
SEA_T_6669	EF							1296			
SEA_T_6669	ES							4135	412		
SEA_T_6669	TL.3							2	2		
SEA_T_6669	VS2							9672	91		
SEA_T_8296	WF9							5886	3		
SEA_T_8296	WF12							3879	661		
SEA_T_8297	PL.2	9370	1489								
SEA_T_8297	VS2	5347	1269								
SEA_T_8297	WF11	838									
SEA_T_8300	EF							3073			
SEA_T_8300	WF11							10842	215		
SEA_T_8301	WF11							16210	696		
SEA_T_8332	WF9							3480	7		
SEA_T_8332	WF11							1332	5		
Total loss (m^2)		66781	7356	210	210	1214	250	59807	2092	32	0

To provide some assurance that sufficient space is available for future offset at the time of detailed design and regional consenting, an assessment has been carried out on the Realistic Lower Bound SEA loss scenario. The SEA loss was estimated at approximately 4.53 ha (Table 8-4). Appendix 15 details the result of the Biodiversity Compensation Model (BCM) undertaken for each NoR potentially affected by SEA loss. The results indicate a conservative offset extent of 34.1 ha.

For each potentially affected NoR, degraded habitat adjacent to existing SEAs and within the designation boundary provide restoration potential.

NoRs not affected by potential SEA loss provide further offset potential where degraded habitats within the designation boundaries are in proximity to an existing SEA or near higher value features (for example stream and wetlands).

The sum of areas available within the designation boundaries with SEA offset potential is approximately 26 ha. In addition, other Council owned areas in the vicinity (such as Hoskings Reserve, Hooton Park, and the area next to Green Road and Dairy Flat) provide in the order of 132 ha of potential offset area. It follows that there is a relatively high assurance that the offset requirements can be met when required in the future.

Table 8-4. SEA loss per value type at for lower bound and total offset requirement as calculated through the BCM

	Estimated loss (ha)				
Type per value	NoR 1	NoR 4	NoR 7	NoR 9	NoR 10
2 (Low value)	0.0	0.00	0.0	0.153	0.000
3 (Moderate value)	0.4	0.01	0.0	0.131	0.001
4 (High value)	2.1	0.00	0.1	0.297	0.000
5 (Very High value)	0.04	0.00	0.0	1.360	0.000
Total loss per NoR (ha)	2.5	0.01	0.1	1.9	0.001
Total loss (ha)	**4.53**				
Offset extent required (BCM) ha	12.2	0.1	0.4	21.5	0.0028
Total required lower bound (ha)	**34.1**				

8.1.2 Long-tailed Bats

Mature trees in suitable habitat areas may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. Suitable habitat within each NoR is identified in Table 5-4. The presence of bats and roosts will be re-assessed prior to obtaining any Regional resource consents for vegetation removal (relevant under regional matters) and ensure compliance with the Wildlife Act 1953.

The presence of bat habitat and bat roosts will require a BMP under regional consents. The objectives of bat management will be to:

- Identify bat habitat that may be affected by the Project;
- Avoid bat habitat through alignment and design;
- Avoid effects of lighting and noise on bats within bat habitat;
- Avoid injury and/or death of roosting bats during vegetation removal through the implementation of a bat roost removal protocol as per those set by the DOC Bat Recovery Group, 2021;
- Avoid disturbance through construction management (seasonal restriction on vegetation removal December to April);
- Outline additional mitigation where avoidance is not feasible including any offset/compensation that may be required.

8.1.3 Avifauna

Native birds as identified in Section 5.2.2.3 have the potential to be present within the Project Area. The habitats within each NoR that native avifauna may utilise are detailed in Table 5-5. Vegetation clearance required for construction could result in the loss of these habitats and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953.

8.1.4 Herpetofauna

Native herpetofauna as identified in Section 5.2.2.4 have the potential to be present within vegetation impacted by the North Projects. Therefore, there is potential that site clearance required for construction could kill or injure native herpetofauna species and result in the removal of their habitat. Any vegetation clearance where native herpetofauna are likely to occur will also need to be managed in accordance with the Wildlife Act 1953.

8.1.5 Invertebrates

Kauri snails are potentially present in the proposed designation boundaries of NoR 4: SH1 improvements and NoR 9: Upgrade to Dairy Flat Highway (between Dairy Flat and Albany). Impact management will be required under the Wildlife Act to prevent killing or injuring these species. As part of this management pre-clearance inspections should be undertaken prior to vegetation removal.

8.2 Freshwater Ecology

The construction of the North Projects will directly impact 70 stream reaches, ranging from **Low** to **High** ecological value. Approximately 7,655 m of stream reclamation may be required to accommodate the Project works; however, this could change during the detailed design and resource consenting phase which would look to assess and avoid, remedy and mitigate freshwater effects. The

predicted permanent and intermittent stream loss for the North Projects is presented in Table 8-5, based on where the indicative designs require the stream sections to be culverted, piped, or realigned.

These calculations will require re-evaluation as part of the future regional consent process. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features.

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 future regional consents 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.

Table 8-5. Potential stream loss (permanent and intermittent) within the Project Area

Stream ID*	Hydroperiod	Ecological Value	Loss (m)	Relevant NoR
N1-S1	Permanent	High	1	NoR 1
N1-S2a*	Permanent	Moderate	31	NoR 1
N1-S2b*	Intermittent	Low	52	NoR 1
N1-S3*	Permanent	Moderate	123	NoR 1
N1-S4*	Permanent	Moderate	292	NoR 1
N1-S5*	Permanent	Moderate	51	NoR 1
N1-S6*	Intermittent	Low	109	NoR 1
N1-S7*	Permanent	Moderate	300 (NoR 1), 310 (NoR 4)	NoR 1, 4
N1-S8*	Intermittent	Low	235 (NoR 1), 79 (NoR 4)	NoR 1, 4
N1-S9	Permanent	Moderate	28 (NoR 1), 40 (NoR 4)	NoR 1, 4
N1-S10a*	Permanent	Moderate	285 (NoR 1), 335 (NoR 4)	NoR 1, 4
N1-S10b*	Permanent	Moderate	52 (NoR 1), 52 (NoR 4)	NoR 1, 4
N4-S3a*	Permanent	Moderate	47	NoR 4
N4-S4*	Permanent	Moderate	77	NoR 4
N4-S5*	Permanent	Moderate	77	NoR 4
N4-S6b*	Permanent	Low	15	NoR 4
N4-S7*	Permanent	Low	95	NoR 4
N4-S8*	Intermittent	Low	15	NoR 4
N4-S10*	Permanent	Low	26	NoR 4
N4-S11*	Permanent	Moderate	160	NoR 4
N4-S12*	Permanent	Moderate	11	NoR 4
N4-S13*	Permanent	Moderate	48	NoR 4

Stream ID*	Hydroperiod	Ecological Value	Loss (m)	Relevant NoR
N4-S14*	Permanent	Low	106	NoR 4
N4-S15a*	Permanent	Low	94	NoR 4
N4-S15b*	Permanent	Moderate	386 (NoR 4), 102 (NoR 5)	NoR 4, 5
N4-S16a*	Permanent	Moderate	114	NoR 4
N4-S17a*	Permanent	Moderate	405	NoR 4
N4-S17b*	Permanent	Moderate	634	NoR 4
N4-S18*	Permanent	Moderate	106	NoR 4
N4-S19*	Permanent	Moderate	91	NoR 4
N4-S20	Permanent	Low	106	NoR 4
N4-S21*	Intermittent	Low	35 (NoR 1), 71 (NoR 4)	NoR 1, 4
N4-S22*	Permanent	High	317	NoR 4
N4-S23*	Permanent	Moderate	117	NoR 4
N4-S24*	Permanent	High	27 (NoR 1), 42 (NoR 4)	NoR 1, 4
N4-S25	Permanent	Moderate	16 (NoR 1), 58 (NoR 11)	NoR 1, 11
N4-S26*	Permanent	Moderate	100	NoR 11
N5-S1a^	Intermittent	Low	14	NoR 13
N5-S1b^	Permanent	Moderate	114	NoR 13
N6-S1*	Permanent	Moderate	172	NoR 6
N6-S2*	Intermittent	Low	94	NoR 6
N6-S3*	Intermittent	Low	137	NoR 6
N6-S4a*	Permanent	Moderate	37	NoR 6
N6-S4b*	Permanent	High	12	NoR 6
N6-S4c*	Intermittent	Low	95	NoR 6
N6-S4d*	Intermittent	Moderate	47	NoR 6
N6-S4e*	Intermittent	Low	60	NoR 6
N6-S5*	Permanent	Moderate	45	NoR 6
N6-S6*	Permanent	Moderate	23	NoR 6
N7-S1a^	Permanent	Moderate	39	NoR 7
N7-S1b*	Permanent	Moderate	51	NoR 7
N7-S2a*	Permanent	Moderate	18	NoR 7

Stream ID*	Hydroperiod	Ecological Value	Loss (m)	Relevant NoR
N7-S2b*	Permanent	Low	21	NoR 7
N8-S1*	Intermittent	Low	36	NoR 8
N8-S2*	Permanent	Moderate	11	NoR 8
N8-S3*	Permanent	Moderate	8	NoR 8
N8-S4*	Permanent	Moderate	17	NoR 8
N8-S5a^	Permanent	Moderate	63	NoR 8
N8-S5b*	Permanent	Low	78	NoR 8
N8-S6*	Permanent	Low	287	NoR 8
N8-S7a*	Permanent	Moderate	12 (NoR 8), 25 (NoR 12)	NoR 8, 12
N8-S8a*	Permanent	Moderate	103	NoR 8
N8-S8b*	Permanent	Low	48	NoR 8
N9-S2*	Permanent	Moderate	9	NoR 9
N10-S1*	Permanent	Moderate	54	NoR 10
N12-S1a^	Permanent	Low	37	NoR 12
N12-S1b*	Permanent	Low	38	NoR 12
N12-S2*	Permanent	Low	42	NoR 12
N12-S4a	Permanent	Moderate	4	NoR 12
N12-S4b	Permanent	Moderate	2	NoR 12

Notes: ^ = Ecological feature assessed from roadside or adjacent property boundary due to access restrictions. * = Ecological feature assessed at a desktop level due to access restrictions

8.3 Wetland Ecology

Wetland extent and approximate values were considered during the Multi Criteria Assessment (MCA) to inform the Alternatives Assessment and proposed designation boundaries for all the proposed alignment options. This was achieved through a desktop wetland delineation for all the NoR options along with a proxy-based assessment of ecological value (catchment condition, vegetation cover, relationship with other ecological features).

The construction of the Projects will impact 94 wetlands, of which 35 are natural inland wetlands, ranging from **Low** to **High** ecological value based on the indicative designs. Approximately 61,831 m^2 of direct wetland loss is estimated based on the footprint of the corridors/stations and batter slopes (see Table 8-6).

Table 8-6. Potential wetland loss within the Project Area

Wetland ID*	Vegetation Type	Ecological Value	Loss (m^2)	Relevant NoR
N1-O1*	OW	Low	292	NoR 1
N1-O2*	OW	Low	175	NoR 1
N1-O3*	OW	Low	132	NoR 1
N1-O4*	OW	Low	291	NoR 1
N1-O5*	OW	Low	493	NoR 1
N1-O8*	OW	Low	103	NoR 1
N1-O9*	OW	Low	309	NoR 1
N1-O10*	OW	Low	526 (NoR 1), 173 (NoR 12)	NoR 1, NoR 12
N1-O11*	OW	Low	407	NoR 1
N1-O12*	OW	Low	1963	NoR 1
N1-O13*	OW	Low	287	NoR 1
N1-O14*	OW	Low	1066	NoR 1
N1-O15*	OW	Low	2009	NoR 1
N1-O16*	OW	Low	130	NoR 1
N1-O18*	OW	Low	4	NoR 1
N1-O19*	OW	Low	1	NoR 1
N1-O20*	OW	Moderate	390 (NoR 1), 440 (NoR 4)	NoR 1
N1-W1*	EW	Low	766	NoR 1
N1-W2*	EW	Low	56	NoR 1
N1-W3*	EW	Low	190	NoR 1
N1-W4	EW	Low	1391	NoR 1
N1-W5^	EW	Low	1323	NoR 1
N1-W6^	EW	Low	3150	NoR 1
N1-W8*	EW	Low	829	NoR 1
N1-W9	EW	Low	2479	NoR 1
N1-W10*	EW	Low	104	NoR 1
N1-W11*	EW	Low	890	NoR 1
N1-W12^	EW	Low	6293	NoR 1
N3-O1*	OW	Low	158	NoR 1
N4-O2*	OW	Moderate	26	NoR 4

Wetland ID*	Vegetation Type	Ecological Value	Loss (m^2)	Relevant NoR
N4-O4*	OW	Moderate	10	NoR 4
N4-O8*	OW	Moderate	671	NoR 4
N4-O9*	OW	Moderate	1082	NoR 4
N4-O12*	OW	Moderate	1068	NoR 4
N4-O13*	OW	Moderate	546	NoR 4
N4-O15*	OW	Low	1822	NoR 4
N4-O16*	OW	Moderate	888	NoR 4
N4-O18*	OW	Low	751	NoR 4
N4-O19*	OW	Moderate	609	NoR 4
N4-O20*	OW	Low	11	NoR 4
N4-O21*	OW	Moderate	1410	NoR 4
N4-O22*	OW	Moderate	367	NoR 4
N4-O23^	OW	Moderate	1295	NoR 4
N4-O24*	OW	Moderate	1	NoR 4
N4-O25*	OW	Moderate	449	NoR 4
N4-O26*	OW	Low	31	NoR 4
N4-O28*	OW	Moderate	521	NoR 1
N4-O31*	OW	Moderate	214	NoR 4
N4-O32*	OW	Moderate	147	NoR 4
N4-O33*	OW	Moderate	327	NoR 4
N4-O34*	OW	Moderate	100	NoR 4
N4-O35*	OW	Moderate	644	NoR 4
N4-O36^	OW	Moderate	213	NoR 4
N4-O37*	OW	Moderate	89	NoR 4
N4-O38*	OW	Moderate	137	NoR 4
N4-O39*	OW	Moderate	701 (NoR 1) 701 (NoR 4)	
N4-W1b	SA1.2	High	195	NoR 4
N4-W3*	EW	Low	33	NoR 4
N4-W4*	EW	Low	444	NoR 4
N4-W5*	EW	Low	23	NoR 4

Wetland ID*	Vegetation Type	Ecological Value	Loss (m^2)	Relevant NoR
N4-W6*	EW	Low	233	NoR 4
N4-W7^	EW	Low	354	NoR 4
N4-W8*	EW	Low	395	NoR 4
N4-W9	EW	Low	3576	NoR 4
N4-W10	EW	Low	982	NoR 4
N4-W11	EW, WL14	Moderate	95	NoR 4
N6-O1*	OW	Low	1103	NoR 6
N6-O3^	OW	Low	35	NoR 6
N6-W1*	EW	Low	1389	NoR 6
N6-W2*	EW	Low	772	NoR 6
N6-W3	WL11, WL19, Native rushland	High	1782	NoR 6
N6-W4*	EW	Low	931	NoR 6
N6-W5*	PLW	Low	3477	NoR 6
N7-W1*	EW	Low	39	NoR 7
N7-W2*	EW	Low	6	NoR 7
N8-O1*	OW	Low	268	NoR 8
N8-O2*	OW	Low	38	NoR 8
N8-O3*	OW	Low	2	NoR 8
N8-O7*	OW	Low	146	NoR 8
N8-O8*	OW	Low	79	NoR 8
N8-W1	EW	Low	1762	NoR 8
N8-W4^	EW	Low	1475	NoR 8
N8-W7^	EW	Low	18	NoR 8
N8-W8	EW	Moderate	26	NoR 8
N9-O2*	OW	Low	75	NoR 9
N11-O2*	OW	Low	303	NoR 11
N11-W1	EW	Low	561	NoR 11
N12-O6*	OW	Low	219	NoR 12
N12-O8*	OW	Low	12	NoR 12
N12-W1*	EW	Low	55	NoR 12

Wetland ID*	Vegetation Type	Ecological Value	Loss (m^2)	Relevant NoR
N12-W2	EW	Low	258	NoR 12
N13-O2*	OW	Low	71	NoR 13
N13-O4*	OW	Low	43	NoR 13

Notes: ^ = Ecological feature assessed from roadside or adjacent property boundary due to access restrictions. * = Ecological feature assessed at a desktop level due to access restrictions

9 Conclusion

9.1 Construction Effects

The district matter ecological effects relevant to construction prior to any mitigation identified are disturbance and displacement to long-tailed bat (*Chalinolobus tuberculatus*) roosts and threatened bird nests (existing) due to construction activities (noise, light, dust, vibration etc.), and the effect of habitat removal on long-tailed bats and lizards, specifically relating to mortality/injury and roost loss/disturbance. Where the level of effect during was assessed to be **Moderate** or higher, then mitigation has been developed.

Recommended construction effect mitigation measures include:

- A Bat Management Plan (BMP) for each NoR (except for 11) should be developed to include:
    - Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed.
    - Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar).
    - Siting of compounds and laydown areas to avoid mature forest types.
    - Lighting design to reduce light levels and spill from construction areas.
    - Restriction of nightworks around mature forest types.
    - Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance.
    - Consideration to the provisions of the Wildlife Act including the implementation of a vegetation removal protocol (Bat Roost Protocol v2 DOC, 2021 or equivalent version at time of removal) (**NoR 1, 4, and 9 only**)
- An Avifauna Management Plan (AMP) for each NoR (except for NoR2 and 5) should include:
    - Preconstruction surveys to confirm presence and guide further management.
    - Where practical, construction works near wetland habitat (Appendix 4) should commence prior to the bird breeding season (September to February) in order to discourage bird nesting.
    - Bird management should be consistent with any regional consent conditions that may be required for regional compliance.
    - Consideration to the provisions of the Wildlife Act including timing vegetation removal to avoid the key nesting period (September to February) or where this is not possible, pre-clearance inspections undertaken prior to vegetation removal (**NoR 1, 4, and 9 only**).
- A Lizard Management Plan (LMP) for NoR 1, 4, and 9, should consider the following:
    - Preconstruction surveys and/or habitat potential surveys to confirm (potential) presence and guide further management.
    - Timing of the implementation of the LMP.
    - A description of methodology for survey, trapping and relocation of lizards rescued including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), nocturnal and diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols.

- A description of the relocation site(s); including discussion of:
    - provision for additional refugia, if required e.g., depositing salvaged logs, wood or debris for newly released native skinks that have been rescued.
    - any protection mechanisms (if required) to ensure the relocation site is maintained (e.g.) covenants, consent notices etc.
    - any weed and pest management to ensure the relocation site is maintained as appropriate habitat.
    - Monitoring methods, including but not limited to: baseline surveying within the site; baseline surveys outside the site to identify potential release sites for salvaged lizard populations and lizard monitoring sites; ongoing annual surveys to evaluate translocation success; pre and post – translocation surveys; and monitoring of effectiveness of pest control and/or any potential adverse effects on lizards associated with pest control.
    - A post-vegetation clearance search for remaining lizards.
    - A suitably qualified and experienced ecologist/herpetologist approved to oversee the implementation of the Lizard Management Plan (LMP) shall certify that the lizard related works have been carried out according to the certified LMP within two weeks of completion of the vegetation clearance works.
    - Lizard management should be consistent with any regional consent conditions (and the Wildlife Act 1953) that may be required for regional compliance.

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

9.2 Operational Effects

District matter ecological effects relevant to operation prior to any mitigation identified are disturbance and displacement to long-tailed bat roosts and threatened bird nests, and loss in connectivity due to the presence of the road (including light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat). Where the level of effect during was assessed to be **Moderate** or higher, then mitigation has been developed.

Recommended operational effect mitigation measures include:

- A Bat Management Plan (BMP) for NoR 1, 4, 6, 7, 8, 9, 10 and 13 should be developed to include consideration for:
    - Buffer planting, hop-over/under planting, retention of existing mature trees between the transport corridor alignment and features with potential for bat roosts as outlined in the indicative bat mitigation in Appendix 14.
    - Light and noise management through design.
    - Future presence of roosts within the alignment (placement of flaps on features with high roost potential).
    - Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action.
- An Avifauna Management Plan (AMP) for NoR 1, 6 and 10 should be developed to include:

- Retention of vegetation near wetland habitat, where practicable.
- Buffer planting between the transport corridor alignment and suitable habitat adjacent to the corridor (Appendix 14).

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

The magnitude of effects of loss in connectivity and disturbance to native herpetofauna is considered **Negligible** across **All NoRs**, both within the current and future environment considerations.

10 References

Adams, R. (2013). *White heron*. In Miskelly, C.M. (ed.) New Zealand Birds Online. https://nzbirdsonline.org.nz/species/white-heron

Armitage, I. (2013). *Little black shag*. n Miskelly, C.M. (ed.) New Zealand Birds Online. https://nzbirdsonline.org.nz/species/little-black-shag

Bellingham, M. (2013). *Banded Rail*. In C. M. Miskelly (Ed.), New Zealand Birds Online. https://nzbirdsonline.org.nz/species/banded-rail

Department of Conservation. (2022a). *Bats and Conservancies Database*.

Department of Conservation. (2022b). *Bioweb Herpetofauna Database*. Department of Conservation.

Department of Conservation. (2023). *Kauri snail/pupurangi: Invertebrates*. https://www.doc.govt.nz/nature/native-animals/invertebrates/kauri-snail/

Department of Conservation Bat Recovery Group. (2021). Protocols for minimising the risk of felling bat roost (Bat Roost Protocols): Version 2.

Dunn, N. R., Allibone, R. M., Closs, G. P., Crow, S. K., David, B. O., Goodman, J. M., Griffiths, M., Jack, D. C., Ling, N., Waters, J. M., & Rolfe, J. R. (2018). Conservation status of New Zealand freshwater fishes. In *New Zealand Threat Classification Series 24*. Department of Conservation. https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs24entire.pdf

eBird. (2022). *eBird Basic Dataset. Version: EBD_relNov-2022*. https://doi.org/https://doi.org/10.15468/dl.t44f88

GBIF.Org User. (2022). *iNaturalist Research-grade Observations NZ - Occurrence Download*. The Global Biodiversity Information Facility. https://doi.org/10.15468/DL.G6D5PU

Gill, B. J. (2013). *Long-tailed Cuckoo*. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

Grainger, N., Harding, J., Drinan, T., Collier, K., Smith, B., Death, R., Makan., T., & Rolfe, J. (2018). Conservation status of New Zealand freshwater invertebrates. In *New Zealand Threat Classification Series 28*. Department of Conservation. https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs28entire.pdf

Hitchmough, R. A., Barr, B., Knox, C., Lettink, M., Monks, J. M., Patterson, G. B., Reardon, J. T., Winkel, D. van, Rolfe, J., & Michel, P. (2021). Conservation status of New Zealand reptiles. In *New Zealand Threat Classification Series 35*. Department of Conservation. https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs35entire.pdf

Johnson, P. N., & Gerbeaux, P. (2004). Wetland Types in New Zealand. *Department of Conservation*. https://www.doc.govt.nz/documents/science-and-technical/WetlandsBW.pdf

Mahlfeld, K., Brook, F. J., Roscoe, D. J., Hitchmough, R. A., & Stringer, I. A. N. (2012). The conservation status of New Zealand terrestrial Gastropoda excluding Powelliphanta. *New Zealand Entomologist*, *35*(2), 103–109. https://doi.org/10.1080/00779962.2012.686313/SUPPL_FILE/TNZE_A_686313_SUP_27142537.ZIP

McEwen, M. (1987). Ecological Regions and Districts of New Zealand. In *New Zealand Biological Resources Centre*. https://www.doc.govt.nz/documents/science-and-technical/ecoregions1.pdf

Melzer, S., Hitchmough, R., van Winkel, D., Wedding, C., Chapman, S., & Rixon, M. (2022). Conservation status of reptile species in Tāmaki Makaurau. In *Auckland Council Technical Report, TR2022/3*. Auckland Council. https://knowledgeauckland.org.nz/publications/conservation-status-of-reptile-species-in-tāmaki-

makaurau-auckland/

Ministry for the Environment. (2020). *Wetland Delineation Protocols* (ME 1515). Ministry for the Environment. www.mfe.govt.nz.

NZ Herpetological Society. (2021). *Herpetofauna Index*. The New Zealand Herpetological Society. https://www.reptiles.org.nz/herpetofauna-index

O'Donnell, C. F. J., Christie, J. E., Lloyd, B., Parsons, S., & Hitchmough, R. A. (2013). Conservation status of New Zealand Bats. *New Zealand Threat Classification Series 6, Department of Conservation*. www.doc.govt.nz

Powlesland, R. G. (2022). *Black shag | Māpunga*. Miskelly, C.M. https://nzbirdsonline.org.nz/species/black-shag

Robertson, H. A., Baird, K. A., Elliott, G. P., Hitchmough, R. A., McArthur, N. J., Makan, T., Miskelly, C. M., O'Donnell, C. J., Sagar, P. M., Scofield, R. P., Taylor, G. A., & Michel, P. (2021). Conservation status of New Zealand birds. In *New Zealand Threat Classification Series 36*. Department of Conservation.

Roper-Lindsay, J., Fuller, S. A., Hooson, S., Sanders, M. D., & Ussher, G. T. (2018). *Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition*. Environmental Institute of Australia and New Zealand.

Singers, N. J. D., Osborne, B., Lovegrove, T., Jamieson, A., Boow, J., Sawyer, J., Hill, K., Andrews, J., Hill, S., & Webb, C. (2017). *Indigenous terrestrial and wetland ecosystems of Auckland*. Auckland Council. https://knowledgeauckland.org.nz/media/1399/indigenous-terrestrial-and-wetland-ecosystems-of-auckland-web-print-mar-2017.pdf

Singers, N. J. D., & Rogers, G. M. (2014). *A classification of New Zealand's terrestrial ecosystems*. www.doc.govt.nz

Stoffels, R. (2022). *New Zealand Freshwater Fish Database (extended)*. The National Institute of Water and Atmospheric Research (NIWA).

Szabo, M. J. (2013). *Dabchick*. In Miskelly, C.M. (ed.) New Zealand Birds Online. https://nzbirdsonline.org.nz/species/new-zealand-dabchick

Williams, E. (2013). *Australasian bittern*. In C. M. Miskelly (Ed.), New Zealand Birds Online. http://www.nzbirdsonline.org.nz/species/australasian-bittern

Williams, M. J. (2013). *Brown Teal*. In Miskelly, C.M. (ed.) New Zealand Birds Online. https://nzbirdsonline.org.nz/species/brown-teal

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 Guidelines) (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 10-1 for terrestrial ecological value and Table 10-2 aquatic ecological value

Table 10-1 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 10-2 Matters and considerations for the assessment of aquatic ecological value

Representativeness (including SEV, RHA and ecological integrity)
Extent to which site/catchment is typical of characteristic
Instream habitat modification

Representativeness (including SEV, RHA and ecological integrity)
Riparian habitat modification
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 in line with the EIANZ Guidelines and are provided in Table 10-3.

Table 10-3 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 10-4.

Table 10-4 Magnitude of effect descriptions

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 changes 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. 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 10-5.

Table 10-5 Ecological value descriptions

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 10-6.

Table 10-6 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 10-6, 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 indicative 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 structured 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

The following tables specify the activity status of land use and activities relevant to the North Projects as set out in the AUP:OP and any permitted standards or matters of control/discretion.

The following abbreviations are used to identify the class of activity:

Activity Class Abbreviation	Meaning
P	Permitted Activity
C	Controlled Activity
RD	Restricted Discretionary Activity
D	Discretionary Activity
NC	Non-complying Activity
Pr	Prohibited Activity

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	D	N/A
(A90) Tree trimming, alteration or removal on roads adjoining rural zones and on roads adjoining the Future Urban Zone	P	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	P	P	RD	N/A
(A92) Tree alteration or removal of any tree greater than 4m in height	RD	RD	N/A	N/A

Activity	Activity Status			Permitted Standards or Matters of Discretion / Control
	Trees in roads [dp]	Open space zones [dp]	Notable trees [dp]	
and/or greater than 400mm in girth				
(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
(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 2500 m^2 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)

Activity	Activity Status	Permitted Standards
(A96) Earthworks up to 2500 m^3 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A97) Earthworks greater than 2500 m^2 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	
(A97A) Earthworks greater than 2500 m^3 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	

3 Appendix 3 – Regional Plan, District Plan and Wildlife Act Matters

Table 10-7 Ecological effects of road infrastructure construction broken down into AUP:OP 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 rural zone • riparian margins • coastal areas • 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: • Roads • Public spaces • ONFs • ONLs • HNCs • 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.		✓	✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	
	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.		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	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 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	Effect on downstream habitat (including		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	presence of the road/stormwater, including reclamations.	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.		✓	
Fish (native)	Presence of culvert.	Loss of connectivity due to culvert preventing fish passage up and downstream.		✓	