Eastern Busway

EB2 and EB3 Residential

Terrestrial and Freshwater Ecological Effects Assessment

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Eastern Busway

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List of Abbreviations and Definitions

Abbreviation and Definitions	Description
AEE	Assessment of Effects on the Environment
AC	Auckland Council
AT	Auckland Transport
AUP(OP)	Auckland Unitary Plan (Operative in part) 2016
BPO	Best practicable option
CMA	Coastal Marine Area
EB1	Eastern Busway 1 (Panmure to Pakuranga)
EB2	Eastern Busway 2 (Pakuranga Town Centre)
EB3 Commercial/ EB3C	Eastern Busway 3 (Ti Rakau Bridge to Botany)
EB3 Residential/ EB3R	Eastern Busway 3 (SEART to Pakuranga Creek)
EB4	Eastern Busway 4 (Link Road and Botany Town Centre Station)
EBA	Eastern Busway Alliance
EcIA	Ecological Impact Assessment
EIANZ	Environmental Institute of Australia and New Zealand Inc.
km	Kilometre(s)
m	Metre(s)
m^2	Square Metre(s)
m^3	Cubic Metre(s)
NES-FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NPS-FM	National Policy Statement for Freshwater Management 2020
NZCPS	New Zealand Coastal Policy Statement 2010
NoR	Notice of Requirement
RTN	Rapid Transit Network
RRF	Reeves Road Flyover
RMA	Resource Management Act 1991
ZOI	Zone of Influence

Executive Summary

The Auckland Manukau Eastern Transport Initiative (the Programme) is an integrated, multi-modal transport system to support population and economic growth in south-east Auckland. The purpose of this Ecological Impact Assessment is to assess the terrestrial and freshwater ecological effects of the proposed construction and operation of Eastern Busway 2 (EB2) and Eastern Busway 3 Residential (EB3R) of the Eastern Busway (the Project) associated with the Programme.

The assessment of Project effects on ecological features has been undertaken in accordance with the Environmental Institute of Australia and New Zealand (EIANZ) Guidelines (2018) and best practice methodology. It utilises the Ecological Impact Assessment (EcIA) approach to assign ecology value (**Negligible, Low, Moderate, High** and **Very high**) to classify ecological features (i.e., freshwater, wetland and terrestrial habitats and their fauna) to develop an ecological impact assessment for the Project. The criteria provide protocols to identify areas that require mitigation to minimise Project effects. This assessment explicitly deals with the effects to terrestrial, freshwater and wetland habitat, with the effects to marine ecosystems (including wetland mangrove habitat and streams within the CMA) provided in the Marine Ecology and Coastal Avifauna Effects Assessment.

Four potential streams were identified within the Zone of Influence (ZOI) of EB2 and EB3R. Project effects on the stream (Stream 1) present within the ZOI of EB2 related to the CMA/marine environment and as such have been considered in the Marine Ecology and Coastal Avifauna Effects Assessment. For EB3R, replacement stormwater outlets will be located at Streams 2, 3a and 3b which are all permanent streams. The stormwater upgrades are considered to meet the permitted activity status requirements outlined within Chapter E3 of the AUP(OP).

The EB2 and EB3R project areas are located in an urban landscape and the surrounding present-day ecological habitats are heavily modified. The Project is not situated within any terrestrial Significant Ecological Areas (SEAs). Terrestrial habitat consists mainly of a mixture of native and exotic planted vegetation of **Low** to **Moderate** ecological value. Based on desktop records and habitat types the presence of "At Risk - Declining" Copper skinks has been assumed in some habitats (including rank grass edges) across the EB2 and EB3R Project area. As such the ecological value of lizards for EB2 and EB3R is **High**.

The majority of land birds recorded in the vicinity of the EB2 and EB3R Project area consist of exotic and 'Not Threatened' native species of **Low** ecological value. Bats are not considered to be active (based on desktop records and an Automated Bat Monitor survey undertaken in April 2022) within the ZOI of EB2 and EB3R Project areas. As such, they were not considered further in the effects assessment.

Wetland habitat includes two NPS-FM natural wetlands (W1 and W2) considered to be of **Low** and **Moderate** value within 100m of EB2. No wetland habitat was identified within the EB3R section of works.

The effects assessment considered direct, indirect and cumulative effects associated with the construction and operation of EB2 and EB3R. The Project by design, has avoided unnecessary habitat loss.

There is a risk that during vegetation clearance that mortality or injury to native species may occur and is an effect that requires mitigation. Lizard salvage should occur (by a permitted herpetologist) prior to vegetation clearance and can only be undertaken when lizards are active (October to April). These and other controls should be detailed in a Lizard Management Plan. Further, if vegetation clearance is to occur within the bird nesting season (September-February), pre-construction nesting bird surveys are recommended.

Habitat loss associated with EB2 and EB3R considered the loss of native, mixed native, exotic vegetation, planted vegetation and rank grasses and accounted for the value these habitats provide for At Risk – declining Lizard species (Copper skink).

- There is an anticipated loss of approximately **0.34 ha** of potential lizard habitat (native and exotic) under the EB2 footprint;
- There is an anticipated loss of approximately **0.09 ha** of potential lizard habitat (native and exotic) under the EB3R footprint.

Overall, the loss of terrestrial habitat for lizards results in a **High** level of effect for EB2 and EB3R but cannot be mitigated at the point of impact, as such it remains a residual effect and requires offset or compensation. The Biodiversity Compensation Model (BCM; Baber et al., 2021) was considered appropriate and was used to estimate the compensation required for the lizard habitat loss at EB2 and EB3R. All habitat extents that could accommodate lizards were included in the BCM.

- The total mitigation planting required to manage the adverse effects of lizard habitat loss for EB2 is **1.15 ha.**
- The total mitigation planting required to manage the adverse effects of lizard habitat loss for EB3R is **0.30 ha.**

Site specific details of lizard habitat restoration planting and the identified sites for this to occur will be detailed within a Habitat Restoration Plan which will form a condition of consent.

All other effects are considered below the threshold of requiring mitigation as detailed in the EIANZ Guidelines criteria. The proposed upgrades to the current stormwater system and use of green infrastructure (refer Stormwater Effects Assessment) are expected to improve discharges to the wider freshwater and marine environment. Stormwater discharges (flow/volume) from the existing stormwater outlet into Wetland 1 within EB2 will remain unchanged. For EB2, the effects from the construction and operation of the two new stormwater outlets (outfall 8/1 – outlet 06-05 and 89-18) on Wetland 1 and 2 is considered to be **Very low,** based on the embedded controls and proximity of the wetlands.

Provided that mitigation, enhancement and best-practice construction measures are followed, the level of effects to ecological features associated with EB2 and EB3R are considered to be **Low - Very low**. Details of lizard habitat replacement and enhancement and species management recommendations will be incorporated within the Project Habitat Restoration Plan and Lizard Management Plan.

1.0 Introduction

1.1 Overview of the Programme

The Eastern Busway Project (the Project) is a package of works focusing on promoting an integrated, multi-modal transport system to support population and economic growth in southeast Auckland. This involves the provision of a greater number of improved public transport choices and aims to enhance the safety, quality and attractiveness of public transport and walking and cycling environments. The Project includes:

- 5km of two-lane busway
- New bridge for buses across Pakuranga Creek
- Improved active mode infrastructure (walking and cycling) along the length of the busway
- Three intermediate bus stations
- Two major interchange bus stations.

The Project forms part of the previous Auckland Manukau Eastern Transport Initiative (AMETI) programme (the AMETI programme) which includes a dedicated busway and bus stations between Panmure, Pakuranga and Botany town centres. The dedicated busway will provide an efficient rapid transit network (RTN) service between the town centres, while local bus networks will continue to provide more direct local connections within the town centre areas. The Project also includes new walking and cycling facilities, as well as modifications and improvements to the road network.

The AMETI programme includes the following works which do not form part of the Project:

- Panmure Bus and Rail Station and construction of Te Horeta Road (completed)
- Eastern Busway 1 (EB1) – Panmure to Pakuranga (completed).

The Project consists of the following packages:

- Early Works Consents – William Roberts Road (WRR) extension from Reeves Road to Ti Rakau Drive (LUC60401706); and Project Construction Yard at 169 – 173 Pakuranga Road (LUC60403744).
- Eastern Busway 2 (EB2) – Pakuranga Town Centre, including the Reeves Road Flyover (RRF) and Pakuranga Bus Station **(this Assessment)**
- Eastern Busway 3 Residential (EB3R) – Ti Rakau Drive from the South Eastern Arterial (SEART) to Pakuranga Creek, including Edgewater and Gossamer Intermediate Bus Stations **(this Assessment)**
- Eastern Busway 3 Commercial (EB3 Commercial) – Gossamer Drive to Guys Reserve, including two new bridges, and an offline bus route through Burswood
- Eastern Busway 4 – Guys Reserve to a new bus station in the Botany Town Centre, including a link road through Guys Reserve.

The overall Project is shown in Figure 1-1 below.

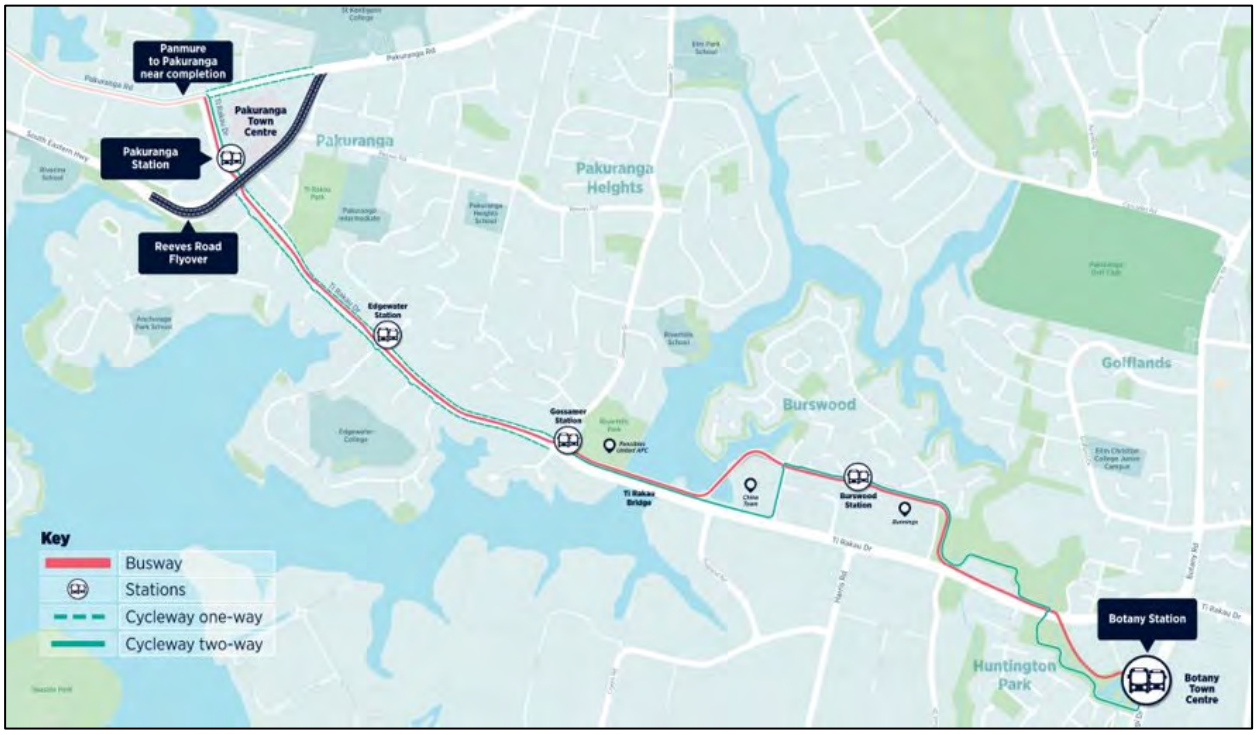

Figure 1-1 Project alignment

1.2 Project Objectives

The Project objectives are:

1. Provide a multi modal transport corridor that connects Pakuranga and Botany to the wider network and increases access to a choice of transport options
2. Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form
3. Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network
4. Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centre
5. Provide transport infrastructure that is safe for everyone
6. Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.

The purpose of this assessment is to assess the ecological implications of the proposed construction and operation of EB2 and EB3R.

2.0 Proposal Description

The below is a summary of the works proposed within the EB2 and EB3R packages. Refer to the Assessment of Effects on the Environment (AEE) for additional detail on the works proposed.

2.1 Eastern Busway 2

The EB2 section of the Project commences from the intersection of Ti Rakau Drive and Pakuranga Road, connecting with EB1, and traverses east along Ti Rakau Drive to the intersection of SEART. The north-south extent of EB2 is between SEART and Pakuranga Road along Reeves Road and William Roberts Road. The main components of EB2 are described below.

2.1.1 Busway and Pakuranga Town Centre Bus Station

A segregated dedicated two-way busway is proposed along Ti Rakau Drive to provide prioritised access for bus services between Pakuranga Town Centre and Botany. From Pakuranga Road to SEART, the busway will run on the northern side of Ti Rakau Drive.

The proposed Pakuranga bus station is a key facility for services running to and from the Panmure Station Interchange, Howick, Highland Park, Eastern Beach, Bucklands Beach and Sunnyhills. The bus station will be located along the northern side of Ti Rakau Drive, on land currently occupied for Pakuranga Plaza and 26 Ti Rakau Drive. The bus station will feature two platforms and will contain a mixture of street furniture and structures, including bus shelters, electronic messaging signage and seating. New proposed pedestrian crossings will provide connections to the bus station and Pakuranga Plaza. Modifications to the Ti Rakau Drive median strip, landscaping, and general traffic lane reconfiguration will enable safe and efficient bus movement for the busway once it becomes operative.

2.1.2 Reeves Road Flyover (RRF)

The RRF will provide two general traffic lanes in each direction connecting SEART to Pakuranga Road, to reduce local traffic congestion along Pakuranga Road and Ti Rakau Drive. The RRF will start opposite Paul Place Reserve, pass over Ti Rakau Drive and Reeves Road, before finishing at a new intersection with Pakuranga Road. Traffic lanes for the RRF will be elevated and run through the centre of SEART, requiring the relocation of the SEART off-ramp to the north of the existing off-ramp.

2.1.3 Walking and Cycling Facilities

EB2 includes improvements to active transport infrastructure and connections. This includes a new cycleway, improved footpaths, and new pedestrian crossings. These works will improve the safety and connectivity of walking and cycling links across Pakuranga Town Centre.

2.1.4 Supporting Works

A range of works will be undertaken in support of the EB2 package. This includes the relocation of network utility services, new street lighting, earthworks, removal of vegetation, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.

2.2 Eastern Busway 3 Residential

The EB3R section of the busway is a continuation of EB2 from the intersection of SEART and Ti Rakau Drive, with the proposed dedicated busway proceeding centrally along Ti Rakau Drive towards Gossamer Drive and Riverhills Park in the east. EB3R will largely occur within land vested as road or land currently owned by Auckland Transport. The construction of EB3R will take a staged approach to minimize disruption to the existing road network and its users. The main components of EB3R have been described below.

2.2.1 Edgewater and Gossamer Intermediate Bus Stations

EB3R includes two intermediate bus stations on Ti Rakau Drive, located within the vicinity of Edgewater Drive and Gossamer Drive. Both stations will have separate platforms for eastbound and westbound bus movements. A range of street furniture and structures will also be constructed, such as modular bus shelters pedestrian linkages, electronic messaging signage, seating and cycling storage facilities.

2.2.2 Western Bridge Abutment

EB3R includes construction of the western bridge abutment for a new future bridge across Pakuranga Creek. The abutment will be located within the area that is currently the southeastern section of Riverhills Park. Only the bridge abutment is included in the EB3R package of works. The remaining parts of the bridge will form part of the EB3C approval package.

2.2.3 Walking and Cycling Facilities

Provision has been made for walking and cycling along the route of EB3R. This includes footpaths and uni-directional cycleways located on either side of Ti Rakau Drive from SEART to Gossamer Drive. Signalised pedestrian crossings will be provided at key intersections along Ti Rakau Drive, including adjacent to the proposed Edgewater bus station.

2.2.4 Associated changes the road network

The proposed changes to the road network include lane arrangement and intersection reconfigurations and changes to the parking arrangement and access to Edgewater Drive Shops. Changes are also proposed to the access arrangements for residential properties along the EB3R alignment. New westbound lanes for general traffic will be established within the land which has been acquired by Auckland Transport and will be vested as road once it becomes operative, as the busway alignment replaces the existing westbound lanes.

2.2.5 Supporting Works

A range of works will be undertaken in support of the EB3R package. This includes the relocation of network utility services, new street lighting, removal of vegetation, earthworks, landscaping, stormwater upgrades, environmental restoration and mitigation and temporary construction sites.

3.0 Specialist Assessment

Chapter Summary
This chapter describes the context of the ecological assessment and the statutory framework. It also outlines the specific project elements that are relevant to this ecological assessment including vegetation clearance, earthworks and stormwater drainage.

3.1 Assessment Content

This assessment describes the assessment of ecological effects associated with the operation and construction of EB2 and EB3R. This assessment pertains to the terrestrial, wetland and freshwater environment and considers both the potential beneficial and adverse effects on features of ecological value that are likely to be impacted by the Project works.

Its purpose is to inform the AEE relating to the Notice of Requirement and required regional resource consents and consents required under National Environment Standards for EB2; and the AEE relating to the district and regional resource consent applications for EB3R and identify the ways in which any adverse effects will be avoided, remedied or mitigated.

An assessment of the marine environment (including coastal avifauna, benthic invertebrates and wetland mangrove habitat within the CMA) and potential impacts associated with the EB2 and EB3R sections of the Project was undertaken separately within the Marine Ecology and Coastal Avifauna Effects Assessment and should be considered in conjunction with this assessment.

The ecological impact assessment methodology relating to the terrestrial, wetland and freshwater environments is detailed in Section 4.1.1.

3.2 Specific Project Elements

The specific Project elements associated with the construction and operation of EB2 and EB3R that ecological effects are derived from include vegetation clearance, earthworks, construction/replacement of stormwater outfalls and new/altered stormwater discharges.

An overview of works relating to this ecological effects assessment for EB2 and EB3R are detailed below.

3.2.1 Vegetation Clearance

Vegetation clearance is required in order to facilitate the construction of the Project. The EB2 works will result in approximately **0.76 ha** of vegetation loss under the footprint. Table 3-1 details the expected loss of vegetation.

Table 3-1 Direct loss of vegetation in the EB 2

Vegetation type (refer Section 5.1)	Total loss (ha) EB2
TL-1 Native dominated treeland*	0.09
TL.2 - Mixed native and exotic treeland*	0.07
TL. 3 – Exotic treeland*	0.53
PL. 1 - Planted native vegetation*	0.07
ES - Exotic scrub*	No direct loss
Total vegetation loss (ha)	**0.76**

*Includes areas of rank grass within the understory of vegetation and along edges

The EB3R works will result in approximately **0.43 ha** of vegetation loss under the footprint. Table 3-2 details the expected loss of vegetation.

Table 3-2 Direct loss of vegetation in the EB 3 Residential.

Vegetation type (refer Section 5.1)	Total loss (ha) EB3R
TL-1 Native dominated treeland*	No direct loss
TL.2 - Mixed native and exotic treeland*	0.34
TL. 3 – Exotic treeland*	0.09
PL.1 - Planted native vegetation*	No direct loss
ES - Exotic scrub*	No direct loss
Total vegetation loss (ha)	**0.43**

*Includes areas of rank grass within the understory of vegetation and along edges.

3.2.2 Earthworks

Construction of the Project will involve bulk earthworks resulting in the clearance of obstructions and within the EB2 and EB3R footprint. The expected duration of earthworks is staged throughout the construction programme over a number of years. Earthworks are expected to result in elevated temporary disturbance (sediment discharge, noise, vibration, artificial light) and dust.

Earthworks will likely result in elevated erosion and sediment resulting from the relocation of network utility services, removal of vegetation, stormwater treatment, environmental restoration and mitigation (e.g. planting and noise barriers), temporary construction and storage areas and other ancillary structures and activities associated with these works. The ecological effects of elevated erosion and sediment are considered within this assessment.

3.2.3 Stormwater

New impervious areas will be created by the EB2 and EB3R works. As a result there will be a number of new and upgraded stormwater outfalls (including pipes and outlets). In addition the stormwater design may result in the alteration of some of the current stormwater discharge flow/volume.

New stormwater outfalls are proposed (two new outfalls EB2, one new outfall EB3R) and existing outfalls are to be modified (3 x outfalls EB2, 5 x outfalls EB3R).

The majority of new or modified outfalls occur within the CMA or the adjacent marine habitat. The outfalls that have been considered as part of this report in regard to stream/wetland effects include:

- Outfall 8-11 (two new outlets 06-05 and 89-18) – within 100m of a natural wetland (refer Section 4.1.5), albeit upslope of wetlands
- Replacement outfall 13/14 (MCC 108699) within Stream 2 (refer Section 4.1.6)
- Replacement outfall 1a (MCC_108703) within Stream 3a (refer Section 4.1.6)
- Replacement outfall 1b (MCC 108707) within Stream 3b (refer Section 4.1.6)

3.3 Reasons for Consent

Consent matters are set out in Section 7 of the EB2 AEE and Section 5 of the EB3R AEE. Reasons for consent are under both the Auckland Unitary Plan: Operative in Part (AUP(OP)) and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES:FW). Consent matters relevant to this assessment include vegetation clearance, works associated with the upgrading of existing or the installation of new stormwater outfalls, and discharge and land disturbance within proximity to streams and wetland.

3.4 Statutory and Planning Framework

This assessment and associated management of effects has been developed to comply with the following list of relevant legislation, policy, plans and strategies:

1. Resource Management Act 1991
2. Wildlife Act 1953
3. Conservation Act 1987
4. National Policy Statement for Freshwater Management 2020
5. National Environmental Standards for Freshwater 2020
6. Auckland Unitary Plan (Operative in part) – Chapters B7, E3, E4, E8, E26, E30
7. Auckland Conservation Management Strategy 2014 to 2024
8. Auckland Council's Indigenous Biodiversity Strategy 2012.

In regards to the objectives and policies of Chapter B7 (Natural Resources) of the AUP (OP), this assessment and associated management of effects is consistent because biodiversity values have been protected and also maintained where degraded or impacted. Terrestrial and freshwater values (vegetation/habitats and fauna) have also been identified and valued as part of the assessment to inform impact management.

4.0 Methodology and Analysis

Chapter Summary

This chapter summarises methodologies used to assess ecological features potentially impacted by EB2 and EB3R and provides rationale for determining the level of expected ecological effects.

Desktop reviews and site investigations were undertaken to assess terrestrial, wetland and freshwater habitats and species within the EB2 and EB3R Zone of Influence. The value of ecological features and associated effects were assessed according to the Environment Institute of Australia and New Zealand (EIANZ) guidelines (2018).

4.1 Assessment Methodology

4.1.1 Ecological Impact Assessment Approach

The approach followed in this assessment is consistent with the approach outlined in the Ecological Impact Assessment Guidelines (EIANZ, 2018) which is summarised in Appendix 1.

The initial step (step one) in the Ecological Impact Assessment (EcIA) approach is to assess the value of ecological features within the ZOI of the Project with respect to Representativeness, Rarity, Diversity and Pattern, and Ecological context. Appendix 2 outlines the specific methodology applied to inform the ecological value assessment for terrestrial and wetland features.

The second step of the EcIA approach requires a systematic assessment of magnitude of ecological effects related to specific Project features and activities. The magnitude of effect is then combined with the outcome of the value assessment (step one) and magnitude assessment (step two) to determine an inherent level of effect prior to impact management (prior to consideration of controls and existing avoidance measures).

The third step relates to identifying reasonable and practical mitigation, generally where the level of effect is determined to be **Moderate** or higher. Mitigation should be developed that is consistent with the mitigation hierarchy, the management of uncertainty and should also consider cumulative effects.

The fourth step relates to the management of any residual effects where mitigation of ecological values cannot be achieved. This may entail offset (to achieve No Net Loss or preferably Net Gain) or compensation measures.

4.1.2 Project Area and Zone of Influence

The ZOI of the Project relates to an area occupied by habitats and species that are adjacent to and may fall beyond the boundary of the Project area. It is defined in the EIANZ Guidelines as “the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities.” ZOI is used throughout this assessment to describe the impacts of the Project (construction and operation) on adjacent or connected terrestrial, freshwater and wetland habitats and associated native species.

The ZOI of the Project on different species differs depending on how they use their environment e.g., mobile species such as long-tailed bats have a larger home range and more diverse habitat requirements compared to lizards and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Project and this was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or dispersal ability within each of the Project areas, varying search distances were used depending on the species context. The size of this search area is stated alongside any species or habitat records identified within the relevant sections of this assessment. It should be noted that presence within the ZOI of a Project does not necessarily mean the ecological feature will be impacted by the Project.

4.1.3 Desktop Review

To characterise and gain an understanding of the value of the terrestrial and freshwater species and habitats present onsite and within the Project's ZOI, the following resources were reviewed:

- AUP(OP) – Overlays
- Auckland Council Geomaps[1]
- Ecological Regions and Districts of New Zealand (McEwen 1987)
- Department of Conservation Threat Classification Series[2]
- Department of Conservation (DOC) Bioweb records
- iNaturalist records, within approximately 5 km radius
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al, 2017)
- New Zealand Bird Atlas eBird database; recorded within 10 km^2 grid squares
- National Institute of Water and Atmospheric Research (NIWA) freshwater fish database.

4.1.4 Terrestrial Ecology – Site Investigations

Visual inspections of terrestrial habitat present within and adjacent to the area of works were undertaken on 15th March 2018, and on 28th and 29th April 2021. This consisted of a walkover of the entire EB2 and EB3R alignment to identify key terrestrial features possessing ecological value. Habitats were classified into ecosystem type based on those described in Singers et al. (2017) and assessed in relation to their potential to support indigenous fauna including birds, bats and lizards.

Habitat assessments focused on areas that may uphold significant ecological value, such as stream corridors and areas of vegetation (trees, scrub, rank grasses). Aerial imagery, species records from relevant literature and biodiversity databases were utilised to refine search efforts to certain areas within the Project areas.

Vegetation assessments focused on maintained and unmanaged areas in open spaces and along the road reserve. The vegetation assessment included recording the dominant or characteristic species present and the general habitat quality including structure, maturity, presence of weeds and evidence of disturbance. Assessments of private gardens were undertaken via desktop to identify key areas of native vegetation and potential habitat for native fauna.

For information regarding roadside amenity trees and garden vegetation refer to the Project's Arboricultural Effects Assessment.

4.1.4.1 Fauna

Incidental observations of any native species seen during site walkovers were recorded. For lizard species, this included incidental searches of natural/artificial refugia, such as turning over logs/wood/corrugated iron on the ground. For birds, incidental observations were made. All vegetation with understory was considered lizard habitat.

Bat surveys

There are two extant species of native bat in New Zealand, the long-tailed bat (*Chalinolobus tuberculatus*) and the lesser short-tailed bat (*Mystacina tuberculata*). There are no known lesser short-tailed bat populations in mainland Auckland (Section 5.1.6). However, to confirm the presence of any long-tailed bat in the EB2 and EB3R project area, five automatic bat monitors (ABM's; Song Meter SM4BAT bioacoustics recorder) were installed in potentially favourable bat habitat on the 24 March

[1] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html
[2] 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

2022 (Figure 4-1). The ABMs were deployed by an ecologist that holds DOC Bat Competency Class A and were left in situ to ensure at least 14 days of suitable weather for bat activity. The data was reviewed by an ecologist that holds DOC Bat Competency Class B to evaluate bat calls at each site.

Figure 4-1 Locations of automatic bat monitors (ABM's) across the project area (EB2 and EB3R) in habitat deemed potentially favourable for bat species.

4.1.5 Wetland Ecology – Site Investigations

4.1.5.1 Wetland delineation

Potential wetlands (excluding coastal/CMA wetlands which are covered in the Marine Ecology and Coastal Avifauna Effects Assessment) associated with the EB2 and EB3R project areas were delineated on desktop using available aerial images including Auckland Council Geomaps, Google Earth© and Retrolens. A site visit was undertaken on 29 April 2021 to ground truth the desktop delineation using the wetland delineation protocol (Clarkson, 2018; MfE, 2020). Where all dominant species across all strata are rated OBL and/or FACW a rapid test was undertaken (MfE, 2020).

Wetlands were divided into units identified based on geomorphology and hydrology (hydrogeomorphic units or HGMs) (adapted from Brinson, 1993) to assist with value interpretation. Wetlands were assessed against the NPS-FM (2021) definition to determine the presence of Natural Wetland (Section 4.1.5.3).

4.1.5.2 Wetland condition assessment

The ecological health or condition of each wetland unit was assessed using the wetland condition assessment developed by Clarkson et al. (2004). The condition assessment evaluates the health of the wetland based on five impact indicators and include hydrology, water quality, ecosystem intactness, change in browsing, predation and harvesting regimes and change in dominance of native plants. Each impact indicator consists of several indicator components. Impact indicator components were scored on a scale from one to five, where very high modification is scored one and very low modification is scored five.

The condition assessment also includes a separate assessment of the catchment for each wetland unit. Catchment condition is based on pressures including, modification to catchment hydrology, water quality within the catchment, animal access, key undesirable species and percentage catchment introduced vegetation. Each catchment pressure was scored on a scale from one to five, where very low pressure was scored one and very high pressure was scored five.

To assist with the interpretation of wetland condition score, the overall impact indicator scores and the catchment pressures scores have been combined and expressed as a percentage. The overall percentage was then interpreted based on the wetland condition classes proposed by Rountree et al., (2007) and defined in Table 4-1 .

Table 4-1 Wetland condition categories and associated descriptions used within this assessment

Category Wetland Condition	Description	Modification (%)
Unmodified	Unmodified/natural	100%
Largely natural	Largely natural with a few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota have taken place	80-100%
Moderately modified	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	60-80%
Largely modified	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred	40-60%
Seriously modified	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable	20-40%
Critically modified	Critically modified. Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota	<20%

4.1.5.3 NPS-FM Natural Wetland Status Criteria

Wetlands (excluding coastal/CMA wetlands which are covered in the Marine Ecology and Coastal Avifauna Effects Assessment) present were assessed against the NPS-FM which defines a 'natural wetland' (as defined in the Act) as not:

a) A wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland) or
b) A geothermal wetland or
c) Any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain derived water pooling.

If the wetland area meets wetland criteria as defined by the NPS-FM the wetland is considered an NPS-FM natural wetland. Further details on the process to assess natural wetlands is detailed in Section 5.2.5.

4.1.6 Freshwater Ecology – Site Investigations

Site walkovers (24th March 2022 and 5th July 2022) of freshwater streams that were impacted by the Project were undertaken to ground truth desktop maps. Detailed stream surveys (Stream Ecological Valuation (Storey et al, 2011) were not required because the stream works are considered to be permitted under the AUP (OP). Stream reaches that occurred within or on the edge of the CMA were

considered to be within a 'marine' environment and were not assessed within this report but have been included in the Marine Ecology and Coastal Avifauna Effects Assessment.

4.1.7 Compensation Criteria

For effects on terrestrial habitat features, where impact management (avoid, remedy, mitigate) has been implemented and residual effects remain, the Biodiversity Compensation Model (BCM) for New Zealand has been applied (Baber et al., 2021). The BCMs can be used instead of biodiversity offset models when quantitative data is difficult to obtain or lacks adequate precision to determine if adverse effects can be demonstrably offset[3] (Baber et al., 2021 a,b,c). The BCM approach provides transparency and rigour to the development of measures to address residual adverse effects and is considered to be as close to an offset as possible.

To date the BCM has been utilised on the Amberfield subdivision for Hamilton City Council; the proposed Dome Valley Landfill for Waste Management New Zealand; Te Ahu a Turanga: Manawatū Tararua Highway for Waka Kotahi NZ Transport Agency and Drury Central and Paerata stations for KiwiRail.

The BCM considers Impact Risk, Impact Uncertainty and Extent of Impact and provides modelled compensation area extents for the Project's effects. Model inputs are conservative to minimise risks of 'False Positives' and Net Gain target outcomes are also conservative, equating to a target of 10% exceedance of No Net Loss.

Appendix 4 provides further information and justification behind the use of the BCM.

[3] A biodiversity offset is a 'measurable conservation outcome' that meets certain principles and balances adverse residual effects that cannot reasonably be avoided, remedied or mitigated, to a NNL/ NG standard. While offsetting requires a measurable outcome that has been quantified through a robust and transparent process, biodiversity compensation does not necessarily need to be quantified and measurable.

5.0 Baseline Environment – EB2 and EB3R

Chapter Summary

This chapter provides a summary of the ecological features and their value present in areas potentially impacted by the EB2 and EB3R infrastructure. Due to the similarities in ecological features present within EB2 and EB3R, these have been presented collectively, with differences noted as required.

Terrestrial, wetland, and freshwater features are described based on information obtained during the desktop review and subsequent site investigations. Ecological value is assigned to terrestrial and wetland features based on EIANZ criteria. Project effects on streams present within the ZOI of EB2 are predominantly related to the marine environment and as such their value and subsequent effects assessment has been considered in the Marine Ecology and Coastal Avifauna Effects Assessment. Streams within the ZOI of EB3R have been described but not surveyed in detail as the proposed stormwater upgrades are considered to meet the permitted activity status within Chapter E3 of the AUP (OP).

5.1 Terrestrial ecology (flora and fauna) – EB2 and EB3R

5.1.1 Ecological context

The Project is situated in the Tāmaki Ecological District. The geology of the district is characterised by sandstone, siltstone and minor limestone with basaltic scoria cones, tuff rings, lava flows and areas of alluvium within stream corridors. Soils in the district are mainly composed of volcanic ash soils and are generally silty, friable, and free draining (McEwen 1987). It also experiences warm, humid summers and relatively mild winters. Rainfall is typically plentiful throughout the year, with sporadic heavy storm events. Rainfall is approximately 1100 to 1450 mm per annum (Chappell, 2012).

The topography of the Project area generally slopes east to west with drainage entering the Tāmaki River estuary. The corridor is urban, with residential areas throughout and commercial activities within Pakuranga Town Centre. Vegetation within the wider Project area is limited, but includes planted and amenity areas associated with private property, maintained roadside berms and reserves.

Prior to forest clearance and land modification, historical forest cover would have been representative of characteristic North Island lowland forest with abundant taraire (*Beilschmiedia taraire*) and puriri (*Vitex lucens*) (McEwen 1987). The dominant historical terrestrial ecosystem types (Singers & Rogers 2014) within the Project area would have been 'kauri, podocarp, broadleaved, beech forest' (WF12). The 'kauri, podocarp, broadleaved, beech forest' would have been dominated by podocarps, including tanekaha (*Phyllocladus trichomanoides*), rimu (*Dacrydium cupressinum*) and miro (*Prumnopitys ferruginea*). Broadleaf species include tawa (*Beilschmiedia tawa*), northern rātā (*Metrosideros robusta*), rewarewa (*Knightia excelsa*) and kohekohe (*Dysoxylum spectabile*), with kauri (*Agathis australis)* confined to ridge lines (Singers, 2017).

Historically, the area would have supported a diverse range of invertebrates, amphibians, reptiles, birds and bats (Singers et al., 2017). However, the ecological district has been heavily modified, with the drainage of freshwater systems and clearance of terrestrial indigenous vegetation in support of urban development.

5.1.1.1 AUP(OP) Zoning and Overlays

Most of the land area impacted by the Project is zoned for residential and business purposes under the AUP(OP); however, there are some green areas which will be impacted by the Project and are zoned 'Open Space' under the AUP(OP). These include:

1. 'Open Space – Sports and Active Recreation Zone' at Riverhills Park, off Gossamer Drive and Ti Rakau Park opposite Mattson Road
2. 'Open Space – Conservation Zone' along the esplanade reserve of Pakuranga Creek.

AUP(OP) overlays indicate that two marine Significant Ecological Areas (SEAs) are located adjacent to the EB2 and EB3R Project areas, namely Pakuranga Creek Roosting Sites and Mangroves (SEA-M1-45a and SEA-M2-45b), which comprises tidal mudflats and mangrove habitat. An assessment of the marine environment (including coastal avifauna) and potential impacts associated with the EB2 and EB3R sections of the Project was undertaken by Boffa Miskell and is included as a separate appendix to the AEEs.

Two Notable trees are located within Ti Rakau Corner Reserve and a stand of Notable Trees are located within Rotary Reserve (known as Bus Stop Reserve) both adjacent to Pakuranga Road (EB2). All these trees are mature exotic species (Willow (*Salix sp.*) and Phoenix palm (*Phoenix canariensis*) and notable for their amenity or cultural value. These trees are unlikely to be impacted by the Project.

5.1.2 Site Description

The present-day terrestrial habitats within the vicinity of the Project are predominantly heavily modified and consist mainly of a mixture of native and exotic planted vegetation. No works are located within Terrestrial SEAs or similar protected areas (Figure 5-1).

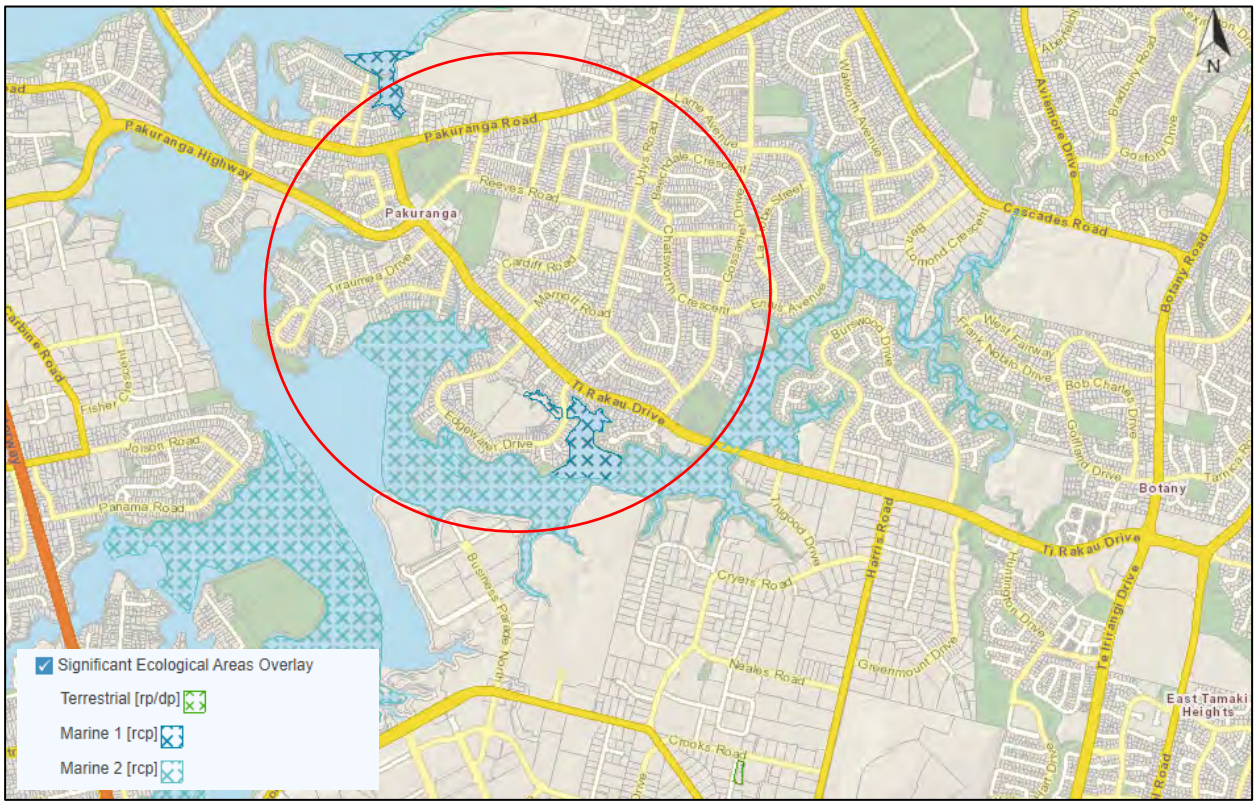

Figure 5-1 Significant Ecological Areas located in the vicinity of the EB2 and EB3R area (Extracted from Auckland Council Geomaps). Marine 1 = SEA-M1-45a, Marine 2= SEA-M2-45b.

5.1.3 Terrestrial Vegetation Habitat Types

The terrestrial habitats within and adjacent to EB2 and EB3R is comprised of maintained amenity areas, mixed native and exotic roadside shelterbelts and native planting. The habitats are generally consistent across both EB2 and EB3R.

An overview of the dominant terrestrial vegetation types in and within the proximity of EB2 and EB3R are detailed below in Table 5-1. The mapped extent of vegetation present in and in the vicinity of EB2 and EB3R is detailed in Figure 5-2 and Figure 5-3.

There are no records and onsite observations of Threatened and At Risk (TAR) plant species occurring within the ZOI of EB2 or EB3R.

Table 5-1 The main vegetation types potentially impacted by EB2 and EB3R

Vegetation Classification (Singers et al., 2017)	Description and species	Photograph
TL.1 – Native dominated treeland	Tree canopy is discontinuous (20-80%). Native dominant (>75%). Includes planted amenity areas with scattered trees, shelter belts, small stands of trees and planted native trees in reserves and roadside berms within the EB2 and EB3R zone of influence. Areas of native treeland largely consist of planted semi mature pōhutukawa (*Metrosideros excelsa*). Understorey is generally absent as these areas are managed, with mown exotic grassland areas. However, unmaintained areas result in rank grasses in understory and edges.	
TL.2 - Mixed native and exotic vegetation	Tree canopy is discontinuous (20-80%). Mixed native/exotic: with 25-75% native tree cover. Includes planted amenity areas with scattered trees, shelter belts and small stands of mixed native and exotic trees in reserves and roadside berms within the EB2 and EB3R zone of influence. Stands of mixed vegetation where native canopy trees include; pōhutukawa (Metrosideros excelsa), karaka (Corynocarpus laevigatus) and totara (*Podocarpus totara*). Exotic trees tend to dominate the canopy and include oak (*Quercus sp.*), eucalyptus (*Eucalyptus sp.)* and ironwood (*Casuarina sp*.). Understory vegetation was generally dominated by exotic weeds such as Chinese privet (*Ligustrum sinense*) and groundcover dominated by tradescantia (*Tradescantia fluminensis*). Unmaintained areas result in rank grasses in understory and edges.	

Vegetation Classification (Singers et al., 2017)	Description and species	Photograph
TL3 – Exotic-dominated treeland	Where tree canopy is discontinuous (20-80%) and exotic species dominate, with <25% native. Includes planted amenity areas with scattered trees, shelter belts and small stands of trees in reserves and roadside berms within the EB2 and EB3R ZOI. Majority of trees include eucalyptus (*Eucalyptus* spp.), casuarina (*Casuarina* sp.), oak (*Quercus spp*.) and Queensland box (*Lophostemon confertus*). Unmaintained areas result in rank grasses in understory and edges.	
PL.1- Planted native vegetation (**only present in EB2**)	Native restoration plantings with <50% exotic biomass. Recently planted <20 years old. Includes restoration planting along roadside berms and riparian areas within the EB2 and EB3R ZOI. Species include manuka (*Leptospermum scoparium*) Ti kouka /cabbage tree (*Cordyline australis*), Karamu (*Coprosma spp*.), harakeke / flax (*Phormium tenax*), taupata (*Coprosma repens*) and pōhutukawa (*Metrosideros excelsa*).	
ES - Exotic Scrub	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Largely occurs within unmanaged riparian corridors. Species include pests like pampas (*Cortaderia selloana*), gorse (*Ulex europaeus*), tree privet (*Ligustrum lucidum*) and woolly nightshade (*Solanum mauritianum*). Occasional native species also occur within these areas.	

Vegetation Classification (Singers et al., 2017)	Description and species	Photograph
EG – Exotic Grassland (mown)	Grassland dominated by exotic species, includes lawns within reserves, grass berms and gardens within private property that is maintained. Dominant species include kikuyu grass (*Pennisetum clandestinum*) and paspalum grass (*Paspalum sp.*).	
EG – Exotic Grassland (rank)	Non-maintained grassland occurring in edge habitat, commonly fringing riparian stream margins or developing in the understory of tree canopies. Defined by tall, dense and coarse grasses. Dominant species include kikuyu grass (*Pennisetum clandestinum*) and paspalum grass (*Paspalum sp.*).	

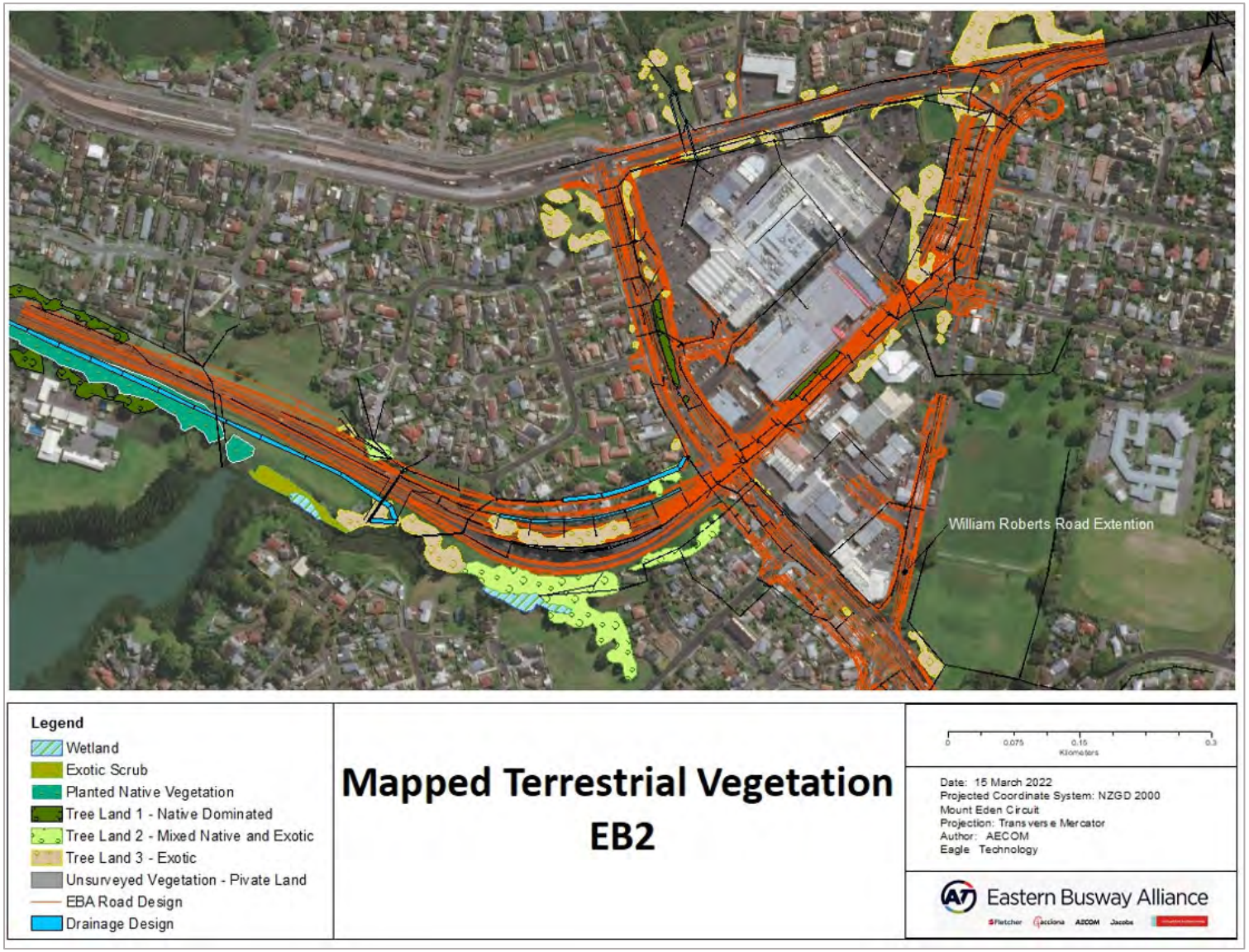

Figure 5-2: Mapped terrestrial vegetation overview at EB2 Pakuranga Section. William Roberts Road (WRR) is not part of this assessment and is covered by the WRR early works package

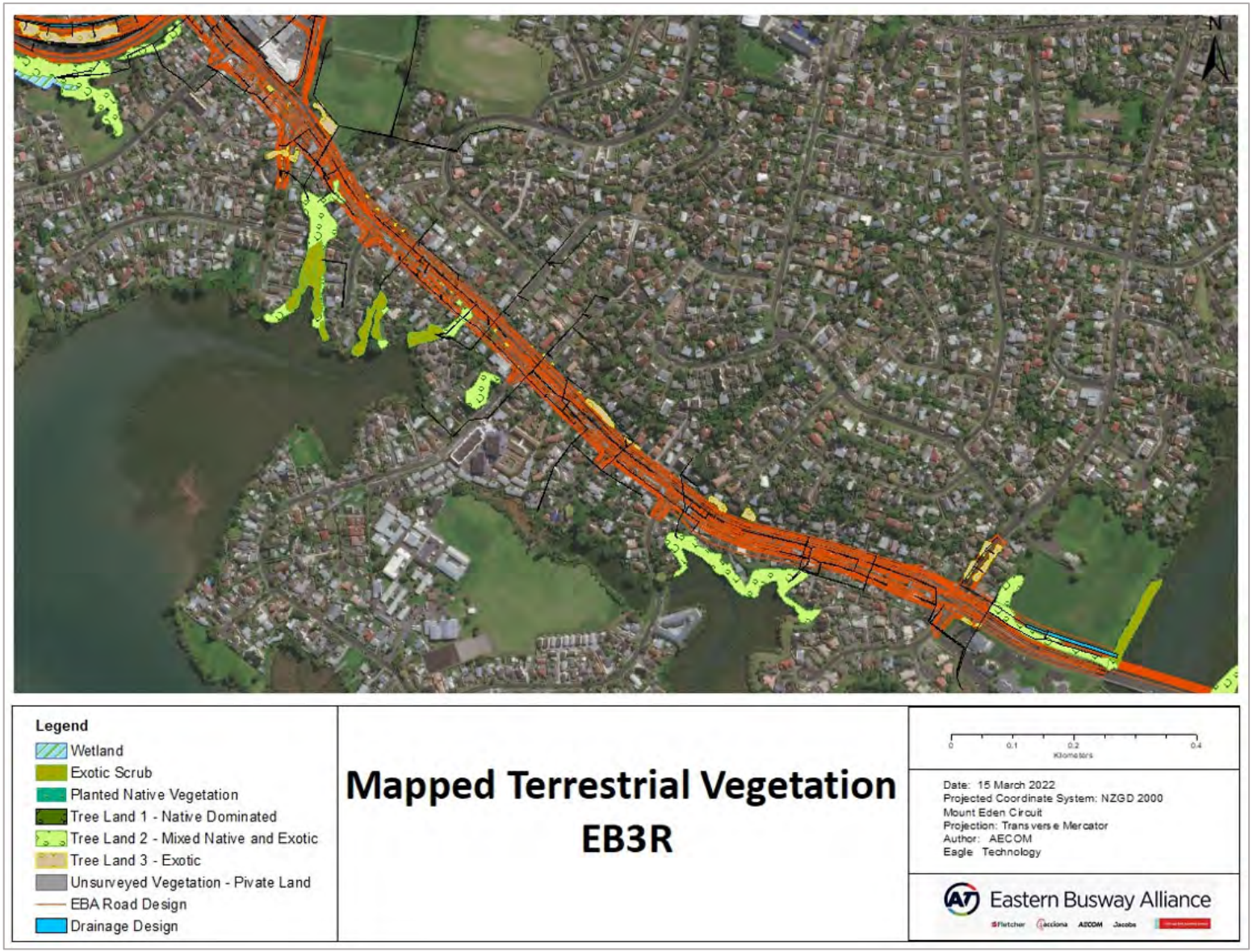

Figure 5-3 Mapped terrestrial vegetation overview at EB3R section

5.1.4 Ecological Value of Terrestrial Vegetation

The value of terrestrial vegetation has been scored in accordance with the EIANZ Guidelines (2018) and is summarised in Table 5-2. Full details of terrestrial value assignment are presented in Appendix 2. The vegetation impacted by EB2 and EB3R are considered to be of **Low** to **Moderate** ecological value. The ecological value of coastal mangrove vegetation is detailed in the Marine Ecology and Coastal Avifauna Effects Assessment.

Table 5-2 Ecological value overview associated with terrestrial habitat present at EB2 and EB3R

Vegetation Type	Location	Ecological value
TL.1 – Native dominated tree-land	EB2 and EB3R	Moderate
TL.2 – Mixed native and exotic vegetation	EB2 and EB3R	Moderate
TL. 3 – Exotic-dominated tree-land	EB2 and EB3R	Moderate
PL.1 – Planted vegetation	EB2	Moderate
ES – Exotic scrub	EB2 and EB3R	Low
EG – Exotic grassland includes mown and rank grasses	EB2 and EB3R	Low

5.1.5 Avifauna

All desktop records of bird species identified within 5km of the Project are collated in Appendix 5; Section A5.4. This data is comprised of a series of five-minute bird counts undertaken at Pakuranga Golf Course (Chaffe, 2016), iNaturalist and NZ Bird Atlas records. The majority of the birds recorded within the vicinity of the Project area are exotic and 'Not Threatened' native species, except for the New Zealand dotterel (*Charadrius obscurus*), Pied Shag (*Phalacrocorax varius),* New Zealand Dabchick *(Poliocephalus rufopectus)* which are 'At Risk-Recovering' and the Little Black Shag *(Phalacrocorax sulcirostris)* which is 'At Risk – Naturally Uncommon'. Besides the New Zealand Dabchick, all of these bird species are those that predominantly reside in the coastal environment and have been assessed in more detail within the Marine Ecology and Coastal Avifauna Effects Assessment. Dabchick habitat requirements include shallow waters with dense vegetation on small freshwater lakes and pools. There is no such suitable habitat within or adjacent to the Project area.

Viable avifauna habitat within the vicinity of EB2 is sparse and highly fragmented. The only vegetation assessed in this assessment considered to provide any meaningful habitat is located within the exotic shelterbelts and amenity plantings located adjacent to the South Eastern Highway (SEART). This vegetation is comprised entirely of edge habitat and considered only to provide basic resources for urban adapted species which are tolerant of high levels of disturbance. Wetland habitat has the potential to support some coastal avifauna species including banded rail (*Gallirallus philippensis*) which is classed as At-Risk Declining. Potential impacts of EB2 and EB3R on coastal avifauna species are detailed within the Marine Ecology and Coastal Avifauna Effects Assessment.

The vegetation within the vicinity of EB3R largely consists of maintained grass areas and edge habitat in small patches of mixed native-exotic vegetation. Though the habitat potential is limited, the vegetation has the capacity to provide some resources and dispersal pathways for local bird populations, particularly around the coastal margin.

Formal bird surveys were not undertaken during the April 2021 site walkover, however incidental observations were made. These have been included in Appendix 5; Section A5.4.

Considering the highly modified urban nature of the habitat available, the conservation status (largely Not Threatened) and mobility of urban-adapted bird species considered common to the area, the ecological value of the bird community potentially impacted by EB2 and EB3R is considered to be **Low**.

5.1.6 Bats

There are two extant species of native bat in New Zealand, the long-tailed bat (*Chalinolobus tuberculatus*) and the lesser short-tailed bat (*Mystacina tuberculata*). There are no known lesser short-tailed bat populations in mainland Auckland. However, long-tailed bat populations do persist in some parts of the wider Auckland Region.

According to DOC records the closest known long-tailed bat population is located at 353 Redoubt Road, 9.5km south of the Project footprint and in the Clevedon Scenic Reserve, 15km south of the Project footprint (Figure 5-4).

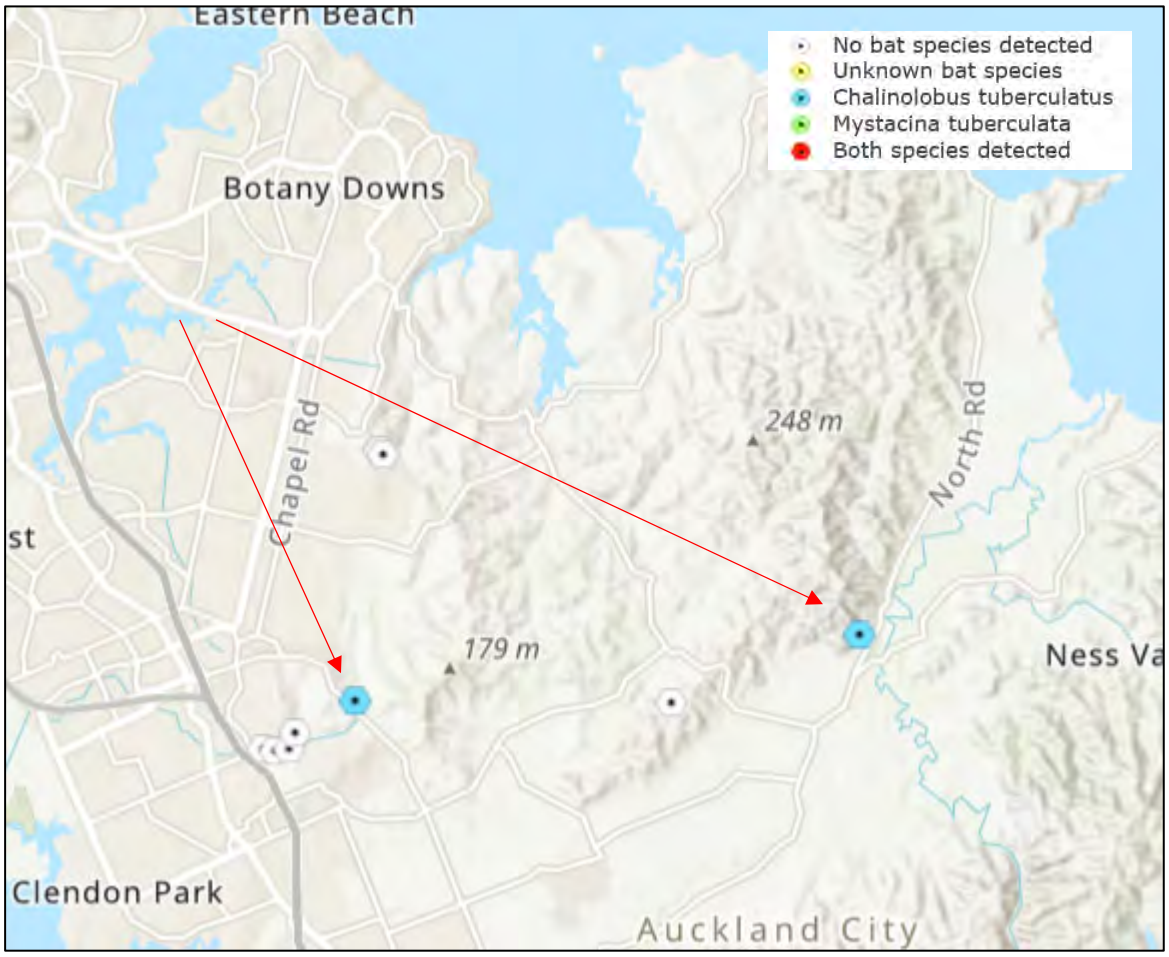

Figure 5-4 Bat records for the Project area

5.1.6.1 Localised bat survey (EB2 and EB3R)

Automated Bat Monitors (ABM's) were deployed to confirm the presence or likely absence of long-tailed bats within the ZOI of the EB2 and EB3R. The ABM's were retrieved on 20th April 2022 following 19 days of suitable weather for bat activity. During the analysis a number of calls were heard but were not considered to be bat species. These results, in addition to the lack of suitable habitat, would discount bat species from being present within the ZOI of EB2 and EB3R. As a result, Project effects associated with bats are not considered further as part of this assessment.

5.1.7 Herpetofauna

Ten species of native lizards (Mokomoko) have been recorded in the wider Auckland region, nine of which are classified as 'At Risk' or 'Threatened' (Bioresearches 2018; Hitchmough et al., 2021). Copper skink (*Oligosoma aeneum*), ornate skink (*Oligosoma ornatum)*, forest gecko and elegant gecko have been recorded within 10km of the Project (Bioresearches 2018) (Table 5-3). Desktop records from the EB1 lizard salvage in 2020 found that Cooper Skink (*n* = 23) were caught at:

- Lagoon Drive approximately 1.5 km from EB2
- Kerswill Corner approximately 0.5 km from EB2. (Bioresearches, 2020).

Forest gecko and elegant gecko are arboreal (tree dwelling) species and are associated with larger areas of established native vegetation and their habitat requirements are not represented within the Project area.

Although no formal lizard surveys were undertaken as part of the baseline surveys within EB2 and EB3R, several areas of vegetation were identified with the potential to support copper skinks and ornate skinks. This includes areas of planted native vegetation (PL.1), native treeland (TL.1) mixed/ exotic treeland (TL.2), exotic scrub (ES), unmanaged rank grassland (EG) on habitat edges and also present along stream corridors located within and outside the CMA and esplanade reserves. These areas of vegetation have sufficient ground cover (such as tradescantia (*Tradescantia fluminensis*), unmanaged grass, leaflitter and woody debris) to support skink. Specifically, these areas include south of SEART and along Pandora Place Esplanade Reserve, Edgewater River Esplanade Reserve, Fremantle Place Esplanade Reserve and Riverhills Park.

Table 5-3 Native lizard (Mokomoko) species recorded within 10km of EB2 and EB3R

Species	Threat Status (Hitchmough et al., 2021)	Habitat Preferences
Elegant gecko (*Naultinus elegans)*	At risk - Declining	Forest and scrub, especially kanuka/manuka shrubland
Forest gecko (*Mokopirirakau granulatus)*	At risk - Declining	Older forest. May persist in remnant stands, scrub, broadleaf and mixed forest and scrub, especially small leaved species with dense growth
Copper skink *(Oligosoma aeneum)*	At risk - Declining	Open and shaded areas where sufficient cover is available (e.g., rock piles, logs, dense vegetation)
Ornate skink *(Oligosoma ornatum)*	At risk - Declining	Forest or open areas with deep leaf litter, or stable cover (e.g., deep rock piles, thick vegetation), usually connected to higher value contiguous forest.

Figure 5-5 Treeland mixed exotic (TL.2) in EB3R, the ground cover of tradescantia, dense leaf litter and woody debris provides suitable potential habitat for native skink species. Photo credits: C. Reid, 29.04.2021.

Figure 5-6 Unmaintained Rank grasses around habitat edges in EB2 provides suitable potential habitat for native skink species. Photo credits: C Reid, 29.04.2021

Copper and Ornate skinks have a threat status of 'At Risk-declining' (Hitchmough et al., 2021). Although these species have not been observed within the EB2 or EB3R Project area, based on habitat potential and nearby desktop records this assessment has taken a precautionary approach and assumed the presence of these species within the Project area. In accordance with EIANZ (2018) the value assessment for these species has been based on the threat status of Copper and Ornate skinks. As such, the ecological value of lizard species potentially present in areas potentially impacted by EB2 and EB3R is considered **High** (Table 5-4).

Table 5-4 Ecological value for terrestrial fauna (TAR species only) – EB2 and EB3R

Fauna type	Species within habitat	Habitat description	Threat status (NZ Classification system)	Ecological Value
Herpetofauna – lizards	Ornate skink (*Oligosoma ornatum*)	Planted native vegetation (PL.1), mixed/ exotic treeland (TL.2), exotic scrub (ES) with understorey,	At risk - declining	High
Herpetofauna – lizards	Copper skink (*Oligosoma aeneum*)		At risk - declining	High

Fauna type	Species within habitat	Habitat description	Threat status (NZ Classification system)	Ecological Value
		including unmanaged rank exotic grassland (EG) habitat edges and along stream corridors and esplanade reserves.		

5.2 Wetland Ecology – EB2 only

5.2.1 Ecological Context

A desktop assessment was undertaken to assess potential wetlands within and beyond the Project ZOI for EB2 and EB3R. The ZOI for the wetland assessment was based on 100m distance from the construction footprint in-line with restrictions on activities such as earthworks, vegetation clearance and discharge associated with the NES-FM (2020).

Wetlands within the broader area are typically associated with the Tāmaki Estuary and its drowned river valley caused by Holocene marine transgression. Wetlands have formed in the low-lying valley bottoms systems and are generally marine influenced and dominated by mangroves (SA1.2) below the CMA boundary. However, two small wetland areas (< 0.16 ha) were identified adjacent to EB2 from desktop and site walkovers above the CMA boundary with freshwater-terrestrial influence. These wetlands are within proximity to the EB2 project footprint and are associated with the creek running alongside Pandora Place Esplanade Reserve, south of the Pakuranga Highway. The direct wetland catchment consists of urban area and the wetlands are partially influenced by existing stormwater runoff. No wetlands were identified within or adjacent to EB3R.

5.2.2 Wetland Delineation

Wetland 1 (W1) is located within the riparian margin of a tributary of the Tāmaki Estuary (Figure 5-7). The wetland is approximately 0.16 ha and associated with a valley bottom characterised by low lying topography. The wetland receives stormwater runoff from an existing upslope stormwater outlet which has likely contributed to this feature. Delineated vegetation is classified as Exotic Wetland (EW) (Singers, 2017) and species include mercer grass (*Paspalum distichum*), dollar weed (*Hydrocotyle umbellate*), taro (*Colocasia esculenta*) and umbrella sedge (*Cyperus eragrostis*). The only native species identified within this area was Muehlenbeckia (*Muehlenbeckia sp*.) (see Figure 5-8). Although not directly impacted by the scheme design, this wetland is approximately 20m downslope from the construction footprint of the busway and 89m upslope from the closest new stormwater outfall (Outfall 8-11, outlet 06-05) (Figure 5-7).

For Wetland 2 (W2) the dominant species across all strata was saltmarsh rush (*juncus gerardii)* which is an exotic FACW species and as such a rapid test was implemented. Other species present included native flax (*Phormium tenax*) and giant umbrella sedge (*Cyperus ustularus*) which are native FACW species. The wetland vegetation is classified as restiad rushland/reedland (WL10) and is considered to have a Regional IUCN threat status: Endangered (Singers, 2017). The wetland is approximately 0.04 ha and is associated within the coastal stream margins, in the upper estuarine zone, where saltwater dilution is greatest. The water table within the lower section of this wetland is influenced by the freshwater running through the creek and the tidal cycle. The boundary of the wetland showed a distinct transition to mangrove habitat downslope. While the upslope section is dominated by pampus grass and harakeke / flax (*Phormium tenax*) (Figure 5-9). The wetland has been highly modified and contains the pest plant pampas grass (*Cortaderia selloana*) along the edge of this wetland. Although not directly impacted by the Project design, this wetland is approximately 40m downslope from the

construction footprint of the busway and 51m upslope from the closest new stormwater outfall (Outfall 8-11, outlet 89-18) (Figure 5-7).

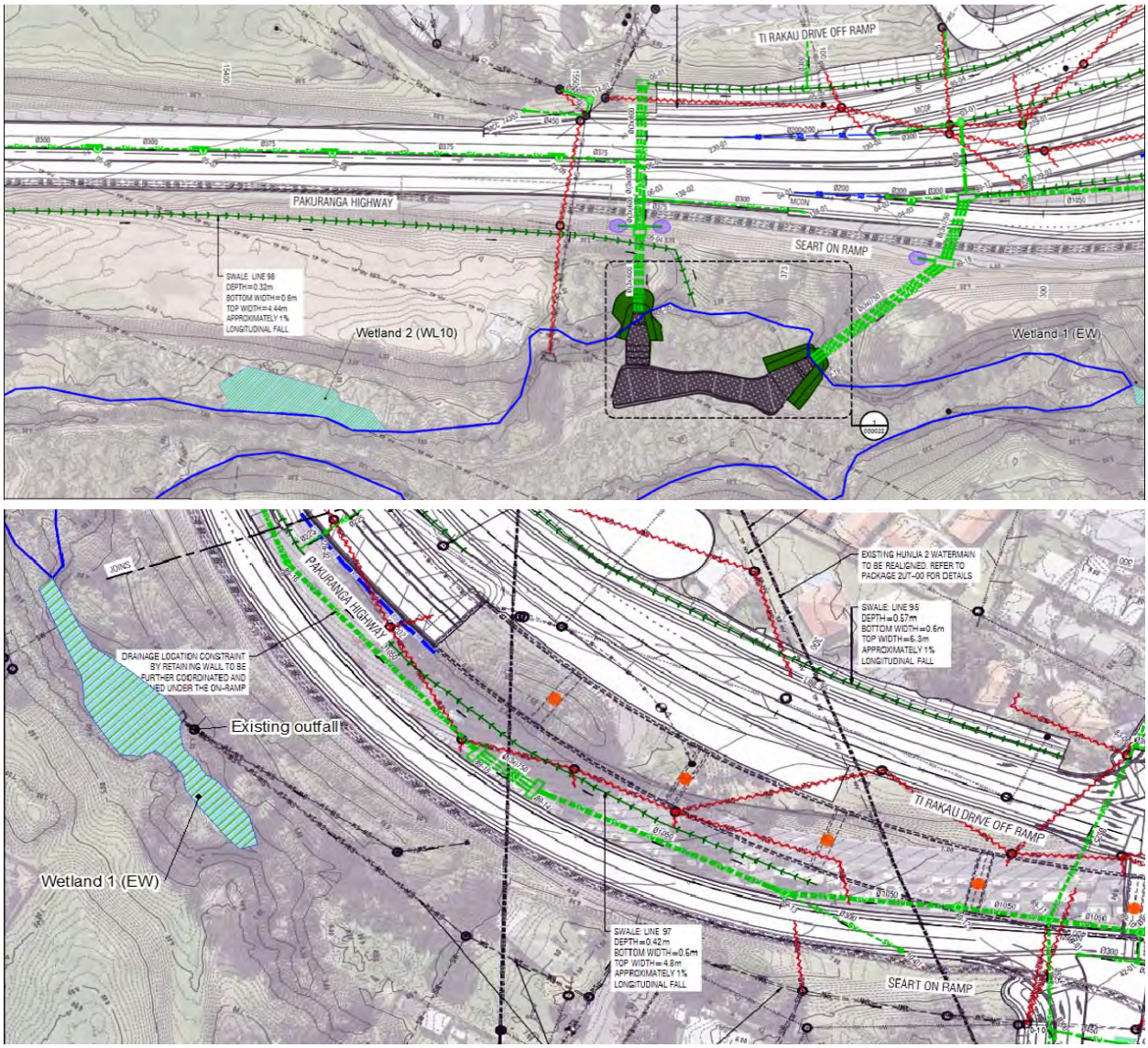

Figure 5-7 Location of wetlands (Wetland 1 and Wetland 2) and new/existing stormwater outfalls present within EB2

Figure 5-8 Wetland 1 Exotic wetland (EW) located adjacent to Pakuranga Highway (EB2). Photo credits: C. Reid, 29/04/2021

Figure 5-9 Wetland 2 (WL10) located adjacent to Pakuranga Highway (EB2). Photo credits: C. Reid, 29/04/2021

5.2.3 Wetland Vegetation

Table 5-5 provides a summary of the wetland vegetation recorded for Wetland 1. Two plots were undertaken in areas considered to be putative wetland habitat. Dominant vegetation included facultative wetland and facultative species. Both plots met the dominance test and prevalence index.

Table 5-5 Summary of wetland vegetation recorded within Wetland 1 during the April 2021 assessment.

Wetland 1 Exotic Wetland (EW)							
Plot	Common Name	Scientific Name	Hydrophytic classification	Cover (%)	Indigenous or Exotic species	Dominance Test (%)	Prevalence index (PI)
Plot 1	Mercer grass	*Paspalum distichum*	FACW	60	Exotic	100	2.4

Wetland 1 Exotic Wetland (EW)							
Plot	Common Name	Scientific Name	Hydrophytic classification	Cover (%)	Indigenous or Exotic species	Dominance Test (%)	Prevalence index (PI)
	Creeping buttercup	*Ranunculus repens*	FAC	40	Exotic		
Plot 2	Dollarweed	*Hydrocotyle umbellata*	FACW	30	Exotic	60	2.5
	Mercer grass	*Paspalum distichum*	FACW	40	Exotic		
	Mint	*Mentha suaveolens*	FACU	10	Exotic		
	Sticky weed	*Galium aparine*	FACU	10	Exotic		
	Wandering Jew	*Tradescantia fluminensis*	FAC	10	Exotic		

For Wetland 2 (W2) the dominant species across all strata was saltmarsh rush (*juncus gerardii)* which is an exotic FACW species. Other species present included native flax (*Phormium tenax*) and giant umbrella sedge (*Cyperus ustularus*) which are FACW. As such, a rapid test was implemented, and further wetland delineation was not required. However, condition assessment was undertaken to determine the ecological value of the wetland (Appendix 3; Section A3.4).

5.2.4 Wetland Soil and Hydroperiod Indicators

Seasonal wetland extent (W1) was generally consistent with leeched or gleyed sandy/loamy/clayey or organic soils in contrast with the brown/yellow/yellow brown/red sandy/loamy/clayey soils characteristic of surrounding terrestrial soils. Seasonal wetland areas were indicated by mottles, soil matrix chroma of 0-2 with generally no sulphidic odour. Wetland 2 was rapidly assessed and did not require further assessment of wetland hydrology (MfE, 2020).

5.2.5 NPS-FM Natural Wetland Status

W1 and W2 were assessed against the NPS-FM Natural Wetland exclusions to determine their status as a Natural Wetland.

Both wetlands are considered to be NPS-FM Natural Wetlands because they meet the definition of a wetland under the Resource Management Act (1991) and as they do not meet the specified exclusion criteria (MfE, 2020; 2021).

5.2.6 Ecological value of wetland habitat

Information obtained for the ecological baseline was used to score the matters that inform the ecological value. A summary table detailing ecological value is summarised below (Table 5-6). Further detail informing wetland condition assessment and the full EcIA value assessment table for wetlands is provided in Appendix 3 (Section A3.4).

*Table 5-6 Ecological value of wetlands present in the Project area (EB2 only) and score justification. The value categories applied ranged from **Negligible** (1) to **Very High** (5).*

Ecological Matters	Wetland 1 Exotic Wetland (EW)	
	Score	Justification
Representativeness	2	Hydrologically, physico-chemically and geomorphically modified. Contains only exotic species and high condition index.
Rarity/ distinctiveness	2	No species of conservation significance, not considered rare or distinctive wetland type, however, provides ecosystem services at a larger context.
Diversity and pattern	1	Low range of habitat and species diversity.
Ecological context	3	Provides important ecosystem services.
Ecological Value	**Low**	
The wetland present is moderately modified and a dominance score of > 50% exotic wetland species and a PI score of < 3.0. The wetland meets the criteria of a natural wetland under the NES-FM (2020). The value assigned is **Low** value, accounting for their ecological context, modification status and the dominance of exotic species over indigenous.		
Ecological Matters	**Wetland 2 Juncus saltmarsh (WL10)**	
	Score	Justification
Representativeness	3	Hydrologically, physico-chemically and geomorphically modified. Represents NPS-FM of natural wetland.
Rarity/ distinctiveness	3	Contains species of conservation significance in addition to the presence of endemic species. Wetland considered rare or distinctive wetland type.
Diversity and pattern	1	Low range of diversity in species and habitat and contains exotic species.
Ecological context	4	Provides important ecosystem services and saltmarsh wetland ecosystems have a Regional IUCN threat status of Endangered.
Ecological Value	**Moderate**	
The wetland present is moderately modified with a dominance score of > 50% Juncus saltmarsh and a PI score of < 3.0. The wetland meets the criteria of a natural wetland under the NES-FM (2020). The value that has been assigned is considered **Moderate** accounting for the modification status, the dominance of indigenous over exotic species including vegetation threat status.		

5.3 Freshwater Ecology – EB2 and EB3R

5.3.1 Ecological Context

A desktop assessment was undertaken to determine potential stream habitat within the ZOI of EB2 and EB3R. The ZOI for the streams assessment was based on 100m distance in association with the AUP(OP). Four waterways were identified within the ZOI of EB2 and EB3R – Stream 1, Stream 2, Stream 3a and Stream 3b. Auckland geomaps identifies these waterways as 'overland flow paths' discharging stormwater into the receiving Tāmaki Estuary (refer Figure 5-10 and Figure 5-11). Streams occur partially within the Coastal Marine Area (CMA) as shown on the Auckland Unitary Plan and as such may be tidally influenced.

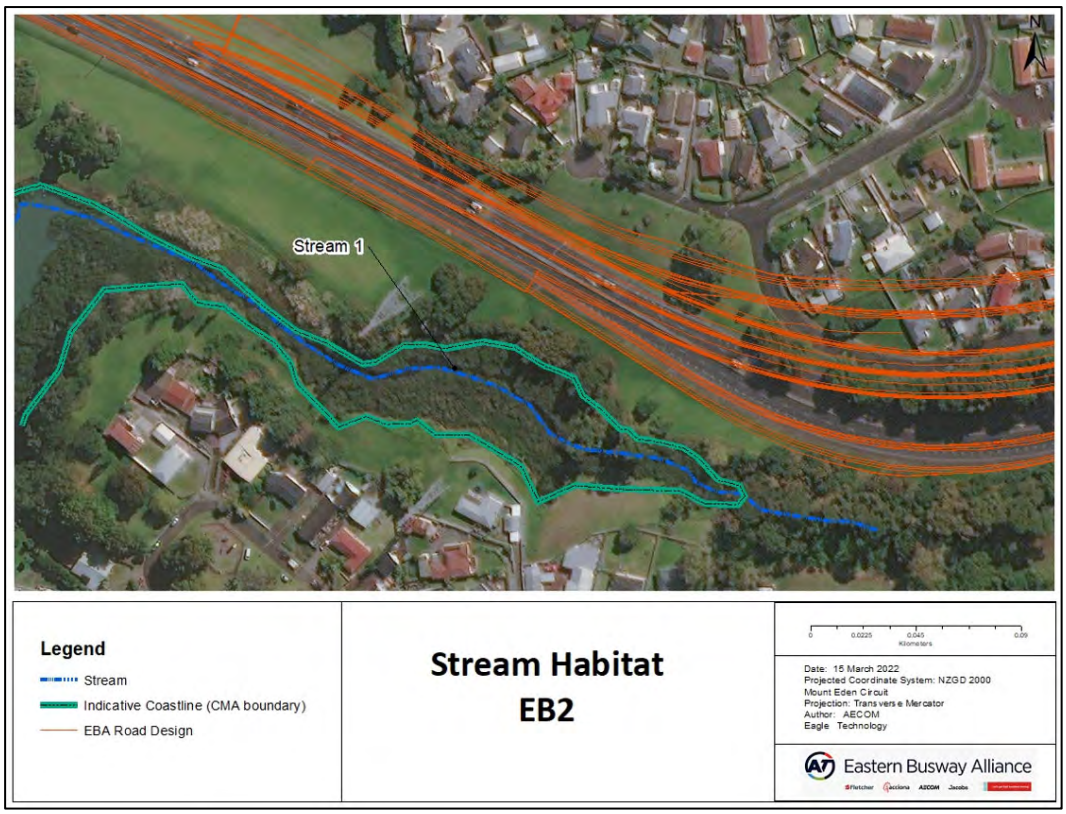

Figure 5-10 Stream 1 discharging into the Tāmaki Estuary at EB2

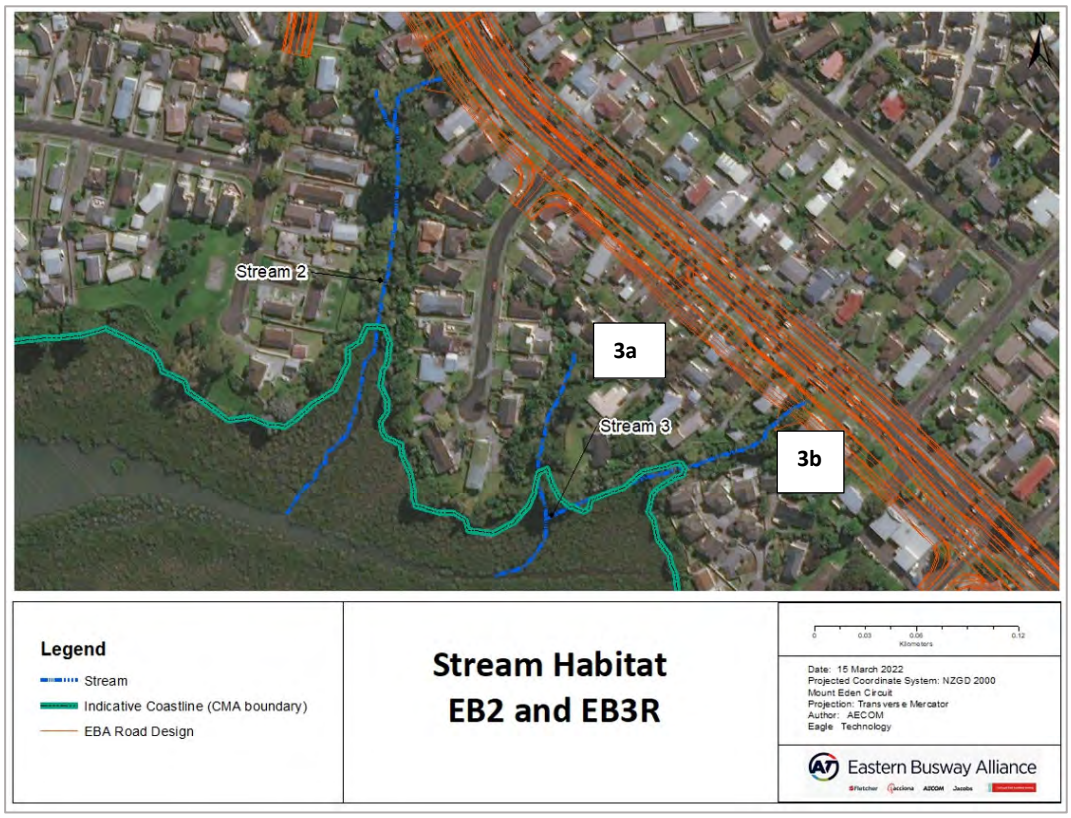

Figure 5-11 Stream 2, Stream 3a and Stream 3b discharging into the Tāmaki Estuary at EB3R extent

5.3.2 Stream Descriptions

Due to access restrictions, site walkovers could only be undertaken of Stream 2 and 3b (upper portion only). Assessment of Stream 3a and Stream 3b (lower portion below existing stormwater outlet) was undertaken from photos and descriptions provided by the marine ecology team.

Stream 1

Project effects to Stream 1 is related to the CMA/marine environment and as such has been solely considered in the Marine Ecology and Coastal Avifauna Effects Assessment.

Stream 2

There is a large stormwater outlet at the top of the drainage feature which discharges directly into a well-defined stream channel. The feature is a soft bottomed permanent stream approximately 1-2m wide (wetted width). Several shortfin eel and other unidentified spp. of eel were identified within the stream. Potential inanga spawning habitat was observed on the true left bank.

Stream banks were undercut indicating instream erosion and fast flows at times. Surrounding terrestrial vegetation is dense and provides good canopy cover with a mix of native and weed species.

Figure 5-12 Evidence of permanent stream with well-defined channels situated at Stream 2

Stream 3a

There is a soft bottomed permanent stream feature at this location with signs of flowing water and a stream channel and bed. The stream channel (wetted width) is less than 1m wide. The feature looks to be predominantly freshwater and is fed by a stormwater outlet at the top of the drainage feature. A mixture of native and exotic vegetation provides good canopy and shade.

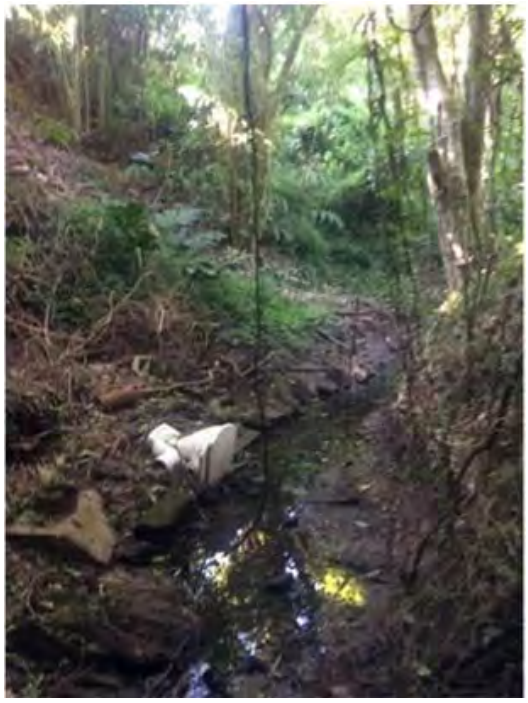

Figure 5-13 Permanent stream feature situated at Stream 3a

Stream 3b

The upper half of the drainage feature does not contain flow, but there is an obvious gully and evidence of a historical stream channel. However, the area is now completely overgrown with vegetation and there is no stream bed.

Halfway down the drainage feature there is an existing stormwater outlet that is discharging into the stream channel. There is a large pool (approximately 2m wide by 3m long) in front of the outlet pipe, two shortfin eels were identified in the pool. The stream is not tidally influenced so is considered to be freshwater habitat.

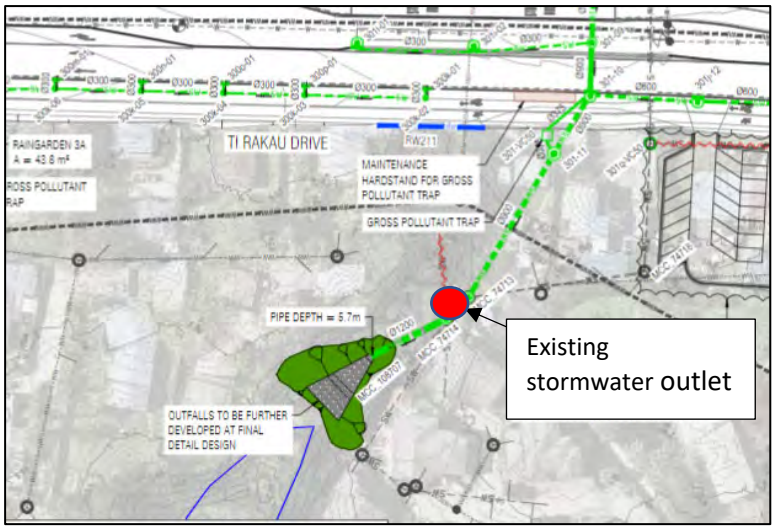

Figure 5-14 Existing outfall situated at Stream 3B

Figure 5-15 Left: Upper section of stream 3b (above existing outfall) showing remanent features of stream channel colonised by terrestrial vegetation. Right: Lower section of stream 3b showing pool and evidence of stream channel with permanent flow.

5.4 Summary of Ecological Value

The ecological value of ecological features present within EB2 and EB3R is summarised below in Table 5-7.

Table 5-7 Summary of the ecological value of ecological features present within EB2 and EB3R

Ecological Feature	Ecological Value	Location
Terrestrial habitat		
TL.1 – Native dominated treeland	Moderate	EB2 and EB3R
TL.2 – Mixed native and exotic vegetation	Moderate	EB2 and EB3R
TL. 3 – Exotic-dominated treeland	Moderate	EB2 and EB3R
PL.1 – Planted vegetation	Moderate	EB2 and EB3R
ES – Exotic Scrub	Low	EB2 and EB3R
EG – Exotic grassland includes mown and rank grasses	Low	EB2 and EB3R
Fauna		
Native birds	Low	EB2 and EB3R
Native herpetofauna	High	EB2 and EB3R
Wetland features		
Wetland 1	Low	EB2
Wetland 2	Moderate	EB2
Freshwater features		
Stream 1	n/a – stream within CMA, covered in Marine Ecology and	EB2

Ecological Feature	Ecological Value	Location
	Coastal Avifauna Effects Assessment	
Stream 2	n/a – stream values not defined as works are permitted	EB3R
Stream 3a		EB3R
Stream 3b		EB3R

6.0 Assessment of Ecological Effects

Chapter Summary

This chapter summarises the potential effects of the construction and operational phases of EB2 and EB3R prior to mitigation.

*Construction of EB2 and EB3R has impacts on lizards (and their habitat) and birds that are **Moderate** or higher, as such mitigation is required. Other construction effects on ecological features are considered to be **Very low** to **Low**.*

*Operational effects of EB2 and EB3R on terrestrial and wetland ecological values are considered to be **Very low** to **Low** based on embedded controls.*

6.1 Construction

6.1.1 Eastern Busway 2 – Terrestrial and Wetland Ecology

The proposed construction activities have the potential to impact on ecological features within and adjacent to the Project area without mitigation. A project description is provided in Section 2.0, with specific project elements that are relevant to the assessment of ecological effects provided in Section 3.2. The following tables presents the assessment of ecological effects on **terrestrial** and **wetland** ecological features for the construction of EB2 (Table 6-1).

Table 6-1 Magnitude of effects and subsequent level of effects (without mitigation) from the Project construction activities upon ecological features present within the EB2 Project area.

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
Terrestrial Vegetation						
1a. Direct	Loss of vegetation including PL.1 Planted vegetation TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub EG. Rank grass	High - Low	Permanent and temporary loss of habitat/ecosystem fragmentation and edge effects due to vegetation removal	Low	Permanent loss of vegetation (0.76 ha in total), unlikely to deviate from the underlying character, composition and attributes of the existing baseline terrestrial habitat and will be similar to pre-development circumstances. Temporary loss of vegetation around stormwater outfalls*.	Low – Very low
Terrestrial - Avifauna and Lizards						
2a. Direct	Native birds utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub PL.1 Planted vegetation	Low	Permanent loss of bird habitat (foraging and breeding) through vegetation removal	Low	The majority of the birds recorded within the vicinity of EB2 are Exotic and 'Not Threatened' native species. Species are urban-adapted. Loss of terrestrial vegetation may result in temporary disruption only to foraging and dispersal behaviour of resident bird populations during construction. Due to the available habitat in the areas adjacent to the Project footprint and the small area of canopy vegetation to be removed, it is likely that the underlying character, composition and attributes of the existing baseline terrestrial habitat will be similar to pre-development circumstances.	Very low

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
3a. Direct	Native birds utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub PL.1 Planted vegetation	Low	Fragmentation of bird habitat and loss of connectivity	Low	Due to the available habitat in the areas adjacent to the Project footprint and the small area of canopy vegetation to be removed, it is likely that the underlying character, composition and attributes of the existing baseline terrestrial habitat will be similar to pre-development circumstances.	Very low
4a. Direct	Native lizards assumed to be utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub PL.1 Planted vegetation EG. Rank grass	High	Permanent loss of lizard foraging and breeding habitat through vegetation removal.	Moderate	Construction will result in the permanent loss of favourable lizard habitat (0.34 ha). Removal of habitat will permanently reduce foraging and breeding habitat for “At Risk-Declining” lizards that are assumed to be present in the Project area. The permanent loss of habitat is likely to reduce overall resources available to the population. (There will be temporary loss of lizard habitat around stormwater outfalls that is temporary and reversible and unlikely to permanently deviate from baseline conditions*.)	High

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
5a. Direct	Native Lizards assumed to be utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub PL.1 Planted vegetation RK. Rank grass	High	Fragmentation of lizard habitat and loss of connectivity.	Low	Removal of habitat will further fragment habitat for "At Risk-Declining" lizards in the Project area. However, habitat fragmentation is unlikely to deviate from baseline conditions as habitat will remain along the southern riparian zones along the Pakuranga highway and adjacent reserves.	Low
6a. Direct	Native birds utilising habitat	Low	Kill or injure individual during vegetation removal	Very high	Killing or injuring native species is considered an unacceptable effect.	Moderate
7a. Direct	Native lizards assumed to be utilising habitat	High	Kill or injure individual during vegetation removal/earthworks	Very high	Killing or injuring native species is considered an unacceptable effect.	Very high
8a. Indirect	Native birds utilising habitat	Low	Construction disturbance resulting from elevated noise, light and dust may result in disruption to dispersal and nest abandonment.	Negligible	Terrestrial avifauna present are urban-adapted and exposed to predisposing road user effects. It is expected there will be a minor shift from baseline conditions.	Very Low

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
9a. Indirect	Native lizards assumed to be utilising habitat	High	Construction disturbance resulting from elevated noise, light and dust may result in disruption to normal behaviours.	Negligible	The level of disturbance (noise, light and vibration) is expected to temporarily increase during construction. For example, earthworks and any pile driving, or night work may result in the temporary loss of habitat quality, disruption or dispersal. However, disturbance to these species is considered temporary, both at a local and population level. Any herpetofauna that may be present will be urban-adapted and exposed to predisposing road user effects. It is expected there will be a minor shift from baseline conditions.	Very Low
Wetlands						
10a. Indirect	Wetlands WL 1 and WL 2	Moderate and Low	Uncontrolled discharge (sediment, chemical spills) from stormwater outfall construction works leading to habitat and water quality degradation. • WL 1 is located 51.8 m from the construction of outfall 8/11 (outlet 06-05) and 20m from the busway footprint • WL 2 is 89.3 m from the construction of outfall 8/11 (outlet 89-18) and 40m from the busway footprint.	Negligible	New outfalls are being constructed adjacent/downslope of wetlands and setback from wetlands is over 10m. The effects assessment assumes the successful implementation of embedded controls such as erosion and sediment controls** and bunded chemical storage. Effective implementation of best practice management will reduce the frequency, duration and probability of this effect occurring. Temporarily elevated sediment discharge may still occur during construction. However, wetlands are located within high sediment laden zones (Tāmaki Estuary). Temporarily elevated sediment discharge is unlikely to affect the current ecological value of the wetland system.	Very Low

* Embedded controls for the temporary loss of vegetation associated with the construction of stormwater outfalls (both existing and new) include the replanting of suitable native planting mixes for the Auckland region. Planting specifications are detailed in the Landscape, Ecological and Arboricultural Mitigation plans (Natural Character, Landscape and Visual Effects Assessment, Appendix 3).

** Embedded controls for surface water will be managed in general accordance with Auckland Council Erosion and Sediment Control Guidelines (GD05). The Erosion and Sediment Control Plan (ESCP) has been prepared and this will be further developed by the contractor and certified by Auckland Council prior to site clearance works. The sediment control measures will include:

- Appropriate staging of works
- Silt fences
- Clean and dirty water diversion bunds
- Decanting earth bund systems
- Flocculant chemicals
- Stabilisation measures, mulching, grass seeding
- Filter protection around stormwater catch pits.

Where possible, existing surface water runoff from the roadways will be diverted away from the construction site and into the existing network drainage system or existing surface overflow paths. Silt fences will manage the sediment run-off within the construction zones. Adherence to best practice erosion and sediment control plans during construction will reduce any unwarranted additional effects.

6.1.1.1 Freshwater Ecology

Project effects on streams (Stream 1) present within the ZOI of EB2 are related to the marine environment and as such have been considered in the Marine Ecology and Coastal Avifauna Effects Assessment.

6.1.1.2 Indirect Effects

Further potential **indirect effects** associated with EB2 include:

- Creation of dispersal corridors for invasive plant species and increased weed incursion
- Potential alteration to soil physiochemical properties (pH, salinity, moisture content and nutrient contents) leading to shifts to exotic plant communities (Lee & Power, 2013)
- Earthworks may also result in elevated airborne dust. There is a risk that this may have an adverse effect on native vegetation adjacent to the Project footprint by affecting their ability to photosynthesise.

These effects are considered **Negligible** and will be dealt with through construction best practice for example the Erosion Sediment Control Plan and Landscape Plans for the Project. As such they were not considered further in accordance with the EIANZ guidelines.

Positive indirect effects on terrestrial vegetation may include native replanting proposed as part of landscaping (refer to Natural Character, Landscape and Visual Effects Assessment).

6.1.2 Eastern Busway 3R – Terrestrial Ecology

The proposed construction activities have the potential to impact on ecological features within and adjacent to the EB3R area without mitigation. A project description is provided in Section 2.0, with specific project elements that are relevant to the assessment of ecological effects provided in Section 3.2. The following tables presents the assessment of ecological effects on **terrestrial** ecological features for the construction of EB3R (Table 6-2).

No wetland habitat was identified within the ZOI of EB3R.

Table 6-2 Magnitude of effects and subsequent level of effects (without mitigation) from the Project construction activities upon ecological features present within the EB3R Project area.

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
Terrestrial Vegetation						
1b. Direct	TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub EG. Rank grass	High - Low	Permanent and temporary loss of habitat/ecosystem fragmentation and edge effects due to vegetation removal	Low	Permanent loss of vegetation (0.43 ha in total), unlikely to deviate from the underlying character, composition and attributes of the existing baseline terrestrial habitat and will be similar to pre-development circumstances. Temporary loss of vegetation around stormwater outfalls. *	Low – Very low
Terrestrial - Avifauna and Lizards						
2b. Direct	Native birds utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub	Low	Permanent loss of bird habitat (foraging and breeding) through vegetation removal.	Low	The majority of the birds recorded within the vicinity of EB2 are Exotic and 'Not Threatened' native species. Species are urban-adapted and considered of **Low** ecological value (Section 5.1.5). Loss of terrestrial vegetation may result in temporary disruption to foraging and dispersal behaviour of resident bird populations during construction. Due to the available habitat in the areas adjacent to the Project footprint and the small area of canopy vegetation to be removed, it is likely that the underlying character, composition and attributes of the existing baseline terrestrial habitat will be similar to pre-development circumstances.	Very low

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
3b. Direct	Native birds utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub	Low	Fragmentation of bird habitat and loss of connectivity.	Low	Due to the available habitat in the areas adjacent to the Project footprint and the small area of canopy vegetation to be removed, it is likely that the underlying character, composition and attributes of the existing baseline terrestrial habitat will be similar to pre-development circumstances.	Very low
4b. Direct	Native lizards assumed to be utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub EG. Rank grass	High	Permanent loss of lizard foraging and breeding habitat through vegetation removal.	Moderate	Construction will result in the permanent loss of lizard habitat (0.09 ha). Removal of habitat will permanently reduce foraging and breeding habitat for “At Risk-Declining” lizards assumed to be present in the Project area. The permanent loss of habitat is likely to reduce overall resources available to the population. (There will be temporary loss of lizard habitat around stormwater outfalls that is temporary and reversible and unlikely to permanently deviate from baseline conditions*.)	High

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
5b. Direct	Native Lizards assumed to be utilising habitat provided by TL.1 Native vegetation TL.2 Mixed native and exotic treeland TL.3 Exotic treeland ES. Exotic scrub EG. Rank grass	High	Fragmentation of lizard habitat and loss of connectivity.	Low	Removal of habitat will further fragment habitat for "At Risk-Declining" lizards in the Project area. However, habitat fragmentation is unlikely to largely deviate from baseline conditions as habitat will be retained along the southern riparian zones along the Pakuranga highway and adjacent reserves.	Low
6b. Direct	Native birds utilising habitat	Low	Kill or injure individual during vegetation removal	Very high	Killing or injuring native species is considered unacceptable and a major alteration from baseline conditions.	Moderate
7b. Direct	Native Lizards assumed to be utilising habitat	High	Kill or injure individual during vegetation removal/earthworks	Very high	Killing or injuring native species is considered an unacceptable effect	Very High
8b. Indirect	Native birds utilising habitat	Low	Construction disturbance resulting from elevated noise, light and dust may result in disruption to dispersal and nest abandonment.	Negligible	Terrestrial avifauna present are urban-adapted and exposed to predisposing road user effects. It is expected there will be a minor shift from baseline conditions.	Very Low

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
9b. Indirect	Native lizards assumed to be utilising habitat	High	Construction disturbance resulting from elevated noise, light and dust may result in disruption to normal behaviours.	Negligible	The level of disturbance (noise, light and vibration) is expected to temporarily increase during construction. For example, earthworks and any pile driving, or night work may result in the temporary loss of habitat quality, disruption to dispersal. However, disturbance to these species is considered temporary, both at a local and population level. Herpetofauna present are urban-adapted and exposed to predisposing road user effects. It is expected there will minor shift from baseline conditions.	Very Low

* Embedded controls for the temporary loss of vegetation associated with the construction of stormwater outfalls (both existing and new) includes the replanting of suitable native planting mixes for the Auckland region. Planting specifications are detailed in the Landscape, Ecological and Arboricultural Plans (Natural Character, Landscape and Visual Effects Assessment, Appendix 3).

6.1.2.1 Freshwater Ecology

Project effects in relation to the stormwater outfall upgrades on streams present within the ZOI of EB3R (Streams 2, 3a and 3b) will meet the permitted activity criteria under Chapter E3 of the AUP(OP). As such they have not been assessed any further in this construction ecological effects assessment.

6.1.2.2 Indirect Effects

Further potential **indirect effects** on terrestrial ecology associated with EB3R include:

- Creation of dispersal corridors for invasive plant species and increased weed incursion
- Potential alteration to soil physiochemical properties (pH, salinity, moisture content and nutrient contents) leading to shifts to exotic plant communities (Lee & Power, 2013)
- Earthworks may also result in elevated airborne dust. There is a risk that this may have an adverse effect on native vegetation adjacent to the Project footprint by affecting their ability to photosynthesise.

These effects are considered **Negligible** and will be dealt with through construction best practice for example the Erosion Sediment Control Plan and Landscape, Ecological and Arboricultural Plans (Natural Character, Landscape and Visual Effects Assessment, Appendix 3) for the Project. As such they were not considered further in accordance with the EIANZ guidelines.

Positive indirect effects on terrestrial vegetation may include native replanting proposed as part of landscaping (Landscape, Ecological and Arboricultural Plans (Natural Character, Landscape and Visual Effects Assessment, Appendix 3).

6.2 Cumulative Construction Effects

The Eastern Busway ZOI is located within an area that is subject to considerable urban development and pre-disposing anthropogenic effects. Cumulative effects from the construction of the Project are likely to result in minor shifts away from baseline conditions. However, there will be removal of native and exotic vegetation that provides habitat for terrestrial avifauna and herpetofauna. The majority of the birds recorded within the vicinity of the Project area are Exotic and 'Not Threatened' native species. Avifauna are urban-adapted and considered of low ecological value. However, potential habitat has been identified for "At- Risk-Declining" lizard species. The cumulative removal of vegetation is likely to result in a moderate magnitude of effect, owing to the loss of connectivity and habitilised by terrestrial fauna. The overall cumulative effect associated with the loss of vegetation is low for avifauna and high for herpetofauna. However, provided mitigation and enhancement measures are in place, the anticipated residual effect is low.

There will be temporary disturbance to terrestrial fauna arising from elevated noise, artificial light, dust and vibration. However, the staged construction approach, naturally minimises temporary cumulative effects across the construction of the Project. Generally, terrestrial fauna within the Project ZOI are expected to be well-accustomed to urbanised environments and elevated temporary disturbances (noise, light, dust and vibration). As such the Project's staged construction is likely to lead to only low levels of effects. Further, freshwater habitats including wetlands and riparian margins are situated in highly disturbed environments and sediment laden zones (i.e. the Tāmaki Estuary). The ESCP states that operational sediment load is expected to be low, so sediment loads are unlikely to deviate from ecological baseline conditions. However, there may be an elevated risk of accidental sediment and contaminant spills due to the proximity of works to freshwater environments. Provided precautionary best practice construction management is followed, the cumulative construction effects are considered to be low.

6.3 Operational Effects

6.3.1 Eastern Busway 2 – Terrestrial and Wetland Ecology

The operation of EB2 has the potential to impact on ecological features within and adjacent to the EB2 area, without mitigation. A project description is provided in Section 2.0, with specific project elements that are relevant to this assessment of ecological effects provided in Section 3.2. Operational effects on ecological features are discussed below (Table 6-3).

Table 6-3 Magnitude of effects and subsequent level of effects (without mitigation) from the Project operational activities upon ecological features present within the EB2 Project area.

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
Avifauna						
1a. Indirect	Disturbance or displacement to native fauna (birds, lizards) from operational activities.	Low - High	Disturbance or displacement to avifauna from increased traffic flows and artificial light.	Low	The Project and adjacent land uses are located within an environment that has been highly modified from residential/commercial development and is subject to high predisposing road user effects. Current faunal assemblages are expected to be well accustomed to high levels of operational disturbances associated with roading (i.e., noise, vibration and lighting). Given the predisposing road user effects and the minor loss of connecting habitat, the Project is unlikely to result in disturbance that deviates from existing conditions.	Very Low - Low

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
Wetlands						
1b. Indirect	Wetland WL 1	Low	Project effects associated with changes to stormwater discharge (contaminants and sediment) from the existing upslope stormwater outlet.	Negligible	The existing stormwater network/outlet is currently discharging runoff into the wetland location. The Project aims to minimise the effects of stormwater discharges on the freshwater receiving environment through use of Water Sensitive Design systems, as well as preventing further erosion issues associated with stormwater discharge. In this regard, the underlying character, composition and attributes of the existing baseline wetland habitat will be similar to pre-development circumstances. The proposed stormwater system is expected to improve the overall quality of the stormwater discharged from the roadway via stormwater management and treatment. Therefore, the resulting change will only cause a very minor shift away from the existing baseline.	Very Low Potential **positive** effect may include: Treatment of stormwater runoff in areas where current treatment is ineffective.
1c.	Wetland WL 1	Low	Project effects associated with changes to stormwater discharge (flow/volume) from the existing upslope stormwater outlet altering wetland hydrology	Low	Wetland WL1 is already subject to existing stormwater effects and fluctuating hydrological circumstances (e.g., high rainfalls and drought). The underlying character, composition and attributes of the existing baseline wetland habitat will be similar to pre-development circumstances based on the design in which the stormwater discharge will remain relatively unchanged.	Very Low

6.3.1.1 Freshwater Ecology

Operational Project effects on streams present within the ZOI of EB2 are predominantly related to the marine environment and as such have been considered in the Marine Ecology and Coastal Avifauna Effects Assessment. None of the new stormwater outfalls are considered to create a barrier to fish passage because there is no upstream fish habitat.

6.3.2 Eastern Busway 3R – Terrestrial Ecology

The operation of EB3R has the potential to impact on ecological features within and adjacent to the project area, without mitigation. A project description is provided in Section 2.0, with specific project elements that are relevant to this assessment of ecological effects provided in Section 3.2. Operational effects on ecological features are discussed in the table below.

No wetland habitat was identified within the EB3R ZOI so there are no features to include in this assessment.

Table 6-4 Magnitude of effects and subsequent level of effects (without mitigation) from the Project operational activities upon ecological features present within the EB3R Project area.

Effect No.	Ecological Feature	Ecological value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of effect Without Mitigation
Avifauna						
2a. Indirect	Disturbance or displacement to native fauna (birds, lizards) from operational activities.	Low - High	Disturbance or displacement to native fauna (birds, lizards) from increased traffic flows and artificial light.	Low	The Project and adjacent land uses are located within an environment that has been highly modified from residential/commercial development and is subject to high predisposing road user effects. Current faunal assemblages are expected to be well accustomed to high levels of operational disturbances associated with roading (i.e., noise, vibration and lighting). Given the predisposing road user effects and the minor loss of connecting habitat, the Project is unlikely to result in disturbance characteristic that deviate from existing conditions.	Very Low - Low

6.3.2.1 Freshwater Ecology

Operational Project effects on streams present within the ZOI of EB3R have not been considered within this section because the stormwater upgrades are considered to meet the permitted activity status requirements outlined within Chapter 3 of the AUP(OP).

6.4 Cumulative Operational Effects

The Eastern Busway ZOI is located within an area subject to considerable urban development and pre-disposing anthropogenic effects. Cumulative effects from the operation of the Project are likely to result in only minor shifts away from baseline conditions. Operational disturbance to terrestrial fauna (avifauna and herpetofauna) is related to the adverse effects that may arise from elevated noise from increased traffic flows and artificial light from the vicinity of the busway. The majority of the birds recorded within the vicinity of the Project area are Exotic and 'Not Threatened' native species. Avifauna are urban-adapted and considered of low ecological value. However, potential habitat has been identified for "At- Risk-Declining" lizard species. Current faunal assemblages are expected to be well accustomed to high levels of operational disturbances associated with roading (i.e., noise, vibration and lighting). Given the predisposing road user effects and the minor loss of connecting habitat, the Project is unlikely to result in disturbance characteristics that deviate from existing conditions. As such cumulative operational effects to terrestrial fauna are considered **Very Low.**

The creation of impervious surfaces within the Project ZOI are expected to have catchment-wide stormwater effects. For example, streams and coastal marine habitats within the wider Project area and the additional impervious surfaces may result in elevated runoff, increasing flow velocities within streams and their receiving environments. This can lead to scouring of riparian margins, resulting in increased sediment loads which can disrupt gill function and feeding abilities of aquatic fauna. Freshwater habitats including wetlands and riparian margins within the Project ZOI are already highly disturbed environments and situated in sediment laden zones (Tāmaki Estuary). Therefore, stormwater effects associated with additional impervious layers across the Project are unlikely to result in significant shifts from baseline conditions. Further, the Project aims to minimise the effects of stormwater discharges on the freshwater receiving environment through use of Green Infrastructure, as well as preventing further erosion issues associated with stormwater discharge. The proposed stormwater system is expected to improve the overall quality of the stormwater discharged from the roadway via stormwater management and treatment devices. Therefore, from an ecological perspective the resulting change will only cause a very minor shift away from existing baseline conditions. As such, with consideration to proposed stormwater upgrades, the cumulative level of effect is considered **Very Low**.

7.0 Impact Management and Residual Effects Assessment

Chapter Summary

The Project has integrated design features to avoid and minimise adverse effects where practicable; however, there will be some impacts on terrestrial ecology that cannot be avoided and will require mitigation (in accordance with EIANZ, 2018).

In summary, mitigation includes the following, and which will form a condition of consent:

- *Preparation and implementation of a Lizard Management Plan which details lizard salvage and relocation requirements by a permitted herpetologist.*
- *Programming of work to avoid the bird nesting season (September to February) or if this isn't possible, then pre-construction nesting bird surveys of vegetation for clearance must occur*
- *Address residual effects by compensating for the loss of lizard habitat at EB2 and EB3R through 1.15 ha and 0.30 ha of habitat replacement/enhancement. This will be detailed within a Habitat Restoration Plan.*

*Provided the mitigation and offset/compensation measures outlined in this assessment are implemented and best-practice construction measures are followed the anticipated residual ecological effects are considered to be **Very low**.*

7.1 Eastern Busway 2 – Mitigation

This section outlines the mitigation requirements for the actual and potential effects from EB2 outlined in Table 6-3. In accordance with the EIANZ guidelines (2018) measures to avoid, remedy or mitigate effects is focused on ecological features where the level of effect was assessed to be **Moderate, High** or **Very high**.

An options assessment process was undertaken whereby the Project has aimed to avoid ecological features of value. The remaining ecological effects that have been identified to require mitigation is the permanent loss of herpetofauna habitat (Table 6-3 Effect No. 4a), which resulted in a **High** level of effect and risk of killing or injuring native birds and lizards during vegetation removal (Table 6-3 Effect No. 6a and 7a), which resulted in a **Moderate** and **Very high** level of effect. Mitigation with respect to birds and lizards is presented below and also ensures compliance with the Wildlife Act 1953.

7.1.1 Birds (Effect No. 6a)

The Project area is likely to contain "Not Threatened" indigenous birds. Although of low value, vegetation clearance of TL.1 Native vegetation TL.2, Mixed native and exotic treeland, TL.2 Exotic treeland and PL.1 Planted vegetation should be avoided (where practicable) within the bird nesting season (September – February). A condition has been included in the conditions set requiring that a pre-construction nesting bird survey is undertaken if vegetation removal is to occur within the nesting season to avoid unintentional injury or mortality to native birds.

7.1.2 Lizards (Effect No 4a and 7a)

There is the potential for indigenous lizard species (Copper Skink and Ornate skink) to be present within the Project area, within the understory of TL.1 Native vegetation TL.2, Mixed native and exotic treeland, TL.2 Exotic treeland and PL.1 Planted vegetation (including unmaintained rank grasses). There is the potential that clearance required for construction may result in mortality or injury to indigenous lizard species. Lizard salvage and relocation will be required prior to any vegetation removal and be undertaken from September to April, inclusive by an appropriately permitted herpetologist. A Draft Lizard Management Plan has been developed which details this and other management controls and is included in EB2 AEE Appendix 18 and EB3R AEE Appendix 17.

The loss of 0.34 ha of lizard habitat cannot be mitigated at the point of impact, as such it remains a residual effect and requires offset or compensation.

7.2 Eastern Busway 3R– Mitigation

This section outlines the mitigation requirements for the actual and potential effects from EB3R detailed in Table 6-4. In accordance with the EIANZ guidelines (2018) measures to avoid, remedy or mitigate effects is focused on ecological features where the level of effect was assessed to be **Moderate, High** or **Very high**.

An options assessment process was undertaken whereby the Project has aimed to avoid ecological features of value. The remaining ecological effects that have been identified to require mitigation is the permanent loss of herpetofauna habitat (Table 6-4 Effect No. 4b), which resulted in a **High** level of effect and risk of killing or injuring native birds and lizards during vegetation removal (Table 6-4 Effect No. 6b and 7b), which resulted in a **Moderate** and **Very high** level of effect. Mitigation with respect to birds and lizards is presented below and also ensures compliance with the Wildlife Act 1953.

7.2.1 Birds (Effect No. 6b)

The Project area is likely to contain "Not Threatened" indigenous birds. Although of low value, vegetation clearance of TL.1 Native vegetation TL.2, Mixed native and exotic treeland, TL.2 Exotic treeland and PL.1 Planted vegetation should be avoided (where practicable) within the bird nesting season (September – February). A condition has been included in the conditions set requiring that a pre-construction nesting bird survey is undertaken if vegetation removal is to occur within the nesting season to avoid unintentional injury or mortality to native birds.

7.2.2 Lizards (Effect No. 4b and 7b)

Potential habitat for indigenous lizard species has been identified within the Project area and as such there is the potential for Copper Skink and Ornate skink to be present within the understory of TL.2, Mixed native and exotic treeland, TL.2 Exotic treeland, PL.1 Planted vegetation, including unmaintained rank grasses. There is the potential that clearance required for construction may result in mortality or injury to indigenous lizard species. Lizard salvage and relocation will be required prior to any vegetation removal and should be undertaken from September to April inclusive by an appropriately permitted herpetologist. A Draft Lizard Management Plan (LMP) has been developed which details this and other management controls.

The loss of 0.09 ha of lizard habitat cannot be mitigated at the point of impact, as such it remains a residual effect and requires offset or compensation .

7.3 Eastern Busway 2 and Eastern Busway 3R – Residual Effects Management

7.3.1 Biodiversity Compensation Model

The BCM has been applied to determine the compensation requirements for residual effects relating to the loss of lizard habitat on EB2 and EB3R. The loss of rank grass is included in the extent of lizard habitat loss owing to the habitat provided by tree-land understory and edges. Thus, the model input data includes the loss of native dominated treeland, mixed native and exotic treeland, exotic treeland, planted vegetation. Further information on the BCM criteria and detailed inputs in regard to the model are provided in Appendix 4.

Model outputs to compensate for the loss of lizard habitat for EB2 and EB3R are summarised below (see Appendix 6 for model inputs).

7.3.2 Lizard habitat replacement

Approximately **0.34 ha** and **0.09 ha** of vegetation (native and exotic) would be lost under the footprint at EB2 and EB3R (respectively), that is assumed to provide lizard habitat.

- The total planting required to compensate for lizard habitat loss associated with EB2 is **1.15 ha**.
- The total planting required to compensate for lizard habitat loss associated with EB3R is **0.3 ha.**

Compensation to address these residual effects on lizard habitat loss related to EB2 and EB3R will be undertaken through habitat restoration and enhancement measures, which will be detailed in the proposed Habitat Restoration Plan which is required to be prepared by the Project conditions.

Provided the Habitat Restoration Plan is implemented, the residual effects associated with the loss of habitat to lizards will be addressed.

7.3.3 Habitat Restoration Plan

Preliminary locations for lizard habitat restoration have been identified and were selected based upon the proximity to the Project area, future development effects and ability to enhance existing connections for lizards. These areas are shown on plans in Appendix 8 (full set is located in the plans included in the Natural Character, Landscape and Visual Effects Assessment, Appendix 3). Lizard relocation areas (as required within the Draft LMP (Appendix 7)) are also shown. These sites will collectively cover lizard habitat area compensation requirements for EB2 (1.15 ha) and EB3R (0.30 ha) and include:

- SEART (Pakuranga Highway)
- Riverhills Park.

The Draft LMP (Appendix 7) includes guidance on the type of planting and supplementary refuges required to enhance habitats for lizards.

A Habitat Restoration Plan will be developed to detail the restoration required to compensate for the loss of lizard habitat. Restoration will be site specific depending on the location. The Plan requirements are detailed in the project conditions and include:

- Identification of areas to be restored as lizard habitat to confirm the quantum of habitat compensation/offset required to achieve no net loss/net gain
- Detail of the restoration required at each site to replace and enhance lizard habitat including the planting design (including vegetation to be retained), and supplementary refuges
- Details of fencing to protect and demarcate plantings (where appropriate)
- A programme of establishment and post establishment protection and maintenance of plants (fertilising, weed removal/spraying, replacement of dead/poorly performing plants, watering to maintain soil moisture, maintenance programme). All plantings shall be maintained for 10 years
- Details of the proposed plant species, plant sourcing (locally EcoSourced native pioneer species that are adapted to the Auckland environment are preferred in the first instance), plant sizes at time of planting, plan of the planted area within the planting area required, density of planting, and timing of planting.

8.0 Recommendations and Conclusions

By design, the Project avoids major loss of vegetation, wetland and freshwater habitat. Effects are further minimised by the implementation of best practice construction methods and embedded controls including:

- Minimising disruption and unnecessary removal of vegetation throughout the Project
- Replanting around stormwater outfalls where temporary vegetation clearance has occurred
- Ensure stormwater discharge flows/volumes to Wetland 1 are maintained
- Best-practice site construction management practices for sediment, dust and erosion control as well as storage of hazardous materials
- Meeting Chapter 3 AUP (OP) permitted activity standards in relation stormwater outfall upgrades.

Project effects have been assessed and some require mitigation. In line with EIANZ (2018) this has been recommended where the level of effect is assessed to be **Moderate** or above. In summary, mitigation includes and has been included as conditions of consent:

- Preparation and implementation of a Lizard Management Plan which details lizard salvage and relocation requirements by a permitted herpetologist.
- Programming of work to avoid the bird nesting season (September to February) or if this isn't possible, then pre-construction nesting bird surveys of vegetation for clearance must occur
- Address residual effects by compensating for the loss of lizard habitat at EB2 and EB3R through **1.15 ha** and **0.30 ha** of habitat replacement/enhancement. This will be detailed within a Habitat Restoration Plan.

Provided the mitigation and offset/compensation measures outlined in this assessment are implemented and best-practice construction measures are followed the anticipated residual ecological effects are considered to be **Very low**.

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Appendix 1 Summary of EcIA Assessment Methodology

The standard by which this assessment was undertaken follows the guidelines published by the Environment Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al. 2018).

The assessment involves the following key stages:

- Scoping;
  - Identification of the likely freshwater and terrestrial zone of influence; and
  - Identification and evaluation of ecological resources and features likely to be affected (existing environment).
- Identification of the biophysical changes likely to affect valued ecological resources and features and an assessment of whether these biophysical changes are likely to give rise to an adverse ecological impact;
- Refinement of the proposed development to incorporate ecological mitigation measures to avoid, minimise or compensate for any adverse impacts; and
- Assessment of cumulative effects.
- The likely zone of influence identified comprises:
  - An immediate zone of influence within the Project Area; and
  - A wider zone of influence extending to all areas/receptors outside the Project Area that could be affected by the proposed development.

A1.1 Assessment of Ecological Value

A1.1.1 Terrestrial and Freshwater habitat

The assessment methodologies used in this assessment follow the guidelines set by EIANZ (Roper-Lindsay et al. 2018) and uses a set of ecological attributes and conservation status to determine overall ecological value.

The ecological values of freshwater systems (riparian vegetation, habitats and species present) potentially impacted by the road widening were assessed against the following attributes:

- Representativeness.
- Rarity or distinctiveness.
- Diversity or pattern.
- Ecological context,

These attributes are described in more detail in the EIANZ Guidelines (Roper-Lindsay et al. 2018) and differ slightly for terrestrial and freshwater systems. These attributes align with DOC assessment criteria (Davis et al. 2016).

The terrestrial and freshwater habitat features recorded during the site investigations were assessed considering each of the attributes. To avoid suppressing potential impacts on individual components, features of interest were subjectively given a rating on a scale of 'Very Low' to 'High' for each attribute and assigned a value in accordance with the description provided in Table A-1.

Table A-1 Rating system for assessing ecological value of terrestrial and freshwater systems (Roper-Lindsay et al. 2018).

Description	Value
Feature rates **Very Low** for at least three assessment attributes and **Low** to **Moderate** for the remaining attribute(s).	Negligible

Feature rates **Very Low** to **Low** for most assessment attributes and **Moderate** for one.	Low
Feature rates **High** for one assessment attribute and **Low** to **Moderate** for the remainder. OR The Project Area rates **Moderate** for at least two attributes and Very Low to **Low** for the rest. Likely to be important at the level of the Ecological District.	Moderate
Feature rates **High** for at least two assessment attributes and **Low** to **Moderate** for the remainder, OR The Project Area rates **High** for one attribute and **Moderate** for the rest. Likely to be regionally important.	High
Feature rates **High** for at least three assessment attributes. Likely to be nationally important.	Very High

A1.1.2 Species

Assigning value at the species level considered the threat class of the species considered to be present in areas potentially impacted by the Project (de Lange et al. 2018; Dunn et al. 2018; Hitchmough et al. 2016; O'Donnell et al. 2018; Robertson et al. 2013; Townsend et al. 2008). The ecological value of the species assessed was assigned in accordance with the information outlined in Table A-2.

Table A1-2 Attributes to consider when assessing ecological value at the species level (Roper-Lindsay et al. 2018; Townsend et al. 2008)

Threat Class	Threat Sub-class	Value
Exotic: Introduced and Naturalised	-	Negligible
Native: Common/Not threatened	-	Low
Native: Locally uncommon or distinctive species	Listed as 'Not threatened' nationally, but with a regionally elevated threat classification	Moderate
Native: At Risk	1. Naturally uncommon 2. Relict 3. Recovering	Moderate
	4. Declining	High
Native: Threatened	1. Nationally Critical 2. Nationally Endangered 3. Nationally Vulnerable	Very High

A1.2 Assessment of the Magnitude of Effects

The magnitude of effects is determined by the scale (temporal and spatial) of potential impacts identified and the degree of ecological change that is expected to occur as a result road widening (Roper-Lindsay et al. 2018).

Based on the assessor's knowledge and experience, the magnitude of identified impacts on the ecological values within the Project Area and zone of influence were assessed and rated on a scale of 'Negligible' to 'Very High' based on the description provided in Table 0-4.

Table A1-2 Criteria for describing the magnitude of effects (Roper-Lindsay et al. 2018

Description	Magnitude
Very slight change from existing conditions. Change barely distinguishable, approximating "no change"; and/or having negligible effect on the known population or range of the feature.	Negligible
Minor shift away from existing conditions. Change arising from the loss/alteration will be discernible, but underlying attributes will be similar to pre-development circumstances; and/or having a minor effect on the known population or range of the feature.	Low
Loss or alteration to one or more key features of the existing condition, such that post-development attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the feature.	Moderate
Major loss or alteration of key features of existing conditions, such that post-development attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the feature.	High
Total loss or very major alteration to key features of existing conditions, such that the post-development attributes will be fundamentally changed and may be lost altogether; and/or loss of a very high proportion of the known population or range of the feature.	Very High

Assessment also considered the temporal scale at which potential impacts were likely to occur:

- Permanent (>25 years).
- Long-term (15-25 years).
- Medium-term (5-15 years).
- Short-term (0-5 years).
- Temporary (during construction),

A1.3 Assessment of the Level of Effects

The overall level of effect on each ecological feature identified within the zone of influence were determined by considering the magnitude of effects and the values of impacted ecological features (Roper-Lindsay et al. 2018). Results from the assessment of ecological value and the magnitude of identified effects were used to determine the overall level of effects or extent on identified ecological features within the Project Area and the zone of influence using the matrix described in Table A-3.

Table A1-3 Matrix for determining the level of described ecological impacts (Roper-Lindsay et al. 2018)

Ecological Value						
Level of Effect		Negligible	Low	Moderate	High	Very High
Magnitude of impact	Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain
	Negligible	Very Low	Very Low	Very Low	Very Low	Low
	Low	Very Low	Very Low	Low	Low	Moderate
	Moderate	Very Low	Low	Moderate	High	High

Ecological Value						
Level of Effect		Negligible	Low	Moderate	High	Very High
	High	Very Low	Low	Moderate	Very High	Very High
	Very Higher	Low	Moderate	High	Very High	Very High

Results from the matrix were used to determine the type of responses that may be required to mitigate potential direct and indirect impacts within the Project Area and within the zone of influence, considering the following guidelines (Roper-Lindsay et al. 2018):

- A '**Low**' or '**Very Low'** level of impact is not normally of concern, though design should take measures to minimise potential effects.
- A '**Moderate**' to '**High**' level of impact indicates a level of impact that qualifies careful assessment on a case-by-case basis. Such activities could be managed through avoidance (revised design) or appropriate mitigation. Where avoidance is not possible, no net loss of biodiversity values would be appropriate.
- A '**Very High**' level of impact is unlikely to be acceptable on ecological grounds alone and should be avoided. Where avoidance is not possible, a net gain in biodiversity values would be appropriate.

A1.3.1 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.

Appendix 2 Terrestrial Habitat Value Assessment Methodology

Table A2-1 details the assessment criteria undertaken to assess key criteria in assessing Terrestrial vegetation value.

Table A2-1 Terrestrial habitat value assessment methodology

Ecological Matter	**Ecological Attribute and Rating**		
	Level	Rating	Description
Representativeness	**Typical structure and composition**		
	High	4	Habitat and species are unchanged from reference/baseline/ benchmark/potential conditions.
	Moderate	3	Habitat and species have been insignificantly affected by human activities.
	Low	2	Habitat and species have been affected by human activities.
	Very low	1	Habitat and species have been significantly altered by human activities.
	Indigenous representation		
	High	4	>90% of species are indigenous
	Moderate	3	50-90% of species are indigenous
	Low	2	10-50% of species are indigenous
	Very low	1	<10% of species are indigenous
Rarity/distinctiveness	**Species of conservation significance**		
	High	4	Nationally Threatened species, found in the ZOI either permanently or seasonally or Species listed as At Risk - Declining, found in the ZOI, either permanently or seasonally.
	Moderate	3	Species listed as any other category of At Risk, found in the ZOI, either permanently or seasonally/ or locally uncommon or distinctive species.
	Low	2	Nationally and locally common indigenous species.
	Very low	1	Exotic species, including pests, species having recreational value.
	Range of restricted or endemic species		
	High	4	Habitat known to sustain ≥ 95% of the global population of an endemic or restricted-range species

	Moderate	3	Habitat known to sustain ≥ 1% but < 95% of the global population of an endemic or restricted-range species.
	Low	2	More than one population (or taxon) judged to be unique at a local scale.
	Very low	1	No population (or taxon) judged to be unique at a local scale.
	Distinctive ecological values (ecosystem services)		
	Very High	4	Habitat playing an important role in provisional or regulatory ecosystem services typically on National scale.
	High	3	Habitat playing an important role in provisional or regulatory ecosystem services typically on a Regional scale.
	Moderate	2	Habitat playing an important role in provisional or regulatory ecosystem services typically on Catchment scale.
	Marginal	1	Habitat playing an important role in provisional or regulatory ecosystem services typically on Local scale.
	None	0	Habitat not playing an important role in provisional or regulatory ecosystem services at any scale.
Diversity and pattern	**Habitat** diversity		
	High	4	Rated on a National scale
	Moderate	3	Rated on a Regional scale
	Low	2	Rated on a Local scale
	Very low	1	Not significant at any scale
	Pattern in habitat use		
	High	4	Restricted habitat important for lifecycle completion or periodic habitat utilisation typically on a National scale.
	Moderate	3	Restricted habitat important for lifecycle completion or periodic habitat utilisation typically on a Regional scale.
	Low	2	Restricted habitat important for lifecycle completion or periodic habitat utilisation typically on a Local scale.
	Very low	1	Not significant at any scale
Ecological context	**Size shape and buffering**		
	High	4	Very high proportional representation original habitat type (>20%).

	Moderate	3	High proportional representation original habitat type (10-20%).
	Low	2	Moderate proportional representation original habitat type (5-10%).
	Very low	1	Low proportional representation original habitat type (<5%).
	None	0	No representation of original habitat type.
	Sensitivity to change (resilience)		
	High	4	Intact habitat with two or more of the following: (1) high species diversity (2) high guild diversity (3) a low dispersal ability (biome restricted species) (4) delayed succession.
	Moderate	3	largely intact habitat with one of the following: (1) high species diversity (2) high guild diversity (3) a low dispersal ability (biome restricted species) (4) delayed succession.
	Low	2	Moderately intact habitat with at least one of the following: (1) high species diversity (2) high guild diversity (3) a low dispersal ability (biome restricted species) (4) delayed succession.
	Very low	1	Moderately intact habitat with no residual sensitive receptors.
	None	0	Largely modified habitat.
	Ecological networks (linkages, pathways, migration)		
	High	4	Habitat is Nationally an important breeding and feeding link in terms of connectivity for the survival of species.
	Moderate	3	Habitat is Regionally an important breeding and feeding link in terms of connectivity for the survival of species.
	Low	2	Habitat is an important breeding and feeding link in terms of connectivity for the survival of species within the District.
	Very low	1	Habitat is locally an important breeding and feeding link in terms of connectivity for the survival of species.
	None	0	Habitat is not important in terms of connectivity for the survival of any species at any scale.
	Protected Status		
	High	4	Habitat or area is a designated a National category of protected status that reflects its importance for the conservation of ecological diversity at that scale.

	Moderate	3	Habitat or area within a Regional protected status or some other category of protected status that reflects its importance for the conservation of ecological diversity at that scale.
	Low	2	Habitat or area falls within a District protected status or some other category of protected status that reflects its importance for the conservation of ecological diversity at that scale.
	Very low	1	Habitat or area falls within a local reserve or some other category of protected status that reflects its importance for the conservation of ecological diversity a local scale.
	None	0	Habitat or area does not fall within any category of protected status that reflects its importance for the conservation of ecological diversity at any scale.

Appendix 3 Wetland Assessment Methodology and Wetland Value Assessment

A3.1 Hydrogeomorphic Unit

Conceptual model for different HGM units as applied within this assessment (Figure A4-1).

Hydrogeomorphic types		Description	Source of water maintaining the wetland[1]	
			Surface	Sub-surface
Floodplain		Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel		Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hillslope seepage		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans)		A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important output in all of the above settings

Water source: * Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on the local circumstances

*/ *** Contribution may be small or important depending on the local circumstances.

Wetland

Figure A4-1 The HGM classification according to Brinson (1993) and adopted from Kotze et al. (2007)

A3.2 Wetland Functional Value

Matrix outlining the likely presence of specific wetland functions associated with different wetland types (Table A4-1)

Table A4-1 Likely presence of different functional wetland values associated with different HGM units (Wetland and Types)

Variable	Early wet season flood attenuation	Late wet season flood attenuation	Stream flow regulation	Erosion control	Sediment trapping	Phosphate removal	Nitrate removal	Toxicants
Depression	Likely	Likely	Unlikely	Unlikely	Unlikely	Unlikely	Likely	Likely
Hillslope seep (Isolated)	Likely	Unlikely	Unlikely	Very Likely	Unlikely	Unlikely	Very Likely	Likely
Hillslope seep (Connected)	Likely	Unlikely	Likely	Very Likely	Unlikely	Unlikely	Very Likely	Very Likely
Unchanneled valley bottom	Likely	Likely	Unlikely	Very Likely	Very Likely	Likely	Likely	Very Likely
Channelled valley bottom	Likely	Unlikely	Likely	Very Likely	Likely	Likely	Likely	Likely
Floodplain	Very Likely	Likely	Unlikely	Very Likely	Very Likely	Very Likely	Likely	Likely

A3.3 Wetland Functional Value

Based on *Clarkson et al.,* (2003) handbook for monitoring wetland condition, to assess a range of external pressures which can lead to a decline in the health or condition of the wetland. For example, changes in hydrology, water pollution, nutrient enrichment, and invasion by weeds and pests can lead to biodiversity loss and impaired wetland functioning (Table A4-2). The wetland condition score was interpreted through wetland condition categories proposed by Kleynhans (2007) (Table A-8). These conditions where used to value the functional integrity of the wetland habitat and therefore provide a way to value the system with regards to the EIANZ Guidelines.

Table 4-2 Summary of aspects and components considered within the wetland condition assessment (Clarkson et al., 2004). The degree of modification was assessed using the following scoring 5 = very low/non, 4= low, 3 = medium, 2 = high, 1 = very high and 0 = extreme.

Impact indicator	Impact components
Hydrological integrity	Impact of manmade structure
	Water table depth
	Dryland plant invasion
Physico-chemical parameters	Fire damage
	Degree of sedimentation
	Nutrient levels
	Von Post index
Change in browsing, predation and harvesting regimes	Damage by domestic or feral animals
	Introduces predator impact on wildlife
	Harvesting levels
Change in dominance of native plants	Introduced plant canopy cover
	Introduced plant understory cover
Total wetland condition index/25	

Table A3-2 Key wetland pressures assessed within the catchment of the wetland (Clarkson et al. 2004). Pressure scores were assigned as follows: 5 = very high, 4 = high, 3 = medium, 2 = low, 1 = very low, 0 = none.

Pressure
Modification to catchment hydrology
Water quality within the catchment
Animal access
Key undesirable species
% catchment introduced vegetation
Other
Total catchment pressure index/30

Table A3-3 Wetland condition categories and associated descriptions used within this assessment.

Category Wetland Condition	Description	%
Unmodified	Unmodified/natural	100%
Largely natural	Largely natural with a few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota have taken place.	80 – 100%
Moderately	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	60 – 80%
Largely	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	40-60%
Seriously	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	20-40%
Critically	Critically modified. Modifications have rich a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	<20%

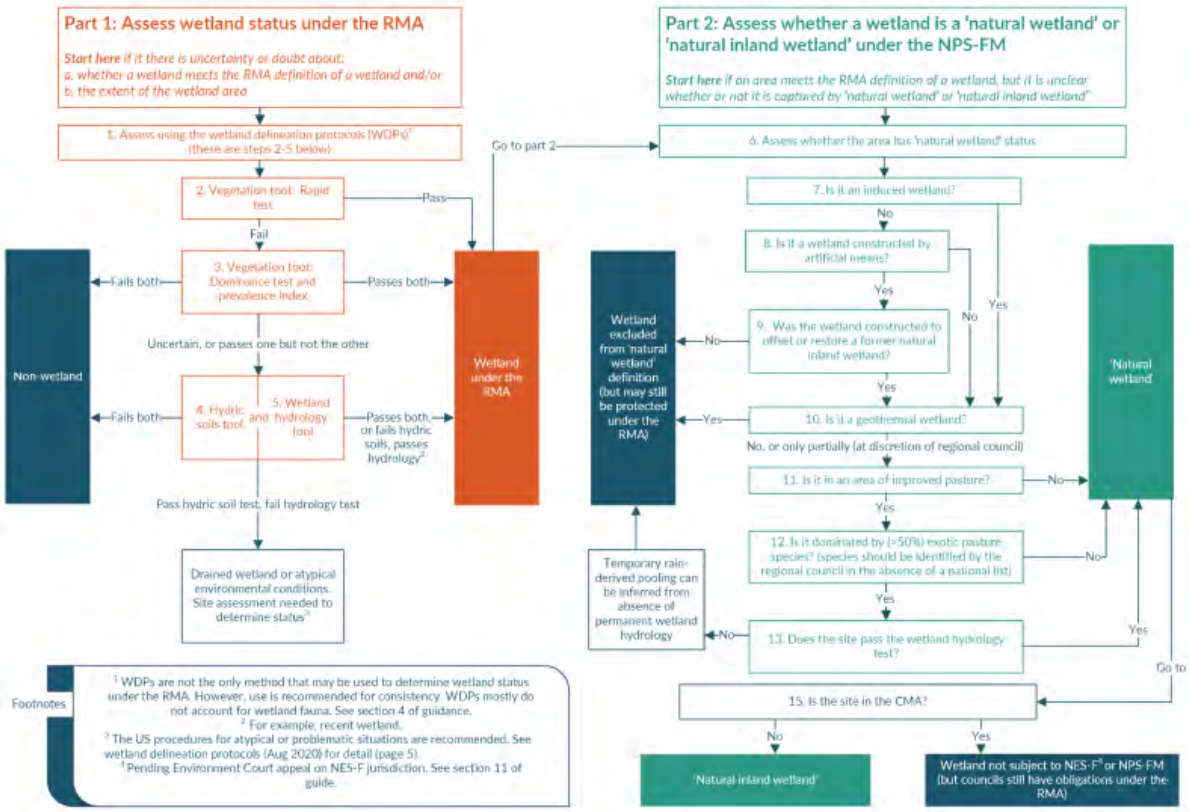


Figure A3-4 Criteria for defining natural wetland and natural inland wetland status under the NPS-FM taken from Mfe, 2021.

A3.4 Wetland Ecological Value Assessment

Table A5-3 details a summary of the impact indictor scores for wetland 1 (EW) and wetland 2 (WL10).

Table A5-3 Summary of impact indicator scores for each component included within the wetland condition assessment, including the overall wetland condition category for HGM1 assessed during April 2021.

Wetland impact indicator	Wetland 1 - Exotic (EW)	Wetland 2 - (WL10)
Hydrological integrity	2.7	4
Physico-chemical	2	3
Change in ecosystem intactness	3	3
Change in browsing, predation and harvesting regimes	3.5	3.5
Change in dominance of native plants	2	4.5
Wetland condition index /25	13.2	18
Condition Index (%)	52.67	72
Condition index category	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	Moderately modified. Ecosystem processes and loss of natural habitat has taken place, but the natural habitat remains predominantly intact.
Catchment pressures	1	1
Modification to catchment hydrology	4	4
Water quality within the catchment	4	4
Animal access	1	1
Key undesirable species	3	3
Catchment introduced vegetation	4	4
Catchment pressure index/25	16	16
Catchment condition (%)	36	36
Combined condition (%)	44	54
Overall wetland condition category	Largely modified	Largely modified

Table A5-4 below details all criteria for scoring the value of wetland habitat.

Table A5-4 EcIA criteria assessment of ecological value of Wetland 1 and Wetland 2

Attributes		Wetland feature	
		Wetland 1 (EW)	Wetland 2 (WL10)
Representativeness	Hydrological modification	2	2
	Physico-chemical modification	2	2
	Sediment and geomorphological modification	1	1
	Biota	1	3
	Wetland Conditions Index Score	2	2
	Score	**2**	**3**
Rarity/distinctiveness	Species of conservation significance	1	3
	Range restricted or endemic species	1	3
	Wetland type (rare or distinctive)	1	3
	Distinctive ecological values (ecosystem services) Larger context	1	1
	Score	**1**	**3**
Diversity and pattern	Diversity of habitat types	1	1
	Species diversity	1	1
	Score	**1**	**1**
Ecological context (Ecosystem services, importance and sensitivity)	Sensitivity to change in floods	1	1
	Sensitivity to change in baseflows (low flows)	1	1
	Sensitivity to change in water quality	1	1
	Flood attenuation	2	2
	Streamflow regulation	2	2
	Sediment trapping	2	2
	Phosphate assimilation	1	1
	Nitrate assimilation	3	3
	Toxicant assimilation	3	3
	Erosion control	3	3
	Carbon storage	1	1
	Connectivity and migration	1	1
	Protected status of the wetland	3	4
	Score	**3**	**4**

Appendix 4 Summary Biodiversity Compensation Model Methodology

A4.1 Overview

The BCMs are used instead of biodiversity offset models when quantitative data is not available or lacks adequate precision to determine if adverse effects can be demonstrably offset[4] (Baber et al., 2021a,b,c). This is almost always the case for plan change and resource consent applications that are based on future predictions rather than on real data that has been collected after compensation has been undertaken (Baber et al. 2021a,b).

The BCMs include the determination of a biodiversity value score (herein "value score") for habitats and/or species, both before and after impacts ("losses") and before and after implementation of proposed compensation action(s) ("gains"). These value scores are derived from the EcIA assessments of ecological effects. Specifically, the assessments of ecological value (before impacts) and magnitude of effect are as set out in the respective ecology reports. To this end, the value scores are based on a combination of site-specific field assessments, scientific literature and the professional judgement of project ecologists.

The BCM approach and methods are described in detail in the User Guide developed by Tonkin & Taylor Ltd (T+T) (Baber et al. 2021a).

A4.2 Advantages of BCMs

To date, determination of biodiversity compensation requirements for plan change or resource consent applications has been based solely on professional opinion and may include the use of compensation ratios or 'multipliers'. These approaches have increasingly been challenged due to a lack of transparency and rigour, and often ad-hoc application.

The general advantages of BCMs in comparison to these previous approaches are that BCMs provide greater transparency and rigour to the process of developing measures to address residual adverse effects on biodiversity through compensation actions at proposed compensation site(s). In doing so, the BCMs operate at the 'as close to offset as possible' end of the compensation continuum. This is termed 'biodiversity compensation' in the Draft National Policy Statement for Indigenous Biodiversity (NPSIB).

A4.3 Model limitations

In applying any biodiversity offset or compensation model, it is important to acknowledge the limitations, constraints and uncertainties associated with such models (Maseyk et al, 2018). Notably for BCMs, these limitations, constraints and uncertainties have the potential to generate false positives, i.e. instances where the models generate Net Gain outcomes when the converse is true (Baber et al, 2021b). Model inputs are conservative to minimise this risk, and NG target outcomes are also conservative, equating to a target of 10% exceedance of No Net Loss.

It is also important to recognise that as described above in A4.2, this approach is robust, provides transparency and a validation process for determining compensation requirements to address residual adverse effects.

[4] A biodiversity offset is a 'measurable conservation outcome' that meets certain principles and balances adverse residual effects that cannot reasonably be avoided, remedied or mitigated, to a NNL/ NG standard. While offsetting requires a measurable outcome that has been quantified through a robust and transparent process, biodiversity compensation does not necessarily need to be quantified and measurable.

Appendix 5 Terrestrial Ecological Observations and Value Assessment

A5.1 Eastern Busway 2 - Terrestrial Observations

Exotic shelterbelt (southern border of Pakuranga highway, facing north)

Exotic shelterbelt and road reserve (southern border of Pakuranga highway, facing north east)

Exotic shelterbelt and road reserve (southern border of Pakuranga highway, facing east)

Lizard habitat in the exotic shelterbelt understorey

Lizard habitat in the exotic shelterbelt understorey

Exotic shelterbelt (northern border of Pakuranga highway, facing north)

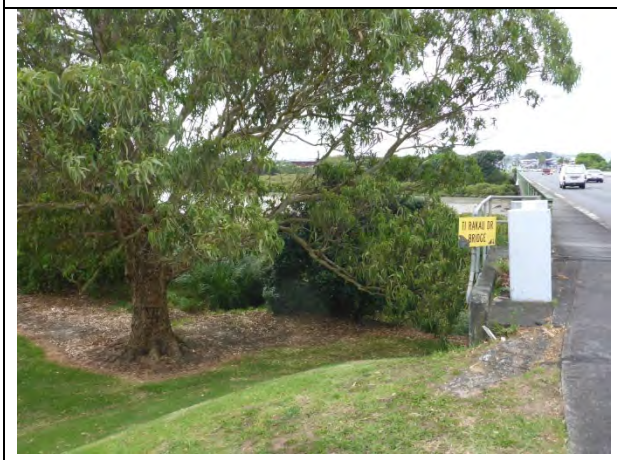
A5.2 Eastern Busway 3 Residential - Terrestrial Observations

Native amenity planting (facing east)

Restoration planting (Pakuranga Creek eastern esplanade reserve, facing northwest)

Restoration planting (Pakuranga Creek eastern esplanade reserve, facing north)

Restoration planting (Pakuranga Creek eastern esplanade reserve, facing southwest)



Restoration planting (Pakuranga Creek western esplanade reserve, facing east)

Restoration planting (Pakuranga Creek western esplanade reserve, facing southwest)

	
Mixed native exotic planting (facing northwest)	Mixed native exotic planting (facing southeast)

A5.3 Terrestrial Habitat Value Assessment

Table A5-1 details the justification and scoring output for ecological value of terrestrial features.

Table A5-1 Justification of ecological value for terrestrial habitats related to the Project (Scores are weight 0 - 4)

Ecological Matters	**TL.1 – Native dominated treeland**	
	Score	Justification
Representativeness	3	Habitat has been significantly altered by human activities, however, contains 50-90% indigenous species within a stand.
Rarity/ distinctiveness	3	Nationally and locally common indigenous species where habitat may play an important role in provisional or regulatory ecosystem services at a local scale. Likely to contain 'At Risk-declining' lizard species in understory and along habitat edges.
Diversity and pattern	3	Moderate diversity of vegetation with habitat utilised by native birds and lizards at a local scale.
Ecological context	3	Habitat could provide locally important connectivity link for native avifauna. Habitat present is largely fragmented.
Ecological Value	**Moderate**	
Ecological Matters	**TL.2 - Mixed native and exotic vegetation**	
	Score	Justification
Representativeness	2	Habitat has been significantly altered by human activities and contains 10-50% indigenous species within a stand.
Rarity/ distinctiveness	3	Nationally and locally common indigenous species present where habitat may play an important role in provisional or regulatory ecosystem services at a local scale. Likely contains 'At Risk-declining' lizard species in understory and along habitat edges.
Diversity and pattern	2	Moderate diversity of vegetation largely exotic, with understorey dominated by exotic weeds. Habitat utilised by native species at a local scale.

Ecological context	3	Largely modified and fragmented habitat with exotic weeds. However, habitat could provide locally important connectivity link for native avifauna. While understory and habitat edges likely to provide for At Risk-declining' lizard species.
Ecological Value	**Moderate**	
Ecological Matters	**TL.2 – Exotic dominated treeland**	
	Score	Justification
Representativeness	1	Habitat has been significantly altered by human activities and contains <10% indigenous species within a stand.
Rarity/ distinctiveness	3	Exotic species present where habitat may play an important role in provisional or regulatory ecosystem services at a local scale. Likely to contain 'At Risk-declining' lizard Species in understory and along habitat edges.
Diversity and pattern	2	Exotic trees with understorey are largely absent and/or dominated by exotic weeds. Habitat utilised by native species at a local scale.
Ecological context	2	Largely modified and fragmented habitat with exotic weeds. However, habitat could provide locally important connectivity link for native avifauna. Habitat understory likely providing habitat for "At risk declining" lizards at a local scale.
Ecological Value	**Moderate**	
Ecological Matters	**TL.2 – Exotic dominated treeland**	
	Score	Justification
Representativeness	3	Habitat has been significantly altered by human activities, however, contains 50-90% indigenous species.
Rarity/ distinctiveness	3	Nationally and locally common indigenous species where habitat may play an important role in provisional or regulatory ecosystem services at a local scale. Likely to contain 'At Risk-declining' lizard species in understory and along habitat edges.
Diversity and pattern	2	Moderate diversity of vegetation with habitat utilised by native birds and lizards at a local scale.
Ecological context	3	Habitat could provide locally important connectivity link for native avifauna.
Ecological Value	**Moderate**	
Ecological Matters	**EG - Exotic scrub**	
	Score	Justification
Representativeness	1	Habitat and species have been significantly altered by human activities. <10% of the species are indigenous.
Rarity/ distinctiveness	3	Exotic species, including weed species and pests. Exotic understorey dominated by exotic weeds. Likely contain 'At Risk-declining' Lizard Species.
Diversity and pattern	1	Limited habitat diversity dominated by exotic species. Habitat potentially utilised by native species at a local scale.

Ecological context	2	Largely modified habitat. Habitat could provide some connectivity for the survival of species as any scale.
Ecological Value	**Low**	
Ecological Matters	**EG - Exotic grassland (Maintained)**	
	Score	Justification
Representativeness	1	Habitat and species have been significantly altered by human activities (mown areas). <10% of the species are indigenous.
Rarity/ distinctiveness	3	Exotic species, including weed species and pests. Rank grass to likely contain 'At Risk-declining' Lizard Species.
Diversity and pattern	1	Limited habitat diversity. Not significant at any scale.
Ecological context	2	Largely modified habitat. However, Rank grasses (non-maintained) areas are likely to provide lizard habitat.
Ecological Value	**Low**	
Ecological Matters	**EG - Exotic grassland (Rank grass)**	
	Score	Justification
Representativeness	1	Habitat and species have been significantly altered by human activities Subject to periodic mowing under vegetation stands along berms. <10% of the species are indigenous.
Rarity/ distinctiveness	3	Exotic species, including weed species and pests. Rank grass to likely contain 'At Risk-declining' Lizard Species.
Diversity and pattern	2	Limited habitat diversity. Habitat potentially utilised by native species at a local scale.
Ecological context	2	Largely modified habitat. However, Rank grasses (non-maintained) areas are likely to provide lizard habitat.
Ecological Value	**Low**	

A5.4 Bird records

Table A5-2 details all bird records undertaken from incidental bird assessments and available scientific sources.

Table A5-2 Desktop records and incidental observations of bird species within a 5km radius of the Project Area

Common Name	Scientific Name	Source	Conservation Status (Robertson et al. 2017)
Blackbird*	*Turdus merula*	Chaffe, 2016	Introduced and Naturalised
Chaffinch	*Fringilla coelebs*		Introduced and Naturalised
Eastern rosella*	*Platycercus eximius*		Introduced and Naturalised
Fantail*	*Rhipidura fuliginosa*		Native - Not Threatened
Goldfinch*	*Carduelis*		Introduced and Naturalised

Common Name	Scientific Name	Source	Conservation Status (Robertson et al. 2017)
Greenfinch	*C. chloris*		Introduced and Naturalised
Grey warbler*	*Gerygone igata*		Native - Not Threatened
Magpie*	*Gymnorhina tibicen*		Introduced and Naturalised
Mallard	*Anas platyrhynchos*		Introduced and Naturalised
Myna*	*Acridotheres tristis*		Introduced and Naturalised
Song thrush*	*T. philomelos*		Introduced and Naturalised
Sparrow*	*Passer domesticus*		Introduced and Naturalised
Spotted dove*	*Streptopelia chinensis*		Introduced and Naturalised
Starling	*Sturnus vulgaris*		Introduced and Naturalised
Tui*	*Prosthemadera novaeseelandiae*		Native - Not Threatened
Yellowhammer	*Emberiza citrinella*		Introduced and Naturalised
White faced heron*	*Egretta novaehollandiae*	iNaturalist	Not threatened
Pukeko*	*Porphyrio melanotus*	iNaturalist	Not threatened
New Zealand dotterel	*Charadrius obscurus*	iNaturalist	At-risk recovering
Pied shag	*Phalacrocorax varius*	NZ Bird Atlas	At risk-recovering
New Zealand Dabchick	*Poliocephalus rufopectus*	NZ Bird Atlas	At risk-recovering
Little Black shag	*Phalacrocorax sulcirostris*	NZ Bird Atlas	At risk- naturally uncommon
Kingfisher/Kotare*	*Todiramphus sanctus*	Incidental observation	Native – not threatened
Pheasant	*Phasianus colchicus*	Incidental observation	Introduced and Naturalised
Silvereye/tauhou*	*Zosterops lateralis*	Incidental observation	Native – not threatened

*Also, incidental observations in 2018 and 2021 site walkover.

Appendix 6 Biodiversity offset Model for EB2 and EB3

A6.1 Terrestrial BCMs EB2

A single preliminary BCM has been developed for the EB2 and EB3R application, to determine the type and magnitude of effort that is expected to achieve Net Gain outcomes for terrestrial biodiversity after 10 years.

Table A6-1 and Table A6-2 below describes the data inputs into the BCM. Table 6-3 below provides a data input and output summary. In conclusion, the BCM predicts that 10 % Net Gain outcomes for effects on the terrestrial habitats will be exceeded through the proposed compensation actions, i.e., the compensation score is 10% higher than the impact score. Given the nature of the Project location, a significant proportion of grasses are maintained, all perspective rank grasses are assumed to be present within the vegetation understory and fringing habitat and extents have been accounted for in the model. All habitat with understory has been valued as high (3) to account for potential lizard habitat lost as per the EcIA assessment.

Table A6-1 Biodiversity compensation model inputs ecological compensation ratios for vegetation clearance at EB2

TL-3 Exotic Treeland		
Criteria	Data input	Justification
Impact risk multiplier	1.1 (+10%)	The impact risk assessed was deemed 'High' and is multiplied by 1.10 (+10%)
Impact uncertainty contingency	1 (+5%)	Effects associated explicitly with the loss of vegetation are of low uncertainty. Impact score is multiplied by 1.05 (+5%). Assumption that lizards are present in relatively low numbers given the results from the EB1 lizard salvage. No areas subject to predator control.
Areal extent	0.27 ha	As determined by the extent of loss under the Project footprint
Value score prior to impact	3	Ecological value of habitat prior to impact relating to the representativeness, rarity, distinctiveness, diversity and ecological context and utilisation by lizards owning to the At Risk- Declining threat status of lizards. A score of '4' 'very high' habitat would include native vegetation with coarse woody debris subject to pest control, pest control is unlikely possible given the nature of the location. Score is of '3' is deemed conservative given the model justifies a score of 3 as "high value habitat that would typically provide for all species or species assemblage life-history requirements and/or provide a critical resource or resource(s) for life-history requirements. The habitat quality is high and the relative abundance within the habitat is, or is likely to be, high compared to other habitat types."
Value score after impact	0.001	Permanent loss of vegetation will occur (the model does not accept a score of 0).
Planted native vegetation		

Criteria	Data input	Justification
Impact risk multiplier	1.1 (+10%)	The impact risk assessed was deemed 'High' and is multiplied by 1.10 (+10%)
Impact uncertainty contingency	1 (+5%)	Effects associated explicitly with the loss of vegetation are of low uncertainty. Impact score is multiplied by 1.05 (+5%)
Areal extent	0.07 ha	As determined by the extent of loss under the Project footprint
Value score prior to impact	3	Ecological value of habitat prior to impact relating to the representativeness, rarity, distinctiveness, diversity and ecological context and utilisation by lizards.
Value score after impact	0.001	Permanent loss of vegetation will occur (the model does not accept a score of 0).

Table A6-2 Compensation actions model inputs for loss of vegetation at EB2

Compensation Actions	Action 1 (Revegetation)	Justification
Discount rate	3.0%	Temporal time lag between impact occurring and the biodiversity gains generated. Discount of 3% is recommended by the model (Maseyk et al., 2015; Baber et al., 2021).
Finite end point	10	The finite end point equates to the time between commencement of compensation and revegetation at 10 years. Defined by the duration of proposed monitoring and management programmes.
Impact uncertainty contingency	3	Moderate compensation confidence (50% to 75%) has been applied for the success of the proposed compensation measures.
Areal extent of impact (ha)	**1.15**	Adjusted to meet project net gain outcomes of 10%.
Value prior to compensation	0.5	Compensation proposed onsite to assist with corridor connectivity. Current value along the road corridor and within adjacent parks are mown grass with some biodiversity < 1. Marginal habitat criteria denotes this value as "may be used but is not important for any part of the species or species assemblage life cycle(s)."
Value score after compensation	3	Revegetation of habitat is considered of High ecological value. Consistent with replanted vegetation scores. The native revegetation is expected to improve terrestrial biodiversity value through the provision of terrestrial habitat in the form of native plants and coarse woody debris (felled logs) that in time will provide habitat for indigenous terrestrial species that colonise from surrounding habitats. This revegetation will also improve ecological connectivity by increasing ecological linkages between existing high value habitats and will provide a buffer within the development area.

Table A6-3 Mitigation requirements associated with vegetation loss for EB2

Model output	Total impact score
Exotic vegetation	-0.23554
Planted native vegetation	-0.18705
Compensation score	0.26741
Net-gain outcome	**13.5%**

A6.2 Terrestrial BCMs EB3R

A single preliminary BCM has been developed for the EB2 and EB3R application, to determine the type and magnitude of effort that is expected to achieve Net Gain outcomes for terrestrial biodiversity after 10 years.

Table A6-4 and Table A6-5 below describes the data inputs into the BCM. Table A6-6 below provides a data input and output summary. In conclusion, the BCM predicts that 10 % Net Gain outcomes for effects on the terrestrial habitats will be exceeded through the proposed compensation actions, i.e., the compensation score is 10% higher than the impact score. Given the nature of the Project location, a significant proportion of grasses are maintained, all perspective rank grasses are assumed to be present within the vegetation understory and fringing habitat and extents have been accounted for in the model. All habitat with understory has been valued as high (3) to account for potential lizard habitat lost.

Table A6-4 Biodiversity compensation model inputs ecological compensation ratios for vegetation clearance at EB2

TL-3 Exotic Treeland		
Criteria	Data input	Justification
Impact risk multiplier	3.0%	The impact risk assessed was deemed 'High' and is multiplied by 1.10 (+10%)
Impact uncertainty contingency	1 (+5%)	Effects associated explicitly with the loss of vegetation are of low uncertainty. Impact score is multiplied by 1.05 (+5%)
Areal extent	0.09 ha	As determined by the extent of loss under the Project footprint
Value score prior to impact	3	Ecological value of habitat prior to impact relating to the representativeness, rarity, distinctiveness, diversity and ecological context and utilisation by lizards.
Value score after impact	0.001	Permanent loss of vegetation will occur (the model does not accept a score of 0).

Table A6-5 Compensation actions model inputs for loss of vegetation at EB3R

Compensation Actions	Action 1 (Revegetation)	Justification
Discount rate	3.0%	Temporal time lag between impact occurring and the biodiversity gains generated. Discount of 3% is

		recommended by the model (Maseyk et al., 2015; Baber et al 2021).
Finite end point	10	The finite end point equates to the time between commencement of compensation and revegetation at 10 years. Defined by the duration of proposed monitoring and management programmes.
Impact uncertainty contingency	3	Moderate compensation confidence (50% to 75%) has been applied for the success of the proposed compensation measures.
Areal extent of impact (ha)	0.3	Adjusted to meet project net gain outcomes of 10%.
Value prior to compensation	0.5	Compensation proposed onsite to assist with corridor connectivity. Current value along the road corridor and within adjacent parks are exotic scrub/mown grass with some biodiversity < 1.
Value score after compensation	3	Ecological value of habitat prior to impact relating to the representativeness, rarity, distinctiveness, diversity and ecological context and utilisation by lizards owning to the At Risk- Declining threat status of lizards. A score of '4' 'very high' habitat would include native vegetation with coarse woody debris subject to pest control, pest control is unlikely possible given the nature of the location. Score is of '3' is deemed conservative given the model justifies a score of 3 as "high value habitat that would typically provide for all species or species assemblage life-history requirements and/or provide a critical resource or resource(s) for life-history requirements. The habitat quality is high and the relative abundance within the habitat is, or is likely to be, high compared to other habitat types."

Table A6-6 Mitigation requirements associated with vegetation loss for EB3R

Model output	Total impact score
Exotic vegetation	-0.06235
Compensation score	0.06976
Net-gain outcome	**11.9%**

Appendix 7 Lizard Habitat Restoration Plans

POTENTIAL LIZARD RELOCATION ZONE

LEGEND:

- EB2 Landscape Mitigation Planting
- EB3R Landscape Mitigation Planting
- Ecological Mitigation Planting
- Ecological Mitigation Planting - SW Outfalls
- Maintanence Bays
- Concrete/ Basalt rock
- Grass

- 45L TREES
- 80L TREES
- 160L TREES

PACKAGE NO.

NOT FOR CONSTRUCTION

Filename: BIM 360://CI-APAC (NZL) 60644113-Eastern Busway 234/EB-2-D-23-UD-MD-00-Landscape Model_Consenting.rvt

ORIGINAL SIZE A1

ORIGINAL IN COLOUR

REV	DATE	DRAWN	REVISION DESCRIPTION
A	20.07.2022	PMi	FOR CONSENTING APPROVAL

Designed	EDi	Checked	CBe
Drawn	PMi	Checked	
Approved			
Date		Approver Signature	

Scale Bar

KEY PLAN

AUCKLAND MANUKAU EASTERN TRANSPORT INITIATIVE
EASTERN BUSWAY ALLIANCE
(PAKURANGA TO BOTANY)

Eastern Busway

Drawing Status

Horizontal Datum: NZGD 2000 MOUNT EDEN CIRCUIT

Vertical Datum: 2016 NEW ZEALAND

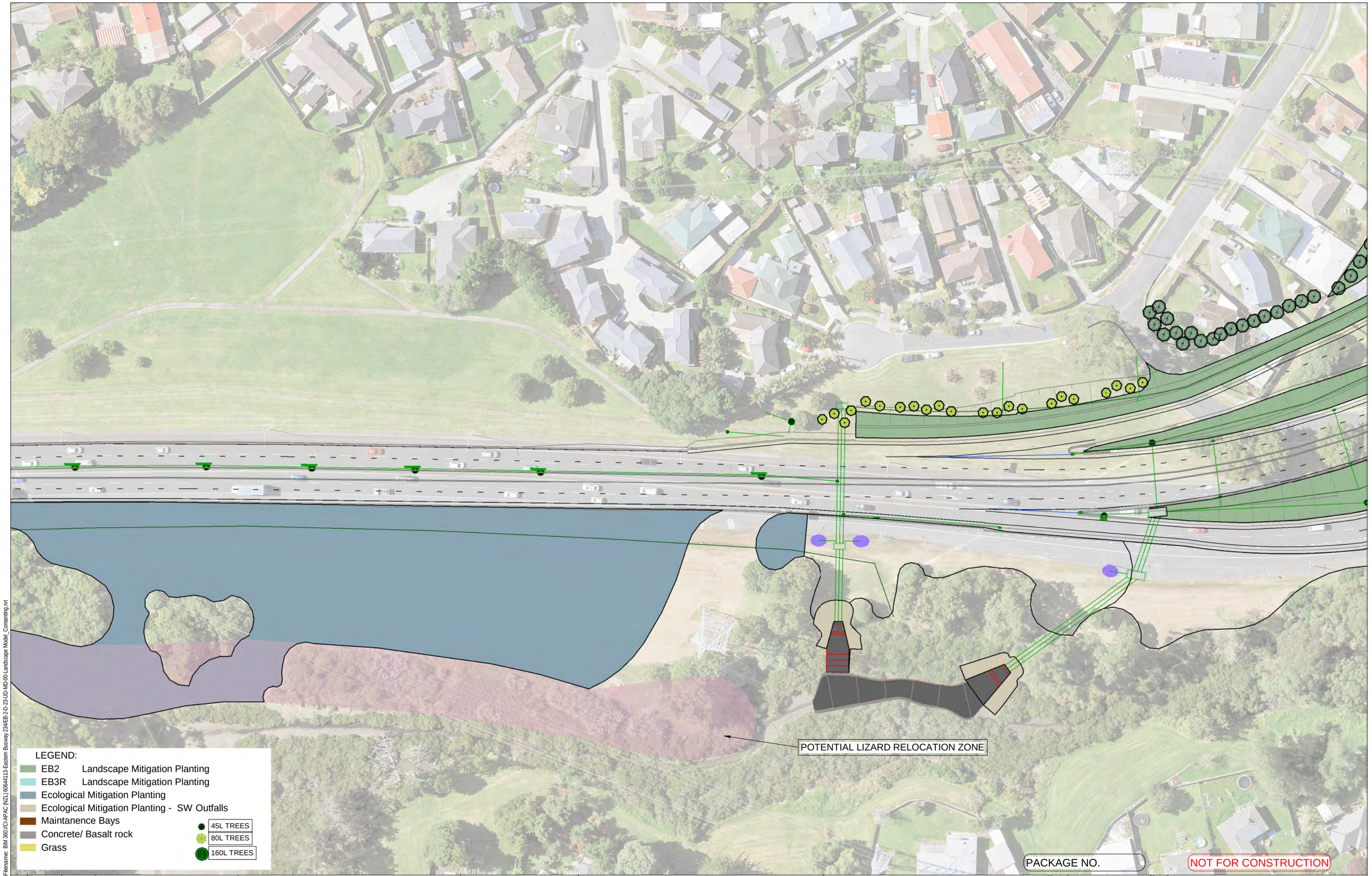
A1 SCALE 1 : 500 A3 SCALE

Design Package: Consenting Package

Drawing Title: Landscape, Ecological & Arboricultural Mitigation Plan

Drawing Number: EB-2-D-2-UD-DG-000121

Revision: A



Filename: BIM 360://C1-APAC (NZL)/6064113-Eastern Busway 234/EB-2-D-23-UD-MD-00-Landscape Model_Consenting.rvt

ORIGINAL SIZE A1

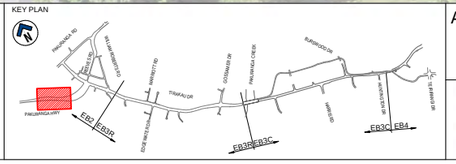
ORIGINAL IN COLOUR

REV	DATE	DRAWN	REVISION DESCRIPTION
A	20.07.2022	PMi	FOR CONSENTING APPROVAL

Designed	EDi	Checked	CBe
Drawn	PMi	Checked	
Approved		Approver Signature	
Date			

Scale Bar

KEY PLAN



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Drawing Title: Landscape, Ecological & Arboricultural Mitigation Plan

Drawing Number: EB-2-D-2-UD-DG-000122

Revision: A

POTENTIAL LIZARD RELOCATION ZONE

LEGEND:

- EB2 Landscape Mitigation Planting
- EB3R Landscape Mitigation Planting
- Ecological Mitigation Planting
- Ecological Mitigation Planting - SW Outfalls
- Maintanence Bays
- Concrete/ Basalt rock
- Grass

- 45L TREES
- 80L TREES
- 160L TREES

PACKAGE NO.

NOT FOR CONSTRUCTION

Filename: BIM 360://CI-APAC (NZL) 60644113-Eastern Busway 234/EB-2-D-23-UD-MD-00-Landscape Model_Consenting.rvt

ORIGINAL SIZE A1

ORIGINAL IN COLOUR

REV	DATE	DRAWN	REVISION DESCRIPTION
A	20.07.2022	PMi	FOR CONSENTING APPROVAL

This drawing shall only be used for the purpose of this project. The signing of this title block confirms the design and drafting of this project have been prepared and checked in accordance with the Alliance quality assurance system to ISO 9001. Printed copies of this document are UNCONTROLLED. Do not scale from this drawing

Designed	EDi	Checked	CBe
Drawn	PMi	Checked	
Approved			
Date		Approver Signature	

Scale Bar

KEY PLAN

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EASTERN BUSWAY ALLIANCE
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A1 SCALE: 1 : 500 | A3 SCALE

Design Package: Consenting Package

Drawing Title: Landscape, Ecological & Arboricultural Mitigation Plan

Drawing Number: EB-2-D-3-UD-DG-000105

Revision: A